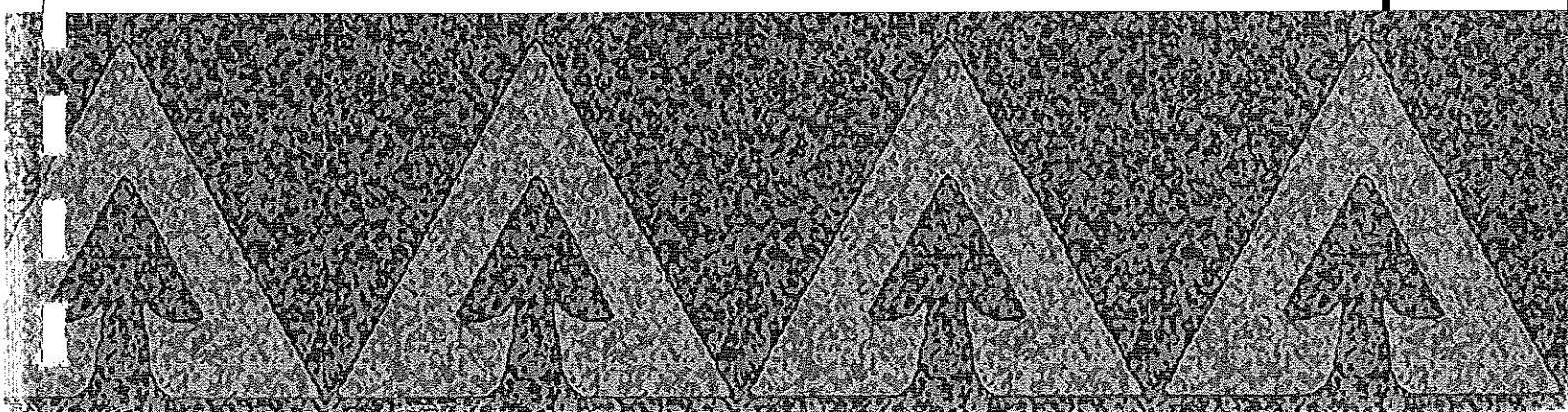
FINAL

Remedial Investigation Report
Chlor-Alkali Plant
Longview, Washington

PREPARED FOR
Weyerhaeuser

CH2MHILL
JULY 25, 2001



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Executive Summary

This report addresses the remedial investigation (RI) performed for Weyerhaeuser Company's Chlor-Alkali Plant at its forest products complex in Longview, Washington. The location of the plant is shown in Figure ES-1. Chlorine and caustic were initially produced at the plant using the mercury electrolytic cell process in the 1950s. Concerns over potential releases of mercury into the environment prompted Weyerhaeuser to change methods for handling process wastes and convert to a different process technology (diaphragm cells). Environmental control systems were put into place in the 1970s. In 1976, mercury use in the plant processes ceased, as did releases to the environment. Because of the possibility of historical releases of mercury to the environment, Weyerhaeuser has conducted and continues to conduct comprehensive sampling of various media to determine mercury concentrations and, when necessary, to perform remediation of materials at the Chlor-Alkali Plant that contain mercury. On March 15, 1999, Weyerhaeuser shut down the chlorine production at this facility. Following decommissioning activities, the plant will be put into mothball status. No decisions about the long-term use of the site have been announced.

Remedial investigation work, as an independent action by Weyerhaeuser, involved collecting samples as prescribed in a work plan approved by the Washington State Department of Ecology (CH2M HILL, 1995). This RI report has been prepared per the directives in the work plan, in accordance with the requirements of the January 1996 Model Toxics Control Act (MTCA) (Washington Administrative Code [WAC] 173-340-350).

Purpose of RI Report

This RI report presents the findings of past and current investigations undertaken in potential areas of concern identified by Weyerhaeuser and Ecology (see Figure ES-2). Because there is a considerable amount of existing data on plant operations, site conditions, and mercury concentrations, as documented in the approved work plan (CH2M HILL, 1995), an extensive site investigation during the RI was unnecessary. Sampling conducted at this site has been comprehensive and provides a firm basis for remedial decisionmaking. Because much of the information required for the RI/FS by MTCA is already included in the work plan, the objectives of the RI report are focused on the following, per WAC 173-340-350 (1):

- To present the information collected during the RI
- To determine the extent and concentration of mercury in soil, groundwater, surface water, and sediment
- To evaluate the risk to receptors identified in approved work plan
- To provide information necessary to determine the need for additional remedial measures and to enable the selection of a cleanup action under WAC 173-340-360

Summary of Fieldwork

The collection of additional field data was proposed in the work plan (CH2M HILL, 1995) to address data needs and to further define the site conceptual model. Field investigation tasks were conducted from September 1998 through May 1999. Following are summaries of the fieldwork items performed during this investigation for soils, groundwater, sediment, and surface water. Also included is a brief description of the topographic survey that was conducted of the stormwater drainage ditch.

Soil

- Four soil samples were collected from the brine spill area to confirm the effectiveness of previous soil removal activities from a historical spill of depleted brine solution.
- Four soil samples were collected from the former surface impoundment area to help evaluate soil remedial alternatives in the feasibility study.
- Five samples were collected from the stormwater drainage ditch to determine the extent of detectable mercury concentrations in the ditch.

Groundwater

- Two alluvial-zone groundwater monitoring wells were installed at the Weyerhaeuser site upgradient of the Chlor-Alkali Plant to further characterize the upgradient (CH-7) and cross-gradient (CH-8) extent of mercury in groundwater.
- Two rounds of groundwater sampling were completed on deep and shallow monitoring wells located across the site to document the mercury concentrations, pH, and specific conductance in groundwater at the Chlor-Alkali Plant.
- Water levels in both the monitoring wells and the Columbia River were monitored for a period of 72 hours to assess the magnitude of tidal influences on groundwater in the basalt and alluvial zone.

Sediment

- Sediment samples were collected during two separate field sampling events. These sediments were collected from the Columbia River adjacent to, upstream of, and downstream of the former diffuser associated with the former No. 1 Cell Room, and near the abandoned No. 2 Cell Room Diffuser. The purpose of the sampling was to assess the extent of mercury in the river near the former diffusers.

Surface Water Sampling

- Flow measurements were taken and surface water sampling was completed in the eastern stormwater drainage ditch during three storm events at the discharge point to the Columbia River. The purpose of the sampling was to estimate the potential mass loading of mercury to the Columbia River via stormwater discharge.

Topographic Survey

- The stormwater drainage ditch and surrounding area were surveyed to delineate the topography of the ditch drainage and to determine the area at the Chlor-Alkali Plant that contributes runoff to the ditch and whether this includes the former surface impoundment area and former No. 1 Cell Room.

Nature and Extent of Mercury

Following are summaries of results of the data collection activities and discussions of the nature and extent of mercury, based on historical investigations and the field investigations described above.

Soils

The mercury in soil at the Chlor-Alkali Plant is inorganic mercury, which is believed to be present in soil at areas where releases are known or suspected to have occurred. These "potential areas of concern" were identified in the approved work plan and include the former surface impoundment area, staging area, former No. 1 Cell Room, No. 2 Cell Room, brine spill area, caustic storage area, loading area, liquefaction area, brine treatment area, and west area (see Figure ES-2). The following conclusions were made for each area:

- Concentrations of mercury are low (that is, less than 16 milligrams per kilogram [mg/kg]) in the west area, the stormwater drainage ditch, and—within the central process area—the liquefaction and loading areas.
- Concentrations of mercury are moderate (that is, less than 189 mg/kg total mercury) in the brine spill and brine treatment areas and—within the central process area—in the No. 2 Cell Room, brine treatment area, caustic storage area, and staging area.
- Mercury concentrations are the highest within the areas of the former No. 1 Cell Room and former surface impoundment area. These areas have undergone removal actions, and the area of the former No. 1 Cell Room is currently covered with a polymer-modified asphalt cap.

Five surface soil samples were collected from the stormwater drainage ditch and analyzed for total mercury. Concentrations of mercury ranged from 0.6 mg/kg to 4.8 mg/kg, with an average of 2 mg/kg. These results suggest that the soil in the ditch does not represent a significant source of mercury to the Columbia River via runoff.

Groundwater

Groundwater occurs in saturated portions of the alluvial and basalt aquifers at the Chlor-Alkali facility. The Columbia River, which borders the edge of the site, forms the base for the local and regional hydrologic systems. Groundwater beneath the site discharges to the Columbia River, and the river stage has only a minor influence on groundwater levels beneath the site.

In general, mercury concentrations in groundwater are remaining steady or decreasing with time. The rate of decrease is slowest in the area of the former No. 1 Cell Room and the

former surface impoundments. Except for in these areas, mercury concentrations are at or below the MCL of 0.002 mg/L for mercury.

Potential explanations for the slow rate of decrease in mercury concentrations in the area of the former No. 1 Cell Room include the following:

- The amount of groundwater flux (and therefore the rate of flushing) is limited because the asphalt cap reduces rainfall infiltration, and the permeability of the basalt and alluvium fill above the basalt is very low.
- It is possible that small amounts of elemental mercury are present below the water table as isolated globules in basalt fractures. If present, these globules could serve as an ongoing source of dissolved mercury in basalt groundwater.

Although transient fluctuations in mercury concentrations may occur as a result of unusually high groundwater levels and rainfall conditions, concentrations in groundwater are not expected to increase substantially over time because the initial mercury sources were removed from the plant more than 23 years ago, and subsequent removal actions as described in the RI work plan (CH2M HILL, 1995) have addressed former mercury sources. Furthermore, results from soil and groundwater sampling suggest that leaching of mercury from soil to groundwater by infiltration and percolation of precipitation is not a major factor influencing mercury concentrations in groundwater.

Mercury is not present in groundwater north of (that is, in the general upgradient direction from) the former No. 1 Cell Room and former surface impoundment area, as seen in sampling results of the new Monitoring Wells CH-7 and CH-8. Mercury was not detected in either well during the four rounds of sampling conducted as part of semiannual monitoring between October 1998 and March 2000.

The mercury discharge to the Columbia River from groundwater is estimated to be approximately 0.4 pound per year. Because the basalt is the area of the plant that contains the highest mercury concentrations but transmits the least amount of groundwater flow, it contributes a relatively insignificant amount of mercury mass to the surrounding groundwater and Columbia River. Conversely, the alluvial aquifer, which contains relatively low mercury concentrations but transmits more significant quantities of groundwater flow, contributes substantially more mercury mass to the river. Essentially, all of the mercury loaded to the river from groundwater is discharged from the alluvium; the basalt zone contributes approximately 0.002 percent of this total.

Sediment

Mercury in sediment adjacent to the Chlor-Alkali plant is either not present or is found in very low concentrations. A total of 33 sediment samples were collected during two separate sampling events. The first event was performed during September and October 1998, near the former No. 1 Cell Room diffuser, and the second event was conducted in March 1999, near the abandoned No. 2 Cell Room Diffuser. The first sampling effort resulted in reported mercury concentrations that were above detection limits in only two samples (at 0.2 mg/kg), collected adjacent to the salt dock. The detected concentrations were equal to or lower than those found in background sediment collected during historical investigations. No mercury was detected in sediment collected near the former No. 1 Cell Room diffuser.

The second sampling event resulted in four detections. The highest concentration of 0.4 mg/kg was found approximately 450 feet downstream of the abandoned No. 2 Cell Room diffuser. A concentration of 0.2 mg/kg was found in one sample collected directly adjacent to the diffuser. No mercury was detected in three additional samples collected directly adjacent to the diffuser. Mercury was also detected at 0.1 mg/kg at two locations downstream of the diffuser.

Samples collected to characterize the extent of mercury in surface sediment associated with the former No. 1 Cell Room Diffuser and the abandoned No. 2 Cell Room diffuser indicate that sediments do not contain significant concentrations of mercury. The concentrations of mercury detected during these sampling events are similar to background mercury levels. Only one sediment sample collected around the No. 1 Cell Room and No. 2 Cell Room diffusers has exceeded the sediment cleanup level of 0.2 mg/kg. This one exceedance is not statistically significant given the size of the sample population (33 samples) and the absence of mercury at surrounding sample locations.

The sediment sampling results are consistent with the model that demonstrates that sediments in the area have been dredged or scoured and that sedimentation in the area no longer occurs. After the 1981 volcanic eruption of Mount St. Helens, a large amount of sediment was deposited in the river. Subsequent dredging activities restored the navigational channel to a width that was 200 feet less than it was before the eruption. Dredge spoils were disposed of near the east powerhouse, creating a spit. The narrower channel and the presence of the spit have increased flow velocities, reduced sediment deposition in the area, and created a self-scouring environment. Therefore, the accumulation of mercury-laden sediments in the area is unlikely; this conclusion is supported by the absence of mercury in the majority of samples collected during this sampling effort.

Surface Water

All stormwater sample results from the eastern stormwater ditch indicated that mercury concentrations were below the detection limit of 0.0002 mg/L. There is currently no mercury load to the Columbia River from this ditch. Based on these surface water results and the results from sampling soil within the ditch, stormwater runoff not captured by the stormwater treatment system is not considered to represent a significant source of mercury to the Columbia River.

Topographic Survey

A topographic survey was completed on the area surrounding the stormwater drainage ditch to determine whether the area of the former No. 1 Cell Room and the former surface impoundment area contribute runoff to the ditch. The survey and a visual inspection of the area during a rainfall event indicate that only part of the area actually drains into the drainage ditch; a portion of the area drains away from the ditch and gets collected in storm drains located near the ditch. Therefore, only a portion of the water from the area around the former surface impoundment area is discharged to the Columbia River through the stormwater drainage ditch. The area of the former No. 1 Cell Room is paved, and the stormwater is collected and then conveyed through the stormwater collection system.

MTCA Assessment

A Model Toxics Control Act (MTCA) assessment was performed per the requirements of WAC 173-340-700 to 760. A conceptual exposure model was revised from the approved work plan (CH2M HILL, 1995) and is included as Figure ES-3. At the Chlor-Alkali Plant, the land use is currently heavy industrial and will remain industrial. The most plausible exposure scenarios at the plant are as follows:

- Potential future occupational exposure to mercury in soil by incidental direct contact
- Potential future occupational exposure to mercury in groundwater
- Potential current or future recreational consumption of affected fish (that is, nonmigratory or semiresident fish) from the Columbia River

It is plausible that fish from the Columbia River could be consumed not just by recreational anglers but by ethnic subpopulations, such as Native Americans. There are no formally adjudicated fishing rights in the vicinity of Longview. Additionally, available information pertaining to actual fish consumption near the Chlor-Alkali Plant by these subpopulations is missing, and other available data (for example, Columbia River Inter-Tribal Fish Commission, 1994) do not allow quantitative characterization of possible exposure for these subpopulations.

Cleanup levels (CULs) were identified as shown in Table ES-1, and a comparison to site data was performed. The results of the comparison indicate that for direct contact with soil, none of the 95 percent upper confidence limit (UCL) exceeded the Method C CUL. In addition, no exceedances of the 2x or 10 percent MTCA criteria were seen. However, most of the soil data exceeds the onsite-soil-to-protect-groundwater CUL of 1 mg/kg. For groundwater, concentrations in the central process area, former No. 1 Cell Room, and former surface impoundment area exceed the onsite groundwater CUL, although the site conditions that are represented by this CUL (that is, groundwater as a drinking water source) are nonexistent at this time and will remain so in the future.

Impacts from mercury in groundwater discharged to the Columbia River are best evaluated by examining the data from sediments, surface water, and fish tissue sampled from the river. In recent sampling events, mercury was detected six times in sediments. However, only one of the samples collected contained mercury at a level that exceeded the sediment cleanup level of 0.2 mg/kg . This one exceedance is not statistically significant given the size of the sample population (33 samples) and the absence of mercury at surrounding sample locations.

Mercury was not detected in surface water. The detection limits were low enough to provide assurance that mercury was not present at concentrations exceeding the freshwater acute AWQC, but not low enough to provide assurance that mercury was below the freshwater chronic AWQC.

Finally, although mercury can be detected in the tissues of aquatic organisms sampled from the river, the distribution of mercury in these samples does not indicate an association between the site and mercury in aquatic organisms. Also, mercury in tissues appears to be declining over time. Considered collectively, the data from sediments, surface water, and aquatic organisms do not indicate that the site (including groundwater discharging from the

site) is producing a definable mercury problem in the Columbia River. It is not likely that attempts to reduce mercury concentrations in aquatic organisms by managing mercury at the site will produce an observable result, simply because conditions in the river cannot be associated with the site.

Conclusions

Based on the results and evaluations presented in this report, the feasibility study will establish remedial action goals and remediation levels (that is, concentrations above which remedial action may be required) for soil to protect groundwater from a rising water table and for groundwater, taking into account its current and future use. The establishment of remediation levels may result in an evaluation of soil and groundwater remedial alternatives.

TABLE ES-1
CULs Used for the Chlor-Alkali Plant

Medium	Pathway	CUL	Source
Onsite Soil	Direct contact by humans	1,050 mg/kg	CLARC II
Onsite Soil to Protect Groundwater	Ingestion by humans	1.05 mg/kg	WAC 173-340-745 Table 3
Onsite Groundwater	Ingestion by humans	2 µg/L	CLARC II (MCL as ARAR)
Sediment (Columbia River)	Effect levels for benthic organisms	0.2-2.0* mg/kg	Ontario Sediment Standards
Sediment (Columbia River)	Accumulation into fish	0.61* mg/kg	Ecology Sediment Quality Criterion
Surface Water (Columbia River)	Acute exposure to aquatic organisms	2.4 µg/L	State of Washington AWQC
Surface Water (Columbia River)	Chronic exposure to aquatic organisms and subsequent users	0.012 µg/L	State of Washington AWQC
Fish Tissue	Food-chain transfer; consumption by recreational anglers	1 mg/kg	U.S. Food and Drug Administration Action Level

*A promulgated MTCA CUL for sediment is not currently available. Values listed are selected as alternate comparison criteria.

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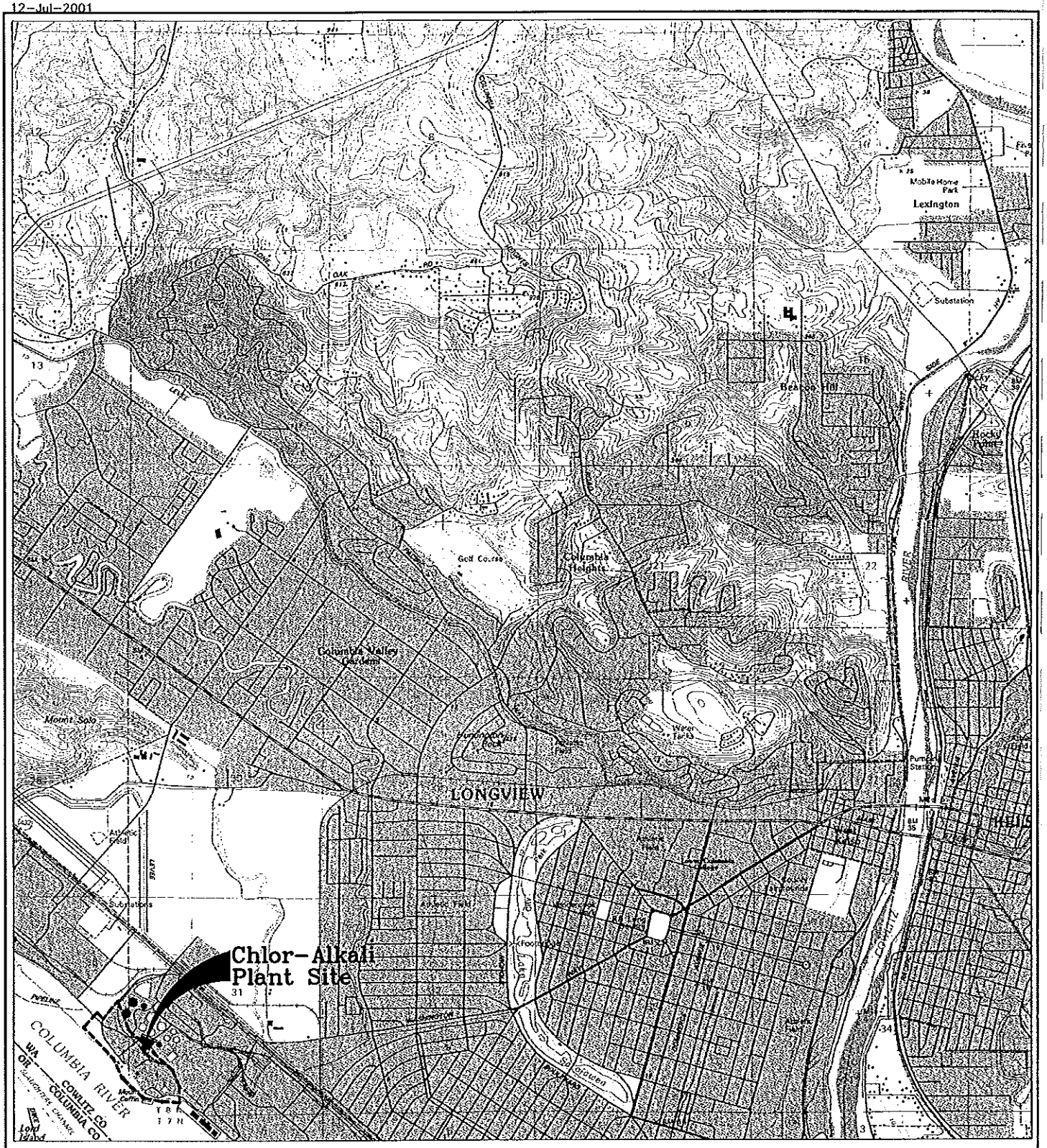

LEGEND

-------- Approximate Site Boundary

FIGURE ES-1
Location Map
WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

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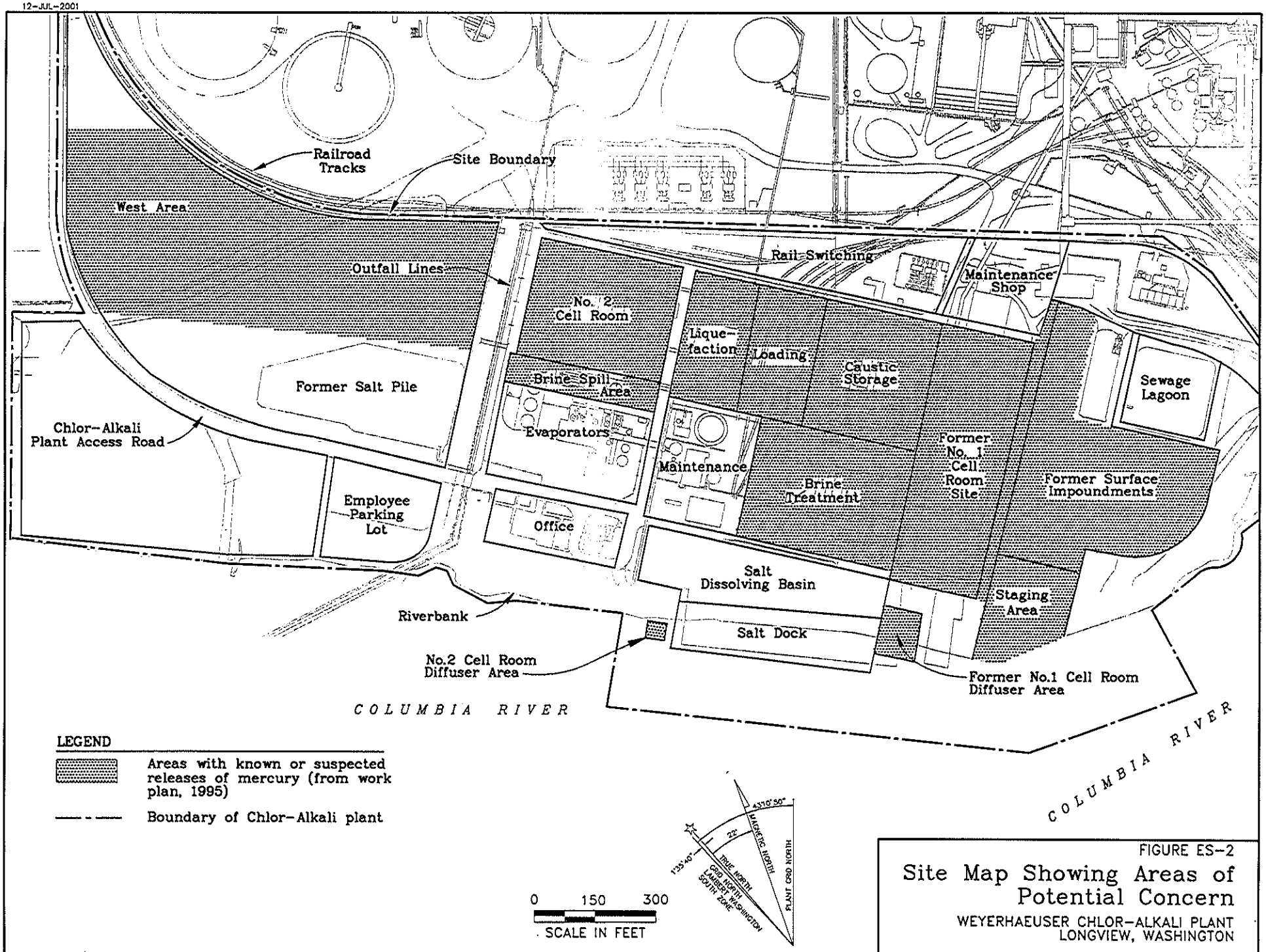

FIGURE ES-2

Site Map Showing Areas of Potential Concern

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

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SECTION 1

Introduction

SECTION 1

Introduction

1.1 Purpose of RI Report

This remedial investigation (RI) report has been prepared by CH2M HILL on behalf of Weyerhaeuser Company, which owns and previously operated a Chlor-Alkali Plant at its forest products complex in Longview, Washington. On March 15, 1999, Weyerhaeuser shut down the chlorine production at this facility. The plant has been put into mothball status. No decisions about the long-term use of the site have been announced.

The location of the Chlor-Alkali Plant is shown in Figure 1-1. Chlorine and caustic were initially produced at the plant using the mercury electrolytic cell process in the late 1950s to the mid-1970s. In the 1970s, concerns over potential releases of mercury into the environment prompted Weyerhaeuser to change its methods of handling process wastes and to convert to a different process technology (diaphragm cells). By 1976, mercury was no longer used at the plant. As a result of past practices, Weyerhaeuser implemented a program of sampling various media to determine mercury concentrations. From the early 1970s to the mid-1990s, Weyerhaeuser conducted remediation of materials at the Chlor-Alkali Plant that contained mercury.

This RI report presents the findings of past and current sampling work performed according to requirements of the January 1996 Model Toxics Control Act (MTCA) (Washington Administrative Code [WAC] 173-340-350). This remedial investigation was undertaken as an independent action and is based on a work plan prepared by CH2M HILL and approved by the Washington Department of Ecology (hereafter referred to as Ecology) in 1998. In January 2001, Weyerhaeuser and Ecology entered into an Agreed Order to conduct a feasibility study for the site.

Potential areas of concern (see Figure 1-2) were identified in the approved work plan (CH2M HILL, 1995). Because there is a considerable amount of data available on plant operations, site conditions, and mercury concentrations, as documented in the approved work plan (CH2M HILL, 1995), an extensive site investigation during the RI was unnecessary. Sampling conducted at the site in the potential areas of concern has been comprehensive and provides a basis for remedial decisionmaking. Because much of the information required for the RI/FS by MTCA is already included in the work plan, the objectives of the RI report are focused on the following, per WAC 173-340-350 (1):

- To present the information collected during the RI
- To determine the extent and concentration of mercury in soil, groundwater, surface water, and sediment
- To evaluate the risk to receptors identified in the approved work plan

- To provide information necessary to determine the need for additional remedial measures and to enable the selection of a cleanup action under WAC 173-340-360.

Table 1-1 presents the requirements of MTCA (WAC 173-340-350) and the document that includes (or, in the case of the feasibility study, that will include) the required information. Table 1-1 shows that the majority of the information required by MTCA was included in the work plan (CH2M HILL, 1995).

1.2 Report Organization

The report is organized into the following main sections:

- **Section 1: Introduction.** This section describes the purpose of the RI report and its organization and presents background information, a brief site history, and tables showing WAC requirements and summarizing major events in the history of the site.
- **Section 2: Study Area Investigation Activities.** This section describes the methods and extent of the 1998-1999 RI fieldwork. The locations and types of samples are discussed.
- **Section 3: Physical Site Conceptual Model.** This section summarizes the geology, groundwater, and surface water quality information for the Chlor-Alkali Plant.
- **Section 4: Nature and Extent of Mercury.** This section discusses the nature and extent of mercury contamination in soil, sediment, groundwater, and surface water and presents the mercury conceptual model.
- **Section 5: MTCA Cleanup Level Comparison.** This section presents the conceptual site model for exposure pathways and receptors, evaluates MTCA cleanup levels, compares cleanup levels to site data, and summarizes the risk associated with mercury at the Chlor-Alkali Plant.
- **Section 6: Conclusions.** This section presents the conclusions of the remedial investigation. These conclusions provide the basis for the feasibility study.
- **Section 7: Works Cited.** This section presents an alphabetical summary of reference documents used in this RI report.

1.3 Background Information and Brief Site History

The site is located on the north shore of the Columbia River near the city of Longview, in Cowlitz County in southwest Washington (see Figure 1-1 for the location of the Chlor-Alkali Plant). The plant site is flat and overlies a remnant of Mount Coffin, an isolated basalt erosional peak that was removed as part of site development. The subsurface consists of alluvium and basalt. Both surface water and groundwater from the site flow toward the Columbia River. A summary of major activities at the site is presented in Table 1-2.

In the mid-1950s, Weyerhaeuser Company began production of chlorine and caustic for its pulp and paper mills. Construction of the Chlor-Alkali Plant in Longview began in 1956.

Facility operations, including those of the former No. 1 Cell Room, commenced in the fall of 1958. The former No. 1 Cell Room was constructed above the remnant of Mount Coffin, an approximately 300-foot-high basalt promontory. The plant was expanded in 1966 with the addition of a second cell room (the No. 2 Cell Room) and a liquefaction building.

The technology that was available and used at this time (the late 1950s) to produce chlorine and caustic was the mercury electrolytic process. This two-part process used a brine electrolyzer and an amalgam decomposer. Leaks from pumps, valves, and process lines from the former No. 1 Cell Room have resulted in mercury releases to onsite soils. The potential for mercury releases from the No. 2 Cell Room was considerably lower than from the former No. 1 Cell Room because of differences in building construction and the duration of process operations. Environmental control systems for the plant were put into place in the 1970s. In the mid-1970s, the mercury electrolytic chlorine and caustic production cells were replaced with diaphragm cell technology. This change-out effectively ended the production-related loss of mercury to the environment.

The mercury that was released more than 20 years ago is currently detectable in soil and groundwater, and several removal actions have taken place to remove the highest mercury concentrations in soil at the plant. Groundwater at the plant, which discharges into the Columbia River, has been monitored since 1987. Surface water, sediments, and fish in the Columbia River have been monitored for mercury since the 1970s. Currently, mercury concentrations in the river near the plant are similar to mercury concentrations upstream and downstream of the plant.

The Chlor-Alkali Plant is currently listed on Ecology's Hazardous Waste Site List (which is found within the site register for the Toxics Cleanup Program), based on past reviews by Ecology and submittals by Weyerhaeuser. A work plan for a remedial investigation and feasibility study for mercury in the environment at the Chlor-Alkali Plant (CH2M HILL, 1995) was submitted to Ecology and approved in 1998.

The remedial investigation fieldwork has been completed at the plant as an independent action by Weyerhaeuser. This work has involved collecting samples as prescribed in the approved work plan, and this RI report has been prepared. The current phase of this work is the preparation of a feasibility study (under an Agreed Order) to address mercury present in the environment.

Additional information about the site history (particularly details on regulatory history and investigations prior to 1998) is available in the approved work plan (CH2M HILL, 1995).

TABLE 1-1
Comparison of WAC Requirements to Reports

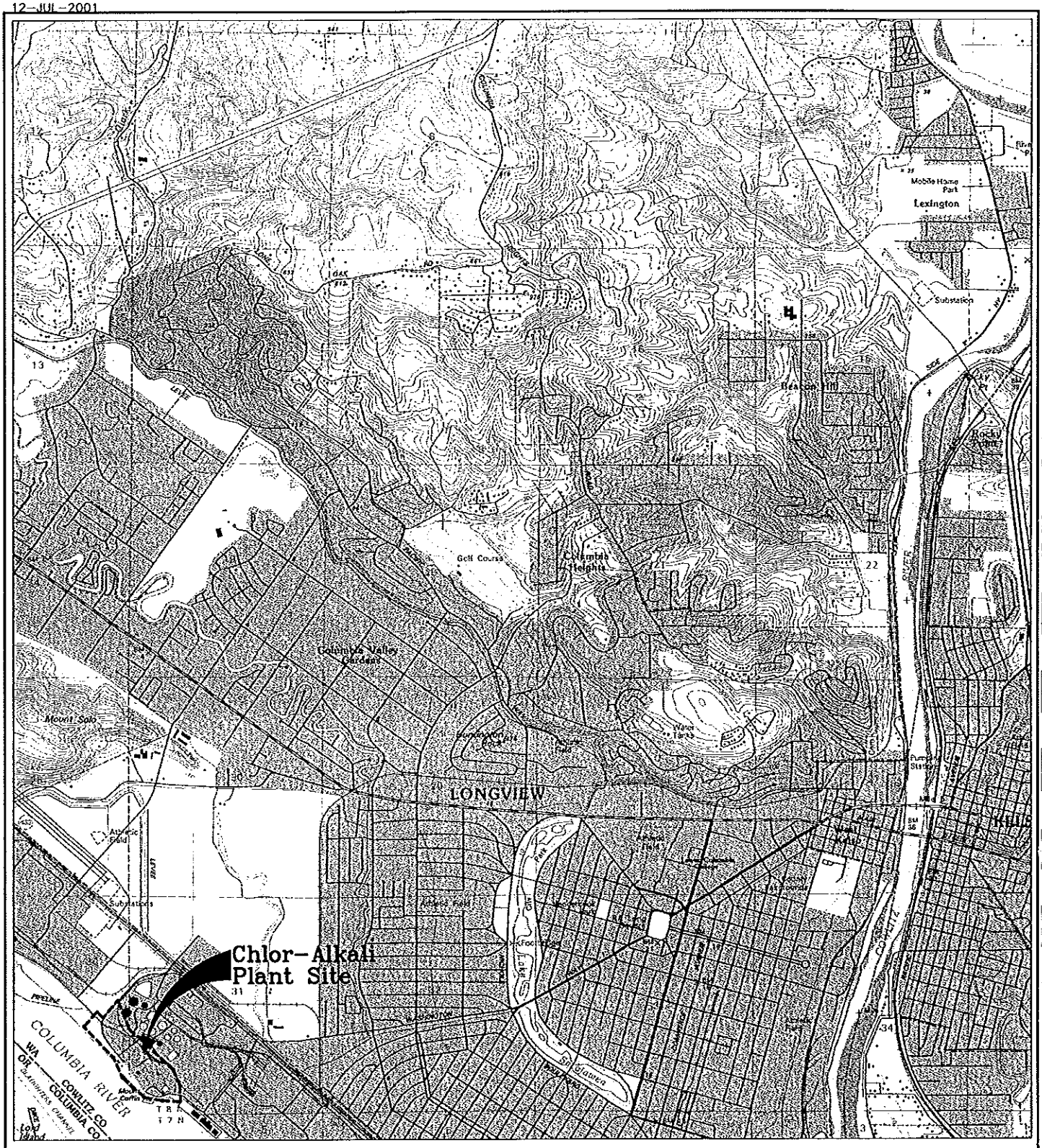
Requirement (WAC-340-350)	Approved Work Plan	Remedial Investigation	Feasibility Study
1. Purpose	--	X	--
2. Timing	X	X	--
3. Administrative Options	X (a)	X (a)	X (b)
4. Public Participation	--	--	X
5. Scope	--	X	X
6. Contents			
a. General Facility Information	X	--	--
b. Site Conditions Map	X	--	--
c. Field Investigations	X	X	--
i. surface water and sediments	X	X	--
ii. soils	X	X	--
iii. geology and groundwater	X	X	--
iv. air (c)	NA	NA	NA
v. land use	X	--	--
vi. natural resources and ecology	X	--	--
vii. hazardous substance sources	X	X	--
viii. regulatory classifications	X	--	--
d. Risk Assessment	--	X	--
e. Cleanup Action Alternatives	--	--	X
f. Work Plans	X	--	--
g. Treatability Studies (d)	NA	NA	X
h. State Environmental Policy Act	X	--	--
i. Other Information (e)	X	X	X
7. Departures from Section 6 (f)	NA	NA	NA
8. Report	X	X	X

Notes:
(a) Independent action.
(b) Agreed Order.
(c) Air not include in scope of work because buildings were enclosed and vents had scrubbers, per approved work plan.
(d) If warranted.
(e) Other information required by Ecology. None identified.
(f) None identified.
-- = included in other document.
NA = Not applicable.
X = Requirement addressed in this report.

TABLE 1-2
Summary of the Major Events in the Site History

Event	Date
Site History	
Mount Coffin leveled	1940s-1950s
Former No. 1 Cell Room built (used the mercury cell process)	1958
No. 2 Cell Room built (used the mercury cell process)	1966
Direct discharges of aqueous process waste to Columbia River ceased	1970s
Surface impoundments remediated	1972-1977
No. 2 Cell Room switched to diaphragm cells	1975
Surface impoundments no longer in use	1976
Chlorine production ceased in the former No. 1 Cell Room	1976
Eruption of Mt. St. Helens and subsequent dredging	1980s
Former No. 1 Cell Room demolished	1991
No. 1 Diffuser in Columbia River removed	1992
Shutdown of chlorine production	March 1999
RI/FS Process	
Site ranked on Hazardous Sites List	1985
Work plan submitted	May 1995
Work plan approved, implemented	June 1998
Draft RI report submitted	April 1999
Draft FS reported submitted	February 2001

12-JUL-2001



LEGEND

-------- Approximate Site Boundary

FIGURE 1-1
Location Map
WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

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SR8

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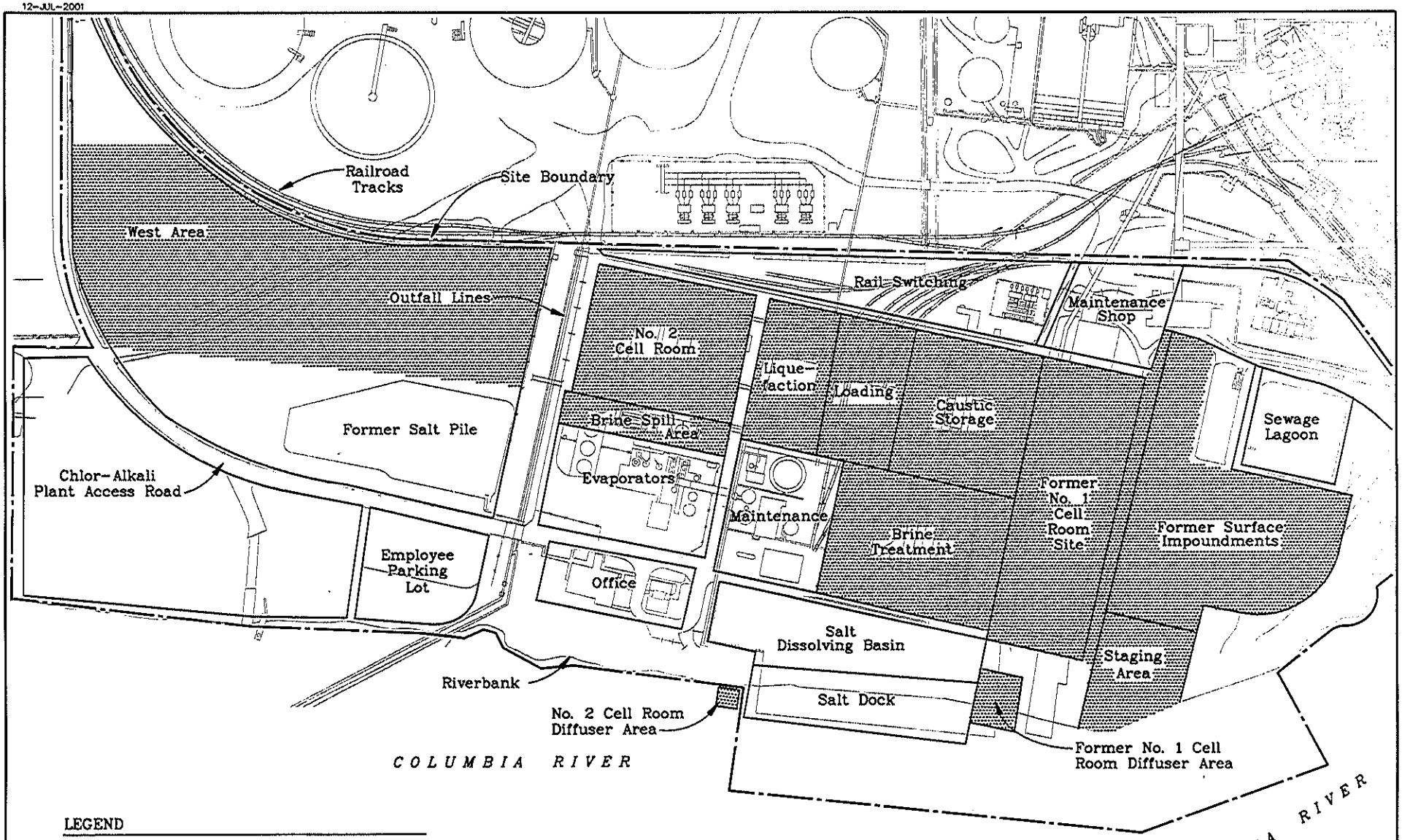

FIGURE 1-2

Site Map Showing Areas of Potential Concern

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

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SECTION 2

Study Area Investigation Activities

SECTION 2

Study Area Investigation Activities

2.1 Introduction

This section of the RI report summarizes the field tasks completed during the remedial investigation; it has been written to provide an overview of individual field tasks. The RI involved investigations for mercury of several media: soil, sediment, groundwater, and surface water.

These activities were conducted in accordance with the sampling methods and equipment and sampling handling procedures specified in the approved work plan (CH2M HILL, 1995). Field investigation tasks were conducted from September 1998 through May 1999. Specific sampling details for each sampled medium are presented in Sections 2.2 through 2.7 of this report. Appendix A of this document contains detailed descriptions of the following tasks:

- Soil sampling methods
- Monitoring well installation
- Groundwater sampling procedures
- Decontamination procedures
- Sediment sampling methods
- Surface water sampling methods

Performing all the field tasks helped in the completion of previously defined data quality objectives (DQOs) and requirements specified in the approved work plan (CH2M HILL, 1995). All laboratory analyses for sampling completed during the RI were performed by Weyerhaeuser's Analytical and Testing Services Laboratory (WATS) in Federal Way, Washington.

2.2 Soil Investigation

In identifying data needs for soil in the work plan, the following factors were considered:

- A considerable amount of data on current mercury concentrations in soil is already available. The extent of mercury in soil can, to a large extent, be determined with available data. In addition, most of the data required to define mercury migration pathways, evaluate risks, and develop and evaluate remedial alternatives are available.
- Numerous voluntary remedial actions have already been implemented at the Chlor-Alkali Plant. These actions have significantly reduced mercury concentrations in soil and/or have reduced the potential for mercury to migrate from soil to other media. As a result, potential human health and environmental risks have been reduced.

- Relatively few technically practicable remedial technologies exist for mercury in soil. This fact focuses the amount and types of data that are required for the development and evaluation of remedial action.

Based on these factors, the soil investigation was narrowly focused on collecting the following information:

- Four soil samples were collected from the brine spill area to confirm the effectiveness of previous soil removal activities from an historical spill of depleted brine solution.
- Four soil samples were collected from the former surface impoundment area to help evaluate soil remedial alternatives in the feasibility study.
- Five samples were collected from the eastern stormwater drainage ditch to determine the concentration and extent of detectable mercury concentrations in the ditch.
- A soil sample was collected from each new monitoring well (CH-7 and CH-8) to assess the mobility of mercury in the groundwater zone.

2.2.1 Soil Sampling in the Brine Spill Area

Four soil samples were collected in the brine spill area at the locations shown in Figure 2-1 on September 21, 1998. The grab split-spoon samples were collected using a hollow-stem auger, which was needed to drill through the 3 feet of asphalt and crushed rock backfill that had been placed over the original soil excavation. Samples of the underlying native soil were collected from a depth of 3 feet beneath the pavement surface. The samples collected were analyzed for total mercury (U.S. Environmental Protection Agency [EPA] Method 7471), pH (EPA Method 150.1 Modified), alkalinity (EPA Method 310.1 Modified), chloride (EPA 300.0 Modified), and sulfide (EPA 376.1 Modified) to assist in the evaluation of soil remedial technologies as well as to determine the concentration of mercury left in place following excavation. A discussion of the results can be found in Section 4 of this report.

2.2.2 Soil Sampling in the Former Surface Impoundment Area

On September 21, 1998, four soil samples were collected in the former surface impoundment area at the locations shown in Figure 2-2. The grab soil samples were collected with a split spoon at a depth of 3 feet with the use of a hollow-stem auger. The auger was used to drill through the 3 feet of crushed rock backfill placed over the top of the area. The samples collected were analyzed for pH, alkalinity, chloride, and sulfide. Mercury analysis was not performed on these samples because mercury characterization in surface and subsurface soil was completed during previous investigations. A discussion of the results can be found in Section 4 of this report.

2.2.3 Stormwater Drainage Ditch Soil Sampling

On September 22, 1998, five soil samples were collected along the length of the eastern stormwater drainage ditch at approximately 100-foot intervals. Sampling locations are shown in Figure 2-3. At the time the samples were collected, there was no surface water flow in the stormwater ditch. Samples were collected by scooping the top 0 to 6 inches of soil into laboratory-prepared bottles using a clean, disposable stainless steel spoon. Samples

were analyzed for total mercury. As required by the work plan, three samples were also analyzed for chloride, pH, alkalinity, and sulfide.

2.2.4 Wells CH-7 and CH-8 Soil Sampling

On September 9, 1998, one split-spoon sample was collected from the screened interval in the water-bearing zone of each well (CH-7 and CH-8) and analyzed for total organic carbon.

2.3 Installation of Groundwater Monitoring Wells

On September 9, 1998, two alluvial-zone groundwater monitoring wells were installed at the Weyerhaeuser site upgradient of the Chlor-Alkali Plant to further characterize the upgradient (CH-7) and cross-gradient (CH-8) extent of mercury in groundwater. Additionally, the wells were installed and sampled to further characterize mercury distribution in the alluvial groundwater zone to provide a basis for evaluating the feasibility of remedial alternatives such as hydraulic or physical containment. Monitoring Wells CH-7 and CH-8 were installed at the locations shown in Figure 2-4. Both wells were installed in accordance with the construction regulations of the state of Washington (WAC 173-160-500) and the requirements of the approved work plan (CH2M HILL, 1995). A discussion of these results can be found in Section 4 of this document. Boring and well logs for CH-7 and CH-8 can be found in Appendix B. Table 2-1 shows monitoring well and soil boring completion information.

2.4 Groundwater Investigation

In identifying data needs for groundwater in the work plan, the following factors were considered:

- A considerable amount of data on mercury concentrations in groundwater already exists. The extent of mercury in groundwater can, to a large extent, be determined using available data. In addition, most of the data required to define contaminant migration pathways, evaluate risks, and develop and evaluate remedial alternatives are available.
- Relatively few technically practicable remedial technologies exist for mercury in groundwater. This fact focuses the amount and type of data that are required for the development and evaluation of remedial action.

Based on these factors, the groundwater investigation was narrowly focused on collecting the following information:

- Five rounds of groundwater sampling events were completed on deep and shallow monitoring wells located across the site to document the mercury concentrations, pH, and specific conductance in groundwater at the Chlor-Alkali Plant. Of these five rounds, three sampling events were performed as part of the ongoing semiannual groundwater monitoring program and are included as part of this RI report. Appendix C presents historical groundwater data for 1991 through March 2000.
- Seventy-two-hour measurements of water elevations in monitoring wells and in the Columbia River were performed to assess the magnitude of tidal influences on groundwater in the basalt and alluvial zones.

2.4.1 Groundwater Sampling

From October 1998 through March 2000, semiannual groundwater level measurements were taken and groundwater sampling was completed on monitoring wells at the site. The sampling was part of the semiannual groundwater sampling that has been performed at the site since 1998 (quarterly samples were collected from 1989 to 1998). The October 1998 samples underwent more extensive analysis than is normally required in the current, Ecology-approved semiannual monitoring program, in order to meet the needs of the RI investigation. Wells HLA-1A, HLA-4A, and HLA-6A were not sampled because they were dry. Figure 2-4 shows the locations of all wells that were sampled. Field measurements collected for each sample were pH, Eh (redox potential), temperature, and specific conductance and turbidity. For each monitoring location, laboratory analyses were conducted for the following:

- Total and dissolved mercury (EPA Method 7470)
- Cations (calcium, iron, magnesium, manganese, and potassium) (EPA Method 200.7)
- Anions (nitrate, nitrite, sulfate, chloride, and fluoride) (EPA Method 300.0 and 353.2)
- Alkalinity (EPA Method 310.1)
- Sulfide (EPA Method 376.1)
- Silica (EPA Method 200.7)
- Total dissolved solids (TDS) (EPA Method 160.1) and total suspended solids (TSS) (EPA Method 160.2)

During the RI fieldwork, the groundwater samples were not filtered in the field because of the additional analysis (cations, etc.) that would be performed by the lab. Previous monitoring (from 1989 to 1998) reported dissolved mercury concentrations only and not total mercury.

The second round of RI groundwater sampling, completed in March 1999 (this was the first round for the 1999 semiannual monitoring), included water level measurements and groundwater sample collection at each well. Since March 1999, groundwater sampling has continued as part of the semiannual groundwater monitoring program. Samples were analyzed for dissolved mercury, pH, and specific conductance, in accordance with the requirements of the approved work plan (CH2M HILL, 1995). Groundwater results through March 2000 are discussed in Section 4 of this document.

2.4.2 Continuous Water Level Monitoring

On September 23, 1998, data loggers were installed in six monitoring wells (three bedrock, three alluvial) and in the Columbia River. Water levels were then monitored for 72 hours. Figure 2-5 shows the locations of wells that were monitored and the Columbia River monitoring point. The results from this monitoring are discussed in Section 3.

2.5 Sediment Investigation

From September 29 through September 30, 1998, sediment samples were collected from the Columbia River adjacent to, upstream of, and downstream of the former diffuser associated with the former No. 1 Cell Room. The purpose of the sampling was to assess the extent of mercury in the river in the vicinity of the former diffuser. The sediment was collected from

the river bottom using a petite ponar clamshell device. Figure 2-6 shows the locations where sediment samples were collected. Samples were not taken from three of the locations proposed in the work plan because the bottom substrate consisted of rocks and organic debris with too little sediment, such that a sediment sample could not be taken with the sampling device.

Seventeen sediment samples were analyzed for total mercury (EPA Method 7471), total organic carbon (TOC) (EPA Method 415.1), and grain size distribution (American Society of Testing and Materials [ASTM] D422-63). The results are discussed in Section 4.

During the preparation of the draft RI report, an abandoned diffuser associated with the No. 2 Cell Room was identified as a potential past source of discharge of mercury to the environment (similar to the former No. 1 Cell Room diffuser). No information on historical discharges from the No. 2 Cell Room diffuser to the Columbia River is available; however, the use of mercury in the No. 2 Cell Room process was discontinued in 1976. Currently, the diffuser is no longer in service.

Thirteen sediment samples were collected on May 19 and 20, 1999, from the bottom of the Columbia River adjacent to and downstream of the abandoned diffuser associated with the No. 2 Cell Room (see Figure 2-6). The objective of this sampling was to determine the presence or absence of mercury concentrations in surface sediment near this area. Sampling was conducted using a petite ponar clamshell device. Samples were not collected from one of the sample locations proposed in the field sampling plan (the location directly downstream of Sample Location H031) because the current was too swift, as a result of both river flow and tidal influences; in addition, the bottom substrate at this location was too compacted to allow a sample to be collected.

2.6 Surface Water Sampling

Between November 1998 and January 1999, flow measurements were taken and surface water sampling was completed in the eastern stormwater drainage ditch during three storm events at the discharge point to the Columbia River. The purpose of the sampling was to estimate the potential mass loading of mercury to the Columbia River via stormwater discharge. The surface water sample location is shown in Figure 2-3.

Samples were collected by filling laboratory-prepared bottles at the discharge of the outflow pipe. Surface water samples were analyzed for total mercury (EPA Method 7470). The results of this sampling are discussed in Section 4 of this report. The flow rate was calculated from a measurement taken at the end of the discharge pipe using a calibrated bucket, which was placed directly into the flow from the outflow pipe. The total volume collected was determined, and the resulting flow rate was calculated.

2.7 Topographic Survey

The stormwater drainage ditch located on the eastern portion of the plant and surrounding area were surveyed to delineate the topography of the ditch drainage and to determine the area at the Chlor-Alkali Plant that contributes runoff to the ditch. This open ditch is the only stormwater drainage ditch that discharges stormwater directly into the Columbia River

from the Chlor-Alkali Plant that is in the scope of the RI. Figure 2-7 shows the stormwater drainage ditch and the results of the survey. Elevation and location data were collected at approximately 10-foot intervals within the survey area. Section 3 of this document discusses the results of the topographic survey.

2.8 Quality Assurance/Quality Control Procedures and Review

This section presents a summary of the quality assurance/quality control (QA/QC) procedures used for the RI. These procedures are described in detail in Section 7.2 of the approved work plan (CH2M HILL, 1995) and in the sampling and analysis plan included as Appendix C of the work plan. In summary, analytical precision was assessed through the use of field and laboratory duplicate samples; accuracy was assessed through the use of surrogate, blank, and matrix spikes; and comparability was ensured through the use of standard methods within accepted holding times. Criteria for assessing laboratory data generated during the RI were the maximum sample holding times, laboratory control limits, and detection limit goals. Field procedures were assessed through the use of field equipment blanks and trip blanks. In addition, field procedures were evaluated through a field audit conducted by CH2M HILL as required by the approved work plan. Details of the QA/QC review are provided in Appendix D.

2.8.1 Data QA/QC

The majority of the data have met the QA/QC acceptance criteria, and all data are usable for the purposes outlined in the work plan.

The majority of mercury results for all samples met all QA/QC criteria for the selected QC parameters. A completeness objective of 95 percent was achieved for all samples analyzed for each parameter, based on precision and accuracy. Nonconformances with the QA/QC criteria were observed as follows:

- Four dissolved mercury and three total mercury results for groundwater samples were qualified as estimates and flagged with a "J" for positive results or with a "UJ" for nondetected results because the analysis holding times were exceeded.
- Two total mercury results for sediment samples were qualified as estimates and flagged with a "J" for positive results because the analysis holding times were exceeded.
- Five total mercury results for soil samples were qualified as biased high and flagged with a "K" for positive results because the matrix spike recovery was reported above the QC acceptance criteria.

2.8.2 Field Audit

As required by the work plan, CH2M HILL conducted field audits during the Columbia River sediment sampling events conducted on September 29, 1998 and May 19 and 20, 2000. The field audits revealed that proper decontamination techniques were being used and all equipment was in good working order. The sample collection method and sample containers used were those specified in the sampling and analysis plan (Appendix C of the work plan [CH2M HILL, 1995]). The samples were recorded on both the sample labels and the chain-of-custody forms as the samples were collected, in accordance with the work plan

requirements. Requisite QA/QC samples were collected. The samples were packed and secured prior to shipping, as required by the work plan.

Table 2-1
Well Completion and Monitoring Well Summary
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

Well ID	Unit [a]	Installation Date	Total Depth [b]	Borehole Diameter (inches)	1st Encountered Groundwater [c]	Screen Length (feet)	Screened Interval [b]	Screen Interval Elevation (Bottom-top) [c]	Approximate Top of Filter Pack [b]	MPE [d]	GSE [e]	Screened Material [f]	Well Location	Comments
MW-1	A	Jul-1987	21.5	NA	10	15	4 - 19	4.9 - 19.9	0	24.06	23.9	Sand (SP)	West Area	
MW-2	A	Jul-1987	21.5	NA	10	15	5 - 20	-3.6 - 11.4	0	17.57	16.4	Sand & Silt (SP-ML) and Sand (SP)		
MW-3	A	Jul-1987	21.5	NA	10	15	5 - 20	-3.9 - 11.1	0	17.10	16.1	Fine Sandy Silt (SP-OL) and Sand (SW/SP).		
MW-4	A	Jul-1987	26.5	NA	15	15	9 - 24	1.8 - 16.8	0	26.38	25.8	Sand (SW grading to SP)		
HLA-1A	A	Jan-91	6.8	8	3	2.8	4 - 6.8	19.1 - 21.8	3	27.63	25.8	Sand (SP) and Gravel (GP) at base.	Former No. 1 Cell Room	
HLA-1B	B	Jan-91	33	6.5	5	10	20 - 30	-4.2 - 5.8	18	27.03	25.7	Basalt, some alteration clays in fractures.		Depth to bedrock: 16 ft bgs.
HLA-2A	A	Jan-91	6.5	8	2.5	2	4.5 - 6.5	19.3 - 21.3	2	27.21	26.1	Sand (SP), trace basalt fragments.		
HLA-3A	A	Jan-91	7	8	4.5	2	5 - 7	19.3 - 21.3	2.5	26.54	25.9	Sand (SP) fine-grained & some coarse-grained angular basalt gravel.		
HLA-3B	B	Jan-91	28	6.5	3.5	10	18 - 28	-2.4 - 7.6	15	27.26	26.0	Basalt		Depth to bedrock: 4.8 ft bgs.
HLA-4A	A	Jan-91	5.5	8	3.5	1.5	4 - 5.5	20.4 - 21.9	3	27.36	25.8	Sand (SP), grades with fractured basalt, some sand & silt.		
HLA-5A	A	Jan-91	4.3	8	None	--	--	--	--	--	--	--		Backfilled, auger refusal.
HLA-6A	A	Jan-91	8	8	None	3	5 - 8	17.8 - 20.8	3	27.16	25.8	Dry, rusty brn silt, some clay, mixed w/ angular basalt pieces.		
HLA-6B	B	Jan-91	28.2	6.5	21.9	10	17 - 27	-1.1 - 8.9	15	27.32	25.8	Basalt, some alteration clays in fractures.		Depth to bedrock: 6.5 ft bgs.
HLA-7A	A	Jan-91	4	8	None	--	--	--	--	--	--	--		Depth to bedrock: 3 ft bgs.
HLA-7B	B	Jan-91	26	6.5	9	10	16 - 26	0.9 - 10.9	14	26.08	26.4	Basalt		Depth to bedrock: 3.5 ft bgs.
CH-1	A	Sep-91	17	10	3	10	5 - 15	8.3 - 18.3	2.5	25.29	23.3	Sand (SP)	Central Site	
CH-2	A	Sep-91	15	10	1	10	5 - 15	8.8 - 18.8	3	25.42	23.8	Sand (SP)	Former Surface Impoundments	
CH-3	A	Oct-91	17.5	8	12	10	7.4 - 17.4	8.3 - 18.3	3.5	25.07	25.7	Sand (SP)		Depth to bedrock: 17 ft bgs.
CH-4	A	Sep-91	22	10	15	10	11 - 21	6.2 - 16.2	9	26.30	27.2	Sand (SP)		

Table 2-1
Well Completion and Monitoring Well Summary
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

Well ID	Unit [a]	Installation Date	Total Depth [b]	Borehole Diameter (inches)	1st Encountered Groundwater [c]	Screen Length (feet)	Screened Interval [b]	Screen Interval Elevation (Bottom-top) [c]	Approximate Top of Filter Pack [b]	MPE [d]	GSE [e]	Screened Material [f]	Well Location	Comments
CH-5	A	Sep-91	15	10	3.5	10	5 - 15	10.3 - 20.3	4	27.41	25.3	Sand & Gravel (SW)	Central Site	
CH-6	A	Oct-91	32	8	17.5	11	19 - 30	-6.3 - 4.7	17	23.16	23.7	Sand (SP)	River Boundary	
CH-7	A	Sep-98	21	6	9.5	10	10 - 20	8.5 - 18.5	7.5	31.56	28.5	Silt with sand (SP), and Sand (SP)	Former No. 1 Cell Room (Background)	GSE = Concrete base.
CH-8	A	Sep-98	23	6	11	10	12 - 22	4.7 - 14.7	10	29.42	26.7	Sand (SW)		GSE = Concrete base.

Notes:

Refer to Figure 2-4 for well locations.

All wells constructed with 2-inch-diameter PVC casing.

Boreholes HLA-5A and HLA-7A backfilled after drilling.

Casing and screen constructed with flush-threaded Schedule 40 or 80 polyvinyl chloride with 0.010-inch machine-slotted screen.

a Groundwater Unit: A = Alluvial or B = Basalt.

b Feet, below ground surface (ft bgs).

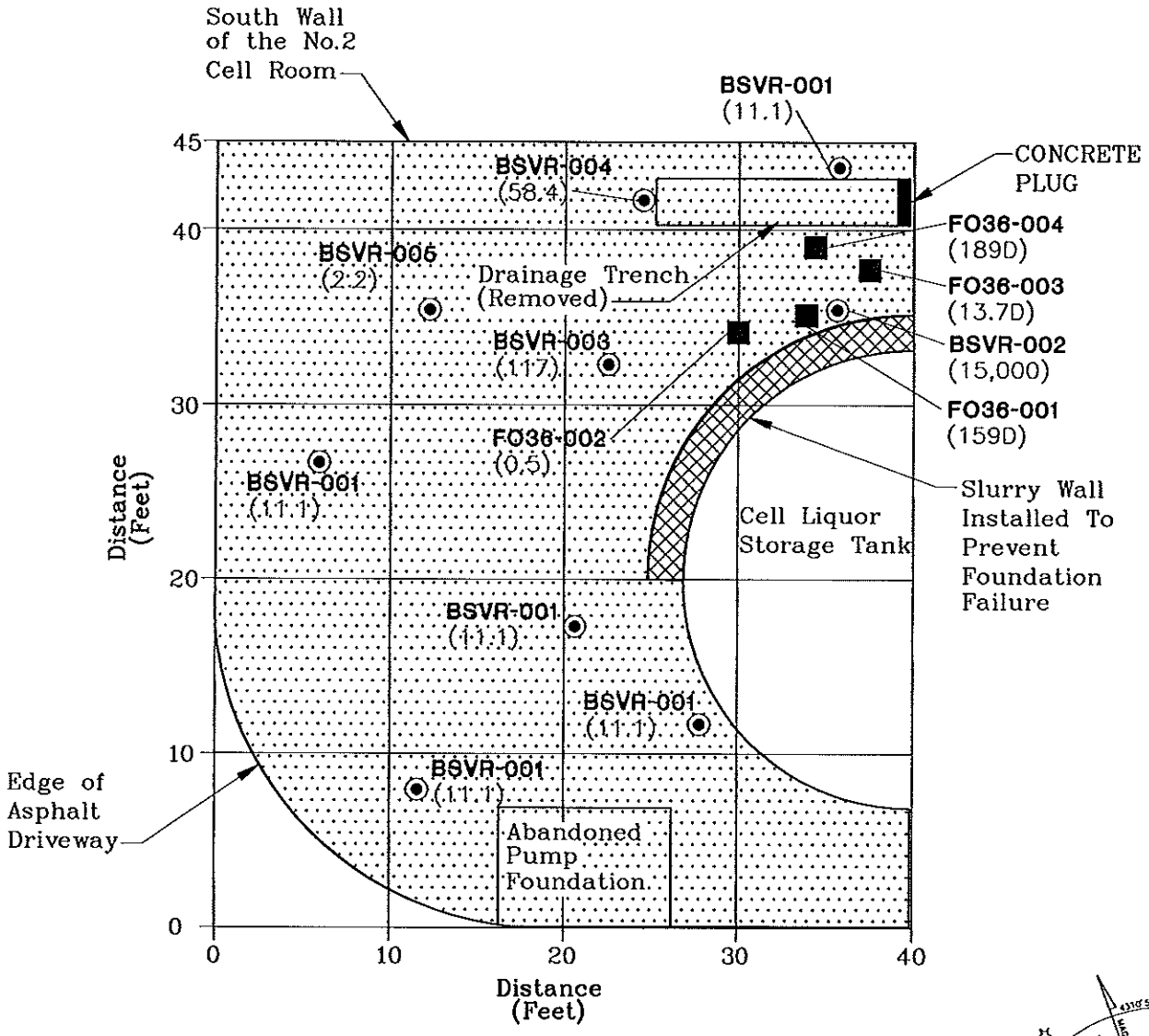
c Elevations are in feet above mean sea level (USC & GS datum).

d MPE = measuring point elevation.

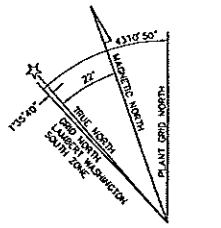
e GSE = Ground surface elevation.

f For explanation of soil classification codes, refer to ASTM D 2488, Standard Practice for Description and Identification of Soils (American Society for Testing and Materials, August 1990).

NA = Information not available.



Shaded Area Designates the Limits of the Brine Spill Cleanup Area



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◉ BSVR-001	1991 Sample locations
■ FO36-004	1998 Sample locations
(189D)	Mercury concentration in soil (mg/kg)
D	Dilution required

Note: Soil sample locations are approximate.

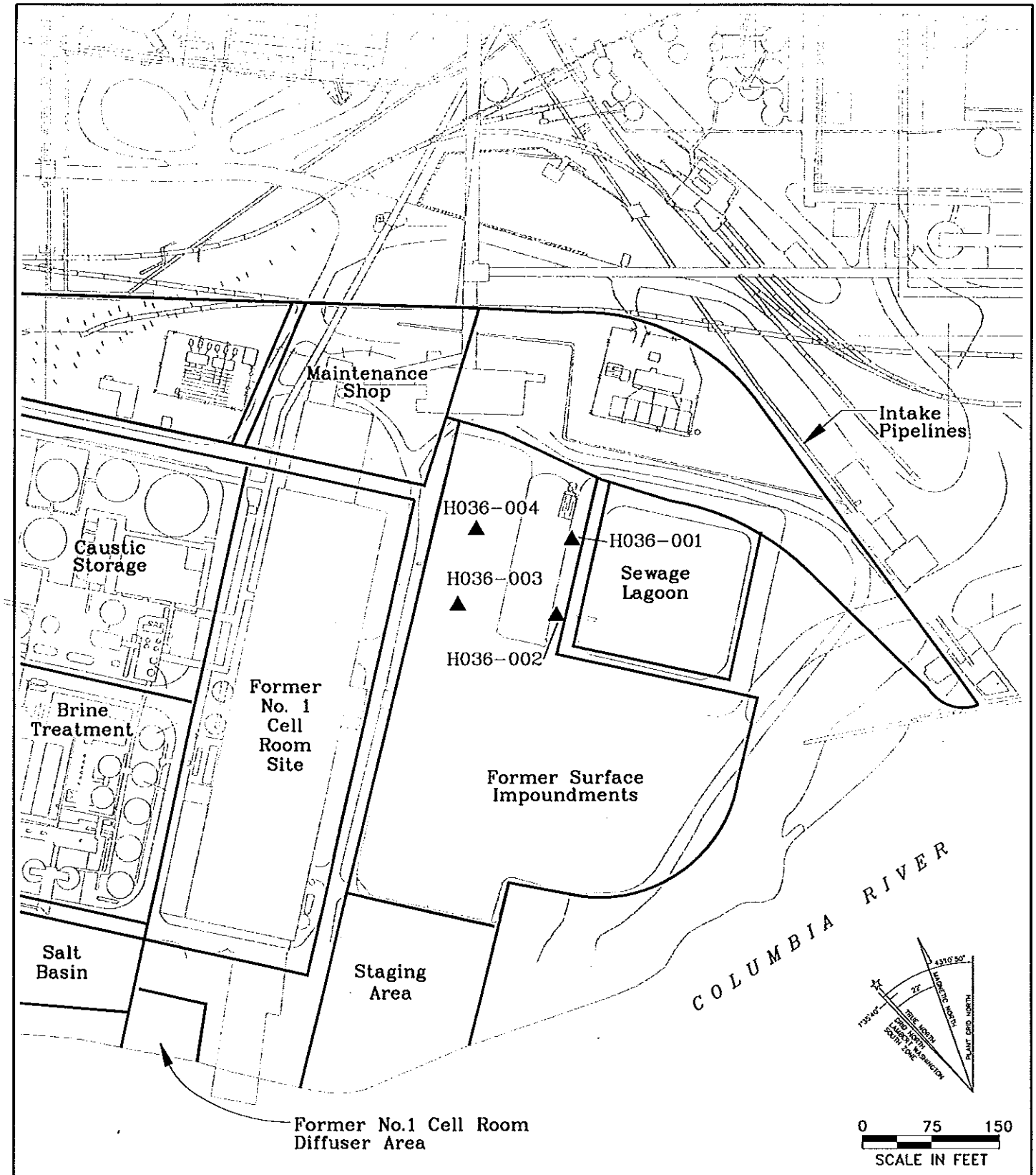
FIGURE 2-1

Soil Sample Locations in the Brine Spill Area

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

06-APR-1999



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▲ 1998 Soil sample locations

Note:
Sampling locations are approximate.

FIGURE 2-2

Soil Sample Locations in the Former Surface Impoundment Area

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

8834g014.DWG

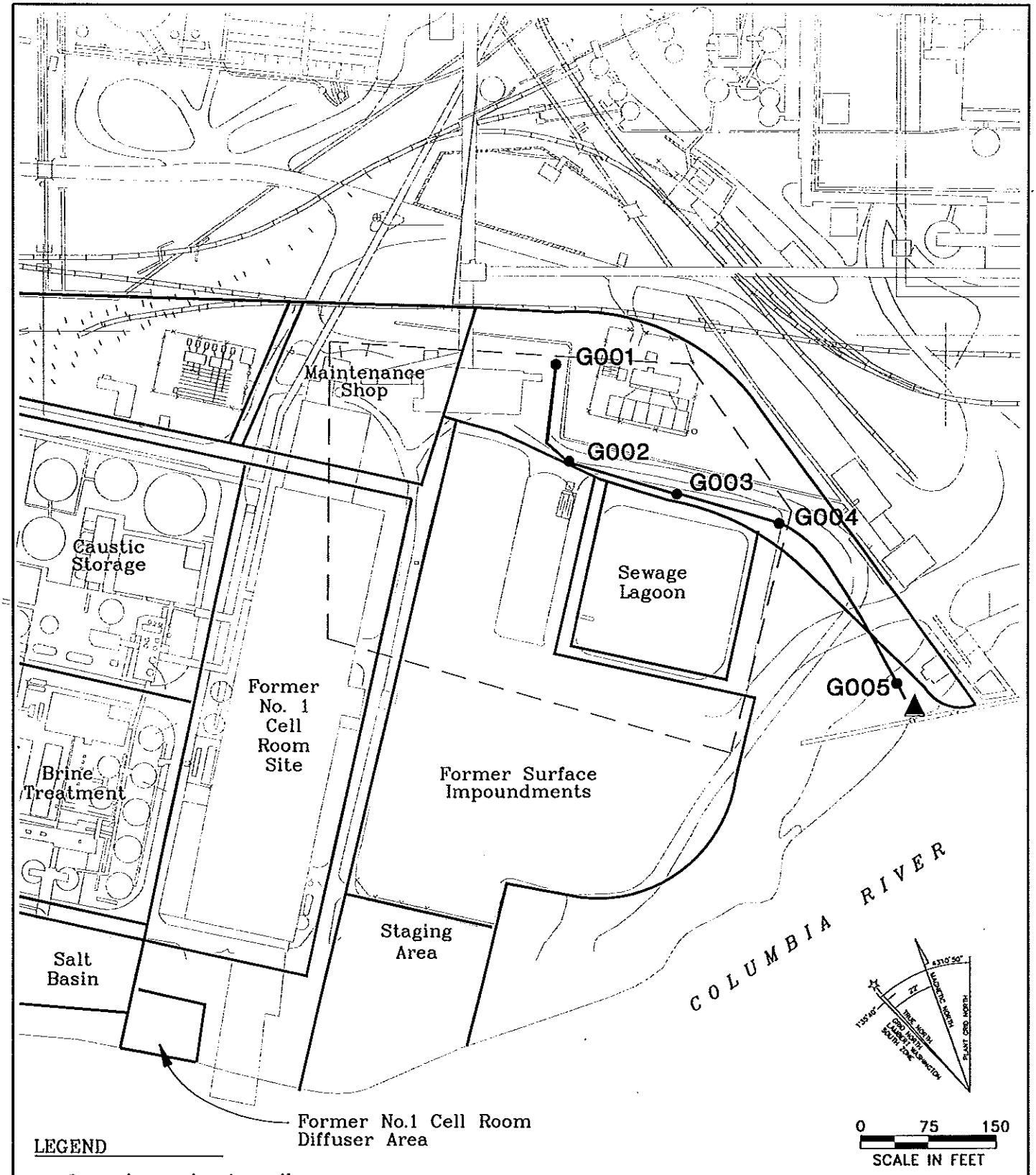


FIGURE 2-3

Surface Water and Soil Sample Locations for the Stormwater Drainage Ditch and Area of Topographic Survey

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

8834g012.DWG

19-JULY-2001

MW-1
MW-4
MW-2
MW-3
CH-1
CH-7
CH-2
CH-8
HLA-1A
HLA-1B
HLA-2A
HLA-4A
CH-5
HLA-3B
HLA-3A
CH-3
HLA-7B
CH-6
HLA-6B
HLA-6A
CH-4
COLUMBIA RIVER
COLUMBIA RIVER

LEGEND

Monitoring well

CH-6 Monitoring well identification

0 100 200
SCALE IN FEET

Note: Well locations are approximate.

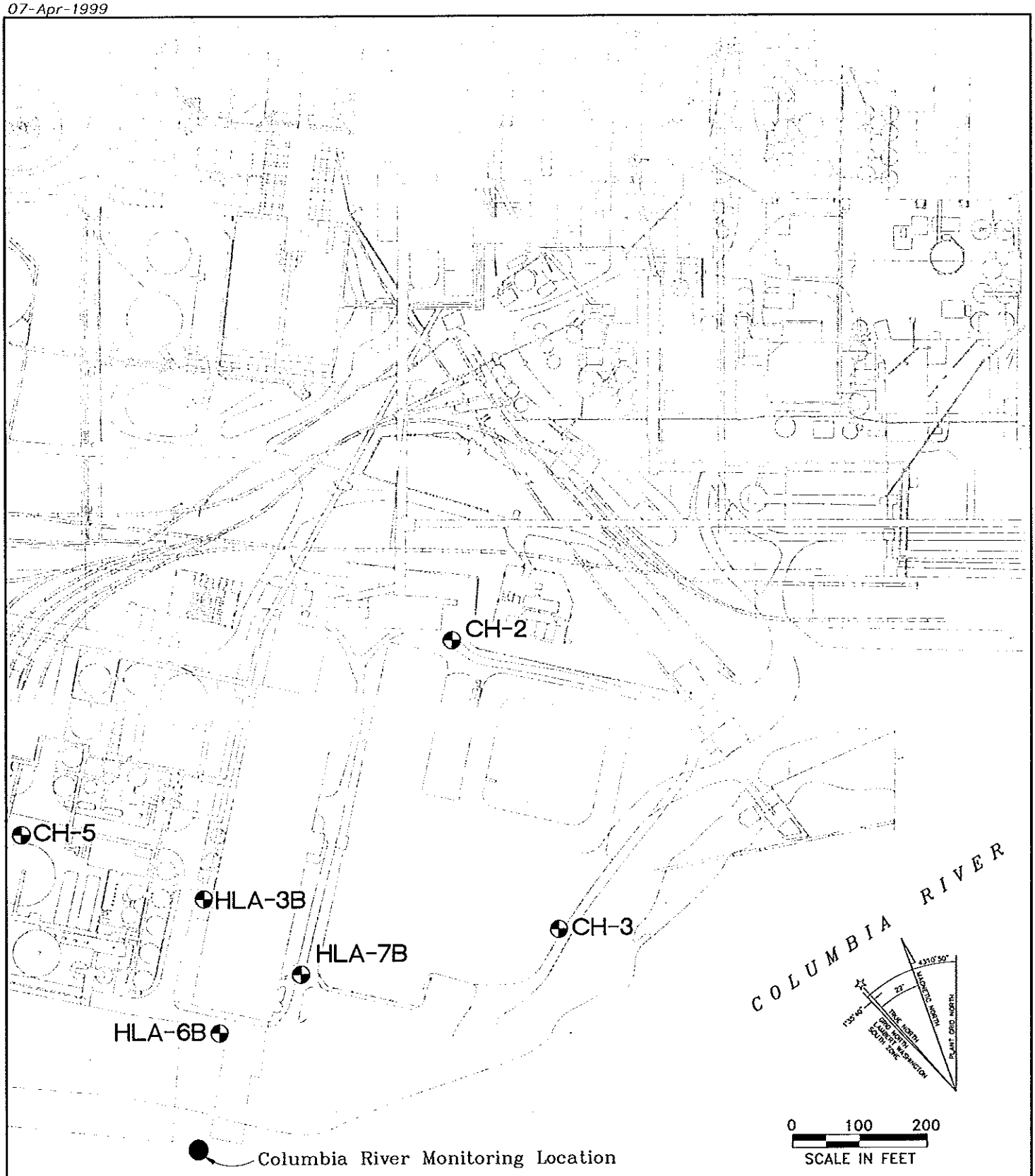
FIGURE 2-4
Monitoring Well Locations

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

P:\WEYERHAS\CAD\8834g016.dwg

07-Apr-1999



LEGEND

- Monitoring wells
- CH-6 Monitoring well identification
- Note: Well locations are approximate.

FIGURE 2-5

Continuous Water Level Monitoring Locations

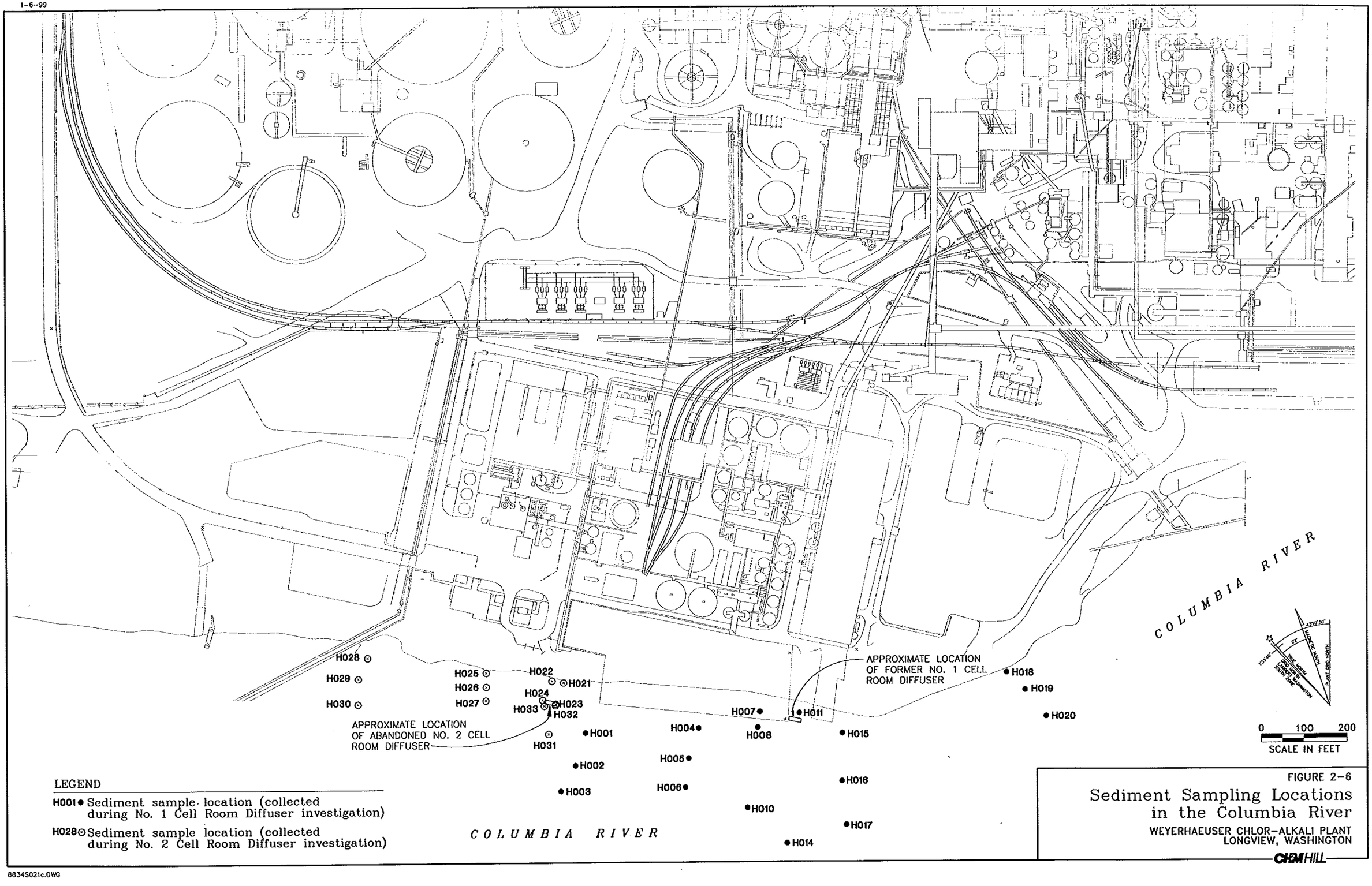
WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

P:\WEYERHAS\CAD\8834g015.dwg

SRB

1-6-99



LEGEND

H001● Sediment sample location (collected during No. 1 Cell Room Diffuser investigation)

H028⊙ Sediment sample location (collected during No. 2 Cell Room Diffuser investigation)

FIGURE 2-6

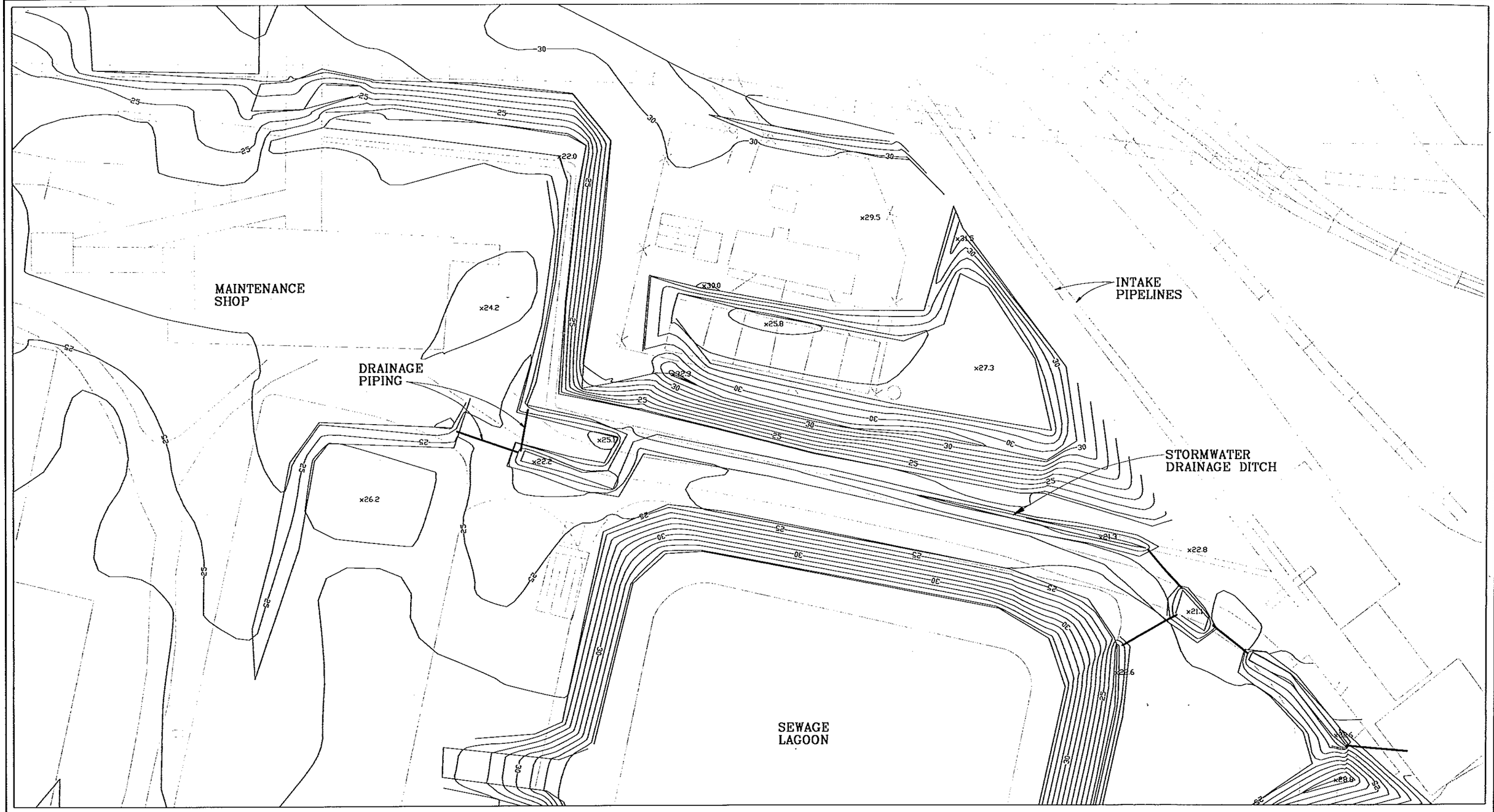
Sediment Sampling Locations in the Columbia River

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

8834S021c.DWG

06-APR-1999



LEGEND

—30— Contour Elevation
Contour Interval = 1 Foot

0 20 40 60 60
SCALE IN FEET

FIGURE 2-7
Topographical Survey of Ditch Area
WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

P:\148834\CAD\8834s006.DWG

SECTION 3

Physical Site Conceptual Model

SECTION 3

Physical Site Conceptual Model

This section presents the physical site conceptual model at the Chlor-Alkali Plant.

3.1 Geology

Site-specific stratigraphic information was obtained from geotechnical studies and hydrogeologic investigations that have been conducted at the Chlor-Alkali Plant. These include investigations by the following:

- Shannon and Wilson Inc. (1966, 1973)
- Hart Crowser & Associates Inc. (1977, 1980a, 1980b)
- Sweet-Edwards/EMCON (1985, 1987, 1988)
- Harding Lawson Associates (1991)
- CH2M HILL (1990, 1991)

The plant is situated on the floodplain of the Columbia River. In general, a surficial layer of dredged sand fill obtained from the river overlies the Columbia River alluvium. Flows of the Columbia River Basalt Group underlie the alluvium. Figure 3-1 shows the wells and boreholes used to construct two geologic cross sections for the site; the cross sections presented in Figures 3-2 and 3-3 depict the subsurface profile at the site.

Dredged sediment, gravel fill, and remains from the blasting of Mount Coffin have been placed across portions of the site over the years to provide for structural foundation support and surficial grading. Fill thickness varies from 2 to 16 feet in the vicinity of the former No. 1 Cell Room to approximately 20 feet in the west area of the Chlor-Alkali Plant.

Alluvium underlying the fill consists of silt, sandy silt, and silty sand. Borings installed in the west area indicate that the alluvial thickness ranges from 20 feet to an undetermined thickness (some of the borings did not penetrate the full thickness of the deposits). The logs of Weyerhaeuser's production wells indicate that fine-grained alluvial deposits predominate to a depth of approximately 200 feet, where the alluvium becomes generally a coarse-grained mixture of sand, gravel, and cobbles.

Basalt at the site occurs at variable depths because of the buried remnant of Mount Coffin; basalt is shallowest directly over the former peak of Mount Coffin and is deeper elsewhere. The top of Mount Coffin was removed by blasting and quarrying operations before the former No. 1 Cell Room was constructed on the highest part of the remnant of Mount Coffin, where the ground surface elevations were 22 to 23 feet, National Geodetic Vertical Datum (NGVD, 1929). Basalt occurs approximately 3 to 6 feet below ground surface (bgs) in the former No. 1 Cell Room area. Near the salt dock, basalt was encountered at depths ranging from 2 feet bgs to 40 feet bgs. Cross section A-A' (Figure 3-2) presents a geodetic northwest-southeast transect across the former No. 1 Cell Room and depicts the top of the basalt, alluvium, and fill in the subsurface. Cross Section B-B' (Figure 3-3) presents a

northeast-southwest transect showing the increasing depth to the top of the basalt west of the former No. 1 Cell Room area.

3.2 Groundwater Site Conceptual Model

Groundwater occurs in saturated portions of the alluvial and basalt aquifers at the Chlor-Alkali facility. The Columbia River, which borders the edge of the site, forms the base for the local and regional hydrologic systems. Groundwater beneath the site discharges to the Columbia River, and the river stage has a minor influence on groundwater levels beneath the site.

3.2.1 Alluvial Zone

Groundwater occurs in the upper part of the fill and alluvial deposits under unconfined conditions at depths of 8 to 15 feet bgs in the west area and 2.5 to 4.5 feet bgs in the former No. 1 Cell Room area. Groundwater elevations in the upper, finer-grained part of the alluvium monitored by site monitoring wells are controlled by seasonal variations in precipitation amounts and, to a lesser extent, by fluctuations in the Columbia River stage. Figure 3-4 presents a hydrograph of two wells screened in the alluvium (CH-3 and CH-5), two wells screened in the basalt (HLA-1B and HLA-3B), the Columbia River stage, and monthly precipitation data recorded for the Longview area since 1991.

In general, groundwater elevations tend to be highest in the spring and lowest in the late summer or early fall. Although a general relationship between precipitation, river stage, and groundwater levels is apparent in Figure 3-4, groundwater levels appear to mimic precipitation trends to a greater degree than they do the river stage. Table 3-1 lists groundwater elevations measured in monitoring wells at the plant since 1991 (refer to Figure 2-4 for the locations of these monitoring wells).

Figures 3-5 and 3-6 are potentiometric surface maps of groundwater elevations in the shallow alluvial zone across the plant for September 1999 (dry season) and March 2000 (wet season). The direction of groundwater flow varies across the site. In the central and western portions of the site, groundwater generally flows to the west-southwest, toward the Columbia River. In the eastern portion of the site, groundwater in the alluvium flows around the less permeable, buried remnant of Mount Coffin, with south-southeasterly flow east of Mount Coffin and west-southwesterly flow west of Mount Coffin. The area where the elevation of basalt exceeds 10 feet, and probably exhibits a greater effect on shallow groundwater flow, is shown with a dashed line on the potentiometric surface maps (Figures 3-5 and 3-6). The groundwater levels in the thin veneer of fill on top of the remnant of Mt. Coffin are higher than in the surrounding alluvium; this zone probably contributes a minor amount of flow to the surrounding alluvium.

Water level measurements in September 1999 and March 2000 indicate that hydraulic gradients observed in the alluvial zone at the plant vary from about 0.008 foot per foot (ft/ft) in the west area to a high of about 0.04 ft/ft near the former No. 1 Cell Room. Using the specific capacity information obtained during monitoring well purging in the modified nonequilibrium formula described by Driscoll (1986), and assuming an effective aquifer thickness of 10 feet, yields an average hydraulic conductivity of $1x10^{-2}$ centimeter per second (cm/sec), or 28 feet per day, for the alluvium at the Chlor Alkali Plant. Combining this

estimate with an assumed effective porosity of 0.2 yields a horizontal groundwater flow velocity ranging from 1 to 6 feet/day.

Below a depth of approximately 200 feet, groundwater occurs in a productive, confined aquifer that serves as a source of process water for local industry. The total thickness of this aquifer is poorly documented, but logs from production wells at the Reynolds Metals Company facility immediately west of the Chlor-Alkali Plant suggest that the aquifer is at least 130 feet thick. A "brown shale" layer reported to occur at a depth of approximately 400 feet in one Reynolds well may represent the lower extent of the confined aquifer. The depth to water in the confined aquifer ranges from the ground surface to approximately 20 bgs. Myers (1970) found that water levels in the confined aquifer are strongly affected by the stage of the Columbia River, and deep wells have been reported to flow at the surface during periods of extremely high river stage. Specific capacity measurements reported on the logs for Weyerhaeuser's production wells suggest that the transmissivity of the confined aquifer ranges from 100,000 gallons per day per foot (gpd/ft) to 1 million gpd/ft.

3.2.2 Basalt Zone

Because of its low permeability, groundwater flux in the basalt remnant of Mount Coffin is less than in the surrounding alluvium. In effect, the basalt remnant acts as an obstruction around which alluvial groundwater flows.

Harding Lawson Associates (1991) completed slug tests on wells HLA-3B and HLA-6B and determined a hydraulic conductivity range for the basalt of 6×10^{-7} cm/sec to 4×10^{-6} cm/sec (2×10^{-3} to 1×10^{-2} ft/day). Recovery data from a short-term pumping test on HLA-1B yielded an estimated hydraulic conductivity of 9×10^{-4} cm/sec (3 ft/day). This range is one to three orders of magnitude less than the hydraulic conductivity calculated for the shallow alluvium. Using an average hydraulic conductivity of 6×10^{-3} ft /day (from the HLA-3B and HLA-6B slug tests), a hydraulic gradient of 0.03 for March 2000 (taken from groundwater elevations in Figure 3-7), and an assumed effective porosity of 5 percent, a flow velocity of 0.004 ft/day (approximately 1.5 feet per year) is calculated for the basalt zone.

3.2.3 Vertical Hydraulic Gradients

Table 3-2 presents calculated vertical gradients from well pairs HLA-1A and HLA-1B and HLA-3A and HLA-3B. Both well pairs are located in the vicinity of the former No. 1 Cell Room. A downward vertical gradient that averages approximately 0.005 ft/ft (March 1999 and March 2000) is observed in the HLA-3 well pair, although an upward gradient has been observed on two occasions (April 1992 and October 1998). In the HLA-1 well pair, the vertical gradient between the basalt and alluvial zone varies from upward to downward, although gradients generally are upward. A maximum upward gradient of 0.02 ft/ft and a maximum downward gradient of 0.01 ft/ft have been observed since collection of water level data began in 1991.

3.2.4 Continuous Groundwater Level Monitoring

To evaluate the hydraulic connection between the basalt and alluvial groundwater zones and the Columbia River water levels, three alluvial monitoring wells (CH-2, CH-3, and CH-5), three basalt monitoring wells (HLA-3B, HLA-6B, and HLA-7B), and the Columbia

River were monitored continuously for 72 hours. Locations of wells that were monitored and the Columbia River monitoring location are shown on Figure 2-5. In both zones, groundwater elevations showed very minor fluctuations in response to semi-diurnal tidal fluctuations in river stage of up to 4 feet. Figures 3-8 and 3-9 are hydrographs of water levels measured during this period. The results indicate that a limited hydraulic connection exists between the Columbia River and the shallow alluvial and basalt zones in the vicinity of the Weyerhaeuser Chlor-Alkali plant. Basalt Monitoring Wells HLA-3B, HLA-6B, and HLA-7B all responded with about 0.01 ft of measured change to 4 feet of change in the Columbia River. Within the alluvial wells, no measured change could be observed in the data sets. The combination of relatively low permeability and unconfined aquifer conditions at the Chlor-Alkali facility cause the shallow aquifer to be inefficient at transmitting short-term tidal fluctuations in river stage inland; however, longer-term seasonal variations in river stage are observed in monitoring wells at the site.

3.3 Surface Water and Sediment Site Conceptual Model

Two surface water drainage features investigated during the RI are located on or adjacent to the Weyerhaeuser Chlor-Alkali Plant:

- The Columbia River, which borders the Chlor-Alkali Plant along the entire southwest boundary.
- A stormwater drainage ditch located near the sanitary lagoon and former surface impoundment. This ditch discharges to the Columbia River.

The depression surrounding the outfall lines collects stormwater from adjacent areas and discharges directly to the Columbia River. This depression was identified in the work plan (CH2M HILL, 1995) but was not investigated during the RI because it does not receive runoff from unpaved areas that have mercury in soil.

3.3.1 Columbia River

The Columbia River is the main surface water drainage feature adjacent to the site. It is approximately 2,500 feet wide near the plant and ranges in depth from approximately 34 feet to 48 feet (U.S. Army Corps of Engineers, 1997). The river stage is affected by both tidal fluctuations and changes in flow caused by precipitation runoff and releases from Bonneville Dam. The main navigational channel ranges from 40 feet to 46 feet deep and is located approximately 1,300 feet from the shore near the plant (U.S. Army Corps of Engineers, 1997). The depositional characteristics on this section of the river are unknown because detailed bathymetric data are unavailable. Observations during sediment sampling indicate that sediments adjacent to the Chlor-Alkali Plant are a medium- to fine-grained sand with some small, interspersed pebbles. The exception to this was closer to shore on the east end of the salt dock (near the former No. 1 Cell Room diffuser and abandoned No. 2 Cell Room Diffuser). Sediments in these locations are sparse and are covered with larger pebbles, rocks, and organic debris. The high water flow also inhibits sediment deposition.

3.3.2 Stormwater Drainage Ditch

The stormwater drainage ditch receives runoff from an area near the Maintenance Building, the Hog Fuel Surge Bin, and the freshwater intake pipelines. The ditch is dry during most of the year and flows only during significant storm events. Because the ditch rarely flows and generally does not contain stagnant surface water, the ditch does not exhibit depositional characteristics.

3.3.3 Topographic Survey

A topographic survey was completed on the area surrounding the eastern stormwater drainage ditch to determine whether the area of the former No. 1 Cell Room and the former surface impoundment area contribute runoff to the ditch. The eastern ditch is the only stormwater ditch at the plant that could contribute mercury to the river. Figure 2-3 shows the location of the ditch and the surrounding area, while Figure 2-7 shows the results of the survey. The survey and a visual inspection of the area during a rainfall event indicate that only part of the area actually drains directly into the drainage ditch; a portion of the area drains away from the ditch and gets collected in storm drains near the ditch that are a part of the plant's stormwater collection system. Therefore, only a portion of the water from the area around the former surface impoundment area is discharged to the Columbia River through the stormwater drainage ditch.

Table 3-1
Monitoring Well Groundwater Elevation Data Summary
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

	MW-1		MW-2		MW-3		MW-4		HLA-1A *a*		HLA-1B		HLA-2A		HLA-3A		HLA-3B		HLA-4A *b*		HLA-6A	HLA-6B		HLA-7B	
MPE	24.06		17.57		17.10		26.38		27.63		27.03		27.21		26.54		27.26		27.36		27.16	27.32		26.08	
Location	Western Site Area								Former No. 1 Cell Room Area																
Date	DTW	ELEV	DTW	ELEV	DTW	ELEV	DTW	ELEV	DTW	ELEV	DTW	ELEV	DTW	ELEV	DTW	ELEV	DTW	ELEV	DTW	ELEV	DTW	DTW	ELEV	DTW	ELEV
11/06/91	11.19	12.87	10.53	7.04	9.45	7.65	15.27	11.11	5.50	22.13	4.79	22.24	5.10	22.11	3.94	22.60	5.21	22.05	5.05	22.31	DRY	11.35	15.97	8.30	17.78
01/20/92	9.39	14.67	9.37	8.20	8.92	8.18	13.98	12.40	5.25	22.38	4.90	22.13	4.66	22.55	3.45	23.09	4.55	22.71	5.15	22.21	DRY	11.45	15.87	7.92	18.16
04/20/92	9.35	14.71	9.10	8.47	8.35	8.75	14.08	12.30	5.69	21.94	5.11	21.92	5.33	21.88	5.31	21.23	4.18	23.08	5.35	22.01	DRY	11.43	15.89	8.63	17.45
07/20/92	10.49	13.57	10.59	6.98	10.23	6.87	15.15	11.23	7.22	20.41	6.72	20.31	6.84	20.37	5.62	20.92	6.54	20.72	DRY		DRY	11.55	15.77	9.48	16.60
11/16/92	11.59	12.47	10.70	6.87	9.97	7.13	15.18	11.20	7.55	20.08	7.00	20.03	7.06	20.15	5.80	20.74	DRY		6.70	20.66	DRY	11.58	15.74	9.32	16.76
02/01/93	9.75	14.31	9.36	8.21	8.75	8.35	14.06	12.32	5.31	22.32	4.77	22.26	4.76	22.45	3.38	23.16	4.56	22.70	5.04	22.32	DRY	11.43	15.89	7.83	18.25
04/22/93	10.00	14.06	9.15	8.42	8.32	8.78	14.03	12.35	5.85	21.78	5.27	21.76	5.27	21.94	3.89	22.65	5.02	22.24	5.49	21.87	DRY	11.50	15.82	8.47	17.61
07/22/93	11.35	12.71	10.10	7.47	9.02	8.08	10.10	16.28	6.90	20.73	6.30	20.73	6.30	20.91	4.82	21.72	5.82	21.44	6.55	20.81	DRY	11.45	15.87	9.22	16.86
11/22/93	10.87	13.19	10.54	7.03	10.15	6.95	15.12	11.26	DRY		7.43	19.60	7.43	19.78	5.57	20.97	6.48	20.78	DRY		DRY	11.50	15.82	9.75	16.33
01/25/94	9.70	14.36	9.79	7.78	9.43	7.67	14.04	12.34	6.10	21.53	5.52	21.51	5.66	21.55	3.95	22.59	5.00	22.26	5.73	21.63	DRY	11.45	15.87	9.00	17.08
04/26/94	10.96	13.10	9.77	7.80	9.05	8.05	14.44	11.94	6.90	20.73	6.32	20.71	6.79	20.42	4.61	21.93	5.68	21.58	6.55	20.81	DRY	11.45	15.87	8.53	17.55
07/19/94	11.52	12.54	10.78	6.79	10.49	6.61	15.18	11.20	DRY		7.30	19.73	DRY		5.55	20.99	6.60	20.66	DRY		DRY	11.36	15.96	9.22	16.86
11/15/94	9.62	14.44	9.01	8.56	8.12	8.98	15.65	10.73	7.10	20.53	6.27	20.76	6.72	20.49	5.09	21.45	5.97	21.29	6.46	20.90	DRY	11.40	15.92	8.19	17.89
01/11/95	8.82	15.24	8.28	9.29	7.82	9.28	13.83	12.55	4.96	22.67	4.48	22.55	4.51	22.70	3.13	23.41	4.28	22.98	4.74	22.62	DRY	11.45	15.87	8.09	17.99
04/12/95	9.21	14.85	8.92	8.65	8.48	8.62	14.03	12.35	5.98	21.65	5.27	21.76	5.75	21.46	3.92	22.62	5.08	22.18	5.82	21.54	DRY	11.43	15.89	8.10	17.98
07/19/95	9.48	14.58	9.40	8.17	8.83	8.27	14.49	11.89	7.11	20.52	6.66	20.37	6.60	20.61	4.92	21.62	6.07	21.19	DRY		DRY	11.79	15.53	8.97	17.11
11/29/95	9.80	14.26	7.23	10.34	6.22	10.88	13.34	13.04	5.20	22.43	3.70	23.33	5.16	22.05	3.41	23.13	4.59	22.67	4.02	23.34	DRY	11.59	15.73	8.64	17.44
01/17/96	8.38	15.68	6.55	11.02	6.84	10.26	13.34	13.04	5.33	22.30	4.48	22.55	5.17	22.04	3.45	23.09	4.68	22.58	4.65	22.71	DRY	11.97	15.35	13.50	12.58
04/10/96	9.06	15.00	7.68	9.89	7.87	9.23	13.88	12.50	6.17	21.46	5.40	21.63	6.14	21.07	4.07	22.47	5.21	22.05	5.53	21.83	DRY	11.69	15.63	12.35	13.73
07/17/96	10.43	13.63	8.80	8.77	8.52	8.58	14.53	11.85	7.14	20.49	6.75	20.28	7.18	20.03	4.69	21.85	5.74	21.52	DRY		DRY	11.75	15.57	13.03	13.05
11/12/96	9.31	14.75	9.38	8.19	9.12	7.98	13.92	12.46	6.56	21.07	5.76	21.27	6.05	21.16	3.89	22.65	4.95	22.31	6.02	21.34	DRY	11.72	15.60	9.07	17.01
01/15/97	7.36	16.70	4.75	12.82	5.52	11.58	11.69	14.69	5.05	22.58	4.41	22.62	4.68	22.53	2.98	23.56	4.06	23.20	4.49	22.87	DRY	11.69	15.63	9.24	16.84
04/14/97	8.43	15.63	7.17	10.40	7.59	9.51	13.56	12.82	5.72	21.91	4.65	22.38	5.48	21.73	3.85	22.69	4.92	22.34	5.04	22.32	DRY	11.71	15.61	8.53	17.55
08/12/97	10.15	13.91	9.12	8.45	9.02	8.08	14.44	11.94	7.11	20.52	6.65	20.38	6.91	20.30	4.74	21.80	5.87	21.39	DRY		DRY	11.99	15.33	10.46	15.62
03/10/98	9.05	15.01	7.52	10.05	7.91	9.19	13.75	12.63	5.64	21.99	4.59	22.44	5.40	21.81	3.37	23.17	4.51	22.75	4.68	22.68	DRY	11.65	15.67	8.58	17.50
10/06/98	10.58	13.48	10.60	6.97	9.98	7.12	14.74	11.64	DRY		NM		7.23	19.98	4.89	21.65	5.49	21.77	DRY		DRY	12.12	15.20	11.07	15.01
03/23/99	8.35	15.71	6.75	10.82	6.81	10.29	13.20	13.18	5.58	22.05	4.91	22.12	5.25	21.96	3.58	22.96	4.37	22.89	4.82	22.54	DRY	11.82	15.50	8.35	17.73
09/21/99	10.80	13.26	10.53	7.04	10.36	6.74	14.85	11.53	7.85	19.78	7.67	19.36	7.39	19.82	5.20	21.34	6.03	21.23	DRY		DRY	12.06	15.26	9.43	16.65
03/27/00	9.83	14.23	8.24	9.33	8.22	8.88	13.87	12.51	6.24	21.39	5.54	21.49	6.12	21.09	4.20	22.34	5.01	22.25	5.63	21.73	DRY	11.76	15.56	11.00	15.08

Notes:

a Bottom elevation of HLA-1A = 19 feet. Groundwater elevation in this location is actually less than this value. Posted for plotting purposes.

b Bottom elevation of HLA-4A = 20.3 feet. Groundwater elevation in this location is actually less than this value. Posted for plotting purposes.

MPE = Measuring Point Elevation (feet, 1929 NGVD), corresponding to top of PVC well casing.

DTW = Depth to groundwater (feet below MPE).

NM = Not Measured.

ELEV = Groundwater elevation (feet, NGVD 1929). Groundwater elevation = MPE - DTW.

Table 3-1
Monitoring Well Groundwater Elevation Data Summary
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

	CH-1		CH-2		CH-3		CH-4		CH-5		CH-6		CH-7		CH-8		RIVER (before)		RIVER (after)	
MPE	25.29		25.42		25.07		26.30		27.41		23.16		31.56		29.42		23.82		23.82	
Location	Central Site		Former Surface Impoundments Area						Central Site		Adjacent to River		Background, Former No. 1 Cell Room / Surface Imoundments				Columbia River			
Date	DTW	ELEV	DTW	ELEV	DTW	ELEV	DTW	ELEV	DTW	ELEV	DTW	ELEV	DTW	ELEV	DTW	ELEV	DTW	ELEV	DTW	ELEV
11/06/91	10.34	14.95	3.13	22.29	8.57	16.50	12.87	13.43	10.13	17.28	16.20	6.96					16.10	7.72	18.08	5.74
01/20/92	9.33	15.96	3.29	22.13	8.29	16.78	15.88	10.42	10.38	17.03	16.15	7.01					20.48	3.34	18.57	5.25
04/20/92	9.22	16.07	3.17	22.25	8.32	16.75	16.15	10.15	10.40	17.01	15.57	7.59					18.37	5.45	19.72	4.10
07/20/92	10.17	15.12	3.49	21.93	8.57	16.50	16.93	9.37	11.10	16.31	16.89	6.27					19.32	4.50	20.28	3.54
11/16/92	10.22	15.07	3.92	21.50	8.98	16.09	16.89	9.41	10.76	16.65	16.66	6.50					18.39	5.43	19.63	4.19
02/01/93	7.84	17.45	3.57	21.85	8.42	16.65	16.63	9.67	7.74	19.67	15.62	7.54					17.59	6.23	18.34	5.48
04/22/93	9.68	15.61	4.02	21.40	8.66	16.41	16.77	9.53	8.75	18.66	15.77	7.39					18.61	5.21	19.60	4.22
07/22/93	10.20	15.09	5.00	20.42	8.97	16.10	16.78	9.52	10.90	16.51	16.20	6.96					18.20	5.62	19.20	4.62
11/22/93	10.65	14.64	5.63	19.79	9.57	15.50	16.95	9.35	10.88	16.53	17.51	5.65					20.45	3.37	NM	NM
01/25/94	9.65	15.64	3.93	21.49	8.82	16.25	16.53	9.77	9.72	17.69	16.22	6.94					19.88	3.94	17.34	6.48
04/26/94	9.90	15.39	4.95	20.47	9.03	16.04	16.72	9.58	10.82	16.59	15.87	7.29					19.29	4.53	20.76	3.06
07/19/94	11.03	14.26	3.79	21.63	8.94	16.13	16.65	9.65	11.05	16.36	16.15	7.01					21.54	2.28	NM	NM
11/15/94	7.58	17.71	2.97	22.45	8.63	16.44	16.59	9.71	7.88	19.53	16.28	6.88					20.65	3.17	17.17	6.65
01/11/95	8.56	16.73	4.85	20.57	8.41	16.66	16.52	9.78	10.54	16.87	15.54	7.62					15.25	8.57	NM	NM
04/12/95	9.08	16.21	3.62	21.80	8.48	16.59	16.47	9.83	10.71	16.70	16.60	6.56					20.34	3.48	19.51	4.31
07/19/95	7.94	17.35	5.36	20.06	9.00	16.07	16.70	9.60	7.75	19.66	15.92	7.24					18.28	5.54	18.11	5.71
11/29/95	7.25	18.04	2.31	23.11	8.05	17.02	14.05	12.25	7.84	19.57	11.60	11.56					11.50	12.32	NM	NM
01/17/96	8.14	17.15	2.77	22.65	8.20	16.87	16.38	9.92	10.65	16.76	13.84	9.32					13.88	9.94	13.07	10.75
04/10/96	8.62	16.67	3.75	21.67	8.55	16.52	16.39	9.91	10.63	16.78	15.50	7.66					16.50	7.32	15.78	8.04
07/17/96	9.56	15.73	5.81	19.61	8.85	16.22	16.26	10.04	10.62	16.79	15.55	7.61					17.34	6.48	NM	NM
11/12/96	8.25	17.04	3.90	21.52	8.75	16.32	16.45	9.85	10.61	16.80	15.45	7.71					19.63	4.19	20.18	3.64
01/15/97	7.69	17.60	3.12	22.30	8.06	17.01	15.82	10.48	10.21	17.20	13.40	9.76					13.97	9.85	15.40	8.42
04/14/97	6.60	18.69	3.01	22.41	8.27	16.80	16.44	9.86	10.09	17.32	14.96	8.20					16.95	6.87	NM	NM
08/12/97	8.12	17.17	5.08	20.34	8.80	16.27	16.11	10.19	10.40	17.01	14.86	8.30					18.50	5.32	18.45	5.37
03/10/98	7.87	17.42	2.65	22.77	8.11	16.96	16.16	10.14	10.33	17.08	15.54	7.62					18.80	5.02	17.78	6.04
10/06/98	6.06	19.23	5.67	19.75	9.15	15.92	16.74	9.56	10.45	16.96	NM		14.87	16.69	14.84	14.58	15.66	8.16	NM	NM
03/23/99	7.50	17.79	2.61	22.81	8.05	17.02	16.22	10.08	10.10	17.31	NM		15.23	16.33	14.02	15.40	15.60	8.22	NM	NM
09/21/99	8.16	17.13	5.39	20.03	9.20	15.87	16.50	9.80	10.30	17.11	16.40	6.76	15.30	16.26	14.17	15.25	20.24	3.58	NM	NM
03/27/00	4.01	21.28	3.13	22.29	8.30	16.77	16.38	9.92	10.29	17.12	16.27	6.89	15.25	16.31	14.18	15.24	20.40	3.42	NM	NM

Notes:

a Bottom elevation of HLA-1A = 19 feet. Groundwater elevation in this location is actually less than this value. Posted for plotting purposes.

b Bottom elevation of HLA-4A = 20.3 feet. Groundwater elevation in this location is actually less than this value. Posted for plotting purposes.

MPE = Measuring Point Elevation (feet, 1929 NGVD), corresponding to top of PVC well casing.

DTW = Depth to groundwater (feet below MPE).

NM = Not Measured.

ELEV = Groundwater elevation (feet, NGVD 1929). Groundwater elevation = MPE - DTW.

Table 3-2
Vertical Hydraulic Gradient Estimates
Alluvial Zone to Basalt Zone
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

MPE:	HLA-1A 27.63		HLA-1B 27.03		Vertical Separation: *a* 19.6 feet	HLA-3A 26.54		HLA-3B 27.26		Vertical Separation: *a* 17 feet
Screen Interval (feet bgs)	4 - 6.8		20 - 30		Vertical Hydraulic Gradient *b*	5 - 7		18 - 28		Vertical Hydraulic Gradient *b*
Date	DTW	ELEV	DTW	ELEV		DTW	ELEV	DTW	ELEV	
11/06/91	5.50	22.13	4.79	22.24	0.0056	3.94	22.60	5.21	22.05	-0.0324
01/20/92	5.25	22.38	4.90	22.13	-0.0128	3.45	23.09	4.55	22.71	-0.0224
04/20/92	5.69	21.94	5.11	21.92	-0.0010	5.31	21.23	4.18	23.08	0.1088
07/20/92	7.22	20.41	6.72	20.31	-0.0051	5.62	20.92	6.54	20.72	-0.0118
11/16/92	7.55	20.08	7.00	20.03	-0.0026	5.80	20.74	DRY	N/A	N/A
02/01/93	5.31	22.32	4.77	22.26	-0.0031	3.38	23.16	4.56	22.70	-0.0271
04/22/93	5.85	21.78	5.27	21.76	-0.0010	3.89	22.65	5.02	22.24	-0.0241
07/22/93	6.90	20.73	6.30	20.73	0.0000	4.82	21.72	5.82	21.44	-0.0165
11/22/93	DRY	NA	7.43	19.60	N/A	5.57	20.97	6.48	20.78	-0.0112
01/25/94	6.10	21.53	5.52	21.51	-0.0010	3.95	22.59	5.00	22.26	-0.0194
04/26/94	6.90	20.73	6.32	20.71	-0.0010	4.61	21.93	5.68	21.58	-0.0206
07/19/94	DRY	NA	7.30	19.73	N/A	5.55	20.99	6.60	20.66	-0.0194
11/15/94	7.10	20.53	6.27	20.76	0.0117	5.09	21.45	5.97	21.29	-0.0094
01/11/95	4.96	22.67	4.48	22.55	-0.0061	3.13	23.41	4.28	22.98	-0.0253
04/12/95	5.98	21.65	5.27	21.76	0.0056	3.92	22.62	5.08	22.18	-0.0259
07/19/95	7.11	20.52	6.66	20.37	-0.0077	4.92	21.62	6.07	21.19	-0.0253
11/29/95	5.20	22.43	3.70	23.33	0.0459	3.41	23.13	4.59	22.67	-0.0271
01/17/96	5.33	22.30	4.48	22.55	0.0128	3.45	23.09	4.68	22.58	-0.0300
04/10/96	6.17	21.46	5.40	21.63	0.0087	4.07	22.47	5.21	22.05	-0.0247
07/17/96	7.14	20.49	6.75	20.28	-0.0107	4.69	21.85	5.74	21.52	-0.0194
11/12/96	6.56	21.07	5.76	21.27	0.0102	3.89	22.65	4.95	22.31	-0.0200
01/15/97	5.05	22.58	4.41	22.62	0.0020	2.98	23.56	4.06	23.20	-0.0212
04/14/97	5.72	21.91	4.65	22.38	0.0240	3.85	22.69	4.92	22.34	-0.0206
08/12/97	7.11	20.52	6.65	20.38	-0.0071	4.74	21.80	5.87	21.39	-0.0241
03/10/98	5.64	21.99	4.59	22.44	0.0230	3.37	23.17	4.51	22.75	-0.0247
10/06/98	DRY	NA	NA	NA	N/A	4.89	21.65	5.49	21.77	0.0071
03/23/99	5.58	22.05	4.91	22.12	0.0036	3.58	22.96	4.37	22.89	-0.0041
09/21/99	7.85	19.78	7.67	19.36	-0.0214	5.20	21.34	6.03	21.23	-0.0065
03/27/00	6.24	21.39	5.54	21.49	0.0051	4.20	22.34	5.01	22.25	-0.0053

Notes:

MPE = Measuring point elevation (feet).

DTW = Depth to water in feet below measuring point.

ELEV = Groundwater Elevation (feet, NGVD). Groundwater Elevation = MPE - DTW.

a Vertical separation is the vertical distance (feet) between the midpoints of the screened intervals of the monitoring wells.

b Vertical hydraulic gradient (foot/foot) is calculated as the groundwater elevation difference (shallow-deep) divided by the vertical separation. A positive vertical hydraulic gradient value is upward; a negative vertical hydraulic gradient value is downward.

SR8

13-DEC-1999

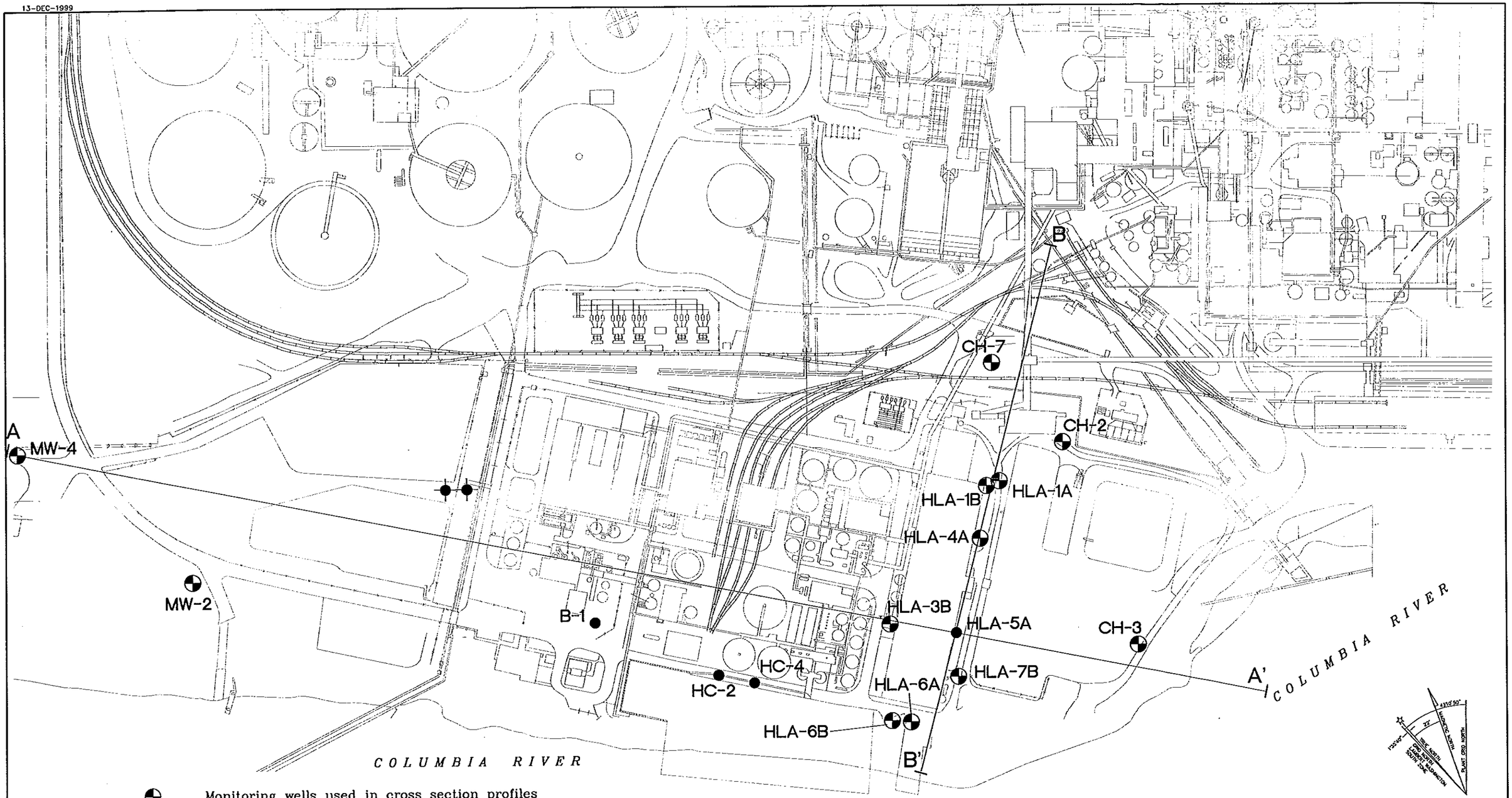


FIGURE 3-1

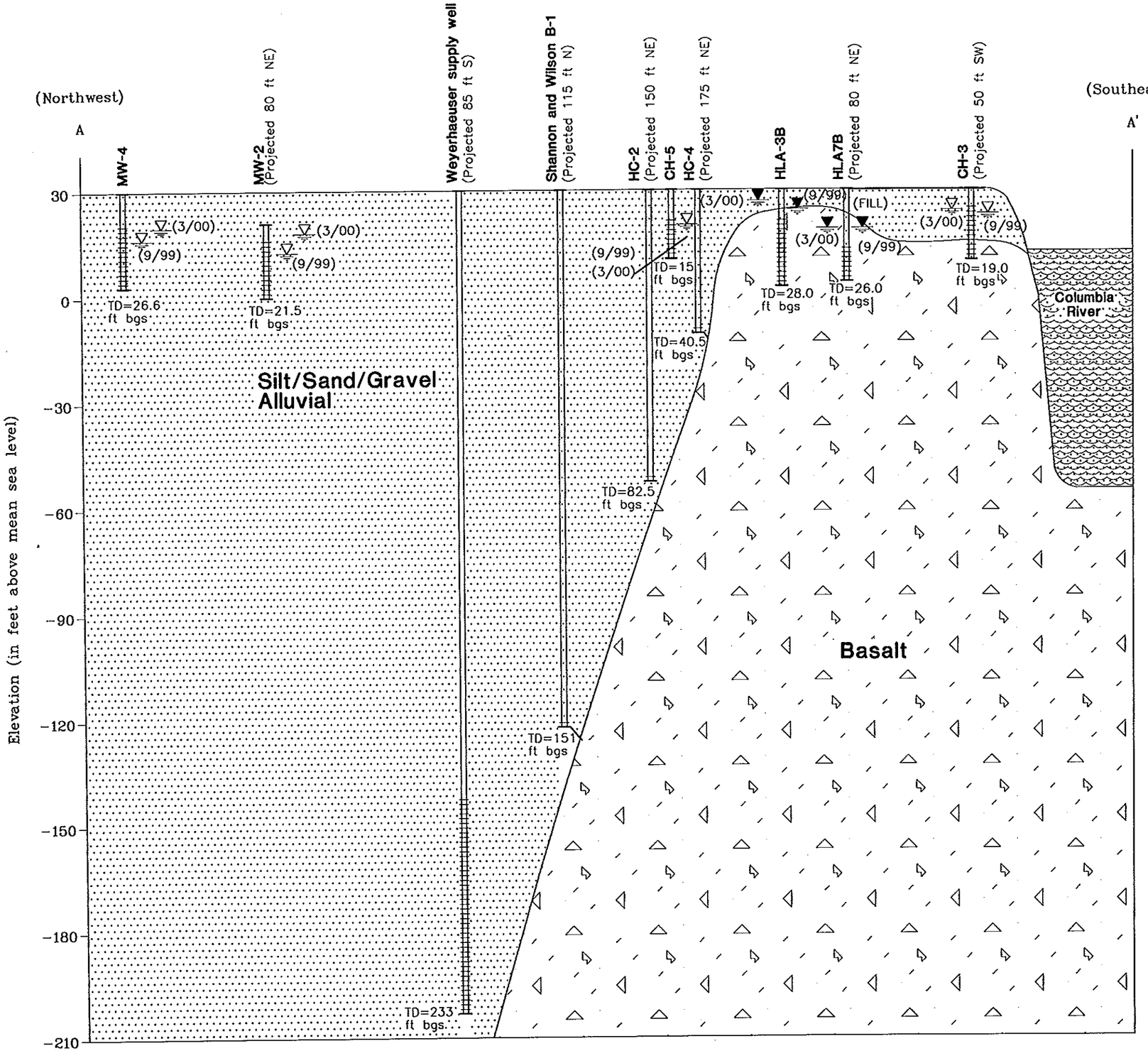
Cross Section Location Map

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

P:\WEYERHAS\CAD\8834G017.DWG

18-MAY-2000



LEGEND

CH-3 — Well ID

TD=19.0 ft bgs — Monitoring well or borehole with screened interval and total (TD) in feet below ground surface (bgs)

Groundwater elevation (NGVD) for basalt monitoring well
(9/99) – Dry season water level (Sept.99)
(3/00) – Wet season water level (March 00)

Alluvial zone
(9/99) – Dry season water level (Sept.99)
(3/00) – Wet season water level (March 00)

Ground Surface Elevation is Generalized

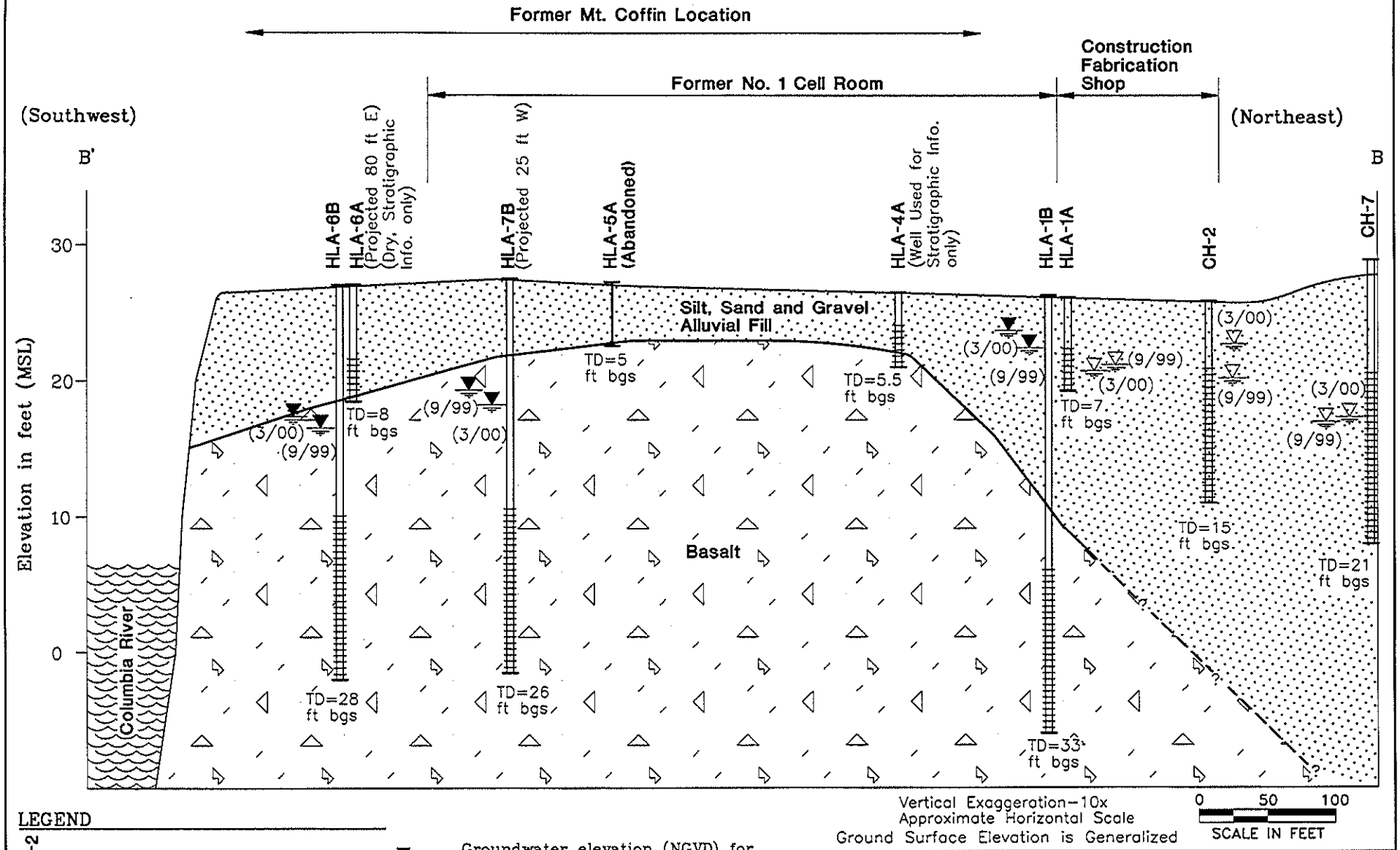
Vertical Exaggeration–10x
Approximate Horizontal Scale

0 150 300
SCALE IN FEET

FIGURE 3-2
Schematic Cross Section A–A'
WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

P:\WEYERHAS\148834\CAD\8834G011A.DWG



LEGEND

CH-2 — Well ID

Monitoring well or borehole with screened interval and total depth (TD) in feet below ground surface (bgs)

TD=5.5 ft bgs

Groundwater elevation (NGVD) for basalt monitoring well

(9/99) -Dry season water level (Sept.99)

(3/00) -Wet season water level (March 00)

Alluvial zone

(9/99) -Dry season water level (Sept.99)

(3/00) -Wet season water level (March 00)

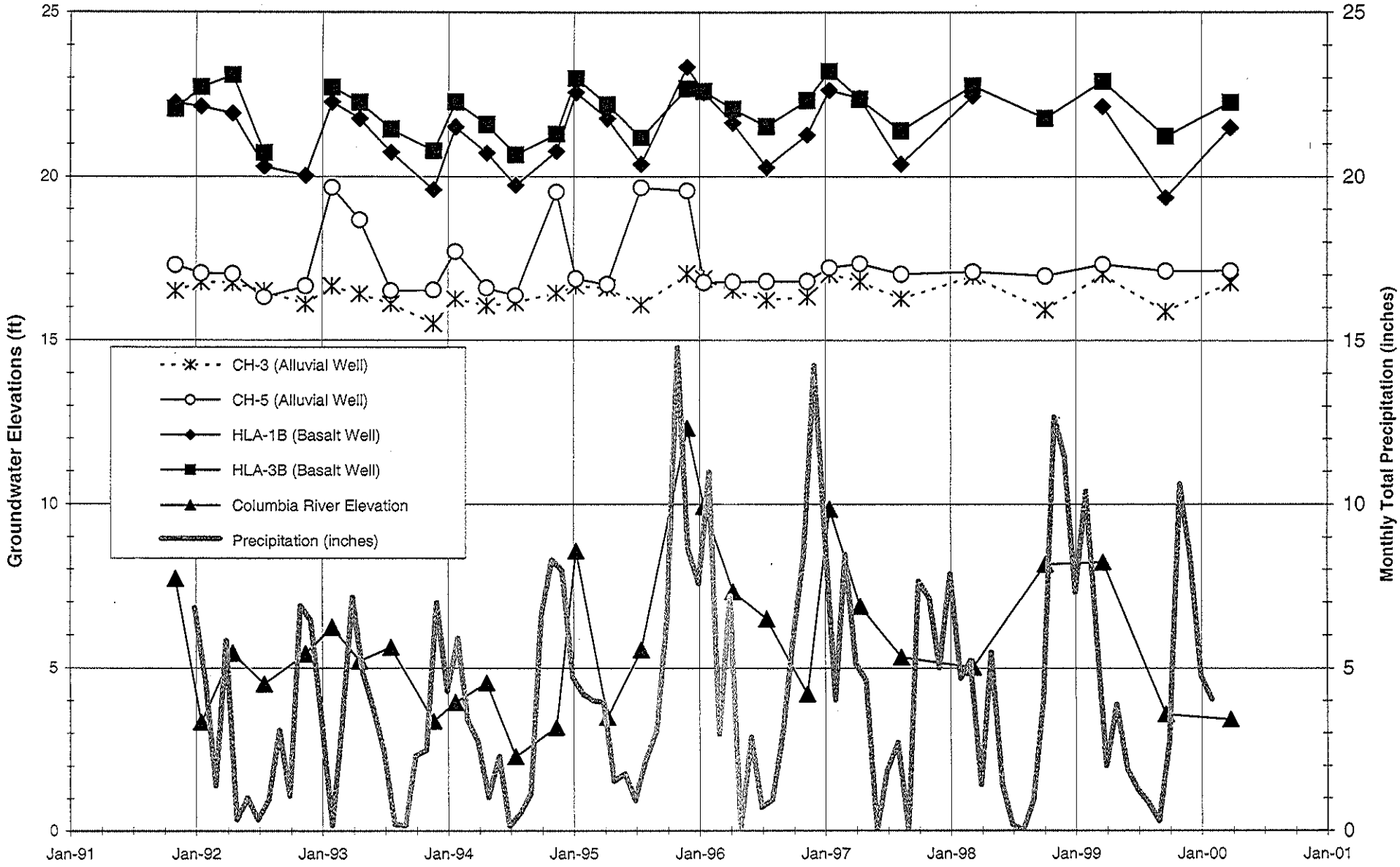
FIGURE 3-3

Schematic Cross Section B-B'

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2M HILL

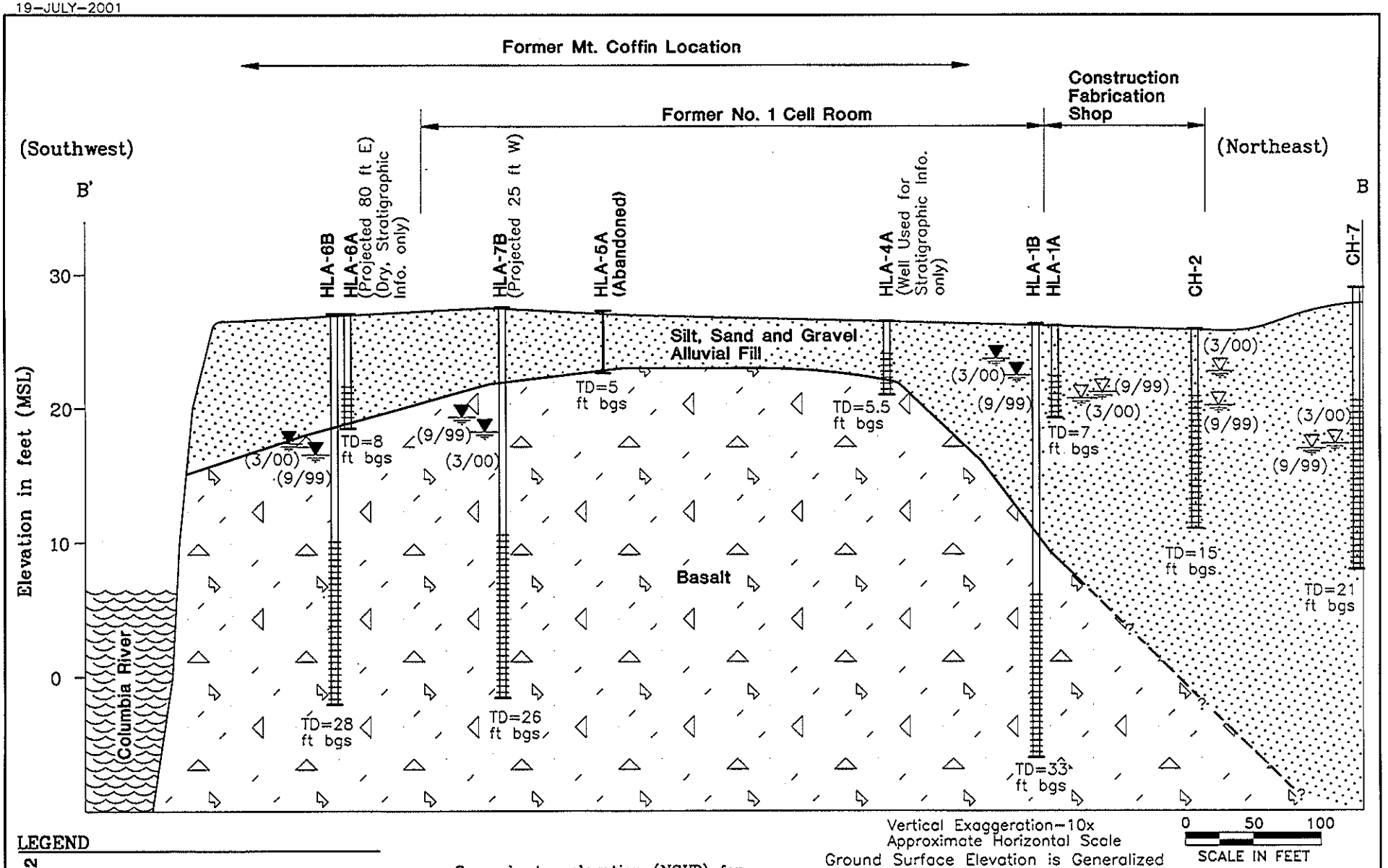
P:\WEYERHAS\148834\CAD\8834G010A.DWG



Precipitation Data Source: Western Regional Climate Center, www.wrcc.dri.edu. Data through February 2000.

Figure 3-4
Hydrograph of Groundwater Elevations vs Precipitation for HLA -1B, HLA-3B, CH-3, CH-5 and the Columbia River
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

19-JULY-2001



LEGEND

CH-2 — Well ID

Monitoring well or borehole with screened interval and total depth (TD) in feet below ground surface (bgs)

TD=5.5 ft bgs

Groundwater elevation (NGVD) for basalt monitoring well

(9/99) – Dry season water level (Sept.99)

(3/00) – Wet season water level (March 00)

Alluvial zone

(9/99) – Dry season water level (Sept.99)

(3/00) – Wet season water level (March 00)

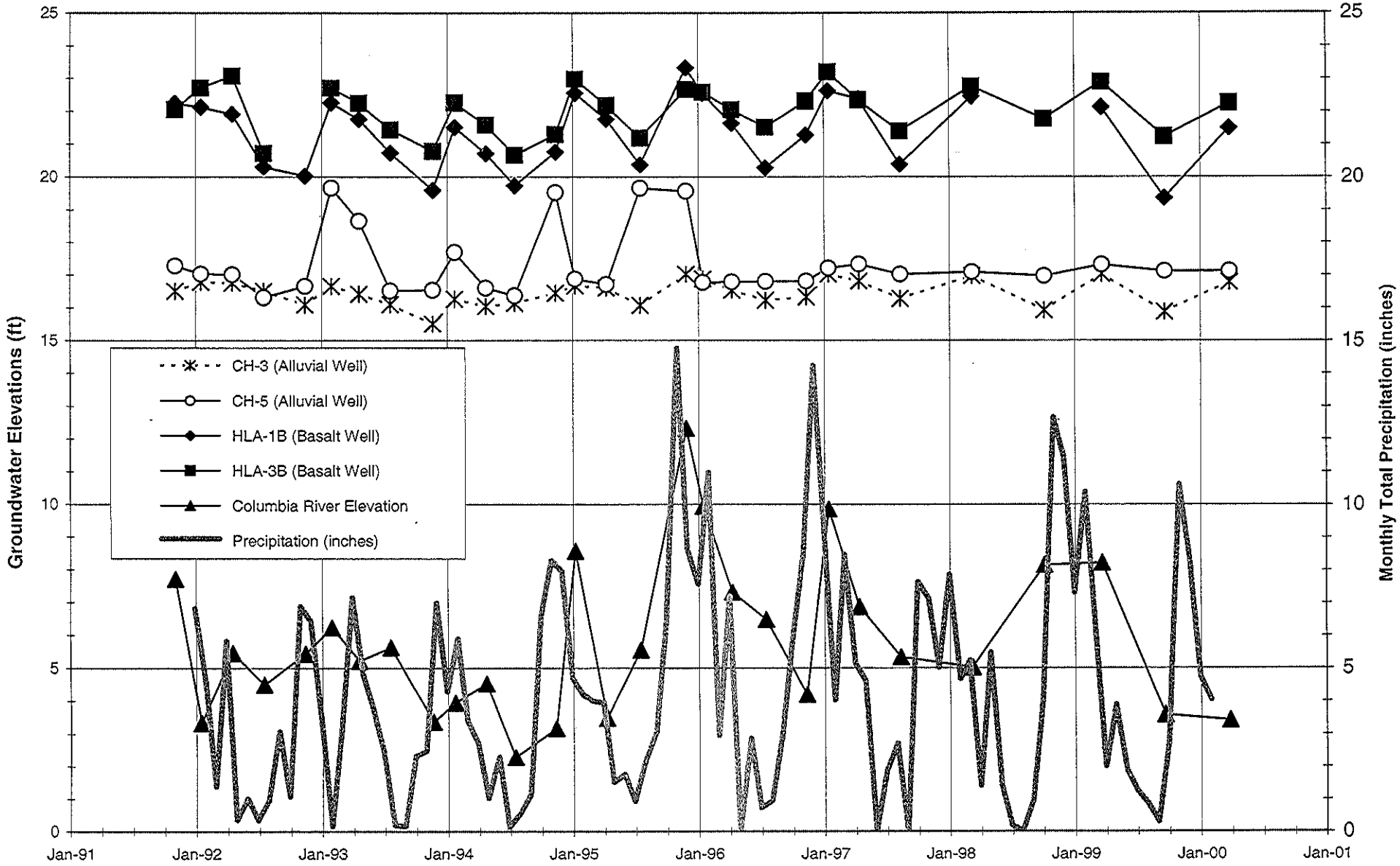
FIGURE 3-3

Schematic Cross Section B-B'

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

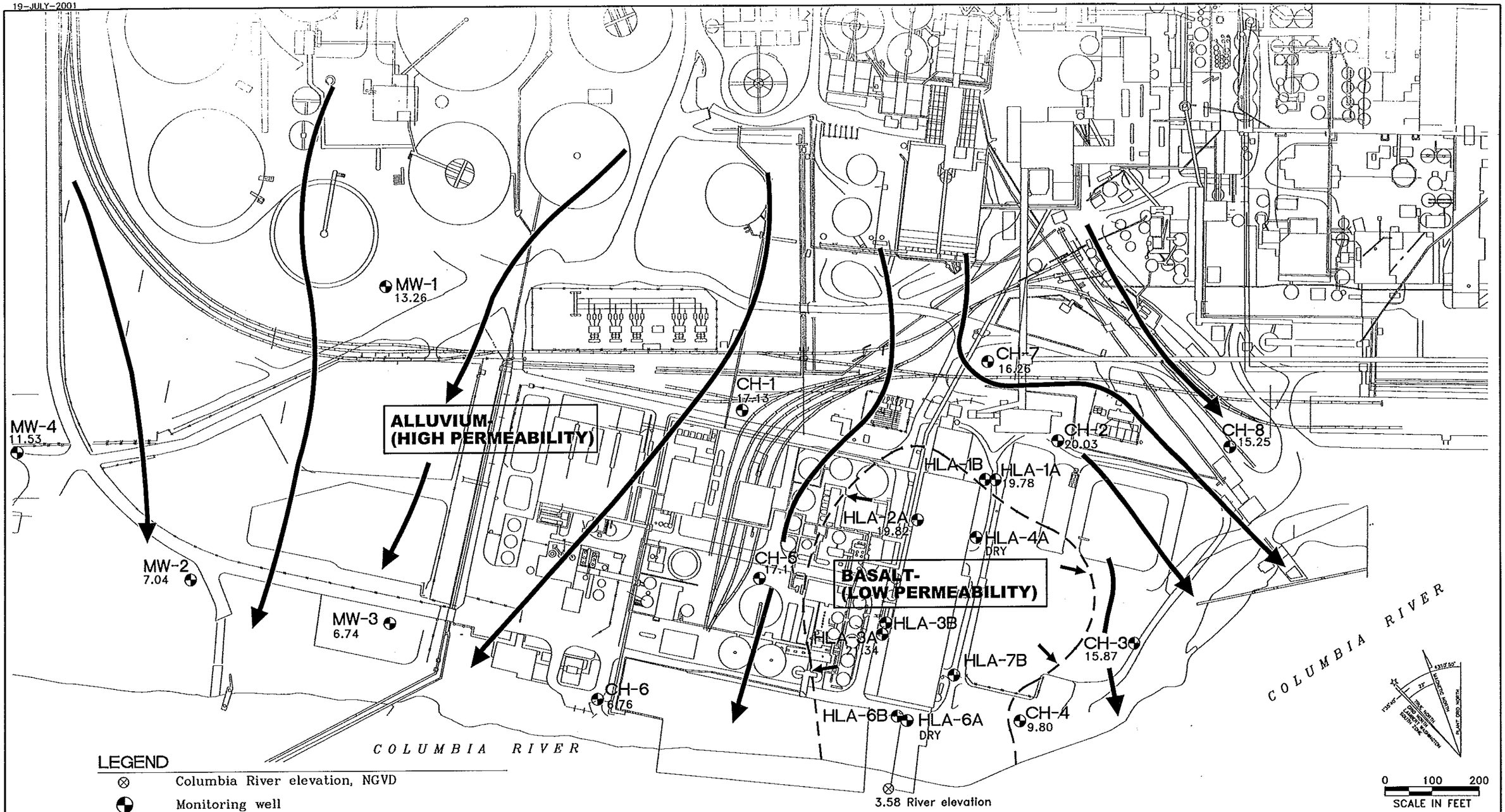
P:\WEYERHAS\148834\CAD\8834G010A.DWG



Precipitation Data Source: Western Regional Climate Center, www.wrcc.dri.edu. Data through February 2000.

Figure 3-4
Hydrograph of Groundwater Elevations vs Precipitation for HLA -1B, HLA-3B, CH-3, CH-5 and the Columbia River
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

19-JULY-2001



LEGEND

⊗	Columbia River elevation, NGVD
◓	Monitoring well
CH-6	Monitoring well identification
6.76	Groundwater elevation, NGVD
- - -	Approximate area where basalt elevation exceeds 10 ft, NGVD
←	Approximate direction of groundwater flow
NGVD	National Geodetic Vertical Datum

Note: Well locations are approximate. Flow directions are generalized and are based on a composite of different elevations from wells of different depths.

FIGURE 3-5

September 1999 Dry Season Groundwater Elevations in Alluvium

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

P:\WEYERHAS\CAD\8834g08B.dwg

19-JULY-2001

MW-1
14.23

MW-4
12.51

MW-2
9.33

MW-3
8.88

CH-1
21.28

CH-7
16.31

CH-2
22.29

CH-8
15.24

HLA-1B

HLA-1A
21.39

HLA-2A
21.09

HLA-4A
21.73

CH-5
17.12

CH-6
6.89

HLA-3B

HLA-8A
22.34

HLA-7B

CH-3
16.77

HLA-6B

HLA-6A
DRY

CH-4
9.92

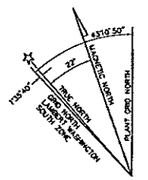
ALLUVIUM (HIGH PERMEABILITY)

BASALT- (LOW PERMEABILITY)

COLUMBIA RIVER

COLUMBIA RIVER

3.42 River elevation



0 100 200
SCALE IN FEET

LEGEND

⊗	Columbia River elevation, NGVD
◓	Monitoring well
CH-6	Monitoring well identification
6.89	Groundwater elevation, NGVD
- - -	Approximate area where basalt elevation exceeds 10 ft, NGVD
←	Approximate direction of groundwater flow
NGVD	National Geodetic Vertical Datum

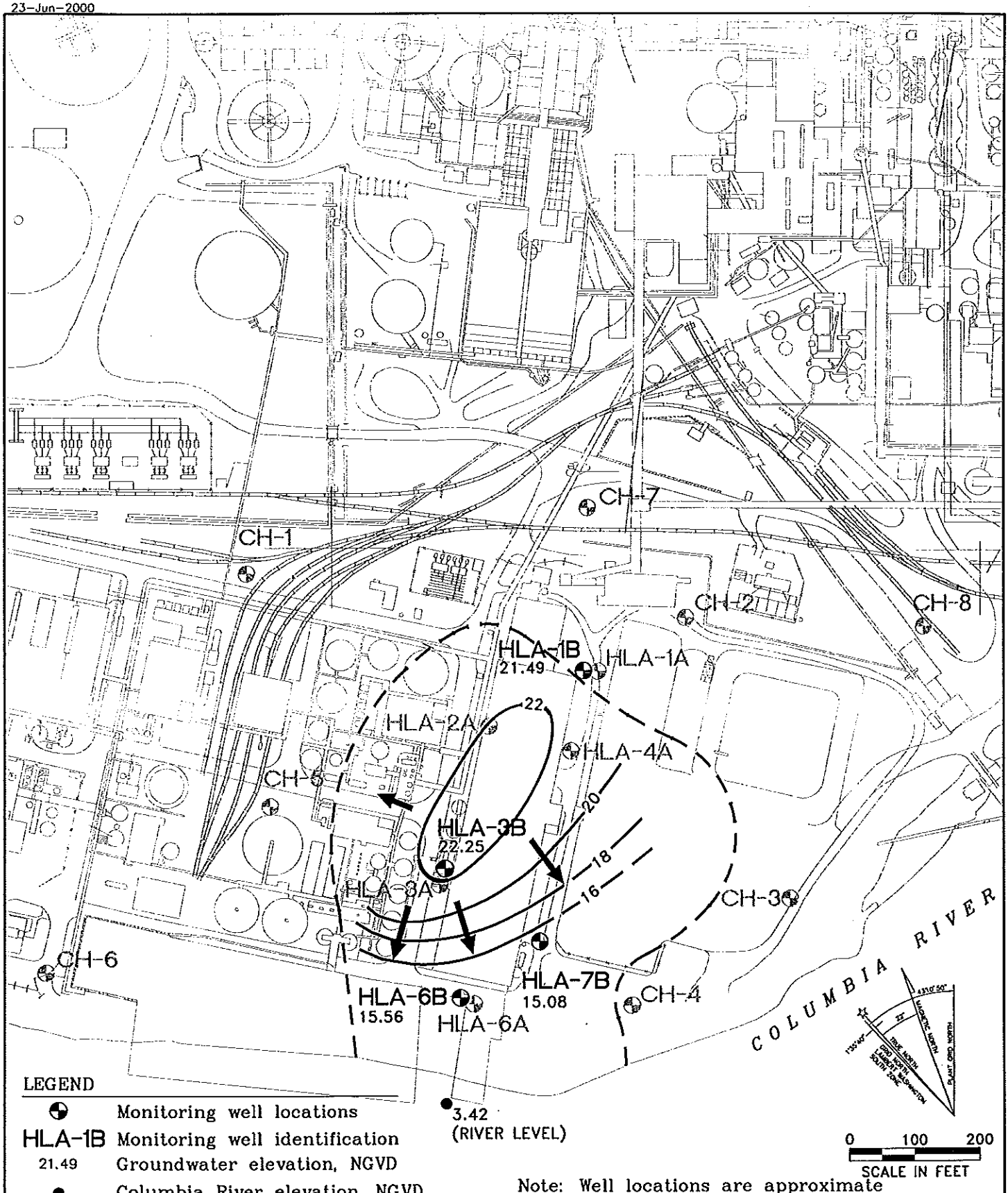
Note: Well locations are approximate. Flow directions are generalized and are based on a composite of different elevations from wells of different depths.

FIGURE 3-6
March 2000
Wet Season Groundwater Elevations in Alluvium
WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

P:\WEYERHAS\CAD\8834g08C.dwg

23-Jun-2000



LEGEND

- Monitoring well locations
- HLA-1B — Monitoring well identification
- 21.49 — Groundwater elevation, NGVD
- Columbia River elevation, NGVD
- Direction of groundwater flow
- 16 — Groundwater elevation contour (ft.)
- Approximate area where basalt elevation exceeds 10 ft, NGVD
- NGVD — National Geodetic Vertical Datum

Note: Well locations are approximate

FIGURE 3-7

March 2000 Groundwater Elevations in Basalt

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

P:\WEYERHAS\CAD\8834s009B.dwg

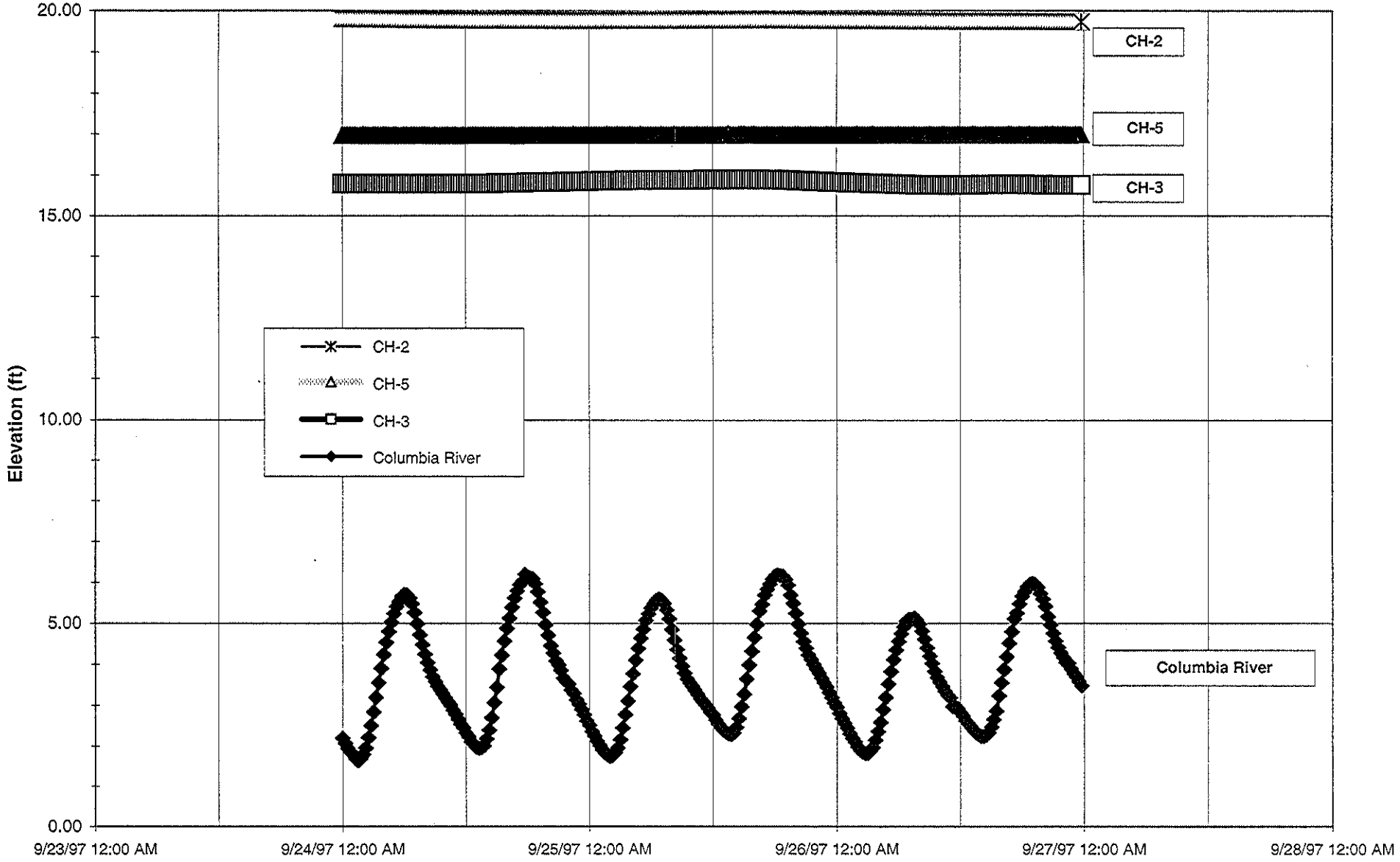


Figure 3-8
Hydrograph for Alluvial Monitoring Wells CH-2, CH-3, CH-5, and Columbia River During 72-Hour Continuous Monitoring
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

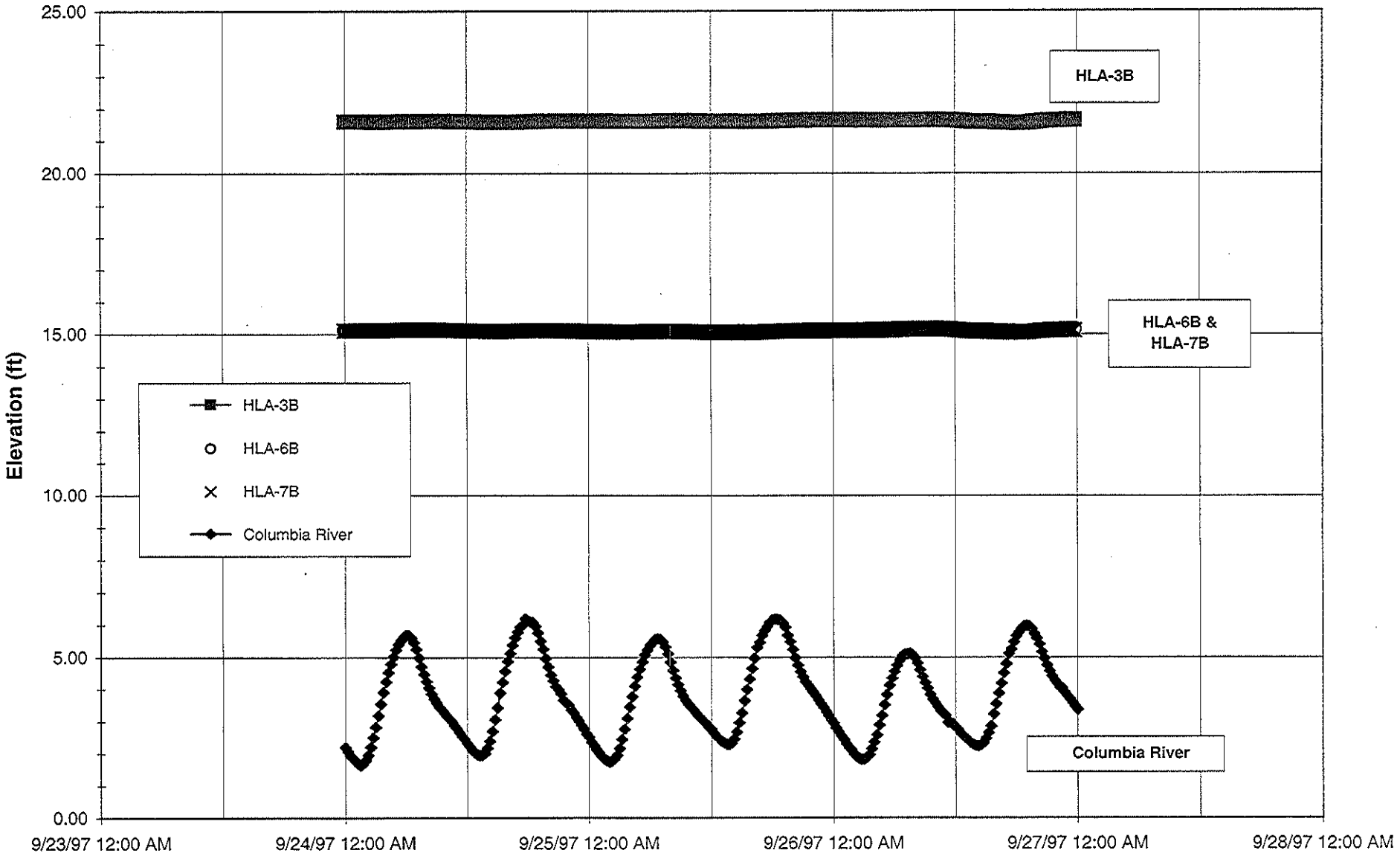


Figure 3-9
Hydrograph for Basalt Monitoring Wells HLA-3B, HLA-6B, HLA-7B, and Columbia River During 72-Hr Continuous Monitoring
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

SECTION 4

Nature and Extent of Mercury

SECTION 4

Nature and Extent of Mercury

In this section, the nature and extent of mercury at the Weyerhaeuser Chlor-Alkali Plant is summarized using historical data (that is, pre-1998 data that are presented in other documents), data collected during the 1998 RI field program, and semiannual groundwater data collected through March 2000 from site monitoring wells. The media discussed in this section are soil, groundwater, surface water, and sediment. Results of previous investigations are presented, where appropriate, to augment conclusions concerning observed mercury distribution and source characterization. A complete data set with figures indicating sample locations is presented in Appendix C.

4.1 Nature of Mercury at the Site

Mercury can exist in three valence states in soil and water (zero, +1, or +2), depending on the prevailing oxidation-reduction potential and pH. Both the +1 and +2 valence states are adsorbed by clay minerals, metal oxides, and organic carbon, with organic carbon being the most important factor controlling mercury adsorption (Rai and Zachara, 1984). Adsorption increases with increasing pH (McLean and Bledsoe, 1992). In its soil screening guidance document, EPA (1996) calculated that the distribution coefficient for mercury (the tendency to partition from the aqueous to the solid phase) ranges from approximately 25 to 320 milliliters per gram over a typical environmental pH range of 6.5 to 8.5. Because pH in soil and groundwater at the site is neutral to alkaline, the distribution coefficient would be near the upper end of this range, indicating relatively low mobility.

Depending on pH, oxidation-reduction potential, and the concentration of other ions, mercury can form a wide range of complex ions. The alkaline pH and presence of chloride at the site suggest that hydroxide and chloride complexes are likely to be the most important. Evans (1989) indicates that above a pH of approximately 6.8 (such as that occurring at much of the site), mercury-hydroxide complexes will predominate over mercury-chloride complexes.

Methylmercury, a potentially important organic complex ion with high toxicity, can be produced by methane-generating bacteria in contact with metallic mercury (Hem, 1989). Methane fermentation occurs under geochemically reducing conditions. Stumm and Morgan (1981), for example, indicate that methane fermentation occurs below an Eh of approximately -170 millivolts (mV). Soil and groundwater at the site do not occur under reducing conditions because high concentrations of organic contaminants—the biodegradation of which would cause reducing conditions to occur—are absent from the site. Oxidation-reduction potential (ORP) in groundwater was measured (using a flow-through cell) in October 1998. Converting ORP measurements to Eh measurements (for example, converting platinum electrode readings to normal hydrogen electrode readings) yielded Eh values ranging from -58 mV to +380 mV. Only one well (MW-4) had negative Eh, and this well is located far from the mercury source areas. For this reason, mercury in soil and groundwater at the site should exist in the inorganic mercury form only, and

methylmercury is expected to be absent. Similarly, methylmercury is not expected to occur in sediment in the Columbia River because metallic mercury is not present, as reflected in the low concentrations of mercury in sediment offshore from the site, as described in Section 4.4.

4.2 Soil

Prior to the remedial investigation fieldwork, extensive sampling of soil was conducted to determine the distribution of mercury in onsite soil (from 1986 to 1998). Figure 4-1 provides a summary of past sampling results for the various potential areas of concern identified in the work plan. The minimum, mean, and maximum mercury concentrations detected in soil that is still located at the plant (that is, that has not been excavated) from each area are shown. Refer to the work plan (CH2M HILL, 1995) for a more detailed description of the historical sampling results. The purpose of the 1998 RI fieldwork was to fill in data gaps that were identified in the work plan, as follows:

- Determine the effectiveness of the brine spill cleanup
- Determine the chemical properties of soil to evaluate treatment technologies
- Determine potential mercury mobility in soil by collecting soil samples while installing two new wells (CH-7 and CH-8)

This section of the RI report presents a summary of the extent of mercury in soil (as described in the work plan) to support the review of the risk assessment and the conclusions presented in this report. Comparisons of soil concentrations to MTCA cleanup levels will be presented in Section 5.

4.2.1 Nature and Extent of Mercury in Soil

The mercury in soil at the Chlor-Alkali Plant is inorganic mercury, which is present in soil at areas where releases are known or suspected to have occurred. These "potential areas of concern" were identified in the work plan (CH2M HILL, 1995) and include the former surface impoundment area, staging area, former No. 1 Cell Room, No. 2 Cell Room, brine spill area, caustic storage, loading, and liquefaction areas, brine treatment, and west area (see Figure 1-2).

The use of mercury at the plant ceased in 1976, and all of the processes and equipment using mercury have been converted to another type of process or removed. Therefore, there are no known current sources of mercury to soil at the Chlor-Alkali Plant.

Previous remedial activities at the site have resulted in the removal of most onsite soils with mercury concentrations exceeding 260 milligrams per kilogram (mg/kg), the Resource Conservation and Recovery Act (RCRA) high-mercury treatment subcategory threshold concentration in 1991 (CH2M HILL, 1995). These remedial actions are documented in the approved work plan. Figure 4-1 shows the areas that have been excavated to remove these soils. All of the potential areas of concern identified in the work plan (CH2M HILL, 1995) are covered with either asphalt, buildings, or equipment, except portions of the west area and the former surface impoundment area, as shown in Figure 4-2.

4.2.1.1 West Area

The west area was used as a disposal site for solid waste from the Chlor-Alkali Plant and the Weyerhaeuser Longview Mill as a whole. To determine whether mercury was a contaminant of concern in the west area, samples were collected from the following:

- Three soil borings in 1986, to a maximum depth of 15 feet
- Four monitoring wells (MW-1 through MW-4) during their installation in 1987, to a maximum depth of 24 feet
- Three soil test pits in 1987, to a maximum depth of 10 feet

The maximum detected mercury concentration was 16 mg/kg, with an average concentration of 3 mg/kg. In accordance with the work plan (CH2M HILL, 1995), these data are considered qualitatively rather than quantitatively useful because of a lack of QA/QC data.

4.2.1.2 Central Process Area and Adjacent Areas

No. 2 Cell Room. The No. 2 Cell Room, shown on Figure 4-2, was used to produce chlorine and caustic by the mercury cell process. Possible releases to the environment from the No. 2 Cell Room could have occurred where mercury vapor condensing equipment was present on the east side of the cell room. Soil near the condensing equipment was excavated in 1991. After soil was removed from the area, the average concentration of mercury left in place was 18 mg/kg, with a maximum concentration of 72.8 mg/kg. The area is currently paved.

Caustic Storage, Loading, and Liquefaction Areas. Extensive sampling has been conducted in the caustic storage, loading, and liquefaction areas, and soil has been removed from the caustic storage area based on the sampling results (see Figure 4-1). The following samples, which represent current soil conditions, have been collected:

- Nineteen soils samples to a depth of 1 foot in all three areas
- Twenty-eight soil samples from the top 6 feet in the caustic storage area

The 19 samples were considered qualitatively useful (according to the work plan) and are provided in Appendix C. Maximum detected concentrations of mercury were 185 mg/kg in the caustic storage area, 4.6 mg/kg in the loading area, and 11 mg/kg in the liquefaction area. In the caustic storage area, the highest concentrations were detected where process piping could have leaked. The average concentration in the caustic storage area is 18 mg/kg. The caustic storage and liquefaction areas are paved and covered by tanks and buildings. The rail loading area has graveled rail lines interspersed with paved roads, pads, and buildings.

Brine Treatment Area. Twenty subareas within the brine treatment area were sampled in 1991 to determine the extent of mercury in soil resulting from releases from a mechanical press for brine sludge. After soils were removed, mercury concentrations of soil left in place ranged up to 118 mg/kg, with an average of 37 mg/kg.

Brine Spill Area. Depleted brine solution from overhead process piping spilled on the east side of the cell-liquor tank during cell room operations. During this RI, four soil samples were collected at the brine spill area from a depth of 3 feet to verify the effectiveness of the previous excavation in 1991, when a sample concentration of 15,000 mg/kg total mercury

was measured at the bottom of the excavation. Additional soil was removed after this detection; however, confirmation samples could not be collected from the excavation because of intense rainfall and unstable soil conditions prior to backfilling. The average mercury concentration during the 1998 RI sampling was 54 mg/kg, with a maximum concentration of 189 mg/kg. Figure 4-3 shows the 1998 results with the 1991 results screened back for reference. These results indicate that the excavation effort was effective in removing the mercury released in the brine spill area.

The four samples collected in 1998 were also analyzed for treatment parameters to evaluate the feasibility of soil treatment remedial technologies such as acid leaching and thermal recovery. The results of the sampling are presented in Table 4-1, with the average values as follows:

- Alkalinity: 4,100 mg/kg
- Chloride: 1,408 mg/kg
- pH: 10
- Total solids: 85 percent
- Sulfide: 108 mg/kg

Soil in the brine spill area has a higher chloride content, alkalinity, and pH than soil in the former surface impoundment area as a result of the brine solution that was used in the area and spilled in the location where the samples were collected. The area is currently covered by asphalt, tanks, and buildings.

Staging Area. The staging area was used for staging the cells and equipment from the former No. 1 Cell Room. The area is currently being used as a temporary laydown and staging area for lumber. Four shallow test pits were excavated in the temporary staging area to a depth of 1.5 feet. Concentrations of mercury ranged up to 40.9 mg/kg, with an average of 24 mg/kg total mercury. The northeastern half of the area is paved, and the southwestern half is graveled.

4.2.1.3 Former No. 1 Cell Room

The former No. 1 Cell Room was used to produce chlorine and caustic by the mercury cell process. Soil at the former No. 1 Cell Room has been extensively sampled since building demolition, which included the removal of soils beneath the building. A total of 102 samples were collected from soil left in place after demolition. The average mercury concentration in soil was 46 mg/kg, with a maximum concentration of 634 mg/kg. The area is currently covered with a polymer-modified asphalt cap.

4.2.1.4 Former Surface Impoundment Area

The former surface impoundments were used as treatment ponds for aqueous waste from the Chlor-Alkali Plant. The following soil samples have been collected in the former surface impoundment area to determine the extent of mercury in soil and to evaluate remedial technologies:

- Two soil borings (one 5 feet deep, the other 10 feet deep) in 1986 to determine the extent of mercury
- Seven test pits to a depth of 10 feet in 1987 to determine the extent of mercury

- Fourteen borings to a maximum depth of 17.5 feet in 1990 to determine the extent of mercury
- Four soil borings to a depth of 3 feet in 1998 to determine treatability parameters

Soil boring and test pit results suggest that mercury is present in the entire soil column to the basalt (that is, to a depth of between 10 and 17.5 feet bgs). Concentrations range from nondetectable at 0.001 mg/kg up to 237 mg/kg for total mercury and up to 0.091 milligram per liter (mg/L) for toxicity characteristic leaching procedure (TCLP) mercury, with the highest mercury levels generally present at around 5 feet bgs. The estimated bottom of the impoundments ranges from 4 to 7.5 ft bgs. A table of the historical mercury results is presented in Appendix C, with the relevant figures showing sample locations (again, data from excavated soils have been removed and confirmation samples have been included).

During the 1998 RI fieldwork, four samples were collected to evaluate the feasibility of soil treatment remedial technologies such as acid leaching and thermal recovery. The results of the sampling are presented in Table 4-2, with the average values as follows:

- Alkalinity: 1,750 mg/kg
- Chloride: 20 mg/kg
- pH: 8
- Total solids: 79 percent
- Sulfide: 106 mg/kg

These results will be evaluated in the feasibility study to determine the feasibility of potential soil treatment. The sample locations are present in Figure 2-2. The southern half of the area is currently paved, while the northern half is covered with gravel. The area currently is used as a storage, temporary laydown, and parking area.

4.2.1.5 Stormwater Drainage Ditch

Five surface soil samples were collected from the eastern stormwater drainage ditch and analyzed for total mercury, as shown in Figure 4-4. Concentrations of mercury ranged from 0.6 mg/kg to 4.8 mg/kg, with an average concentration of 2 mg/kg. The previous sampling results of 15 mg/kg and 35 mg/kg from 1987 were not confirmed.

The sampling results suggest that the soil in the ditch does not represent a significant source of mercury to the Columbia River via runoff (see also Section 4.4, "Surface Water in the Stormwater Drainage Ditch").

4.2.1.6 Soil in Wells CH-7 and CH-8

During the installation of Monitoring Wells CH-7 and CH-8, one soil sample was collected from each well and analyzed for total organic carbon (EPA Method 415.1). The organic content of the soil was 1.6 mg/kg in CH-7 and 0.05 mg/kg in CH-8.

4.2.2 Summary of Mercury in Soil

Releases of inorganic mercury to soil ceased more than 20 years ago. Several removal actions have removed the highest concentrations of mercury (that is, most soil with concentrations greater than 260 mg/kg). Additionally, most areas at the Chlor-Alkali Plant

are paved or covered by structures; thus, direct contact of workers with soil and infiltration of water are minimized. The other pathway for mercury to migrate within the plant is from soil to groundwater. An evaluation of the potential for the mercury currently present in soil to travel to groundwater is presented in Section 4.5.3, "Mercury Travel from Groundwater to Columbia River."

In summary:

- Concentrations of mercury in the liquefaction and loading areas in the central process area, the west area, and the stormwater drainage ditch are low (less than 16 mg/kg).
- Concentrations of mercury are moderate (less than 189 mg/kg total mercury) in the brine spill area and—within the central process area—the No. 2 Cell Room and the brine treatment, caustic storage, and staging areas.
- Mercury concentrations are the highest within the areas of the former No. 1 Cell Room and former surface impoundment area. These areas have undergone previous removal actions.

4.3 Groundwater

This section focuses on the interpretation of the extent of mercury in the water-bearing zones underlying the Chlor-Alkali Plant. The distribution of mercury in water-bearing zones is predominantly controlled by source location and groundwater flow. Gradients and physical features that influence groundwater flow are discussed in Section 3 of this document. The following discussions use comparisons to the maximum contaminant level (MCL) of 0.002 mg/L for mercury to aid the reader in understanding the distribution of mercury in groundwater. A comparison of groundwater concentrations to MTCA cleanup levels is provided in Section 5.

A quarterly groundwater monitoring program was initiated in 1991 and continued through April of 1997; since that time, sampling has been conducted semiannually. New wells CH-7 (upgradient) and CH-8 (cross gradient) have been sampled a total of four times since installation during RI activities. Analytical results from the groundwater monitoring program from 1991 through March 2000 are presented in Appendix C.

Listed in Figure 4-5 are the dissolved mercury concentrations for individual monitoring wells over the past seven sampling events, which were conducted from April 1997 through March 2000. The analytical results in Figure 4-5 and the tables in Appendix C indicate that the areas of the plant where mercury concentrations have consistently exceeded the detection limit of 0.0005 mg/L are the former No. 1 Cell Room and the former surface impoundment area. In addition to analytical results, Appendix C contains plots of dissolved mercury concentrations over time for all monitoring wells located at the site. Some of these representative figures are included in the text to assist in the following discussions concerning detectable mercury concentrations in groundwater across the site.

4.3.1 West Area

Wells monitored in the west area of the plant (MW-1, MW-2, MW-3, and MW-4) have been sampled for dissolved mercury since 1987. The analytical results for these events can be

found in Appendix C and are plotted in Figure 4-6. Mercury concentrations in Wells MW-1, MW-2, and MW-3 have consistently been below the MCL of 0.002 mg/L for mercury. Well MW-4 had not been above detection limits since 1991 but showed isolated detections of 0.0004 mg/L in April 1997 and 0.0027 mg/L in October 1998. Prior to these detections, detectable dissolved mercury concentrations in MW-4 had shown a steep downward trend from 1987 through 1991; since then, concentrations have been stable and below the detection limit, with the exception of the April 1997 and October 1998 samples. After 1998, sampling at these wells has been conducted annually (see Appendix C for sample dates). The last two annual sampling events, which were conducted in March 1999 and March 2000, indicated that mercury concentrations in groundwater have declined to less than the laboratory reporting limit of 0.0002 mg/L (see Figure 4-5 and Figure 4-6).

4.3.2 Central Process Area

Monitoring Wells CH-1, CH-5, and CH-6 are located in the central process portion of the plant. This part of the plant includes the No. 2 Cell Room and the liquefaction, loading, caustic storage, and brine treatment areas. These wells were sampled quarterly from 1991 to 1997 and have been sampled semiannually since 1997. Analytical results can be found in Appendix C. Figure 4-5 shows a plan view map of monitoring well mercury concentrations across the site, and Figure 4-7 shows concentrations over time for wells in the central process area. Mercury concentration trends for monitoring wells in the central process area are discussed below:

- **CH-6.** Between 1991 and January 1997, mercury concentrations in CH-6 have consistently been below laboratory detection limits. Between April 1997 and March 2000 mercury was detected occasionally, at low concentrations ranging from nondetect (<0.0002 mg/L, October 1998) to 0.001 mg/L (March 1998); these concentrations are below the mercury MCL of 0.002 mg/L.

- **CH-1.** Mercury concentrations in Well CH-1 have been below or slightly above detection limits for a majority of the sampling rounds. Concentrations have ranged from less than the detection limit (0.0005 mg/L) to 0.0022 mg/L, in April 1997; this concentration exceeds the MCL of 0.002 mg/L.

- **CH-5.** Mercury concentrations in Well CH-5 have fluctuated since sampling began in 1991. Mercury concentrations have ranged from less than the laboratory reporting limit (0.0002 mg/L) up to 0.0091 mg/L in November of 1996. Prior to April 1997, concentrations of mercury in CH-5 had exceeded the MCL; however, concentrations have declined to less than the laboratory detection limit during the last three sampling events, which took place in March and September 1999 and March 2000.

Mercury concentrations in both CH-1 and CH-5 may have been influenced by higher groundwater levels caused by increased precipitation that occurred between 1995 and 1997.

4.3.3 Former No. 1 Cell Room and Former Surface Impoundment Area

The monitoring wells labeled with the prefix "HLA" are associated with the former No. 1 Cell Room. Monitoring Wells CH-2, CH-3, and CH-4 are associated with the former surface impoundments. Analytical results for groundwater sampling at the Chlor-Alkali Plant have shown that, on average, Wells HLA-1A, HLA-1B, and HLA-2A have the highest detectable

concentrations of mercury at the site (see Figures 4-5 and 4-8). Wells HLA-2A and HLA-1A are both screened in the upper alluvial zone at the site. HLA-1B is screened in the basalt zone underlying the upper alluvial zone. These wells are located in the immediate vicinity of the former No. 1 Cell Room.

Detected concentrations at all three former No. 1 Cell Room area wells have consistently been above the mercury MCL.

Monitoring well mercury concentration trends from sampling conducted between 1991 and March 2000 are discussed below:

- **HLA-1B.** Mercury concentrations at Well HLA-1B have fluctuated between 0.0135 mg/L (March 1999) and 0.33 mg/L (January 1991). Mercury concentrations decreased slightly between March 1999 and March 2000 after an increase in the mid-1990s (see Figure 4-8). Although mercury concentrations in HLA-1B exceeded the MCL in March 1999 (0.0135 mg/L), September 1999 (0.0770 mg/L), and March 2000 (0.0246 mg/L), they were one order of magnitude lower than those reported between 1996 and 1998.

- **HLA-1A/HLA-2A.** Mercury concentrations in Well HLA-1A have fluctuated between 0.0275 mg/L (August 1997) and 0.68 mg/L (July 1996). Well HLA-2A has fluctuated between 0.0007 mg/L (March 1999) and 0.2270 mg/L (November 1996). Figure 4-9 shows that concentrations in these wells are variable but essentially consistent over time, with the exception of a substantial decrease in average mercury concentrations in HLA-1A following elevated levels observed in 1997.

During demolition of the No. 1 Cell Room, elemental mercury was observed to be present in the basalt. Weyerhaeuser made extensive efforts to remove the mercury during demolition, but it is likely that small amounts of elemental mercury remain in the subsurface at the site in isolated globules (within basalt fractures). These mercury globules act as an ongoing source of dissolved mercury in groundwater and could account for the relatively steady mercury concentrations observed in monitoring wells in the vicinity of the former No. 1 Cell Room. In support of this conclusion is the fact that the former No. 1 Cell Room area has been capped since 1991 with a polymer-modified asphalt cap that inhibits water infiltration. Additionally, a considerable portion of the basalt surface was sealed with concrete during cell room demolition activities. If the source of mercury in the area of No 1. Cell Room was infiltration of precipitation and leaching from soil, it would be expected that groundwater concentrations would have decreased noticeably since cap installation. The fact that this has not occurred suggests the presence of a subsurface source, such as the dissolution of elemental mercury.

The wells closest to and downgradient of Wells HLA-1A, HLA-1B, and HLA-2A are Alluvial Wells HLA-3A and HLA-4A and Basalt Wells HLA-3B and HLA-7B.

- **HLA-3A and HLA-4A.** These alluvial wells have reported mercury concentrations in groundwater that are consistently above the MCL, but at concentrations substantially lower than in the wells closer to the former No. 1 Cell Room. Figure 4-10 shows that mercury concentrations in these wells have remained fairly consistent, with the exception of a few anomalously elevated concentrations in HLA-3A that correspond to the period of high groundwater levels associated with heavy precipitation during 1996.

The basalt wells located downgradient from the former No. 1 Cell Room include HLA-3B and HLA-7B.

- **HLA-3B/HLA-7B.** Mercury concentrations in these wells are consistently above the MCL for mercury but are substantially lower than in HLA-1B. Similar to HLA-1B, mercury concentrations in the basalt wells appeared to increase during the mid-1990s, possibly in response to higher water levels related to higher than average precipitation amounts. Mercury concentrations decreased starting early in 1996 and appear to have reached asymptotic levels (see Figure 4-11).

Wells downgradient of the former No. 1 Cell Room and former surface impoundment area located closest to the Columbia River are HLA-6B, CH-3, and CH-4. Well HLA-6A, which is a shallow alluvial well in this area, is dry and therefore cannot be sampled.

- **HLA-6B.** The plot of dissolved mercury concentrations over time in HLA-6B (see Figure 4-12) indicates that concentrations were typically below the laboratory reporting limit through January 1997. In April 1997 mercury was detected at 0.0019 mg/L, and concentrations continued to increase until October 1998 (0.0030 mg/L). After this peak, mercury levels returned to less than the laboratory detection limit (0.0002 mg/L) during March and September 1999 and March 2000.

- **CH-4.** Mercury concentrations in Well CH-4 (see Figures 4-12 and 4-13) have consistently been below the MCL of 0.002 mg/L for mercury and have been decreasing since reaching a peak of just below 0.002 mg/L in early 1996.

- **CH-3.** Mercury concentrations in Well CH-3 have consistently been slightly above the MCL for mercury. After a slight increase in mercury levels during mid-1995, concentrations appeared to reach asymptotic levels (approximately 0.003 mg/L) in the late 1990s. Mercury concentrations at CH-3 appear to have fluctuated seasonally over the past 2 years.

In summary, the concentration of mercury in wells near the Columbia River downgradient of the former Cell Room No. 1 and the former surface impoundments has fluctuated around the MCL since monitoring began in 1991.

Two additional monitoring wells were installed in the upper alluvial zone as part of the RI investigation. Monitoring Wells CH-7 and CH-8 were installed to determine the extent of mercury in groundwater east and north of the former No. 1 Cell Room and former surface impoundment area. Mercury was not detected at either location for the four sampling events conducted during October 1998, March and September 1999, and March 2000. These results indicate that mercury is not present in groundwater upgradient of the former No. 1 Cell Room and former surface impoundments. Process information also supports this conclusion, as mercury processes were not located north (upgradient) of the former No. 1 Cell Room and former surface impoundment area.

4.3.4 Mercury Mass Loading

Using the groundwater flow information presented in Section 3 and the concentration data presented above for wells located near the Columbia River, it is possible to calculate the flux of mercury to the Columbia River from the Chlor-Alkali facility. Because of their differing

hydraulic properties, it is necessary to calculate flux separately for the basalt zone and the shallow alluvial aquifer.

Alluvial aquifer discharge:

- Discharge zone length = 850 feet total. (West side: distance from Well CH-6 to basalt is approximately 500 feet. East side: distance from CH-3 to basalt is approximately 350 feet). Assumed discharge zone thickness = 10 feet.
- Hydraulic conductivity = 28 feet per day, based on specific capacity analysis in alluvial wells.
- Hydraulic gradient to river = 0.03 for area west of basalt, 0.11 for area east of basalt, based on March 1999 water level measurements.
- Average mercury concentration = 0.00025 mg/L for area west of basalt (average for CH-6 in 1999), 0.0017 mg/L for area east of basalt (average for CH-3 and CH-4 for 1999).

Using these data, the mass of mercury discharged to the Columbia River from the alluvial aquifer in 1999 is estimated to be 0.44 pound per year.

Basalt zone discharge:

- Discharge zone length = 400 feet (estimated from Figure 3-5)
- Assumed discharge zone thickness = 10 feet
- Hydraulic conductivity = 0.01 ft per day, based on slug testing in HLA-6B
- Hydraulic gradient to river = 0.089 for March 1999
- Average mercury concentration = 0.0001 mg/L, based on 1999 data from HLA-6B

Using these data, the mass of mercury discharged to the Columbia River from the basalt zone in 1999 is estimated to be 0.00001 pound per year. The total mercury discharge for both groundwater zones, therefore, was approximately 0.4 pound (0.20 kilogram) in 1999. Because of its low permeability, the basalt zone contributes a negligible fraction of this total.

4.3.5 pH and Specific Conductance

The pH measured in site monitoring wells during sampling indicates that pH varies from near neutral (between 6 and 8) to nearly 11 (see Figure 4-14). Wells HLA-1A, HLA-1B, HLA-3A, HLA-7B, MW-4, and CH-5 all exhibit elevated pH. These wells are near areas where caustic was handled at the site. With the exception of MW-4, these wells are located near the former No. 1 Cell Room. Except under strongly oxidizing conditions, where the formation of a chloride-hydroxyl complex increases the solubility of mercury, pH has relatively little effect on mercury solubility (Rai and Zachara, 1984).

Specific conductance measurements provide an indication of the concentration of total dissolved solids in water samples. Because specific conductance values in inland areas of western Washington typically are low—on the order of 300 to 1,000 micromhos per centimeter (µmho/cm)—elevated specific conductance values at the Chlor-Alkali Plant can be used as an indicator of where sodium chloride brine has entered groundwater. Wells MW-3, HLA-3A, HLA-3B, HLA-6B, MW-7B, CH-3, and CH-6 have specific conductance values ranging from 2,000 µmho/cm to more than 100,000 µmho/cm (see Figure 4-15).

Elevated specific conductance values occur around the salt dissolving basin and downgradient of the former No. 1 Cell Room. It is likely that specific conductance measurements at CH-6 have declined during the last two monitoring events because the salt pile was removed from this area. Measurements of specific conductance at Basalt Wells HLA-6B and HLA-7B increased around the time the plant shut down in March 1999.

4.3.6 Summary of Mercury in Groundwater

Based on the discussion of groundwater and mercury presented in this report, the following conclusions can be made:

- In general, mercury concentrations in groundwater are remaining steady or decreasing with time. The rate of decrease is slowest in the area of the former No. 1 Cell Room and the former surface impoundments. Except for in these areas, mercury concentrations are at or below the MCL of 0.002 mg/L for mercury.
- Potential explanations for the slow rate of decrease in mercury concentrations in the area of the former No. 1 Cell Room include the following:
  - The amount of groundwater flux (and therefore the rate of flushing) is limited because the asphalt cap reduces rainfall infiltration, and the permeability of the basalt and alluvium fill above the basalt is very low.
  - It is possible that small amounts of elemental mercury are present below the water table as isolated globules in basalt fractures. If present, these globules could serve as an ongoing source of dissolved mercury in basalt groundwater.
- Although transient fluctuations in mercury concentrations may occur as a result of unusually high groundwater levels and rainfall conditions, concentrations in groundwater are not expected to increase substantially over time because the initial mercury sources were removed from the plant more than 23 years ago, and subsequent removal actions as described in the RI work plan (CH2M HILL, 1995) have addressed former mercury sources. Furthermore, results from soil and groundwater sampling suggest that leaching of mercury from soil to groundwater by infiltration and percolation of precipitation is not a major factor influencing mercury concentrations in groundwater.
- Mercury is not present in groundwater north of (that is, in the general upgradient direction from) the former No. 1 Cell Room and former surface impoundment area, as seen in sampling results of the new Monitoring Wells CH-7 and CH-8. Mercury was not detected in either well during the four rounds of sampling conducted as part of semiannual monitoring between October 1998 and March 2000.
- The mercury discharge to the Columbia River from groundwater is estimated to be approximately 0.4 pound per year. Because the basalt is the area of the plant that contains the highest mercury concentrations but transmits the least amount of groundwater flow, it contributes a relatively insignificant amount of mercury mass to the surrounding groundwater and Columbia River. Conversely, the alluvial aquifer, which contains relatively low mercury concentrations but transmits more significant quantities of groundwater flow, contributes substantially more mercury mass to the river. Essentially,

all of the mercury loaded to the river from groundwater is discharged from the alluvium; the basalt zone contributes approximately 0.002 percent of this total.

4.4 Columbia River Sediment

4.4.1 Former No. 1 Cell Room

As required in the work plan (CH2M HILL, 1995), mercury concentrations in Columbia River sediment adjacent to the Chlor-Alkali plant were investigated. Inorganic mercury discharged to the river tends to adsorb to sediment particulates. If present, elemental (metallic) mercury may be converted into organic forms through microbial methylation. Seventeen samples were collected from sediment directly adjacent to the Chlor-Alkali plant, specifically near the former No. 1 Cell Room diffuser. The following paragraphs describe the historical and current nature and extent of mercury distribution in sediment along an approximately 3,000-foot stretch of the Columbia River adjacent to the Chlor-Alkali Plant.

There were numerous historical investigations of mercury contamination in Columbia River sediment at or near the Chlor-Alkali plant prior to the September 1998 investigation. Appendix I of the work plan (CH2M HILL, 1995) provides details of the investigations, sample locations, and mercury concentrations.

Background mercury concentrations along an approximately 6-mile stretch upstream of the plant ranged from below the detection limit of 0.02 mg/kg to a detection of 0.26 mg/kg at the mouth of the Kalama River. Results from sediment collected adjacent to the Chlor-Alkali Plant indicated that mercury concentrations were equal to or lower than those found in background sediment. The exception is the area near the former No. 1 Cell Room diffuser. Before the diffuser was removed, mercury concentrations ranged from less than 0.2 mg/kg to 0.6 mg/kg. After removal of the diffuser in 1992, concentrations from the same sample area increased from 0.3 mg/kg to 7.2 mg/kg.

In 1998, surface sediment samples were collected from seventeen locations adjacent to the Chlor-Alkali Plant. Figure 4-16 shows sediment sample locations and mercury concentrations in parentheses. Table 4-3 shows the results of the total mercury and particle size analysis. Samples were primarily a fine- to medium-grained sand with some silt. Eleven of the 17 samples contained more than 80 percent sand. Mercury was detected in two of the 17 samples (H001 and H004), both at a concentration of 0.2 mg/kg. These samples were taken adjacent to the west end of the salt dock, downstream from the former No. 1 Cell Room diffuser. Mercury was not detected in the remaining 15 samples.

No mercury was found in samples collected near the former No. 1 Cell Room diffuser. Three additional samples were proposed for collection in this same area but could not be collected. The sediment in this area was too compacted in one location for the sampler to penetrate the sediment surface, and large organic debris and gravel prevented the sampler from closing and collecting samples in the two other locations. Additional attempts were made to collect samples at different locations near this same area but they were unsuccessful for the same reasons.

4.4.2 Abandoned No. 2 Cell Room Diffuser

4.4.2.1 Background

Surface sediment sampling was conducted as part of the Weyerhaeuser Chlor-Alkali Plant RI project. During the preparation of the draft RI report, an abandoned diffuser associated with the No. 2 Cell Room was identified as a potential past source of discharge of mercury to the environment (similar to the former No. 1 Cell Room diffuser). No information on historical discharges from the No. 2 Cell Room diffuser to the Columbia River is available; however, the use of mercury in the No. 2 Cell Room process was discontinued in 1976. The diffuser itself is no longer in service.

The objective of the sediment collection was to determine the presence or absence of mercury concentrations in surface sediment near the No. 2 Cell Room diffuser. This information is provided to evaluate risk to potential receptors.

4.4.2.2 Sample Collection

Sediment samples were collected on May 19 and May 20, 1999, from the Columbia River adjacent to and downstream of the abandoned diffuser associated with the No. 2 Cell Room (see Figure 4-16). Thirteen sediment samples (H021 through H033) were collected from the river bottom using a petite ponar clamshell device. Samples were not collected from one of the sample locations proposed in the field sampling plan (the location directly downstream of Sample Location H031) because the current was too swift, as a result of both river flow and tidal influences; in addition, the bottom substrate at this location was too compacted to allow a sample to be collected.

The characteristics of the river near the area of the diffuser varied depending on the distance from the shoreline. A depositional area existed in the river from the shoreline to approximately 125 feet offshore; this was indicated by the slower river flow and the presence of finer sands and silts. All samples except H031 were collected in an area with depositional characteristics. The flow visibly increased beyond 125 feet offshore, and the characteristics of the sediment changed to coarser sand with some smaller gravels. Attempts to collect sediment outside of the depositional area were difficult because the current was too swift, as a result of both river flow and tidal influences, and the bottom substrate was too compacted.

4.4.2.3 Sample Analysis and Results

Sediment samples were analyzed for total mercury (EPA Method 7471), total organic carbon (EPA Method 415.1), and grain size distribution (ASTM D422-63). The results of the mercury analysis are presented in Table 4-3.

Mercury was detected in four of the 13 samples from this event. The highest concentration of 0.4 mg/kg was found at Location H030, approximately 450 feet downstream of the abandoned No. 2 Cell Room diffuser. A concentration of 0.2 mg/kg was found at Location H031, directly adjacent to the diffuser. No mercury was detected in three additional samples collected directly adjacent to the diffuser. Mercury was also detected at 0.1 mg/kg at two locations downstream of the diffuser (H026 and H027).

4.4.3 Sediment Sampling Conclusions

In summary, mercury concentrations in sediments near the former No. 1 Cell Room at the Chlor-Alkali Plant are less than 0.2 mg/kg, and in most samples, mercury is not detectable. These low concentrations indicate that metallic mercury is not present and that methylmercury should be absent. Additionally, the results indicate that mercury concentrations were equal to or lower than those found in background sediment samples. Therefore, mercury in sediment near the former No. 1 Cell Room is not considered a significant source of mercury to the river.

Samples collected to characterize the extent of mercury in surface sediment associated with the abandoned No. 2 Cell Room diffuser indicate that sediments do not contain significant concentrations of mercury. The concentrations of mercury detected during this sampling event are similar to both the background mercury level and the sample results from the former No. 1 Cell Room diffuser. Only one sediment sample collected near the No. 1 Cell Room and No. 2 Cell Room diffusers has exceeded the sediment cleanup level of 0.2 mg/kg. This one exceedance is not statistically significant given the size of the sample population (more than 30 samples) and the absence of mercury at surrounding sample locations.

These sampling results are consistent with the model that demonstrates that sediments in the area have been dredged or scoured and that sedimentation no longer occurs in the area. After the 1981 volcanic eruption of Mount St. Helens, a large amount of sediment was deposited in the river. Subsequent dredging activities restored the navigational channel to a width that was 200 feet less than it was before the eruption. Dredge spoils were disposed of near the east powerhouse, creating a spit. The narrower channel and the presence of the spit have increased flow velocities, reduced sediment deposition in the area, and created a self-scouring environment (see Table 2-1 in the work plan [CH2M HILL, 1995] for a description of dredging activities near the plant from 1971 to 1994). These dredging activities narrowed the channel by 200 feet, which increased flow velocities and reduced sediment deposition. Therefore, the accumulation of mercury-laden sediments in the area is unlikely; this conclusion is supported by the absence of mercury in the majority of samples collected during this sampling effort.

4.5 Surface Water in the Stormwater Drainage Ditch

Surface water samples were collected from the eastern stormwater drainage ditch and analyzed for total mercury during three storm events (November 15 and 25, 1998, and January 19, 1999). In addition, flow rates were measured to determine mass loading to the Columbia River. Figure 4-4 shows the surface water sampling location at the end of this drainage ditch (black triangle symbol) where the three stormwater samples were collected. Table 4-4 shows surface water mercury concentrations and flow rates for each of these events. All stormwater sample results indicated that mercury concentrations were below the detection limit of 0.0002 mg/L. There is currently no mercury load to the Columbia River from this stormwater drainage ditch. Drainage into the stormwater ditch and surface water flows are discussed in more detail in Sections 3.3.2 and 3.3.3. Based on these surface water results and the results from soil sampling within the ditch, stormwater runoff not captured by the stormwater treatment system is not considered to represent a significant source of mercury to the Columbia River.

4.6 Mercury Conceptual Model

4.6.1 Mercury Travel from Soil to Groundwater

This section combines the nature and extent information presented in the preceding sections and evaluates the transport mechanisms of mercury from soil to groundwater and subsequently to the Columbia River. Additionally, the transport of mercury from the stormwater drainage ditch to the Columbia River is evaluated. Refer to Appendix C for long-term groundwater monitoring well mercury concentrations (1991 to March 2000).

4.6.1.1 Central Process Area

Concentrations of inorganic mercury in soil are less than 16 mg/kg in the liquefaction and loading areas and less than 189 mg/kg in the No. 2 Cell Room, caustic storage, and brine treatment areas. Groundwater in the central process area is monitored by Wells CH-1, CH-5, and CH-6. Based on the direction of groundwater flow, Well CH-1 is the most upgradient well. CH-5 is downgradient and slightly cross-gradient from CH-1. Well CH-6 is downgradient from CH-1 and CH-5 and is the well closest to the Columbia River of those wells in the central process area (see Figure 2-4).

Mercury concentrations in CH-1 have been consistently below the mercury MCL except in 1997. Mercury concentrations in groundwater dropped below the MCL in 1998 and have remained below the MCL through the most current sampling event, in March 2000. Well CH-1 is located adjacent to the liquefaction and loading areas, where soil concentrations are low (less than 16 mg/kg). Well CH-5 is located adjacent to and downgradient of the caustic storage area and adjacent to the brine treatment area, where soil concentrations are less than 185 mg/kg. Mercury concentrations in groundwater at CH-5 have consistently been above the MCL since monitoring began in 1991, although the results have fluctuated. Between April 1997 and March 2000, mercury concentrations declined to less than the mercury MCL. It is likely that mercury concentrations in both CH-1 and CH-5 have been influenced by higher groundwater levels caused by increased precipitation that occurred between 1995 and 1997. Higher mercury concentrations are likely caused by submergence of mercury in lower portions of the unsaturated zone by rising groundwater levels. Well CH-6, which is closest to the Columbia River, has been consistently at or below detection limits (and thus, the mercury MCL) since monitoring began in 1991. One exception was during March 1998, when mercury concentrations increased to 0.001 mg/L, which is below MCL.

Figure 4-17 shows the water level and mercury concentration in Well CH-5 compared to precipitation in Longview since 1991. This figure indicates that, as water levels rise in CH-5, so do concentrations of mercury (for example, see the peaks in March 1993 and September 1995); however, a similar response does not occur during periods of high precipitation. For example, around March 1993, the precipitation levels fluctuated but mercury concentrations remained close to average, with no distinct peaks. Similarly, during September 1995, the water level and mercury concentration in Well CH-5 started to increase before precipitation began to increase. These trends indicate that the mechanism for mercury to be released from soil to groundwater is rising groundwater levels, not precipitation infiltration.

4.6.1.2 Former No. 1 Cell Room and Former Surface Impoundments

The former No. 1 Cell Room was located on approximately 3 to 6 feet of fill material over the basalt remnant of Mount Coffin. The cell room and associated soils were removed between 1990 and 1991. During building demolition, Weyerhaeuser made extensive efforts to remove elemental mercury present in the basalt, but it is likely that small amounts of mercury remain in the subsurface at the site in isolated globules (that is, within basalt fractures). Sampling conducted after removal of the former No. 1 Cell Room show that concentrations of mercury left in soil are less than 634 mg/kg. Concentrations of mercury in groundwater up to this time were consistently above the MCL. In October of 1991, the cell room was closed under an agreed order with Ecology. Closure involved the placement of clean sand and gravel to match the surrounding grade, installation of a rainwater collection system, and placement of a polymer modified asphalt cap over the area. These closure actions significantly reduced the amount of precipitation that infiltrates into the soil and, therefore, reduced the amount of percolating water that could dissolve mercury from the soil and carry it to groundwater. Since the remedial action in 1991, mercury concentrations in groundwater in the area of the former No. 1 Cell Room have remained consistent over time and have not decreased significantly. As discussed in Section 4.2.3, these factors suggest that it is the presence of mercury below the water table that is causing mercury concentrations to remain steady in this area, rather than the transport of mercury from soil to groundwater.

The former surface impoundments are located on approximately 17.5 feet of fill material over the remnant of Mount Coffin. From 1972 through 1977, pond liners, soil, and brine sludge were removed from the area; concentrations of mercury in soil left in place are now less than 237 mg/kg. Groundwater had not been monitored before or during this time period. Since monitoring began in 1991, the concentration of mercury downgradient of the former surface impoundment has been low, fluctuating around the MCL.

Figure 4-18 shows the water levels in Well CH-3 (located downgradient of the former surface impoundments) compared to mercury concentrations. This figure shows a strong correlation between water levels and mercury concentrations, especially in 1992, 1993, and from 1998 to March 2000. Figure 4-19 shows that mercury concentrations and precipitation are weakly correlated in Well CH-3, with a slightly better correlation between mercury concentrations and groundwater levels. For example, the peak in mercury concentrations measured in February 1993 correlates to a rise in groundwater levels and low precipitation. Similarly, the rise in mercury concentrations observed in 1995 occurred during a period of low precipitation. The very high amounts of precipitation that occurred in Longview in late 1995 through early 1997 occurred during a period of consistently decreasing mercury concentrations in Well CH-3. These observations suggest that dissolution and transport of mercury by the infiltration and percolation of precipitation is not a major factor influencing mercury concentrations in the area of the former surface impoundments.

4.6.1.3 West Area

Further evaluation of the soil-to-groundwater transport mechanism in the west area is not needed because concentrations of mercury in soil are less than 16 mg/kg and groundwater concentrations are consistently below the mercury MCL.

4.6.2 Mercury Travel from Stormwater to the Columbia River

Inorganic mercury present in surface soil in unpaved areas at the plant could be transported in stormwater runoff that is captured by a stormwater drainage ditch. This ditch is on the eastern side of the plant (more specifically, near the former surface impoundments) and is the only ditch that receives this type of runoff. Given the absence of mercury in past sampling of soil and stormwater within the ditch, this mechanism is not expected to be a significant source of mercury to the Columbia River. Furthermore, the portion of the mercury that could be methylmercury is also not considered a significant issue because total mercury is undetectable.

4.6.3 Mercury Travel from Groundwater to Columbia River

Groundwater from the Chlor-Alkali Plant discharges into the Columbia River. Although inorganic mercury is present in low concentrations in wells near the river, there is no observable effect within the Columbia River at the plant; mercury concentrations are similar within surface water, sediment, and fish tissue (see Section 5.3.1.6 for fish tissue results) both upstream and downstream of the plant. The mercury discharge to the Columbia River is approximately 0.4 pound per year. Essentially all of this is discharged from alluvium; the basalt zone contributes approximately 0.002 percent of this total (see Section 4.3.3).

4.6.4 Mercury Discharges Directly to the Columbia River

Currently there are three mechanisms for releasing mercury directly to the Columbia River: groundwater discharge, stormwater runoff, and direct discharge from the No. 2 Cell Room diffuser. The former diffuser associated with the former No. 1 Cell Room, which served as an outfall to the river, was removed in March 1992 and is no longer a mercury release mechanism.

The other diffuser associated with the No. 2 Cell Room was installed in 1965 and is located about 100 feet downstream of the salt dock. It extends approximately 80 feet into the Columbia River and ends at the pierhead line. Plant operators have indicated that this diffuser was not used after 1976. The No. 2 Cell Room diffuser operated for a shorter period of time than the former No. 1 Cell Room diffuser, and it received less mercury (potential releases from the No. 2 Cell Room were considerably less than from the former No. 1 Cell Room). Although this diffuser potentially operated for 10 years (from 1966 to 1976), sediment samples collected during May 1999 indicate that the diffuser did not significantly affect the Columbia River sediments (see Section 4.4.2).

Because mercury was not detectable in stormwater runoff from the stormwater drainage ditch, groundwater discharge is considered the only remaining pathway for mercury migration to the river.

Table 4-1
Soil Sampling Results for the Brine Spill Area, 1998
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

Sample ID	Depth (ft bgs)	Date Sampled	Analyte	Units	Result	Average (a)
F036-001-SO-26498XX	3	09/21/98	Alkalinity, Total as CaCO3	mg/Kg	4,400	
F036-002-SO-26498DU	3	09/21/98	Alkalinity, Total as CaCO3	mg/Kg	3,500	
F036-002-SO-26498XX	3	09/21/98	Alkalinity, Total as CaCO3	mg/Kg	1,900	
F036-003-SO-26498XX	3	09/21/98	Alkalinity, Total as CaCO3	mg/Kg	9,000	
F036-004-SO-26498XX	3	09/21/98	Alkalinity, Total as CaCO3	mg/Kg	1,700	4,100
F036-001-SO-26498XX	3	09/21/98	Chloride	mg/Kg	3,000 D	
F036-002-SO-26498DU	3	09/21/98	Chloride	mg/Kg	420 D	
F036-002-SO-26498XX	3	09/21/98	Chloride	mg/Kg	770 D	
F036-003-SO-26498XX	3	09/21/98	Chloride	mg/Kg	2,700 D	
F036-004-SO-26498XX	3	09/21/98	Chloride	mg/Kg	150 D	1,408
F036-001-SO-26498XX	3	09/21/98	Mercury	mg/Kg	159 D	
F036-002-SO-26498DU	3	09/21/98	Mercury	mg/Kg	0.9	
F036-002-SO-26498XX	3	09/21/98	Mercury	mg/Kg	0.5	
F036-003-SO-26498XX	3	09/21/98	Mercury	mg/Kg	13.7 D	
F036-004-SO-26498XX	3	09/21/98	Mercury	mg/Kg	189 D	72.62
F036-001-SO-26498XX	3	09/21/98	pH	mg/Kg	9.3	
F036-002-SO-26498DU	3	09/21/98	pH	mg/Kg	9	
F036-002-SO-26498XX	3	09/21/98	pH	mg/Kg	9	
F036-003-SO-26498XX	3	09/21/98	pH	mg/Kg	11	
F036-004-SO-26498XX	3	09/21/98	pH	mg/Kg	9.3	9.52
F036-001-SO-26498XX	3	09/21/98	Solids, Total	% @ 105C	83.4	
F036-002-SO-26498DU	3	09/21/98	Solids, Total	% @ 105C	84	
F036-002-SO-26498XX	3	09/21/98	Solids, Total	% @ 105C	83.8	
F036-003-SO-26498XX	3	09/21/98	Solids, Total	% @ 105C	81.4	
F036-004-SO-26498XX	3	09/21/98	Solids, Total	% @ 105C	92	84.92
F036-001-SO-26498XX	3	09/21/98	Sulfide	mg/Kg	50 U	
F036-002-SO-26498DU	3	09/21/98	Sulfide	mg/Kg	45 U	
F036-002-SO-26498XX	3	09/21/98	Sulfide	mg/Kg	40 U	
F036-003-SO-26498XX	3	09/21/98	Sulfide	mg/Kg	108	
F036-004-SO-26498XX	3	09/21/98	Sulfide	mg/Kg	14 U	108

Notes:

Depth (ft bgs) = feet below ground surface.

DU = Duplicate.

U = Not detected at specified detection limit.

D = Dilution required.

(a) Average of detections.

Table 4-2
Chemical Properties of Soil in the Former Surface Impoundment Area, 1998
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

Sample ID	Depth (ft bgs)	Date Sampled	Analyte	Units	Result	Average (a)
H036-001-SO-26498XX	3	09/21/98	Alkalinity, Total as CaCO3	mg/Kg	3,000	
H036-002-SO-26498XX	3	09/21/98	Alkalinity, Total as CaCO3	mg/Kg	200	
H036-003-SO-26498XX	3	09/21/98	Alkalinity, Total as CaCO3	mg/Kg	2,100	
H036-004-SO-26498XX	3	09/21/98	Alkalinity, Total as CaCO3	mg/Kg	1,700	1,750
H036-001-SO-26498XX	3	09/21/98	Chloride	mg/Kg	10 D	
H036-002-SO-26498XX	3	09/21/98	Chloride	mg/Kg	1.8 D	
H036-003-SO-26498XX	3	09/21/98	Chloride	mg/Kg	28 D	
H036-004-SO-26498XX	3	09/21/98	Chloride	mg/Kg	42 D	20.45
H036-001-SO-26498XX	3	09/21/98	pH	mg/Kg	7	
H036-002-SO-26498XX	3	09/21/98	pH	mg/Kg	7.1	
H036-003-SO-26498XX	3	09/21/98	pH	mg/Kg	8.8	
H036-004-SO-26498XX	3	09/21/98	pH	mg/Kg	8.9	7.95
H036-001-SO-26498XX	3	09/21/98	Solids, Total	% @ 105C	69.1	
H036-002-SO-26498XX	3	09/21/98	Solids, Total	% @ 105C	91	
H036-003-SO-26498XX	3	09/21/98	Solids, Total	% @ 105C	74	
H036-004-SO-26498XX	3	09/21/98	Solids, Total	% @ 105C	83.7	79.45
H036-001-SO-26498XX	3	09/21/98	Sulfide	mg/Kg	119	
H036-002-SO-26498XX	3	09/21/98	Sulfide	mg/Kg	11 U	
H036-003-SO-26498XX	3	09/21/98	Sulfide	mg/Kg	93	
H036-004-SO-26498XX	3	09/21/98	Sulfide	mg/Kg	50 U	106

Notes:
Depth (ft bgs) = feet below ground surface.
U = Not detected at specified detection limit.
D = Diluted required.
(a) Average of detections.

Table 4-3
Columbia River Sediment Results
Weyerhaeuser Chlor-Alkali Plant - Longview, WA

Sample ID	Station ID	Latitude	Longitude	Date Sampled	Mercury (mg/Kg)	TOC (%)	Total Solids (%)	Clay (%)	Gravel (%)	Sand (%)	Silt (%)
Former No. 1 Cell Room Sediment Sample Results											
H001-001-SD-27298-XX	H001	46 07 44.972	122 59 28.289	09/29/98	0.2	0.12	73.6	1.8	1.1	92.9	4.1
H001-002-SD-27298-XX	H002	46 07 44.530	122 59 29.247	09/29/98	0.1 U	4.21	39.2	NA	NA	NA	NA
H001-003-SD-27298-XX	H003	46 07 44.324	122 59 30.186	09/29/98	0.1 U	2.78	42.8	33	2	26.4	38.5
H001-004-SD-27298-XX	H004	46 07 43.299	122 59 25.353	09/29/98	0.2	0.18	71.4	2	0.2	89.9	8
H001-005-SD-27298-XX	H005	46 07 42.945	122 59 26.296	09/29/98	0.1 U	4.53	36.1	42.1	0	6.6	51.3
H001-006-SD-27298-XX	H006	46 07 42.500	120 59 27.009	09/29/98	0.1 U	2.12	48	36.9	0	19.9	43.2
H001-007-SD-27298-XX	H007	NM	NM	09/29/98	0.1 U	0.48	68.7	4.9	0.1	57.3	37.6
H001-008-SD-27298-XX	H008	46 07 42.378	122 59 23.855	09/29/98	0.1 U	0.12	73.4	2.4	0	90.6	7
H001-010-SD-27298-XX	H010	46 07 41.201	122 59 25.880	09/29/98	0.1 U	0.17	73.9	1.9	1	93.8	3.3
H001-011-SD-27298-DU	H011	46 07 42.037	122 59 22.548	09/29/98	0.1 U	0.16	74.7	2.2	4	83.7	10
H001-011-SD-27298-XX	H011	46 07 42.037	122 59 22.548	09/29/98	0.1 U	0.09	77.5	1.4	2.6	88.1	8
H001-014-SD-27398-DU	H014	46 07 39.932	122 59 25.685	09/30/98	0.1 U	0.04	74.4	0.8	0.2	98.3	0.7
H001-014-SD-27398-XX	H014	46 07 39.932	122 59 25.685	09/30/98	0.1 U	0.03	70	1.1	0	98.3	0.5
H001-015-SD-27398-XX	H015	46 07 41.016	122 59 21.850	09/30/98	0.1 U	0.13	73	2.3	0.3	85.2	12.2
H001-016-SD-27398-XX	H016	46 07 40.173	122 59 22.933	09/30/98	0.1 U	0.08	76.4	1.6	5.3	91.4	1.7
H001-017-SD-27398-XX	H017	46 07 39.363	122 59 23.751	09/30/98	0.1 U	0.03	78.8	1	1.6	97.1	0.3
H001-018-SD-27398-XX	H018	46 07 39.529	122 59 16.404	09/30/98	0.1 U	0.15	73.6	2.3	0	92.2	5.4
H001-019-SD-27398-XX	H019	46 07 38.939	122 59 16.321	09/30/98	0.1 U	0.11	72.2	2.2	0	90.2	7.6
H001-020-SD-27398-XX	H020	46 07 38.160	122 59 16.369	09/30/98	0.1 U	0.32	65.8	5.9	0.2	66.3	27.7
Abandoned No. 2 Cell Room Diffuser Sediment Sample Results											
H-001-021-SD-13999-xx	H021	46 07 46.168	122 59 27.906	05/19/99	0.1 U	0.54	71.4	3.8	0	33.4	62.8
H-001-022-SD-13999-xx	H022	46 07 46.377	122 59 28.147	05/19/99	0.1 U	0.61	61.8	2.8	0	45.2	52
H-001-023-SD-13999-xx	H023	46 07 45.929	122 59 28.575	05/19/99	0.1 U	0.35	64.7	2.6	0.4	55.3	41.7
H-001-024-SD-14099-xx	H024	46 07 46.192	122 59 28.810	05/20/99	0.1 U	0.17	71.2	0.3	0.4	85	14.4
H-001-025-SD-13999-xx	H025	46 07 47.540	122 59 29.600	05/19/99	0.1 U	0.18	66.7	0	0	71.3	28.7
H-001-026-SD-13999-xx	H026	46 07 47.297	122 59 29.915	05/19/99	0.1	1.81	55	4.0	10	60.2	25.7
H-001-027-SD-14099-xx	H027	46 07 47.069	122 59 30.224	05/20/99	0.1	0.05 U	71.9	0	7.2	86.6	6.2
H-001-028-SD-13999-xx	H028	46 07 49.648	122 59 32.217	05/19/99	0.1 U	0.05 U	70	0	0	79	21
H-001-028-SD-13999-DU	H028	46 07 49.648	122 59 32.217	05/19/99	0.1 U	0.06	69.8	0	0	79.1	20.9
H-001-029-SD-13999-xx	H029	46 07 49.430	122 59 32.912	05/19/99	0.1 U	0.06	69.6	0	1.9	88	10.2
H-001-030-SD-13999-xx	H030	46 07 48.996	122 59 33.4856	05/19/99	0.4	0.05 U	70.2	0	0.4	95.7	4.0
H-001-031-SD-14099-xx	H031	46 07 45.514	122 59 29.403	05/20/99	0.1 U	0.31	68.6	2.2	13.6	70.3	13.9
H-001-032-SD-14099-xx	H032	46 07 45.902	122 59 28.601	05/20/99	0.2	0.57	61.7	2.2	11	58.9	27.9
H-001-033-SD-14099-xx	H033	46 07 46.068	122 59 28.886	05/20/99	0.1 U	0.68	67.3	4.4	3.0	58.4	34.2
H-001-027-SD-14099-EB	H027	46 07 47.069	122 59 30.224	05/20/99	0.2 U	--	--	--	--	--	--

Notes:

NM = Not available. Too few SVs, GPS would not operate. Station located 40 feet toward shore from C008.

NA = Not analyzed. Adequate volume was not collected.

See Figure 4-16 for sample Locations. Data sheets presented in Appendix C.

-- = Not applicable.

TABLE 4-4
Surface Water Sample Results

Date Collected	Mercury (mg/L)	Flow Rate (gpm)
11/15/98	0.0002 U	6.7
11/25/98	0.0002 U	300 E
1/19/99	0.0002 U	10

U = Mercury not detected at specified detection limit.
E = Estimated because of high flows.
gpm = gallons per minute.

ALR
06-APR-1999

West Area
Outfall Lines
Chlor-Alkali Plant Access Road
Boat Ramp
Employee Parking Lot
Salt Pile
No. 2 Cell Room
Brine Spill Area
Evaporators
Office
Liquefaction
Loading
Maintenance
Brine Treatment
Salt Dissolving Basin
Salt Dock
Rail Switching
Caustic Storage
Former No. 1 Cell Room Site
Maintenance Shop
Intake Pipelines
Sewage Lagoon
Former Surface Impoundments
Staging Area
Former Diffuser Area
COLUMBIA RIVER
COLUMBIA RIVER

3 / 0.07 / 16
18 / 0.2 / 72.8
3 / 0.4 / 11
2 / 0.2 / 4.6
18 / 0.2 / 185
54 / 0.5 / 189
37 / 1.5 / 118
46 / 0.2 / 634
21 / 0.3 / 237
24 / 9 / 40.9

LEGEND

Approximate area where soil samples have been collected

Previous soil removal areas

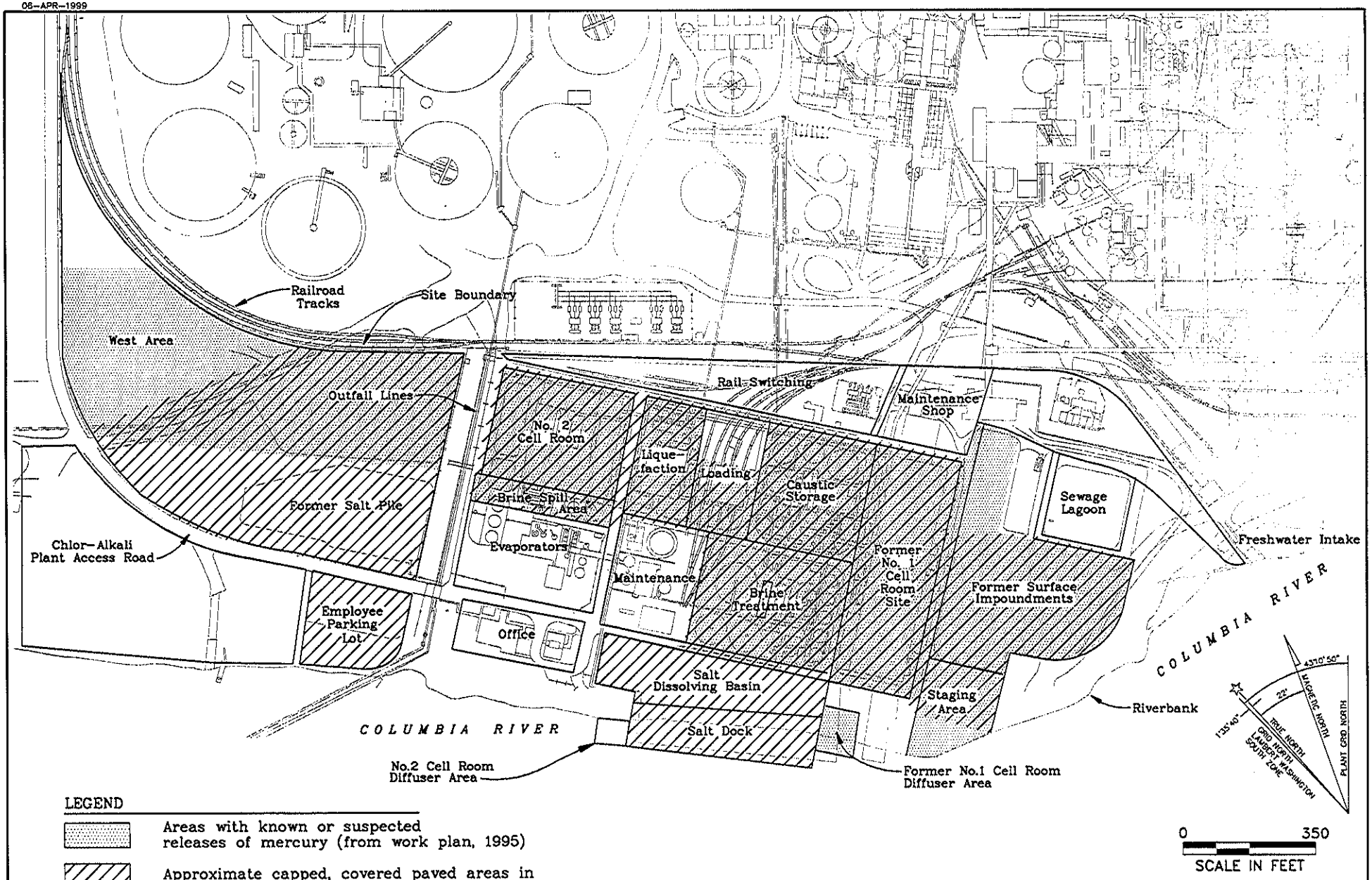
Ave. / Min. / Max. — Average, minimum and maximum concentrations for mercury in mg/kg for entire area (i.e., caustic storage). These soils are still in place and have not been excavated.

0 100 200
SCALE IN FEET

FIGURE 4-1
Soil Sampling and Removal Areas
WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON
CH2MHILL

P:\WEYERHAS\148834\CAD\88345010.DWG

08-APR-1999



LEGEND

Areas with known or suspected releases of mercury (from work plan, 1995)

Approximate capped, covered paved areas in potential areas of concern

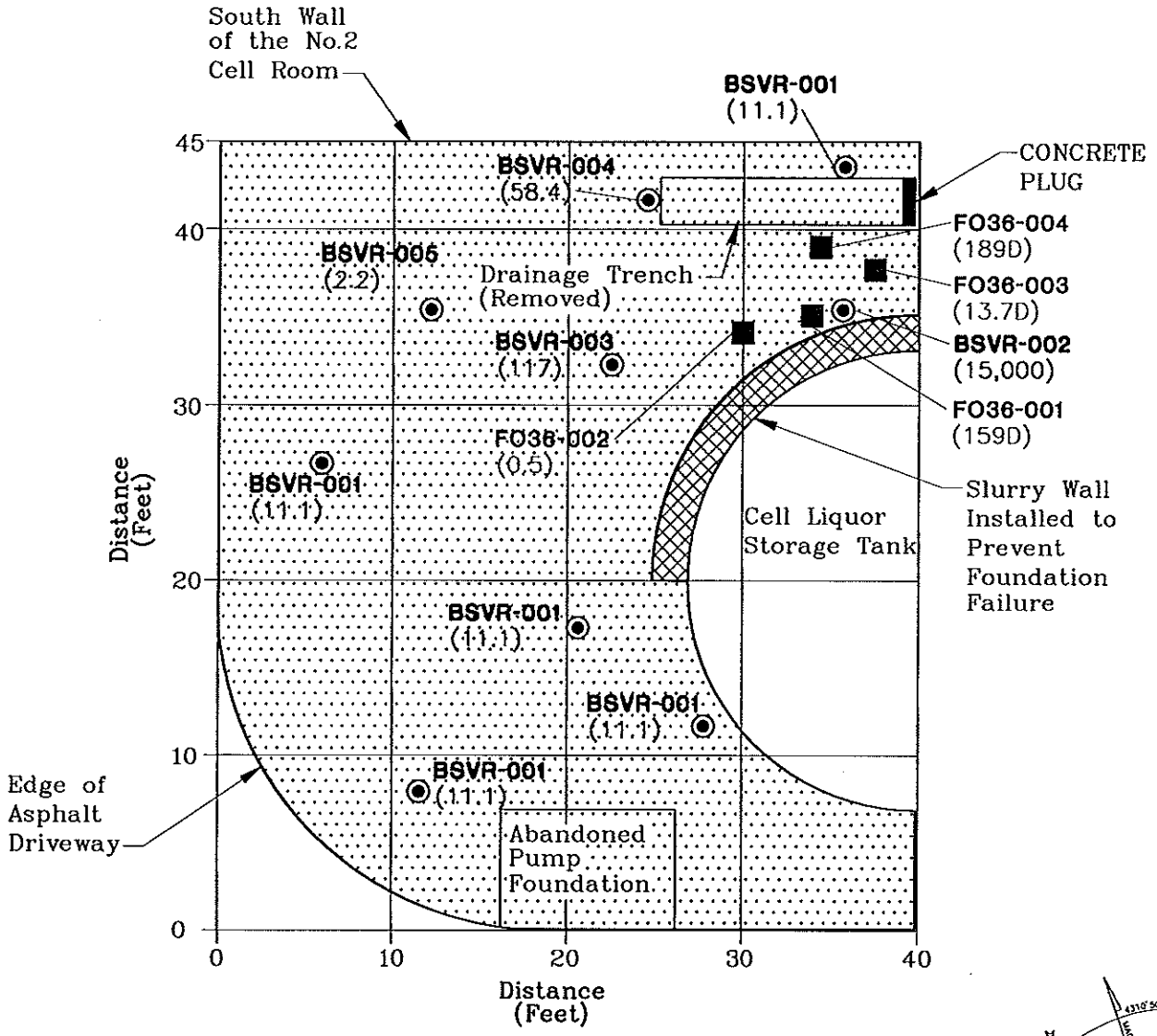
FIGURE 4-2

Capped and Covered Areas

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

8834g019A.DWG



LEGEND

◉ BSVR-001	1991 Sample locations
■ FO36-004	1998 Sample locations
(189D)	Mercury concentration in soil (mg/kg)
D	Dilution required

Note: Soil sample locations are approximate.

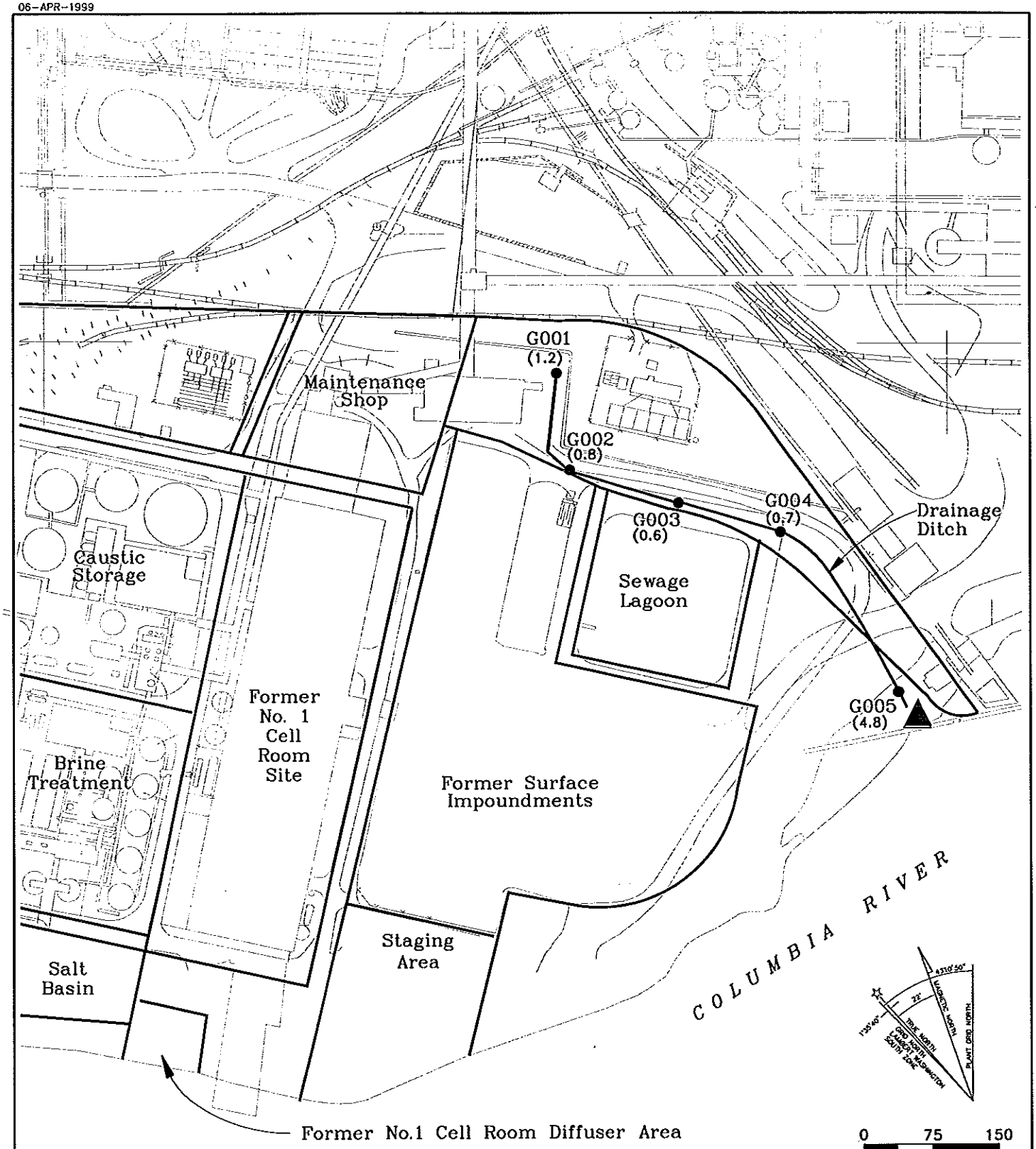
FIGURE 4-3

Soil Sample Locations in the Brine Spill Area

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

06-APR-1999



LEGEND

- ● Approximate soil sample location
- (0.7) Total mercury concentration in soil (mg/kg)
- ▲ Surface water sampling and volumetric flow rate measurement location

FIGURE 4-4

Soil and Surface Water Sample Locations for Stormwater Drainage Ditch Area

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

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SRB
15-JULY2001

MW-1
.0002U
.0005U
.0005U
.0002U
.0002U
.0002U

MW-4
.0004
.0005U
.0005U
.0027
.0002U
.0002U

MW-2
.0005
.0005U
.0005U
.0002U
.0002U
.0002U

MW-3
.0005
.0005U
.0005U
.0011
.0002U
.0002U

CH-1
.0022
.0016
.0011
.0007J
.0004J
.0016J
.0018

CH-5
.0006
.0014
.0005U
.00022
.0002U
.0002U
.0002U

CH-6
.0006
.0005U
.0010
.0002U
.0003
.0002J
.0002J

HLA-1B
.1530
.1560
.1460
.1250J
.0135
.0770J
.0246

HLA-2A
.0411
.0696
.0420
.1420
.0007
.0320J
.0112

HLA-3B
.0037
.0073
.0050
.0066
.0028
.0039J
.0035J

HLA-3A
.0252
.0062
.0038
.0056
.0130
.0077J
.004

HLA-6B
.0019
.0011
.0021
.0030
.0002U
.0002U
.0002U

HLA-6A
DRY
DRY
DRY
DRY
DRY
DRY
DRY
DRY

CH-7
NS
NS
NS
.0002U
.0002U
.0002U
.0002U

CH-2
.0045
.0032
.0005U
.0009
.0002
.0013J
.0005

HLA-1A
.2410
.0275
.0594
DRY
.1600
DRY
.149

HLA-7B
.0340
.0278
.0015
.0102J
.0030
.0008J
.0005

HLA-4A
.0048
DRY
.0005U
DRY
.0002U
DRY
.0002U

CH-8
NS
NS
NS
.0002U
.0002U
.0002U
.0002U

CH-3
.0036
.0033
.0032
.0020
.0034
.0034J
.0035

CH-4
.0015
.0008
.0007
.0006
.0006
.0006J
.0005

COLUMBIA RIVER

COLUMBIA RIVER

LEGEND

- Monitoring well locations
- CH-6 Monitoring well identification
- 0.0411 Mercury concentrations in mg/L
- U Concentration not detected at specified detection limit
- J Estimated concentration
- NS Not sampled; installed in Sept. 1998

Note: Well locations are approximate.

Sample Collection Dates

Apr-97
Aug-97
Mar-98
Oct-98
Mar-99
Sep-99
Mar-00

0 100 200
SCALE IN FEET

FIGURE 4-5
Dissolved Mercury Concentrations in Groundwater from April 1997 – March 2000
WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2M HILL

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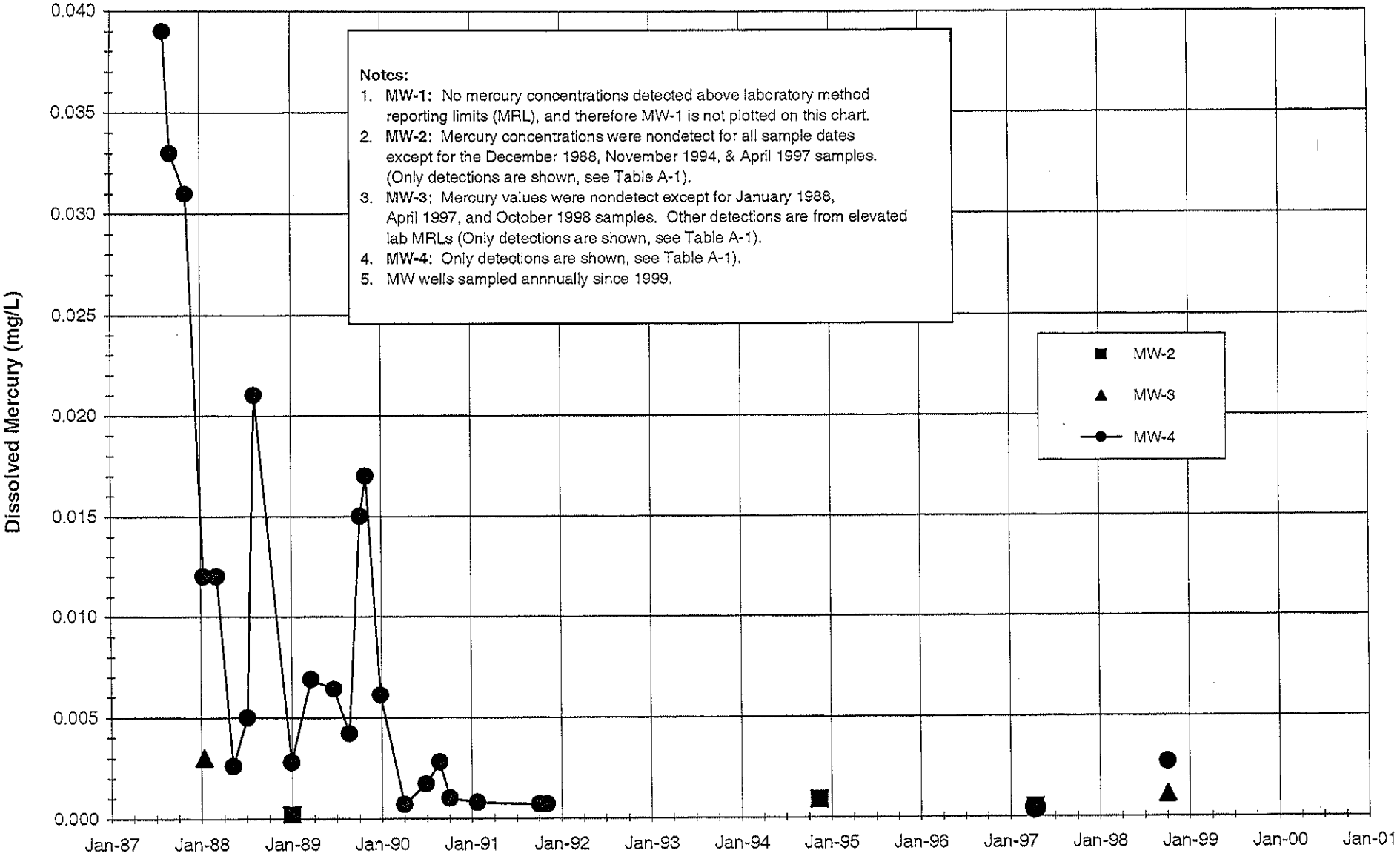


Figure 4-6
Dissolved Mercury Concentrations in Groundwater (MW-1, MW-2, MW-3, MW-4)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

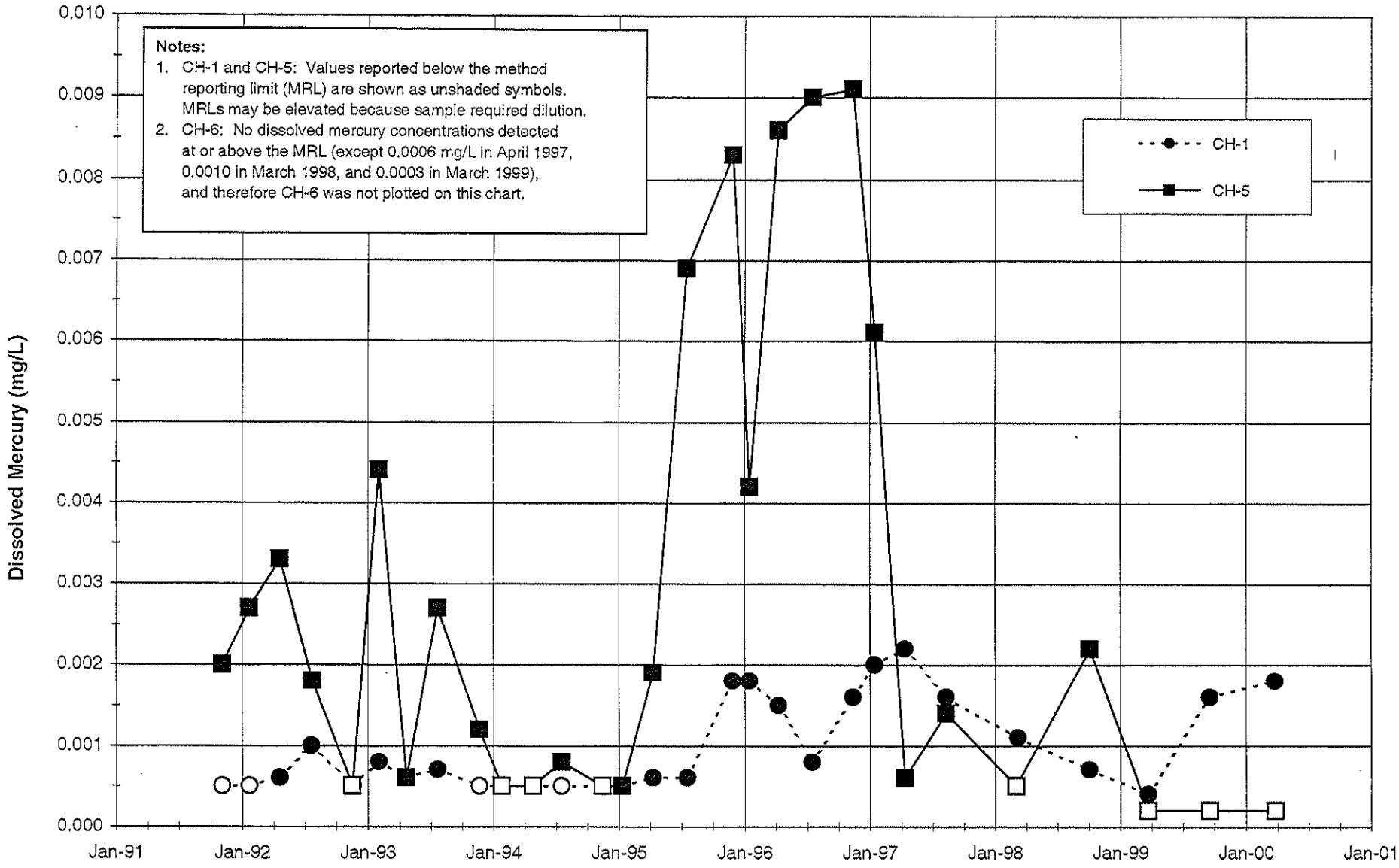


Figure 4-7
Dissolved Mercury Concentrations in Groundwater (CH-1, CH-5, CH-6)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

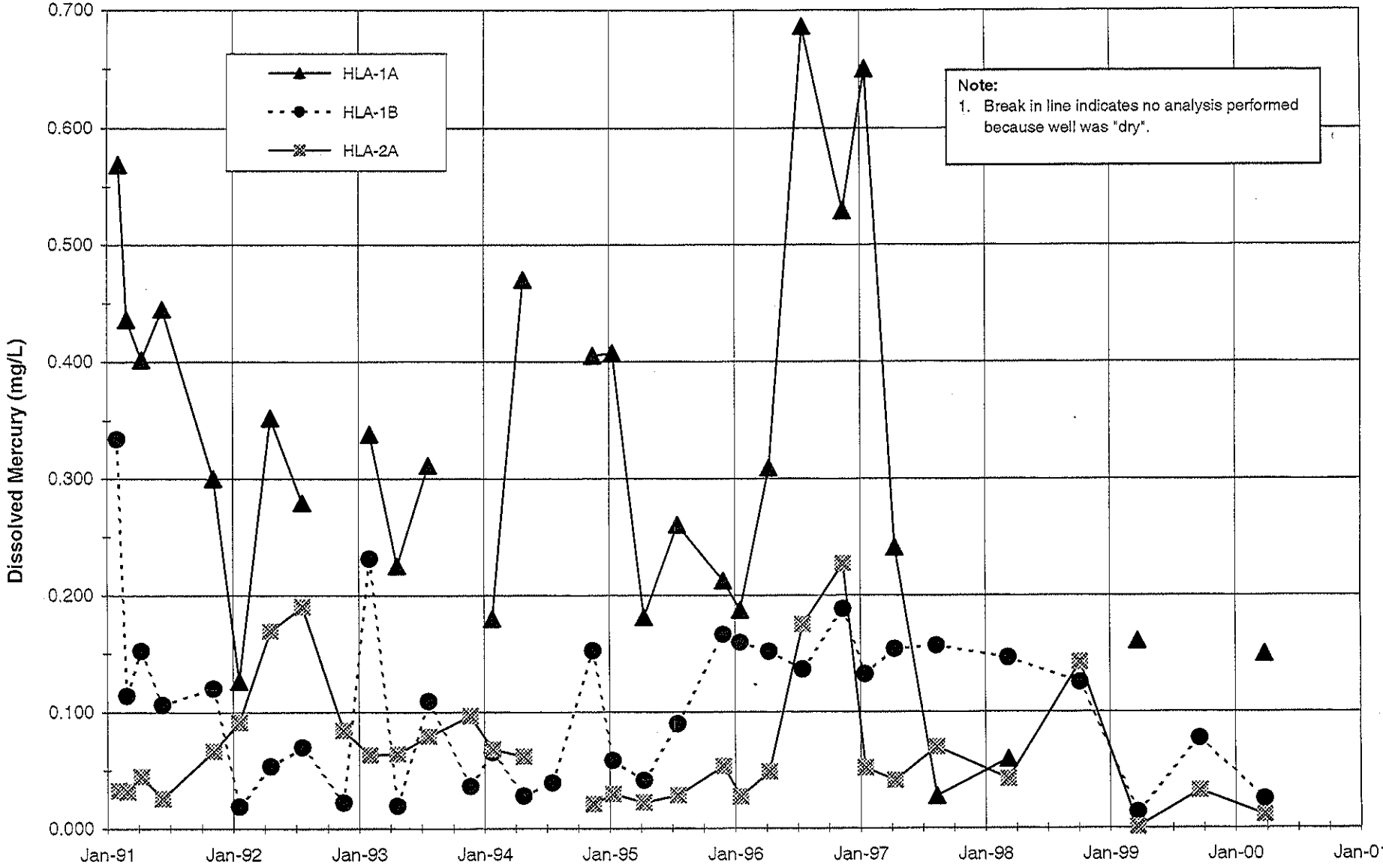


Figure 4-8
Dissolved Mercury Concentrations in Groundwater (HLA-1A, HLA-1B, and HLA-2A)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

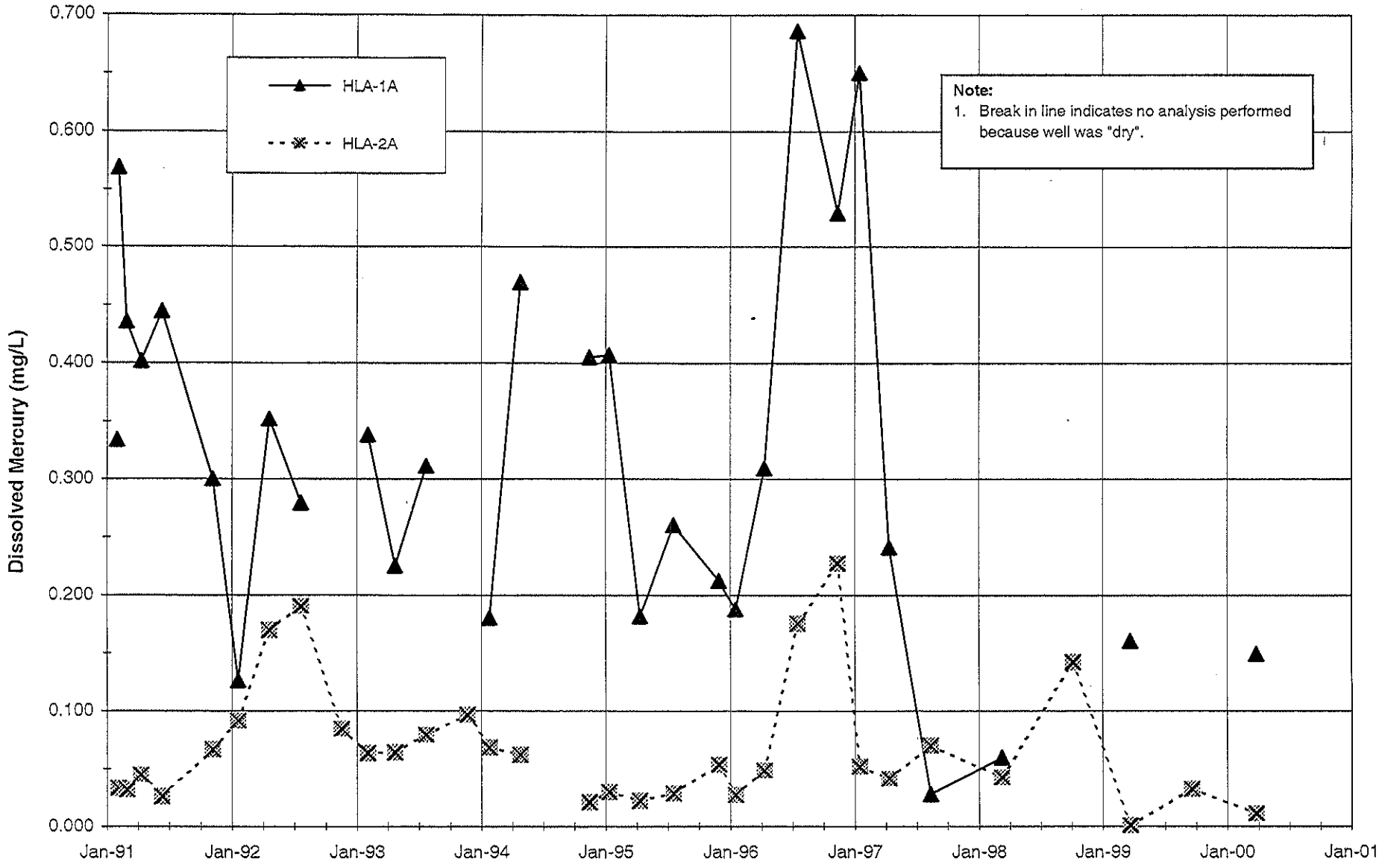


Figure 4-9
Dissolved Mercury Concentrations in Groundwater (HLA-1A, HLA-2A)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

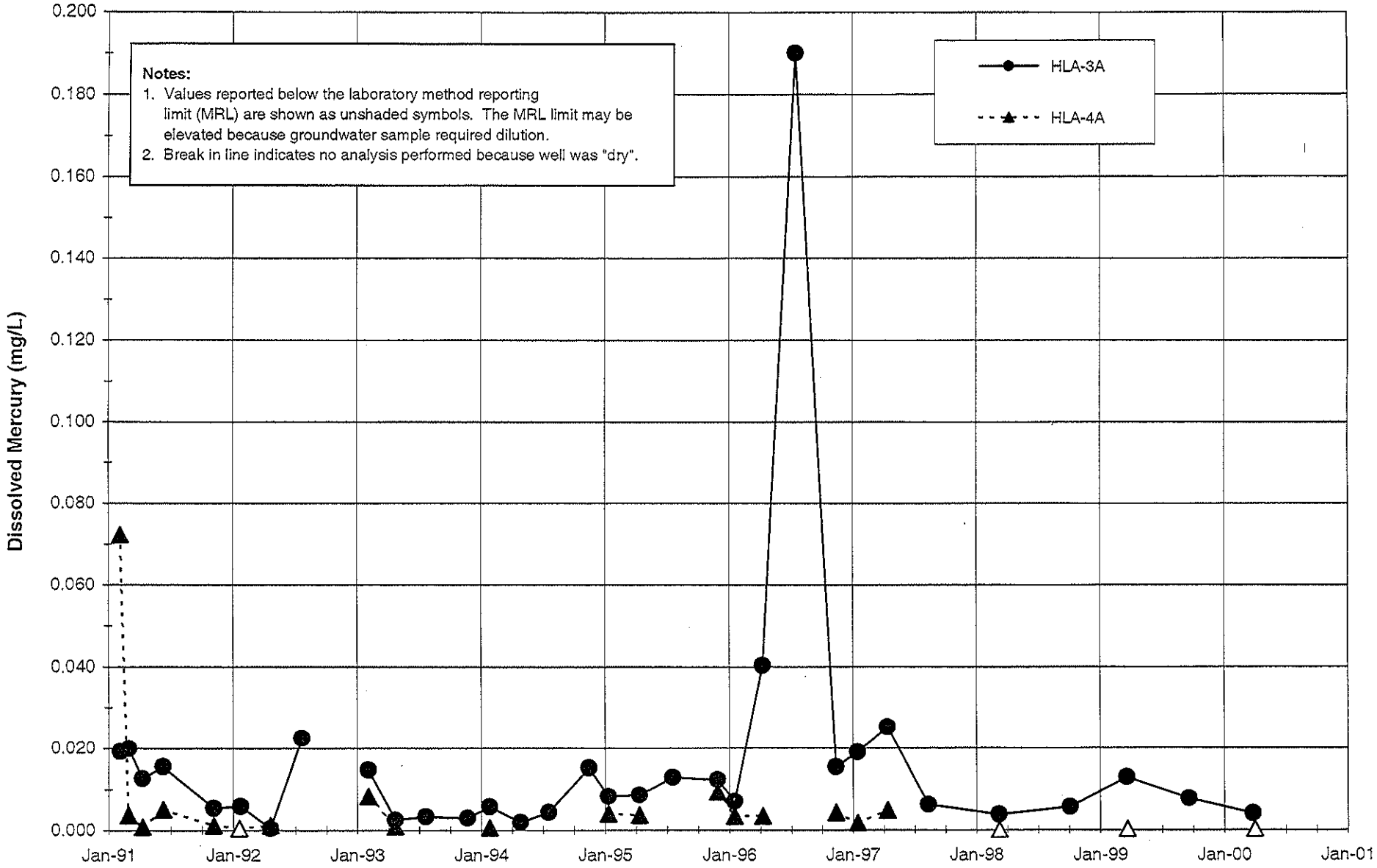


Figure 4-10
Dissolved Mercury Concentrations in Groundwater (HLA-3A, HLA-4A)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

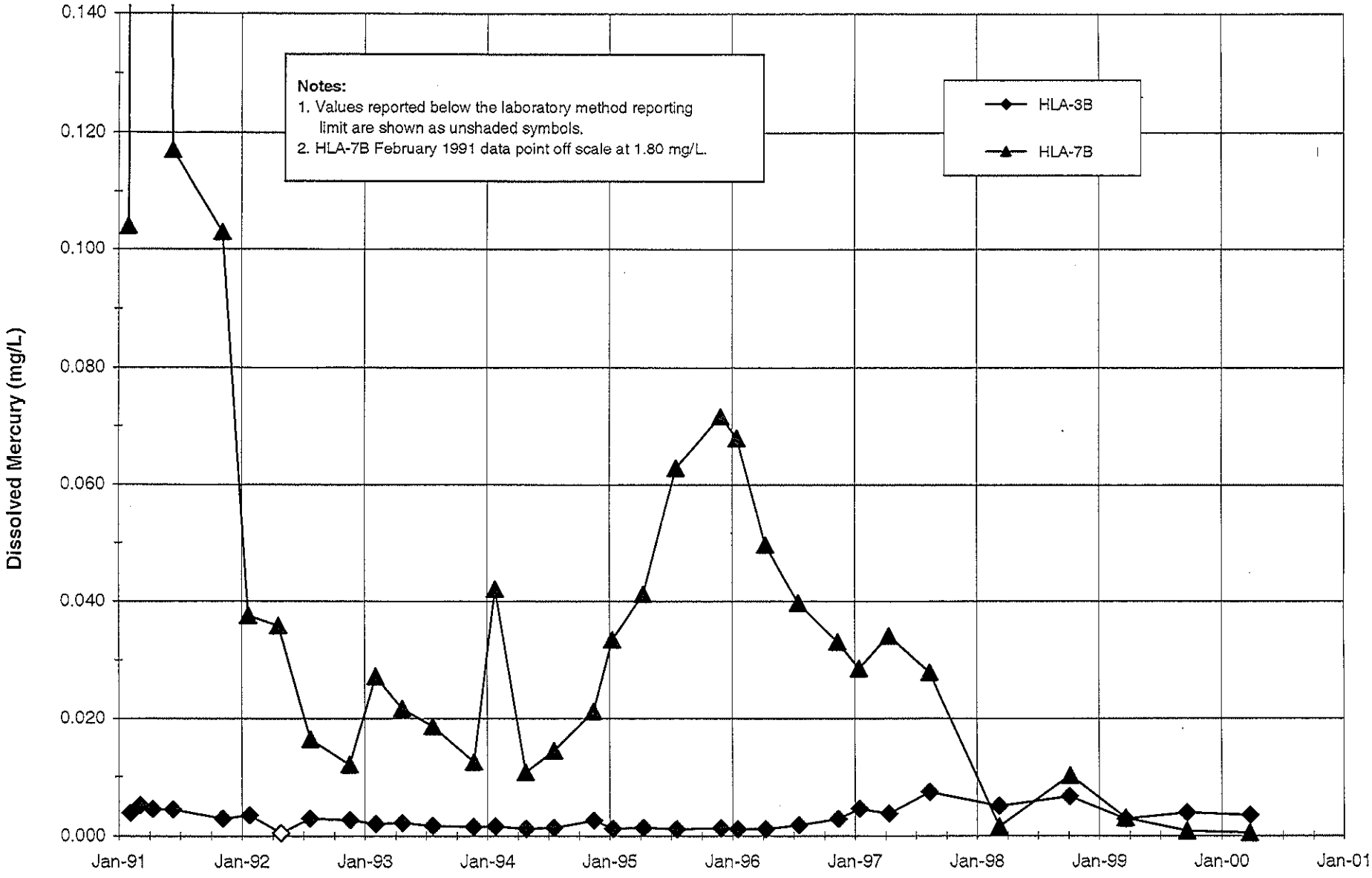


Figure 4-11
Dissolved Mercury Concentrations in Groundwater (HLA-3B, HLA-7B)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

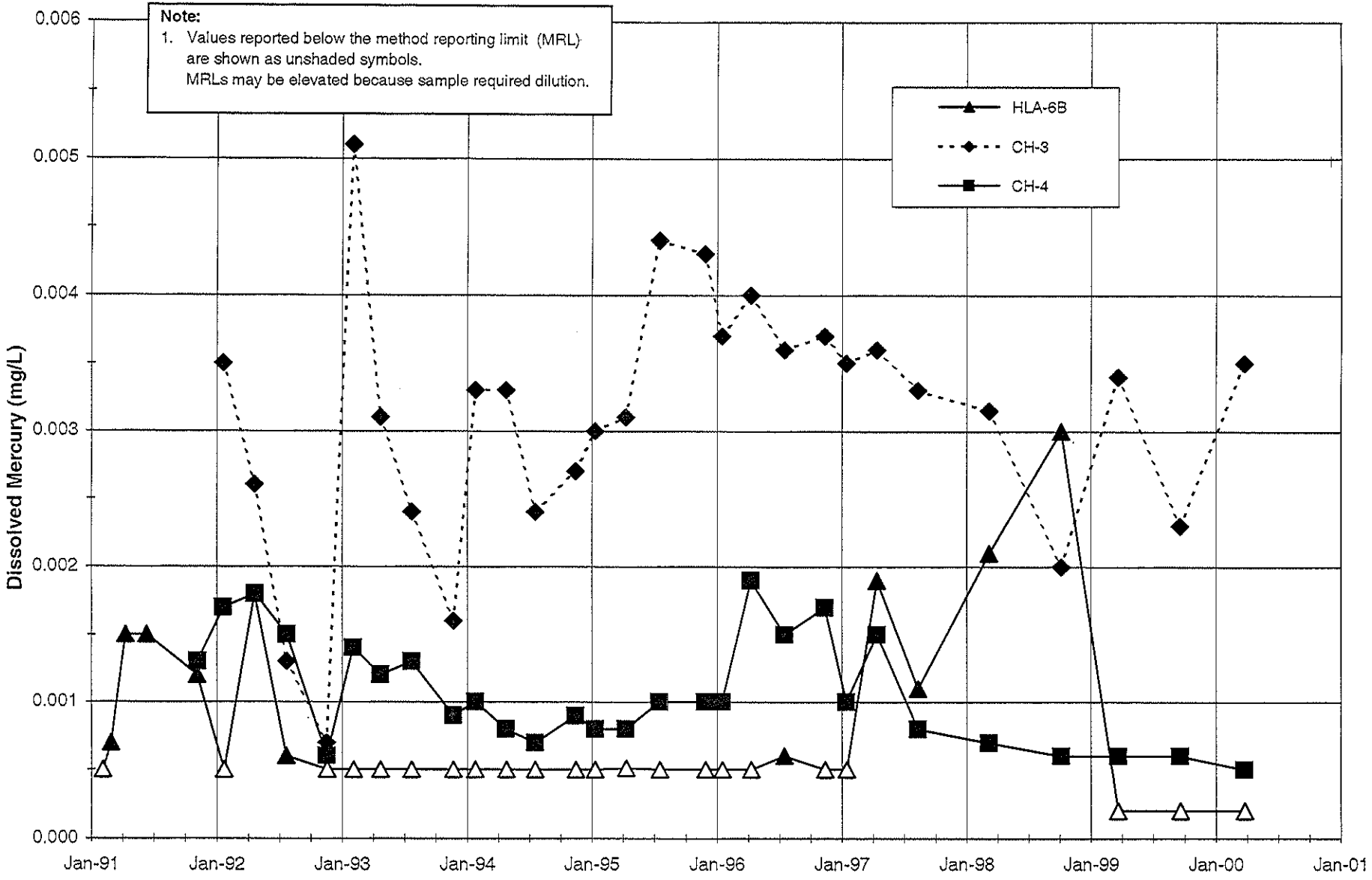


Figure 4-12
Dissolved Mercury Concentrations in Groundwater (HLA-6B, CH-3, CH-4)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

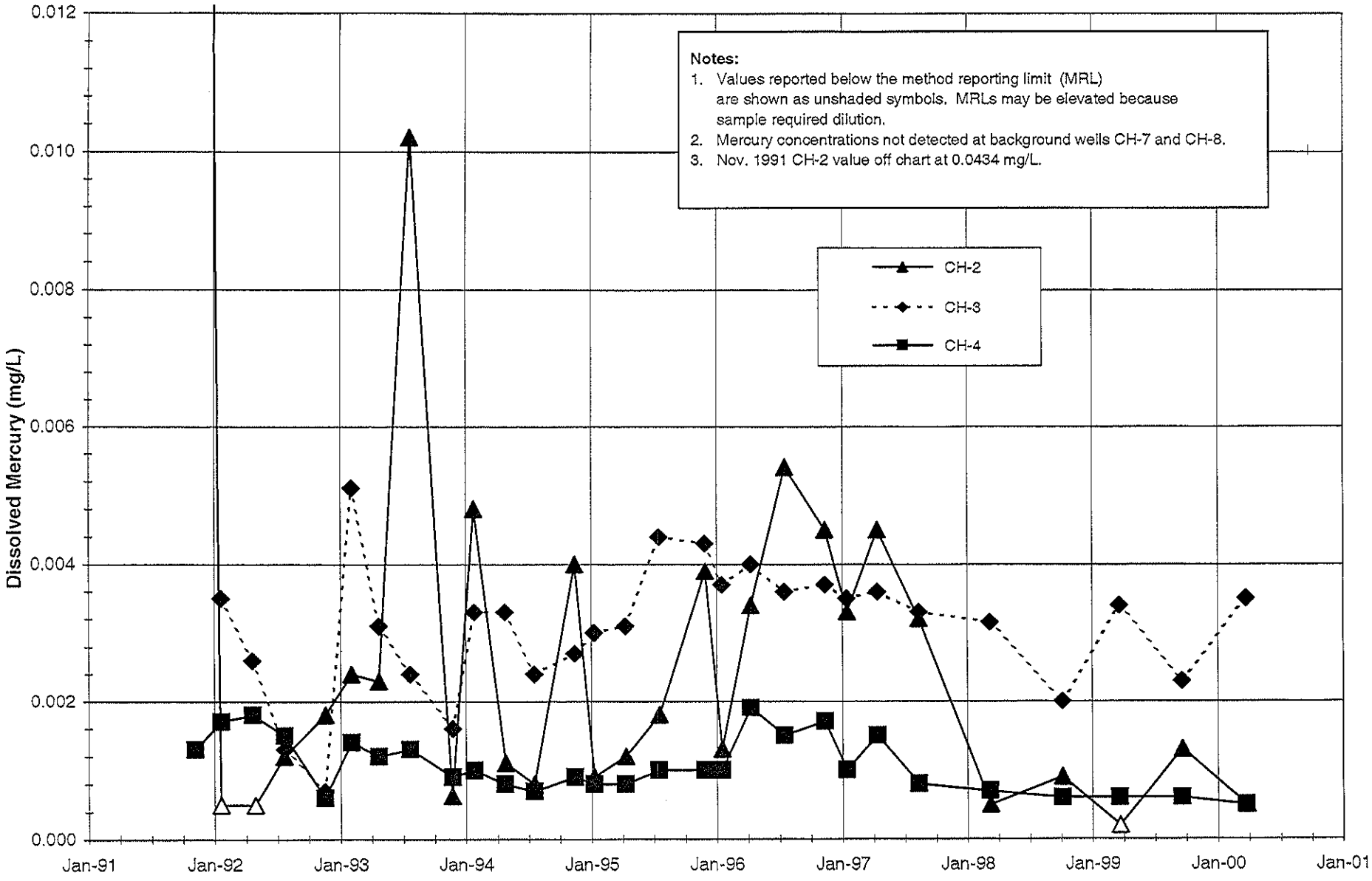
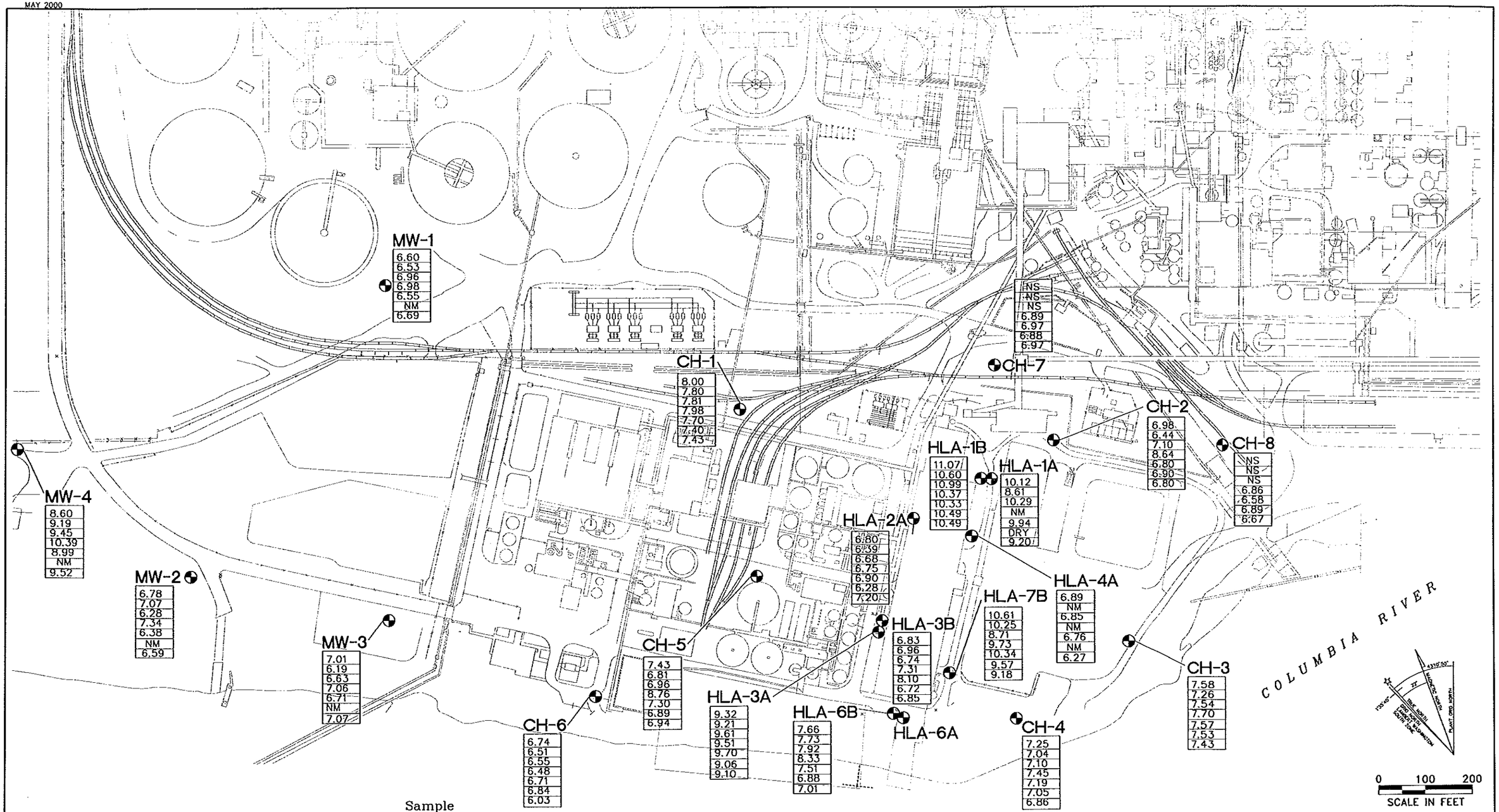


Figure 4-13
Dissolved Mercury Concentrations in Groundwater (CH-2, CH-3, CH-4)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

SRB
MAY 2000



LEGEND

- Monitoring well locations
- CH-1 Monitoring well identification
- 7.5 pH in well
- NM Not measured

Note: Well locations are approximate.

Sample Collection Dates

Apr-97
Aug-97
Mar-98
Oct-98
Mar-99
Sep-99
Mar-00

FIGURE 4-14
Measured pH Values in Groundwater from April 1997 – March 2000
WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON
CH2MHILL

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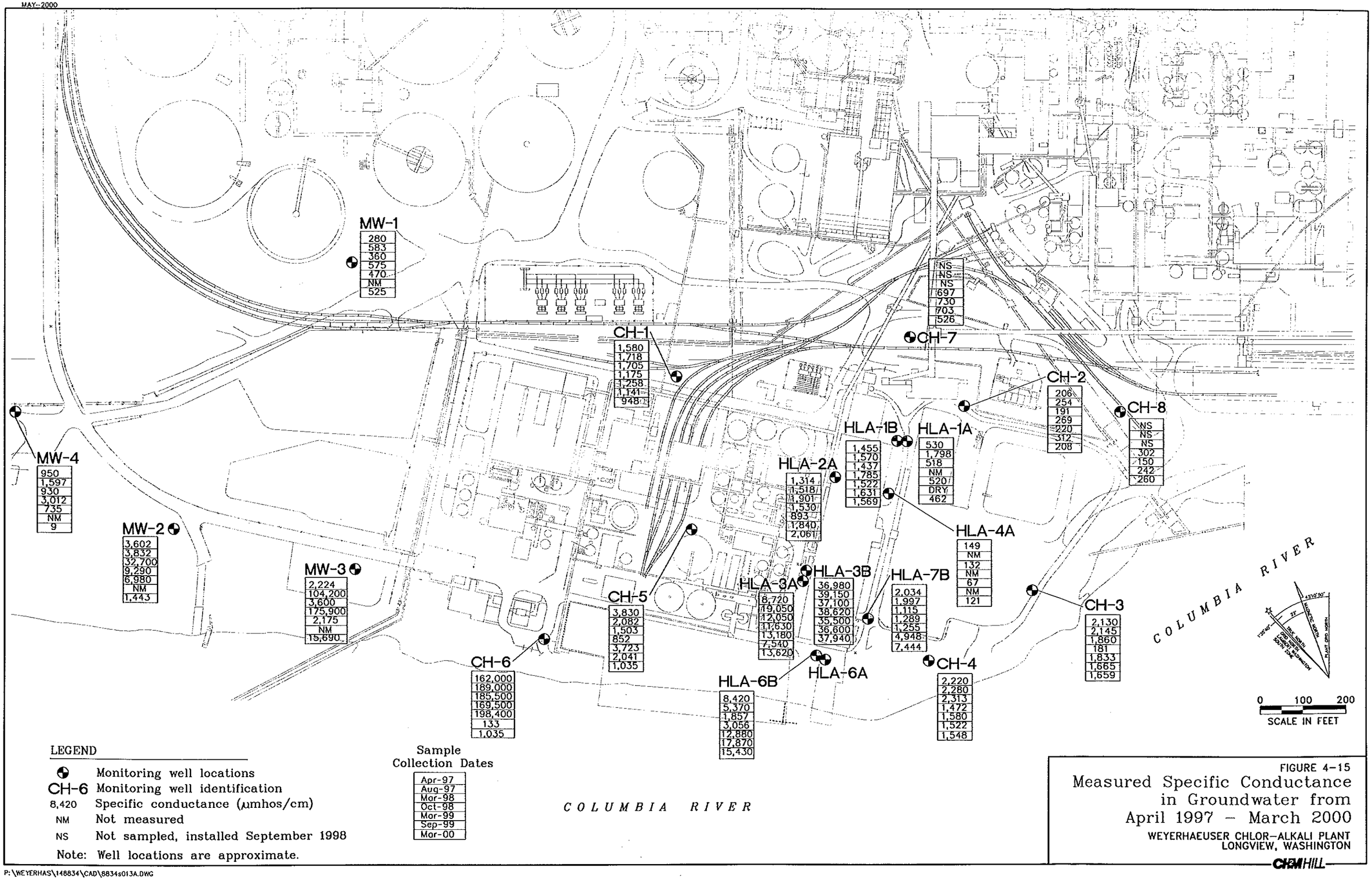
SR8

MAY--2000



LEGEND

- Monitoring well locations
- CH-6 Monitoring well identification
- 8,420 Specific conductance (μmhos/cm)
- NM Not measured
- NS Not sampled, installed September 1998
- Note: Well locations are approximate.

Sample Collection Dates

Apr-97
Aug-97
Mar-98
Oct-98
Mar-99
Sep-99
Mar-00

FIGURE 4-15

Measured Specific Conductance in Groundwater from April 1997 – March 2000

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

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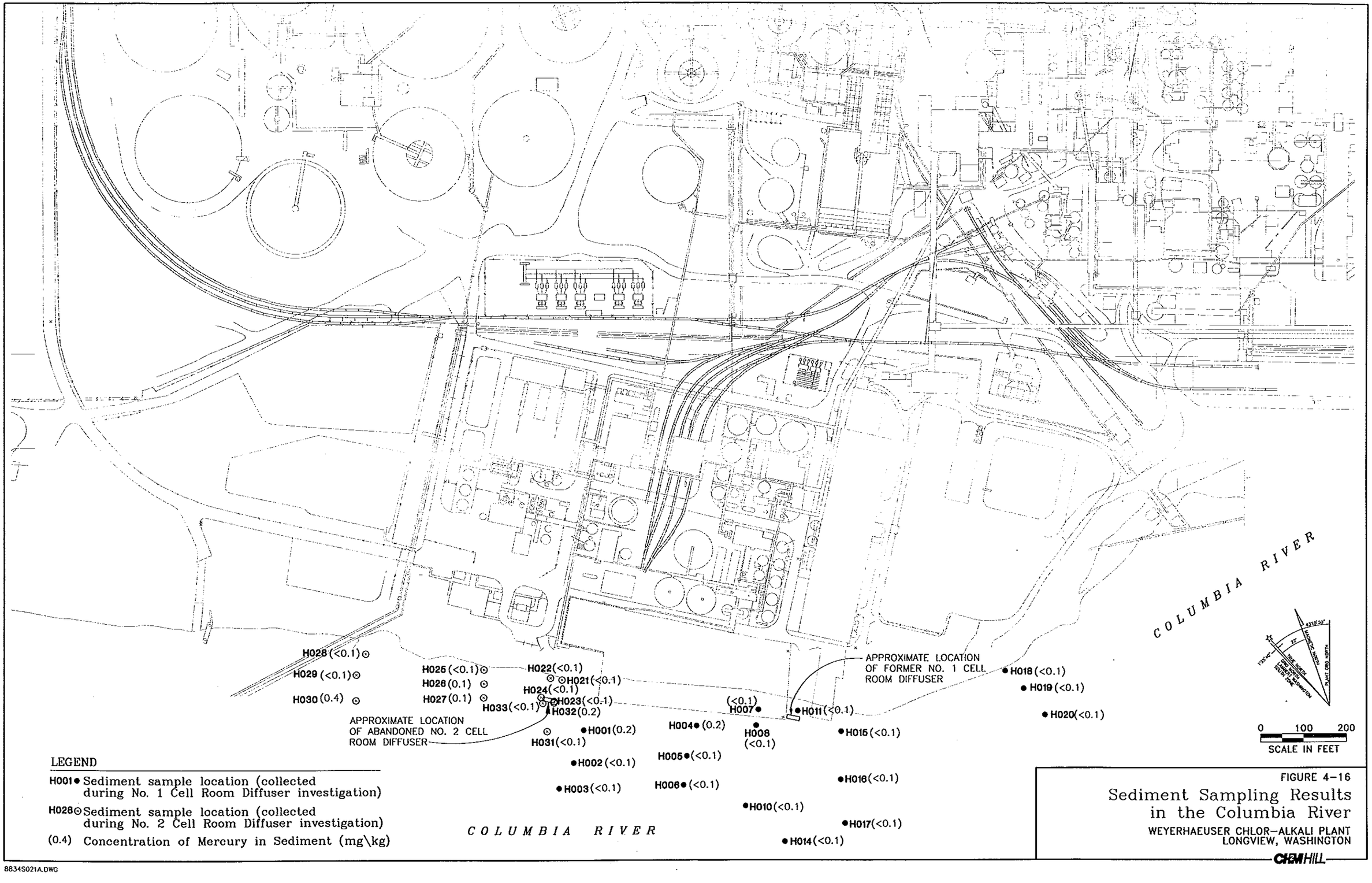
SRB

1-6-99



LEGEND

H001● Sediment sample location (collected during No. 1 Cell Room Diffuser investigation)

H028⊙ Sediment sample location (collected during No. 2 Cell Room Diffuser investigation)

(0.4) Concentration of Mercury in Sediment (mg\kg)

FIGURE 4-16

Sediment Sampling Results in the Columbia River

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

8834S021A.DWG

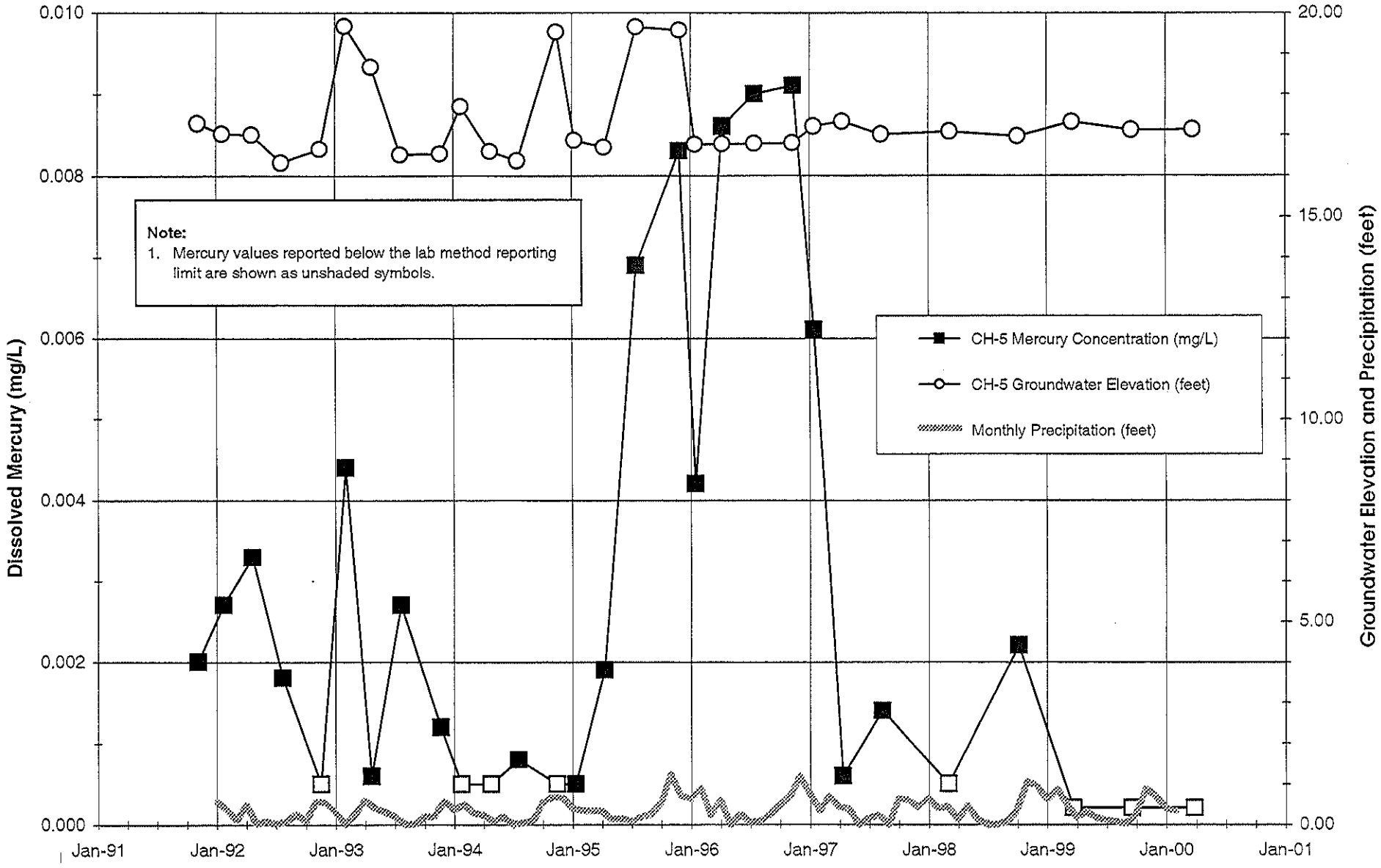


Figure 4-17
Well CH-5 Dissolved Mercury Concentrations and Water Level Comparison
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

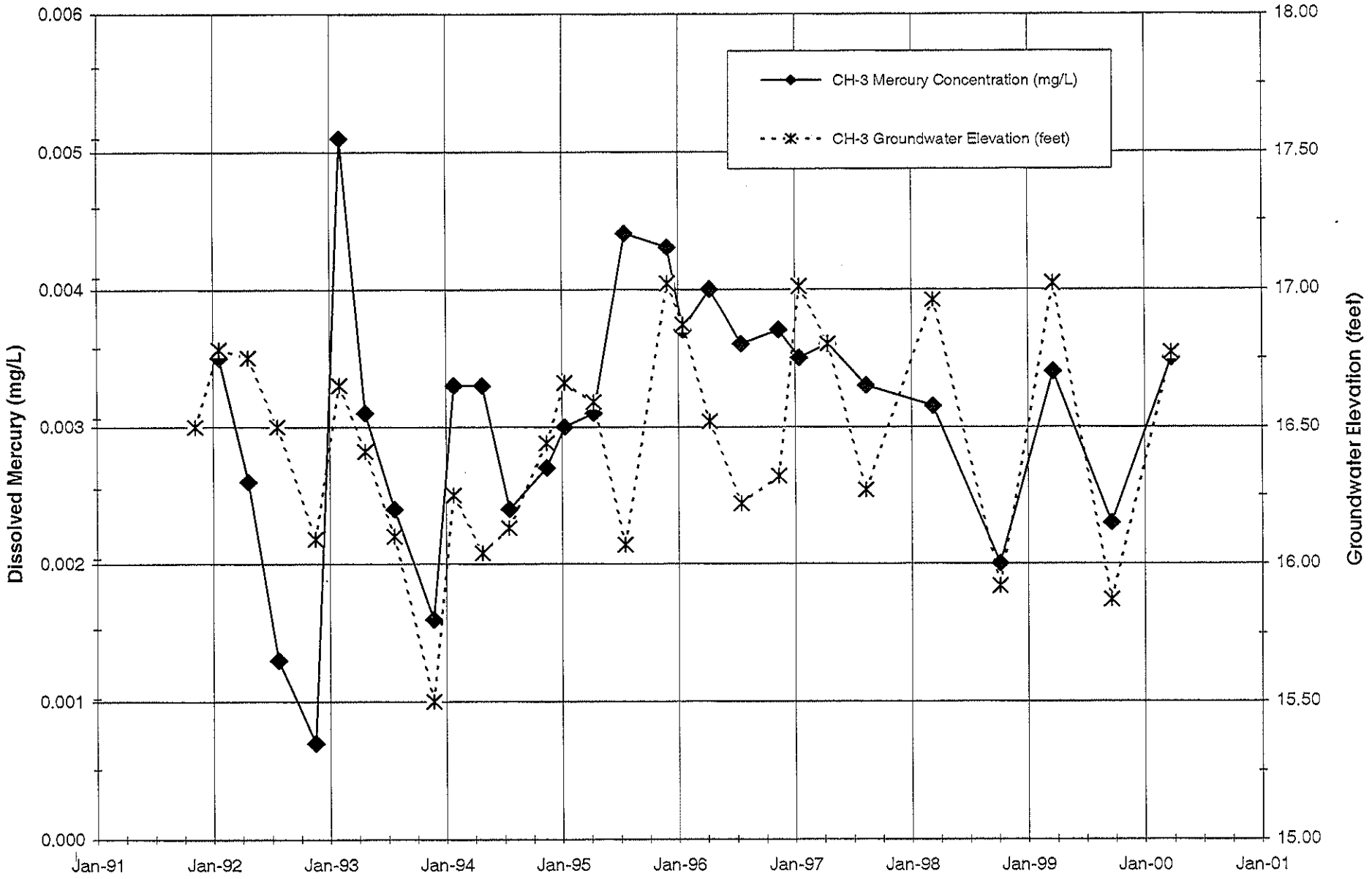


Figure 4-18
Well CH-3 Dissolved Mercury Concentrations and Water Level Comparison
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

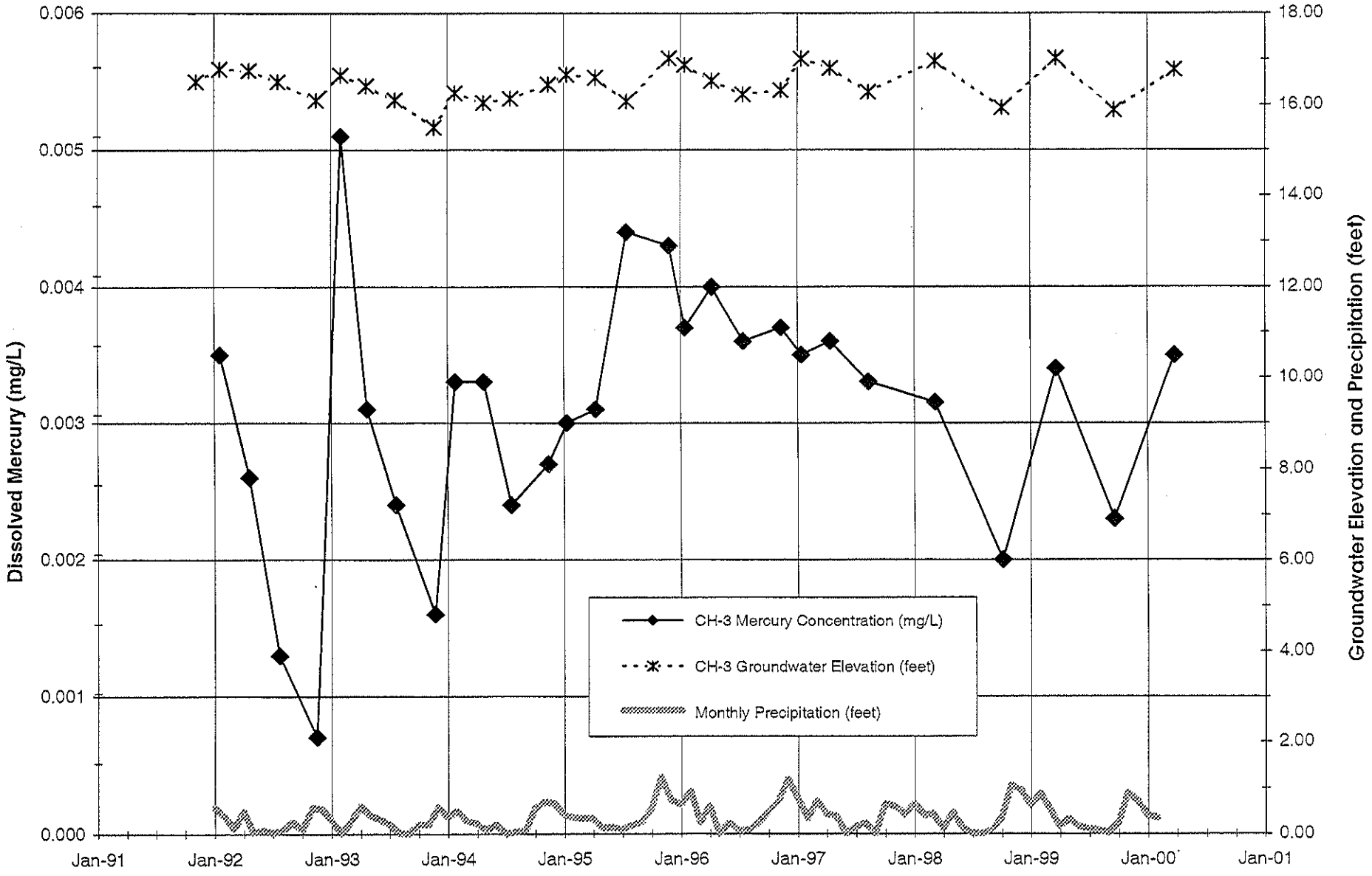


Figure 4-19
Well CH-3 Dissolved Mercury Concentrations, Water Level Comparison, and Precipitation
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

SECTION 5

MTCA Cleanup Level Comparison

SECTION 5

MTCA Cleanup Level Comparison

5.1 Introduction

Under the Model Toxics Control Act (WAC 173-340), cleanup standards are developed for individual sites. Developing cleanup levels involves several steps: determining a reasonable maximum exposure scenario, identifying what substances contribute to the overall site risk, and considering the environmental media that may contain and/or act as a source of the hazardous substance(s) of concern.

The purpose of this MTCA cleanup level (CUL) comparison is to identify cleanup standards and compare them to site conditions at the Chlor-Alkali Plant. This information is then used to support remedial decisionmaking during development of a cleanup action plan (CAP) for the Chlor-Alkali Plant. To accomplish this, the historical, physical, geological, and hydrological characteristics of the site presented in Section 3, combined with nature and extent data (provided in Section 4) and land use and beneficial use information, are first evaluated to formulate a conceptual exposure model (CEM) for the site. Then, CULs are established that are based on health risk and that are consistent with the current and reasonably anticipated future exposure pathways and scenarios developed in the CEM. Finally, the CULs are compared to site characterization data to identify whether, and in what environmental media, there are exceedances of CULs. Exceedances may indicate a need to evaluate remedial options. However, selection of final remedial action levels and corresponding remedial actions will require consideration and balancing of MTCA's remedy selection criteria (WAC 173-340-360). These considerations will be evaluated as part of the feasibility study for the Chlor-Alkali Plant.

WAC 173-340-708 (2) requires that indicator hazardous substances be selected prior to comparison of site data to CULs. Because mercury is the only hazardous substance of concern at the Chlor-Alkali Plant, evaluation of other hazardous substances (and associated CUL adjustments for multiple substances) is not necessary.

5.2 Conceptual Exposure Model

As described earlier in this report, historical manufacturing and waste handling operations at the site have resulted in the release of mercury to the environment. In order to evaluate potential health risks from these releases, a CEM is developed to describe the movement of mercury in environmental media from source and release areas to potentially exposed individuals (receptors). The primary purpose of the CEM is to identify and describe the potentially complete exposure pathways by which receptors might come into contact with mercury released from site-related sources at the Chlor-Alkali Plant, and to provide a basis for selection of the most appropriate CULs. In general, the CEM identifies the historical sources of mercury and depicts its movement through and between environmental media (for example, from soil to water), ultimately leading to potentially exposed receptors. Details

regarding the site history, including past practices, releases, and regulatory history, are provided in Section 1.3 and in the approved work plan (CH2M HILL, 1995).

5.2.1 Elements of a Complete Exposure Pathway

Exposure pathways must be complete for there to be a potential for uptake of chemicals or a potential health risk. For a complete exposure pathway to exist, the following elements must be present:

- A source of chemicals released to the environment
- A receiving environmental medium (soil, water, biota)
- Mechanisms for movement of the chemical within or between environmental media
- An exposure point where a receptor might come into contact with a contaminated medium via a specific route
- A potentially exposed population of receptors

Figure 5-1 provides a diagrammatic representation of the CEM for potential exposure to mercury at the site. This CEM has been updated from the approved work plan (CH2M HILL, 1995) based on issues discussed with Ecology in February 1999.

5.2.2 Sources and Release Mechanisms

The historical source areas of mercury include the former No. 1 Cell Room, the No. 2 Cell Room, the central process area, former unlined surface impoundments, the west area, and dredge fill material from the evaporator and office areas. From the No. 1 and No. 2 Cell Rooms and the central process area, primary releases occurred through spills, leaks, and direct discharges during operations. Leaks from pumps, valves, and process lines associated with the former No. 1 Cell Room could have resulted in mercury releases to onsite soils. The potential for mercury releases from the No. 2 Cell Room was considerably lower than from the former No. 1 Cell Room because of differences in building construction and the duration of process operations. The former surface impoundment was used to contain process wastes, and because it was unlined in the 1970s, mercury passed into the subsurface by infiltration.

The majority of mercury-contaminated source materials, including areas with elemental mercury, have been removed (CH2M HILL, 1995). Furthermore, manufacturing processes at the Chlor-Alkali Plant have not used mercury or released mercury for more than 20 years. The Chlor-Alkali Plant ceased production on March 15, 1999. Because of these actions, this CUL assessment specifically deals with residuals remaining subsequent to these actions.

5.2.3 Transport Pathways

Because of releases from historical sources, soil (including fractured basalt) is both a potential primary exposure medium (via direct contact) and a secondary source of mercury releases to other media. Mercury at the site can be released from soil by three secondary mechanisms:

- Mercury within soil and fractured basalt can leach into groundwater when in contact with water.
- If conditions permit, fugitive dust can erode (or be mechanically entrained) from the surface, releasing particulates into the air.
- Stormwater runoff can erode and transport mercury in soil along engineered stormwater conveyances at the facility.

Transport of mercury from soil into groundwater would largely be caused by mercury in soil being dissolved by rising groundwater in the uppermost saturated zone beneath the site, rather than by rainwater infiltration. Although the highest mercury concentrations in groundwater are observed within the basalt, these concentrations contribute a relatively insignificant amount of mercury mass to surrounding groundwater and the Columbia River, given the low permeability of the basalt. Additionally, mercury was not detectable in stormwater runoff during three separate stormwater sampling events in 1998, and concentrations of mercury in surface soil were found to be low, indicating that the stormwater release mechanism is not significant.

5.2.4 Potential Receptors

The CEM for the Chlor-Alkali Plant depicts a number of potential contact points, receptors, and routes of uptake. Not all of these receptors require quantitative evaluation, as noted in the CEM. Only pathways and receptors with the greatest potential for exposure are considered for the CUL comparison. A critical component of the CEM is the identification of potentially exposed populations, both human and nonhuman. Potentially exposed populations are highly site-specific and are determined by identifying current and reasonably anticipated future land use, as well as beneficial uses of groundwater and surface water at the facility.

At the Chlor-Alkali Plant, the land use is currently heavy industrial and will remain so in the future. The site is not bordered by residential or other nonindustrial land uses. Therefore, occupational workers are considered the potentially exposed population for surface and subsurface soil at the facility. Because the site is nearly totally paved or covered with structures or buildings, current exposures to soils are largely incomplete. Under future conditions (for example, during construction activities), soil may be contacted directly, leading to incidental ingestion and dermal absorption. Although fugitive dust present in wind may be inhaled, the presence of paving and gravel over nearly all of the plant precludes this pathway.

Currently, there are no domestic uses of groundwater in the immediate vicinity of the site (CH2M HILL, 1995). Ten of twelve known wells within 1 mile of the Chlor-Alkali Plant are used for industrial purposes. The use or uses of the other two wells are unknown. There are no known downgradient domestic or industrial water users because the site borders the Columbia River, and regional groundwater discharges to the river. Therefore, human exposure to groundwater under current conditions is incomplete. If groundwater were used in the future, it would be for industrial purposes. Despite the fact that there are no current or reasonably anticipated future human uses of shallow groundwater at the Chlor-Alkali Plant, groundwater data are compared against the drinking water standard as an applicable, relevant, or appropriate requirement (ARAR) in this report, in accordance with MTCA.

The primary beneficial uses of the Columbia River adjacent to the plant include commercial boat transportation, recreational uses such as fishing and boating, and habitat and foraging for fish and wildlife. If groundwater seepage and stormwater runoff discharge into the Columbia River from the facility, any mercury transported to the Columbia River could be taken up by aquatic organisms. If this happens, mercury could enter the food chain and pose exposure via fish consumption. Note that this requires methylation of the inorganic mercury released from the site to the Columbia River. Methylation occurs in micro-organisms in aquatic sediments in the presence of elemental (metallic) mercury, producing methylmercury that bioaccumulates in the food chain. Methylmercury is not present at the Chlor-Alkali Plant and is unlikely to be produced in the Columbia River from mercury discharged from the site because sediment and groundwater data do not indicate the presence of mercury in, or discharging to, the Columbia River. Food chain receptors include aquatic animals, birds, and mammals, including humans.

Recreational users (anglers, boaters) could come into contact with surface water by incidental ingestion and dermal contact. However, it should be noted that the public boat ramp located directly adjacent to and downstream of the Chlor-Alkali Plant was closed in 1999, and a new boat ramp was constructed ¾-mile downstream from the plant. This change in location will substantially reduce the potential for people to be exposed to media (water, sediment, and fish) near the site.

Sediment in the Columbia River may adsorb mercury that discharges from site groundwater, producing a potential for exposure if benthic or epibenthic biota exist. However, the substrate in this area is rocky and, because of the high currents and resulting scouring, very little sediment appears to accumulate in the Columbia River adjacent to the site. This was evident during the 1999 sediment sampling efforts, in which a paucity of sediment made it difficult to acquire sufficient sediment to provide for chemical analysis.

5.2.5 Potentially Complete Human Exposure Pathways

On the basis of the current understanding of conditions at the site, as represented by the CEM in Figure 5-1, the most plausible exposure scenarios that are considered for characterizing potential health concerns for the Chlor-Alkali Plant include the following:

- Potential future occupational exposure to mercury in soil by incidental direct contact
- Potential future occupational exposure to mercury in groundwater
- Potential current or future recreational consumption of affected fish (that is, nonmigratory or semiresident fish) from the Columbia River

It is plausible that fish from the Columbia River could be consumed not just by recreational anglers but by ethnic subpopulations as well, such as Native Americans. However, available information pertaining to actual fish consumption near the Chlor-Alkali Plant by these groups is missing. The most comprehensive tribal consumption study for the Columbia River Basin was conducted by the Columbia River Inter-Tribal Fish Commission in 1994. These data for Native Americans do not allow quantitative characterization of possible exposure at the site for these groups because the data were collected from locations in the upper Columbia River (mostly eastern Washington), and their analysis included consideration of fish ingestion from anadromous and resident fish, but also of store-bought fish.

During the tribal consumption study (Columbia River Inter-Tribal Fish Commission, 1994), there were no surveyed locations close to the Chlor-Alkali Plant.

In order to verify the presence or absence of tribal fishing rights on the Columbia River in the vicinity of Longview, the Columbia River Inter-Tribal Fish Commission was contacted. The commission indicated that it is not aware of any fishing practices in that area, although it is possible that tribes may fish the smelt runs on the Cowlitz River. While there are "usual and accustomed" tribal fishing areas on the Lower Columbia, there are no formally adjudicated fishing rights in the vicinity of Longview. Based on this account, it is reasonable to conclude that there is no tribal subsistence fishing on the Columbia River in the vicinity of Longview. Given these findings, only recreational users are considered in the evaluation of fish tissues.

5.3 Method for MTCA CUL Comparison

This section identifies MTCA CULs for comparison to mercury concentrations in selected environmental media. The most appropriate CULs for the Chlor-Alkali Plant are identified, and the statistical methods used to calculate medium-specific concentrations for comparison with CULs are described. CULs used for this evaluation were selected from MTCA methods and/or additional regulatory requirements (chemical-specific ARARs) that may apply to site-specific conditions or environmental media.

5.3.1 Identification of MTCA Cleanup Levels for Mercury

Selecting an appropriate CUL for comparison to site data involves recognition of the existing and reasonably anticipated future land use and the beneficial uses of groundwater and surface water for the Chlor-Alkali Plant. In this report, the CULs are used for comparison to site data to determine the presence of exceedances and to identify which media and areas are to be addressed in the feasibility studies. Final site remedial cleanup levels will be documented in the cleanup action plan and will consider a balance among all of MTCA's remedy selection criteria.

Under MTCA (WAC 173-340 700), there are three methods used to determine CULs: Method A, Method B, and Method C. Method A is used for routine site cleanups or for sites that involve relatively few hazardous substances. Method B is the standard method that can apply to all sites. Method C is a conditional method used for qualifying industrial properties (such as sites zoned for industrial use that are not bordered by nonindustrial properties). Method C is also used when a CUL under Method A or B is technically impossible to achieve, or when cleanup actions may cause greater environmental harm. MTCA cleanup methods are established for groundwater, surface water, soil, and air as appropriate.

Specific MTCA method CUL concentrations used in this report are obtained from Ecology's *Model Toxics Control Act Cleanup Levels and Risk Calculations (CLARC II) Update* (Washington State Department of Ecology, 1996) or from applicable water quality standards for surface water for the state of Washington (WAC 173-201A). In lieu of available CULs for sediment and fish tissue from CLARC II, alternate sources are used to identify CULs for these media.

Table 5-1 summarizes the CULs used in this evaluation, and their sources.

The following subsections summarize the MTCA cleanup methods and cleanup standards selected and used in this evaluation, by environmental medium.

5.3.1.1 CUL for Direct Contact with Soil

MTCA provides two different Method C standards for soil: commercial and industrial. WAC 173-340-740 provides a commercial Method C standard based on modification of the Method B risk-based algorithm. The modification provides for a lower assumed exposure frequency and intake rate for a child, as might occur in some commercial rather than residential areas. WAC 173-340-745 provides a Method C value specific to industrial sites. The industrial soil CUL is based on an adult worker who weighs 70 kilograms, ingests 50 milligrams of soil per day, and obtains 40 percent of total soil intake from the contaminated area. The contaminant bound to the soil is conservatively assumed to be completely absorbed following ingestion.

Of the soil CULs provided, the MTCA Method C CUL of 1,050 mg/kg applies to the Chlor-Alkali Plant and is used in this evaluation. Both the current and the anticipated future land use of the site are industrial. The MTCA Method C CUL is applied to surface soil within the potential areas of concern identified in the approved work plan (CH2M HILL, 1995) and to surface soil in the engineered stormwater conveyances.

For soil, the CEM see (Figure 5-1) indicates that uptake may occur through incidental ingestion or dermal contact. The MTCA equations provided in WAC 173-340-745 provide only for incidental ingestion, not for dermal contact. MTCA is currently under revision, and the revised regulation will include dermal contact in the soil CUL equation. However, the currently applicable regulation omits this pathway, and the dermal contribution is not included in this evaluation. Because mercury is not readily absorbed through the skin, the inclusion of the dermal pathway would not be expected to change the conclusions of the evaluation presented in this report.

5.3.1.2 Soil CUL for Groundwater Protection

Under MTCA, soil CUL concentrations should be no higher than that which would prevent groundwater concentrations from exceeding drinking water standards. The Method C value for industrial site soil is a risk-based value that includes an assumed default 100-fold dilution and attenuation factor for most chemicals except mercury, which is a 50-fold dilution. The Method C value for mercury is 1.05 mg/kg. Therefore, the value of 1.05 mg/kg soil-to-protect-groundwater CUL is used in this evaluation. It should be realized, however, that soil with mercury concentrations in excess of 1.05 mg/kg will not necessarily result in a concentration of mercury in groundwater in excess of the mercury groundwater CUL (that is, the MCL). The leachability of mercury in soil has many factors that are not taken into account in the 50-fold dilution and attenuation factor. This factor is currently being revised by Ecology to take into account site- and chemical-specific considerations.

5.3.1.3 Groundwater CUL

Groundwater beneath the site is not currently used as a drinking water source, nor will it be developed for drinking water purposes. If groundwater were used in the future, it would be for industrial purposes. Nevertheless, the federal maximum MCL is an ARAR under MTCA, so policy dictates the use of the given groundwater CUL. The MCL for mercury is 0.002

mg/L, which is used as the CUL for this evaluation. It should be realized, however, that exposure to groundwater with mercury concentrations higher than the CUL does not necessarily constitute a risk.

5.3.1.4 Surface Water CUL

There are no surface water bodies on the site, but mercury in soil and groundwater at the site may be transported to the Columbia River. Consequently, a MTCA CUL for surface water was identified for evaluation of surface water data. Under MTCA, surface water quality standards are developed from ARARs, including the state of Washington [WAC 173-201] and EPA ambient water quality criteria (AWQC). The state of Washington AWQC for aquatic life protection for mercury are used in this evaluation for comparison with surface water data. The freshwater acute AWQC is 2.4 micrograms per liter (µg/L). The freshwater chronic AWQC is 0.012 µg/L. These values are intended to protect freshwater aquatic life and their uses. The acute value is a maximum concentration (not to be exceeded over a 1-hour average); the chronic value is a continuous concentration (not to be exceeded over a 4-day average). Exceedance of the AWQC indicates the need to collect and evaluate further information, such as fish tissue concentrations (U.S. Environmental Protection Agency, 1985).

5.3.1.5 Sediment Criteria

Currently there are no promulgated MTCA CULs for freshwater sediment. Freshwater sediment standards are currently under development by Ecology. The draft sediment management standards (WAC 173-204) recently published by Ecology (December 1998) were not used in this comparison because they do not provide specific numerical criteria from which to evaluate these data, and because the draft standards must still be finalized. In lieu of the draft Ecology freshwater sediment standards, alternate comparison criteria (not CULs) were considered from two sources. First, a marine sediment mercury criterion was obtained from Ecology's *Developing Health-Based Sediment Quality Criteria for Cleanup Sites: A Case Study Report* (Washington State Department of Ecology, 1997). This Ecology report used a measured biota-sediment accumulation factor (BSAF) in Puget Sound to derive a mercury sediment quality criterion (SQC) protective of human health (via fish consumption) of 0.61 mg/kg sediment. Second, a sediment criterion developed by the Ontario (Canada) Ministry of Environment for screening contaminated freshwater sediments was considered (Ontario Ministry of Environment, 1992). The "lowest effect level" (LEL) for mercury in sediment is 0.2 mg/kg (dry-weight basis). This is the level of contamination that has no effect on the majority of sediment-dwelling organisms and indicates that the sediment is clean or marginally affected. The "severe effect level"(SEL) is 2 mg/kg (dry-weight basis). This level indicates that the sediment is likely to affect the health of sediment-dwelling organisms.

5.3.1.6 CUL for Fish Tissue

As noted in the CEM, mercury that reaches the Columbia River may accumulate as methylmercury in fish that are consumed by people. Methylmercury in fish tissue is considered potentially hazardous to the health of humans who consume the fish. The U.S. Food and Drug Administration (FDA) provides an action level of 1.0 mg/kg for methylmercury in fish and shellfish (U.S. Food and Drug Administration, 1994). This value also provides the basis

of the chronic AWQC for mercury. To evaluate available fish tissue data for the Columbia River near the Chlor-Alkali Plant, the FDA action level is considered the level of comparison.

5.3.2 Method for Comparison of Site Data with Selected Cleanup Levels

In accordance with the requirements of MTCA, three comparisons are made between soil and groundwater data and the CULs. In the first comparison, the 95th percentile upper confidence limit (UCL 95) on the mean concentration is compared to the CUL. The second comparison involves a point-by-point comparison of the individual data to determine whether any single data point is greater than twice (2x) the CUL. Finally, the percentage of data points exceeding the CUL is calculated to see whether more than 10 percent of the data exceed the CUL. The second and third comparisons are used for evaluation of soil and groundwater data, according to WAC 173-340-720(8)(e, f) and WAC 173-340-740(7)(e, f), respectively.

5.3.2.1 Comparison of the UCL 95 with the CUL

The UCL 95 is a conservative estimate of the mean concentration. Methods for derivation of the UCL 95 are provided in Ecology's *Statistical Guidance for Ecology Site Managers* (Ecology, 1992) and supplements (Ecology, 1993). Ecology also provides MTCA*Stat*, a software add-in to Microsoft Excel, which calculates statistics on site data in a manner consistent with Ecology's statistical guidance. The calculations of UCL 95 for the Chlor-Alkali Plant were performed using MTCA*Stat*.

Briefly, two steps were required to calculate the UCL 95. The first step was to test the distribution characteristics of the site data to see if the data are normally, lognormally, or otherwise distributed. The second step was to calculate the UCL 95 using a method most appropriate to the identified distribution. To test the distribution, the W-test was used for data sets with less than 50 values, whereas D'Agostino's test was used for larger data sets. The results of the distribution test indicated the method that should be used to calculate the UCL 95. If the data were lognormal, Land's method was used to calculate the UCL 95. If the data were normal, the t-statistic was used to calculate the UCL. If the data were neither lognormal nor normal, more advanced methods would be applied. The selected UCL 95 is compared to the respective CUL for each environmental medium and presented in the comparison tables (see Section 5.4).

5.3.2.2 Comparison with the 2x Criterion

Under MTCA, the 2x criterion states that no single data point shall exceed the CUL by more than a factor of 2. The intent of this criterion is to constrain exceedances, and indirectly to control for the possibility of hot spots across a site. However, when a site is well represented by a data set, this criterion may conflict with the UCL 95 comparison. It is possible that a well-characterized site that passes the UCL 95 comparison may fail the 2x comparison. In some cases, the nonstatistical 2x criterion may dominate the decision process when the statistical test indicates a different answer. Nevertheless, the 2x criterion is part of the MTCA regulation and may be used to characterize a site as contaminated when, in fact, statistics indicate otherwise.

5.3.2.3 Comparison with the 10 Percent Criterion

The 10 percent criterion states that fewer than 10 percent of all data points shall exceed the CUL. As with the 2x criterion, the intent of this criterion is to constrain exceedances, and indirectly to control for the possibility of hot spots. The same technical issues that apply to the 2x criterion also apply to the 10 percent criterion.

5.4 Comparison of Media Concentrations to CULs

This section provides the comparison of the site characterization data with the identified CULs selected for each medium at the Chlor-Alkali Plant. These comparisons are presented by medium in the following subsections.

5.4.1 Soil Comparisons

A comparison of the soil CULs (both for direct contact and for groundwater protection) to the site soil data is provided in Table 5-2. In accordance with the areas of concern identified in the work plan (CH2M HILL, 1995), independent comparisons are completed for the following specific areas of concern:

- Brine spill area
- Brine treatment area
- Caustic storage
- Former No. 1 Cell Room
- Former surface impoundment area
- No. 2 Cell Room
- Staging area
- Stormwater drainage ditch
- West area

The UCL 95 concentrations used to address the direct contact pathway for each area of concern were calculated using only soil samples collected above the groundwater table. The UCL 95 concentrations used to address the groundwater protection pathway for each area of concern were calculated using all soil samples, collected both above and below the groundwater table.

For direct contact pathways, the comparison revealed that none of the UCL 95s exceeded the MTCA Method C CUL. Also, no exceedances of the 2x or 10 percent criteria were seen. Therefore, soil at the site meets all three direct contact criteria under MTCA.

Independent comparisons of the areas listed above were also made to the 1-mg/kg soil CUL based on the protection of groundwater. All UCL 95s exceeded the soil-to-protect groundwater CUL. About 82 percent of the sitewide soil analyses exceeded this CUL. As a result, soil areas exceeding this CUL will be addressed in the feasibility study with respect to groundwater protection from rising water elevations, which results in increased mercury concentrations in groundwater.

5.4.2 Groundwater Comparisons

The 95 UCL concentrations for groundwater were calculated by aggregating the mercury results for each monitoring well from each area of concern. Mercury results from each monitoring well are represented by the 12 most recent sampling events, from November 1995 to March 2000. This data set was used in the evaluation to account for potential seasonal variations, while still reflecting current conditions. The comparison of the site data to the groundwater CUL (the MCL of 0.002 mg/L) is provided in Tables 5-3 through 5-5. Comparisons were completed on a point-by-point basis for the following areas of concern:

- The west area (Table 5-3)
- The central process area (Table 5-4)
- The former No. 1 Cell Room and former surface impoundment area (Table 5-5)

For a more detailed discussion of MCL exceedances, see Section 4.2.

5.4.2.1 West Area

The west area is represented by Monitoring Wells MW-1, MW-2, MW-3, and MW-4. A total of 48 analyses were evaluated from the west area, and samples from these wells were collected between November 1995 and March 2000. There was only one exceedance of the MCL in the west area (Table 5-2). Results indicate the following:

- MW-4. The MCL was exceeded at 0.0027 mg/L in October 1998. However this elevated mercury concentration does not appear representative because concentrations prior to this time and more recently (March 1999 and March 2000) indicated non-detections.
- MW-2/MW-3. Mercury was detected below the MCL twice in MW-3 and once in MW-2. Mercury concentrations in groundwater during 1999 and March 2000 were below the detection limit (0.0002 mg/L).

Comparison of groundwater results from the west area to the MTCA cleanup levels did not exceed the 95 percent UCL criterion, the 2x criterion, or the 10 percent MTCA criterion (Table 5-3).

5.4.2.2 Central Process Area

The central process area is represented by Monitoring Wells CH-1, CH-5, and CH-3. The MCL was exceeded in a total of eight samples (Table 5-4). A total of 39 analyses were evaluated from the central process area, and samples from these wells were collected between November 1995 and March 2000. Results indicate the following:

- CH-6. There were no exceedances of the MCL in groundwater samples collected from Monitoring Well CH-6. Mercury was detected three times in CH-6 at concentrations below the MCL.
- CH-1. Only one of 13 samples collected from Monitoring Well CH-1 (0.0022 mg/L in April 1997) slightly exceeded the MCL.
- CH-5. Seven of the 13 samples evaluated from Monitoring Well CH-5 exceeded the MCL. Mercury concentrations from Monitoring Well CH-5 ranged from 0.0006 mg/L (April 1997) to 0.009 mg/L (July and November 1996). March and September 1999 and

March 2000 mercury results from CH-5 indicate that these elevated mercury concentrations are not long-term trends because concentrations declined to less than the laboratory method reporting limit of 0.0002 mg/L.

Comparing groundwater concentrations from the central process area to the MTCA cleanup levels shows that mercury concentrations did not exceed the 95 percent UCL criterion. However, the maximum detected concentration of 0.0091 mg/L exceeded the 2x criterion, and approximately 21 percent of the samples exceeded the groundwater CUL criterion (Table 5-4). While the 2x criteria was exceeded, this elevated concentration occurred approximately 4 years ago, and since that time concentrations have declined below the MCL.

5.4.2.3 Former No. 1 Cell Room and Surface Impoundment Area

The former No. 1 Cell Room and surface impoundment area are represented by the following monitoring wells: HLA-1A, HLA-1B, HLA-2A, HLA-3A, HLA-3B, HLA-4A, HLA-6B, CH-3, HLA-7B, CH2, and CH-4. A total of 143 analyses were evaluated from the former No. 1 Cell Room and surface impoundment area, and samples from these wells were collected between November 1995 and March 2000(Table 5-5). Results indicate the following:

- **CH-4.** There were no exceedances of the MCL in groundwater samples collected from Monitoring Well CH-4.
- **CH-2.** Seven of 13 samples evaluated from Monitoring Well CH-2 exceeded the MCL.
- **HLA-4A.** Five of nine samples (this well is periodically dry) evaluated from Monitoring Well HLA-4A exceeded the MCL.
- **HLA-3B.** Nine of 13 samples evaluated from Monitoring Well HLA-3B exceeded the MCL.
- **Others.** All mercury concentrations from Monitoring Wells HLA-1A, HLA-1B, and HLA-3A exceeded the MCL concentration. The majority of groundwater samples at HLA-2A, HLA-7B, and CH-3 also exceeded the MCL.

Comparing groundwater results from the former No. 1 Cell Room and surface impoundment area to the MTCA cleanup levels shows that mercury concentrations exceed the 95 percent UCL criterion, the maximum detected concentration of 0.686 mg/L exceeds the 2x criterion, and approximately 69 percent of the samples exceeded the groundwater CUL criterion (Table 5-5).

5.4.2.4 Summary for Groundwater

Mercury in groundwater beneath the central process area, former No. 1 Cell Room, and former surface impoundment area exceeds the MCL, indicating the need for evaluation of groundwater in the feasibility study. However, the MCL exceedances do not automatically indicate that mercury in groundwater presents a hazard. As previously noted, the MCL for groundwater is based on the assumed use of groundwater directly for drinking water and other domestic purposes. This condition does not exist for the site nor will it exist in the future, as indicated in the CEM.

5.4.3 Surface Water Comparisons

Historical data from the Columbia River collected in 1986 and 1993 failed to detect mercury above detection limits of 0.5 µg/L (1993 data) and 0.2 µg/L (1986 data), respectively (CH2M HILL, 1995). The comparison of surface water data with CULs is provided in Table 5-6. Based on this information, mercury does not exceed the freshwater acute AWQC. However, from the available data it cannot be determined whether mercury is present between the detection limit and the freshwater chronic AWQC of 0.012 µg/L. If one-half the detection limit (per WAC 173-340-730(7)(f)) is used for comparison, the chronic criterion may be exceeded.

In order to consider the significance of exceedance of the chronic AWQC (if in fact it was exceeded in the nondetect samples), it is necessary to understand how the chronic criterion was derived by EPA (U.S. Environmental Protection Agency, 1985). According to EPA, long-term exposure of aquatic life to mercury results in accumulation in the form of methylmercury. As a result, the chronic AWQC is specific to methylmercury and is defined as the highest surface water concentration that would prevent exceedance of the FDA action level of 1.0 mg/kg for methylmercury in fish tissue. The AWQC document states as follows:

> "Freshwater aquatic organisms and their uses should not be affected unacceptably if the four-day average concentration of mercury does not exceed 0.012 µg/L more than once every three years on average. If the four-day average concentration exceeds 0.012 µg/L more than once in a three year period, the edible portion of consumed species should be analyzed to determine whether the concentration of methylmercury exceeds the FDA action level."(U.S. Environmental Protection Agency, 1985)

Thus, exceedance of the chronic criterion does not automatically imply risk to aquatic life and their uses (for example, human consumption), but only triggers the need for fish tissue sampling. Because fish tissue sampling has been conducted in the river adjacent to the site over a 23-year period between 1970 and 1993, these tissue results should provide direct indication of the significance of any exceedance of the chronic AWQC in surface water. The tissue results are compared with the FDA action level in Section 5.4.5.

5.4.4 Sediment Comparisons

Because no promulgated MTCA CULs are available for freshwater sediments, the sediment concentrations are compared to alternate criteria, including the 1997 Ecology SQC of 0.61 mg/kg and to the Ontario freshwater sediment standards. The Ontario LEL for mercury in sediments is 0.2 mg/kg, whereas the SEL is 2 mg/kg. It should be noted that sedimentation does not significantly occur adjacent to the Chlor-Alkali Plant. The 1999 sediment collection revealed rocky bottom at several locations, and it was difficult to locate enough sediment to sample. It is anticipated that this is due to the scouring characteristics of the river near the site, which prevent sedimentation.

The comparison of available sediment data with CULs is provided in Table 5-7. For historical data from the Columbia River gathered between 1986 and 1993, mercury was not detected in sediments more than half the time (see Figures 4-24 and 4-25 in the work plan [CH2M HILL, 1995]). When mercury was detected, it was generally at low concentrations,

and concentrations were similar upstream of the plant, adjacent to the plant, and downstream of the plant.

Sediment samples were collected upstream of the Chlor-Alkali Plant in 1986 and 1987. One sample taken at the mouth of the Kalama River (located several miles upstream from the plant) produced a mercury concentration of 0.26 mg/kg, just above the LEL but below the SEL and the Ecology SQC. No other upstream sediment samples exceeded the sediment criteria.

Sediment samples were collected near the plant from 1986 to 1998. Sediment samples were collected near the former diffuser area in 1992 after removal of the diffuser, and noted an increase in mercury concentrations over earlier sampling events. Each of nine samples exceeded the LEL of 0.2 mg/kg, six of nine samples exceeded the SEL, and four of nine samples exceeded the SQC. It is believed that sedimentation present in the diffuser was dislodged during diffuser removal and was subsequently sampled.

Additional sampling was completed in 1998, which indicated that mercury was no longer present near the Chlor-Alkali Plant. Seventeen samples were taken, including several near the former diffuser. None contained mercury at levels exceeding any sediment comparison criterion; Therefore, the 1992 results were not confirmed during 1998. During May 1999, 13 sediment samples were collected at the abandoned No. 2 Cell Room Diffuser. Only one sediment sample exceeded the 0.2 mg/kg LEL (H030 at 0.40 mg/kg). This one exceedance is not statistically significant given the size of the sample population (33 samples) and the absence of mercury at surrounding sample locations.

All other samples were nondetect for mercury at a detection limit of 0.1 mg/kg. Based on these most recent results, mercury in sediments at the plant does not appear to exceed the alternate sediment comparison criteria established for this evaluation.

5.4.5 Fish Tissue Comparisons

Fish tissue data have been collected in the Columbia River upstream of, adjacent to, and downstream of the Chlor-Alkali plant boundaries in six separate studies during the period between 1970 and 1993. These data were evaluated for three purposes:

- To compare areas upstream of, adjacent to, and downstream of the plant
- To identify temporal trends in fish tissue mercury levels
- To compare tissue data with the established CUL

Appendix I of the approved work plan (CH2M HILL, 1995) provided a summary of several of these fish tissue studies. To supplement this, additional data were obtained from the *National Study of Chemical Residues in Fish* (U.S. Environmental Protection Agency, 1992), which included several sampling locations on the Columbia River. The available historical data for mercury concentrations in fish tissue are provided in Table 5-8, including the source, the species tested, and the general location relative to the site.

Statistical evaluation of the data is not conducted in this report because of the temporal, spatial, species, and possible analytical differences between data sets. The data come from numerous studies over two decades and are provided for 15 different aquatic species. Different species have different physiologies, life cycles, feeding habits, and habitat

preferences in the water column, which could influence different uptake of mercury. Because of these factors, comparisons between locations, temporally between studies, and to the fish tissue screening level are provided on a point-by-point basis. From these point-by-point comparisons, it is possible to make general observations regarding the temporal and spatial characteristics of the data.

5.4.5.1 Comparison of Upstream, Downstream, and Adjacent Sampling Locations

Considering the general concentration ranges seen for the upstream, downstream, and adjacent sampling locations (as defined by the property boundaries), it is not possible to conclude that aquatic tissue mercury concentrations differ from one sampling location to the next. Over the 23-year period, tissue concentrations observed from aquatic organisms sampled from upstream locations varied between "nondetect" at 0.02 mg/kg to 1.2 mg/kg. Values in fish tissue sampled near the site varied from a low of 0.03 mg/kg to high of 1.8 mg/kg. Values in fish tissue sampled downstream of the site varied from "nondetect" at 0.02 mg/kg to a high of 7.9 mg/kg.

If only the most recent data collected from 1986 to 1996 are considered, the data between stations are indistinguishable. The range of tissue concentrations detected in the upstream, downstream, and adjacent sampling locations were less than 0.02 to 0.36 mg/kg, 0.03 to 0.23 mg/kg, and less than 0.02 to 0.74 mg/kg, respectively.

Based on these observations, mercury detected in aquatic tissues in the Columbia River appears to be a characteristic of the entire watershed, and it is unlikely that the Chlor-Alkali plant is contributing substantially to these concentrations. Managing mercury at the site with the goal of reducing mercury concentrations in aquatic tissues is unlikely to produce an observable result.

5.4.5.2 Temporal Trends in Fish Tissue Mercury Levels

As can be seen from Figure 5-2 and Table 5-8, mercury concentrations in aquatic tissues have been declining over time. This decline is evident across the whole watershed and probably coincides with a general reduction in mercury use in agriculture and industry (such as in the manufacturing process at the Chlor-Alkali Plant). The reduction in fish mercury concentrations since 1970 probably reflects the effectiveness of previous risk management decisions.

Of the 15 species tested between 1970 and 1996, crayfish data are most represented over time, and for sampling locations upstream and downstream from the Chlor-Alkali plant. Figure 5-3 shows the various analytical results for crayfish generated through the years. Mercury concentrations in crayfish at sampling locations related to the site were highest in the 1970 sampling, lower in 1973, and lower again in 1993. At sampling locations upstream and downstream from the site, concentrations generally held constant in 1970 and 1973 (except for one high sample upstream in 1970), then fell by 1993. Since the 1970 sampling event, all values have been below 1.0 mg/kg.

A similar pattern is suggested by the results for samples taken from suckers (see Figure 5-4). Although data are sparse, the samples from 1970 show much higher concentrations than in subsequent years. Other species sampled are less well represented over time, and between

upstream and downstream locations. While there may be some limitations to the data, several points are important with regard to potential mercury risks from the site.

5.4.5.3 Comparison of Tissue Data with the CUL

None of the data since 1970 have exceeded the FDA action level of 1.0 mg/kg for mercury in tissue, as indicated in Figure 5-2. These results indicate that the concentrations of mercury in fish meet the same standards imposed by FDA for marketable fish. These results are consistent with the conclusions of those of the Washington State Department of Health and the Oregon Health Division in their bi-state report *Health Analysis of Chemical Contaminants in Lower Columbia River Fish*. They concluded that, because "methylmercury levels in Columbia River fish are substantially lower than 0.6 mg/kg, a mercury-based advisory for these fish does not appear to be warranted"(Washington State Department of Health and Oregon Health Division, 1996).

It should be noted that the FDA screening level is based on the edible portions of aquatic species. It is not clear from the available data sources whether the analyses were completed for entire organisms or for edible portions. However, methylmercury is not known to preferentially be accumulated in fat, so the possibility that whole fish were used would not be expected to influence the conclusions. It should also be recognized that not all the species tested for mercury are desirable as food species.

Consumption rates will vary with from species to species. For instance, anadromous varieties such as salmonids are generally consumed in highest amounts, but are least likely to be exposed at the site due to their migrating habits. These migratory species are also generally of low tissue concentrations. For screening purposes of this analysis, all species are regarded as though they are edible.

5.4.6 Summary

This MTCA CUL comparison was conducted for Weyerhaeuser's Chlor-Alkali Plant to help interpret past releases of mercury into soil and groundwater, and to determine whether remedial options need to be evaluated in the feasibility study. A conceptual site model was developed to identify and describe potentially complete exposure pathways by which receptors could be exposed to the mercury. MTCA CULs were also identified for these media. The CULs reflect the industrial site-specific land use at the site and account for beneficial uses (such as drinking water) that require the most stringent cleanup standard. Points of compliance were not identified for these media at this time but will be included in the feasibility study when remedial responses will be evaluated following MTCA requirements. Final remedial cleanup levels and points of compliance will be defined in a cleanup action plan that will rely on information obtained from this and the feasibility study report.

Concentrations of mercury in soil at the Chlor-Alkali plant do not exceed the MTCA Method C CUL for direct contact with industrial soil. Provided that the land use remains industrial, further cleanup of soil at the site is unwarranted for this pathway. Concentrations of mercury in soil do exceed the MTCA CUL for protection of groundwater. An evaluation to protect groundwater from mercury in soil during conditions that cause the water table to rise will be addressed in the feasibility study.

Mercury in groundwater exceeds the federal MCL for mercury in drinking water in the central process area, the former No. 1 Cell Room, and the former surface impoundment area, but not in the west area. However, this does not automatically mean that mercury in the aquifer beneath the site is a hazard to health. Because the groundwater is not used as a drinking water source, exposure is likely to be limited to incidental contact by industrial workers who may, in the future, use groundwater for industrial purposes. Groundwater beneath the site will not be developed into a drinking water supply; therefore, opportunities for exposure to groundwater are limited. More relevant pathways are worker exposure to groundwater used for industrial purposes (cooling water, washing trucks, etc.) and surface water pathways as groundwater discharges to the Columbia River. However, because MCL exceedances are observed, groundwater will be addressed in the feasibility study to meet MTCA requirements.

Impacts from mercury in groundwater discharged to the Columbia River is best evaluated by examining the data from sediments, surface water, and fish tissue sampled from the river. In the 1998 and 1999 sampling events, mercury was detected only six times (out of 33 samples) in sediments. However, only one of these samples contained mercury at a level that exceeded available sediment criteria. This one exceedance (0.40 mg/kg) is not statistically significant given the size of the sample population (33 samples) and the absence of mercury at surrounding sample locations.

Mercury was not detected in surface water. The detection limits were low enough to provide assurance that mercury was not present at concentrations exceeding the freshwater acute AWQC, but not low enough to provide assurance that mercury was below the freshwater chronic AWQC.

Finally, although mercury can be detected in the tissues of aquatic organisms sampled from the river, the distribution of mercury in these samples does not indicate an association between the site and mercury in aquatic organisms. Also, mercury in tissues appears to be declining over time. Considered collectively, the data from sediments, surface water, and aquatic organisms do not indicate that the site (including groundwater discharging from the site) are producing a definable mercury problem in the Columbia River. It is not likely that attempts to reduce mercury concentrations in aquatic organisms by managing mercury at the site will produce an observable result, simply because current conditions cannot be associated with the site. Based on the results from sediment, surface water, and fish tissue, these media will not be addressed in the feasibility study.

TABLE 5-1
CULs Used for the Chlor-Alkali Plant

Medium	Pathway	CUL	Source
Onsite Soil	Direct contact by humans	1,050 mg/kg	CLARC II
Onsite Soil to Protect Groundwater	Ingestion by humans	1.05 mg/kg	WAC 173-340-745 Table 3
Onsite Groundwater	Ingestion by humans	2 µg/L	CLARC II (MCL as ARAR)
Sediment (Columbia River)	Effect levels for benthic organisms	0.2-2.0* mg/kg	Ontario Sediment Standards
Sediment (Columbia River)	Accumulation into fish	0.61* mg/kg	Ecology Sediment Quality Criterion
Surface Water (Columbia River)	Acute exposure to aquatic organisms	2.4 µg/L	State of Washington AWQC
Surface Water (Columbia River)	Chronic exposure to aquatic organisms and subsequent users	0.012 µg/L	State of Washington AWQC
Fish Tissue	Food-chain transfer; consumption by recreational anglers	1 mg/kg	U.S. Food and Drug Administration Action Level

*A promulgated MTCA CUL for sediment is not currently available. Values listed are selected as alternate comparison criteria.

Table 5-4
Comparison of Dissolved Mercury Concentrations to Groundwater Cleanup Level
Central Process Area
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

Area of Concern	Well Location	Date Collected	Groundwater Concentration (mg/L)	Groundwater Cleanup Level Conc. (mg/L)	Is Groundwater Conc. Above Cleanup Level?
Central Process Area	CH-1	11/29/1995	0.0018	0.002	No
Central Process Area	CH-1	01/17/1996	0.0018	0.002	No
Central Process Area	CH-1	04/10/1996	0.0015	0.002	No
Central Process Area	CH-1	07/17/1996	0.0008	0.002	No
Central Process Area	CH-1	11/13/1996	0.0016	0.002	No
Central Process Area	CH-1	01/15/1997	0.0020	0.002	No
Central Process Area	CH-1	04/14/1997	0.0022	0.002	Yes
Central Process Area	CH-1	08/13/1997	0.0016	0.002	No
Central Process Area	CH-1	03/11/1998	0.0011	0.002	No
Central Process Area	CH-1	10/06/1998	0.0007	0.002	No
Central Process Area	CH-1	03/25/1999	0.0004	0.002	No
Central Process Area	CH-1	09/21/1999	0.0016 J	0.002	No
Central Process Area	CH-1	03/28/2000	0.0018	0.002	No
Central Process Area	CH-5	11/30/1995	0.0083	0.002	Yes
Central Process Area	CH-5	01/17/1996	0.0042	0.002	Yes
Central Process Area	CH-5	04/10/1996	0.0086	0.002	Yes
Central Process Area	CH-5	07/18/1996	0.0090	0.002	Yes
Central Process Area	CH-5	11/13/1996	0.0091	0.002	Yes
Central Process Area	CH-5	01/15/1997	0.0061	0.002	Yes
Central Process Area	CH-5	04/14/1997	0.0006	0.002	No
Central Process Area	CH-5	08/13/1997	0.0014	0.002	No
Central Process Area	CH-5	03/11/1998	0.0005 U	0.002	No
Central Process Area	CH-5	10/06/1998	0.0022	0.002	Yes
Central Process Area	CH-5	03/25/1999	0.0002 U	0.002	No
Central Process Area	CH-5	09/21/1999	0.0002 R	0.002	No
Central Process Area	CH-5	03/28/2000	0.0002 U	0.002	No
Central Process Area	CH-6	11/29/1995	0.0020 U (a)	0.002	No
Central Process Area	CH-6	01/17/1996	0.0005 U	0.002	No
Central Process Area	CH-6	04/11/1996	0.0005 U	0.002	No
Central Process Area	CH-6	07/17/1996	0.0005 U	0.002	No
Central Process Area	CH-6	11/12/1996	0.0020 U (a)	0.002	No
Central Process Area	CH-6	01/15/1997	0.0005 U	0.002	No
Central Process Area	CH-6	04/14/1997	0.0006	0.002	No
Central Process Area	CH-6	08/13/1997	0.0005 U	0.002	No
Central Process Area	CH-6	03/11/1998	0.0010	0.002	No
Central Process Area	CH-6	10/06/1998	0.0002 U	0.002	No
Central Process Area	CH-6	03/25/1999	0.0003	0.002	No
Central Process Area	CH-6	09/21/1999	0.0002 J	0.002	No
Central Process Area	CH-6	03/28/2000	0.0002 J	0.002	No
95 Percent Upper Confidence Limit					**0.0008**
% of Samples Above Groundwater Cleanup Level of 2 ug/L					**21%**
Maximum Detected Groundwater Concentration					**0.0091**
Is Maximum Detected Groundwater Concentration Greater Than 2X CUL? (b)					**Yes**

Notes:

U = Indicates that mercury was analyzed for but not detected above the method reporting limit.

J = Estimated concentration.

R = Value rejected.

(a) Method reporting limit is elevated as a result of sample dilution.

(b) Note that in the past two years Central Process Area monitoring well mercury concentrations were less than 2X the CUL.

Table 5-5

Comparison of Dissolved Mercury Concentrations to Groundwater Cleanup Level

Former No. 1 Cell Room and Surface Impoundment Areas

Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

Area of Concern	Well Location	Date Collected	Groundwater Concentration (mg/L)	Groundwater Cleanup Level Conc. (mg/L)	Is Groundwater Conc. Above Cleanup Level?
Former Number 1 Cell Room & SI	HLA-1A	11/30/1995	0.2120	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1A	01/18/1996	0.1870	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1A	04/11/1996	0.3090	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1A	07/18/1996	0.6860	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1A	11/13/1996	0.5290	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1A	01/16/1997	0.6500	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1A	04/14/1997	0.2410	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1A	08/13/1997	0.0275	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1A	03/11/1998	0.0594	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1A	10/06/1998	(a)	0.002	
Former Number 1 Cell Room & SI	HLA-1A	03/24/1999	0.1600	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1A	09/22/1999	(a)	0.002	
Former Number 1 Cell Room & SI	HLA-1A	03/28/2000	0.1490	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1B	11/30/1995	0.1660	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1B	01/18/1996	0.1590	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1B	04/11/1996	0.1510	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1B	07/18/1996	0.1360	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1B	11/13/1996	0.1880	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1B	01/16/1997	0.1320	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1B	04/14/1997	0.1530	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1B	08/13/1997	0.1560	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1B	03/11/1998	0.1460	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1B	10/07/1998	0.1250 J	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1B	03/24/1999	0.0135	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1B	09/22/1999	0.0770 J	0.002	Yes
Former Number 1 Cell Room & SI	HLA-1B	03/28/2000	0.0246	0.002	Yes
Former Number 1 Cell Room & SI	HLA-2A	11/30/1995	0.0533	0.002	Yes
Former Number 1 Cell Room & SI	HLA-2A	01/18/1996	0.0272	0.002	Yes
Former Number 1 Cell Room & SI	HLA-2A	04/11/1996	0.0482	0.002	Yes
Former Number 1 Cell Room & SI	HLA-2A	07/18/1996	0.1750	0.002	Yes
Former Number 1 Cell Room & SI	HLA-2A	11/13/1996	0.2270	0.002	Yes
Former Number 1 Cell Room & SI	HLA-2A	01/16/1997	0.0517	0.002	Yes
Former Number 1 Cell Room & SI	HLA-2A	04/14/1997	0.0411	0.002	Yes
Former Number 1 Cell Room & SI	HLA-2A	08/13/1997	0.0696	0.002	Yes
Former Number 1 Cell Room & SI	HLA-2A	03/11/1998	0.0420	0.002	Yes
Former Number 1 Cell Room & SI	HLA-2A	10/07/1998	0.1420 J	0.002	Yes
Former Number 1 Cell Room & SI	HLA-2A	03/25/1999	0.0007	0.002	No
Former Number 1 Cell Room & SI	HLA-2A	09/21/1999	0.0320 J	0.002	Yes
Former Number 1 Cell Room & SI	HLA-2A	03/28/2000	0.0112	0.002	Yes
Former Number 1 Cell Room & SI	HLA-3A	11/30/1995	0.0124	0.002	Yes
Former Number 1 Cell Room & SI	HLA-3A	01/18/1996	0.0070	0.002	Yes
Former Number 1 Cell Room & SI	HLA-3A	04/11/1996	0.0403	0.002	Yes
Former Number 1 Cell Room & SI	HLA-3A	07/18/1996	0.1900	0.002	Yes
Former Number 1 Cell Room & SI	HLA-3A	11/13/1996	0.0155	0.002	Yes
Former Number 1 Cell Room & SI	HLA-3A	01/16/1997	0.0190	0.002	Yes
Former Number 1 Cell Room & SI	HLA-3A	04/14/1997	0.0252	0.002	Yes
Former Number 1 Cell Room & SI	HLA-3A	08/13/1997	0.0062	0.002	Yes
Former Number 1 Cell Room & SI	HLA-3A	03/10/1998	0.0038	0.002	Yes
Former Number 1 Cell Room & SI	HLA-3A	10/07/1998	0.0056	0.002	Yes
Former Number 1 Cell Room & SI	HLA-3A	03/23/1999	0.0130	0.002	Yes
Former Number 1 Cell Room & SI	HLA-3A	09/22/1999	0.0077 J	0.002	Yes
Former Number 1 Cell Room & SI	HLA-3A	03/28/2000	0.0040	0.002	Yes

Table 5-5
Comparison of Dissolved Mercury Concentrations to Groundwater Cleanup Level
Former No. 1 Cell Room and Surface Impoundment Areas
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

Area of Concern	Well Location	Date Collected	Groundwater Concentration (mg/L)	Groundwater Cleanup Level Conc. (mg/L)	Is Groundwater Conc. Above Cleanup Level?
Former Number 1 Cell Room & SI	HLA-3B	11/30/1995	0.0013	0.002	No
Former Number 1 Cell Room & SI	HLA-3B	01/18/1996	0.0011	0.002	No
Former Number 1 Cell Room & SI	HLA-3B	04/11/1996	0.0011	0.002	No
Former Number 1 Cell Room & SI	HLA-3B	07/18/1996	0.0018	0.002	No
Former Number 1 Cell Room & SI	HLA-3B	11/13/1996	0.0028	0.002	Yes
Former Number 1 Cell Room & SI	HLA-3B	01/16/1997	0.0045	0.002	Yes
Former Number 1 Cell Room & SI	HLA-3B	04/14/1997	0.0037	0.002	Yes
Former Number 1 Cell Room & SI	HLA-3B	08/13/1997	0.0073	0.002	Yes
Former Number 1 Cell Room & SI	HLA-3B	03/10/1998	0.0050	0.002	Yes
Former Number 1 Cell Room & SI	HLA-3B	10/07/1998	0.0066	0.002	Yes
Former Number 1 Cell Room & SI	HLA-3B	03/23/1999	0.0028	0.002	Yes
Former Number 1 Cell Room & SI	HLA-3B	09/22/1999	0.0039 J	0.002	Yes
Former Number 1 Cell Room & SI	HLA-3B	03/28/2000	0.0035	0.002	Yes
Former Number 1 Cell Room & SI	HLA-4A	11/30/1995	0.0093	0.002	Yes
Former Number 1 Cell Room & SI	HLA-4A	01/18/1996	0.0034	0.002	Yes
Former Number 1 Cell Room & SI	HLA-4A	04/11/1996	0.0034	0.002	Yes
Former Number 1 Cell Room & SI	HLA-4A	07/18/1996	(a)	0.002	
Former Number 1 Cell Room & SI	HLA-4A	11/13/1996	0.0042	0.002	Yes
Former Number 1 Cell Room & SI	HLA-4A	01/16/1997	0.0017	0.002	No
Former Number 1 Cell Room & SI	HLA-4A	04/14/1997	0.0048	0.002	Yes
Former Number 1 Cell Room & SI	HLA-4A	08/13/1997	(a)	0.002	
Former Number 1 Cell Room & SI	HLA-4A	03/11/1998	0.0005 U	0.002	No
Former Number 1 Cell Room & SI	HLA-4A	10/06/1998	(a)	0.002	
Former Number 1 Cell Room & SI	HLA-4A	03/24/1999	0.0002 U	0.002	No
Former Number 1 Cell Room & SI	HLA-4A	09/22/1999	(a)	0.002	
Former Number 1 Cell Room & SI	HLA-4A	03/28/2000	0.0002 U	0.002	No
Former Number 1 Cell Room & SI	HLA-6B	11/30/1995	0.0005 U	0.002	No
Former Number 1 Cell Room & SI	HLA-6B	01/18/1996	0.0005 U	0.002	No
Former Number 1 Cell Room & SI	HLA-6B	04/11/1996	0.0005 U	0.002	No
Former Number 1 Cell Room & SI	HLA-6B	07/18/1996	0.0006	0.002	No
Former Number 1 Cell Room & SI	HLA-6B	11/13/1996	0.0005 U	0.002	No
Former Number 1 Cell Room & SI	HLA-6B	01/16/1997	0.0005 U	0.002	No
Former Number 1 Cell Room & SI	HLA-6B	04/14/1997	0.0019	0.002	No
Former Number 1 Cell Room & SI	HLA-6B	08/13/1997	0.0011	0.002	No
Former Number 1 Cell Room & SI	HLA-6B	03/10/1998	0.0021	0.002	Yes
Former Number 1 Cell Room & SI	HLA-6B	10/07/1998	0.0030	0.002	Yes
Former Number 1 Cell Room & SI	HLA-6B	03/23/1999	0.0002 U	0.002	No
Former Number 1 Cell Room & SI	HLA-6B	09/22/1999	0.0002 R	0.002	No
Former Number 1 Cell Room & SI	HLA-6B	03/28/2000	0.0002 U	0.002	No
Former Number 1 Cell Room & SI	CH-3	11/29/1995	0.0043	0.002	Yes
Former Number 1 Cell Room & SI	CH-3	01/17/1996	0.0037	0.002	Yes
Former Number 1 Cell Room & SI	CH-3	04/10/1996	0.0040	0.002	Yes
Former Number 1 Cell Room & SI	CH-3	07/17/1996	0.0036	0.002	Yes
Former Number 1 Cell Room & SI	CH-3	11/12/1996	0.0037	0.002	Yes
Former Number 1 Cell Room & SI	CH-3	01/15/1997	0.0035	0.002	Yes
Former Number 1 Cell Room & SI	CH-3	04/14/1997	0.0036	0.002	Yes
Former Number 1 Cell Room & SI	CH-3	08/13/1997	0.0033	0.002	Yes
Former Number 1 Cell Room & SI	CH-3	03/10/1998	0.0032	0.002	Yes
Former Number 1 Cell Room & SI	CH-3	10/07/1998	0.0020	0.002	No
Former Number 1 Cell Room & SI	CH-3	03/23/1999	0.0034	0.002	Yes
Former Number 1 Cell Room & SI	CH-3	09/21/1999	0.0023 J	0.002	Yes
Former Number 1 Cell Room & SI	CH-3	03/27/2000	0.0035	0.002	Yes

Table 5-5
Comparison of Dissolved Mercury Concentrations to Groundwater Cleanup Level
Former No. 1 Cell Room and Surface Impoundment Areas
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

Area of Concern	Well Location	Date Collected	Groundwater Concentration (mg/L)	Groundwater Cleanup Level Conc. (mg/L)	Is Groundwater Conc. Above Cleanup Level?
Former Number 1 Cell Room & SI	HLA-7B	11/30/1995	0.0716	0.002	Yes
Former Number 1 Cell Room & SI	HLA-7B	01/17/1996	0.0679	0.002	Yes
Former Number 1 Cell Room & SI	HLA-7B	04/10/1996	0.0496	0.002	Yes
Former Number 1 Cell Room & SI	HLA-7B	07/17/1996	0.0397	0.002	Yes
Former Number 1 Cell Room & SI	HLA-7B	11/12/1996	0.0330	0.002	Yes
Former Number 1 Cell Room & SI	HLA-7B	01/15/1997	0.0285	0.002	Yes
Former Number 1 Cell Room & SI	HLA-7B	04/14/1997	0.0340	0.002	Yes
Former Number 1 Cell Room & SI	HLA-7B	08/13/1997	0.0278	0.002	Yes
Former Number 1 Cell Room & SI	HLA-7B	03/10/1998	0.0015	0.002	No
Former Number 1 Cell Room & SI	HLA-7B	10/08/1998	0.0102 J	0.002	Yes
Former Number 1 Cell Room & SI	HLA-7B	03/23/1999	0.0030	0.002	Yes
Former Number 1 Cell Room & SI	HLA-7B	09/22/1999	0.0008 J	0.002	No
Former Number 1 Cell Room & SI	HLA-7B	03/27/2000	0.0005	0.002	No
Former Number 1 Cell Room & SI	CH-2	11/30/1995	0.0039	0.002	Yes
Former Number 1 Cell Room & SI	CH-2	01/18/1996	0.0013	0.002	No
Former Number 1 Cell Room & SI	CH-2	04/11/1996	0.0034	0.002	Yes
Former Number 1 Cell Room & SI	CH-2	07/18/1996	0.0054	0.002	Yes
Former Number 1 Cell Room & SI	CH-2	11/13/1996	0.0045	0.002	Yes
Former Number 1 Cell Room & SI	CH-2	01/16/1997	0.0033	0.002	Yes
Former Number 1 Cell Room & SI	CH-2	04/14/1997	0.0045	0.002	Yes
Former Number 1 Cell Room & SI	CH-2	08/13/1997	0.0032	0.002	Yes
Former Number 1 Cell Room & SI	CH-2	03/11/1998	0.0005 U	0.002	No
Former Number 1 Cell Room & SI	CH-2	10/08/1998	0.0009	0.002	No
Former Number 1 Cell Room & SI	CH-2	03/24/1999	0.0002	0.002	No
Former Number 1 Cell Room & SI	CH-2	09/22/1999	0.0013 J	0.002	No
Former Number 1 Cell Room & SI	CH-2	03/28/2000	0.0005	0.002	No
Former Number 1 Cell Room & SI	CH-4	11/29/1995	0.0010	0.002	No
Former Number 1 Cell Room & SI	CH-4	01/17/1996	0.0010	0.002	No
Former Number 1 Cell Room & SI	CH-4	04/10/1996	0.0019	0.002	No
Former Number 1 Cell Room & SI	CH-4	07/17/1996	0.0015	0.002	No
Former Number 1 Cell Room & SI	CH-4	11/12/1996	0.0017	0.002	No
Former Number 1 Cell Room & SI	CH-4	01/15/1997	0.0010	0.002	No
Former Number 1 Cell Room & SI	CH-4	04/14/1997	0.0015	0.002	No
Former Number 1 Cell Room & SI	CH-4	08/13/1997	0.0008	0.002	No
Former Number 1 Cell Room & SI	CH-4	03/11/1998	0.0007	0.002	No
Former Number 1 Cell Room & SI	CH-4	10/08/1998	0.0006	0.002	No
Former Number 1 Cell Room & SI	CH-4	03/24/1999	0.0006	0.002	No
Former Number 1 Cell Room & SI	CH-4	09/22/1999	0.0006 J	0.002	No
Former Number 1 Cell Room & SI	CH-4	03/28/2000	0.0005	0.002	No

95 Percent Upper Confidence Limit	**0.0179**
% of Samples Above Groundwater Cleanup Level of 2 ug/L	**69%**
Maximum Detected Groundwater Concentration	**0.686**
Is Maximum Detected Groundwater Concentration Greater Than 2X CUL?	**Yes**

Notes:

U = Indicates that mercury was analyzed for but not detected above the method reporting limit.

J = Value estimated.

R = Value rejected.

(a) Not measured because well was dry.

Table 5-6
Comparison of Mercury Concentrations in Surface Water to Criteria
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

Surface Water Sampling Location	Location wrt Chlor-Alkali Plant	Study	Date	Sample Name	Surface Water Mercury Conc. (ug/L)		Freshwater Acute AWQC (ug/L)	Surface Water Conc. Above Acute AWQC?	Freshwater Chronic AWQC (ug/L)	Surface Water Conc. Above Chronic AWQC?
Kalama River Mouth	upstream	Weyerhaeuser	1986	1	0.02	U	2.4	No	0.012	(a)
Columbia River at Kalama	upstream	Weyerhaeuser	1986	2	0.02	U	2.4	No	0.012	(a)
Carrols Channel	upstream	Weyerhaeuser	1986	3	0.2	U	2.4	No	0.012	(a)
Cowlitz River Mouth	upstream	Weyerhaeuser	1986	4	0.2	U	2.4	No	0.012	(a)
Columbia River Below Rainier Bridge	upstream	Weyerhaeuser	1986	5	0.2	U	2.4	No	0.012	(a)
Columbia River at Mill Intake	upstream	Weyerhaeuser	1986	6	0.2	U	2.4	No	0.012	(a)
Columbia River Near Boat Ramp	upstream	Ecology	1990	1	0.02	U	2.4	No	0.012	(a)
Columbia River Near Boat Ramp	upstream	Ecology	1990	2	0.02		2.4	No	0.012	(a)
Carrols Channel	upstream	Tetra Tech	1993	D20/W25	0.5	U	2.4	No	0.012	(a)
Columbia River near Cottonwood Island	upstream	Tetra Tech	1993	D21/W26	0.5	U	2.4	No	0.012	(a)
Cowlitz River Mouth	upstream	Tetra Tech	1993	W24	0.5	U	2.4	No	0.012	(a)
Columbia River Near Salt Dock	at plant	Weyerhaeuser	1986	7	0.2	U	2.4	No	0.012	(a)
Columbia River Near Salt Dock	at plant	Weyerhaeuser	1986	8	0.2	U	2.4	No	0.012	(a)
Columbia River Near Salt Dock	at plant	Weyerhaeuser	1986	9	0.2	U	2.4	No	0.012	(a)
Columbia River, Opposite Plant	across river	Weyerhaeuser	1986	10	0.2	U	2.4	No	0.012	(a)
Columbia River Near Boat Ramp	downstream	Weyerhaeuser	1986	11	0.2	U	2.4	No	0.012	(a)
Columbia River Near Boat Ramp	downstream	Weyerhaeuser	1986	12	0.02	U	2.4	No	0.012	(a)
Columbia River at Barrow Island	downstream	Weyerhaeuser	1986	13	0.2	U	2.4	No	0.012	(a)
Columbia River at Fisher's Point	downstream	Weyerhaeuser	1986	14	0.2	U	2.4	No	0.012	(a)
Columbia River at Willow Grove	downstream	Weyerhaeuser	1986	15	0.2	U	2.4	No	0.012	(a)
Columbia River Near Boat Ramp	downstream	Sweet Edwards/Emcon	1987	S-X	0.5	U	2.4	No	0.012	(a)
Columbia River Near Boat Ramp	downstream	Sweet Edwards/Emcon	1987	S-Y	0.5	U	2.4	No	0.012	(a)
Columbia River Near Boat Ramp	downstream	Sweet Edwards/Emcon	1987	S-Z	0.5	U	2.4	No	0.012	(a)
Columbia River Near Carrols Island	downstream	Tetra Tech	1993	D18/W23	0.5	U	2.4	No	0.012	(a)
Columbia River Near Carrols Island	downstream	Tetra Tech	1993	D19/W22	0.5	U	2.4	No	0.012	(a)

References:

Figure 4-23, CH2M HILL 1995 (Mercury Concentrations in Surface Water Collected Near Chlor-Alkali Plant).

Figure 4-24, CH2M HILL 1995 (Mercury Concentrations in Sediment and Surface Water Collected in Columbia River).

Notes:

U = Indicates that mercury was analyzed but not detected at or above the reported method reporting limit.

AWQC = Ambient Water Quality Criterion.

(a) Method reporting limit for surface water samples is above the freshwater chronic criteria; cannot determine if surface water concentration would exceed criteria.

Table 5-7
Comparison of Mercury Concentrations in Sediment to Criteria
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

Sample Locations	Location wrt Chlor-Alkali Plant	Study	Sample Name	Date	Mercury Conc. (mg/Kg)	LEL (mg/Kg)	Conc. above LEL?	SEL (mg/Kg)	Conc. above SEL?	Ecology 1997 SQC	Conc. Above Ecology SQC?
Kalama River Mouth	upstream	Weyerhaeuser	1	1986	0.26	0.2	Yes	2	No	0.61	No
Columbia River at Kalama	upstream	Weyerhaeuser	2	1986	0.05 U	0.2	No	2	No	0.61	No
Carrols Channel	upstream	Weyerhaeuser	3	1986	0.13	0.2	No	2	No	0.61	No
Cowlitz River Mouth	upstream	Weyerhaeuser	4	1986	0.05 U	0.2	No	2	No	0.61	No
Columbia River Below Rainier Bridge	upstream	Weyerhaeuser	5	1986	0.05 U	0.2	No	2	No	0.61	No
Columbia River at Mill Intake	upstream	Weyerhaeuser	6	1986	0.06 (a)	0.2	No	2	No	0.61	No
Columbia River Below Rainier Bridge	upstream	Ecology	49	1987	0.02 U	0.2	No	2	No	0.61	No
Corrols Channel	upstream	Tetra Tech	D20/W25	1993	0.08 U	0.2	No	2	No	0.61	No
Columbia River Near Cottonwood Island	upstream	Tetra Tech	D21/W26	1993	0.08 U	0.2	No	2	No	0.61	No
Columbia River Near Salt Dock	At plant	Weyerhaeuser	7	1986	0.14	0.2	No	2	No	0.61	No
Columbia River Near Salt Dock	At plant	Weyerhaeuser	8	1986	0.15	0.2	No	2	No	0.61	No
Columbia River Near Salt Dock	At plant	Weyerhaeuser	9	1986	0.73	0.2	No	2	No	0.61	Yes
Columbia River Near Plant	across river	Weyerhaeuser	10	1986	0.05 U	0.2	No	2	No	0.61	No
Former Diffuser Area	At plant	Ecology	none	1990	0.008	0.2	No	2	No	0.61	No
Former Diffuser Area	At plant	Work Plan	H006-003-SE-07092-XF	03/10/1992	2.30	0.2	No	2	Yes	0.61	Yes
Former Diffuser Area	At plant	Work Plan	H006-004-SE-07092-XF	03/10/1992	0.50	0.2	No	2	No	0.61	No
Former Diffuser Area	At plant	Work Plan	H006-005-SE-07092-XF	03/10/1992	3.60	0.2	No	2	Yes	0.61	Yes
Former Diffuser Area	At plant	Work Plan	H006-006-SE-07092-XF	03/10/1992	7.20	0.2	No	2	Yes	0.61	Yes
Former Diffuser Area	At plant	Work Plan	H006-007-SE-07092-XF	03/10/1992	0.30	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - Former No. 1 Cell Room	H001-001-SD-27298-XX	09/29/1998	0.2	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - Former No. 1 Cell Room	H001-002-SD-27298-XX	09/29/1998	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - Former No. 1 Cell Room	H001-003-SD-27298-XX	09/29/1998	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - Former No. 1 Cell Room	H001-004-SD-27298-XX	09/29/1998	0.2	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - Former No. 1 Cell Room	H001-005-SD-27298-XX	09/29/1998	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - Former No. 1 Cell Room	H001-006-SD-27298-XX	09/29/1998	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - Former No. 1 Cell Room	H001-007-SD-27298-XX	09/29/1998	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - Former No. 1 Cell Room	H001-008-SD-27298-XX	09/29/1998	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - Former No. 1 Cell Room	H001-010-SD-27298-XX	09/29/1998	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - Former No. 1 Cell Room	H001-011-SD-27298-XX	09/29/1998	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - Former No. 1 Cell Room	H001-014-SD-27398-XX	09/30/1998	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - Former No. 1 Cell Room	H001-015-SD-27398-XX	09/30/1998	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - Former No. 1 Cell Room	H001-016-SD-27398-XX	09/30/1998	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - Former No. 1 Cell Room	H001-017-SD-27398-XX	09/30/1998	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - Former No. 1 Cell Room	H001-018-SD-27398-XX	09/30/1998	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - Former No. 1 Cell Room	H001-019-SD-27398-XX	09/30/1998	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - Former No. 1 Cell Room	H001-020-SD-27398-XX	09/30/1998	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - No. 2 Cell Room Diffuser	H-001-021-SD-13999-xx	05/19/1999	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - No. 2 Cell Room Diffuser	H-001-022-SD-13999-xx	05/19/1999	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - No. 2 Cell Room Diffuser	H-001-023-SD-13999-xx	05/19/1999	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - No. 2 Cell Room Diffuser	H-001-024-SD-14099-xx	05/20/1999	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - No. 2 Cell Room Diffuser	H-001-025-SD-13999-xx	05/19/1999	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - No. 2 Cell Room Diffuser	H-001-026-SD-13999-xx	05/19/1999	0.1	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - No. 2 Cell Room Diffuser	H-001-027-SD-14099-xx	05/20/1999	0.1	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - No. 2 Cell Room Diffuser	H-001-028-SD-13999-xx	05/19/1999	0.1 U	0.2	No	2	No	0.61	No

Table 5-7
Comparison of Mercury Concentrations in Sediment to Criteria
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

Sample Locations	Location wrt Chlor-Alkali Plant	Study	Sample Name	Date	Mercury Conc. (mg/Kg)	LEL (mg/Kg)	Conc. above LEL?	SEL (mg/Kg)	Conc. above SEL?	Ecology 1997 SQC	Conc. Above Ecology SQC?
Columbia River	At plant	RI - No. 2 Cell Room Diffuser	H-001-028-SD-13999-DU	05/19/1999	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - No. 2 Cell Room Diffuser	H-001-029-SD-13999-xx	05/19/1999	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - No. 2 Cell Room Diffuser	H-001-030-SD-13999-xx	05/19/1999	0.4	0.2	Yes	2	No	0.61	No
Columbia River	At plant	RI - No. 2 Cell Room Diffuser	H-001-031-SD-14099-xx	05/20/1999	0.1 U	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - No. 2 Cell Room Diffuser	H-001-032-SD-14099-xx	05/20/1999	0.2	0.2	No	2	No	0.61	No
Columbia River	At plant	RI - No. 2 Cell Room Diffuser	H-001-033-SD-14099-xx	05/20/1999	0.1 U	0.2	No	16	No	0.61	No
Columbia River	At plant	RI - No. 2 Cell Room Diffuser	H-001-027-SD-14099-EB	05/20/1999	0.2 U	0.2	No	17	No	0.61	No
Columbia River Near Boat Ramp	downstream	Weyerhaeuser	11	1986	0.05 U	0.2	No	2	No	0.61	No
Columbia River Near Boat Ramp	downstream	Weyerhaeuser	12	1986	0.05 U	0.2	No	2	No	0.61	No
Columbia River at Barrow Island	downstream	Weyerhaeuser	13	1986	0.07 U	0.2	No	2	No	0.61	No
Columbia River at Fisher's Point	downstream	Weyerhaeuser	14	1986	0.05 U	0.2	No	2	No	0.61	No
Columbia River at Willow Grove	downstream	Weyerhaeuser	15	1986	0.05 U	0.2	No	2	No	0.61	No
Columbia River Near Boat Ramp	downstream	Ecology	18	1987	0.02	0.2	No	2	No	0.61	No
Columbia River Near Boat Ramp	downstream	Ecology	19	1987	0.02 U	0.2	No	2	No	0.61	No
Columbia River Near Carrols Island	downstream	Ecology	25	1987	0.09	0.2	No	2	No	0.61	No
Columbia River Near Boat Ramp	downstream	Sweet Edwards/EMCON	S-X	1987	0.2 U	0.2	No	2	No	0.61	No
Columbia River Near Boat Ramp	downstream	Sweet Edwards/EMCON	S-Y	1987	0.2 U	0.2	No	2	No	0.61	No
Columbia River Near Boat Ramp	downstream	Sweet Edwards/EMCON	S-Z	1987	0.2 U	0.2	No	2	No	0.61	No
Columbia River Near Boat Ramp	downstream	Ecology	1	1990	0.011 U	0.2	No	2	No	0.61	No
Columbia River Near Boat Ramp	downstream	Ecology	2	1990	0.018	0.2	No	2	No	0.61	No
Columbia River Near Carrols Island	downstream	Tetra Tech	D18/W23	1993	0.05 U	0.2	No	2	No	0.61	No
Columbia River Near Carrols Island	downstream	Tetra Tech	D19/W22	1993	0.07 U	0.2	No	2	No	0.61	No

References:

Figure 4-24, CH2M HILL 1995 (Mercury Concentrations in Sediment and Surface Water Collected in Columbia River).

Figure 4-25, CH2M HILL 1995 (Mercury Concentrations in Sediment Collected Near Chlor-Alkali Plant).

Notes:

(a) Result is reported in Work Plan as not detected at this detection limit (<0.06) in Figure 4-24, but as a detection (0.06) in Figure 4-25.

Ont. MOE = Ontario Ministry of the Environment; Low = lowest efffect level and is the 5th percentile of the screening level concentration, except where noted otherwise;

Source document is Persaud et al. (1990); values for organic chemicals were normalized assuming one percent total organic carbon.

LEL = Low Effect Level (mg/Kg)

SEL = Severe Effect Level (mg/Kg)

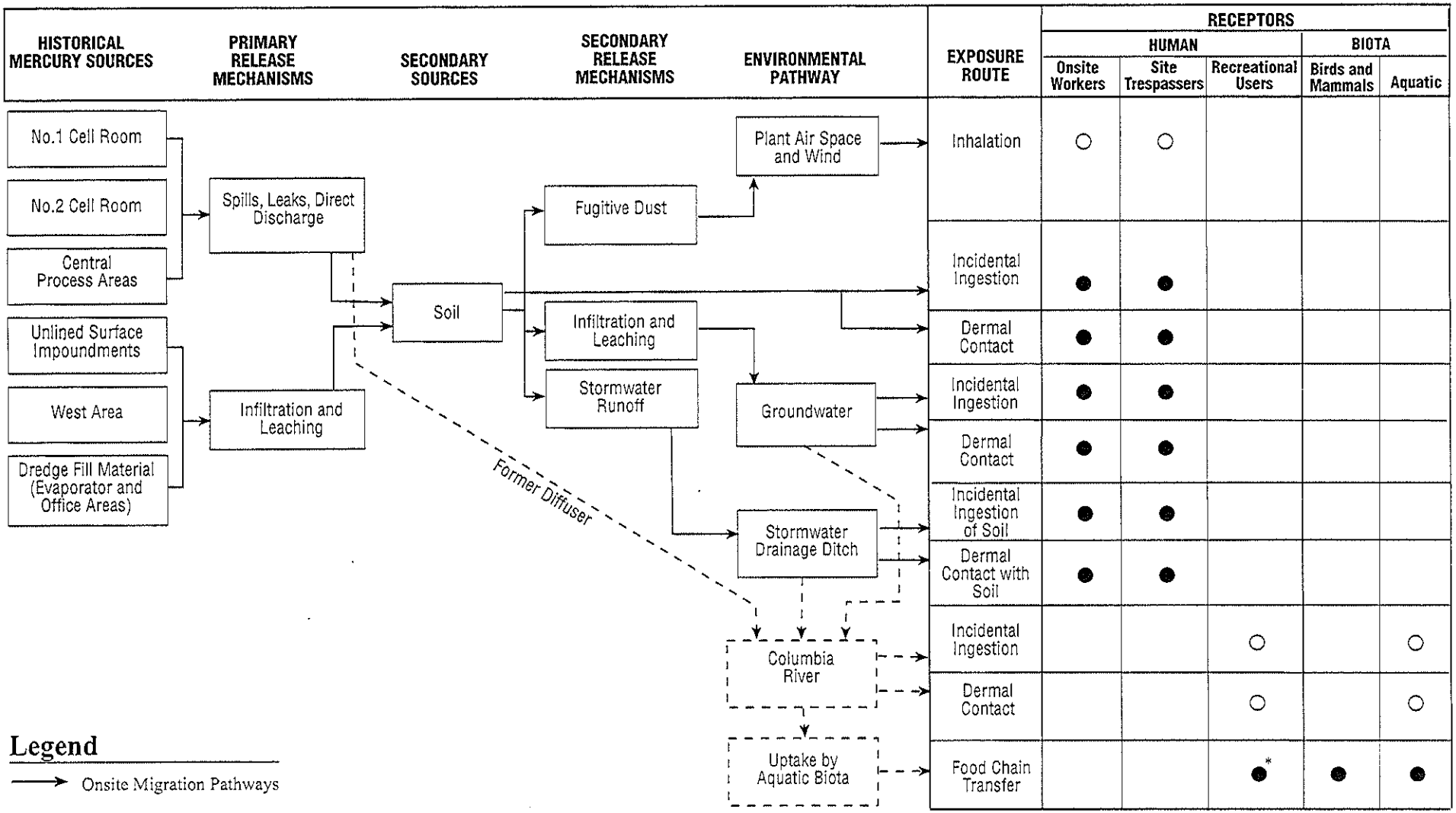
SQC = Sediment Quality Criteria.

TABLE 5-8
Mercury Concentrations in the Tissue of Aquatic Organisms (mg/kg wet weight)

Study Event	Species	Upstream	Site	Downstream
Beak, 1970	Coho	<0.04	0.18; 0.07	
	Sturgeon	0.3; 0.27	0.44	***1.1***; ***1.1***; 0.36
	Carp	0.32	***1.8***	
	Sucker		***1.43***	***1.3***; 0.63
	Chub	0.46		0.65
	Bullhead			***7.9***
	Squawfish	***1.2***; 0.53		***2.0***; ***1.9***
	Crayfish	0.19; 2.0	***1.3***; 1.0	0.5; 0.43
DOE, 1971	Mussels	0.24; 0.16; 0.36	0.26; 0.23; 0.30	
Weyerhaeuser, 1973	Sculpin	0.24; 0.53	0.51; 0.38	
	Crayfish	0.14; 0.19	0.51; 0.34	0.35; 0.51
	Flounder			0.08; 0.07
Fisher, 1986	Coho	0.03		0.05
	Sucker	0.03; <0.02	0.03	
	Flounder	0.04		0.03; 0.03
	Stickleback	0.08		<0.02; 0.04
	Sculpin	0.06	0.12; 0.04	0.07
	Smelt	<0.02		<0.02; <0.02
U.S. EPA, 1992	Carp	0.10		
	Squawfish	0.33; 0.36	0.23	0.74
	Sucker	0.05; 0.09	0.05	0.08; ND
	White Sturgeon	0.10; 0.09		
	Channel catfish			0.34
Tetra Tech, 1993	Sucker	0.061		0.072
	Crayfish	0.022		0.036
	Peamouth	0.095		0.094
	Sturgeon	0.094		

Values in ***bold, italic*** type exceed the U.S. FDA action level for mercury in fish tissue.

148834.R1.RT Weyerhauser 4/13/99 pdx rev. bd/jp



EXPOSURE ROUTE	RECEPTORS: HUMAN: Onsite Workers	HUMAN: Site Trespassers	HUMAN: Recreational Users	BIOTA: Birds and Mammals	BIOTA: Aquatic
Inhalation	○	○			
Incidental Ingestion	●	●			
Dermal Contact	●	●			
Incidental Ingestion	●	●			
Dermal Contact	●	●			
Incidental Ingestion of Soil	●	●			
Dermal Contact with Soil	●	●			
Incidental Ingestion			○		○
Dermal Contact			○		○
Food Chain Transfer			●*	●	●

Legend

- → Onsite Migration Pathways
- - - → Offsite Migration Pathways
- ● Exposure Pathway to Be Evaluated
- ○ Minor Exposure Pathway

* It is reasonable to conclude that there is no subsistence fishing on the Columbia River (Section 5.2.5)

FIGURE 5-1

Conceptual Exposure Model for the Chlor-Alkali Plant

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

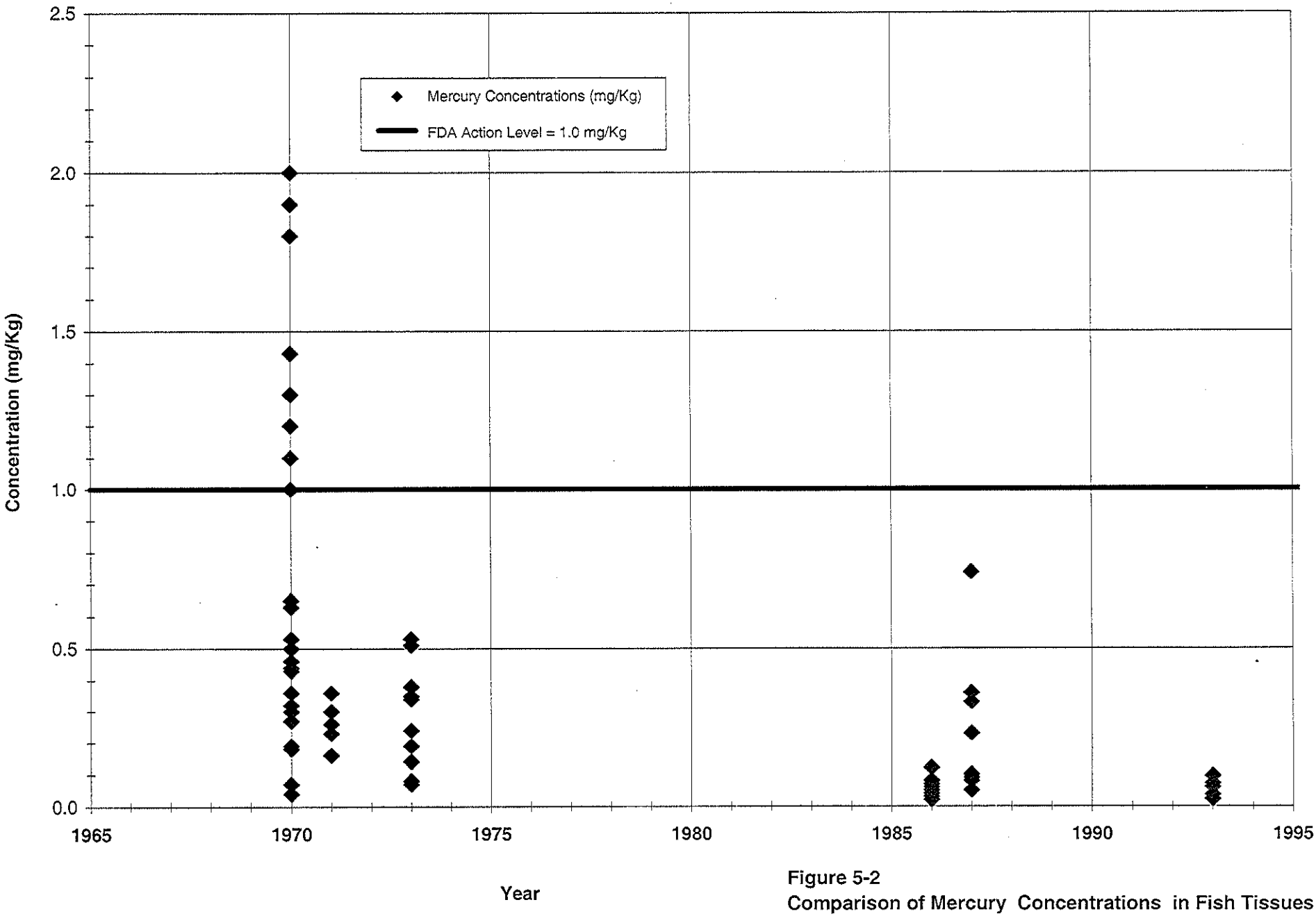


Figure 5-2
Comparison of Mercury Concentrations in Fish Tissues
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

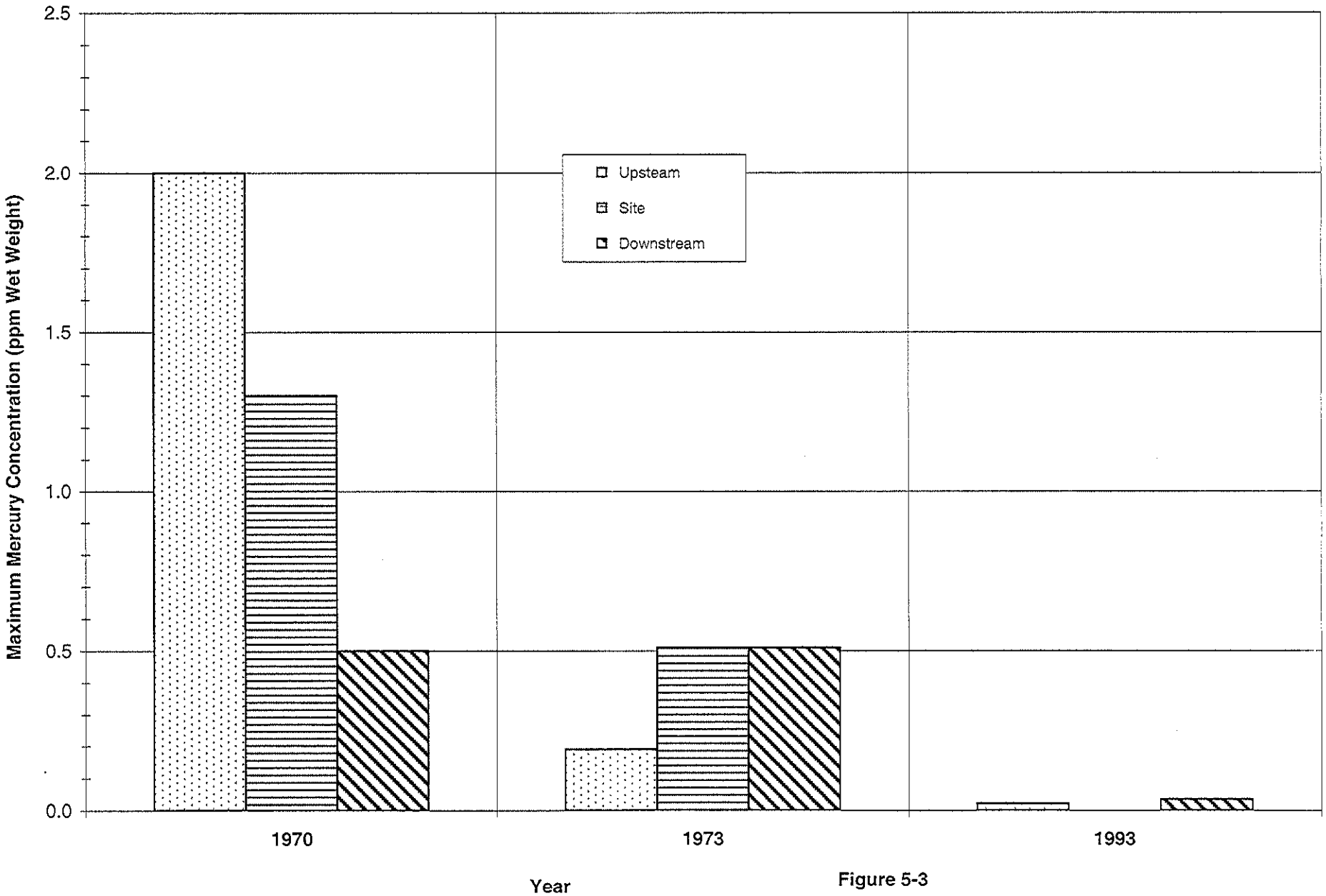


Figure 5-3
Comparison of Mercury Concentrations in Crayfish
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

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Printed 07/19/2001

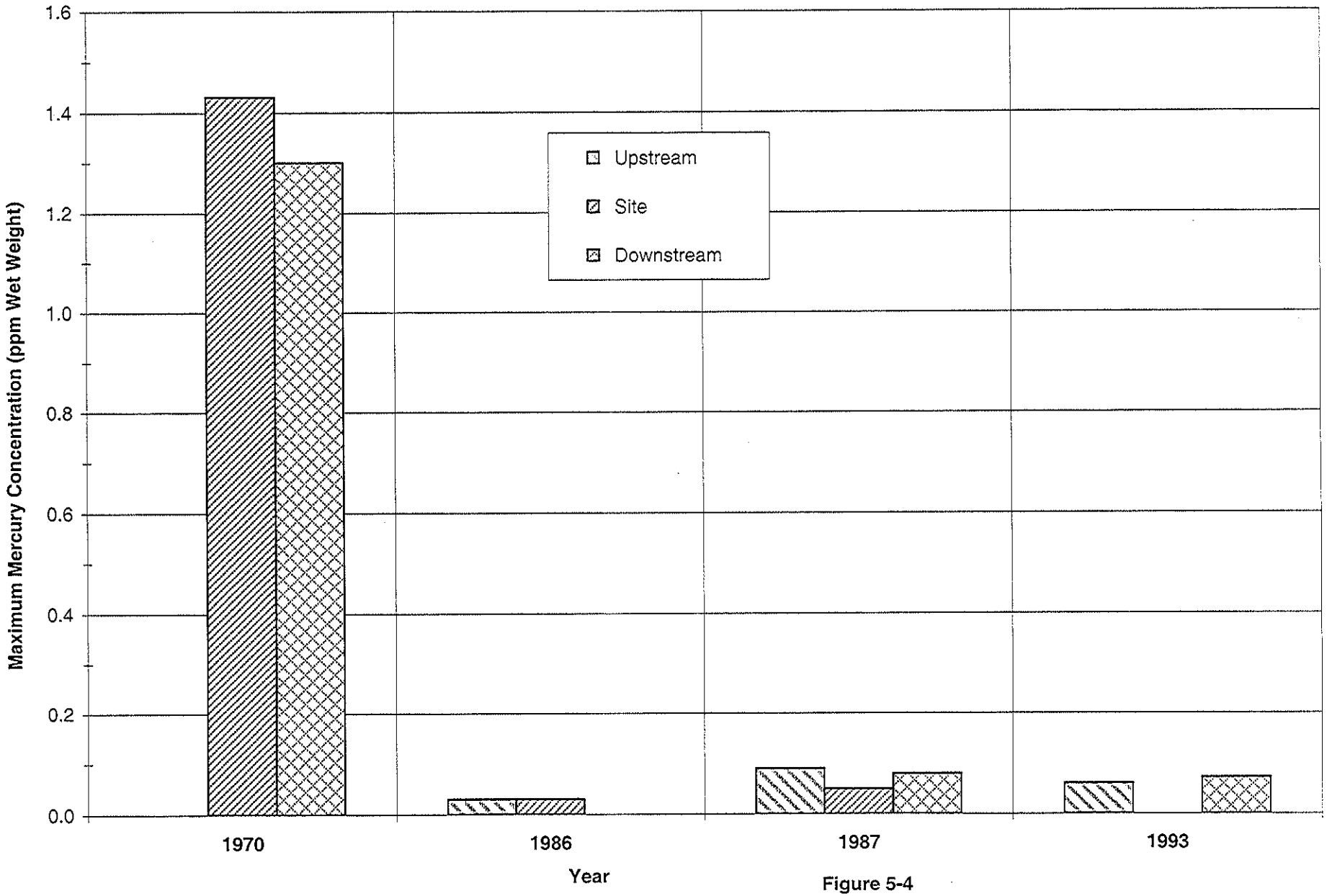

Figure 5-4
Comparison of Mercury Concentrations in Sucker Fish
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

SECTION 6

Conclusions

SECTION 6

Conclusions

This RI report presents the findings of recent sampling work conducted in response to the approved work plan for the Weyerhaeuser Chlor-Alkali facility (CH2M HILL, 1995). Where relevant, it also presents characterization results for sampling conducted prior to work plan implementation. The data are evaluated to determine the extent of mercury in the environment and to determine the risk to potential receptors. Based on this evaluation, the following conclusions have been made:

- The fieldwork was conducted in accordance with the requirements in the work plan (CH2M HILL, 1995).
- Groundwater occurs in the saturated portions of the alluvial and basalt aquifers. General hydrogeologic findings are summarized below:

  Alluvial Zone. Groundwater elevations are highest in the spring and lowest in the late summer or early fall. Groundwater generally flows toward the Columbia River, except where it flows around the buried, less-permeable basalt remnant of Mount Coffin. The alluvial hydraulic gradient ranges from 0.04 to 0.008, the hydraulic conductivity is estimated at 28 feet/day, and the horizontal groundwater flow velocity ranges from 1 to 6 feet/day.

  Basalt Zone. Groundwater flux in the basalt remnant is less than in the surrounding alluvium. The hydraulic gradient is estimated at 0.03, the hydraulic conductivity is estimated at 6×10^{-3} foot/day, and the horizontal groundwater flow velocity is approximately 0.004 foot/day.

  There is a limited hydraulic connection between the Columbia River and the shallow alluvial and basalt zones.
- Mercury that is present in soil at the plant, as a result of releases more than 20 years ago, is inorganic and has relatively low mobility. Concentrations of mercury in soil range from nondetectable to 634 mg/kg. All concentrations in soil are less than the MTCA Method C cleanup level of 1,050 mg/kg for direct contact. However, most mercury concentrations exceed the MTCA Method C cleanup level of 1.05 mg/kg for protection of groundwater.
- Groundwater concentrations are either steady or decreasing with time; the rate of decrease is slowest in the area of the former surface impoundments and the former No. 1 Cell Room. Except for in these areas, mercury concentrations are at or below the MCL of 0.002 mg/L for mercury (which is also the MTCA cleanup level for groundwater).
- Dissolution and transport of mercury from soil to groundwater by infiltration and percolation of precipitation is not a major factor influencing mercury concentrations in groundwater at the plant. A comparison of trends in mercury concentrations, groundwater levels, and precipitation amounts indicates that mercury concentrations in

groundwater tend to rise when the water table elevation rises. A similar effect is generally not observed when mercury concentrations are compared to precipitation amounts. This observation suggests that mercury is added to solution in groundwater not by precipitation transport from shallow or surficial soil, but rather from submergence of deep soil by a seasonally rising water table elevation.

- Sediment in the Columbia River at the plant site is typically sparse and locally inaccessible because of rocks on the river bottom. Mercury in sediment near the site is either absent or present at very low concentrations (less than 0.2 mg/kg). One exception was an exceedance of the 0.20-mg/kg LEL near the abandoned No. 2 Cell Room Diffuser. However, this one exceedance (0.40 mg/kg) is not statistically significant given the size of the sample population (33 samples) and the absence of mercury at surrounding sample locations. Other concentrations are at or below the available sediment criterion of 0.2 mg/kg from Ontario, Canada (MTCA cleanup levels are not available). Background mercury concentrations in sediment along a 6-mile reach of the Columbia River upstream of the plant ranged from 0.02 mg/kg to 0.26 mg/kg. These background upstream results indicate that mercury concentrations at the site are less than or equal to concentrations upstream of the site.

- Mercury was not detected in surface water samples collected from the Columbia River at the plant site. Detection limits are less than the ambient water quality criterion for acute effects (2.4 µg/L) but more than the cleanup level for chronic effects (0.012 µg/L). The absence of mercury in soil and surface water within the stormwater drainage ditch, which discharges into the Columbia River, indicates that the ditch is not a significant source of mercury to the river.

- Concentrations of mercury in fish tissue collected at the plant, upstream of the plant, and downstream from the plant since 1971 are less than the U.S. Food and Drug Administration action level of 1 mg/kg. Concentrations of mercury in fish tissue are similar in samples collected at the plant, upstream of the plant, and downstream from the plant and appear to be characteristic of the entire watershed. It is unlikely that the plant is contributing substantially to these concentrations.

Given these conclusions, the feasibility study will establish remedial action goals and remediation levels (that is, concentrations above which remedial action may be required) for soil to protect groundwater from a rising water table and for groundwater, taking into account its current and future use. The establishment of remediation levels may result in an evaluation of soil and groundwater remedial alternatives.

SECTION 7

Works Cited

SECTION 7

Works Cited

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APPENDIX A

Sampling Procedures

APPENDIX A

Sampling Procedures

The following sampling procedures for soil, groundwater, sediment, and surface water have been updated from the sampling and analysis plan (SAP) included in the *Remedial Investigation and Feasibility Study Work Plan* (CH2M HILL, 1995) to reflect the procedures used during the remedial investigation fieldwork.

Soil Sampling Methods

This section describes the methodologies used for collecting soil samples at the Chlor-Alkali Plant. Soil samples were collected from the surface and from below the ground surface once the stratum of interest was exposed. The following subsurface soil sampling methods were used at the Chlor-Alkali Plant:

- Soil borings via drill rig
- Shovel excavation

The following subsections present the general methodology that applies to all soil sample collection activities. Special considerations for each of the methods of subsurface stratum exposure are also discussed.

After the desired sampling depth was reached, the augers were removed from the borehole. Shallow samples were collected directly from the borehole using a stainless steel spoon. For deeper borings, a split-spoon sampler was used to collect samples from the floor of the borehole.

When appropriate, soil profile information was recorded on a soil boring log in general accordance with the Standard Practices for Description and Identification of Soils [Visual-Manual Procedure, American Society for Testing and Materials (ASTM) D 2488. The borehole was abandoned in accordance with Oregon Administrative Rule (OAR) 690-240.

Split-Spoon Sampling

A steel split-spoon sampler, equipped with stainless steel or brass sample sleeves, was used in conjunction with power augers and well drilling equipment to collect samples at depth in deeper borings. After the desired sampling depth was reached, the split-spoon sampler was driven into the floor of the borehole and a sample core was extracted. When split-spoon sampling was performed, soil profile information was logged as appropriate in general accordance with the Standard Practices for Description and Identification of Soils (Visual-Manual Procedure, ASTM D 2488) on a soil boring log. Split-spoon sample collection procedures are detailed in ASTM D 1586.

Soil Sample Handling and Analysis

The following procedures were used to collect and package samples that were then delivered to the analytical laboratory:

- The collected samples were visually observed for obvious indications of contamination, such as beaded mercury.
- A sample label was filled out with waterproof ink and firmly affixed to the sample jar. The sample label included the site name, unique sample identification number, date and time (24-hour clock) collected, name of sample collector, and requested analyses.
- The sample jar was placed in a Ziploc plastic bag and then immediately placed in a sturdy ice chest containing ice.
- For each sample, the following information was recorded in the field notebook: sample designator, date and time of sample collection, type of sample, sampling method, description of noteworthy physical characteristics of the sample, field observations, and disposition of the sample.
- Once all the samples were packed, a copy of the chain-of-custody form was placed in a plastic bag and taped to the inside of the lid. The chest was then closed, sealed with shipping tape, and labeled. Two chain-of-custody seals were affixed in such a manner that they would be broken if the lid of the chest were raised.
- The sealed chest(s) was delivered to Weyerhaeuser Analytical Testing laboratory in Federal Way, Washington.

Monitoring Well Installation

Drilling

Each monitoring well was installed in a minimum 8-inch-diameter borehole using hollow-stem auger drilling methods to a total depth of approximately 10 feet below the first encountered water-bearing zone. Based on previous site investigations, it was anticipated that the depth to the water table was approximately 10 feet below ground surface (bgs) at the two proposed well locations. Split barrel drive soil samples were collected at 5-foot intervals to total drill depth. One drive soil sample was collected from within the screened interval and analyzed for total organic carbon at the laboratory. The soils were lithologically logged in accordance with the ASTM Visual-Manual Procedures using drill cuttings and split spoon samples.

Well Installation

Preliminary details of monitoring well construction are shown in Figure A-1. The dimensions listed are estimates only and changed according to the actual depth to groundwater and the presence or absence of the basalt underlying the alluvium. Monitoring well design and construction techniques were in accordance with Washington Department of Ecology guidelines for hydrogeologic site characterization and installation of monitoring wells (Washington Administrative Code [WAC] 173-160-500).

A 2-inch-diameter monitoring well casing and screen assembly was installed in the borehole. The well casing was constructed of Schedule 40 polyvinyl chloride (PVC) with a flush-threaded bottom sump, end cap, and casing joints. A 10-foot-long Schedule 40 PVC

screen with a 0.010-inch slot size was installed in the water-bearing zone. Each of these materials was steam-cleaned before its assembly and installation in the borehole.

A sand pack was tremied into the annulus from a minimum of 1 foot below the bottom of screen to approximately 2 to 3 feet above the top of the screen. The sand pack consisted of Colorado 10-20 silica sand (or its equivalent). A 2-foot-thick layer of bentonite chips was placed over the sand column and hydrated in place to form the well seal. Bentonite chips were placed from the top of the seal to within approximately 2 feet of the ground surface and were hydrated in the borehole.

The wells were finished with an above-grade locking steel protective casing set in concrete and extending to a depth of approximately 2 feet bgs. A concrete pad was constructed around the steel casing. The well casing and steel casing stick up approximately 2 feet and 3 feet, respectively. Each well was surveyed for horizontal coordinates and vertical elevation. Horizontal coordinates were surveyed to an accuracy of within 1 foot. Vertical elevations were surveyed with respect to the National Geodetic Vertical Datum (NGVD) of 1929 to an accuracy of 0.01 feet. Each well was surveyed for the top of the steel casing (north side), the top of the PVC (north side), and the top of the concrete pad (north side).

Well Development

After installation, each well was developed to remove turbidity created by the drilling and well construction process. The method of well development used was a combination of bailing and surging. Development was continued until the turbidity of the water removed from the well was not decreasing. The development process was documented in the field notebook and included the volume of water extracted and the average extraction rate.

Groundwater Monitoring Procedures

Two rounds of groundwater monitoring were performed at the site, including sitewide water level measurements and groundwater sample collection. In addition to the newly installed remedial investigation wells (CH-7 and CH-8), each of the existing 15 onsite alluvial wells and four basaltic wells was included in each monitoring round. The first round included water level measurements, groundwater sample collection, and analysis for total and dissolved mercury and general groundwater quality parameters. The second round included water level measurements and groundwater sample collection for dissolved mercury only. Table A-1 presents a summary of groundwater samples and analyses for each monitoring round. The sequential procedure for data and sample collection from each well consisted of measuring the water level, purging the well, and collecting the sample. The depth to water was measured using an electric water-level indicator. The volume of water in one well volume was calculated using the well construction specifications and the depth to water.

At least three well volumes were purged from each well. Purging and sampling were conducted using either a peristaltic pump with dedicated intake tubing or a decontaminated Teflon bailer. The bailer line consisted of monofilament line or other chemically nonabsorbent (nylon) line that was discarded between wells. Clean neoprene gloves were worn by field personnel during all purging and sampling procedures at each well.

The pH, temperature, and specific conductivity of the purge water were measured in the field and recorded on field data sheets throughout the purging process. Measurements of these field parameters were made for an initial water sample obtained from the top of the water column and for grab samples collected after each well volume had been purged.

When three well volumes had been purged and the field parameters were not within 10 percent of the previous measurements, purging was continued until two consecutive measurements were obtained within the prescribed limits. Meters used to obtain the field parameter measurements were calibrated daily in accordance with manufacturer's instructions.

Wells that became dry before three well volumes had been purged were sampled after they had recovered. Otherwise, sample collection occurred immediately after three or more well volumes had been purged. Two blind duplicate samples were collected during each sampling round. These were labeled with separate identification numbers from the nonduplicate samples from the same well, in conformance with the quality assurance project plan (QAPP) in the *Remedial Investigation and Feasibility Study Work Plan* (CH2M HILL, 1995). The duplicates were analyzed only for dissolved mercury. Each sample container was placed in an iced cooler immediately after collection. The sample identification number, the collection date and time, the chemical preservative, the sampler's initials, and the required chemical analysis were written on the sample label with a waterproof pen. Table A-2 outlines the appropriate samples that were collected from each well, along with the specific U.S. Environmental Protection Agency (EPA) analytical method, bottle type, preservative, and holding time. Samples analyzed for dissolved mercury were filtered in the laboratory.

Field Measurements

Field measurements of groundwater included pH, conductivity, dissolved oxygen, turbidity, fluoride, oxidation-reduction potential, and water levels. Field equipment usage, calibration, and maintenance followed the instrument-specific operation manuals. Table A-3 presents the frequency of calibration for field equipment.

Groundwater Sample Handling and Analysis

All groundwater samples were delivered to Weyerhaeuser Analytical Testing Laboratory in Federal Way, Washington, at the end of each day. The laboratory was notified that the samples were to arrive on the day that sampling was conducted.

Even though sample shipment via a freight carrier was not required, water samples were packaged carefully to ensure that chemical parameters did not change and that the samples arrived at the laboratory intact. Each sample (including the equipment blank) was placed in a Ziploc bag and wrapped with bubble-wrap or vermiculite. Ice packaged in two Ziploc bags was used to cool the samples. One copy of the chain-of-custody form, which lists all sample containers in the cooler, was sealed in a Ziploc bag and taped to the inside of the cooler; the two remaining copies were retained for project files. The cooler was taped shut, and signed and dated custody seals were taped to the outside. The cooler remained in the custody of the field sampling team before its delivery to the laboratory.

Tidal Influence Monitoring

Groundwater and surface water levels were measured continuously for approximately 3 days to assess the magnitude of tidal influences on groundwater levels beneath the Chlor-Alkali Plant. Pressure transducers were installed in six of the onsite wells and at one location in the Columbia River. Transducers were set at each location and continuously recorded water elevations were taken with data logger equipment. Manual water level measurements were collected periodically from the six selected wells during the test.

Decontamination Procedures

All field equipment used for well construction, development, water elevation monitoring, and sampling was decontaminated before use at each well location and at the conclusion of field activities in order to minimize the potential for cross-contamination between monitoring wells. The decontamination method for each piece of equipment depended on its use, as described below, and was performed in accordance with the health and safety plan (HSP) included in the *Remedial Investigation and Feasibility Study Work Plan* (CH2M HILL, 1995).

Before drilling, the drill rig and drilling equipment (including hollow-stem augers) were steam-cleaned in a mobile onsite decontamination trailer. At the conclusion of drilling and sampling activities at any given soil boring location, the hollow-stem augers, sampling rods, and portions of the rig that are soiled were cleaned in this area using the same four-step decontamination process described for soil sampling equipment.

Sediment Sampling Methods

Techniques for collection of sediment samples below standing surface water vary, depending on the depth of the water, the consistency of the sediment, and the accessibility of the sampling location. The sampling device used at the Weyerhaeuser site was a petite ponar dredge sediment sampler.

General Sample Collection Techniques for Sediment Samples

All equipment used to collect samples was decontaminated before use at each new sampling location. The decontamination procedure consisted of (1) Alconox and water scrub; (2) DI water rinse; (3) 10 percent nitric acid rinse; and (4) final DI rinse. A stainless steel spoon was used in conjunction with all the other sampling tools to facilitate transfer to the sample container. After collection, sediment samples were transferred to appropriate prelabeled, laboratory-prepared sample containers. Sample identification procedures are provided in Appendix C of the *Remedial Investigation and Feasibility Study Work Plan* (CH2M HILL, 1995).

Once filled with sample, all sample containers were sealed, properly logged in the field logbook and on the sample chain-of-custody form (see Appendix C of the *Remedial Investigation and Feasibility Study Work Plan* [CH2M HILL, 1995] regarding sample documentation and custody), and placed in an iced cooler to await delivery to the laboratory.

Sufficient ice was kept in the sample cooler to maintain the sample temperature at or below 4° C until delivery to the laboratory.

Petite Ponar Grab Sample Methods

Grab samples are appropriate for collection of surface sediment. A ponar dredge was used to collect surface grab samples. This is a "clamshell" type of sediment collection device that is generally used from a boat or bridge. The ponar is connected to a retrieval rope and is dropped through the water in the open position. After contacting the bottom, the "clamshell" closes to collect the sample and the device is pulled back to the surface with the sample. The ponar dredge closes when tension is applied to the retrieval rope.

To collect a sample with the ponar, this procedure was followed:

1. A sufficient length of rope was securely fastened to the sampler.
2. The sampling jaws were opened and the trigger mechanism was cocked.
3. The sampler was dropped into the water at the desired sampling location.
4. When the sampler struck the bottom in the upright position, the retrieval rope was pulled on the ponar dredge to collect the sample.
5. The sampler was retrieved with a slow, steady pull.
6. The contents of the dredge were transferred to a decontaminated stainless steel bowl and then transferred from this bowl to the appropriate sample containers.

Surface Water Collection Procedures

The method for collection of discrete surface water samples was as follows:

1. A new pair of disposable gloves was used for each new sample.
2. The appropriate laboratory-prepared, prelabeled sample containers were dipped directly into the flow at the end of the outfall pipe. To prevent loss of preservatives in the sample containers, an unpreserved laboratory-prepared container was used to collect surface water samples, and the samples were transferred to the preserved container.
3. When the containers were filled and tightly capped, they were properly labeled and logged in the field logbook and on the chain-of-custody form (see Appendix C of the *Remedial Investigation and Feasibility Study Work Plan* [CH2M HILL, 1995] for sample handling, custody details, and documentation). The samples were placed in a cooler with sufficient ice to maintain the sample temperature at or below 4° C until they were received by the laboratory.
4. Flow was measured at the end of the outfall pipe using a calibrated bucket. The bucket was placed directly in the stormwater flow for 1 minute. The total volume collected was measured, and the flow rate was calculated. This procedure was repeated to verify the result.

TABLE A-1
Estimated Number of Groundwater Sampling Locations and Analyses

Groundwater Zone	Number of Wells	Analytes				
		Dissolved Mercury (EPA 7470)	Total Mercury (EPA 7470)	Cations and Anions	General Chemistry*	pH and Specific Conductance
First Groundwater Monitoring Round (Summer 1992)						
Alluvial groundwater zone	15 existing wells 2 newly installed wells	17	17	17	17	17
Basalt groundwater zone	4 existing wells	4	4	4	4	4
Second Groundwater Monitoring Round (Fall 1992)						
Alluvial groundwater zone	17 existing wells	17	0	0	0	17
Basalt groundwater zone	4 existing wells	4	0	0	0	4

Note: pH, temperature, and specific conductance were measured in the field. Eh was measured in the field during the first groundwater monitoring round.

* General chemistry includes alkalinity, silica, sulfide, total dissolved solids, and total suspended solids.

TABLE A-2
Sample Container, Preservation, and Holding Time Requirements for Groundwater Samples

Test/Parameters	Analyze During the First Sampling Round (Summer 1992)	Analyze During the Second Sampling Round (Fall 1992)	Sample Type	Container Type	Preservation	Holding Time
Dissolved Mercury (EPA 7470)	Yes	No	Water	One 250-ml plastic or glass container	4ºC HNO_3	28 days
Total Mercury (EPA 7470)	Yes	Yes	Water	One 250-ml plastic or glass container	4ºC HNO_3	28 days
Anions: (EPA 300.0) Nitrate, Nitrite, Sulfate, Chloride, Fluoride	Yes	Yes	Water[a]	One 1-liter plastic bottle	4ºC	24 hours to 28 days
Alkalinity[b]: (EPA 310.0) Carbonate, Bicarbonate, Hydroxide	Yes	No	Water[a]	One 1-liter plastic bottle	4ºC	14 days
Cations: (EPA 200.7) Calcium, Iron, Magnesium, Manganese, Potassium, Sodium	Yes	Yes	Water	One 1-liter plastic bottle	4ºC <2 pH w/HNO_3	6 months
TSS (EPA 160.2)	Yes	No	Water[a]	One 1-liter plastic bottle	4ºC	
TDS (EPA 160.1)	Yes	No	Water[a]	One 250-ml plastic or glass container	4ºC	7 days
Specific Conductance (EPA 9050)	Yes	Yes	Water[a]	One 500-ml plastic or glass container	4ºC	28 days
pH (EPA 150.1)	Yes	Yes	Water[a]	One 1-liter plastic bottle	4ºC	Immediate
Silica (ICP 200.7)	Yes	No	Water	One 250-ml plastic or glass container	4ºC	6 months
Sulfide (EPA 376.1)	Yes	No	Water	One 500-ml plastic or glass container	4ºC Zinc Acetate w/NaOH	7 days

[a] Samples for these analyses could be collected in a single 1-liter plastic bottle.
[b] Alkalinity titration was to pH 10.5, 8.3, and 4.5 end points.

TABLE A-3
Frequency of Calibration for Field Equipment

Equipment	Calibration Frequency
pH meter[a]	Daily, or more frequently as needed
Specific conductivity meter	Daily, or more frequently as needed
Dissolved oxygen meter	Daily, or more frequently as needed
Turbidity meter	Daily, or more frequently as needed
Field fluoride[a]	Daily, or more frequently as needed

[a] Check at midday in the midrange buffer.

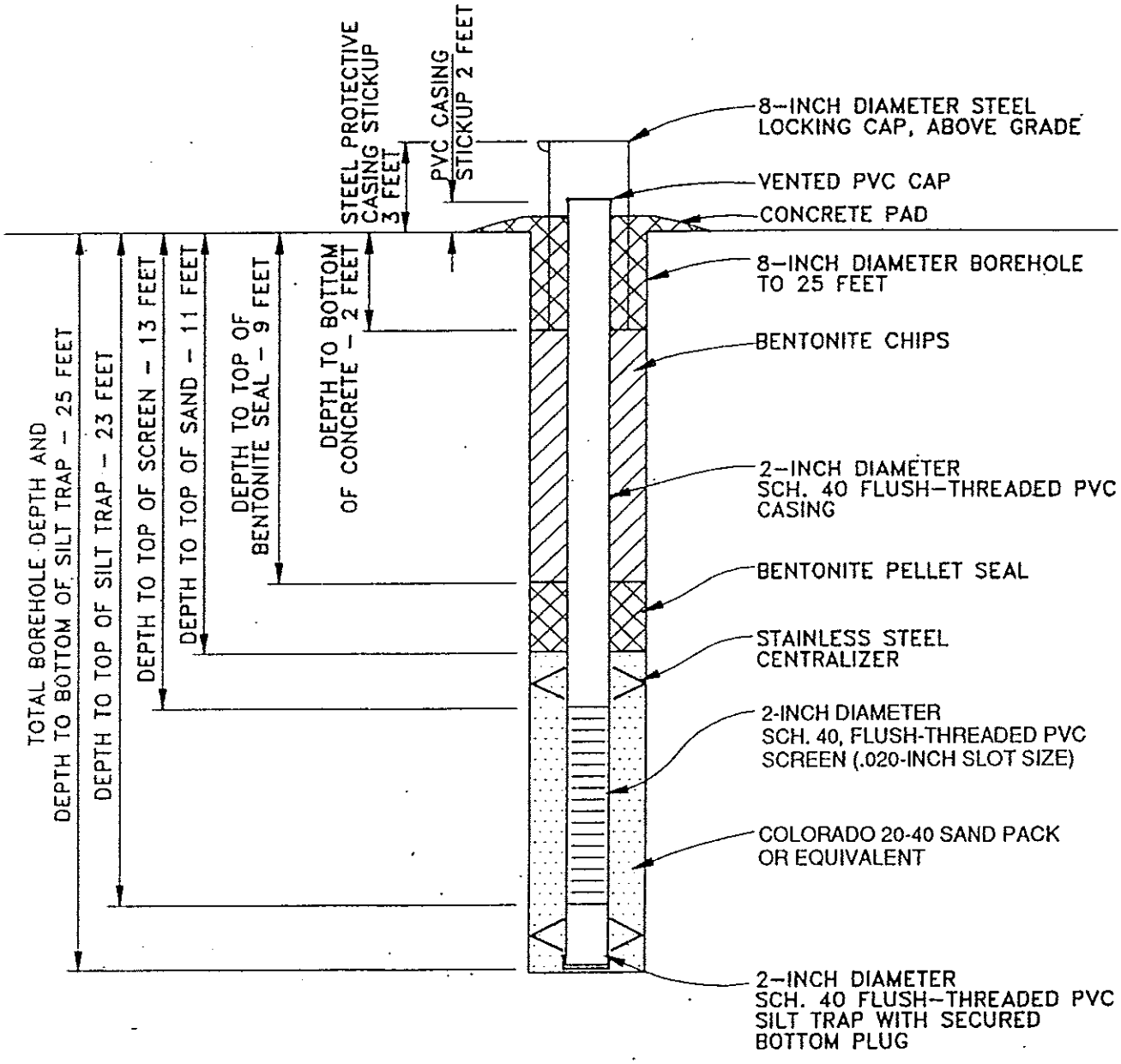


FIGURE A-1

Schematic Well Construction Diagram

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

APPENDIX B

Boring and Well Logs

Site Monitoring Well Logs Installed during RI Work

CH2MHILL

PROJECT NUMBER : 148834.RI.RT

BORING NUMBER: CH-7

SHEET 1 OF 1

SOIL BORING LOG

PROJECT : **WEYERHAEUSER LONGVIEW** LOCATION : **WEYERHAEUSER LONGVIEW, WA**

ELEVATION : **N/A** DRILLING CONTRACTOR : **GEO-TECH EXPLORATION**

DRILLING METHOD AND EQUIPMENT USED : **HSA 6' ID AUGERS**

WATER ELEVATION : START : 0945 END : 1055 LOGGER : **J. BOWKER**

DEPTH BELOW SURFACE (M)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					Asphalt Ground Surface about 5.0' in from edge of parking lot	
					Top 3.0': 1' minus gravel backfill grading into sand	
5						
	6.5		1		SAND (SP/SM), brownish gray (5YR 4/1), moist to dry, loose, medium to fine grained, poorly graded, well sorted	Hg = 0 in casing 0 in breathing 0 in soil sampler
10						Water @ 9.5'
	11.5		1.3		Top 1.0': SAND (SP), medium dark gray (N4), wet, loose, medium to fine grained Bottom 6": SILT WITH SAND (SM), medium dark gray, 10-15% fine grained sand, medium plastic, organic roots/wood, wet.	Hg = 0 in casing 0 in breathing 0 in soil sampler
15						
	16.5		1.5		Top 1.0': SAND (SP), medium dark gray (N4), with small lenes of SILT brownish gray, (5YR4/1) wet, loose, organic roots. Bottom 6": SILT (ML), brownish gray (5YR4/1) medium to low plasticity, friable, wet, 5% roots, wood <5% fine coarse sand Bottom 1": SAND (SM), wet	Collect TOC sample for lab analysis Hg = 0 ppm in all locations
	17 18.5		1.5		SAND (SW), medium dark gray (N4) medium to fine grained, loose, wet, coarse sand than above little to no fines	1.0' of heave in well Hg = 0 ppm in all locations
20					End of Boring @ 21.0' bgs	
25						

CH2MHILL

PROJECT NUMBER : 148834.RI.RT

BORING NUMBER: CH-8

SHEET 1 OF 1

SOIL BORING LOG

PROJECT : **WEYERHAEUSER LONGVIEW** LOCATION : **WEYERHAEUSER LONGVIEW, WA**

ELEVATION : **N/A** DRILLING CONTRACTOR : **GEO-TECH EXPLORATION**

DRILLING METHOD AND EQUIPMENT USED : **HSA 6' ID AUGERS**

WATER ELEVATION : START : 1400 END : LOGGER : **J. BOWKER**

DEPTH BELOW SURFACE (M)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION	COMMENTS
					Ground Surface (gravel and backfill) just off asphalt parking lot	Background Hg = 0 ppm
5	6.5		1	4-4-6	SILT (ML), moderate yellowish brown (10YR5/4), orange mottling, dry to moist, with 5% medium grained sand, friable. Bottom 6": SILT WITH SAND (SM), as above with 35% medium grained sand	Hg = background
10	11.5		1.3		SILT as above (SM-ML), moderate yellowish brown (10YR5/4), wet at 11.5', moist above, medium to fine grained sand, friable	Hg = background Water @ 11.0'
15	16.5		1.5		SAND (SW), medium dark gray (N4), loose, wet, medium to fine gravel well graded/poorly graded.	Hg = background
20	21.5		1.5		Top 6" Sand as above Bottom 1.0': SILT (ML), pale yellowish brown (10YR6/2), light orange mottling, wet, medium stiff, medium plasticity	
25					End of Boring @ 23.0' bgs	

MONITORING WELL RECORD DRAWING & CONSTRUCTION LOG

PROJECT NAME WEYERHAEUSER, LONGVIEW PROJECT NO. 148834.RI.RT

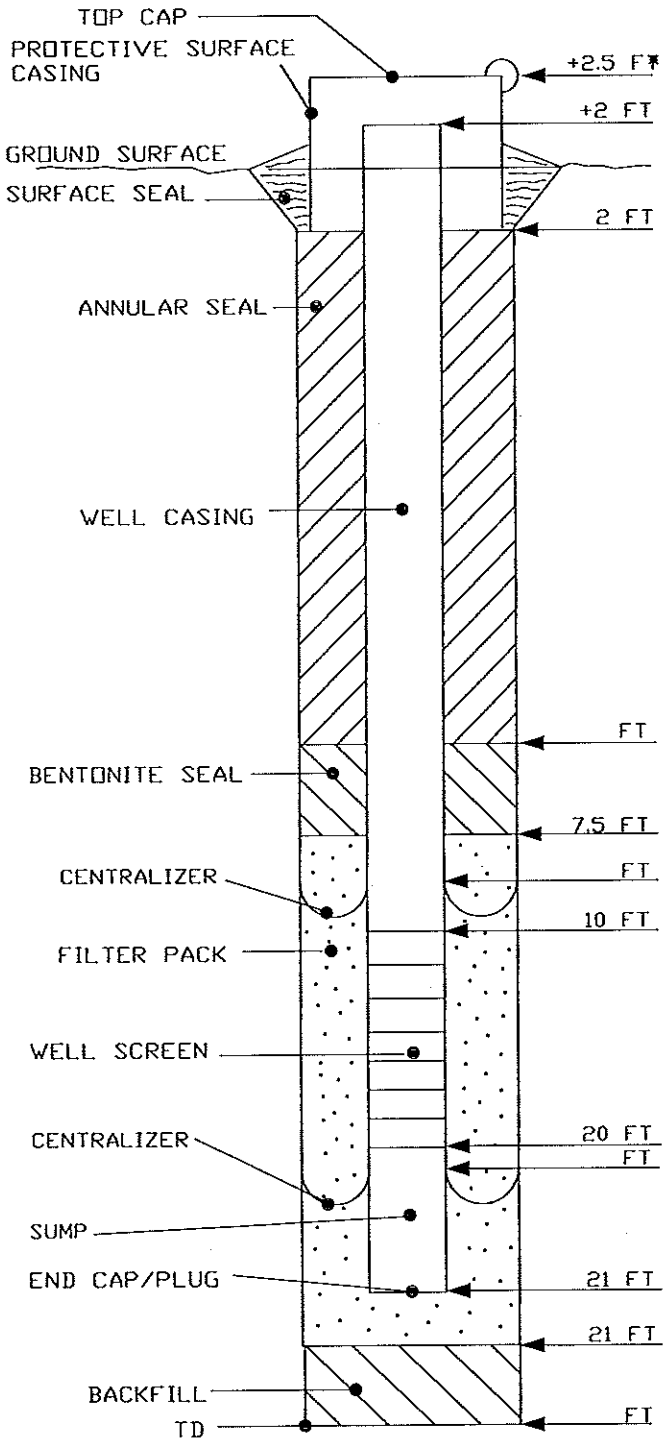
WELL NO. CH-7 FIELD OBSERVERS J BOWKER

ELEV, NGVD (top of well casing) _____ SURFACE ELEV, NGVD _____

WATER LEVEL ELEV/DATE, NGVD _____ START DATE 9/9/98

DRILLING CONTRACTOR GEOTECH EXPLORATION FINISH DATE 9/9/98

DRILLING METHOD 4 1/4" ID HOLLOW STEM AUGER



NOT TO SCALE

* DEPTHS ABOVE/BELOW GROUND SURFACE

WELLCH7.DWG

WELL CONSTRUCTION MATERIALS

BOREHOLE DIA(S) 6 INCHES TO 21 FT BGS

_____ INCHES TO _____ FT BGS

_____ INCHES TO _____ FT BGS

PROTECTIVE CASING TYPE STEEL

PROTECTIVE CASING DIAMETER _____

WELL CASING TYPE SCH 40 PVC DIAMETER 2"

COUPLING TYPE _____

SCREEN TYPE SCH 40 PVC DIAMETER 2"

SLOT SIZE .010 SCREEN LENGTH 10 FT

TOP CAP TYPE _____

END CAP/PLUG TYPE _____

CENTRALIZER TYPE _____

CENTRALIZER LOCATION(S) _____

FILTER PACK TYPE SILICA SAND - 5 BAGS

GRADATION 20x40

SEAL(S)

SURFACE _____

ANNULAR _____

BENTONITE CHIPS - 5 BAGS

BACKFILL _____

WELL DEVELOPMENT

DATE _____

METHOD _____

COMMENTS _____

MONITORING WELL RECORD DRAWING & CONSTRUCTION LOG

PROJECT NAME WEYERHAEUSER, LONGVIEW PROJECT NO. 148834.RI.RT

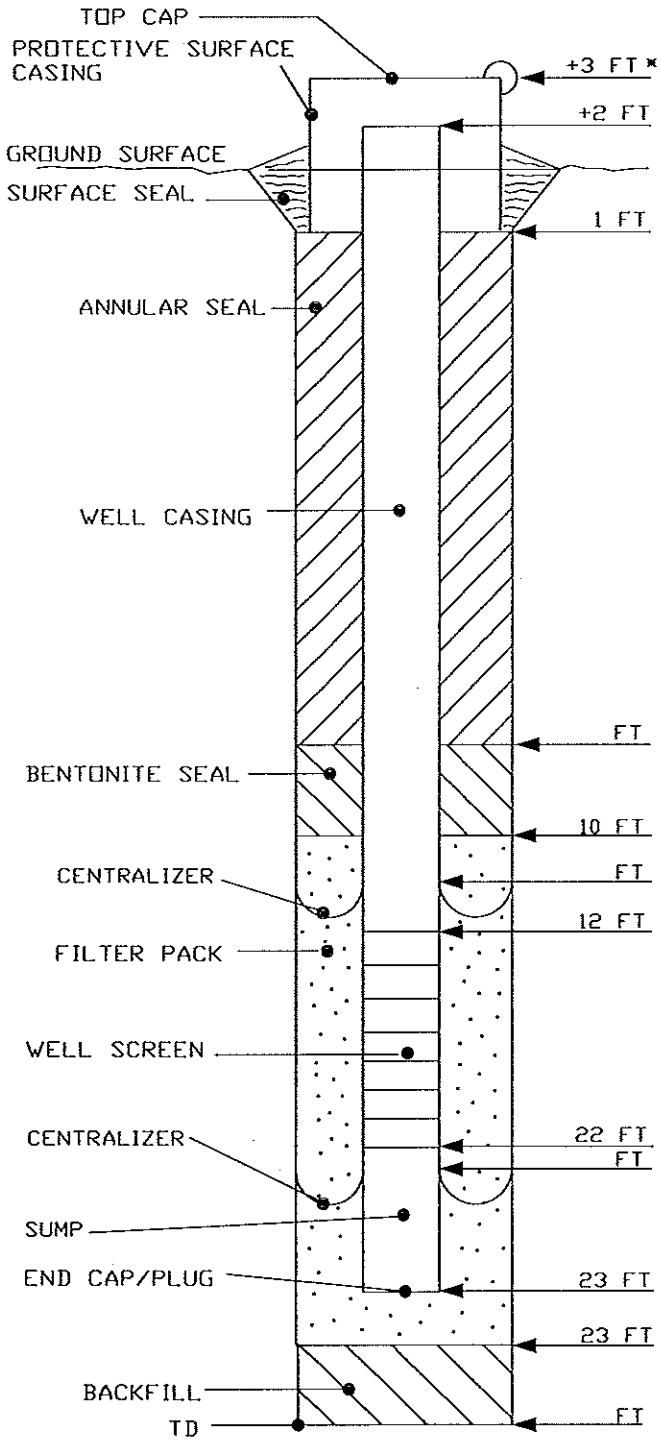
WELL NO. CH-8 FIELD OBSERVERS J BOWKER

ELEV, NGVD (top of well casing) _____ SURFACE ELEV, NGVD _____

WATER LEVEL ELEV/DATE, NGVD _____ START DATE 9/9/98

DRILLING CONTRACTOR GEOTECH EXPLORATION FINISH DATE 9/9/98

DRILLING METHOD 4 1/4" ID HOLLOW STEM AUGER



NOT TO SCALE

* DEPTHS ABOVE/BELOW GROUND SURFACE

WELLCH8.DWG

WELL CONSTRUCTION MATERIALS

BOREHOLE DIA(S) 6 INCHES TO 23 FT BGS

_____ INCHES TO _____ FT BGS

_____ INCHES TO _____ FT BGS

PROTECTIVE CASING TYPE STEEL

PROTECTIVE CASING DIAMETER _____

WELL CASING TYPE SCH 40 PVC DIAMETER 2"

COUPLING TYPE _____

SCREEN TYPE SCH 40 PVC DIAMETER 2"

SLOT SIZE .010 SCREEN LENGTH 10 FT

TOP CAP TYPE _____

END CAP/PLUG TYPE _____

CENTRALIZER TYPE _____

CENTRALIZER LOCATION(S) _____

FILTER PACK TYPE SILICA SAND - 5 BAGS

GRADATION 20x40

SEAL(S)

SURFACE _____

ANNULAR _____

BENTONITE CHIPS - 4 BAGS

BACKFILL _____

WELL DEVELOPMENT

DATE _____

METHOD _____

COMMENTS _____

Site Monitoring Well Logs – Historical

Sweet, Edwards & Associates, Inc.

BORING LO(

PROJECT WEYERHAEUSER-CHLORINE PLANT

Page 1 of

ıtion SEE MAP

Boring No. MW-1

Surface Elevation 24.48 Top of Casing

Drilling Method Hollow Stem Auger

Total Depth 21.5 feet

Drilled By Mountain States Drillin

Date Completed 7-20-87

Logged By C. Wells

WELL DETAILS	PENE-TRATION TIME/ RATE	DEPTH (FEET)	SAMPLE NO.	SAMPLE TYPE	PERME-ABILITY TESTING	SYMBOL	LITHOLOGIC DESCRIPTION	WATER QUALITY
Bentonite Chips; 2" Sch. 80 PVC Riser; Sand; 2" Sch. 80 PVC Screen w/0.010" Slots		0	1	SSP		SP	0-20' SAND, gray, medium grained, poorly graded, loose, trace silt, occasional fine sand zones, saturated below ~10 feet. (FILL).	
		5	2	"				
			3	"				
		10	4	"				
			5	"				
		15	6	"				
			7	"				
		20	8	"				
		25						

SEA-300-02a

Sweet, Edwards & Associates, Inc.

BORING LO

PROJECT WEYERHAEUSER-CHLORINE PLANT

Page 1 of

Location See map.

Boring No. MW-2

Surface Elevation 18.00 Top of Casing

Drilling Method Hollow Stem Auger

Total Depth 21.5 FEET

Drilled By Mountain States Drill

Date Completed 7-21-87

Logged By C. Wells

WELL DETAILS	PENE-TRATION TIME/ RATE	DEPTH (FEET)	SAMPLE NO.	SAMPLE TYPE	PERME-ABILITY TESTING	SYMBOL	LITHOLOGIC DESCRIPTION	WATER QUALITY
Bentonite, Riser, Sand, 2" Sch. 80 PVC Screen w/0.010" Slots		0	1	SSP		SP	0-9.5' SAND, gray-brown, poorly graded, loose, damp, (FILL).	
		5	2	"				
			3	"				
		10	4	"		SP-ML	9.5-14.5' INTERBEDDED SAND and SILT, dark gray; slightly to moderately cohesive, nonplastic, many organics, saturated.	
			5	"				
		15	6	"		SP	14.5-20.5' SAND, dark gray, fine to medium grained, poorly graded, saturated.	
			7	"				
		20	8	"				
		25						

SEA-300-02a

Sweet, Edwards & Associates, Inc.

BORING LC

PROJECT WEYERHAEUSER-CHLORINE PLANT Page 1 of

Location See Map Boring No. MW-3

Surface Elevation 17.84 Top of Casing Drilling Method Hollow Stem Auge

Total Depth 21.5 FEET Drilled By Mountain States Drill

Date Completed 7-21-87 Logged By C. Wells

WELL DETAILS	PENE-TRATION TIME/ RATE	DEPTH (FEET)	SAMPLE NO.	SAMPLE TYPE	PERME-ABILITY TESTING	SYMBOL	LITHOLOGIC DESCRIPTION	WATE QUALI
Bentonite, Riser, Sand, 2" Sch. 80 PVC Screen w/0.010" Slots		0				SP	0-4.5' SAND, brown, medium grained, poorly graded, loose, damp, (FILL).	
			1	SSP				
		5	2	"		SP-OL	4.5-7' FINE SANDY SILT, black, organic, slightly cohesive, moist (Clarifier Sludge).	
			3	"		SW	7-17' SAND, gray-dark gray, medium grained, poorly to well graded, loose, some gravels and organic material 10-12 feet, saturated below ~10 feet.	
		10	4	"				
			5	"				
		15	6	"				
			7	"		SP	17-21.5' SAND, dark gray, fine grained, poorly graded, saturated.	
		20	8	"				
		25						

Sweet, Edwards & Associates, Inc.

BORING LO

PROJECT WEYERHAEUSER-CHLORINE PLANT

Page 1 of

cation See Map.

Boring No. MW-4

Surface Elevation 26.73 Top of Casing

Drilling Method Hollow Stem Auger

Total Depth 26.5 feet

Drilled By Mountain States Drill

Date Completed 7-23-87

Logged By C. Wells

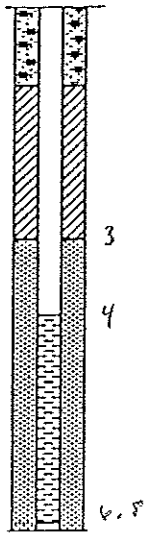
WELL DETAILS	PENE-TRATION TIME/ RATE	DEPTH (FEET)	SAMPLE NO.	SAMPLE TYPE	PERME-ABILITY TESTING	SYMBOL	LITHOLOGIC DESCRIPTION	WATER QUALITY
Bentonite, Riser, gr, Sand, 2" Sch. 80 PVC Screen w/0.010" Slots		0	1	SSP		SP	0-9.5' SAND, brown-gray brown, medium grained, poorly graded, moist, (FILL).	
		5	2	"				
			3	"				
		10	4	"		SW	9.5-12' SAND, gray brown, medium to coarse grained, well graded, loose, damp.	
			5	"		SP	12-20.5' SAND, gray brown, gray, medium grained, poorly poorly graded, saturated below 15 feet.	
		15	6	"				
			7	"				
		20	8	"		SP-ML	20.5-24' SANDY SILT, SILTY SAND, very dark gray, black, slightly to moderately cohesive, some organic material, saturated, (strong petroleum odor?).	
			9	"		ML		
		25	10	"			24-26.5' SILT, gray, moderately cohesive, trace sand.	
		30						

00107

Top of Casing 27.76 ft

Equipment 2" I.D. Split Spoon

Elevation 25.8 ft Date 1/17/91



Casing extends 2.0 feet above ground surface
Bentonite-Cement Seal

Bentonite Seal

2" Dia. Blank PVC pipe

Colorado 20 x 40 Silica Sand Pack

2" Dia. (0.020) Slotted PVC pipe

Well Cap

Depth ft
Sample

0 — Asphalt

BROWN SAND (SP)
fine-grained, with trace fine-grained gravel.

5 — GRAVEL (GP)
fine- to coarse-grained basaltic gravel.
grades to gray at 6 feet

Boring terminated at 6.7 feet due to auger refusal.
Groundwater encountered at 3.0 feet.
Boring converted to Monitor Well on 1/23/91.

10

15

20

Harding Lawson Associates
Engineering and Environmental Services

LOG OF BORING HLA-1A (sheet 1 of 1)

Weyerhaeuser Chlor-Alkali Plant
Longview, Washington

PLATE A-2

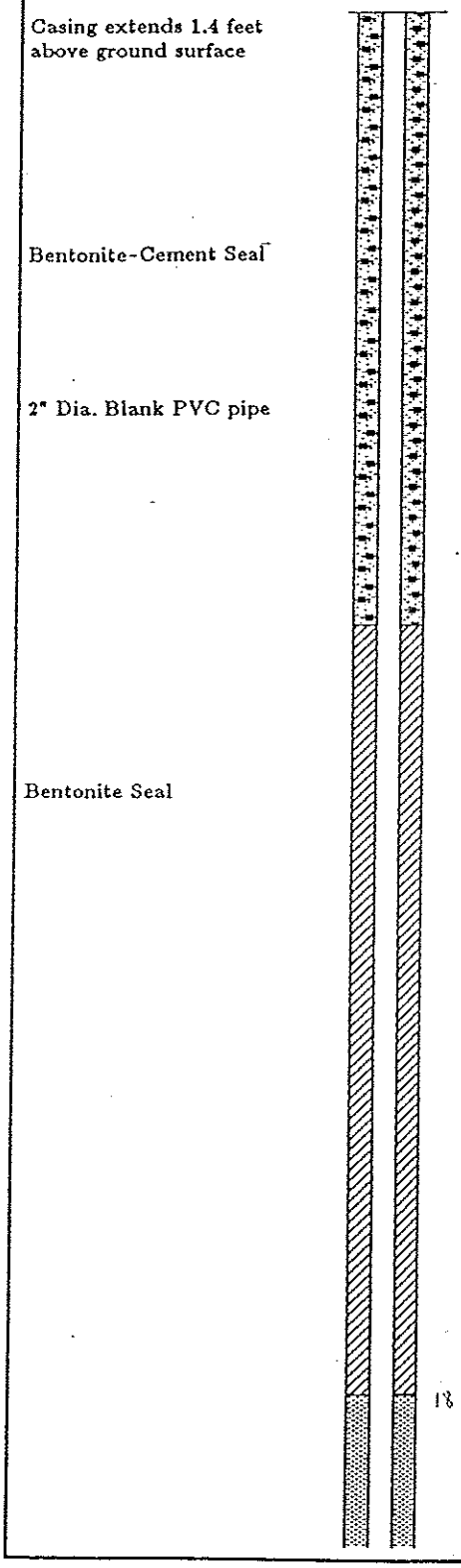
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
M.O'M.	20099,012.09		3/91		

00107

Top of Casing 27.18 ft

Equipment Spoon/Diamond Core

Elevation 25.8 ft Date 1/23/91



Blows/ft	Depth ft	Sample	
	0		BROWN SAND (SP) fine-grained, with trace fine-grained gravel.
23	5		GRAVEL (GP) fine- to coarse-grained angular basalt.
			SAND (SP) fine- to medium-grained.
	10		
	15		grades with gravel
	16'		BLACK BASALT jointed black porphyritic basalt with phenocrysts of altered plagioclase, trace pyrite on fracture surface, fractures oxidized, fractures 3" to 12" apart.
18	20		

Harding Lawson Associates
Engineering and Environmental Services

LOG OF BORING HLA-1B (sheet 1 of 2)

Weyerhaeuser Chlor-Alkali Plant
Longview, Washington

PLATE A-3

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
K.O'H.	20099,012.09		3/91		

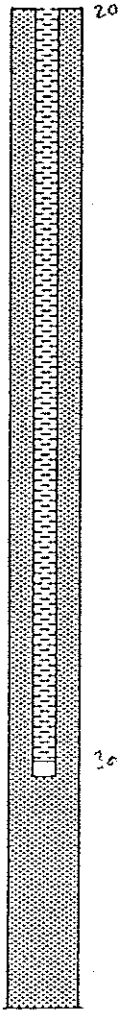
00107

Blows/ft

Depth(ft) Sample

Equipment Spoon/Diamond Core

Elevation 25.8 ft Date 1/23/91



Colorado 20 x 40
Silica Sand Pack

2" Dia. (0.020)
Slotted PVC pipe

Well Cap

20

25

30

35

40

pyrite grades out, fractures filled with waxy alteration product (clay?)

Boring terminated at 33.0 feet.
Groundwater encountered at 5.0 feet.
Borehole reamed to 6.5" diameter down to 31.0 feet, boring converted to Monitor Well on 1/27/91.

Harding Lawson Associates
Engineering and Environmental Services

LOG OF BORING HLA-1B (sheet 2 of 2)

Weyerhaeuser Chlor-Alkali Plant
Longview, Washington

PLATE A-3

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
M.O'H.	20099,012.09		3/91		

99107

Top of Casing 27.36 ft

Equipment 2" I.D. Split Spoon

Elevation 25.8 ft Date 1/16/91

Casing extends 1.6 feet above ground surface
Bentonite-Cement Seal

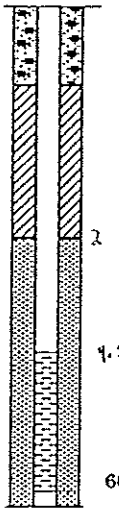
Bentonite Seal

2" Dia. Blank PVC pipe

Colorado 20 x 40 Silica Sand Pack

2" Dia. (0.020) Slotted PVC pipe

Well Cap



Blows/ft

3

5

4.5

60/8.5"

Depth ft
Sample

0

BROWN SAND (SP)
dry, fine-grained, with trace fine-grained gravel.

wet, with trace coarse-grained gravel

5

saturated, fine- to medium-grained, trace basalt fragments, angular basalt chips in shoe

Boring terminated at 6.5 feet.
Groundwater encountered at 2.5 feet.
Boring converted to Monitor Well on 1/16/91.

10

15

20

Harding Lawson Associates
Engineering and Environmental Services

LOG OF BORING HLA-2A (sheet 1 of 1)

Weyerhaeuser Chlor-Alkali Plant
Longview, Washington

PLATE A-4

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
M.O'M.	20099,012.09		3/91		

00107

Top of Casing 27.80 ft

Equipment 2" I.D. Split Spoon

Elevation 26.3 ft Date 1/16/91

Casing extends 1.5 feet above ground surface
Bentonite-Cement Seal

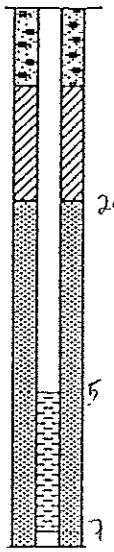
Bentonite Seal

2" Dia. Blank PVC pipe

Colorado 20 x 40 Silica Sand Pack

2" Dia. (0.020) Slotted PVC pipe

Well Cap



BROWN SAND (SP)
fine- to medium-grained with trace fine-grained gravel.

grades wet

wet, fine-grained sand, coarse-grained angular basalt gravel

Boring terminated at 7.5 feet due to auger refusal.
Groundwater encountered at 4.5 feet.
Boring converted to Monitor Well on 1/16/91.

Harding Lawson Associates
Engineering and Environmental Services

LOG OF BORING HLA-3A (sheet 1 of 1)

Weyerhaeuser Chlor-Alkali Plant
Longview, Washington

PLATE A-5

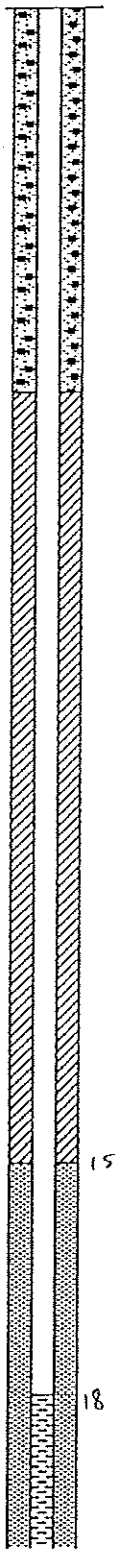
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
M.O'H.	20099,012.09		3/91		

00107

Top of Casing 27.39 ft

Equipment 2" I.D. Split Spoon

Elevation 25.6 ft Date 1/25/91



Casing extends 1.8 feet above ground surface

Bentonite-Cement Seal

2" Dia. Blank PVC pipe

Bentonite Seal

Depth ft
Sample

0 — Asphalt

DARK GRAYISH-BROWN GRAVELLY SAND (SW)
loose, moist, trace to some fine-grained sub-angular to sub-rounded gravels, and trace (5%) silt (fill).

DARK BROWN SAND (SP)
loose, moist to wet, trace silt (fill).

bedrock at 4.8 feet

5 — BLACK BASALT
hard, locally fractured, cuttings are angular chips and powdered rock.

drilled with downhole hammer from 6 to 28 feet

10

15

20

Harding Lawson Associates
Engineering and Environmental Services

LOG OF BORING HLA-3B (sheet 1 of 2)

Weyerhaeuser Chlor-Alkali Plant
Longview, Washington

PLATE A-6

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
M.O'H.	20099,012.09		3/91		

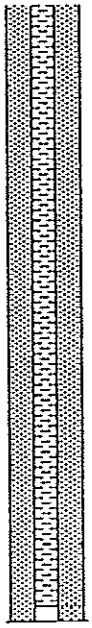
80197

Blows/ft

Depth(ft) Sample

Equipment 2" I.D. Split Spoon

Elevation 25.6 ft Date 1/25/91



Colorado 20 x 40
Silica Sand Pack

2" Dia. (0.020)
Slotted PVC pipe

Well Cap

18'

20

25

30

35

40

Boring terminated at 28.0 feet.
Groundwater encountered at 3.5 feet.
Boring converted to Monitor Well on 1/25/91.

PLATE

Harding Lawson Associates
Engineering and Environmental Services

LOG OF BORING HLA-3B (sheet 2 of 2)

Weyerhaeuser Chlor-Alkali Plant
Longview, Washington

A-6

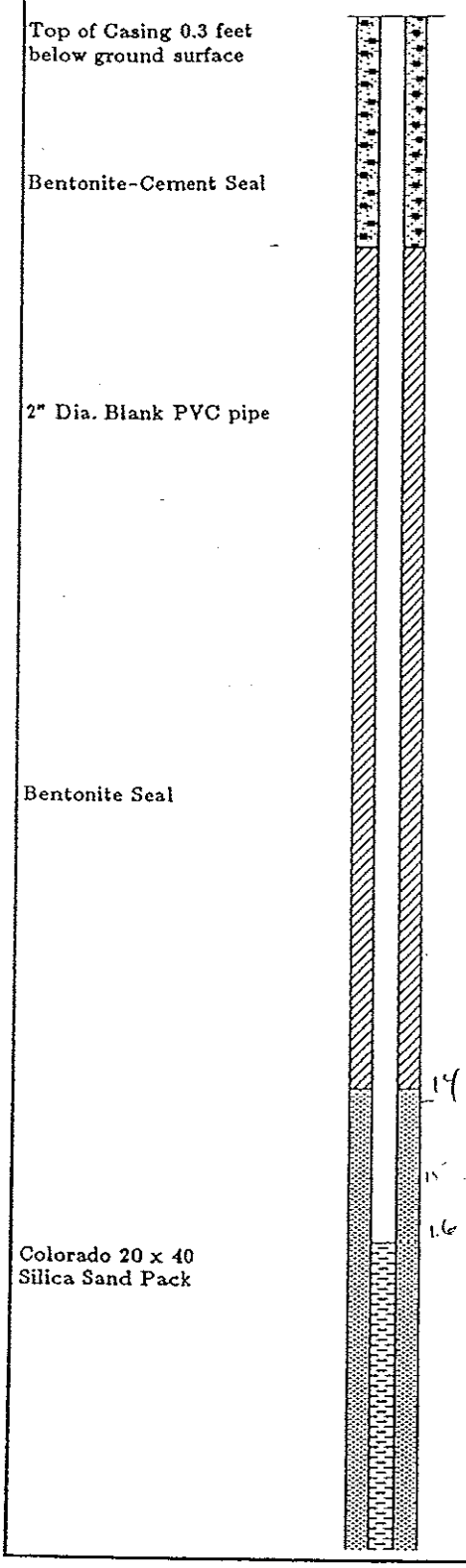
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
M.O'M.	20099,012.09		3/91		

00107

Top of Casing 26.61 ft

Equipment 2" I.D. Split Spoon

Elevation 26.9 ft Date 1/26/91



Depth ft	Sample	Blows/ft	
0			DARK GRAY SANDY GRAVEL (GW) loose, moist.
		43	DARK BROWN SILTY SAND (SM) loose to medium-dense, moist.
		35	BASALT bedrock rubble or fractured bedrock?
5			drilled with downhole hammer from 5.4 to 26 feet
			wet
10			competent bedrock
			black aphanitic basalt, hard, dry to damp, angular chips and fine powdered rock
15			trace pyrite in cuttings
20			

Harding Lawson Associates
Engineering and Environmental Services

LOG OF BORING HLA-7B (sheet 1 of 2)

Weyerhaeuser Chlor-Alkali Plant
Longview, Washington

PLATE A-12

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
M.O'M.	20099,012.09		3/91		

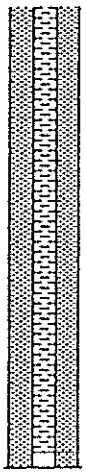
00107

Blows/ft

Depth(ft) Sample

Equipment 2" I.D. Split Spoon

Elevation 26.9 ft Date 1/26/91



2" Dia. (0.020)
Slotted PVC pipe

Well Cap

20

25

30

35

40

Boring terminated at 26.0 feet.
Groundwater encountered at 9.0 feet.
Boring converted to Monitor Well on 1/26/91.

PLATE

Harding Lawson Associates
Engineering and Environmental Services

LOG OF BORING HLA-7B (sheet 2 of 2)

Weyerhaeuser Chlor-Alkali Plant
Longview, Washington

A-12

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
M.O'M.	20099,012.09		3/91		

PROJECT NUMBER	WELL NUMBER
P0X32451.E0	CH-1 SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Weyerhaeuser Company LOCATION Longview, Washington

MEASURING POINT ELEV (NGVD) 25.29 ft. DRILLING CONTRACTOR Geo-Tech Exploration

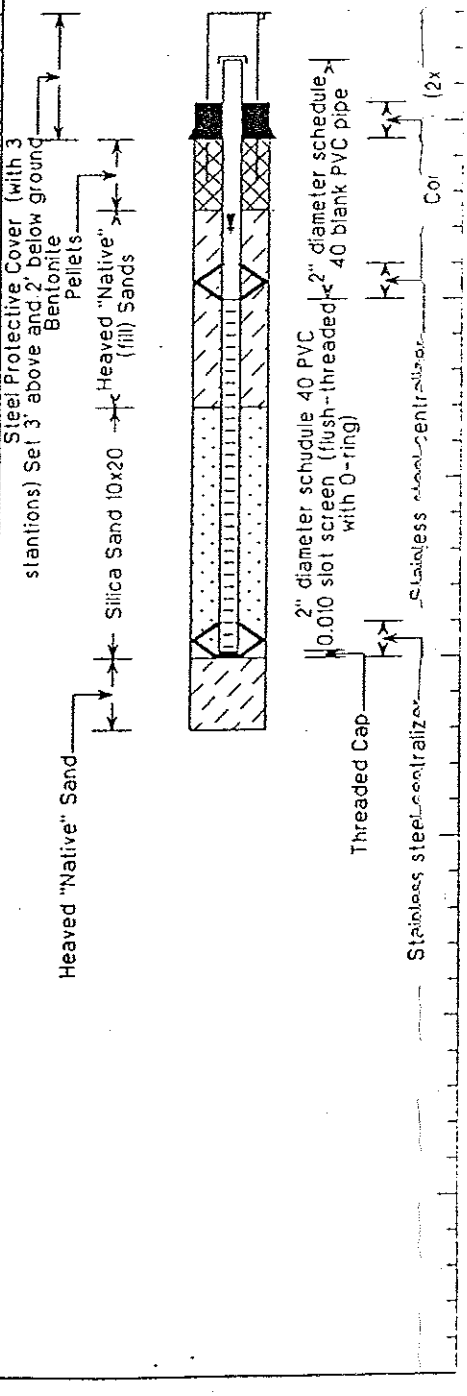
DRILLING METHOD AND EQUIPMENT HSA (6 1/4 i.d.) trailer mounted

WATER LEVEL ELEV/DATE 3 feet START 09/25/91 FINISH 09/26/91 LOGGER S. Prowell

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: SOIL CHEM ANALYSIS	SAMPLE: PERCENT RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG
0.0					GRAVEL SURFACE (0-4 inches)	
5.0	5.0					
	6.5			6-3-9	POORLY GRADED SAND, (SP), (FILL), black, wet, loose, fine to medium grains.	
10.0	10.0					
	11.5			4-5-4	POORLY GRADED SAND, (SP), similar to above.	
15.0	15.0					
	16.5			7-5-3	POORLY GRADED SAND, (SP), similar to above.	
20.0					Boring terminated at 17 feet BGS 09/26/91 Groundwater encountered at approximately 3 feet BGS during drilling. The first CH-1 borehole to 17 feet BGSwas abandoned due to heaving sands and backfilled with bentonite chips on 09/25/91. CH-1 was redrilled approximately 10 feet west of the abandoned hole on 09/26/91. 10 inch well bore diameter	
25.0						
30.0						

WELL COMPLETION DIAGRAM

DEPTH OF CASING, DRILLING RATE
CASING MATERIAL
WELL SEAL & GRAVEL PACK



PROJECT NUMBER	WELL NUMBER
POX32451.E0	CH-2

SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

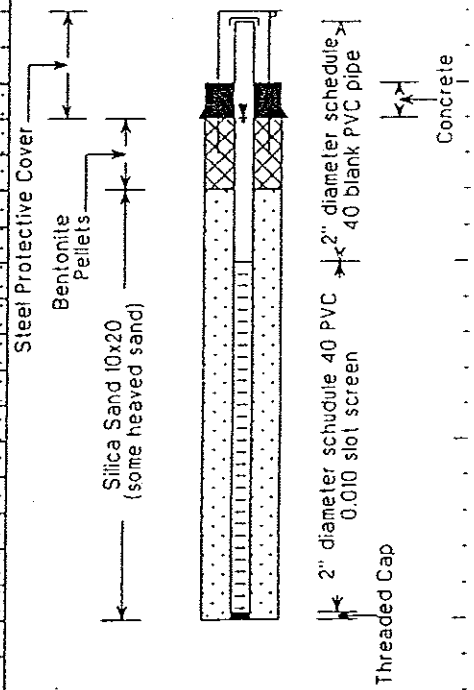
PROJECT Weyerhaeuser Company LOCATION Longview, Washington

MEASURING POINT ELEV (NGVD) 25.42 ft. DRILLING CONTRACTOR Geo-Tech Exploration

DRILLING METHOD AND EQUIPMENT HSA (6 1/4 i.d.) trailer mounted

WATER LEVEL ELEV/DATE 1 foot START 09/27/91 FINISH 09/27/91 LOGGER S. Proweli

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: SOIL CHEM ANALYSIS	SAMPLE: PERCENT RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	WELL COMPLETION DIAGRAM: DEPTH OF CASING, DRILLING RATE, CASING MATERIAL, WELL SEAL & GRAVEL PACK
0.0					Encounter ground water at 1 foot.		
5.0	5.0			7-13-12	POORLY GRADED SAND, (SP), (FILL), brown, wet, medium dense, medium grained.		
	6.5						
10.0	10.0			5-8-9	POORLY GRADED SAND, (SP), (FILL), brown, wet, loose, fine to medium grained.		
15.0	11.5				Boring terminated at 15 feet BGS 09/27/91 Groundwater encountered at approximately 1 foot BGS during drilling. 10 inch well bore diameter		
20.0							
25.0							
30.0							



CH2M HILL

PROJECT NUMBER	WELL NUMBER
PDX32451.E0	CH-3

SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Weyerhaeuser Company LOCATION Longview, Washington

MEASURING POINT ELEV (NGVD) 25.07 ft. DRILLING CONTRACTOR Staco Well Service, Mt. Angel, Oregon

DRILLING METHOD AND EQUIPMENT Air rotary (Schramm Rotadrill)

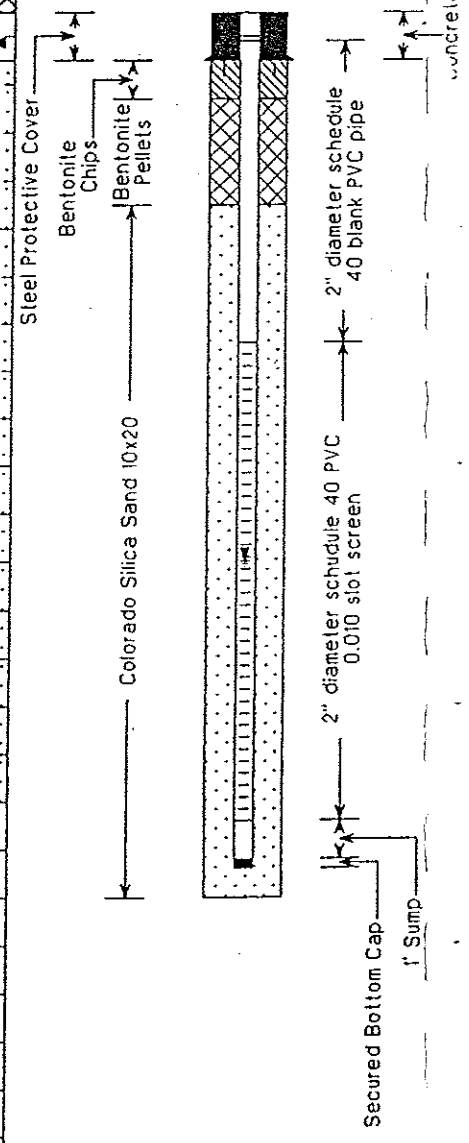
WATER LEVEL ELEV/DATE 12 feet START 10/02/91 FINISH 10/04/91 LOGGER R. Ferguson

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: SOIL CHEM ANALYSIS	SAMPLE: PERCENT RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY
					Pavement at 0-6 inches Large broken angular Basalt at 4-18 inches (FILL).
5.0	5.0				POORLY GRADED SAND, (SP), (FILL), brown, fine to medium grained (unable to sample due to drilling casing sticking up above ground).
	6.5				
10.0	10.0				
	11.5			6-10-15	POORLY GRADED SAND, (SP), black, medium grained, angular.
					Groundwater encounted at 12 feet.
15.0	15.0				
	16.5			6-59	No Recovery - Encountered fractured basalt at 17 feet (Native?), Broken angular, some rounded edges, wet.
20.0					Boring terminated at 19 feet Groundwater encountered at approximately 12 feet BGS on 10/03/91. 8 inch well bore diameter
25.0					

SYMBOLIC LOG

WELL COMPLETION DIAGRAM

DEPTH OF CASING, DRILLING RATE
CASING MATERIAL
WELL SEAL & GRAVEL PACK



PROJECT NUMBER	WELL NUMBER
PDX32451.E0	CH-4

SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Weyerhaeuser Company LOCATION Longview, Washington

MEASURING POINT ELEV (NGVD) 26.3 ft. DRILLING CONTRACTOR Geo-Tech Exploration

DRILLING METHOD AND EQUIPMENT HSA (6 1/4 i.d.) trailer mounted

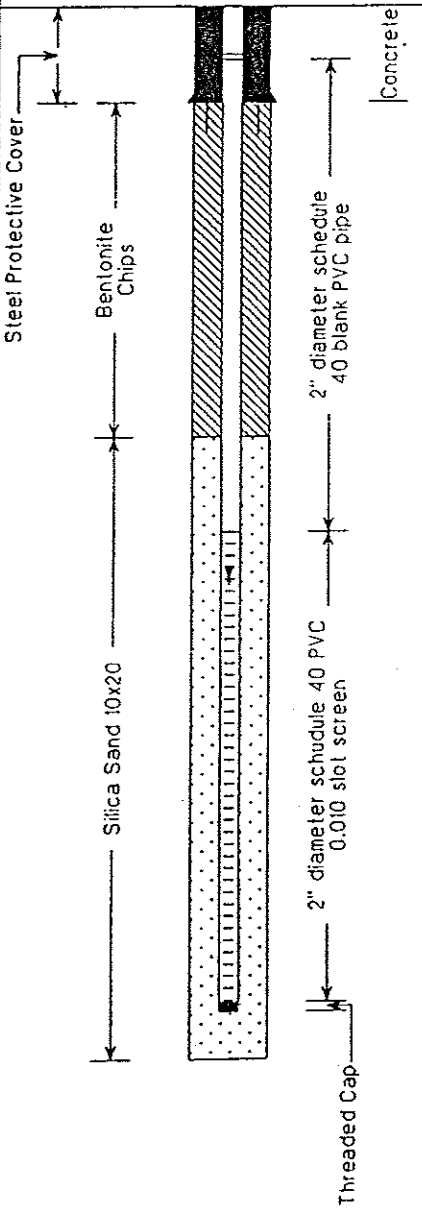
WATER LEVEL ELEV/DATE 12 feet START 09/24/91 FINISH 09/24/91 LOGGER S. Prowell

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: SOIL CHEM ANALYSIS	SAMPLE: PERCENT RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY
					Asphalt at 0-6 inches
5.0	5.0 - 6.5			6-5-4	POORLY GRADED SAND with GRAVEL, (SP), (FILL), brown, dry, loose, medium grained.
10.0	10.0 - 11.5			7-6-7	POORLY GRADED SAND with GRAVEL, (SP), (FILL), similar to above.
15.0	15.0 - 16.5			3-3-3	POORLY GRADED SAND, (SP), (FILL), black, wet, loose, fine to medium grained. Groundwater encountered at 15 feet.
20.0	20.0 - 21.5			3-5-2	SILT, (ML), (Native?), brown, wet, soft, some clay and some wood fragments.
25.0					Boring terminated at 22 feet on 09/24/91 Groundwater encountered at approximately 15 feet BGS during drilling. 10 inch well bore diameter

SYMBOLIC LOG

WELL COMPLETION DIAGRAM

DEPTH OF CASING, DRILLING RATE
CASING MATERIAL
WELL SEAL & GRAVEL PACK



PROJECT NUMBER	WELL NUMBER
PDX32451.E0	CH-5

SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Weyerhaeuser Company LOCATION Longview, Washington

MEASURING POINT ELEV (NGVD) 27.41 ft. DRILLING CONTRACTOR Geo-Tech Exploration

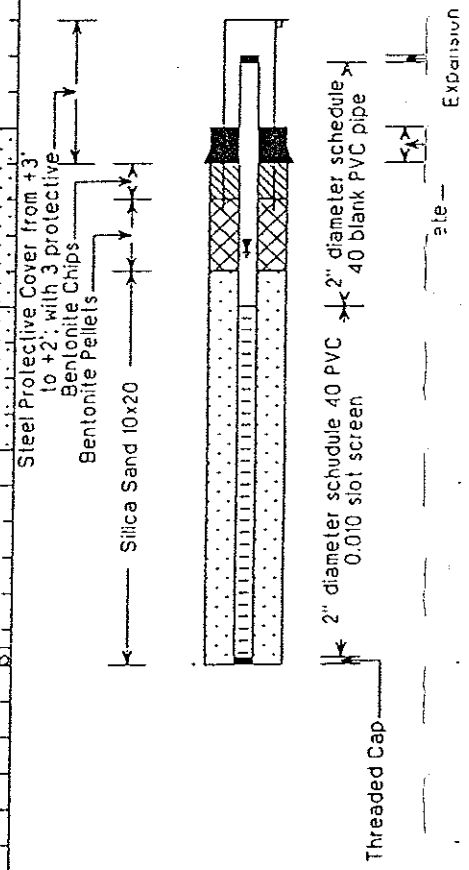
DRILLING METHOD AND EQUIPMENT HSA (6 1/4 i.d.) trailer mounted

WATER LEVEL ELEV/DATE 3.5 feet START 09/26/91 FINISH 09/26/91 LOGGER S. Prowell

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: SOIL CHEM ANALYSIS	SAMPLE: PERCENT RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG
0.0						
					Encountered groundwater at 3.5 feet	
5.0	5.0			7-26-33	POORLY GRADED SAND, (SP), (FILL), brown, wet, medium, medium grained, fill material.	
	6.5					
10.0	10.0			3-9-2	WELL GRADED SAND with GRAVEL, (SW), brown, wet, loose, course grained.	
	11.5					
15.0					WELL GRADED GRAVEL, (GW), Refusal at 15 feet.	
					Boring terminated at 15 feet BGS on 09/26/91. Groundwater encountered at approximately 3.5 feet BGS during drilling. 10 inch well bore diameter	
20.0						
25.0						
30.0						

WELL COMPLETION DIAGRAM

DEPTH OF CASING, DRILLING RATE
CASING MATERIAL
WELL SEAL & GRAVEL PACK



PROJECT NUMBER	WELL NUMBER
PDX32451.E0	CH-6

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Weyerhaeuser Company LOCATION Longview, Washington

MEASURING POINT ELEV (NGVD) 23.16 ft. DRILLING CONTRACTOR Staco Well Service, Mt. Angel, Oregon

DRILLING METHOD AND EQUIPMENT Air Rotary (Schramm Rotadrill)

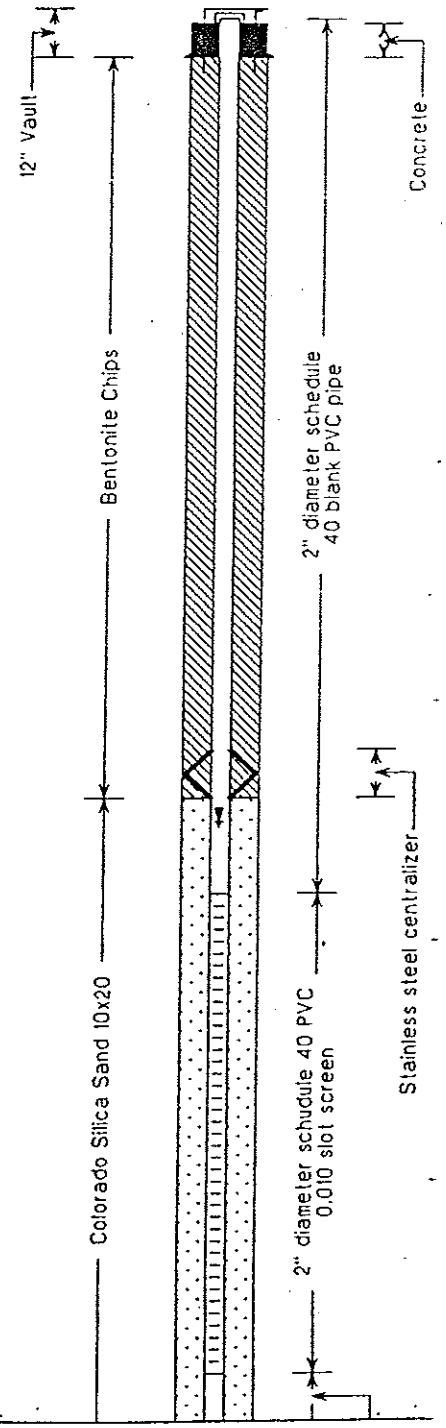
WATER LEVEL ELEV/DATE 17.5 feet START 10/07/91 FINISH 10/07/91 LOGGER R. Ferguson

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: SOIL CHEM ANALYSIS	SAMPLE: PERCENT RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY
0					Asphalt with Gravel Base from 0-6 inches POORLY GRADED SAND, (SP), (FILL), dark brown, medium to course grained.
5.0					POORLY GRADED SAND, (SP), (FILL), brown-black, medium to course grained.
10.0	10.0				
	11.5			7-8-11	SILTY GRAVEL, (GM), (FILL), dark brown, dry, rounded basalt fragments of 2 inch diameter.
15.0	15.0				
	15.5			8	SILTY SAND with GRAVEL, (SM), (FILL), brown, moist, 2 inch diameter with rounded edges.
20.0	20.0				
	21.5			6-8-36	POORLY GRADED SAND, (SP), black, wet, medium to coarse grained.
25.0	25.0				
	26.5			3-5-7	POORLY GRADED SAND, (SP), black, wet, fine to medium coarse, native sediments.

SYMBOLIC LOG

WELL COMPLETION DIAGRAM

DEPTH OF CASING, DRILLING RATE
CASING MATERIAL
WELL SEAL & GRAVEL PACK



PROJECT NUMBER	WELL NUMBER
PDX32451.E0	CH-6 SHEET 2 OF 2

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

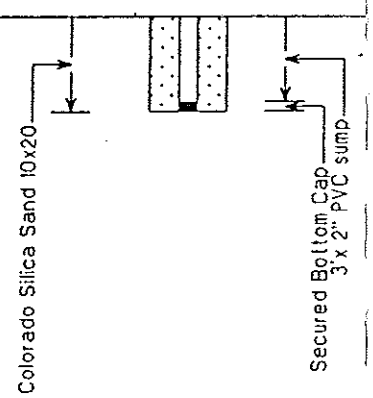
PROJECT Weyerhaeuser Company LOCATION Longview, Washington

MEASURING POINT ELEV (NGVD) 23.16 ft. DRILLING CONTRACTOR Staco Well Service, Mt. Angel, Oregon

DRILLING METHOD AND EQUIPMENT Air Rotary (Schramm Rotadrill)

WATER LEVEL ELEV/DATE 17.5 feet START 10/07/91 FINISH 10/07/91 LOGGER R. Ferguson

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: SOIL CHEM ANALYSIS	SAMPLE: PERCENT RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	WELL COMPLETION DIAGRAM: DEPTH OF CASING, DRILLING RATE, CASING MATERIAL, WELL SEAL & GRAVEL PACK
30.0							
	31.0				SILT, (ML), dark gray, some clay and some wood fragments and some Basalt fragments.		
	32.0				Boring terminated at 32 feet BGS on 10/07/91. Groundwater encountered at approximately 17.5 feet BGS during drilling. 8 inch well bore diameter		
35.0							
40.0							
45.0							
50.0							
55.0							



APPENDIX C

Laboratory Data

Soil Summary Table

Table C-1
Soil Samples from Chlor-Alkali Plant Following Removal Actions

Sample Number	Date Sampled	Sample ID	Depth From (ft)	Depth To (ft)	Analyte	Result	Units
BRINE SPILL AREA							
See Figure C-1 and Section 4, Figure 4-3.							
BSVR	2/13/91	BSVR-10	3	3	Mercury	54.20	mg/Kg
BSVR	2/14/91	BSVR-01	3	3	Mercury	11.10	mg/Kg
BSVR	2/14/91	BSVR-03	3	3	Mercury	117.00	mg/Kg
BSVR	2/14/91	BSVR-04	3	3	Mercury	58.40	mg/Kg
BSVR	2/15/91	BSVR-05	3	3	Mercury	2.20	mg/Kg
BSVR	2/15/91	BSVR-06	3	3	Mercury	6.60	mg/Kg
BSVR	2/15/91	BSVR-07	3	3	Mercury	2.30	mg/Kg
BSVR	2/15/91	BSVR-08	3	3	Mercury	22.20	mg/Kg
BSVR	2/15/91	BSVR-09	3	3	Mercury	66.10	mg/Kg
F036	9/21/98	F036-001-SO-26498XX	3	3	Alkalinity, Total as CaCO3	4400.00	mg/Kg
F036	9/21/98	F036-001-SO-26498XX	3	3	Chloride	3000.00 D	mg/Kg
F036	9/21/98	F036-001-SO-26498XX	3	3	Mercury	159.00 K	mg/Kg
F036	9/21/98	F036-001-SO-26498XX	3	3	Ph	9.30	mg/Kg
F036	9/21/98	F036-001-SO-26498XX	3	3	Solids, Total	83.40	% @ 105C
F036	9/21/98	F036-001-SO-26498XX	3	3	Sulfide	50.00 U	mg/Kg
F036	9/21/98	F036-002-SO-26498DU	3	3	Alkalinity, Total as CaCO3	3500.00	mg/Kg
F036	9/21/98	F036-002-SO-26498DU	3	3	Chloride	420.00 D	mg/Kg
F036	9/21/98	F036-002-SO-26498DU	3	3	Mercury	0.90 K	mg/Kg
F036	9/21/98	F036-002-SO-26498DU	3	3	Ph	9.00	mg/Kg
F036	9/21/98	F036-002-SO-26498DU	3	3	Solids, Total	84.00	% @ 105C
F036	9/21/98	F036-002-SO-26498DU	3	3	Sulfide	45.00 U	mg/Kg
F036	9/21/98	F036-002-SO-26498XX	3	3	Alkalinity, Total as CaCO3	1900.00	mg/Kg
F036	9/21/98	F036-002-SO-26498XX	3	3	Chloride	770.00 D	mg/Kg
F036	9/21/98	F036-002-SO-26498XX	3	3	Mercury	0.50 K	mg/Kg
F036	9/21/98	F036-002-SO-26498XX	3	3	Ph	9.00	mg/Kg
F036	9/21/98	F036-002-SO-26498XX	3	3	Solids, Total	83.80	% @ 105C
F036	9/21/98	F036-002-SO-26498XX	3	3	Sulfide	40.00 U	mg/Kg
F036	9/21/98	F036-003-SO-26498XX	3	3	Alkalinity, Total as CaCO3	9000.00	mg/Kg
F036	9/21/98	F036-003-SO-26498XX	3	3	Chloride	2700.00 D	mg/Kg
F036	9/21/98	F036-003-SO-26498XX	3	3	Mercury	13.70 K	mg/Kg
F036	9/21/98	F036-003-SO-26498XX	3	3	Ph	11.00	mg/Kg
F036	9/21/98	F036-003-SO-26498XX	3	3	Solids, Total	81.40	% @ 105C
F036	9/21/98	F036-003-SO-26498XX	3	3	Sulfide	108.00	mg/Kg
F036	9/21/98	F036-004-SO-26498XX	3	3	Alkalinity, Total as CaCO3	1700.00	mg/Kg
F036	9/21/98	F036-004-SO-26498XX	3	3	Chloride	150.00 D	mg/Kg
F036	9/21/98	F036-004-SO-26498XX	3	3	Mercury	189.00 K	mg/Kg
F036	9/21/98	F036-004-SO-26498XX	3	3	Ph	9.30	mg/Kg
F036	9/21/98	F036-004-SO-26498XX	3	3	Solids, Total	92.00	% @ 105C
F036	9/21/98	F036-004-SO-26498XX	3	3	Sulfide	14.00 U	mg/Kg

Table C-1
Soil Samples from Chlor-Alkali Plant Following Removal Actions

Sample Number	Date Sampled	Sample ID	Depth From (ft)	Depth To (ft)	Analyte	Result	Units
BRINE TREATMENT AREA							
See Figure C-2.							
C006	9/18/91	C006-101-SO-26191-XX	0	0.5	Mercury	46.00	mg/Kg
C006	9/18/91	C006-105-SO-26191-XX	0	0.5	Mercury	27.80	mg/Kg
C006	9/18/91	C006-106-SO-26191-XX	0	0.5	Mercury	31.30	mg/Kg
C006	9/18/91	C006-107-SO-26191-XX	0	0.5	Mercury	118.00	mg/Kg
C006	9/18/91	C006-108-SO-26191-XX	0	0.5	Mercury	26.20	mg/Kg
C006	9/18/91	C006-109-SO-26191-XX	0	0.5	Mercury	69.10	mg/Kg
C006	9/18/91	C006-111-SO-26191-DU	0	0.5	Mercury	16.20	mg/Kg
C006	9/18/91	C006-111-SO-26191-XX	0	0.5	Mercury	8.70	mg/Kg
C006	9/18/91	C006-112-SO-26191-XX	0	0.5	Mercury	86.50	mg/Kg
C006	9/18/91	C006-114-SO-26191-XX	0	0.5	Mercury	12.10	mg/Kg
C006	9/18/91	C006-115-SO-26191-XX	0	0.5	Mercury	32.70	mg/Kg
C006	9/18/91	C006-116-SO-26191-XX	0	0.5	Mercury	74.10	mg/Kg
C006	9/18/91	C006-117-SO-26191-XX	0	0.5	Mercury	25.90	mg/Kg
C006	9/18/91	C006-118-SO-26191-XX	0	0.5	Mercury	9.90	mg/Kg
C006	9/18/91	C006-119-SO-26191-DU	0	0.5	Mercury	7.30	mg/Kg
C006	9/18/91	C006-119-SO-26191-XX	0	0.5	Mercury	8.50	mg/Kg
C006	9/18/91	C006-120-SO-26191-XX	0	0.5	Mercury	11.40	mg/Kg
C006	9/18/91	C006-121-SO-26191-XX	0	0.5	Mercury	19.90	mg/Kg
C006	9/18/91	C006-122-SO-26191-XX	0	0.5	Mercury	25.10	mg/Kg
C006	9/18/91	C006-123-SO-26191-XX	0	0.5	Mercury	14.10	mg/Kg
C006	9/18/91	C006-124-SO-26191-XX	0	0.5	Mercury	1.50	mg/Kg
C006	9/18/91	C006-125-SO-26191-DU	0	0.5	Mercury	1.30	mg/Kg
C006	9/18/91	C006-125-SO-26191-XX	0	0.5	Mercury	1.70	mg/Kg
CR05	9/23/91	CR05	0	0.5	Mercury	47.80	mg/Kg
CR10	9/25/91	CR10	0	0.5	Mercury	35.80	mg/Kg
CR11	9/25/91	CR11	0	0.5	Mercury	65.20	mg/Kg
CR12	9/25/91	CR12	0	0.5	Mercury	77.90	mg/Kg
CR13	9/25/91	CR13	0	0.5	Mercury	39.80	mg/Kg

Table C-1
Soil Samples from Chlor-Alkali Plant Following Removal Actions

Sample Number	Date Sampled	Sample ID	Depth From (ft)	Depth To (ft)	Analyte	Result	Units
CAUSTIC STORAGE							
See Figure C-3 and C-4.							
B006	9/19/91	B006-198-5026091-XX	0	0.5	Mercury	3.40	mg/Kg
B006	9/19/91	B006-199-5026091-DU	0	0.5	Mercury	1.80	mg/Kg
B006	9/19/91	B006-199-5026091-XX	0	0.5	Mercury	1.70	mg/Kg
B006	9/23/91	B006-697-SO-26691-XX	0	0.5	Mercury	2.30	mg/Kg
B006	9/23/91	B006-698-SO-26691-XX	0	0.5	Mercury	0.30	mg/Kg
B006	9/23/91	B006-699-SO-26691-XX	0	0.5	Mercury	0.90	mg/Kg
B006	9/23/91	B006-799-SO-26691-DU	0	0.5	Mercury	0.70	mg/Kg
B006	9/23/91	B006-799-SO-26691-XX	0	0.5	Mercury	0.60	mg/Kg
B006	9/23/91	B006-899-SO-26691-XX	0	0.5	Mercury	1.90	mg/Kg
B006	9/23/91	B006-998-SO-26691-XX	0	0.5	Mercury	14.00	mg/Kg
B006	9/23/91	B006-999-SO-26691-XX	0	0.5	Mercury	6.60	mg/Kg
B006	9/25/91	B006-101-SO-26891-XX	0	0.5	Mercury	0.60	mg/Kg
B006	9/25/91	B006-102-SO-26891-XX	0	0.5	Mercury	2.60	mg/Kg
B006	9/25/91	B006-103-SO-26891-XX	0	0.5	Mercury	0.80	mg/Kg
B006	9/25/91	B006-201-SO-26891-XX	0	0.5	Mercury	54.60	mg/Kg
B006	9/25/91	B006-202-SO-26891-XX	0	0.5	Mercury	9.00	mg/Kg
B006	9/25/91	B006-203-SO-26891-XX	0	0.5	Mercury	1.80	mg/Kg
B006	9/25/91	B006-204-SO-26891-XX	0	0.5	Mercury	1.30	mg/Kg
B006	9/25/91	B006-298-SO-26891-XX	0	0.5	Mercury	185.00	mg/Kg
B006	9/25/91	B006-299-SO-26891-XX	0	0.5	Mercury	65.00	mg/Kg
B006	9/25/91	B006-301-SO-26891-XX	0	0.5	Mercury	1.00	mg/Kg
B006	9/25/91	B006-302-SO-26891-XX	0	0.5	Mercury	1.00	mg/Kg
B006	9/25/91	B006-303-SO-26891-XX	0	0.5	Mercury	0.40	mg/Kg
B006	9/25/91	B006-304-SO-26891-XX	0	0.5	Mercury	0.40	mg/Kg
B006	9/25/91	B006-305-SO-26891-DU	0	0.5	Mercury	0.40	mg/Kg
B006	9/25/91	B006-305-SO-26891-XX	0	0.5	Mercury	0.20 U	mg/Kg
B006	9/25/91	B006-399-SO-26891-XX	0	0.5	Mercury	0.20	mg/Kg
B006	9/25/91	B006-401-SO-26891-XX	0	0.5	Mercury	13.20	mg/Kg
B006	9/25/91	B006-402-SO-26891-XX	0	0.5	Mercury	150.00	mg/Kg
B006	9/25/91	B006-501-SO-26891-XX	0	0.5	Mercury	4.00	mg/Kg
B006	9/25/91	B006-502-SO-26891-XX	0	0.5	Mercury	7.60	mg/Kg
B006	9/25/91	B006-599-SO-26891-DU	0	0.5	Mercury	6.50	mg/Kg
B006	9/25/91	B006-599-SO-26891-XX	0	0.5	Mercury	5.40	mg/Kg
B012	1/1/95	B012-001-SO-1995-XX	0	1	Mercury	0.20 U a	mg/Kg
B012	1/1/95	B012-002-SO-1995-XX	0	1	Mercury	0.90 a	mg/Kg
B012	1/1/95	B012-003-SO-1995-XX	0	1	Mercury	0.80 a	mg/Kg

Table C-1
Soil Samples from Chlor-Alkali Plant Following Removal Actions

Sample Number	Date Sampled	Sample ID	Depth From (ft)	Depth To (ft)	Analyte	Result	Units
FORMER NUMBER 1 CELL ROOM							
See Figure C-5 and Section 2, Figure 2-4.							
HLA1A	1/21/91	1A-1	3.0	4	Mercury	634.00	mg/Kg
HLA1A	1/21/91	1A-2	6.0	7	Mercury	15.80	mg/Kg
HLA1A	1/21/91	HLA-1-055-060	5.5	6	Mercury	48.70	mg/Kg
HLA1A	1/21/91	HLA-1-GRAB-015	1.5	1.5	Mercury	403.00	mg/Kg
HLA1B	1/21/91	HLA-1B-055	5.5	5.5	Mercury	72.70	mg/Kg
HLA1B	1/21/91	HLA-1B-GRAB-040-050	4.0	4	Mercury	76.00	mg/Kg
HLA2A	1/21/91	2A-1	3.0	4	Mercury	15.40	mg/Kg
HLA2A	1/21/91	HLA-2-060-065	6.0	6.5	Mercury	11.90	mg/Kg
HLA2A	1/21/91	HLA-2-GRAB-015	1.5	1.5	Mercury	76.60	mg/Kg
HLA3A	1/21/91	3A-1	3.0	4	Mercury	22.90	mg/Kg
HLA3A	1/21/91	HLA-3-060-065	6.0	6.5	Mercury	43.20	mg/Kg
HLA3A	1/21/91	HLA-3-070-073	7.0	7.3	Mercury	27.80	mg/Kg
HLA3A	1/21/91	HLA-3-GRAB-015	1.5	1.5	Mercury	7.70	mg/Kg
HLA3B	1/21/91	HLA-3B	5.0	6	Mercury	96.50	mg/Kg
HLA4A	1/21/91	4A-1	3.0	4	Mercury	5.40	mg/Kg
HLA4A	1/21/91	HLA-4-GRAB-015	1.5	1.5	Mercury	10.10	mg/Kg
HLA4A	1/21/91	HLA-4-GRAB-050	5.0	5	Mercury	23.90	mg/Kg
HLA5A	1/21/91	HLA-5-044-BASALT	4.4	4.4	Mercury	1.10	mg/Kg
HLA5A	1/21/91	HLA-5-GRAB-015	1.5	1.5	Mercury	7.60	mg/Kg
HLA6A	1/21/91	6A-1	3.0	4	Mercury	0.60	mg/Kg
HLA6A	1/21/91	6A-2	6.0	7	Mercury	0.20	mg/Kg
HLA6A	1/21/91	HLA-6-030-035	3.0	3.5	Mercury	0.30	mg/Kg
HLA6A	1/21/91	HLA-6-GRAB-015	1.5	1.5	Mercury	5.80	mg/Kg
HLA6B	1/21/91	HLA-6B	5.0	6	Mercury	1.70	mg/Kg
HLA6B	1/21/91	HLA-6-BASALT-035-040	3.5	4	Mercury	19.80	mg/Kg
HLA7A	1/21/91	7A-1	3	4	Mercury	0.30	mg/Kg
CF001	5/6/91	CF001	0	0.5	Mercury	24.80	mg/Kg
CF002	5/6/91	CF002	0	0.5	Mercury	4.90	mg/Kg
CF003	5/6/91	CF003	0	0.5	Mercury	28.50	mg/Kg
CF004	5/14/91	CF004	0	0.5	Mercury	38.50	mg/Kg
CF005	5/20/91	CF005	0	0.5	Mercury	1.10	mg/Kg
CF006	5/20/91	CF006	0	0.5	Mercury	81.70	mg/Kg
CF007	5/15/91	CF007	0	0.5	Mercury	10.80	mg/Kg
CF008	5/15/91	CF008	0	0.5	Mercury	39.90	mg/Kg
CF009	5/16/91	CF009	0	0.5	Mercury	264.00	mg/Kg
CF010	5/20/91	CF010	0	0.5	Mercury	69.50	mg/Kg
CF011B	5/31/91	CF011B	0	0.5	Mercury	141.00	mg/Kg
CF012	5/21/91	CF012	0	0.5	Mercury	80.80	mg/Kg
CF013	5/21/91	CF013	0	0.5	Mercury	5.30	mg/Kg
CF014	5/22/91	CF014	0	0.5	Mercury	176.00	mg/Kg
CF015	5/22/91	CF015	0	0.5	Mercury	0.60	mg/Kg
CF016	5/29/91	CF016	0	0.5	Mercury	27.10	mg/Kg
CF017	5/29/91	CF017	0	0.5	Mercury	0.20 U	mg/Kg
CF018	6/3/91	CF018	0	0.5	Mercury	1.50	mg/Kg
CF019	6/3/91	CF019	0	0.5	Mercury	1.80	mg/Kg
CF020	5/28/91	CF020	0	0.5	Mercury	0.40	mg/Kg
CF021	5/28/91	CF021	0	0.5	Mercury	0.20 U	mg/Kg
CF022	5/22/91	CF022	0	0.5	Mercury	2.10	mg/Kg
CF023	5/22/91	CF023	0	0.5	Mercury	1.30	mg/Kg
CF024	5/6/91	CF024	0	0.5	Mercury	9.40	mg/Kg
CF025	5/6/91	CF025	0	0.5	Mercury	71.20	mg/Kg
CF026	5/6/91	CF026	0	0.5	Mercury	53.40	mg/Kg
CF027	5/14/91	CF027	0	0.5	Mercury	117.00	mg/Kg
CF028	5/16/91	CF028	0	0.5	Mercury	34.50	mg/Kg
CF029	5/14/91	CF029	0	0.5	Mercury	5.80	mg/Kg

Table C-1
Soil Samples from Chlor-Alkali Plant Following Removal Actions

Sample Number	Date Sampled	Sample ID	Depth From (ft)	Depth To (ft)	Analyte	Result	Units
FORMER NUMBER 1 CELL ROOM (continued)							
See Figure C-5 and Section 2, Figure 2-4.							
CF030	5/14/91	CF030	0	0.5	Mercury	2.30	mg/Kg
CF031	5/15/91	CF031	0	0.5	Mercury	8.40	mg/Kg
CF032	5/16/91	CF032	0	0.5	Mercury	41.20	mg/Kg
CF033	5/20/91	CF033	0	0.5	Mercury	4.50	mg/Kg
CF034A	5/24/91	CF034A	0	0.5	Mercury	26.40	mg/Kg
CF035	5/21/91	CF035	0	0.5	Mercury	30.70	mg/Kg
CF036	5/21/91	CF036	0	0.5	Mercury	16.90	mg/Kg
CF037	5/21/91	CF037	0	0.5	Mercury	3.20	mg/Kg
CF038	5/22/91	CF038	0	0.5	Mercury	10.60	mg/Kg
CF039	6/3/91	CF039	0	0.5	Mercury	0.20 U	mg/Kg
CF040	6/3/91	CF040	0	0.5	Mercury	4.30	mg/Kg
CF041	5/6/91	CF041	0	0.5	Mercury	85.80	mg/Kg
CF042	5/6/91	CF042	0	0.5	Mercury	27.20	mg/Kg
CF043	5/6/91	CF043	0	0.5	Mercury	287.00	mg/Kg
CF044	5/10/91	CF044	0	0.5	Mercury	71.50	mg/Kg
CF045	5/13/91	CF045	0	0.5	Mercury	44.90	mg/Kg
CF046	5/13/91	CF046	0	0.5	Mercury	15.20	mg/Kg
CF047	5/15/91	CF047	0	0.5	Mercury	33.60	mg/Kg
CF048	5/13/91	CF048	0	0.5	Mercury	93.80	mg/Kg
CF049A	5/21/91	CF049A	0	0.5	Mercury	57.80	mg/Kg
CF050	5/20/91	CF050	0	0.5	Mercury	284.00	mg/Kg
CF052	5/21/91	CF052	0	0.5	Mercury	170.00	mg/Kg
CF053	5/21/91	CF053	0	0.5	Mercury	6.90	mg/Kg
CF054	5/21/91	CF054	0	0.5	Mercury	4.80	mg/Kg
CF055	5/22/91	CF055	0	0.5	Mercury	80.10	mg/Kg
CF056	5/28/91	CF056	0	0.5	Mercury	108.00	mg/Kg
CF057	5/28/91	CF057	0	0.5	Mercury	45.70	mg/Kg
CF058	5/6/91	CF058	0	0.5	Mercury	163.00	mg/Kg
CF059	5/6/91	CF059	0	0.5	Mercury	61.50	mg/Kg
CF060	5/6/91	CF060	0	0.5	Mercury	2.60	mg/Kg
CF061	5/10/91	CF061	0	0.5	Mercury	6.90	mg/Kg
CF062	5/10/91	CF062	0	0.5	Mercury	23.10	mg/Kg
CF063	5/10/91	CF063	0	0.5	Mercury	0.20	mg/Kg
CF064	5/13/91	CF064	0	0.5	Mercury	4.10	mg/Kg
CF065	5/13/91	CF065	0	0.5	Mercury	0.20 U	mg/Kg
CF066	5/15/91	CF066	0	0.5	Mercury	8.80	mg/Kg
CF067	5/16/91	CF067	0	0.5	Mercury	55.40	mg/Kg
CF068	5/16/91	CF068	0	0.5	Mercury	8.70	mg/Kg
CF069	5/21/91	CF069	0	0.5	Mercury	20.40	mg/Kg
CF070	5/21/91	CF070	0	0.5	Mercury	20.30	mg/Kg
CF071	5/22/91	CF071	0	0.5	Mercury	41.60	mg/Kg
CF072	5/22/91	CF072	0	0.5	Mercury	0.40	mg/Kg
CF073	5/28/91	CF073	0	0.5	Mercury	5.60	mg/Kg
CF074	5/28/91	CF074	0	0.5	Mercury	33.40	mg/Kg
CF075	5/21/91	CF075	0	0.5	Mercury	8.90	mg/Kg
CF076	5/6/91	CF076	0	0.5	Mercury	47.10	mg/Kg
CF077	5/21/91	CF077	0	0.5	Mercury	1.10	mg/Kg
CF078	5/21/91	CF078	0	0.5	Mercury	2.70	mg/Kg
CF079	5/21/91	CF079	0	0.5	Mercury	5.90	mg/Kg
CF080	5/21/91	CF080	0	0.5	Mercury	0.20 U	mg/Kg
CF081	5/29/91	CF081	0	0.5	Mercury	173.00	mg/Kg
CF082	5/13/91	CF082	0	0.5	Mercury	23.60	mg/Kg

Table C-1
Soil Samples from Chlor-Alkali Plant Following Removal Actions

Sample Number	Date Sampled	Sample ID	Depth From (ft)	Depth To (ft)	Analyte	Result	Units
FORMER NUMBER 1 CELL ROOM (continued)							
See Figure C-5 and Section 2, Figure 2-4.							
CF083	5/13/91	CF083	0	0.5	Mercury	27.60	mg/Kg
CF084	5/16/91	CF084	0	0.5	Mercury	13.40	mg/Kg
CF085	5/21/91	CF085	0	0.5	Mercury	29.40	mg/Kg
CF086	5/21/91	CF086	0	0.5	Mercury	23.80	mg/Kg
CF087	5/21/91	CF087	0	0.5	Mercury	2.60	mg/Kg
CF088	5/21/91	CF088	0	0.5	Mercury	2.70	mg/Kg
CF089	5/28/91	CF089	0	0.5	Mercury	3.30	mg/Kg
CF090A	5/31/91	CF090A	0	0.5	Mercury	5.70	mg/Kg
CF091	5/28/91	CF091	0	0.5	Mercury	6.40	mg/Kg
CF092A	5/31/91	CF092A	0	0.5	Mercury	26.20	mg/Kg
CF092B	5/31/91	CF092B	0	0.5	Mercury	2.00	mg/Kg
CF093	5/13/91	CF093	0	0.5	Mercury	20.00	mg/Kg
CF094	5/13/91	CF094	0	0.5	Mercury	12.50	mg/Kg
CF101	5/6/91	CF101	0	0.5	Mercury	5.60	mg/Kg
CF102	5/22/91	CF102	0	0.5	Mercury	57.60	mg/Kg
CF103	5/28/91	CF103	0	0.5	Mercury	0.20 U	mg/Kg
CF104	5/16/91	CF104	0	0.5	Mercury	21.60	mg/Kg
CF105	5/13/91	CF105	0	0.5	Mercury	123.00	mg/Kg
CF106	5/6/91	CF106	0	0.5	Mercury	2.70	mg/Kg
CF107	5/21/91	CF107	0	0.5	Mercury	6.90	mg/Kg
CF108	5/13/91	CF108	0	0.5	Mercury	7.50	mg/Kg

Table C-1
Soil Samples from Chlor-Alkali Plant Following Removal Actions

Sample Number	Date Sampled	Sample ID	Depth From (ft)	Depth To (ft)	Analyte	Result	Units
FORMER SURFACE IMPOUNDMENT AREA							
See Figures C-6, C-7 and Section 2, Figure 2-2.							
1	1987	1-2TP	2	2	Mercury	5 a	mg/kg
1	1987	1-5TP	5	5	Mercury	4.9 a	mg/kg
	1987	1-10TP	10	10	Mercury	34 a	mg/kg
2	1987	2-2TP	2	2	Mercury	0.08 a	mg/kg
2	1987	2-5TP	5	5	Mercury	1.5 a	mg/kg
2	1987	2-10TP	10	10	Mercury	0.32 a	mg/kg
3	1987	3-2TP	2	2	Mercury	3.8 a	mg/kg
3	1987	3-5TP	5	5	Mercury	1.6 a	mg/kg
3	1987	3-10TP	10	10	Mercury	1.9 a	mg/kg
4	1987	4-2TP	2	2	Mercury	5.3 a	mg/kg
4	1987	4-5TP	5	5	Mercury	8.0 a	mg/kg
4	1987	4-10TP	10	10	Mercury	2.3 a	mg/kg
5	1987	5-2TP	2	2	Mercury	1.70 a	mg/kg
5	1987	5-5TP	5	5	Mercury	0.40 a	mg/kg
	1987	5-10TP	10	10	Mercury	0.31 a	mg/kg
6	1987	6-2TP	2	2	Mercury	0.10 a	mg/kg
6	1987	6-5TP	5	5	Mercury	1.7 a	mg/kg
6	1987	6-10TP	10	10	Mercury	0.39 a	mg/kg
7	1987	7-2TP	2	2	Mercury	3.6 a	mg/kg
7	1987	7-5TP	5	5	Mercury	10 a	mg/kg
7	1987	7-10TP	10	10	Mercury	0.66 a	mg/kg
4	1986	4-2B	2	2	Mercury	1.1 a	mg/kg
4	1986	4-5B	5	5	Mercury	1.6 a	mg/kg
4	1986	4-10B	10	10	Mercury	0.72 a	mg/kg
5	1986	5-2B	2	2	Mercury	0.09 a	mg/kg
5	1986	5-5B	5	5	Mercury	30 a	mg/kg
WDGB-B-1	4/4/90	WDGB-B-1-10.0-11.5	10	11.5	Mercury	1.40	mg/Kg
WDGB-B-1	4/4/90	WDGB-B-1-2.5-4.0	2.5	4	Mercury	4.60	mg/Kg
WDGB-B-1	4/4/90	WDGB-B-1-4.0-5.5	4	5.5	Mercury	4.00	mg/Kg
WDGB-B-1	4/4/90	WDGB-B-1-6.0-7.5	6	7.5	Mercury	6.80	mg/Kg
WDGB-B-1	4/4/90	WDGB-B-1-8.0-9.5	8	9.5	Mercury	3.00	mg/Kg
WDGB-B-2	4/4/90	WDGB-B-11-6.0-7.5 (DU)	6	7.5	Mercury	11.20	mg/Kg
WDGB-B-2	4/4/90	WDGB-B-2-10.0-11.5	10	11.5	Mercury	0.50	mg/Kg
WDGB-B-2	4/4/90	WDGB-B-2-2.5-4.0	2.5	4	Mercury	3.00	mg/Kg
WDGB-B-2	4/4/90	WDGB-B-2-4.0-5.5	4	5.5	Mercury	4.00	mg/Kg
WDGB-B-2	4/4/90	WDGB-B-2-6.0-7.5	6	7.5	Mercury	16.80	mg/Kg
WDGB-B-2	4/4/90	WDGB-B-2-8.0-9.5	8	9.5	Mercury	0.60	mg/Kg
WDGB-B-3	4/4/90	WDGB-B-3-0-1.5	0	1.5	Mercury	0.30	mg/Kg
WDGB-B-3	4/4/90	WDGB-B-3-10.0-11.5	10	11.5	Mercury	30.30	mg/Kg
WDGB-B-3	4/4/90	WDGB-B-3-4.0-5.5	4	5.5	Mercury	237.00	mg/Kg
WDGB-B-3	4/4/90	WDGB-B-3-4.5-5.0	4.5	5	Mercury	141.00	mg/Kg
WDGB-B-3	4/4/90	WDGB-B-3-6.0-7.5	6	7.5	Mercury	43.00	mg/Kg
WDGB-B-3	4/4/90	WDGB-B-3-8.0-9.5	8	9.5	Mercury	20.00	mg/Kg
WDGB-B-3	4/4/90	WDGB-B-3-4.0-5.5	4	5.5	Mercury - TCLP	0.00	mg/L
WDGB-B-3	4/4/90	WDGB-B-3-8.0-9.5	8	9.5	Mercury - TCLP	0.00	mg/L
WDGB-B-4	4/4/90	WDGB-B-4-10.0-11.5	10	11.5	Mercury	1.10	mg/Kg
WDGB-B-4	4/4/90	WDGB-B-4-2.5-4.0	2.5	4	Mercury	2.40	mg/Kg
WDGB-B-4	4/4/90	WDGB-B-4-4.0-5.5	4	5.5	Mercury	144.00	mg/Kg
WDGB-B-4	4/4/90	WDGB-B-4-6.0-7.5	6	7.5	Mercury	70.00	mg/Kg
WDGB-B-4	4/4/90	WDGB-B-4-8.0-9.5	8	9.5	Mercury	10.70	mg/Kg
WDGB-B-5	4/4/90	WDGB-B-10-4.0-5.5 (DU)	4	5.5	Mercury	5.50	mg/Kg
WDGB-B-5	4/4/90	WDGB-B-5-0-1.5	0	1.5	Mercury	52.10	mg/Kg
WDGB-B-5	4/4/90	WDGB-B-5-10.0-11.5	10	11.5	Mercury	0.80	mg/Kg
WDGB-B-5	4/4/90	WDGB-B-5-4.0-5.5	4	5.5	Mercury	5.50	mg/Kg
WDGB-B-5	4/4/90	WDGB-B-5-6.0-7.5	6	7.5	Mercury	3.90	mg/Kg
WDGB-B-5	4/4/90	WDGB-B-5-8.0-9.5	8	9.5	Mercury	0.30	mg/Kg
WDGB-B-6	4/4/90	WDGB-B-6-0-1.5	0	1.5	Mercury	4.80	mg/Kg
WDGB-B-6	4/4/90	WDGB-B-6-10.0-11.5	10	11.5	Mercury	0.40	mg/Kg
WDGB-B-6	4/4/90	WDGB-B-6-4.0-5.5	4	5.5	Mercury	2.20	mg/Kg
WDGB-B-6	4/4/90	WDGB-B-6-6.0-7.5	6	7.5	Mercury	2.40	mg/Kg
WDGB-B-6	4/4/90	WDGB-B-6-8.0-9.5	8	9.5	Mercury	0.30	mg/Kg

Table C-1
Soil Samples from Chlor-Alkali Plant Following Removal Actions

Sample Number	Date Sampled	Sample ID	Depth From (ft)	Depth To (ft)	Analyte	Result	Units
FORMER SURFACE IMPOUNDMENT AREA (continued)							
See Figures C-6, C-7 and Section 2, Figure 2-2.							
SB-7	5/3/90	SB-50-10-11.5 (DU)	10	11.5	Mercury	0.30	mg/Kg
SB-7	5/3/90	SB-7-0-1.5	1.5	1.5	Mercury	1.10	mg/Kg
SB-7	5/3/90	SB-7-10-11.5	10	11.5	Mercury	0.30	mg/Kg
SB-7	5/3/90	SB-7-12-13.5	12	13.5	Mercury	0.80	mg/Kg
SB-7	5/3/90	SB-7-14-15.5	14	15.5	Mercury	0.20 U	mg/Kg
SB-7	5/3/90	SB-7-16-17.5	16	17.5	Mercury	0.20 U	mg/Kg
SB-7	5/3/90	SB-7-2-3.5	2	3.5	Mercury	0.40	mg/Kg
SB-7	5/3/90	SB-7-4-5.5	4	5.5	Mercury	3.90	mg/Kg
SB-7	5/3/90	SB-7-6-7.5	6	7.5	Mercury	0.60	mg/Kg
SB-7	5/3/90	SB-7-8-9.5	8	9.5	Mercury	0.50	mg/Kg
SB-7	5/3/90	SB-50-10-11.5 (DU)	10	11.5	Mercury - TCLP	0.00 U	mg/L
SB-7	5/3/90	SB-7-0-1.5	1.5	1.5	Mercury - TCLP	0.00	mg/L
SB-7	5/3/90	SB-7-10-11.5	10	11.5	Mercury - TCLP	0.00 U	mg/L
SB-7	5/3/90	SB-7-12-13.5	12	13.5	Mercury - TCLP	0.00 U	mg/L
SB-7	5/3/90	SB-7-14-15.5	14	15.5	Mercury - TCLP	0.00 U	mg/L
SB-7	5/3/90	SB-7-16-17.5	16	17.5	Mercury - TCLP	0.00 U	mg/L
SB-7	5/3/90	SB-7-2-3.5	2	3.5	Mercury - TCLP	0.00 U	mg/L
SB-7	5/3/90	SB-7-4-5.5	4	5.5	Mercury - TCLP	0.00 U	mg/L
SB-7	5/3/90	SB-7-6-7.5	6	7.5	Mercury - TCLP	0.00 U	mg/L
SB-7	5/3/90	SB-7-8-9.5	8	9.5	Mercury - TCLP	0.00 U	mg/L
SB-8	5/3/90	SB-8-0-1.5	1.5	1.5	Mercury	5.00	mg/Kg
SB-8	5/3/90	SB-8-10-11.5	10	11.5	Mercury	9.40	mg/Kg
SB-8	5/3/90	SB-8-12-13.5	12	13.5	Mercury	7.40	mg/Kg
SB-8	5/3/90	SB-8-14-15.5	14	15.5	Mercury	10.40	mg/Kg
SB-8	5/3/90	SB-8-2-3.5	2	3.5	Mercury	5.20	mg/Kg
SB-8	5/3/90	SB-8-4-5.5	4	5.5	Mercury	7.40	mg/Kg
SB-8	5/3/90	SB-8-6-7.5	6	7.5	Mercury	20.20	mg/Kg
SB-8	5/3/90	SB-8-8-9.5	8	9.5	Mercury	8.30	mg/Kg
SB-8	5/3/90	SB-8-0-1.5	1.5	1.5	Mercury - TCLP	0.00 U	mg/L
SB-8	5/3/90	SB-8-10-11.5	10	11.5	Mercury - TCLP	0.00	mg/L
SB-8	5/3/90	SB-8-12-13.5	12	13.5	Mercury - TCLP	0.00	mg/L
SB-8	5/3/90	SB-8-14-15.5	14	15.5	Mercury - TCLP	0.00	mg/L
SB-8	5/3/90	SB-8-2-3.5	2	3.5	Mercury - TCLP	0.00 U	mg/L
SB-8	5/3/90	SB-8-4-5.5	4	5.5	Mercury - TCLP	0.00	mg/L
SB-8	5/3/90	SB-8-6-7.5	6	7.5	Mercury - TCLP	0.00 U	mg/L
SB-8	5/3/90	SB-8-8-9.5	8	9.5	Mercury - TCLP	0.00 U	mg/L
SB-10	5/4/90	SB-10-0-1.5	0	1.5	Mercury	2.70	mg/Kg
SB-10	5/4/90	SB-10-10-11.5	10	11.5	Mercury	1.00	mg/Kg
SB-10	5/4/90	SB-10-14-15.5	14	15.5	Mercury	1.20	mg/Kg
SB-10	5/4/90	SB-10-16-17.5	16	17.5	Mercury	0.40	mg/Kg
SB-10	5/4/90	SB-10-2-3.5	2	3.5	Mercury	10.10	mg/Kg
SB-10	5/4/90	SB-10-4-5.5	4	5.5	Mercury	5.10	mg/Kg
SB-10	5/4/90	SB-10-6-7.5	6	7.5	Mercury	2.80	mg/Kg
SB-10	5/4/90	SB-10-8-9.5	8	9.5	Mercury	1.00	mg/Kg
SB-10	5/4/90	SB-10-0-1.5	0	1.5	Mercury - TCLP	0.00 U	mg/L
SB-10	5/4/90	SB-10-10-11.5	10	11.5	Mercury - TCLP	0.00 U	mg/L
SB-10	5/4/90	SB-10-14-15.5	14	15.5	Mercury - TCLP	0.00 U	mg/L
SB-10	5/4/90	SB-10-16-17.5	16	17.5	Mercury - TCLP	0.00 U	mg/L
SB-10	5/4/90	SB-10-2-3.5	2	3.5	Mercury - TCLP	0.00 U	mg/L
SB-10	5/4/90	SB-10-4-5.5	4	5.5	Mercury - TCLP	0.00	mg/L
SB-10	5/4/90	SB-10-6-7.5	6	7.5	Mercury - TCLP	0.00 U	mg/L
SB-10	5/4/90	SB-10-8-9.5	8	9.5	Mercury - TCLP	0.00 U	mg/L
SB-3B	5/4/90	SB-3B-14-15.5	14	15.5	Mercury	86.20	mg/Kg
SB-3B	5/4/90	SB-3B-14-15.5	14	15.5	Mercury - TCLP	0.00	mg/L
SB-4B	5/4/90	SB-4B-12-13.5	12	13.5	Mercury	0.80	mg/Kg
SB-4B	5/4/90	SB-4B-14-15.5	14	15.5	Mercury	0.20 U	mg/Kg
SB-4B	5/4/90	SB-4B-16-17.5	16	17.5	Mercury	1.00	mg/Kg
SB-4B	5/4/90	SB-4B-12-13.5	12	13.5	Mercury - TCLP	0.00 U	mg/L
SB-4B	5/4/90	SB-4B-14-15.5	14	15.5	Mercury - TCLP	0.00 U	mg/L
SB-4B	5/4/90	SB-4B-16-17.5	16	17.5	Mercury - TCLP	0.00 U	mg/L
SB-5E	5/4/90	SB-5E-0-1.5	1.5	1.5	Mercury	10.10	mg/Kg
SB-5E	5/4/90	SB-5E-0-1.5	1.5	1.5	Mercury - TCLP	0.00 U	mg/L
SB-5N	5/4/90	SB-5N-0-1.5	1.5	1.5	Mercury	23.90	mg/Kg

Table C-1
Soil Samples from Chlor-Alkali Plant Following Removal Actions

Sample Number	Date Sampled	Sample ID	Depth From (ft)	Depth To (ft)	Analyte	Result	Units
FORMER SURFACE IMPOUNDMENT AREA (continued)							
See Figures C-6, C-7 and Section 2, Figure 2-2.							
SB-5N	5/4/90	SB-5N-0-1.5	1.5	1.5	Mercury - TCLP	0.00 U	mg/L
SB-5S	5/4/90	SB-5S-0-1.5	1.5	1.5	Mercury	45.60	mg/Kg
SB-5S	5/4/90	SB-5S-0-1.5	1.5	1.5	Mercury - TCLP	0.00 U	mg/L
SB-5W	5/4/90	SB-5W-0-1.5	1.5	1.5	Mercury	0.70	mg/Kg
SB-5W	5/4/90	SB-5W-0-1.5	1.5	1.5	Mercury - TCLP	0.00 U	mg/L
FORMER SURFACE IMPOUNDMENT AREA (continued)							
See Figures C-6, C-7 and Section 2, Figure 2-2.							
SB-9	5/4/90	SB-9-0-1.5	0	1.5	Mercury	169.00	mg/Kg
SB-9	5/4/90	SB-9-10-11.5	10	11.5	Mercury	0.80	mg/Kg
SB-9	5/4/90	SB-9-12-13.5	12	13.5	Mercury	55.40	mg/Kg
SB-9	5/4/90	SB-9-14-15.5	14	15.5	Mercury	50.70	mg/Kg
SB-9	5/4/90	SB-9-16-17.5	16	17.5	Mercury	6.70	mg/Kg
SB-9	5/4/90	SB-9-2-3.5	2	3.5	Mercury	17.00	mg/Kg
SB-9	5/4/90	SB-9-4-5.5	4	5.5	Mercury	13.20	mg/Kg
SB-9	5/4/90	SB-9-6-7.5	6	7.5	Mercury	14.40	mg/Kg
SB-9	5/4/90	SB-9-8-9.5	8	9.5	Mercury	0.50	mg/Kg
SB-9	5/4/90	SB-9-0-1.5	0	1.5	Mercury - TCLP	0.00 U	mg/L
SB-9	5/4/90	SB-9-10-11.5	10	11.5	Mercury - TCLP	0.00 U	mg/L
SB-9	5/4/90	SB-9-12-13.5	12	13.5	Mercury - TCLP	0.01	mg/L
SB-9	5/4/90	SB-9-14-15.5	14	15.5	Mercury - TCLP	0.00 U	mg/L
SB-9	5/4/90	SB-9-16-17.5	16	17.5	Mercury - TCLP	0.00 U	mg/L
SB-9	5/4/90	SB-9-2-3.5	2	3.5	Mercury - TCLP	0.00	mg/L
SB-9	5/4/90	SB-9-4-5.5	4	5.5	Mercury - TCLP	0.00	mg/L
SB-9	5/4/90	SB-9-6-7.5	6	7.5	Mercury - TCLP	0.00 U	mg/L
SB-9	5/4/90	SB-9-8-9.5	8	9.5	Mercury - TCLP	0.00 U	mg/L
HLA7B	1/21/91	HLA-7B	3	4	Mercury	0.50	mg/Kg
HLA7B	1/21/91	HLA-7-GRAB-015	1.5	1.5	Mercury	105.00	mg/Kg
H036	9/21/98	H036-001-SO-26498XX	3	3	Alkalinity, Total as CaCO3	3000.00	mg/Kg
H036	9/21/98	H036-001-SO-26498XX	3	3	Chloride	10.00 D	mg/Kg
H036	9/21/98	H036-001-SO-26498XX	3	3	Ph	7.00	mg/Kg
H036	9/21/98	H036-001-SO-26498XX	3	3	Solids, Total	69.10	% @ 105C
H036	9/21/98	H036-001-SO-26498XX	3	3	Sulfide	119.00	mg/Kg
H036	9/21/98	H036-002-SO-26498XX	3	3	Alkalinity, Total as CaCO3	200.00	mg/Kg
H036	9/21/98	H036-002-SO-26498XX	3	3	Chloride	1.80 D	mg/Kg
H036	9/21/98	H036-002-SO-26498XX	3	3	Ph	7.10	mg/Kg
H036	9/21/98	H036-002-SO-26498XX	3	3	Solids, Total	91.00	% @ 105C
H036	9/21/98	H036-002-SO-26498XX	3	3	Sulfide	11.00 U	mg/Kg
H036	9/21/98	H036-003-SO-26498XX	3	3	Alkalinity, Total as CaCO3	2100.00	mg/Kg
H036	9/21/98	H036-003-SO-26498XX	3	3	Chloride	28.00 D	mg/Kg
H036	9/21/98	H036-003-SO-26498XX	3	3	Ph	8.80	mg/Kg
H036	9/21/98	H036-003-SO-26498XX	3	3	Solids, Total	74.00	% @ 105C
H036	9/21/98	H036-003-SO-26498XX	3	3	Sulfide	93.00	mg/Kg
H036	9/21/98	H036-004-SO-26498XX	3	3	Alkalinity, Total as CaCO3	1700.00	mg/Kg
H036	9/21/98	H036-004-SO-26498XX	3	3	Chloride	42.00 D	mg/Kg
H036	9/21/98	H036-004-SO-26498XX	3	3	Ph	8.90	mg/Kg
H036	9/21/98	H036-004-SO-26498XX	3	3	Solids, Total	83.70	% @ 105C
H036	9/21/98	H036-004-SO-26498XX	3	3	Sulfide	50.00 U	mg/Kg
LIQUEFACTION AREA							
See Figure C-4.							
K012	1/1/95	K012-001-SO-1995-XX	0	1	Mercury	1.30 a	mg/Kg
K012	1/1/95	K012-002-SO-1995-XX	0	1	Mercury	7.20 a	mg/Kg
K012	1/1/95	K012-003-SO-1995-XX	0	1	Mercury	1.30 a	mg/Kg
K012	1/1/95	K012-004-SO-1995-XX	0	1	Mercury	11.00 a	mg/Kg
K012	1/1/95	K012-005-SO-1995-XX	0	1	Mercury	0.40 a	mg/Kg
K012	1/1/95	K012-006-SO-1995-XX	0	1	Mercury	0.90 a	mg/Kg
K012	1/1/95	K012-007-SO-1995-XX	0	1	Mercury	1.60 a	mg/Kg
K012	1/1/95	K012-008-SO-1995-XX	0	1	Mercury	1.20 a	mg/Kg
K012	1/1/95	K012-009-SO-1995-XX	0	1	Mercury	3.30 a	mg/Kg

Table C-1
Soil Samples from Chlor-Alkali Plant Following Removal Actions

Sample Number	Date Sampled	Sample ID	Depth From (ft)	Depth To (ft)	Analyte	Result	Units
NUMBER 2 CELL ROOM							
See Figure C-8.							
A006	9/17/91	A006-101-SO-26091-DU	0	0.5	Mercury	2.10	mg/Kg
A006	9/17/91	A006-101-SO-26091-XX	0	0.5	Mercury	2.80	mg/Kg
A006	9/17/91	A006-102-SO-26091-XX	0	0.5	Mercury	3.50	mg/Kg
A006	9/17/91	A006-103-SO-26091-XX	0	0.5	Mercury	14.90	mg/Kg
A006	9/17/91	A006-104-SO-26091-XX	0	0.5	Mercury	19.30	mg/Kg
A006	9/17/91	A006-105-SO-26091-XX	0	0.5	Mercury	9.10	mg/Kg
A006	9/17/91	A006-106-SO-26091-XX	0	0.5	Mercury	1.20	mg/Kg
A006	9/17/91	A006-107-SO-26091-XX	0	0.5	Mercury	41.20	mg/Kg
A006	9/17/91	A006-108-SO-26091-XX	0	0.5	Mercury	15.00	mg/Kg
A006	9/17/91	A006-109-SO-26091-XX	0	0.5	Mercury	4.20	mg/Kg
A006	9/17/91	A006-110-SO-26091-XX	0	0.5	Mercury	8.00	mg/Kg
A006	9/17/91	A006-111-SO-26091-XX	0	0.5	Mercury	28.90	mg/Kg
A006	9/17/91	A006-112-SO-26091-XX	0	0.5	Mercury	5.30	mg/Kg
A006	9/17/91	A006-113-SO-26091-XX	0	0.5	Mercury	0.20	mg/Kg
A006	9/17/91	A006-114-SO-26091-XX	0	0.5	Mercury	0.30	mg/Kg
A006	9/17/91	A006-201-SO-26091-XX	0	0.5	Mercury	39.70	mg/Kg
A006	9/17/91	A006-202-SO-26091-XX	0	0.5	Mercury	0.70	mg/Kg
A006	9/17/91	A006-203-SO-26091-XX	0	0.5	Mercury	0.90	mg/Kg
A006	9/17/91	A006-204-SO-26091-XX	0	0.5	Mercury	20.40	mg/Kg
A006	9/17/91	A006-205-SO-26091-XX	0	0.5	Mercury	6.20	mg/Kg
A006	9/17/91	A006-206-SO-26091-XX	0	0.5	Mercury	29.00	mg/Kg
A006	9/17/91	A006-207-SO-26091-XX	0	0.5	Mercury	1.30	mg/Kg
A006	9/17/91	A006-208-SO-26091-DU	0	0.5	Mercury	7.90	mg/Kg
A006	9/17/91	A006-208-SO-26091-XX	0	0.5	Mercury	6.60	mg/Kg
A006	9/17/91	A006-299-SO-26091-XX	0	0.5	Mercury	7.90	mg/Kg
A006	9/17/91	A006-304-SO-26091-XX	0	0.5	Mercury	10.30	mg/Kg
A006	9/17/91	A006-397-SO-26091-XX	0	0.5	Mercury	64.80	mg/Kg
A006	9/17/91	A006-398-SO-26091-XX	0	0.5	Mercury	3.10	mg/Kg
A006	9/17/91	A006-399-SO-26091-DU	0	0.5	Mercury	62.90	mg/Kg
A006	9/17/91	A006-399-SO-26091-XX	0	0.5	Mercury	20.00	mg/Kg
A006	9/17/91	A006-401-SO-26091-XX	0	0.5	Mercury	13.20	mg/Kg
A006	9/17/91	A006-402-SO-26091-XX	0	0.5	Mercury	69.40	mg/Kg
A006	9/17/91	A006-403-SO-26091-XX	0	0.5	Mercury	27.40	mg/Kg
A006	9/17/91	A006-404-SO-26091-DU	0	0.5	Mercury	8.60	mg/Kg
A006	9/17/91	A006-404-SO-26091-XX	0	0.5	Mercury	8.30	mg/Kg
CR06	9/24/91	CR06	1	1	Mercury	62.80	mg/Kg
CR07	9/24/91	CR07A	3	3	Mercury	72.80	mg/Kg
CR08	9/24/91	CR08	2	2	Mercury	2.00	mg/Kg
CR09	9/24/91	CR09	3	3	Mercury	2.30	mg/Kg
UPGRADIENT SAMPLES							
See Section 2, Figure 2-4.							
CH7-195	9/9/98	CH7-195-SO-25298XX	19.5	19.5	Solids, Total	68.30	% @ 105C
CH7-195	9/9/98	CH7-195-SO-25298XX	19.5	19.5	Total Organic Carbon	1.60	mg/Kg
CH8-195	9/9/98	CH8-195-SO-25298XX	19.5	19.5	Solids, Total	79.60	% @ 105C
CH8-195	9/9/98	CH8-195-SO-25298XX	19.5	19.5	Total Organic Carbon	0.05	mg/Kg
LOADING							
See Figure C-4.							
L012	1/1/95	L012-001-SO-1995-XX	0	1	Mercury	0.80	mg/Kg
L012	1/1/95	L012-002-SO-1995-XX	0	1	Mercury	0.90	mg/Kg
L012	1/1/95	L012-003-SO-1995-XX	0	1	Mercury	1.40	mg/Kg
L012	1/1/95	L012-004-SO-1995-XX	0	1	Mercury	1.00	mg/Kg
L012	1/1/95	L012-005-SO-1995-XX	0	1	Mercury	0.70	mg/Kg
L012	1/1/95	L012-006-SO-1995-XX	0	1	Mercury	4.60	mg/Kg
L012	1/1/95	L012-007-SO-1995-XX	0	1	Mercury	0.20 U	mg/Kg

Table C-1
Soil Samples from Chlor-Alkali Plant Following Removal Actions

Sample Number	Date Sampled	Sample ID	Depth From (ft)	Depth To (ft)	Analyte	Result	Units
STAGING AREA							
See Figure C-8.							
E018	9/25/91	E018-001-SO-26891-DU	1.5	1.5	Mercury	14.20	mg/Kg
E018	9/25/91	E018-001-SO-26891-XX	1.5	1.5	Mercury	9.00	mg/Kg
E018	9/25/91	E018-002-SO-26891-XX	1.5	1.5	Mercury	24.10	mg/Kg
E018	9/25/91	E018-003-SO-26891-XX	1.5	1.5	Mercury	22.60	mg/Kg
E018	9/25/91	E018-004-SO-26891-XX	1.5	1.5	Mercury	40.90	mg/Kg
STORMWATER DRAINAGE DITCH							
See Section 2, Figure 2-3.							
G006	9/22/98	G006-001-SD-26598XX	0	0.5	Alkalinity, Total as CaCO3	3100.00	mg/Kg
G006	9/22/98	G006-001-SD-26598XX	0	0.5	Chloride	17.00 D	mg/Kg
G006	9/22/98	G006-001-SD-26598XX	0	0.5	Mercury	1.20	mg/Kg
G006	9/22/98	G006-001-SD-26598XX	0	0.5	Ph	7.70	mg/Kg
G006	9/22/98	G006-001-SD-26598XX	0	0.5	Solids, Total	37.30	% @ 105C
G006	9/22/98	G006-001-SD-26598XX	0	0.5	Sulfide	790.00	mg/Kg
G006	9/22/98	G006-002-SD-26598XX	0	0.5	Mercury	0.80 J	mg/Kg
G006	9/22/98	G006-002-SD-26598XX	0	0.5	Solids, Total	85.10	% @ 105C
G006	9/22/98	G006-003-SD-26598XX	0	0.5	Mercury	0.60 J	mg/Kg
G006	9/22/98	G006-003-SD-26598XX	0	0.5	Solids, Total	90.70	% @ 105C
G006	9/22/98	G006-004-SD-26598DU	0	0.5	Alkalinity, Total as CaCO3	450.00	mg/Kg
G006	9/22/98	G006-004-SD-26598DU	0	0.5	Chloride	6.80 D	mg/Kg
G006	9/22/98	G006-004-SD-26598DU	0	0.5	Mercury	0.70	mg/Kg
G006	9/22/98	G006-004-SD-26598DU	0	0.5	Ph	7.40	mg/Kg
G006	9/22/98	G006-004-SD-26598DU	0	0.5	Solids, Total	82.80	% @ 105C
G006	9/22/98	G006-004-SD-26598DU	0	0.5	Sulfide	25.00 U	mg/Kg
G006	9/22/98	G006-004-SD-26598XX	0	0.5	Alkalinity, Total as CaCO3	380.00	mg/Kg
G006	9/22/98	G006-004-SD-26598XX	0	0.5	Chloride	6.70 D	mg/Kg
G006	9/22/98	G006-004-SD-26598XX	0	0.5	Mercury	0.70	mg/Kg
G006	9/22/98	G006-004-SD-26598XX	0	0.5	Ph	7.40	mg/Kg
G006	9/22/98	G006-004-SD-26598XX	0	0.5	Solids, Total	83.60	% @ 105C
G006	9/22/98	G006-004-SD-26598XX	0	0.5	Sulfide	23.00 U	mg/Kg
G006	9/22/98	G006-005-SD-26598XX	0	0.5	Alkalinity, Total as CaCO3	840.00	mg/Kg
G006	9/22/98	G006-005-SD-26598XX	0	0.5	Chloride	22.00 D	mg/Kg
G006	9/22/98	G006-005-SD-26598XX	0	0.5	Mercury	4.80	mg/Kg
G006	9/22/98	G006-005-SD-26598XX	0	0.5	Ph	7.10	mg/Kg
G006	9/22/98	G006-005-SD-26598XX	0	0.5	Solids, Total	58.30	% @ 105C
G006	9/22/98	G006-005-SD-26598XX	0	0.5	Sulfide	32.00 U	mg/Kg

Table C-1
Soil Samples from Chlor-Alkali Plant Following Removal Actions

Sample Number	Date Sampled	Sample ID	Depth From (ft)	Depth To (ft)	Analyte	Result	Units
WEST AREA							
See Figure C-9.							
SITE-1	1/1/86	D-SB-SITE1-2	2	2	Mercury	12.00	mg/Kg
SITE-1	1/1/86	D-SB-SITE1-5	5	5	Mercury	1.30	mg/Kg
SITE-1	1/1/86	D-SB-SITE1-9	9	9	Mercury	0.08	mg/Kg
SITE-2	1/1/86	D-SB-SITE2-15	15	15	Mercury	0.07	mg/Kg
SITE-2	1/1/86	D-SB-SITE2-2	2	2	Mercury	16.00	mg/Kg
SITE-2	1/1/86	D-SB-SITE2-5	5	5	Mercury	9.60	mg/Kg
SITE-2	1/1/86	D-SB-SITE2-9	9	9	Mercury	0.14	mg/Kg
SITE-3	1/1/86	D-SB-SITE3-10	10	10	Mercury	0.10	mg/Kg
SITE-3	1/1/86	D-SB-SITE3-2	2	2	Mercury	12.00	mg/Kg
SITE-3	1/1/86	D-SB-SITE3-5	5	5	Mercury	1.30	mg/Kg
SITE-3	1/1/86	D-SB-SITE3-7	7	7	Mercury	0.35	mg/Kg
TP-1	1/1/87	D-TP-1-0-1	0	1	Mercury	1.30	mg/Kg
TP-1	1/1/87	D-TP-1-1-2.2	1	2.2	Mercury	0.40	mg/Kg
TP-1	1/1/87	D-TP-1-2.2-5.2	2.2	5.2	Mercury	0.30	mg/Kg
TP-2	1/1/87	D-TP-2-2.4-5	2.4	5	Mercury	2.70	mg/Kg
TP-2	1/1/87	D-TP-2-6.2	2	6.2	Mercury	1.30	mg/Kg
TP-3	1/1/87	D-TP-3-0-6	0	6	Mercury	1.00	mg/Kg
TP-3	1/1/87	D-TP-3-6-8	6	8	Mercury	1.00	mg/Kg
TP-3	1/1/87	D-TP-3-8-10	8	10	Mercury	1.20	mg/Kg
MW1	1/1/87	D-MW01-SO	0	0	Mercury	0.10 U	mg/Kg
MW2	1/1/87	D-MW02-SO-10-11.5	10	11.5	Mercury	0.46	mg/Kg
MW3	1/1/87	D-MW03-SO-5-6.5	5	6.5	Mercury	1.90	mg/Kg
MW4	1/1/87	D-MW04-SO-10-11.5	10	11.5	Mercury	0.10	mg/Kg
MW4	1/1/87	D-MW04-SO-22-24	22	24	Mercury	0.10	mg/Kg
MW4	1/1/87	D-MW04-SO-5-6.5	5	6.5	Mercury	0.20	mg/Kg
MW4	1/1/87	D-MW04-SO-7-9	7	9	Mercury	0.20	mg/Kg

Notes

(a) Useful for qualitative purposes only. Laboratory data sheets and QA not available.

U Not detected at specified detection limit

D Dilution Required

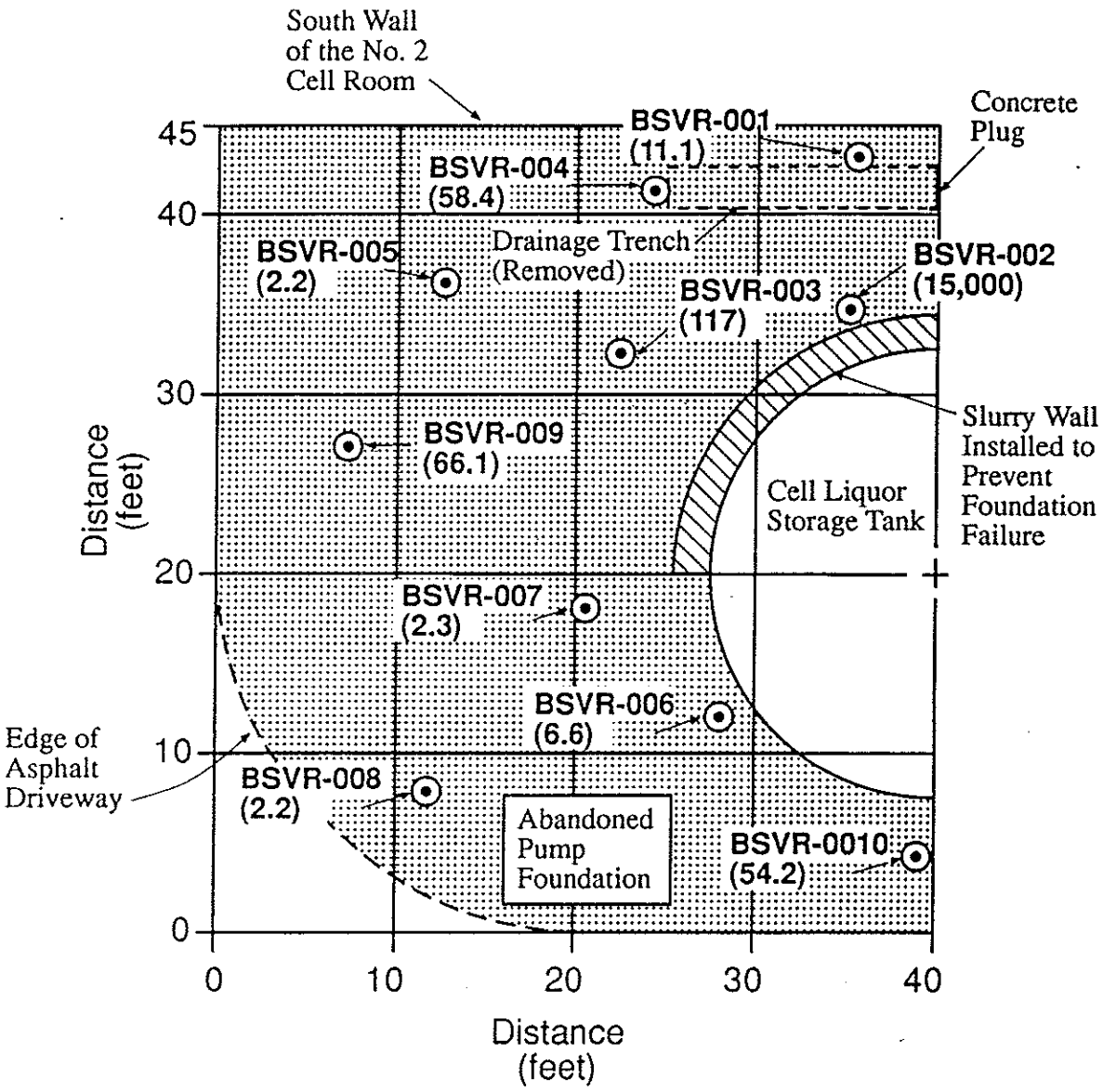
DU Duplicate

J Estimated Value

K Result biased high because the matrix spiked recovery was above the QC acceptance criteria

Soil Sample Locations

Soil Sample Locations



Legend

- Soil sample location — BSVR-007
- (2.3) Mercury concentration in soil (mg/kg)

0 5 10 Feet

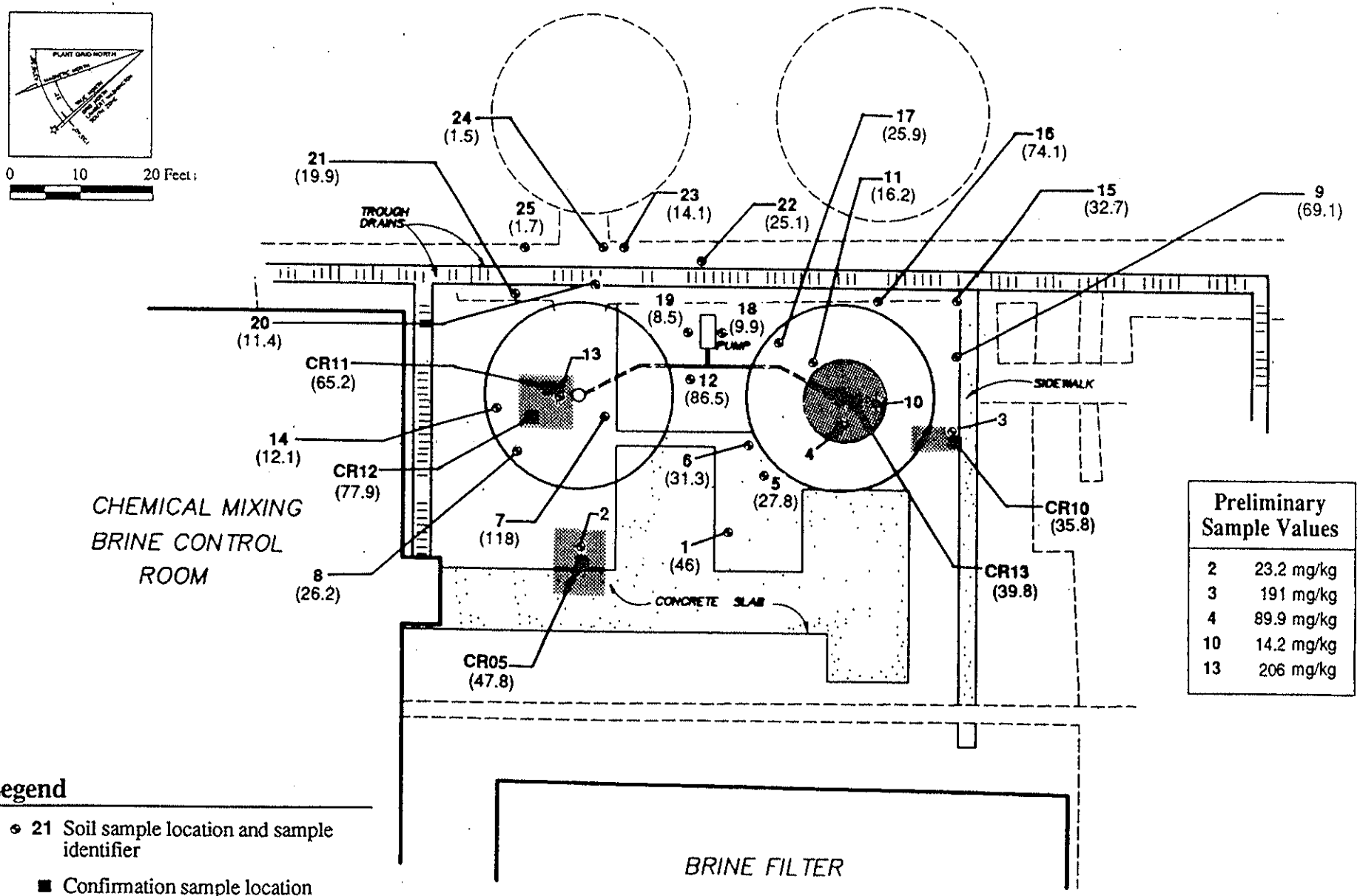
Note: Sample locations are approximate. Samples obtained by HLA, 1991e

Figure C-1

Soil Sample Locations in the Brine Spill Cleanup Area

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL



Preliminary Sample Values	
2	23.2 mg/kg
3	191 mg/kg
4	89.9 mg/kg
10	14.2 mg/kg
13	206 mg/kg

Legend

- ⊙ 21 Soil sample location and sample identifier
- ■ Confirmation sample location
- (28.9) Mercury concentrations in soil (mg/kg)
- ▒ Excavated area

Note: Sample locations are approximate.
Samples obtained by CH2M HILL and HLA 1991h

Figure C-2

Mercury Concentrations and Soil Sample Locations in the Brine Treatment Area

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

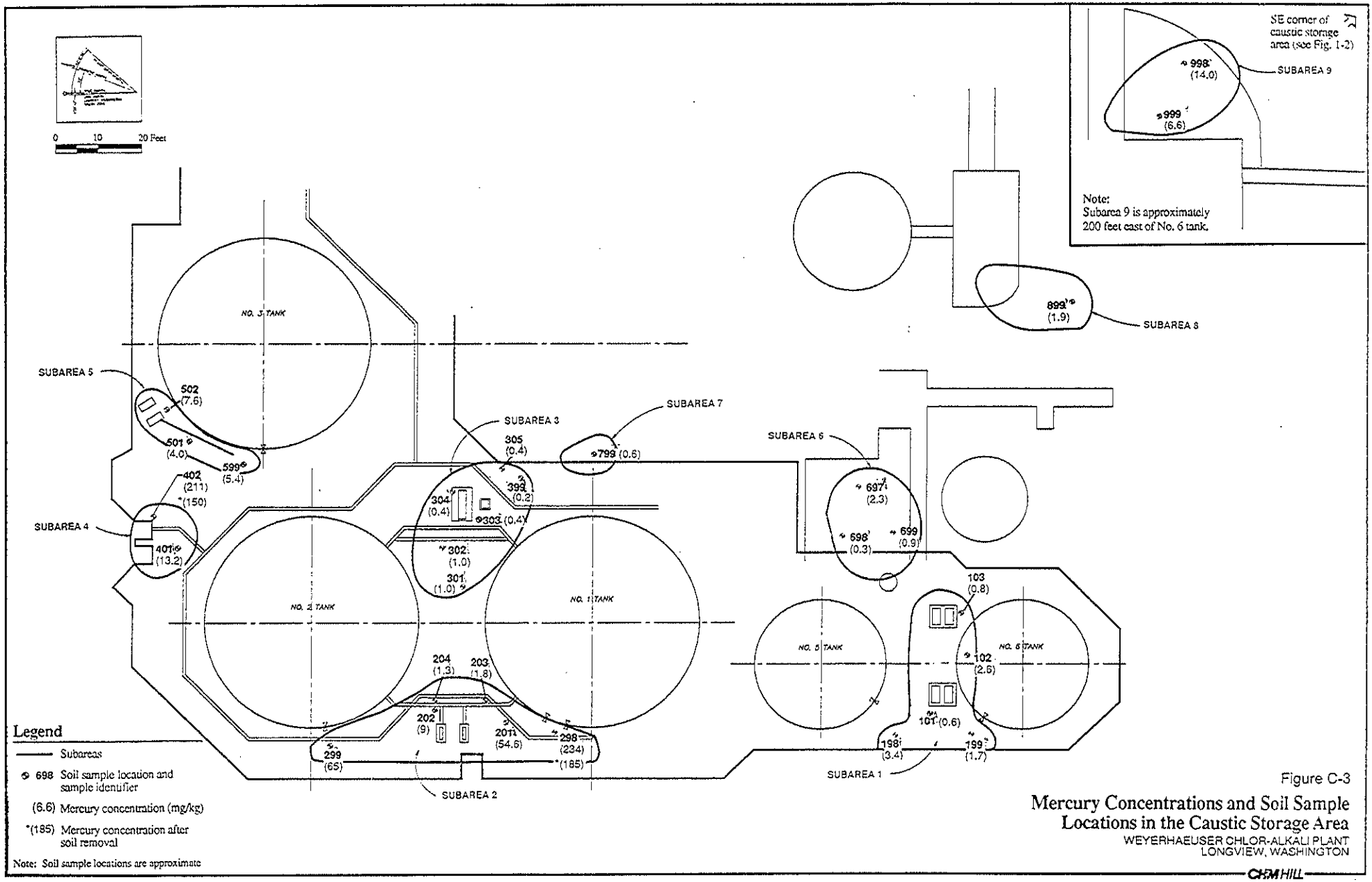


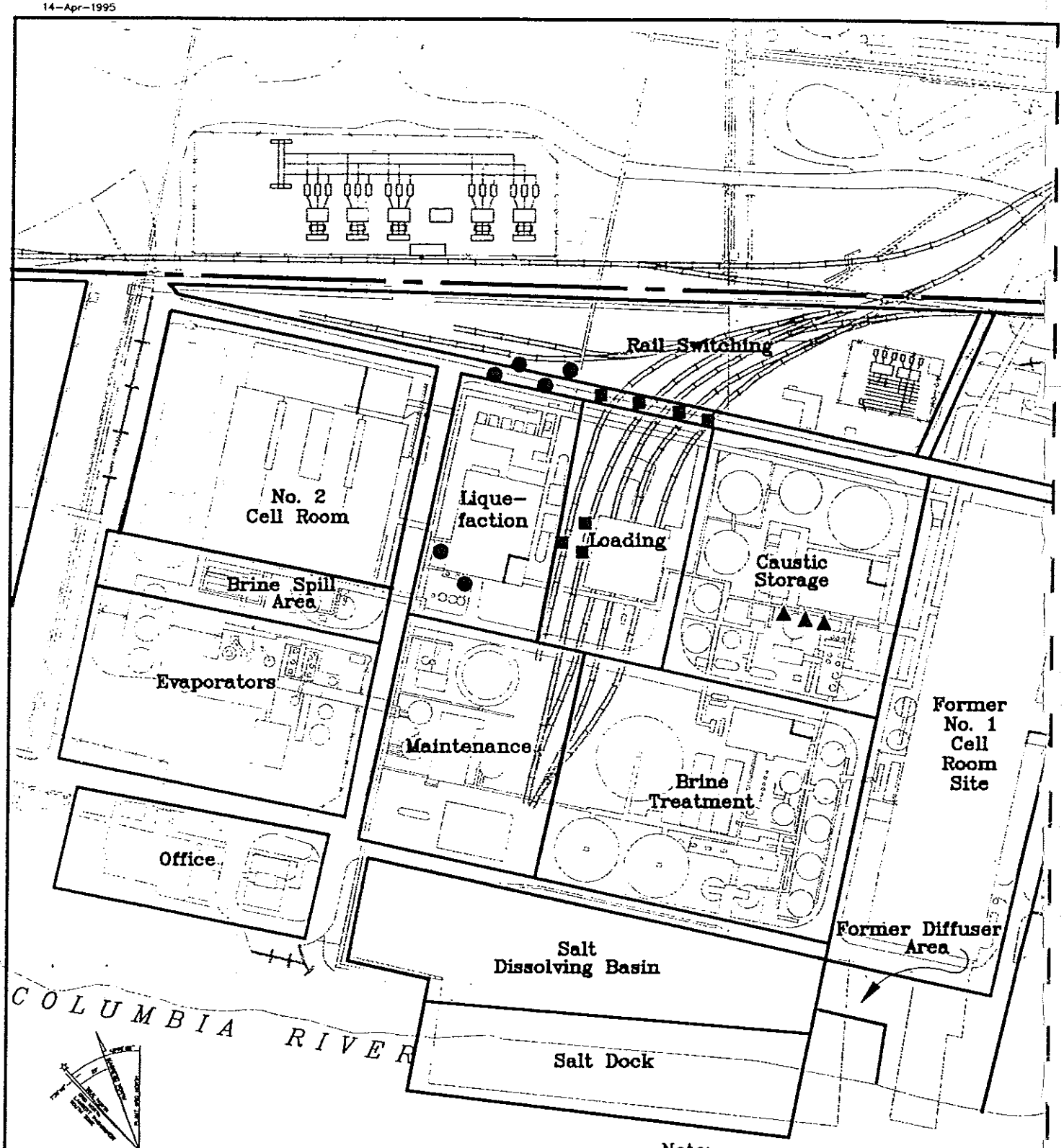
Figure C-3

Mercury Concentrations and Soil Sample Locations in the Caustic Storage Area

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2M HILL

SRB 2451G33.DWG
14-Apr-1995



Note:
Sample locations are approximate.
Samples obtained by
Sweet-Edwards/EMCON, 1985

Legend

- ▲ Soil sample location (Site 11: Hypo Test Lab)
- ■ Soil sample location (Site 12: Rail Loading Station)
- ● Soil sample location (Site 13: No.2 Liquefaction)

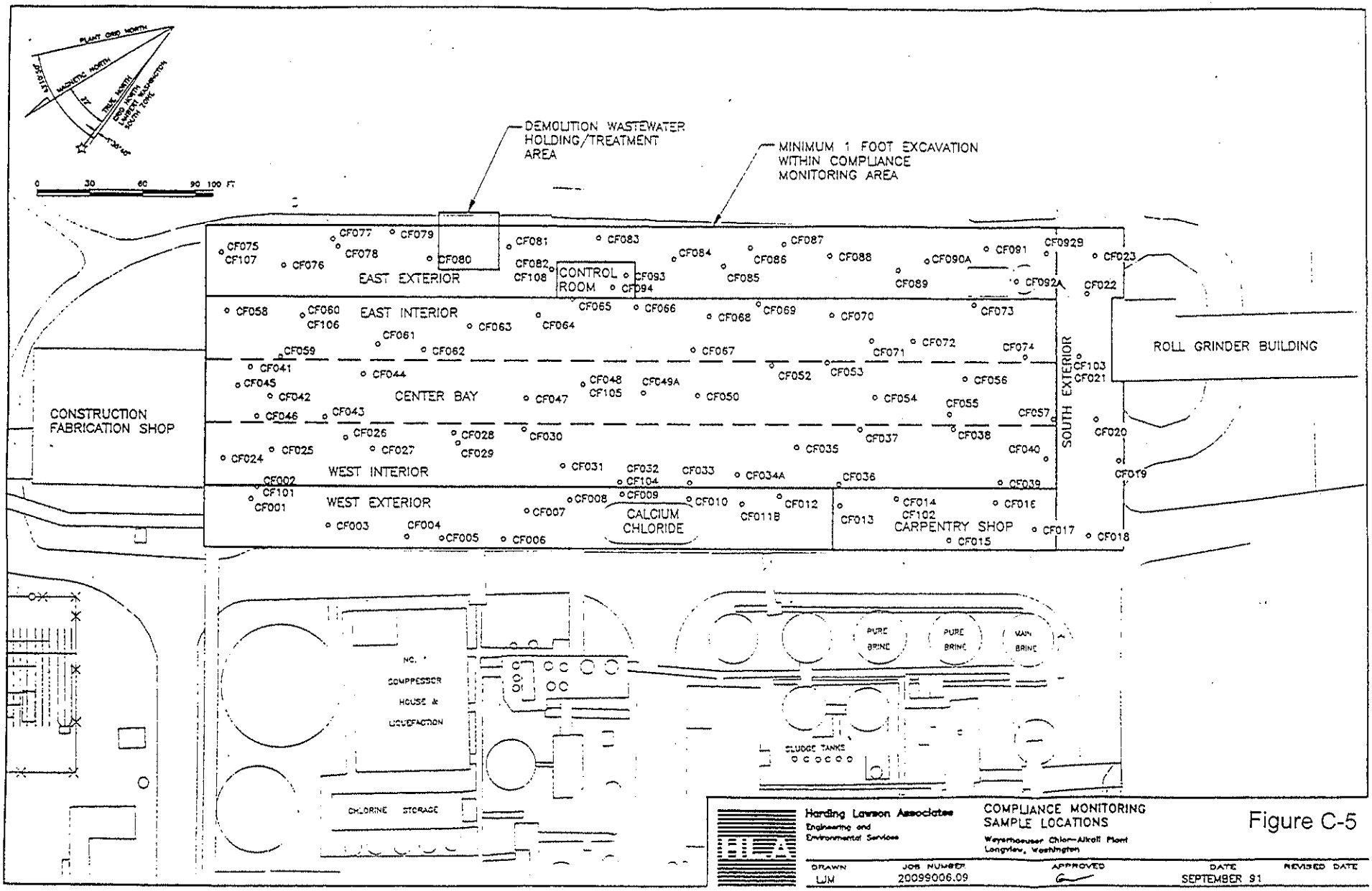
Figure C-4

Soil Sample Locations in the Central, Process Areas

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

2451G33.DWG



Harding Lawson Associates
Engineering and Environmental Services

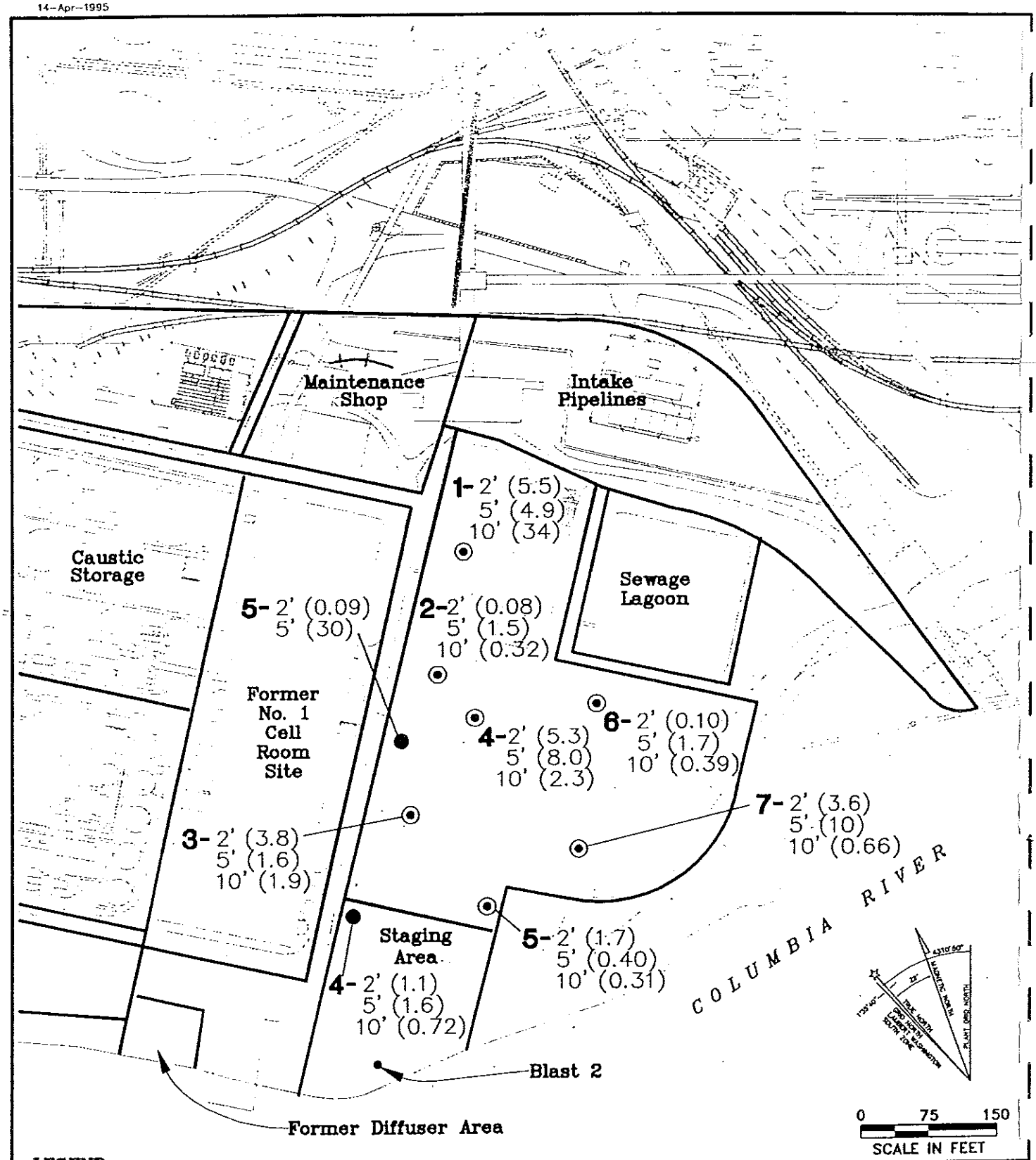
COMPLIANCE MONITORING SAMPLE LOCATIONS

Weyerhaeuser Chlor-Alkali Plant
Longview, Washington

Figure C-5

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
LJM	20099006.09		SEPTEMBER 91	

14-Apr-1995



LEGEND

- ● Soil boring (Weyerhaeuser, 1986)
- ⊙ Soil test pit (Weyerhaeuser, 1987)
- (1.7) Mercury concentrations in soil (mg/kg)

Note:
Sample locations are approximate.

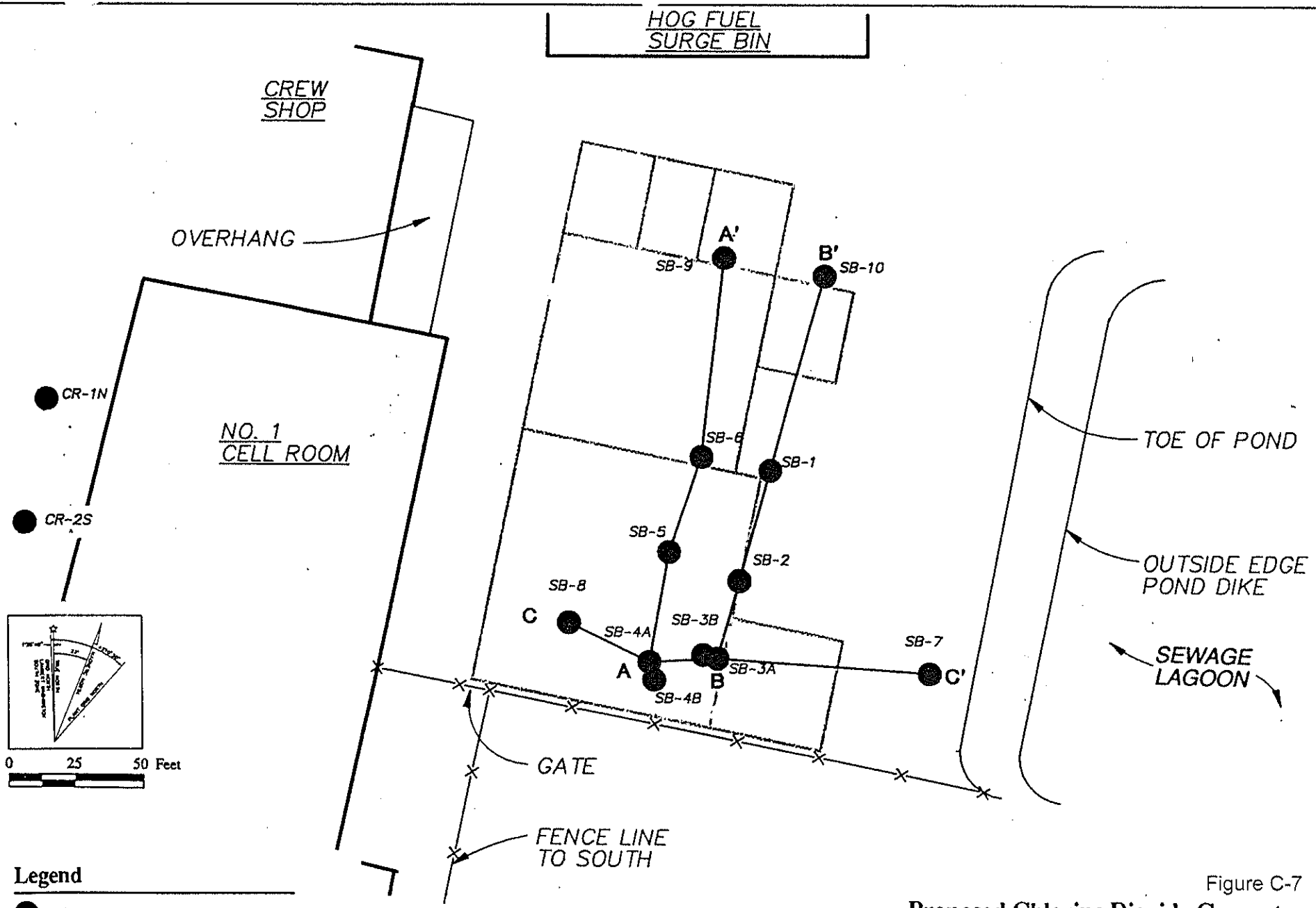
Figure C-6

Mercury Soil Concentrations for Test Pits and Soil Borings in the Former Surface Impoundment Area

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

2451G41.DWG



Legend

● Soil boring

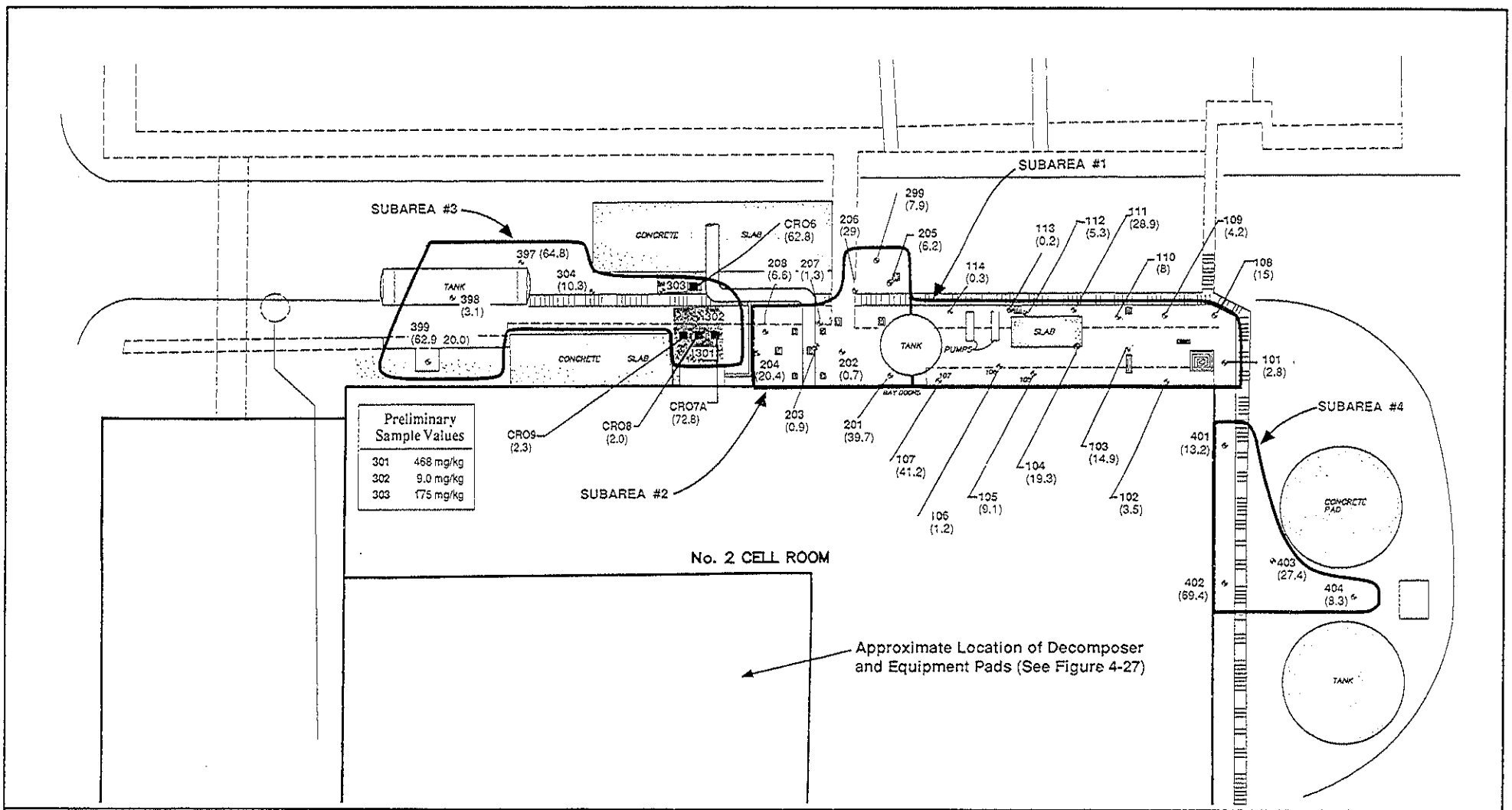
Note: Sample locations are approximate.
Samples obtained by CH2M HILL, 1990

Figure C-7

Proposed Chlorine Dioxide Generator Building Site and Cross Section Locations

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2M HILL



Legend

- Subareas
- 403 Soil sample location
- ■ Confirmation sample location
- (27.4) Mercury concentrations in soil (mg/kg)
- Excavated area

Note: Sample locations are approximate.
Samples obtained by CH2M HILL, 1991 and HLA, 1991b

Figure C-8

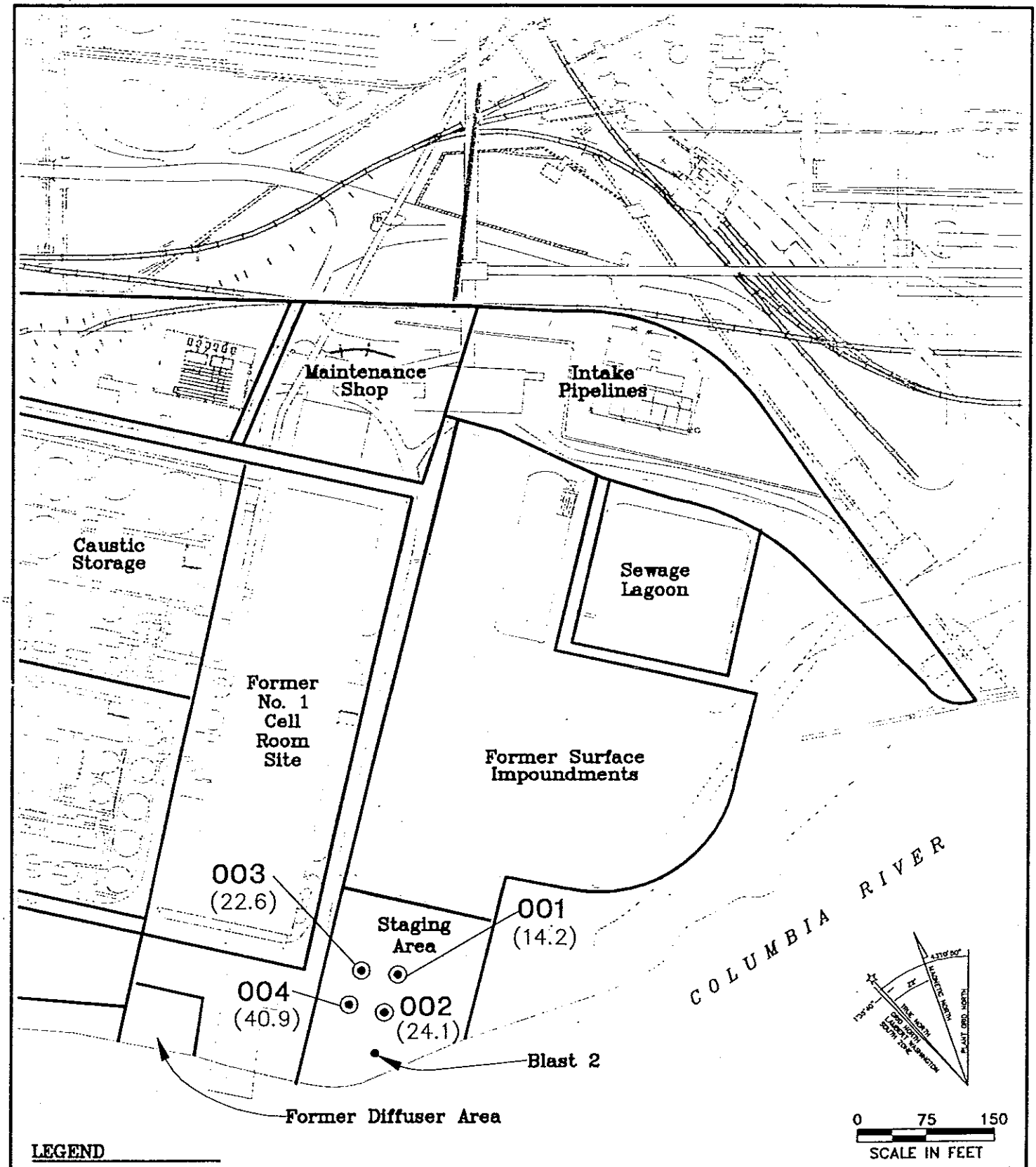
Mercury Concentrations and Soil Sample Locations in the No. 2 Cell Room Area

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2M HILL

p:\32451\cad\2451g39.dwg

12-Apr-1995



LEGEND

⊙ Soil test pit

(40.9) Mercury concentrations in soil (mg/kg)

Note:
Sample locations are approximate.
Samples obtained CH2M HILL

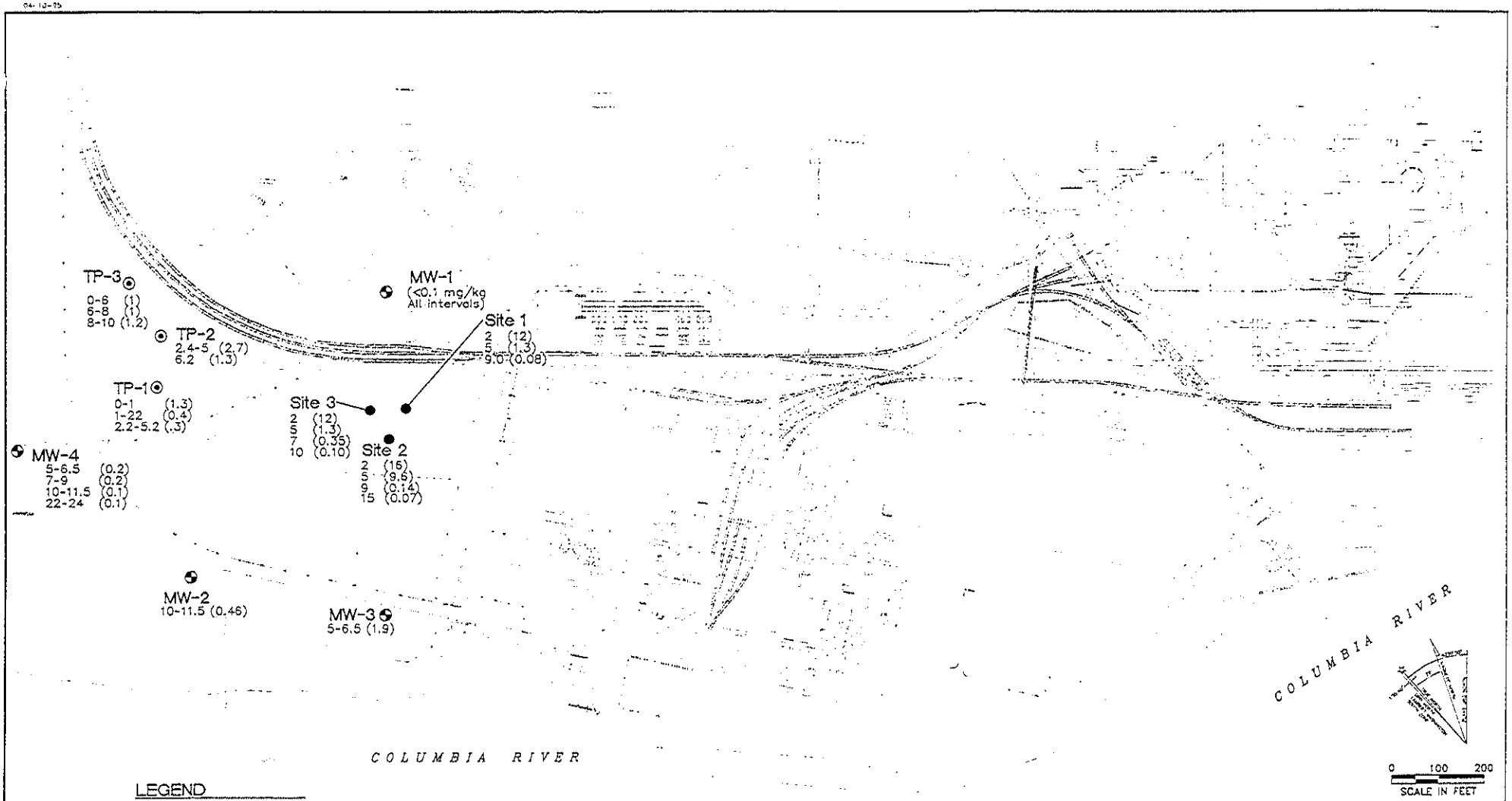
Figure C-9

Mercury Soil Concentrations and Test Pit Locations in the Staging Area

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

2451G39.DWG



LEGEND

- Monitoring well, Sweet Edwards, 1987
- Soil test pit, Sweet Edward, 1987
- Soil boring, Weyerhaeuser, 1986
- 11-12 Depth interval in feet
- (0.7) Mercury concentrations (mg/kg)

Note: Sample locations are approximate. Only depth intervals that exhibited mercury above the detection limit are illustrated.

Figure C-10

Mercury Concentrations and Soil Sample Locations in the West Area

WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2MHILL

Soil Laboratory Data Sheets and Chain-of-Custody Forms

November 10, 1998

Ms. Kira Sykes
CH2M Hill
825 NE Multnomah Drive, Suite 1300
Portland, OR 97232

RE: Service Request 98-1157 Longview Chloralkali Plant Soils

Dear Kira:

Attached are the corrected copies of our final report for the sample you requested we analyze. These are from our service request number 98-1157. Tina asked that we include flags that indicate dilutions, in an effort to determine the correct reporting limit for the electronic data. This report has flagged data for all dilutions and the amount diluted. In order to get the correct reporting limit (QL), simply multiply the dilution by the value reported on QL page. If you have any questions concerning this report, please feel free to contact me at (253) 924-6242.

Thank you for using our laboratory for this analysis and we look forward to working with you on future projects.

Sincerely,

Dennis Catalano, Project Manager
Weyerhaeuser Analytical and Testing Services

Attachments

Cc: Tina Rice CH2M Hill Portland

NOTE: Service request 98-1240 did not have any dilutions and did not require updating.

Weyerhaeuser Analytical and Testing Services
32901 Weyerhaeuser Way South
Federal Way, Washington 98003

Service Request 98-1157

Report

Longview Chlor-Alkali Plant Soils
CH2M Hill

Client ID:		HO36-001-SO 26498XX 09/21/98 1020	HO36-002-SO 26498XX 09/21/98 1040	HO36-003-SO 26498XX 09/21/98 1055	HO36-004-SO 26498XX 09/21/98 1115	FO36-002-SO 26498XX 09/21/98 1150
Lab ID:		001	002	003	004	005
Test	Units					
Alkalinity	mg/kg $CaCO_3$	3000	200	2100	1700	1900
Cl	mg/kg	10 (D10)	1.8 (D10)	28 (D100)	42 (D100)	770 (D1000)
Soil pH		7.0	7.1	8.8	8.9	9.0
Sulfide (Titrate)	mg/kg	119	< 11	93	50	40
Total Solids	% @ 105°C	69.1	91.0	74.0	83.7	83.8
Total Hg	mg/kg	-	-	-	-	0.5

Client ID:		FO36-002-SO 26498DU 09/21/98 1150	FO36-001-SO 26498XX 09/21/98 1340	F036-003-SO 26498XX 09/21/98 1405	F036-004-SO 26498XX 09/21/98 1430
Lab ID:		006	007	008	009
Test	Units				
Alkalinity	mg/kg $CaCO_3$	3500	4400	9000	1700
Cl	mg/kg	420 (D1000)	3000 (D2000)	2700 (D2000)	150 (D200)
Soil pH		9.0	9.3	11.0	9.3
Sulfide (Titrate)	mg/kg	45	50	108	14
Total Solids	% @ 105°C	84.0	83.4	81.4	92.0
Total Hg	mg/kg	0.9	159 (D100)	13.7 (D20)	189 (D100)

Approved: Bill Trout
Telephone: 253/924-6157

Date: 10/27/1998 Revised 11/06/98

Weyerhaeuser Analytical and Testing Services
32901 Weyerhaeuser Way South
Federal Way, Washington 98003

Service Request 98-1157 Weyerhaeus
32901 Weyeri
Federal Way,

Report

Longview Chlor-Alkali Plant Soils
CH2M Hill

Client ID:		CH7-195-SO 25298XX 09/09/98 1030	CH8-195-SO 25298XX 09/21/98 1500	G006-001-SD 26598XX 09/22/98 0915	G006-002-SD 26598XX 09/22/98 0940	Test
Lab ID:		010	011	012	013	
Test	Units					
Alkalinity	mg/kg $CaCO_3$	-	-	3100	-	Alkalinity
Cl	mg/kg	-	-	17 (D10)	-	Cl
Soil pH		-	-	7.7	-	Soil pH
Sulfide (Titrate)	mg/kg	-	-	790	-	Sulfide (Titrate)
Total Solids	% @ 105°C	68.3	79.6	37.3	85.1	Total Solids
TOC	%	1.6	0.05	-	-	TOC
Total Hg	mg/kg	-	-	1.2	0.8	Total Hg
						Total Hg
						Total Hg

Client ID:		G006-003-SD 26598XX 09/22/98 1005	G006-005-SD 26598XX 09/22/98 1035	G006-004-SD 26598XX 09/22/98 1105	G006-004-SD 26598DU 09/23/98 1105
Lab ID:		014	015	016	017
Test	Units				
Alkalinity	mg/kg $CaCO_3$	-	840	380	450
Cl	mg/kg	-	22 (D100)	6.7 (D10)	6.8 (D10)
Soil pH		-	7.1	7.4	7.4
Sulfide (Titrate)	mg/kg	-	32	23	25
Total Solids	% @ 105°C	90.7	58.3	83.6	82.8
Total Hg	mg/kg	0.6	4.8	0.7	0.7

Note: Samples 013 and 014 were analyzed 3 days past the holding time of 28 days for mercury.

Approved: Bill Trout
Telephone: 253/924-6157

Date: 10/27/1998 Revised 11/06/98

Approved: Bil
Telephone: 2

er Analytical and Testing Services
haeuser Way South
, Washington 98003

Service Request 98-1157

Report

Longview Chlor-Alkali Plant Soils
CH2M Hill

Units	Samples	Analyzed	QL	Method
mg/kg $CaCO_3$, O.D. Basis		10/14&20/98	50	1-0015-LMG
mg/kg, O.D. Basis		10/02/98	0.1	Mod. EPA 300.0
		09/23/98	-	Mod. EPA 150.1
mg/kg, O.D. Basis		10/02/98	10	1-0045-LMG
% @ 105°C		09/28/98	-	AM 1-160.3
%, O.D. Basis		10/12/98	0.05	PSEP
mg/kg O.D. Basis	7-9,12,15-17	10/07/98	0.1	AM 1-245.5
mg/kg O.D. Basis	5, 6	10/5/98	0.1	AM 1-245.5
mg/kg O.D. Basis	13, 14	10/23/98	0.1	AM 1-245.5

ll Trout
53/924-6157

Date: 10/27/98

Weyerhaeuser

32901 Weyerhaeuser Way South
Federal Way WA 98003
Tel (253) 924-6872
Fax (253) 924-6654

October 28, 1998

Ms. Kira Sykes
CH2M Hill
825 NE Multnomah Drive, Suite 1300
Portland, OR 97232

RE: Service Request 98-1157 Longview Chloralkali Plant Soils

Dear Kira:

Attached are the copies of our final report for the sample you requested we analyze. These are from our service request number 98-1157. Invoicing for this work will be directly to Weyerhaeuser. If you have any questions concerning this report, please feel free to contact me at (253) 924-6242.

Thank you for using our laboratory for this analysis and we look forward to working with you on future projects.

Sincerely,

Dennis Catalano, Project Manager
Weyerhaeuser Analytical and Testing Services

Attachments

Cc: Phyllis Rice CH2M Hill Portland

Weyerhaeuser Analytical and Testing Services
32901 Weyerhaeuser Way South
Federal Way, Washington 98003

Service Request 98-1157

Report

Longview Chlor-Alkali Plant Soils
CH2M Hill

Client ID:		HO36-001-SO 26498XX 09/21/98 1020	HO36-002-SO 26498XX 09/21/98 1040	HO36-003-SO 26498XX 09/21/98 1055	HO36-004-SO 26498XX 09/21/98 1115	FO36-002-SO 26498XX 09/21/98 1150
Lab ID:		001	002	003	004	005
Test	Units					
Alkalinity	mg/kg $CaCO_3$	3000	200	2100	1700	1900
Cl	mg/kg	10	1.8	28	42	770
Soil pH		7.0	7.1	8.8	8.9	9.0
Sulfide (Titrate)	mg/kg	119	< 11	93	50	40
Total Solids	% @ 105°C	69.1	91.0	74.0	83.7	83.8
Total Hg	mg/kg	-	-	-	-	0.5

Client ID:		FO36-002-SO 26498DU 09/21/98 1150	FO36-001-SO 26498XX 09/21/98 1340	F036-003-SO 26498XX 09/21/98 1405	F036-004-SO 26498XX 09/21/98 1430
Lab ID:		006	007	008	009
Test	Units				
Alkalinity	mg/kg $CaCO_3$	3500	4400	9000	1700
Cl	mg/kg	420	3000	2700	150
Soil pH		9.0	9.3	11.0	9.3
Sulfide (Titrate)	mg/kg	45	50	108	14
Total Solids	% @ 105°C	84.0	83.4	81.4	92.0
Total Hg	mg/kg	0.9	159	13.7	189

Approved: Bill Trout

Telephone: 253/924-6157

Date: 10/27/98

Weyerhaeuser Analytical and Testing Services
32901 Weyerhaeuser Way South
Federal Way, Washington 98003

Service Request 98-1157

Report

Longview Chlor-Alkali Plant Soils
CH2M Hill

Client ID:		CH7-195-SO 25298XX 09/09/98 1030	CH8-195-SO 25298XX 09/21/98 1500	G006-001-SD 26598XX 09/22/98 0915	G006-002-SD 26598XX 09/22/98 0940
Lab ID:		010	011	012	013
Test	Units				
Alkalinity	mg/kg $CaCO_3$	-	-	3100	-
Cl	mg/kg	-	-	17	-
Soil pH		-	-	7.7	-
Sulfide (Titrate)	mg/kg	-	-	790	-
Total Solids	% @ 105°C	68.3	79.6	37.3	85.1
TOC	%	1.6	0.05	-	-
Total Hg	mg/kg	-	-	1.2	0.8

Client ID:		G006-003-SD 26598XX 09/22/98 1005	G006-005-SD 26598XX 09/22/98 1035	G006-004-SD 26598XX 09/22/98 1105	G006-004-SD 26598DU 09/23/98 1105
Lab ID:		014	015	016	017
Test	Units				
Alkalinity	mg/kg $CaCO_3$	-	840	380	450
Cl	mg/kg	-	22	6.7	6.8
Soil pH		-	7.1	7.4	7.4
Sulfide (Titrate)	mg/kg	-	32	23	25
Total Solids	% @ 105°C	90.7	58.3	83.6	82.8
Total Hg	mg/kg	0.6	4.8	0.7	0.7

Note: Samples 013 and 014 were analyzed 3 days past the holding time of 28 days for mercury.

Approved: Bill Trout

Telephone: 253/924-6157

Date: 10/27/98

Weyerhaeuser Analytical and Testing Services
32901 Weyerhaeuser Way South
Federal Way, Washington 98003

Service Request 98-1157

Report

Longview Chlor-Alkali Plant Soils
CH2M Hill

Test	Units	Samples	Analyzed	QL	Method
Alkalinity	mg/kg $CaCO_3$, O.D. Basis		10/14&20/98	50	1-0015-LMG
Cl	mg/kg, O.D. Basis		10/02/98	0.1	Mod. EPA 300.0
Soil pH			09/23/98	-	Mod. EPA 150.1
Sulfide (Titrate)	mg/kg, O.D. Basis		10/02/98	10	1-0045-LMG
Total Solids	% @ 105°C		09/28/98	-	AM 1-160.3
TOC	%, O.D. Basis		10/12/98	0.05	PSEP
Total Hg	mg/kg O.D. Basis	7-9,12,15-17	10/07/98	0.1	AM 1-245.5
Total Hg	mg/kg O.D. Basis	5, 6	10/5/98	0.1	AM 1-245.5
Total Hg	mg/kg O.D. Basis	13, 14	10/23/98	0.1	AM 1-245.5

Approved: Bill Trout
Telephone: 253/924-6157

Date: 10/27/98

Weyerhaeuser Analytical and Testing Services
32901 Weyerhaeuser Way South
Federal Way, Washington 98003

Service Request 98-1157

Longview Chlor-Alkali Plant Soils
CH2M Hill

SPIKES

Compound	Matrix	Sample Designation	Lab Code	Units	Sample + Spike Value	Sample Value	Spike Added	% Recovery
Sulfide	Soil	HO36-001-SO	001	mg/kg	893	119	564	95
Sulfide	Soil	spiked sand blank		mg/kg	652	11	564	115
Total Hg	Soil	HO36-001-SO		mg/kg	1.95	0.50	0.94	129

DUPLICATES

Compound	Matrix	Sample Designation	Lab Code	Units	Sample Value	Duplicate Value	RPD
Alkalinity	Soil	HO36-001-SO	001	mg/kg CaCO3	3000	3100	3
Chloride	Soil	HO36-001-SO	001	mg/kg	10	11	7
Sulfide	Soil	HO36-001-SO	001	mg/kg	119	122	2
TOC	Soil	HO36-001-SO	001	%	1.6	1.6	1
TOC	Soil	HO36-001-SO	001	%	1.6	1.7	6
Total Hg	Soil	FO36-002-SO	005	mg/kg	0.50	0.56	11

CONTROL SAMPLES

Compound	Matrix	Source of LCS	Units	Measured Value	Known Value	% Recovery	
Alkalinity	Soil	SPEX	mg/kg CaCO3	9.8	10.4	94	10/14/98
Alkalinity	Soil	SPEX	mg/kg CaCO3	10.2	10.4	98	10/20/98
Chloride	Soil	Dionex 5 anion	mg/L	30.4	29.7	102	10/02/98
TOC	Soil	NIST 1646	%	1.7	1.6	104	10/12/98
Total Hg	Sed.	NIST SRM 2704	mg/kg	1.45	1.64	88	10/05/98
Total Hg	Sed.	NIST SRM 2704	mg/kg	1.41	1.64	86	10/07/98
Total Hg	Sed.	NIST SRM 2704	mg/kg	1.32	1.64	80	10/23/98

BLANKS

Compound	Matrix	Type of Blank	Units	Measured Value	
Alkalinity	Soil	Method	mg/kg CaCO3	< 0.5	10/14/98
Alkalinity	Soil	Method	mg/kg CaCO3	< 0.5	10/20/98
Chloride	Soil	Method	mg/kg	<0.05	10/02/98
Sulfide	Soil	Method	mg/kg	11	10/02/98
TOC	Soil	Method	%	<0.05	10/12/98
Total Hg	Soil	Method	mg/kg	< 0.1	10/05/98
Total Hg	Soil	Method	mg/kg	< 0.1	10/07/98
Total Hg	Soil	Method	mg/kg	< 0.1	10/23/98

Approved: Bill Trout Date: 10/27/98
Telephone: 253/924-6157

SR 1157

CH2MHILL Analytical Services
CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

☐ LMG 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-1444 FAX (334) 271-3428
☐ LRD 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244-4109
☐ LKW Canviro Analytical Laboratories, Inc., 50 Bathurst, Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747-2575 FAX (519) 747-3806
☐ CVO 2300 NW Walnut Boulevard, Corvallis, OR 97330-3638, (541) 752-4271 FAX (541) 752-0276

COC # ~~9860522~~

Project # 148834.RI.FM	Purchase Order # —
Project Name: Weyco Longview Chemical Plant	
Company Name: CH2M Hill/PDX	
Project Manager or Contact & Phone #: 503-235-5200 King Sykes/PDX	Report Copy to: 503-235-5200 Joel Bowker/PDX
Requested Completion Date: Std.	Site ID: —
Sample Disposal: Dispose ☒ Return ☐	

TOTAL # OF CONTAINERS

Requested Analytical Method #: 7471 total Hg; 0.1 ppm det limit; sulfide, pH, Cr, Alk; TOC

Preservative: 4°C; 4°C

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	LAB QC	TOTAL # OF CONTAINERS	Requested Analytical Method #	Preservative
9/21/98	1020	X			X		H036-001-SO-26498XX		1	X	X
	1040						H036-002-SO-26498XX		1	X	X
	1055						H036-003-SO-26498XX		1	X	X
	1115						H036-004-SO-26498XX		1	X	X
	1150						F036-002-SO-26498XX		2	X	X
	1150						F036-002-SO-26498DU			X	X
	1340						F036-001-SO-26498XX			X	X
	1405						F036-003-SO-26498XX			X	X
	1430						F036-004-SO-26498XX			X	X
9/9/98	1030						CH7-195-SO-25298XX		1	X	
	1500						CH8-195-SO-25298XX		1	X	

THIS AREA FOR LAB USE ONLY

Lab #	Page / of
Lab PM	Custody Review
Log In	LIMS Verification
pH	Custody Seals Y N
	Ice Y N
QC Level 1 2 3 Other	
Cooler Temperature	

Alternate Description	Lab ID

Relinquished By: Barry Glum	Empty Bottles: 1520	Date/Time: 9-21-98	Received By: Chappel
Sampled By and Title: Same (Please sign and print name)		Date/Time	Relinquished By (Please sign and print name)
Received By (Please sign and print name)		Date/Time	Relinquished By (Please sign and print name)
Received By (Please sign and print name)		Date/Time	Shipped Via: UPS Fed-Ex Other Courier

Empty Bottles: 9.22.98 0700

Date/Time

Date/Time

Date/Time

Shipping #

Special Instructions: Short holding time on pH, low detection limit for Hg --- To Weyco Lab Federal Way

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DISTRIBUTION: Original ... LAB Y... LAB Pi...

CH2MHILL Analytical Services
CHAIN OF CUSTODY RECORD
AND AGREEMENT TO PERFORM SERVICES

☐ LMG 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-1444 FAX (334) 271-3428

☐ LRD 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244-4109

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☐ CVO 2300 NW Walnut Boulevard, Corvallis, OR 97330-3638, (541) 752-4271 FAX (541) 752-0276

COC # _____

Project # 148834.RI.FW	Purchase Order # —
Project Name: Weyco Longview Chemical Plant	
Company Name: CH2M/PDX	
Project Manager or Contact & Phone #: 503-235-5000 Kira Sykes/PDX	Report Copy to: Joel Bowker/PDX
Requested Completion Date: STD	Site ID —
Sample Disposal: Dispose ☒ Return ☐	

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	LAB QC	TOTAL # OF CONTAINERS	Requested Analytical Method # (total Hg, detection 0.1 ppm detection limit; Cl, sulfide, pH, Alk)	Preservative (4°C)
9/22/98	0915	X			X		G006-001-SD-26598XX		2	X	X
	0940						G006-002-SD-26598XX		1	X	
	1005						G006-003-SD-26598XX		1	X	
	1035						G006-005-SD-26598XX		2	X	X
	1105						G006-004-SD-26598XX		2	X	X
	1105						G006-004-SD-26598DU		2	X	X

THIS AREA FOR LAB USE ONLY

Lab #	Page / of
Lab PM	Custody Review
Log In	LIMS Verification
pH	Custody Seals Y N
	Ice Y N
QC Level 1 2 3 Other	
Cooler Temperature	
Alternate Description	Lab ID

Relinquished By: Barry Calloum	Empty Bottles	Date/Time: 9-22-98 1530	Received By / Empty Bottles / Date/Time
Sampled By and Title: Same	(Please sign and print name)	Date/Time	Relinquished By (Please sign and print name) / Date/Time
Received By: Dana L. Schaffer DANA L. SCHAFFER	(Please sign and print name)	Date/Time 0930 9/23/98	Relinquished By (Please sign and print name) / Date/Time
Received By	(Please sign and print name)	Date/Time	Shipped Via: Weyco Courier (UPS / Fed-Ex / Other) / Shipping #

Special Instructions: Short hold time on pH, 0.1 ppm detection limit for total Hg, to Weyco lab, Federal Way, WA

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original LAB Yellow LAB Pink Client

Groundwater Summary Tables

Table C-2
Groundwater Analytical Results for CH Wells
Central Process Area and Former Surface Impoundment Area
Weyerhaeuser Company - Longview, Washington

Site Location	Well Number	Sample Collection Date	Dissolved Mercury Concentration (mg/L)	pH [H+]	Specific Conductance (umhos/cm)
Central Process Areas	CH-1	11/06/91	0.0005 U (a)	7.10	4,220
		01/23/92	0.0005 U	7.20	3,790
		04/20/92	0.0006	7.71	3,120
		07/21/92	0.0010	9.29	3,780
		11/18/92	0.0005 U	8.63	3,400
		02/01/93	0.0008	7.63	3,630
		04/23/93	0.0006	7.47	3,790
		07/23/93	0.0007	7.68	3,710
		11/22/93	0.0005 U	7.10	4 (c)
		01/25/94	0.0005	7.77	3,850
		04/27/94	0.0005 U	7.61	4,290
		07/20/94	0.0005 U	7.24	4,430
		11/15/94	0.0005 U	7.10	4,830
		01/12/95	0.0005 U	7.14	3,840
		04/12/95	0.0006	7.56	3,620
		07/20/95	0.0006	7.78	3,490
		11/29/95	0.0018	8.01	2,010
		01/17/96	0.0018	7.82	223
		04/10/96	0.0015	7.86	829
		07/17/96	0.0008	7.71	3,100
		11/13/96	0.0016	7.70	2,680
		01/15/97	0.0020	7.56	2,183
		04/14/97	0.0022	8.00	1,580
		08/13/97	0.0016	7.80	1,718
		03/11/98	0.0011	7.81	1,705
		10/06/98	0.0007	7.98	1,175
		03/25/99	0.0004	7.70	1,258
		09/21/99	0.0016 J	7.40	1,141
		03/28/00	0.0018	7.43	948

Table C-2
Groundwater Analytical Results for CH Wells
Central Process Area and Former Surface Impoundment Area
Weyerhaeuser Company - Longview, Washington

Site Location	Well Number	Sample Collection Date	Dissolved Mercury Concentration (mg/L)	pH [H+]	Specific Conductance (umhos/cm)
Central Process Areas (continued)	CH-5	11/06/91	0.0020	6.38	1,640
		01/23/92	0.0027	6.43	3,190
		04/20/92	0.0033	6.72	1,400
		07/23/92	0.0018	7.06	2,190
		11/17/92	0.0005 U	9.10	1,770
		02/02/93	0.0044	9.36	1,910
		04/23/93	0.0006	8.49	2,020
		07/23/93	0.0027	7.38	2,300
		11/22/93	0.0012	7.10	1,160
		01/25/94	0.0005 U	6.91	700
		04/26/94	0.0005 U	7.78	1,460
		07/20/94	0.0008	7.26	1,340
		11/15/94	0.0005 U	6.26	4,180
		01/12/95	0.0005	6.79	1,430
		04/12/95	0.0019	7.24	2,020
		07/19/95	0.0069	7.89	4,260
		11/30/95	0.0083	9.00	1,670
		01/17/96	0.0042	7.26	1,750
		04/10/96	0.0086	9.42	1,800
		07/18/96	0.0090	8.66	1,110
		11/13/96	0.0091	9.71	1,320
		01/15/97	0.0061	10.21	1,248
		04/14/97	0.0006	7.43	3,830
		08/13/97	0.0014	6.81	2,082
		03/11/98	0.0005 U	6.96	1,503
		10/07/98	0.0022	8.76	852
		03/25/99	0.0002 U	7.30	3,723
		09/21/99	0.0002 R	6.89	2,041
		03/29/00	0.0002 U	6.94	1,035

Table C-2
Groundwater Analytical Results for CH Wells
Central Process Area and Former Surface Impoundment Area
Weyerhaeuser Company - Longview, Washington

Site Location	Well Number	Sample Collection Date	Dissolved Mercury Concentration (mg/L)	pH [H+]	Specific Conductance (umhos/cm)
Central Process Areas (continued)	CH-6	11/06/91	0.0005 U	6.17	65,200
		01/23/92	0.0005 U	6.17	48,200
		04/20/92	0.0005 U	6.28	68,200
		07/21/92	0.0005 U	6.22	78,200
		11/18/92	0.0005 U	5.90	119,000
		02/03/93	0.0008 U (b)	6.45	173,000
		04/23/93	0.0008 U (b)	6.10	159,000
		07/23/93	0.0005 U	6.38	78,900
		11/23/93	0.0005 U	6.68	220,000
		01/26/94	0.0040 U (b)	6.44	95,400
		04/26/94	0.0020 U (b)	6.90	115,000
		07/20/94	0.0008 U (b)	6.52	228,000
		11/16/94	0.0005 U	7.10	107,000
		01/12/95	0.0005 U	6.24	157,000
		04/12/95	0.0005 U	6.13	173,000
		07/19/95	0.0005 U	6.61	114,000
		11/29/95	0.0020 U (b)	6.35	19,600
		01/17/96	0.0005 U	7.24	190,000
		04/11/96	0.0005 U	6.51	200,000
		07/17/96	0.0005 U	6.65	208,000
		11/12/96	0.0020 U (b)	6.55	200,000
		01/15/97	0.0005 U	6.74	199,000
		04/14/97	0.0006	6.74	162,000
		08/13/97	0.0005 U	6.51	189,000
		03/11/98	0.0010	6.55	185,500
		10/08/98	0.0002 U	6.48	169,500
		03/25/99	0.0003	6.71	198,400
		09/21/99	0.0002 J	6.84	133
		03/29/00	0.0002 J	6.03	67,200

Table C-2
Groundwater Analytical Results for CH Wells
Central Process Area and Former Surface Impoundment Area
Weyerhaeuser Company - Longview, Washington

Site Location	Well Number	Sample Collection Date	Dissolved Mercury Concentration (mg/L)	pH [H+]	Specific Conductance (umhos/cm)
Former Surface Impoundment Area	CH-2	11/07/91	0.0434	6.65	326
		01/20/92	0.0005 U	6.80	434
		04/20/92	0.0005 U	6.93	298
		07/21/92	0.0012	7.09	277
		11/18/92	0.0018	6.90	650
		02/02/93	0.0024	7.00	400
		04/23/93	0.0023	7.22	311
		07/23/93	0.0102	6.90	298
		11/22/93	0.0006	6.84	243
		01/25/94	0.0048	6.86	297
		04/27/94	0.0011	6.95	259
		07/20/94	0.0008	6.76	262
		11/15/94	0.0040	6.97	326
		01/11/95	0.0009	6.70	266
		04/13/95	0.0012	7.03	212
		07/20/95	0.0018	7.01	210
		11/30/95	0.0039	7.22	244
		01/18/96	0.0013	7.55	204
		04/11/96	0.0034	7.13	212
		07/18/96	0.0054	7.07	209
		11/13/96	0.0045	7.01	306
		01/16/97	0.0033	6.56	172
		04/14/97	0.0045	6.98	206
		08/13/97	0.0032	6.44	254
		03/11/98	0.0005 U	7.10	191
		10/08/98	0.0009	8.64	269
		03/24/99	0.0002	6.80	220
		09/22/99	0.0013 J	6.90	312
		03/28/00	0.0005	6.80	208

Table C-2
Groundwater Analytical Results for CH Wells
Central Process Area and Former Surface Impoundment Area
Weyerhaeuser Company - Longview, Washington

Site Location	Well Number	Sample Collection Date	Dissolved Mercury Concentration (mg/L)	pH [H+]	Specific Conductance (umhos/cm)
Former Surface Impoundment Area (continued)	CH-3	01/20/92	0.0035	7.20	3,970
		04/20/92	0.0026	7.56	1,980
		07/23/92	0.0013	7.58	2,700
		11/17/92	0.0007	7.76	2,150
		02/02/93	0.0051	7.49	3,690
		04/23/93	0.0031	7.42	5,120
		07/23/93	0.0024	7.51	1,930
		11/23/93	0.0016	7.77	1,480
		01/26/94	0.0033	7.39	1,880
		04/26/94	0.0033	7.52	1,760
		07/20/94	0.0024	7.52	1,790
		11/15/94	0.0027	7.67	1,380
		01/11/95	0.0030	7.40	2,070
		04/12/95	0.0031	7.54	2,890
		07/19/95	0.0044	7.58	2,500
		11/29/95	0.0043	7.42	2,970
		01/17/96	0.0037	7.39	1,945
		04/10/96	0.0040	7.42	2,135
		07/17/96	0.0036	7.55	1,940
		11/12/96	0.0037	7.34	2,085
		01/15/97	0.0035	7.34	2,650
		04/14/97	0.0036	7.58	2,130
		08/13/97	0.0033	7.26	2,145
		03/10/98	0.0032	7.54	1,860
		10/07/98	0.0020	7.70	1,810
		03/23/99	0.0034	7.57	1,833
		09/21/99	0.0023 J	7.53	1,665
		03/27/00	0.0035	7.43	1,659

Table C-2
Groundwater Analytical Results for CH Wells
Central Process Area and Former Surface Impoundment Area
Weyerhaeuser Company - Longview, Washington

Site Location	Well Number	Sample Collection Date	Dissolved Mercury Concentration (mg/L)	pH [H+]	Specific Conductance (umhos/cm)
Former Surface Impoundment Area (continued)	**CH-4**	11/07/91	0.0013	7.60	1,580
		01/21/92	0.0017	7.20	2,030
		04/22/92	0.0018	7.33	1,970
		07/23/92	0.0015	7.32	2,460
		11/17/92	0.0006	7.31	2,510
		02/02/93	0.0014	7.26	2,840
		04/23/93	0.0012	7.32	3,180
		07/23/93	0.0013	7.06	3,100
		11/23/93	0.0009	7.52	2,480
		01/26/94	0.0010	7.22	2,410
		04/26/94	0.0008	7.30	2,350
		07/20/94	0.0007	7.29	2,260
		11/15/94	0.0009	7.37	2,230
		01/11/95	0.0008	7.20	2,850
		04/12/95	0.0008	7.20	2,640
		07/19/95	0.0010	7.25	2,150
		11/29/95	0.0010	7.26	2,500
		01/17/96	0.0010	6.99	2,370
		04/10/96	0.0019	7.13	3,310
		07/17/96	0.0015	7.15	2,470
		11/12/96	0.0017	6.95	2,140
		01/15/97	0.0010	7.01	2,380
		04/14/97	0.0015	7.25	2,220
		08/13/97	0.0008	7.04	2,280
		03/10/98	0.0007	7.10	2,313
		10/08/98	0.0006	7.45	1,472
		03/23/99	0.0006	7.19	1,580
		09/21/99	0.0006 J	7.05	1,522
		03/27/00	0.0005	6.86	1,548

Table C-2
Groundwater Analytical Results for CH Wells
Central Process Area and Former Surface Impoundment Area
Weyerhaeuser Company - Longview, Washington

Site Location	Well Number	Sample Collection Date	Dissolved Mercury Concentration (mg/L)	pH [H+]	Specific Conductance (umhos/cm)
Background Well Northeast site	CH-7	10/06/98	0.0002 U	6.89	697
		03/24/99	0.0002 U	6.97	730
		09/22/99	0.0002 R	6.88	703
		03/29/00	0.0002 U	6.97	526
Background Well Northeast site	CH-8	10/06/98	0.0002 U	6.86	302
		03/24/99	0.0002 U	6.58	150
		09/22/99	0.0002 R	6.89	242
		03/28/00	0.0002 U	6.67	260

Notes:

(a) U = Not detected at or above the Laboratory Method Reporting Limit.

(b) Method Reporting Limit is elevated because sample required dilution.

(c) Value questionable because significantly different from historical data record.

J Sample result is an estimate. Sample required dilution.

1. EPA Methods: Dissolved Mercury = 7470; pH = 150.1; Conductivity = 120.1
2. After 1992 values presented are averages of parent and duplicate samples. Prior to this time, only parent sample values were reported.

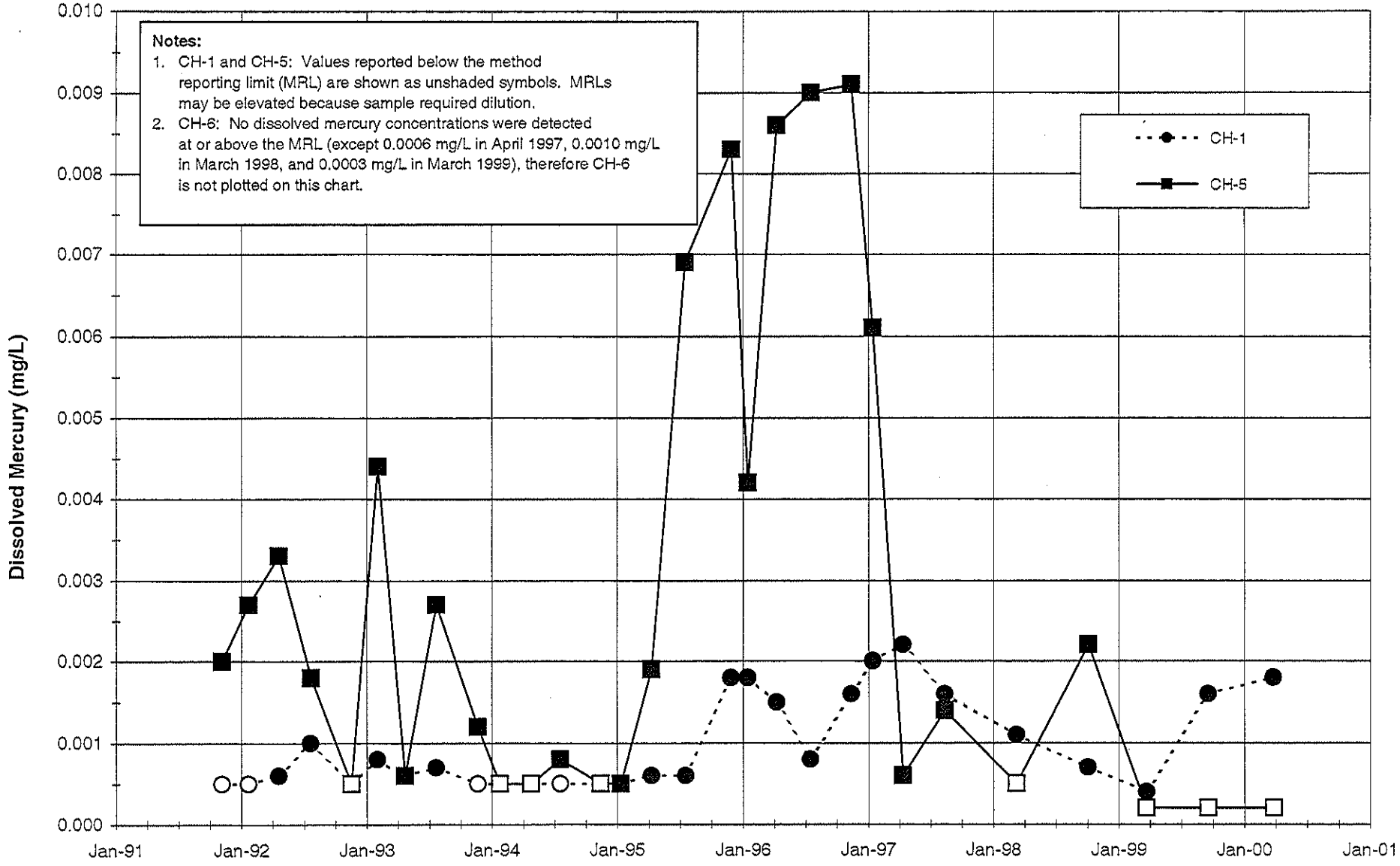

Figure C-11
Dissolved Mercury Concentrations in Groundwater (CH-1, CH-5, CH-6)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

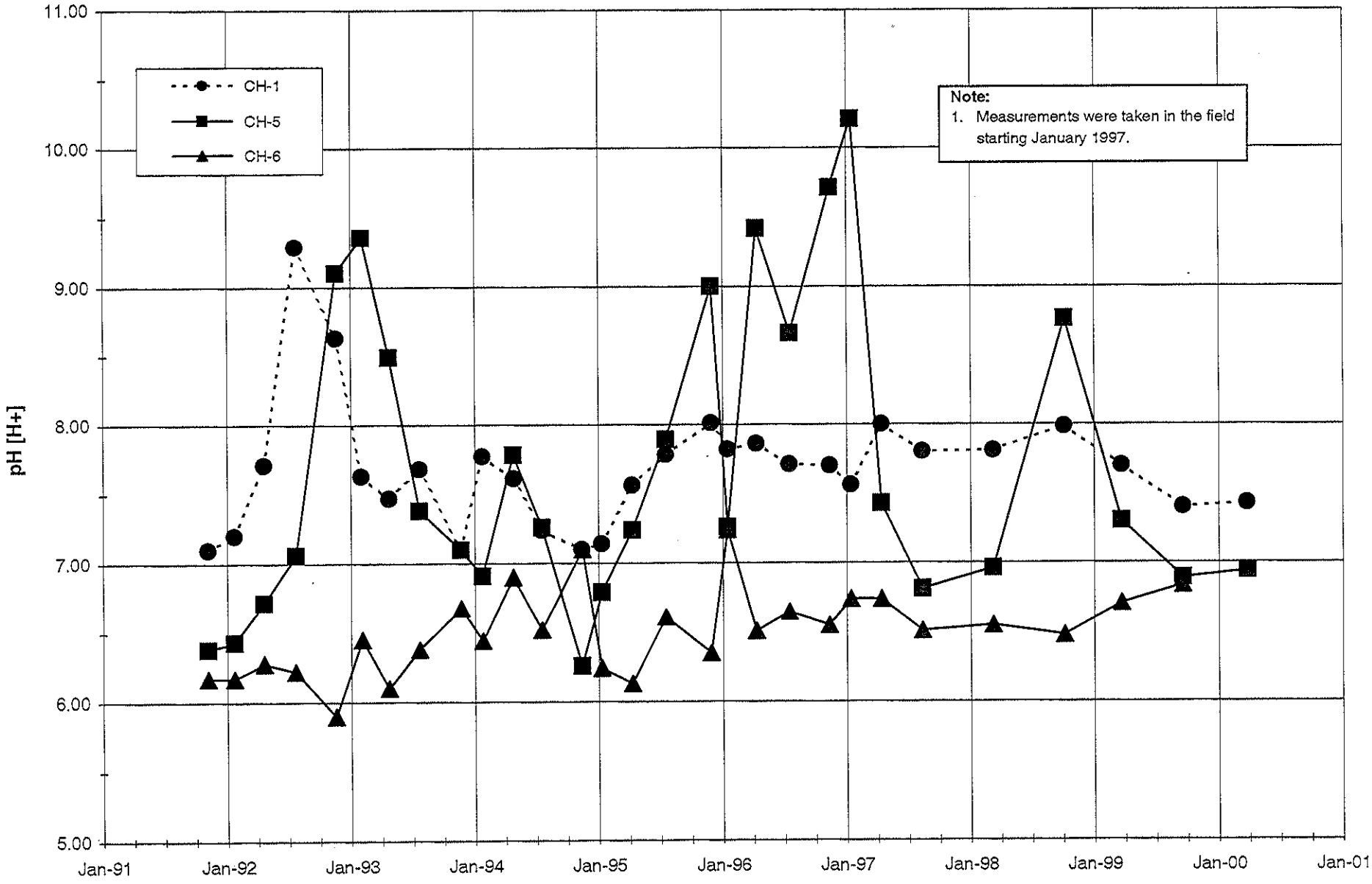

Figure C-12
pH Measurements (CH-1, CH-5, CH-6)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

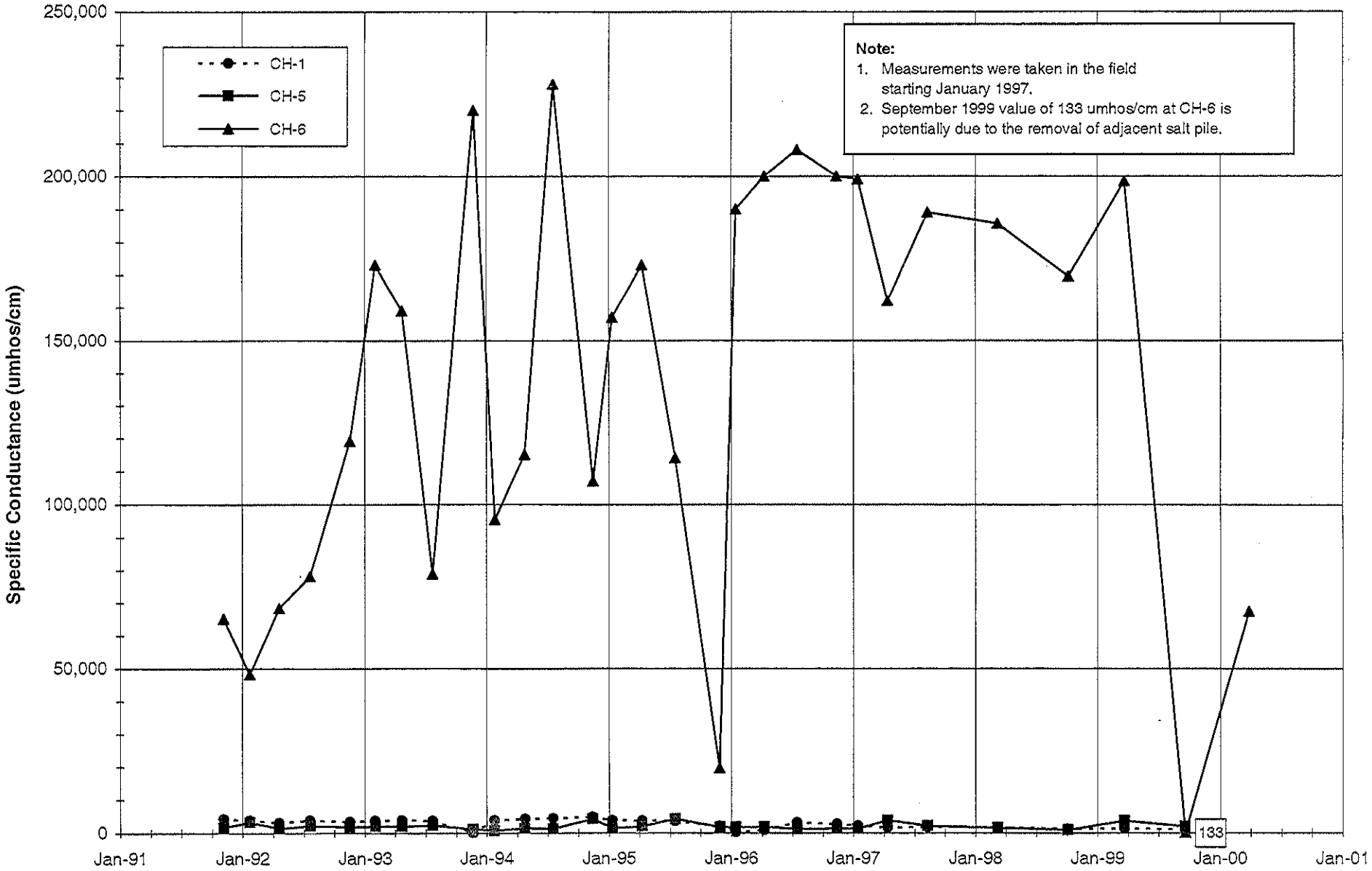

Figure C-13
Specific Conductance Measurements (CH-1, CH-5, CH-6)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

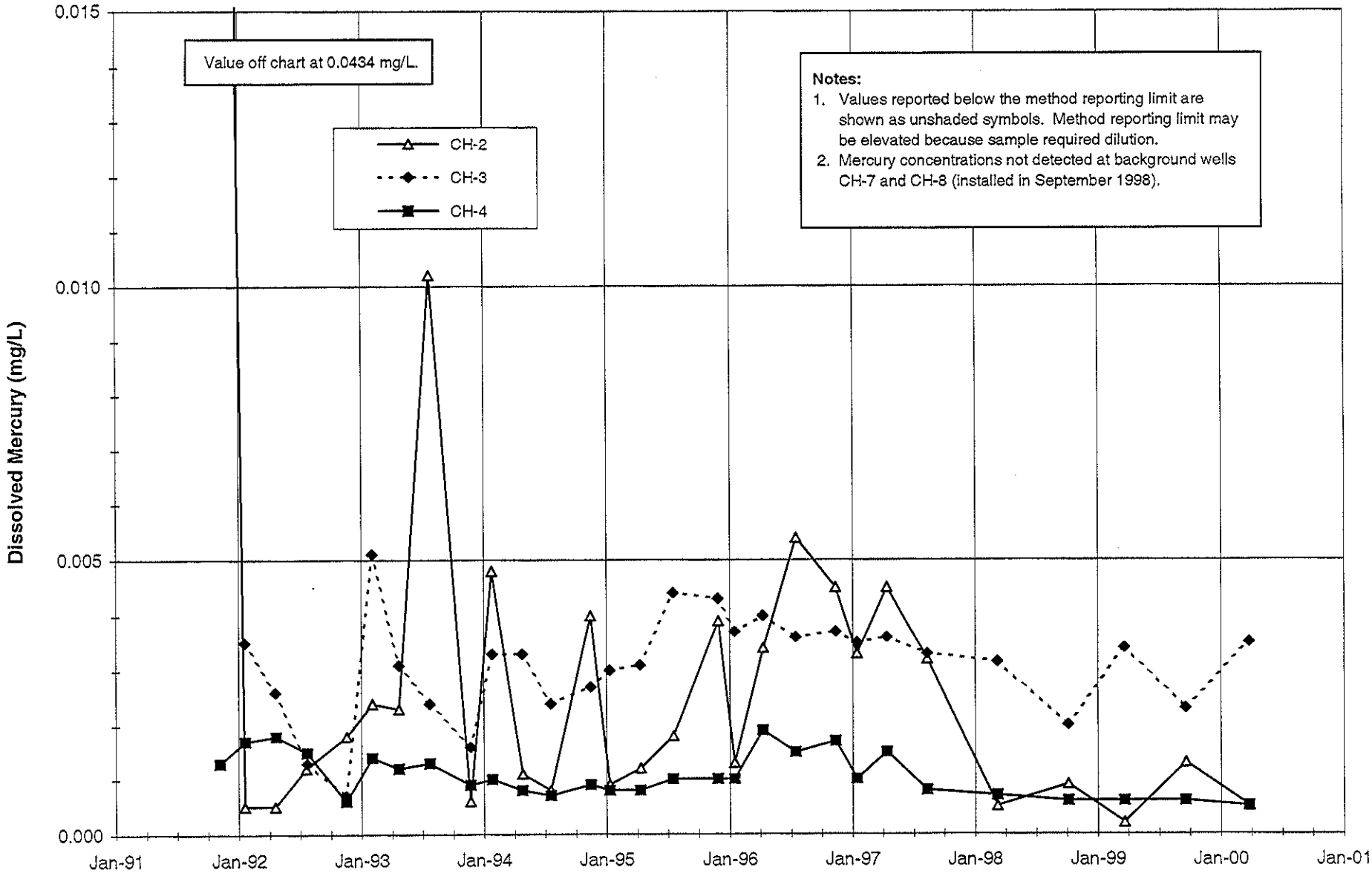

Figure C-14
Dissolved Mercury Concentrations in Groundwater (CH-2, CH-3, CH-4)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

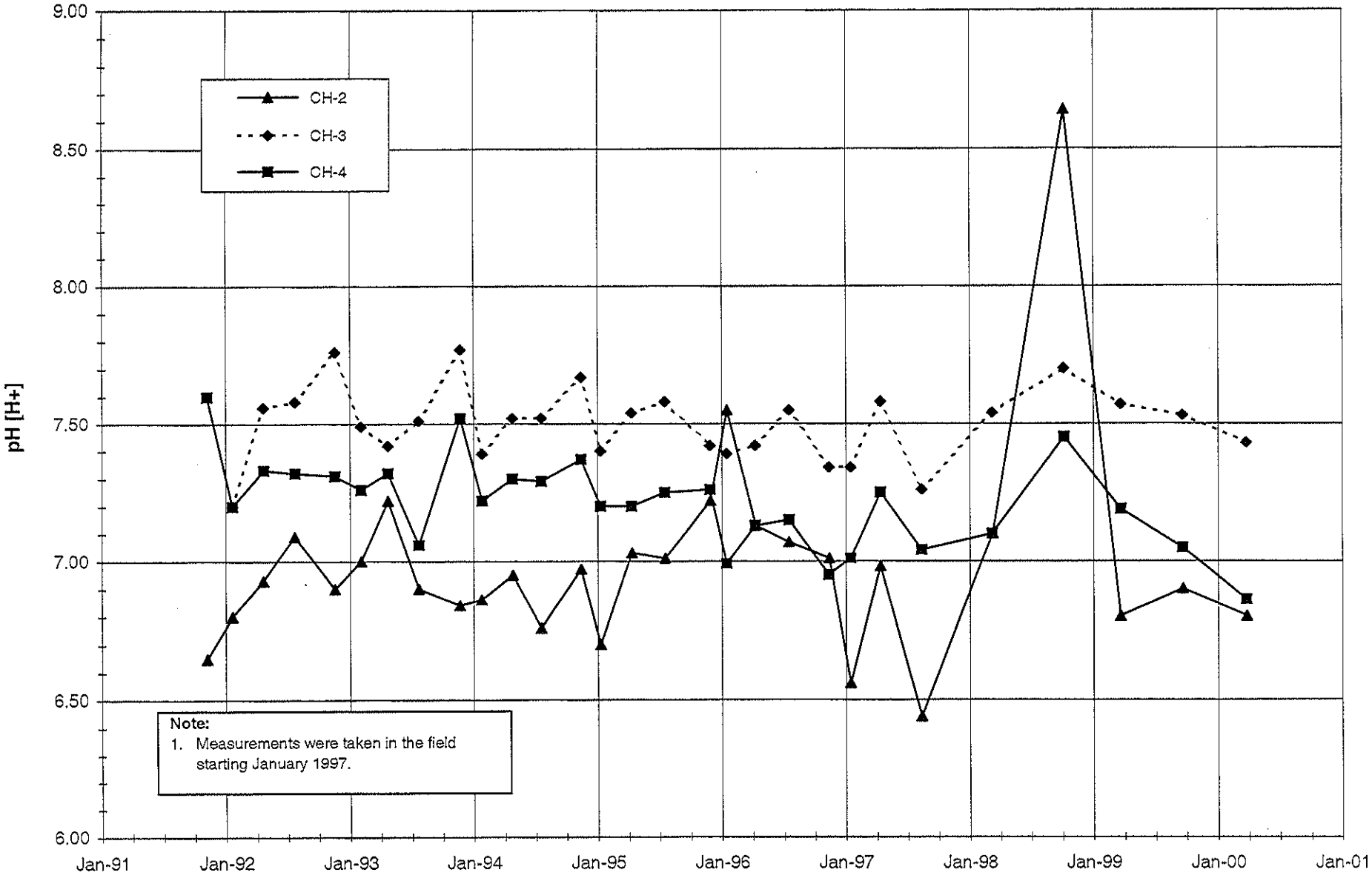

Figure C-15
pH Measurements (CH-2, CH-3, CH-4)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

P:\Weyco\148834\RIReport\AppdC\
chwells2000.xls\C-15 pH Chart CH-2,3,4

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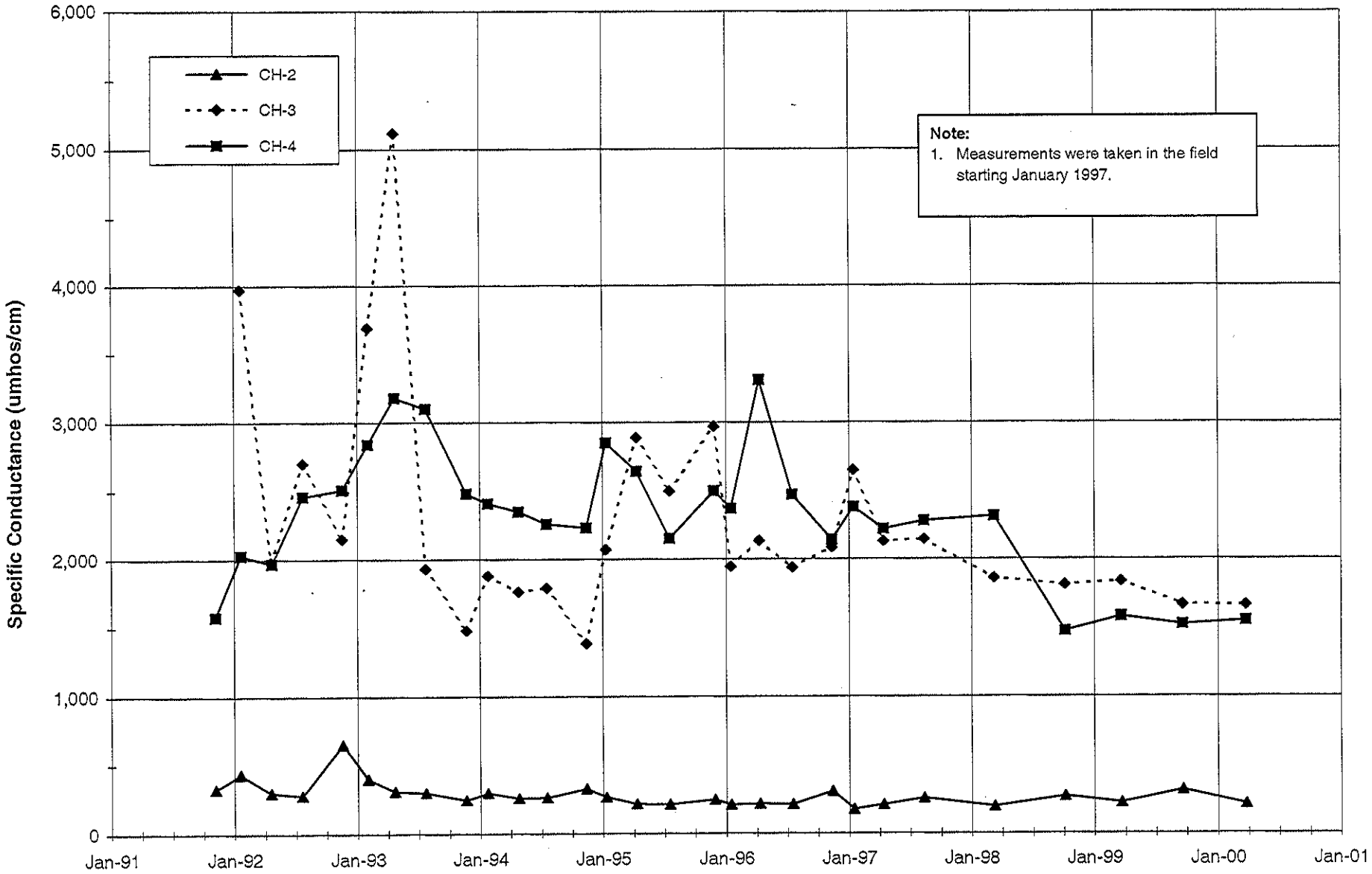

Figure C-16
Specific Conductance Measurements (CH-2, CH-3, CH-4)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

P:\Weyco\148834\gwmonitor\
chwells2000.xls\C-16 Spec Cond Chart CH-2,3,4

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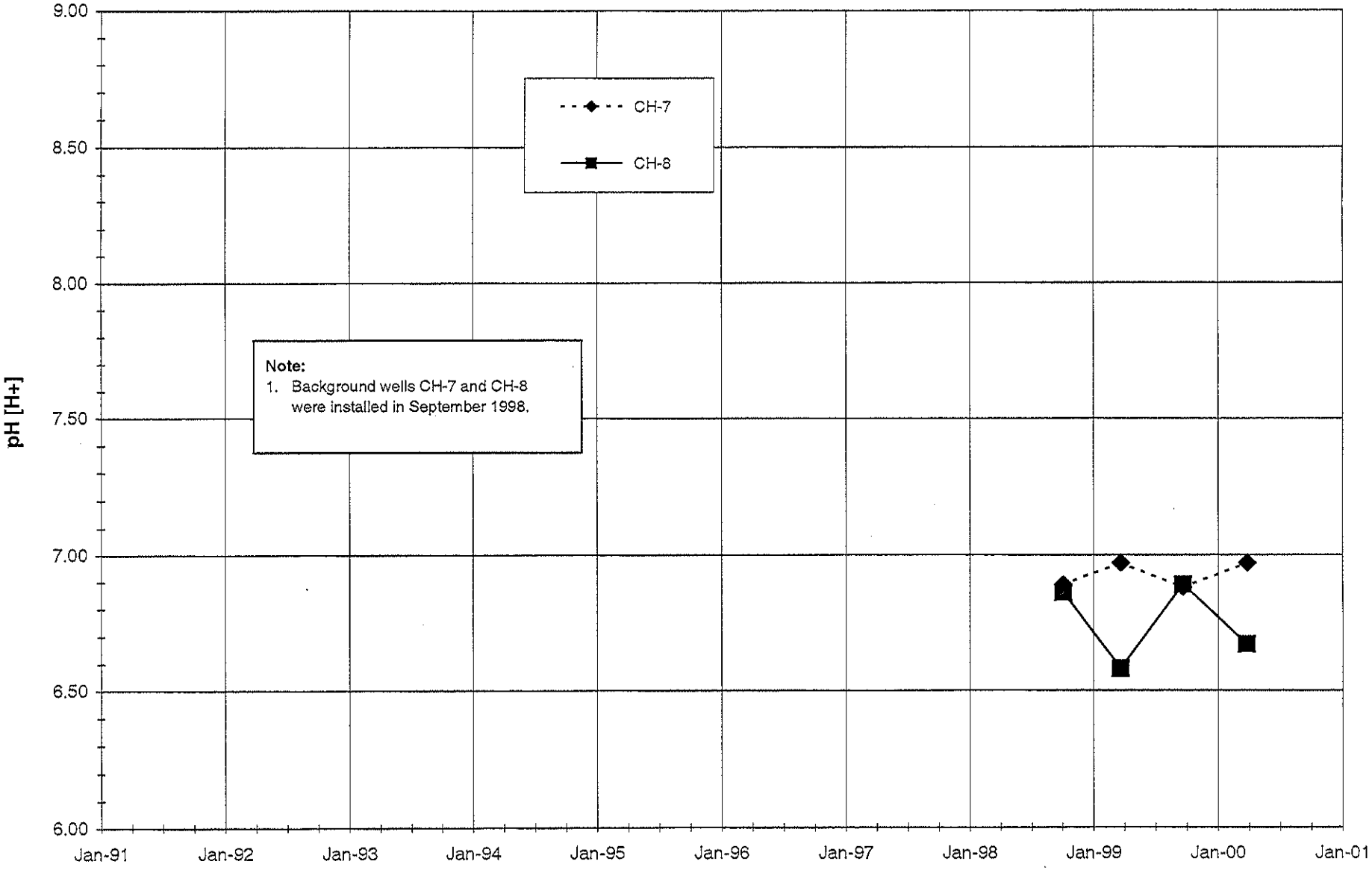

Figure C-17
pH Measurements (CH-7, CH-8)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

P:\Weyco\148834\RIReport\AppDC\
chwells2000.xls\C-17 pH Chart CH-7, -8

Printed 07/23/2001

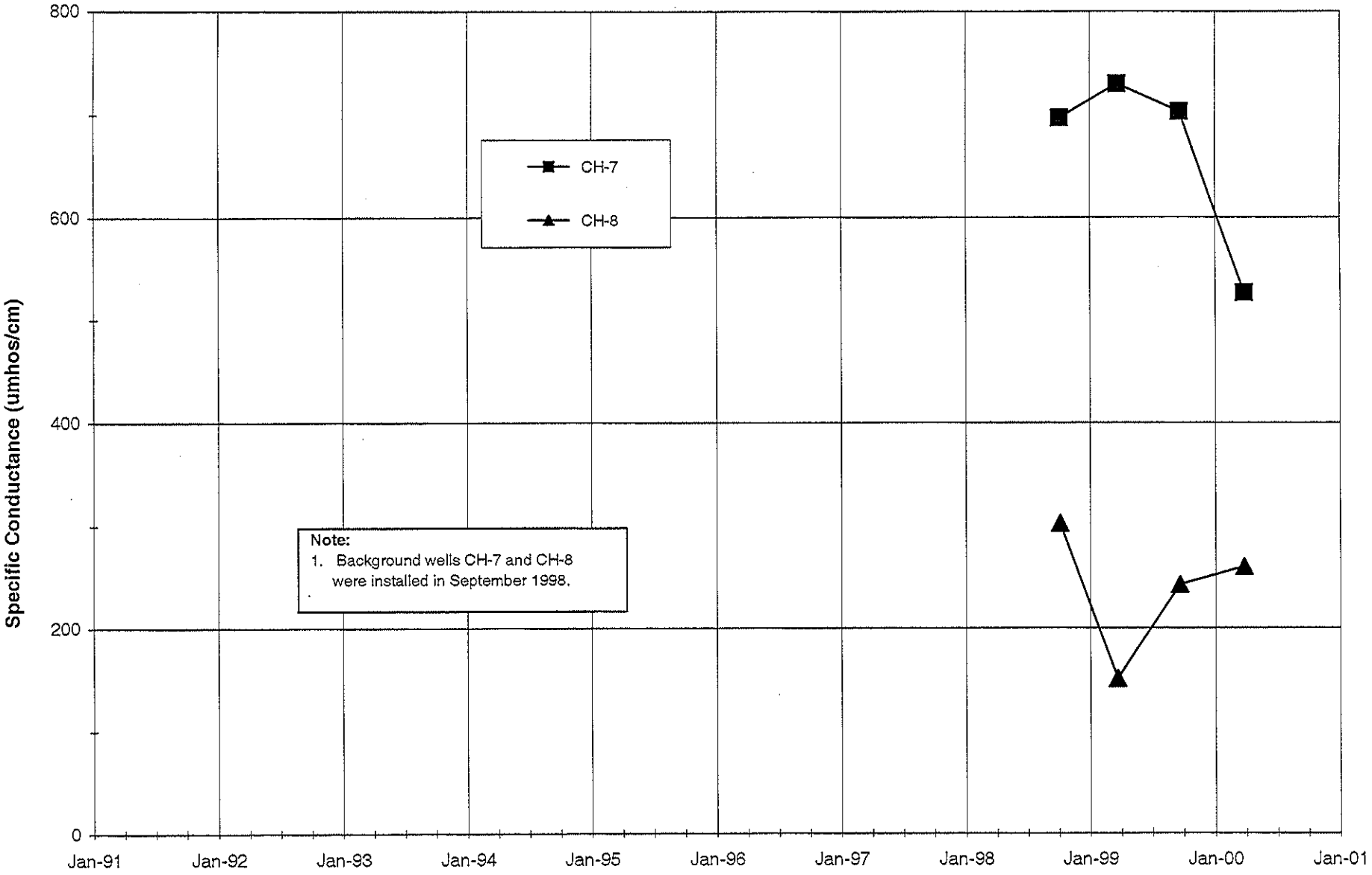

Figure C-18
Specific Conductance Measurements (CH-7, CH-8)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

P:\Weyco\148834\RIReport\APPDc\
chwells2000.xls\C-18 Spec Cond Chart CH-7,8

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Table C-3
Groundwater Analytical Results for MW Wells - West Area
Weyerhaeuser Company - Longview, Washington

Well ID	Sample Collection Date	Dissolved Mercury Concentration (mg/L)		pH [H^+]	Specific Conductance (umhos/cm)
MW-1	8/5/87	0.0002	U (a)	NA (b)	NA
	9/3/87	0.0005	U	NA	NA
	11/4/87	0.0002	U	NA	NA
	1/12/88	0.0005	U	NA	NA
	3/7/88	0.0008	U	NA	NA
	5/9/88	0.0002	U	NA	NA
	7/7/88	0.0010	U	NA	NA
	8/5/88	0.0001	U	NA	NA
	12/30/88	0.0002	U	NA	NA
	3/22/89	0.0005	U	NA	NA
	6/23/89	0.0005	U	NA	NA
	8/23/89	0.0005	U	NA	NA
	10/9/89	0.0008	U	NA	NA
	11/1/89	0.0005	U	NA	NA
	12/28/89	0.0005	U	NA	NA
	4/2/90	0.0005	U	NA	NA
	6/29/90	0.0005	U	NA	NA
	8/24/90	0.0005	U	NA	NA
	10/4/90	0.0005	U	NA	NA
	1/9/91	0.0005	U	NA	NA
	10/4/91	0.0005	U	6.74	741
	11/5/91	0.0005	U	6.86	640
	1/20/92	0.0005	U	6.95	1,860
	4/20/92	0.0005	U	7.15	1,540
	7/21/92	0.0005	U	6.88	1,190
	11/17/92	0.0005	U	7.03	798
	2/1/93	0.0005	U	7.02	972
	4/23/93	0.0005	U	7.05	759
	7/23/93	0.0005	U	6.87	956
	11/22/93	0.0005	U	6.79	1,190
	1/25/94	0.0005	U	7.13	493
	4/26/94	0.0005	U	7.02	1,030
	7/20/94	0.0005	U	6.82	1,000
	11/15/94	0.0005	U	6.75	588
	1/11/95	0.0005	U	6.87	307
	4/12/95	0.0005	U	6.90	339
	7/19/95	0.0005	U	7.32	813
	11/29/95	0.0005	U	7.21	175
	1/17/96	0.0005	U	6.81	2,110
	4/10/96	0.0005	U	7.13	448
	7/18/96	0.0005	U	7.00	474
	11/12/96	0.0005	U	6.57	576
	1/16/97	0.0005	U	6.37	262
	4/14/97	0.0002	U	6.60	280
	8/13/97	0.0005	U	6.53	583
	3/11/98	0.0005	U	6.96	360
	10/7/98	0.0002	U	6.98	575
	3/24/99	0.0002	U	6.55	470
	3/29/00	0.0002	U	6.69	525

Table C-3
Groundwater Analytical Results for MW Wells - West Area
Weyerhaeuser Company - Longview, Washington

Well ID	Sample Collection Date	Dissolved Mercury Concentration (mg/L)		pH [H^+]	Specific Conductance (umhos/cm)
MW-2	8/5/87	0.0002	U	NA	NA
	9/3/87	0.0005	U	NA	NA
	11/4/87	0.0002	U	NA	NA
	1/12/88	0.0020	U	NA	NA
	3/7/88	0.0008	U	NA	NA
	5/9/88	0.0008	U	NA	NA
	7/7/88	0.0010	U	NA	NA
	8/5/88	0.0001	U	NA	NA
	12/30/88	0.0002		NA	NA
	3/22/89	0.0005	U	NA	NA
	6/23/89	0.0005	U	NA	NA
	8/23/89	0.0005	U	NA	NA
	10/9/89	0.0008	U	NA	NA
	11/1/89	0.0005	U	NA	NA
	12/28/89	0.0005	U	NA	NA
	4/2/90	0.0005	U	NA	NA
	6/29/90	0.0005	U	NA	NA
	8/24/90	0.0005	U	NA	NA
	10/4/90	0.0005	U	NA	NA
	1/9/91	0.0005	U	NA	NA
	10/4/91	0.0005	U	7.12	19,800
	11/5/91	0.0005	U	6.73	24,200
	1/20/92	0.0005	U	6.50	18,800
	4/20/92	0.0005	U	6.68	12,000
	7/20/92	0.0005	U	6.75	21,600
	11/16/92	0.0005	U	7.45	13,600
	2/1/93	0.0005	U	7.00	21,800
	4/23/93	0.0005	U	6.96	15 (c)
	7/23/93	0.0005	U	6.63	14,400
	11/22/93	0.0005	U	6.90	10 (c)
	1/25/94	0.0005	U	6.87	9,680
	4/26/94	0.0005	U	7.08	8,010
	7/20/94	0.0005	U	7.32	10,500
	11/15/94	0.0009		7.39	1,820
	1/11/95	0.0005	U	9.57	7,270
	4/12/95	0.0005	U	6.89	8,310
	7/19/95	0.0005	U	6.99	8,010
	11/29/95	0.0005	U	6.98	2,280
	1/17/96	0.0005	U	6.57	9,600
	4/10/96	0.0005	U	6.55	8,800
	7/17/96	0.0005	U	7.26	4,030
	11/12/96	0.0005	U	6.84	4,710
	1/16/97	0.0005	U	6.67	4,301
	4/14/97	0.0005		6.78	3,602
	8/13/97	0.0005	U	7.07	3,832
	3/10/98	0.0005	U	6.28	32,700
	10/6/98	0.0002	U	7.34	9,290
	3/24/99	0.0002	U	6.38	6,980
	3/29/00	0.0002	U	6.59	1,443

Table C-3
Groundwater Analytical Results for MW Wells - West Area
Weyerhaeuser Company - Longview, Washington

Well ID	Sample Collection Date	Dissolved Mercury Concentration (mg/L)		pH [H^+]	Specific Conductance (umhos/cm)
MW-3	8/5/87	0.0040	U	NA	NA
	9/3/87	0.0005	U	NA	NA
	11/4/87	0.0002	U	NA	NA
	1/12/88	0.0030		NA	NA
	3/7/88	0.0008	U	NA	NA
	5/9/88	0.0008	U	NA	NA
	7/7/88	0.0010	U	NA	NA
	8/5/88	0.0001	U	NA	NA
	12/30/88	0.0015	U	NA	NA
	3/22/89	0.0005	U	NA	NA
	6/23/89	0.0005	U	NA	NA
	8/23/89	0.0005	U	NA	NA
	10/9/89	0.0008	U	NA	NA
	11/1/89	0.0005	U	NA	NA
	12/28/89	0.0010	U	NA	NA
	4/2/90	0.0005	U	NA	NA
	6/29/90	0.0005	U	NA	NA
	8/24/90	0.0040	U	NA	NA
	10/4/90	0.0072	U	NA	NA
	1/9/91	0.0005	U	NA	NA
	10/4/91	0.0005	U	7.92	443,000
	11/5/91	0.0005	U	7.53	321,000
	1/20/92	0.0005	U	6.76	11,100
	4/20/92	0.0005	U	8.33	170,000
	7/21/92	0.0005	U	7.73	127,000
	11/16/92	0.0005	U	7.69	117,000
	2/1/93	0.0005	U	7.09	109,000
	4/23/93	0.0005	U	7.30	9,840
	7/23/93	0.0005	U	7.25	67,900
	11/22/93	0.0005	U	7.53	30 (c)
	1/25/94	0.0040	U (d)	6.87	9,720
	4/26/94	0.0020	U (d)	6.75	9,180
	7/20/94	0.0008	U (d)	7.63	288,000
	11/15/94	0.0005	U	7.34	1,060
	1/11/95	0.0005	U	7.28	127,000
	4/12/95	0.0005	U	6.96	48,700
	7/19/95	0.0005	U	6.78	96,200
	11/29/95	0.0005	U	7.05	315
	1/17/96	0.0005	U	7.13	1,070
	4/10/96	0.0005	U	7.38	2,070
	7/17/96	0.0005	U	6.76	93,300
	11/12/96	0.0005	U	6.06	166,000
	1/16/97	0.0005	U	6.34	3,355
	4/14/97	0.0005		7.01	2,224
	8/13/97	0.0005	U	6.19	104,200
	3/10/98	0.0005	U	6.63	3,600
	10/7/98	0.0011		7.06	175,900
	3/24/99	0.0002	U	6.71	2,175
	3/29/00	0.0002	U	7.07	15,690

Table C-3
Groundwater Analytical Results for MW Wells - West Area
Weyerhaeuser Company - Longview, Washington

Well ID	Sample Collection Date	Dissolved Mercury Concentration (mg/L)		pH [H^+]	Specific Conductance (umhos/cm)
MW-4	8/5/87	0.0390		NA	NA
	9/3/87	0.0330		NA	NA
	11/4/87	0.0310		NA	NA
	1/12/88	0.0120		NA	NA
	3/7/88	0.0120		NA	NA
	5/9/88	0.0026		NA	NA
	7/7/88	0.0050		NA	NA
	8/5/88	0.0210		NA	NA
	12/30/88	0.0028		NA	NA
	3/22/89	0.0069		NA	NA
	6/23/89	0.0064		NA	NA
	8/23/89	0.0042		NA	NA
	10/9/89	0.0150		NA	NA
	11/1/89	0.0170		NA	NA
	12/28/89	0.0061		NA	NA
	4/2/90	0.0007		NA	NA
	6/29/90	0.0017		NA	NA
	8/24/90	0.0028		NA	NA
	10/4/90	0.0010		NA	NA
	1/24/91	0.0008		NA	NA
	10/4/91	0.0007		10.32	6,190
	11/5/91	0.0007		10.47	7,360
	1/20/92	0.0005	U	9.38	1,230
	4/28/92	0.0005	U	9.53	2,120
	7/20/92	0.0005	U	9.55	6,370
	11/16/92	0.0005	U	9.03	3,170
	2/1/93	0.0005	U	10.25	6,090
	4/22/93	0.0005	U	7.68	469
	7/23/93	0.0005	U	9.86	5,520
	11/23/93	0.0005	U	7.91	1,460
	1/25/94	0.0005	U	7.86	704
	4/26/94	0.0005	U	9.52	2,130
	7/20/94	0.0005	U	8.84	1,300
	11/15/94	0.0005	U	9.46	1,980
	1/11/95	0.0005	U	9.57	883
	4/12/95	0.0005	U	8.96	1,660
	7/19/95	0.0005	U	9.33	1,740
	11/29/95	0.0005	U	8.64	966
	1/17/96	0.0005	U	7.36	35 (c)
	4/10/96	0.0005	U	7.50	1,000
	7/17/96	0.0005	U	8.60	1,260
	11/12/96	0.0005	U	7.74	1,390
	1/16/97	0.0005	U	6.67	366
	4/14/97	0.0004		8.60	950
	8/13/97	0.0005	U	9.19	1,597
	3/11/98	0.0005	U	9.45	930
	10/6/98	0.0027		10.39	3,012
	3/25/99	0.0002	U	8.99	735
	3/29/00	0.0002	U	9.52	9 (c)

Notes:
(a) U = Not detected at or above the Laboratory Method Reporting Limit.
(b) NA = Laboratory data not available for pH and electrical conductivity.
(c) Value questionable because significantly different from historical data record.
(d) Method detection limit was elevated because sample required diluting.
1. Beginning 1999, MW wells sampled at an annual frequency.
2. After 1992 values presented are averages of parent and duplicate samples. Prior to this time, only parent sample values were reported.
3. EPA Methods: Dissolved Mercury = 7470; pH = 150.1; Conductivity = 120.1.

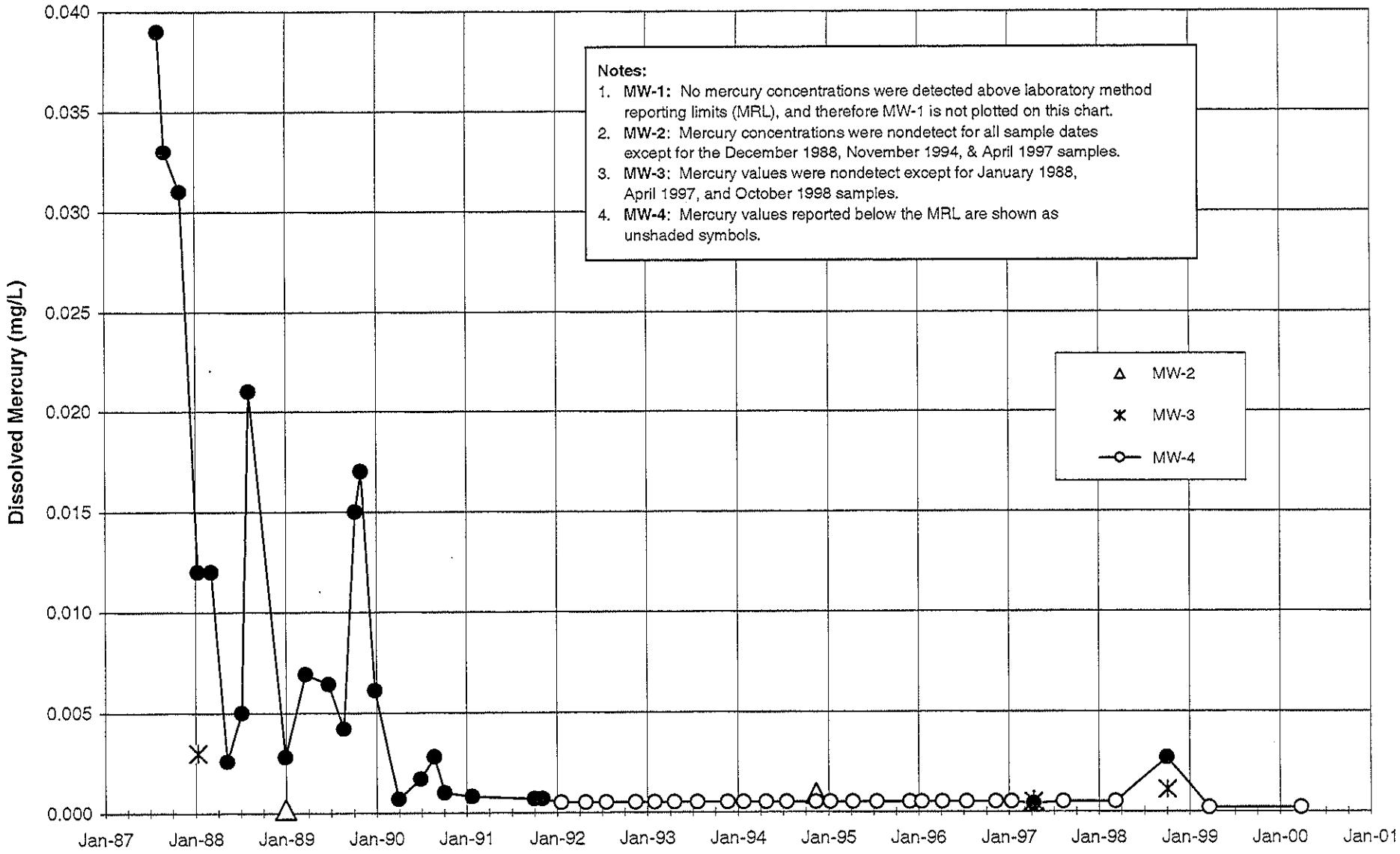

Figure C-19
Dissolved Mercury Concentrations in Groundwater (MW-1, MW-2, MW-3, MW-4)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

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MWwells2000.xls\C-19 Hg Chart MW Wells

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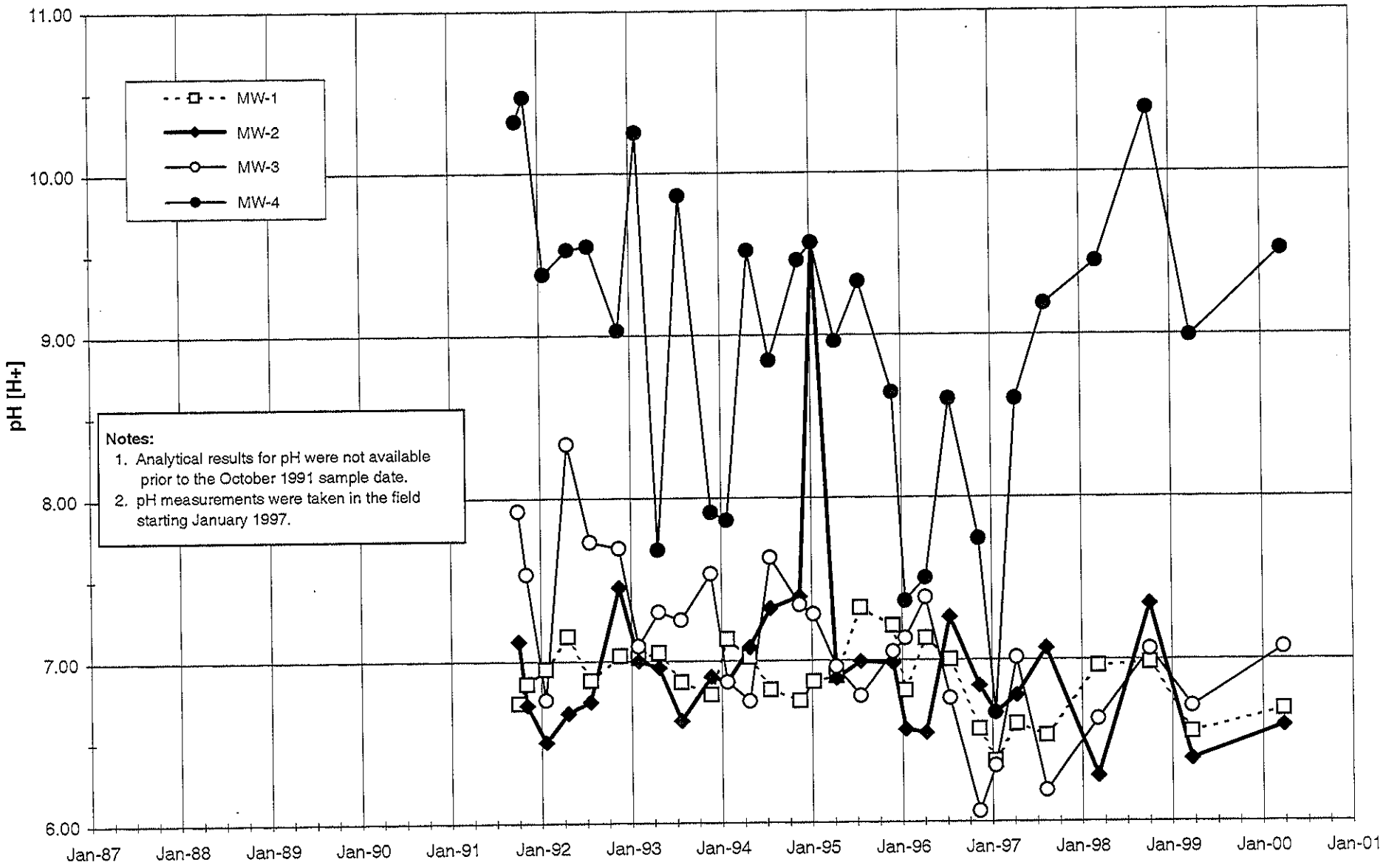

Figure C-20
pH Measurements (MW-1, MW-2, MW-3, MW-4)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

P\Weyco\148834\RIReport\AppdC\
MWwells2000.xls\C-20 pH Chart MW Wells

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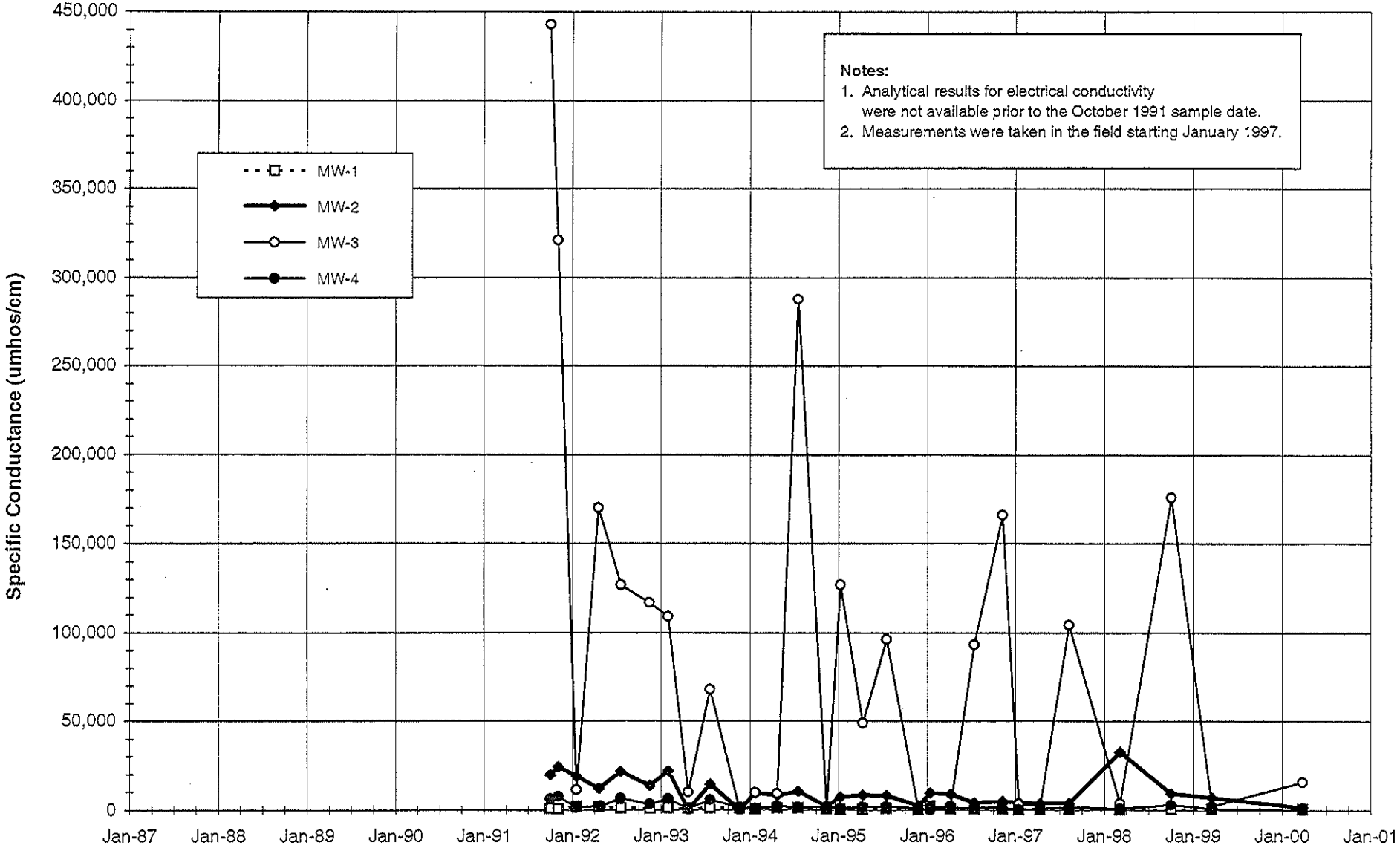

Figure C-21
Specific Conductance
Measurements (MW-1. MW-2, MW-3, MW-4)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

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MWwells2000.xls\C-21 Spec Cond Chart MW Wells

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Table C-4
Groundwater Analytical Results for HLA Wells
Former No. 1 Cell Room Area
Weyerhaeuser Company - Longview, Washington

Well No.	Sample Collection Date	Dissolved Mercury Concentration (mg/L)	pH [H+]	Specific Conductance (umhos/cm)
HLA-1A	02/04/91	0.5690	9.7 (a)	843
	02/28/91	0.4360	10.2 (a)	750 (b)
	04/12/91	0.4020	9.8 (a)	440 (b)
	06/11/91	0.4450	9.7 (a)	620 (b)
	11/06/91	0.3000	9.68	928
	01/20/92	0.1260	9.47	856
	04/20/92	0.3520	9.90	573
	07/22/92	0.2790	8.91	1,290
	11/16/92	(c)	(c)	(c)
	02/02/93	0.3380	9.32	666
	04/23/93	0.2250	8.87	436
	07/23/93	0.3110	8.44	772
	11/22/93	(c)	(c)	(c)
	01/25/94	0.1800	8.61	624
	04/27/94	0.4700	8.96	344
	07/20/94	(c)	(c)	(c)
	11/16/94	0.4050	9.57	690
	01/12/95	0.4070	9.21	692
	04/13/95	0.1810	9.68	528
	07/20/95	0.2600	9.04	1,610
	11/30/95	0.2120	9.75	734
	01/18/96	0.1870	9.85	562
	04/11/96	0.3090	9.81	557
	07/18/96	0.6860	9.35	885
	11/13/96	0.5290	9.57	619
	01/16/97	0.6500	9.76	470
	04/14/97	0.2410	10.12	530
	08/13/97	0.0275	8.61	1,798
	03/11/98	0.0594	10.29	518
	10/06/98	(c)	(c)	(c)
	03/24/99	0.1600	9.94	520
	09/22/99	(c)	(c)	(c)
	03/28/00	0.1490	9.20	462

Table C-4
Groundwater Analytical Results for HLA Wells
Former No. 1 Cell Room Area
Weyerhaeuser Company - Longview, Washington

Well No.	Sample Collection Date	Dissolved Mercury Concentration (mg/L)		pH [H+]		Specific Conductance (umhos/cm)	
HLA-1B	01/30/91	0.3340		11.1	(a)	1,370	
	02/27/91	0.1140		11.2	(a)	1,800	(b)
	04/11/91	0.1520		10.9	(a)	1,600	(b)
	06/11/91	0.1060		11.1	(a)	2,550	(b)
	11/06/91	0.1200		10.90		2,980	
	01/20/92	0.0187		10.82		2,420	
	04/20/92	0.0532		10.82		2,040	
	07/22/92	0.0695		10.57		2,250	
	11/18/92	0.0220		10.24		2,410	
	02/02/93	0.2310		10.79		2,170	
	04/23/93	0.0192		10.74		2,350	
	07/23/93	0.1090		10.88		2,320	
	11/22/93	0.0362		10.34		2,010	
	01/25/94	0.0651		10.62		2,060	
	04/27/94	0.0280		10.71		2,075	
	07/20/94	0.0390		10.48		2,050	
	11/16/94	0.1520		10.42		1,885	
	01/12/95	0.0581		10.44		1,610	
	04/13/95	0.0408		10.54		1,720	
	07/20/95	0.0898		10.80		1,540	
	11/30/95	0.1660		10.71		1,645	
	01/18/96	0.1590		10.81		1,465	
	04/11/96	0.1510		10.71		1,555	
	07/18/96	0.1360		10.60		1,275	
	11/13/96	0.1880		10.78		1,685	
	01/16/97	0.1320		10.64		1,218	
	04/14/97	0.1530		11.07		1,455	
	08/13/97	0.1560		10.60		1,570	
	03/11/98	0.1460		10.99		1,437	
	10/07/98	0.1250	J	10.37		1,785	
	03/24/99	0.0135		10.33		1,522	
	09/22/99	0.0770	J	10.49		1,631	
	03/28/00	0.0246		10.49		1,569	

Table C-4
Groundwater Analytical Results for HLA Wells
Former No. 1 Cell Room Area
Weyerhaeuser Company - Longview, Washington

Well No.	Sample Collection Date	Dissolved Mercury Concentration (mg/L)		pH [H+]		Specific Conductance (umhos/cm)	
HLA-2A	02/04/91	0.0327		5.1	(a)	794	
	03/01/91	0.0314		6.7	(a)	750	(b)
	04/11/91	0.0446		6.6	(a)	4,000	(b)
	06/11/91	0.0256		7.4	(a)	760	(b)
	11/06/91	0.0662		6.64		4,190	
	01/20/92	0.0915		6.82		1,990	
	04/20/92	0.1690		6.67		2,400	
	07/22/92	0.1900		6.99		1,610	
	11/18/92	0.0845		6.69		2,080	
	02/03/93	0.0629		7.02		1,830	
	04/23/93	0.0639		7.05		2,880	
	07/23/93	0.0789		6.54		2,240	
	11/22/93	0.0968		6.69		1,825	
	01/26/94	0.0678		6.75		1,835	
	04/27/94	0.0620		6.91		1,230	
	07/20/94		(c)		(c)		(c)
	11/16/94	0.0210		7.23		5,640	
	01/12/95	0.0294		7.48		242	
	04/12/95	0.0221		6.93		1,320	
	07/20/95	0.0281		6.89		1,840	
	11/30/95	0.0533		7.45		387	
	01/18/96	0.0272		6.74		1,520	
	04/11/96	0.0482		6.61		1,600	
	07/18/96	0.1750		6.80		2,020	
	11/13/96	0.2270		6.38		4,580	
	01/16/97	0.0517		6.51		12,380	
	04/14/97	0.0411		6.80		1,314	
	08/13/97	0.0696		6.39		1,518	
	03/11/98	0.0420		6.68		1,901	
	10/07/98	0.1420	J	6.75		1,530	
	03/25/99	0.0007		6.90		893	
	09/21/99	0.0320	J	6.28		1,840	
	03/28/00	0.0112		7.20		2,061	

Table C-4
Groundwater Analytical Results for HLA Wells
Former No. 1 Cell Room Area
Weyerhaeuser Company - Longview, Washington

Well No.	Sample Collection Date	Dissolved Mercury Concentration (mg/L)		pH [H+]		Specific Conductance (umhos/cm)	
HLA-3A	02/04/91	0.0192		9.7	(a)	4,910	
	03/01/91	0.0199		8.0	(a)	10,000	(b)
	04/11/91	0.0127		9.4	(a)	10,000	(b)
	06/11/91	0.0156		9.0	(a)	14,500	(b)
	11/06/91	0.0054		8.81		16,400	
	01/24/92	0.0058		8.93		16,000	
	04/20/92	0.0005	U	9.09		9,700	
	07/22/92	0.0225		8.73		4,890	
	11/16/92		(c)		(c)		(c)
	02/03/93	0.0148		9.78		7,035	
	04/23/93	0.0025		8.86		17,400	
	07/22/93	0.0033		9.21		13,000	
	11/22/93	0.0030		8.40		12	(d)
	01/26/94	0.0057		9.15		7,780	
	04/27/94	0.0020		9.72		11,000	
	07/20/94	0.0044		8.85		9,150	
	11/16/94	0.0152		9.05		10,800	
	01/12/95	0.0083		9.41		7,630	
	04/13/95	0.0086		9.21		9,740	
	07/20/95	0.0130		9.48		8,790	
	11/30/95	0.0124		9.61		967	(d)
	01/18/96	0.0070		9.44		9,770	
	04/11/96	0.0403		9.13		10,200	
	07/18/96	0.1900		9.30		17,300	
	11/13/96	0.0155		9.55		22,900	
	01/16/97	0.0190		9.17		9,560	
	04/14/97	0.0252		9.32		8,720	
	08/13/97	0.0062		9.21		19,050	
	03/10/98	0.0038		9.61		12,050	
	10/07/98	0.0056		9.51		11,630	
	03/23/99	0.0130		9.70		13,180	
	09/22/99	0.0077	J	9.06		7,540	
	03/28/00	0.0040		9.10		13,620	

Table C-4
Groundwater Analytical Results for HLA Wells
Former No. 1 Cell Room Area
Weyerhaeuser Company - Longview, Washington

Well No.	Sample Collection Date	Dissolved Mercury Concentration (mg/L)		pH [H+]		Specific Conductance (umhos/cm)	
HLA-3B	02/04/91	0.0039		8.2	(a)	31,500	
	03/06/91	0.0052				37,000	(b)
	04/12/91	0.0045		7.9	(a)	24,000	(b)
	06/11/91	0.0044		7.6	(a)	38,500	(b)
	11/06/91	0.0029		7.50		65,000	
	01/24/92	0.0035		7.44		35,800	
	04/26/92	0.0005	U	7.33		46,800	
	07/22/92	0.0029		7.15		46,600	
	11/18/92	0.0027		7.22		39,800	
	02/03/93	0.0020		7.49		55,200	
	04/23/93	0.0022		7.34		47,000	
	07/23/93	0.0017		7.49		28,500	
	11/22/93	0.0015		7.24		1,830	(d)
	01/26/94	0.0016		7.29		34,100	
	04/27/94	0.0012		7.30		36,000	
	07/20/94	0.0014		7.02		44,800	
	11/16/94	0.0026		7.03		52,000	
	01/12/95	0.0012		7.06		50,000	
	04/13/95	0.0014		7.19		35,300	
	07/20/95	0.0011		7.13		43,100	
	11/30/95	0.0013		7.20		43,500	
	01/18/96	0.0011		7.31		38,500	
	04/11/96	0.0011		7.36		35,500	
	07/18/96	0.0018		6.78		40,800	
	11/13/96	0.0028		7.37		44,300	
	01/16/97	0.0045		6.44		30,640	
	04/14/97	0.0037		6.83		36,980	
	08/13/97	0.0073		6.96		39,150	
	03/10/98	0.0050		6.74		37,100	
	10/07/98	0.0066		7.31		38,620	
	03/23/99	0.0028		8.10		35,500	
	09/22/99	0.0039	J	6.72		36,600	
	03/28/00	0.0035		6.85		37,940	

Table C-4
Groundwater Analytical Results for HLA Wells
Former No. 1 Cell Room Area
Weyerhaeuser Company - Longview, Washington

Well No.	Sample Collection Date	Dissolved Mercury Concentration (mg/L)		pH [H+]		Specific Conductance (umhos/cm)	
HLA-4A	02/04/91	0.0723		6.7	(a)	409	(b)
	02/28/91	0.0037		8.3	(a)	360	(b)
	04/11/91	0.0008		7.1	(a)	850	(b)
	06/11/91	0.0050		7.8	(a)	980	(b)
	11/06/91	0.0011		7.28		903	
	01/20/92	0.0005	U	7.04		976	
	04/20/92	0.0012		7.04		542	
	07/20/92		(c)		(c)		(c)
	11/16/82		(c)		(c)		(c)
	02/02/93	0.0082		7.70		648	
	04/23/93	0.0009		7.58		544	
	07/22/93		(c)		(c)		(c)
	11/22/93		(c)		(c)		(c)
	01/26/94	0.0006		7.47		451	
	04/26/94		(c)		(c)		(c)
	07/20/94		(c)		(c)		(c)
	11/15/94		(c)		(c)		(c)
	01/12/95	0.0040		7.02		262	
	04/13/95	0.0037		7.27		284	
	07/20/95		(c)		(c)		(c)
	11/30/95	0.0093		7.50		268	
	01/18/96	0.0034		7.21		225	
	04/11/96	0.0034		7.33		215	
	07/18/96		(c)		(c)		(c)
	11/13/96	0.0042		6.87		288	
	01/16/97	0.0017		6.43		144	
	04/14/97	0.0048		6.89		149	
	08/13/97		(c)		(c)		(c)
	03/11/98	0.0000	U	6.85		132	
	10/06/98		(c)		(c)		(c)
	03/24/99	0.0002	U	6.76		67	
	09/22/99		(c)		(c)		(c)
	04/03/00	0.0002	U	6.27		121	

Table C-4
Groundwater Analytical Results for HLA Wells
Former No. 1 Cell Room Area
Weyerhaeuser Company - Longview, Washington

Well No.	Sample Collection Date	Dissolved Mercury Concentration (mg/L)		pH [H+]		Specific Conductance (umhos/cm)	
HLA-6B	02/04/91	0.0005	U	7.7	(a)	18,700	
	02/27/91	0.0007		7.9	(a)	20,000	(b)
	04/11/91	0.0015		7.9	(a)	10,000	(b)
	06/11/91	0.0015			NR		NR
	11/06/91	0.0012		7.86		11,900	
	01/23/92	0.0005		7.50		15,700	
	04/20/92	0.0018		7.71		11,100	
	07/22/92	0.0006		7.55		18,400	
	11/18/92	0.0005	U	7.35		15,500	
	02/03/93	0.0005	U	7.72		23,700	
	04/23/93	0.0005	U	7.69		18,700	
	07/23/93	0.0005	U	7.57		14,000	
	11/23/93	0.0005	U	7.64		26,300	
	01/26/94	0.0005	U	7.38		21,900	
	04/27/94	0.0005	U	7.48		22,000	
	07/20/94	0.0005	U	7.36		26,400	
	11/16/94	0.0005	U	7.36		28,700	
	01/12/95	0.0005	U	7.47		23,500	
	04/13/95	0.0005	U	7.63		12,600	
	07/20/95	0.0005	U	7.79		10,300	
	11/30/95	0.0005	U	7.51		17,400	
	01/18/96	0.0005	U	7.67		14,800	
	04/11/96	0.0005	U	7.94		10,200	
	07/18/96	0.0006		7.75		6,630	
	11/13/96	0.0005	U	7.96		16,500	
	01/16/97	0.0005	U	7.43		10,000	
	04/14/97	0.0019		7.66		8,420	
	08/13/97	0.0011		7.73		5,370	
	03/10/98	0.0021		7.92		1,857	
	10/07/98	0.0030		8.33		3,056	
	03/23/99	0.0002	U	7.51		12,880	
	09/22/99	0.0002	R	6.88		17,870	
	03/28/00	0.0002	U	7.01		15,430	

Table C-4
Groundwater Analytical Results for HLA Wells
Former No. 1 Cell Room Area
Weyerhaeuser Company - Longview, Washington

Well No.	Sample Collection Date	Dissolved Mercury Concentration (mg/L)		pH [H+]		Specific Conductance (umhos/cm)	
HLA-7B	01/31/91	0.1040		10.3	(a)	2,380	
	02/26/91	1.8000		10.4	(a)	380	(b)
	04/11/91	0.4980		10.2	(a)	2,000	(b)
	06/11/91	0.1170		10.1	(a)	4,850	(b)
	11/06/91	0.1030		10.62		5,140	
	01/21/92	0.0376		10.49		2,160	
	04/20/92	0.0358		10.58		3,190	
	07/23/92	0.0164		10.37		3,910	
	11/17/92	0.0120		10.36		3,850	
	02/02/93	0.0272		10.67		3,540	
	04/23/93	0.0217		10.65		3,350	
	07/23/93	0.0186		10.96		3,080	
	11/23/93	0.0125		10.85		2,280	
	01/26/94	0.0421		11.00		2,430	
	04/26/94	0.0107		11.03		1,640	
	07/20/94	0.0144		10.95		2,020	
	11/15/94	0.0212		10.79		1,670	
	01/11/95	0.0334		10.68		1,680	
	04/12/95	0.0412		10.61		1,660	
	07/19/95	0.0628		10.58		1,620	
	11/29/95	0.0716		10.23		1,690	
	01/17/96	0.0679		10.32		1,600	
	04/10/96	0.0496		10.21		1,790	
	07/17/96	0.0397		10.40		1,800	
	11/12/96	0.0330		10.42		2,020	
	01/15/97	0.0285		10.63		2,183	
	04/14/97	0.0340		10.61		2,034	
	08/13/97	0.0278		10.25		1,997	
	03/10/98	0.0015		8.71		1,115	
	10/08/98	0.0102	J	9.73		1,289	
	03/23/99	0.0030		10.34		1,255	
	09/22/99	0.0008	J	9.57		4,948	
	03/27/00	0.0005		9.18		7,444	

Notes:

(a) Data collected in the field using methodology other than EPA Method 150.1.

(b) Data collected in the field using methodology other than EPA Method 120.1.

(c) Not analyzed because well was dry during sampling.

(d) Value questionable because significantly different from historical data record.

1. After 1992, values presented are averages of parent and duplicate samples. Prior to this time, only parent sample values were reported.
2. U = Value below Laboratory Method Reporting Limit.
3. NR = Value not reported.
4. EPA Methods: Dissolved Mercury = 7470; pH = 150.1; Conductivity = 120.1.

Source: HLA, 1991d for February through June 1991. CH2M HILL, 11/91, 1/92, 4/92, 7/92, 11/92, 2/93.

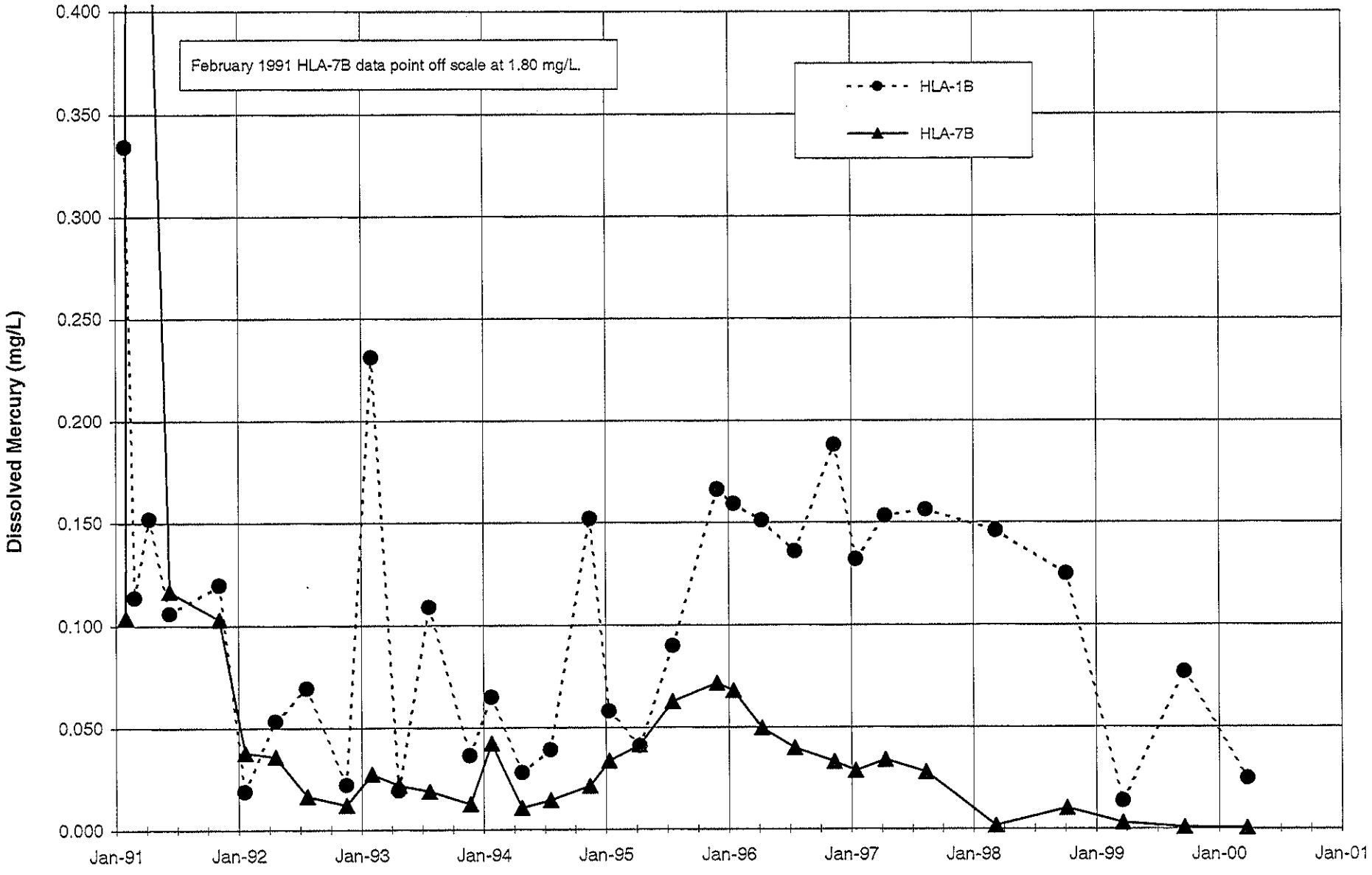

Figure C-22
Dissolved Mercury Concentrations in Groundwater (HLA-1B, HLA-7B)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

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HLAChem2000.xls\C-22 Hg HLA-1B_7B

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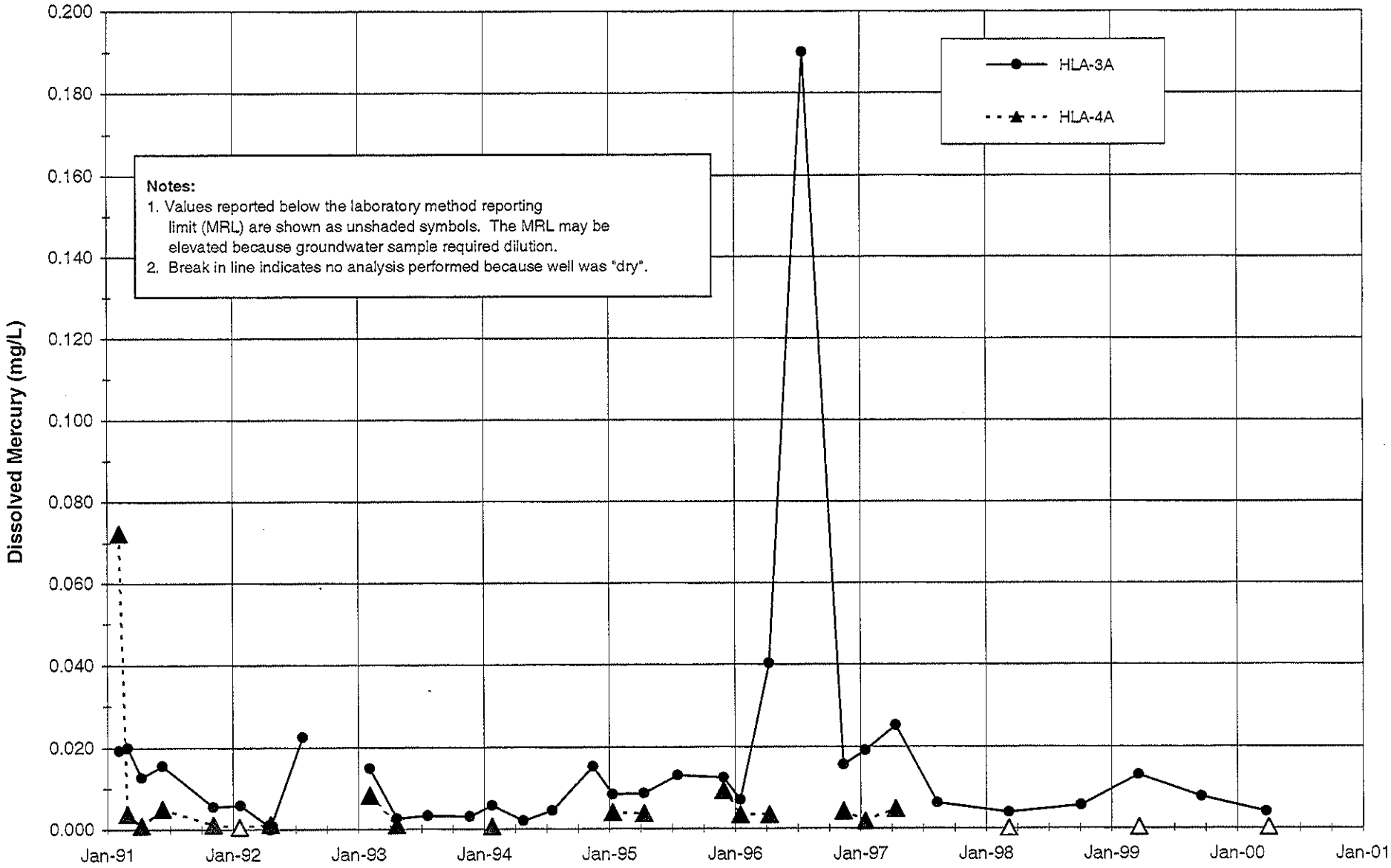

Figure C-23
Dissolved Mercury Concentrations in Groundwater (HLA-3A, HLA-4A)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

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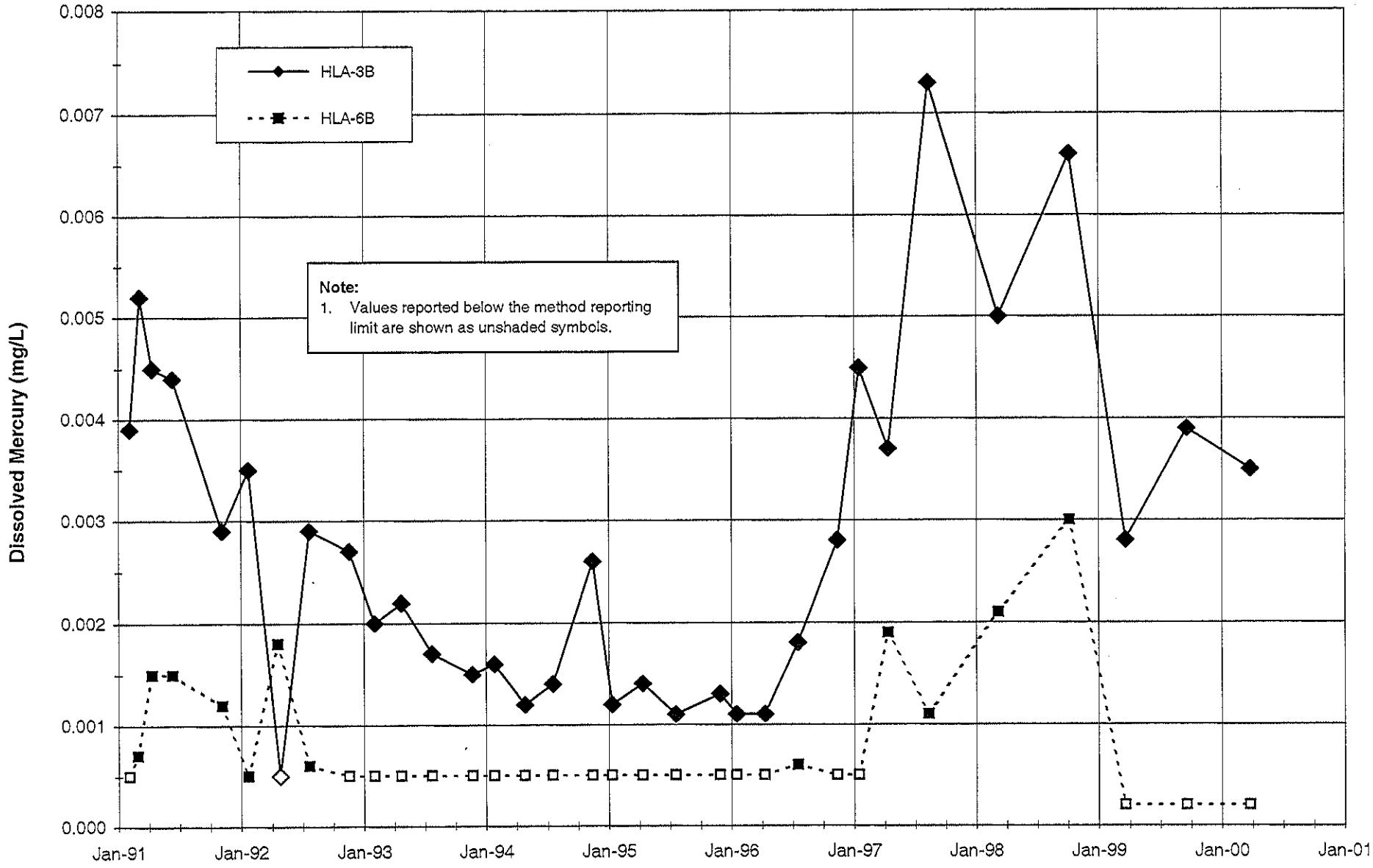

Figure C-24
Dissolved Mercury Concentrations in Groundwater (HLA-3B, HLA-6B)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

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HLAChem2000.xls\C-24 Hg HLA3B_6B

Printed 07/23/2001

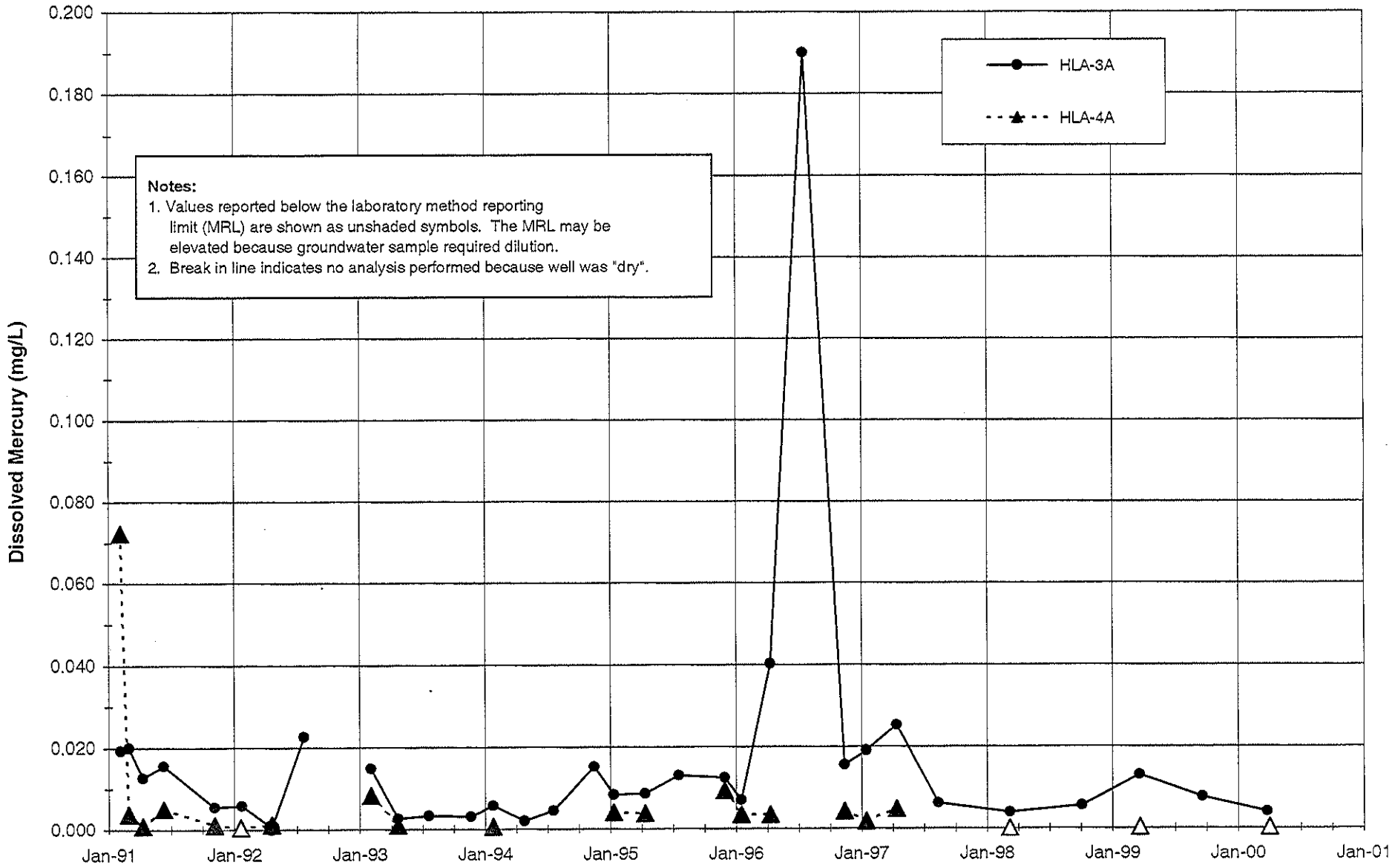


Figure C-23
Dissolved Mercury Concentrations in Groundwater (HLA-3A, HLA-4A)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

P:\Weyco\164539\GWMO\Annualrpt\GWMO2000\
HLAChem2000.xls\C-23 Hg HLA-3A_4A

Printed 07/23/2001

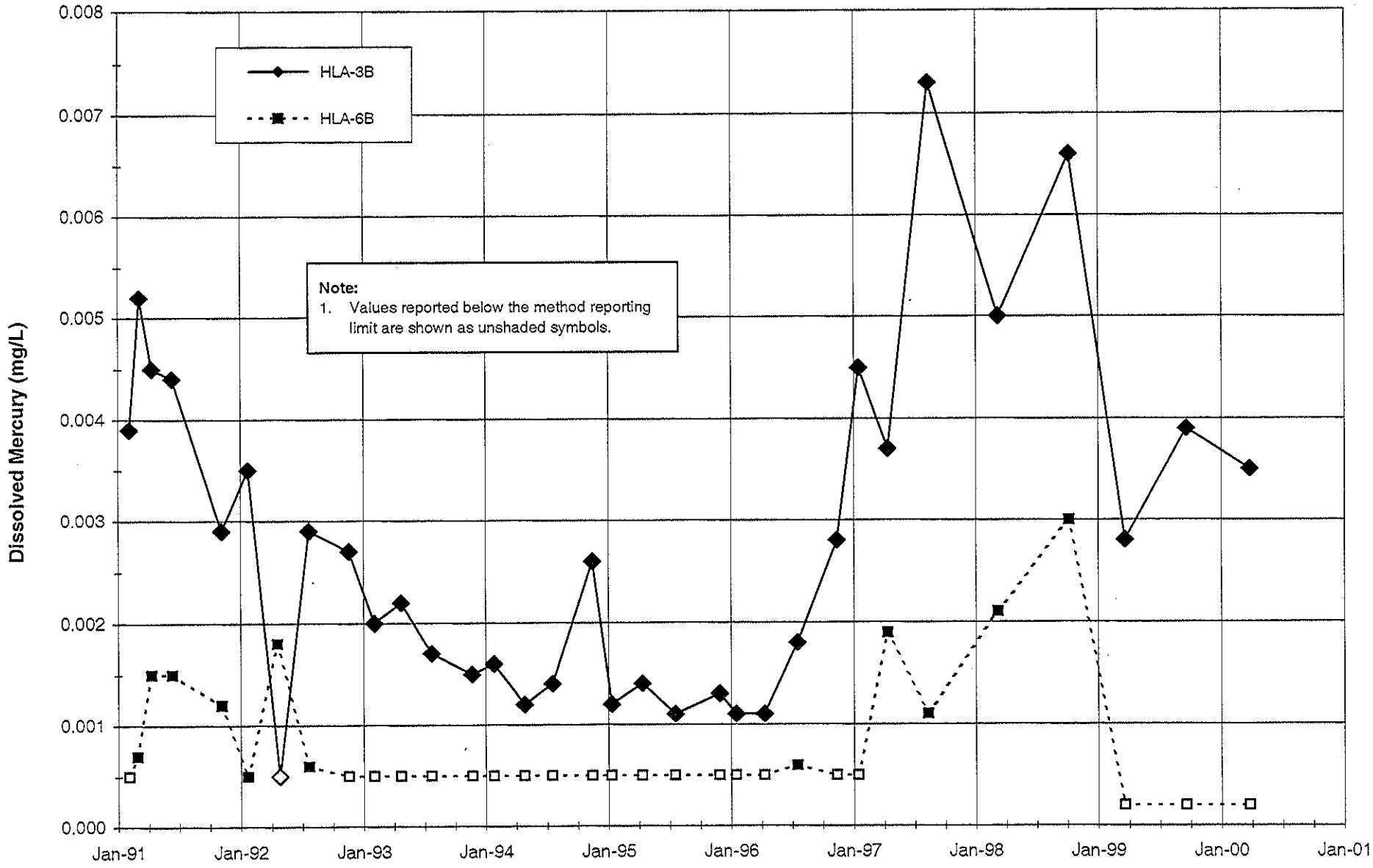


Figure C-24
Dissolved Mercury Concentrations in Groundwater (HLA-3B, HLA-6B)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

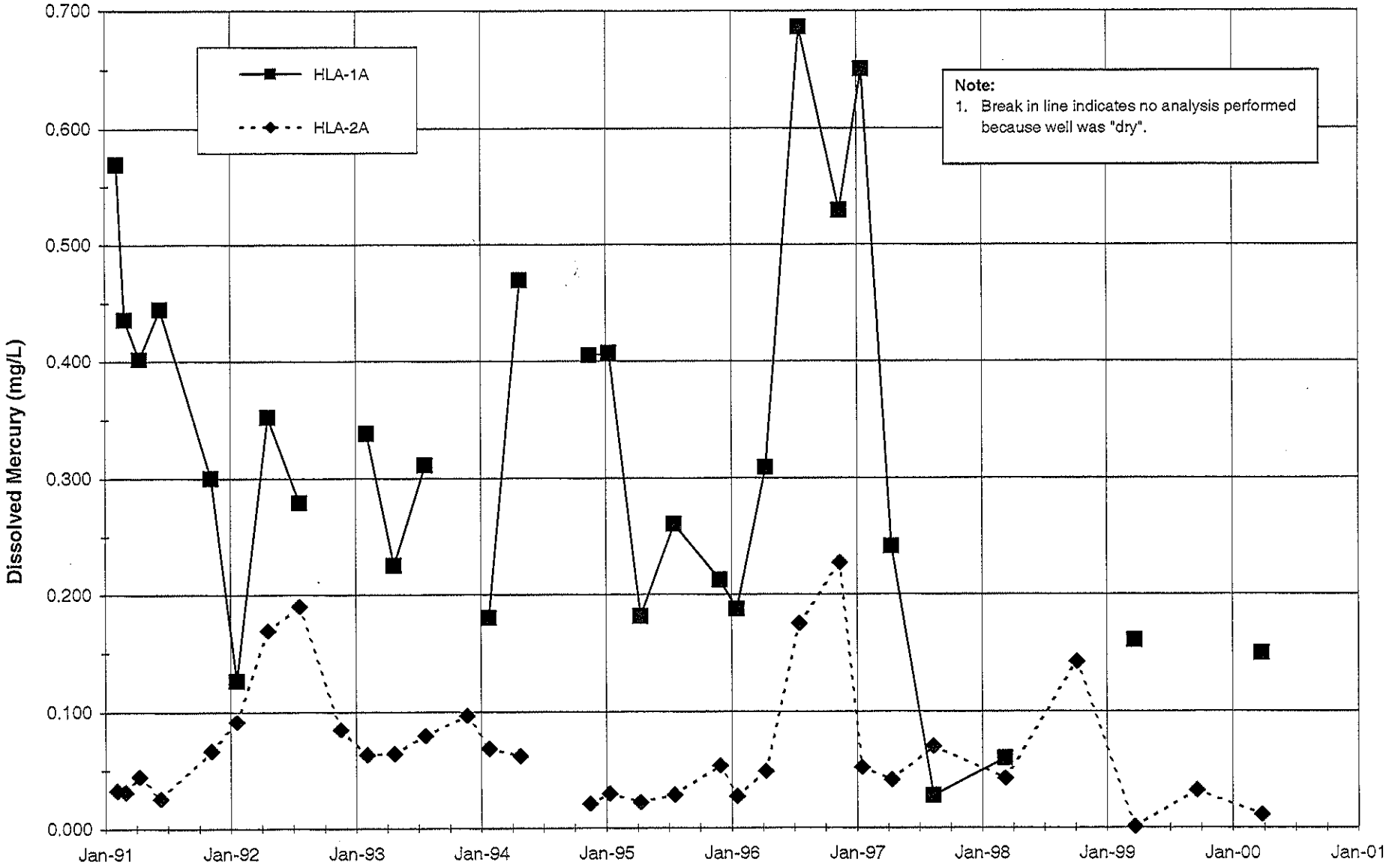


Figure C-25
Dissolved Mercury Concentrations in Groundwater (HLA-1A, HLA-2A)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

P:\Weyco\164539\GWMO\Annualrpt\GWMO2000\
HLAChem2000.xls\C-25 Hg HLA1A_HLA2A

Printed 07/23/2001

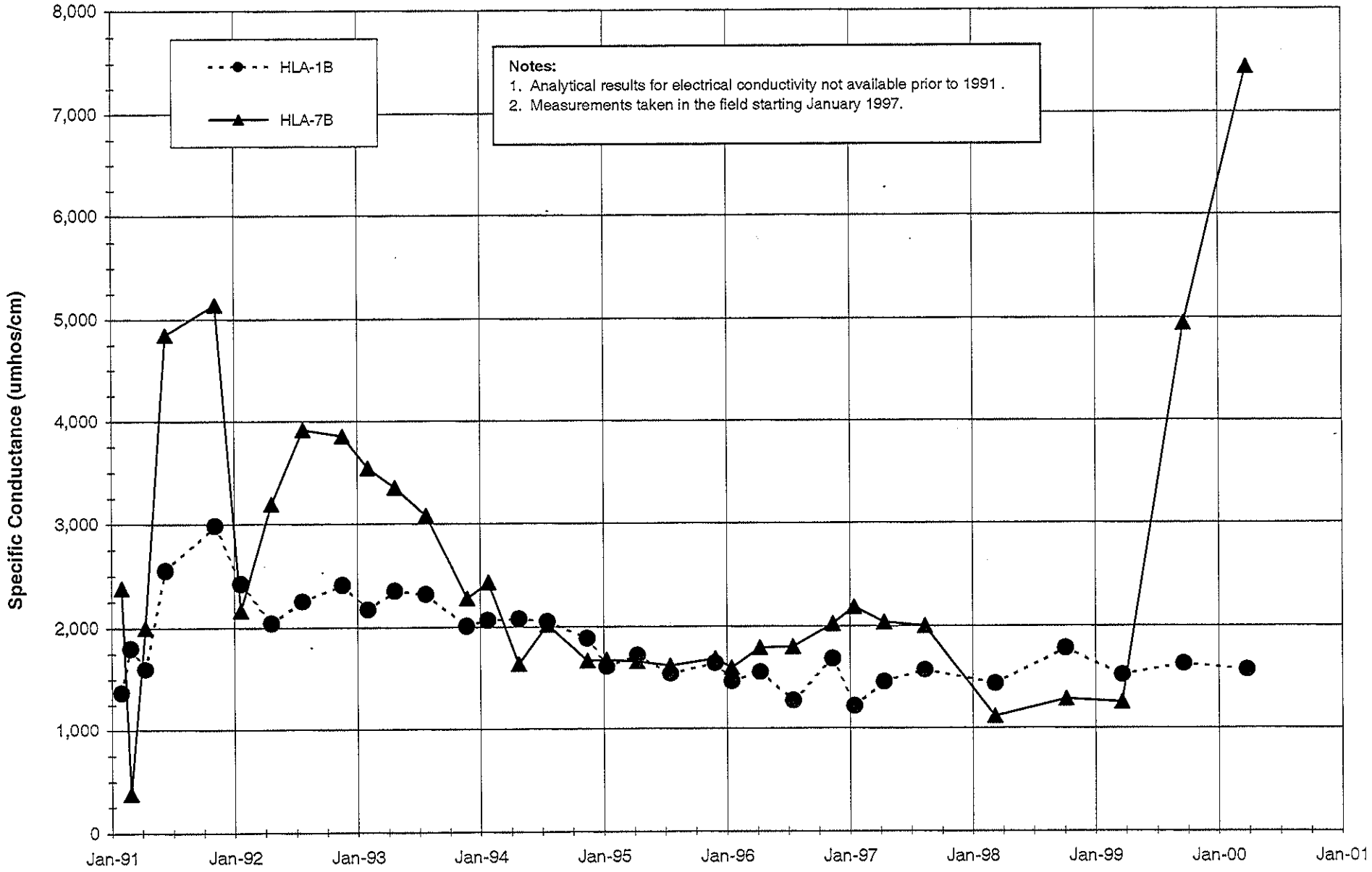


Figure C-26
Specific Conductance Measurements (HLA-1B, HLA-7B)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

P:\Weyco\164539\GWMO\Annualrpt\GWMO2000\
HLAChem2000.xls\C-26 Spec Cond HLA1B_7B

Printed 07/23/2001

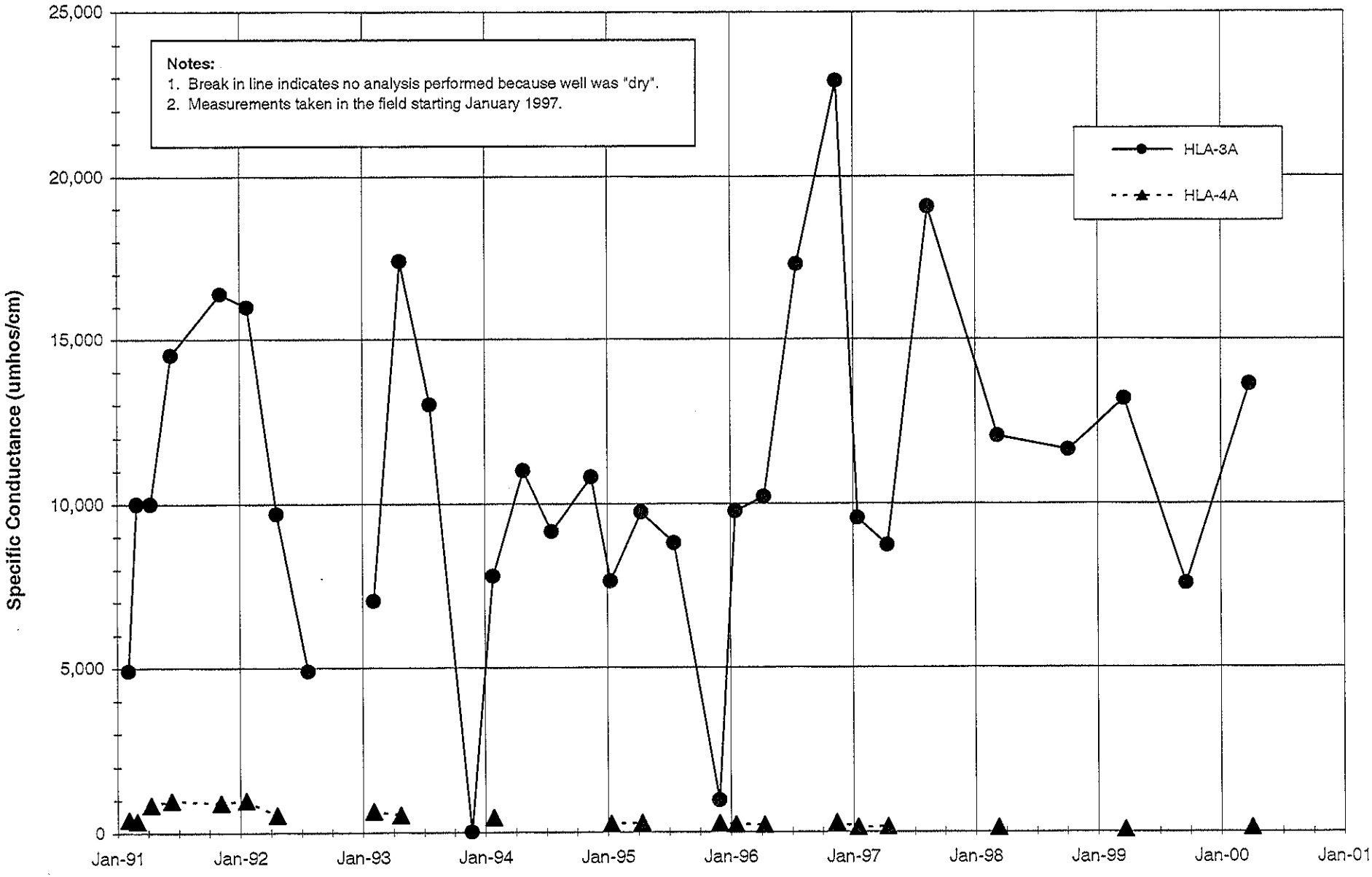


Figure C-27
Specific Conductance Measurements (HLA-3A, HLA-4A)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

P:\Weyco\164539\GWMO\Annualrpt\GWMO2000\
HLAChem2000.xls\C-27 Spec Cond HLA3A_4A

Printed 07/23/2001

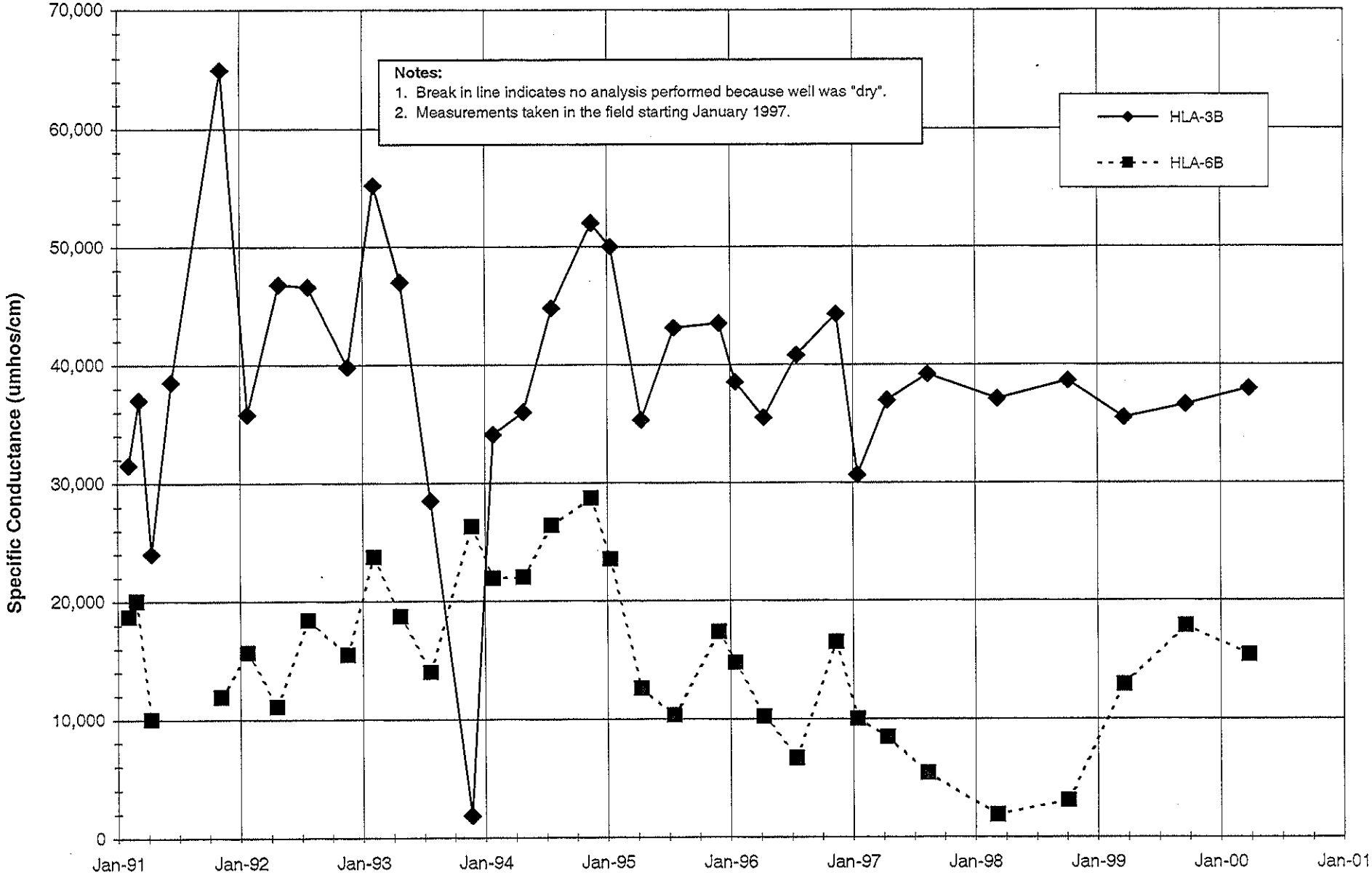


Figure C-28
Specific Conductance Measurements (HLA-3B, HLA-6B)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

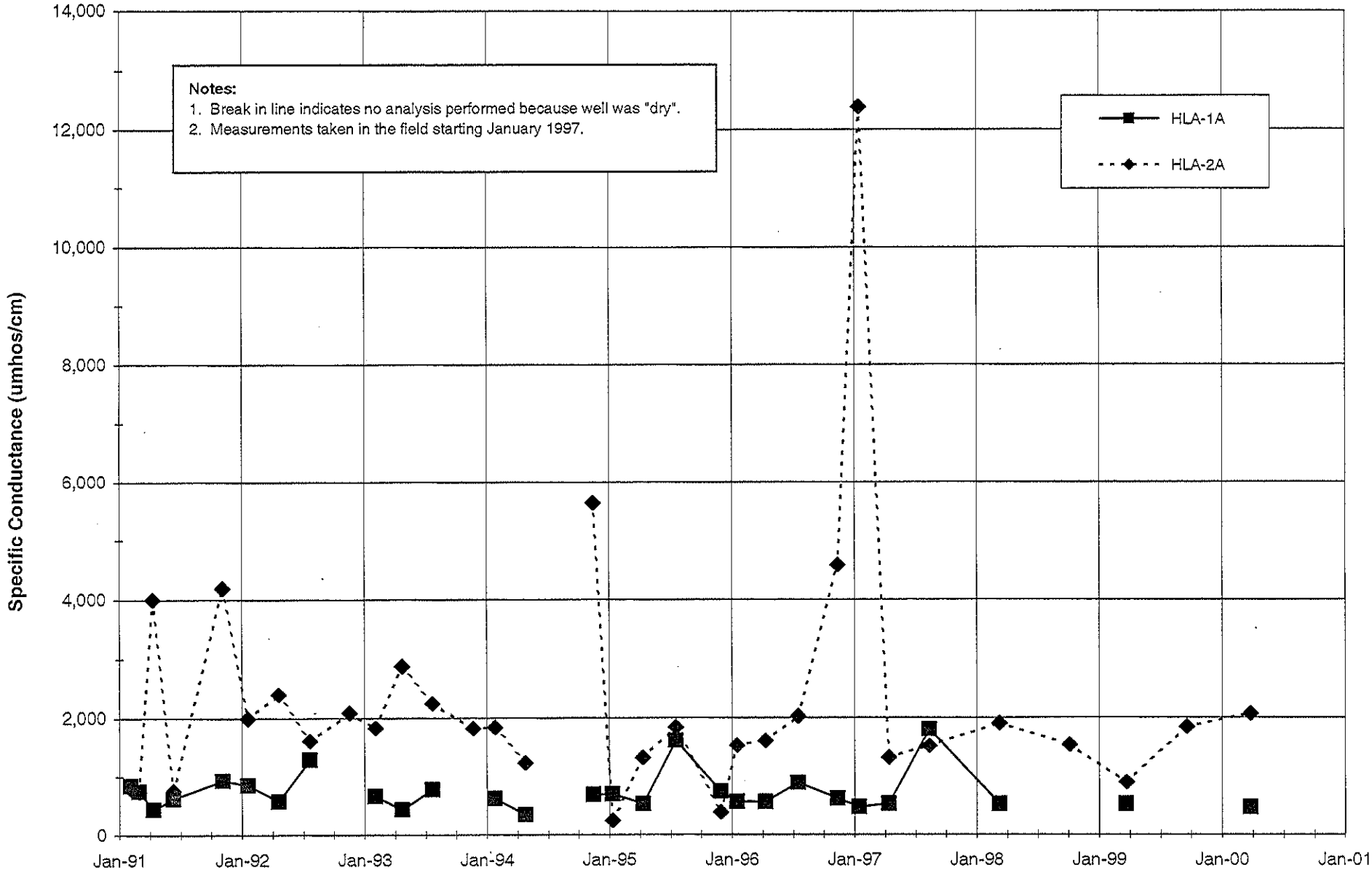


Figure C-29
Specific Conductance Measurements (HLA-1A, HLA-2A)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

P:\Weyco\164539\GWMO\Annualrpt\GWMO2000\
HLAChem2000.xls\C-29 Spec Cond HLA1A, 2A

Printed 07/23/2001

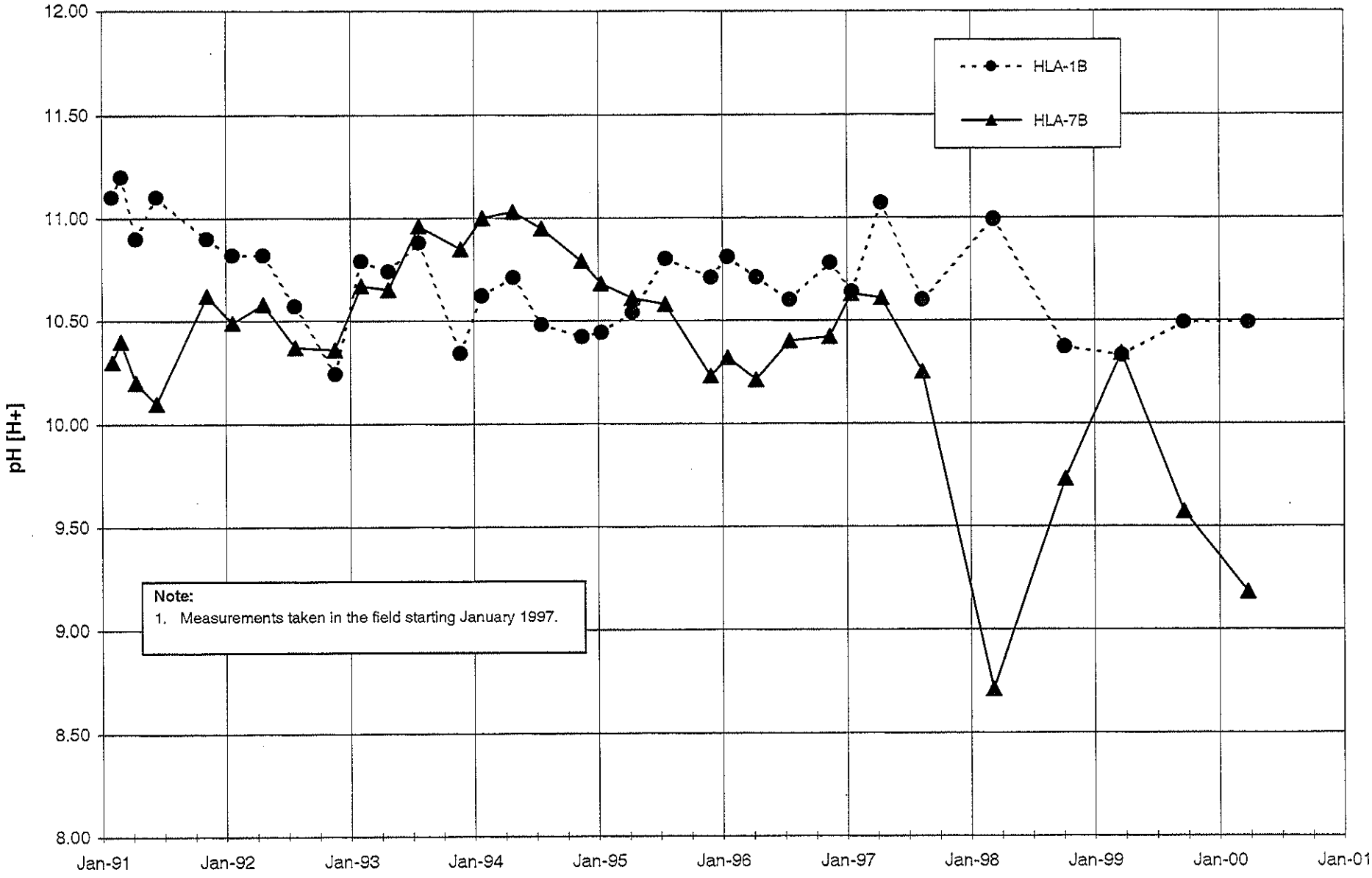


Figure C-30
pH Measurements (HLA-1B, HLA-7B)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

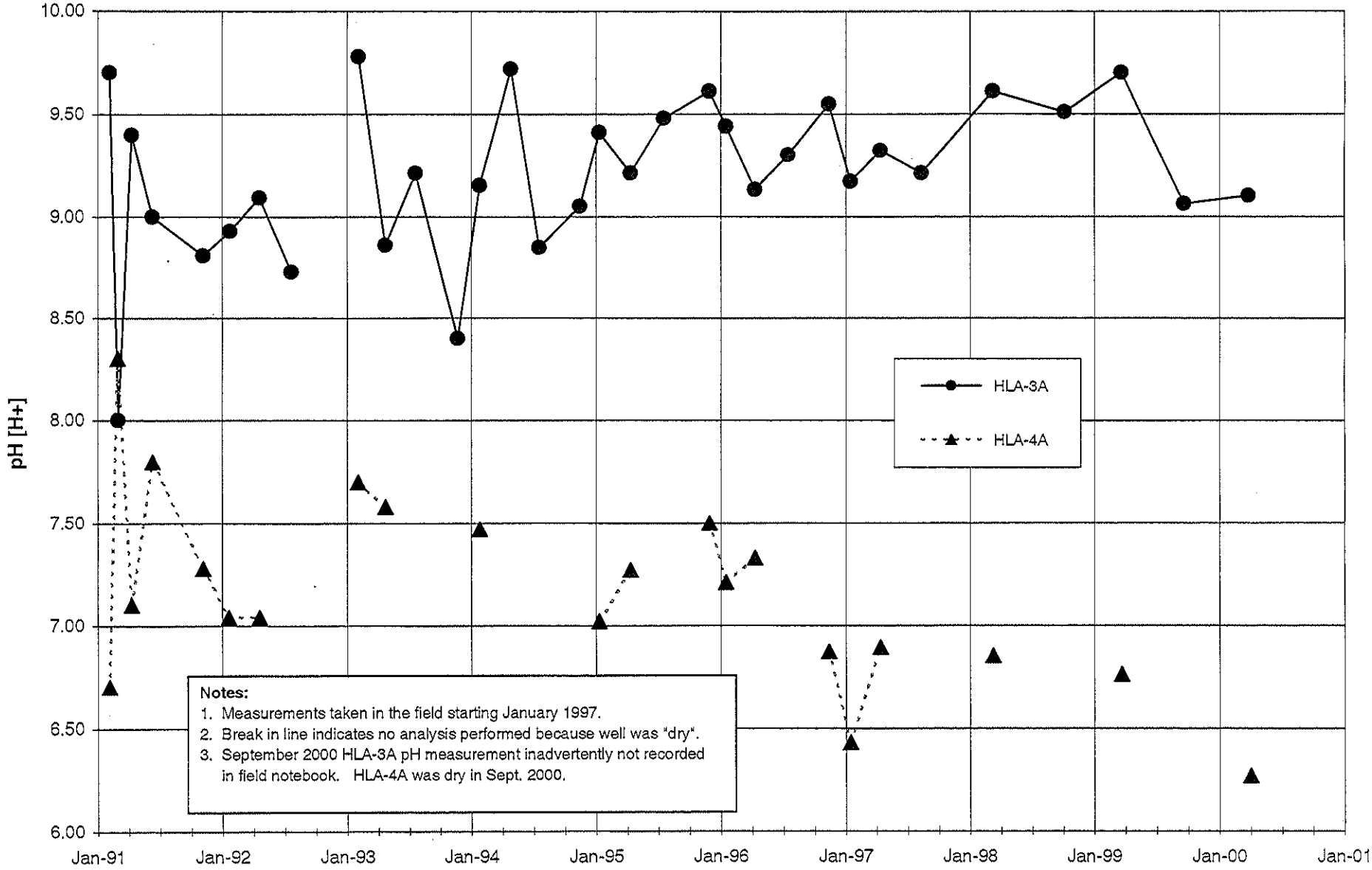


Figure C-31
pH Measurements (HLA-3A, HLA-4A)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

P:\Weyco\164539\GWMO\Annualrpt\GWMo2000\
HLAChem2000.xls\C-31 pH HLA3A,4A

Printed 07/23/2001

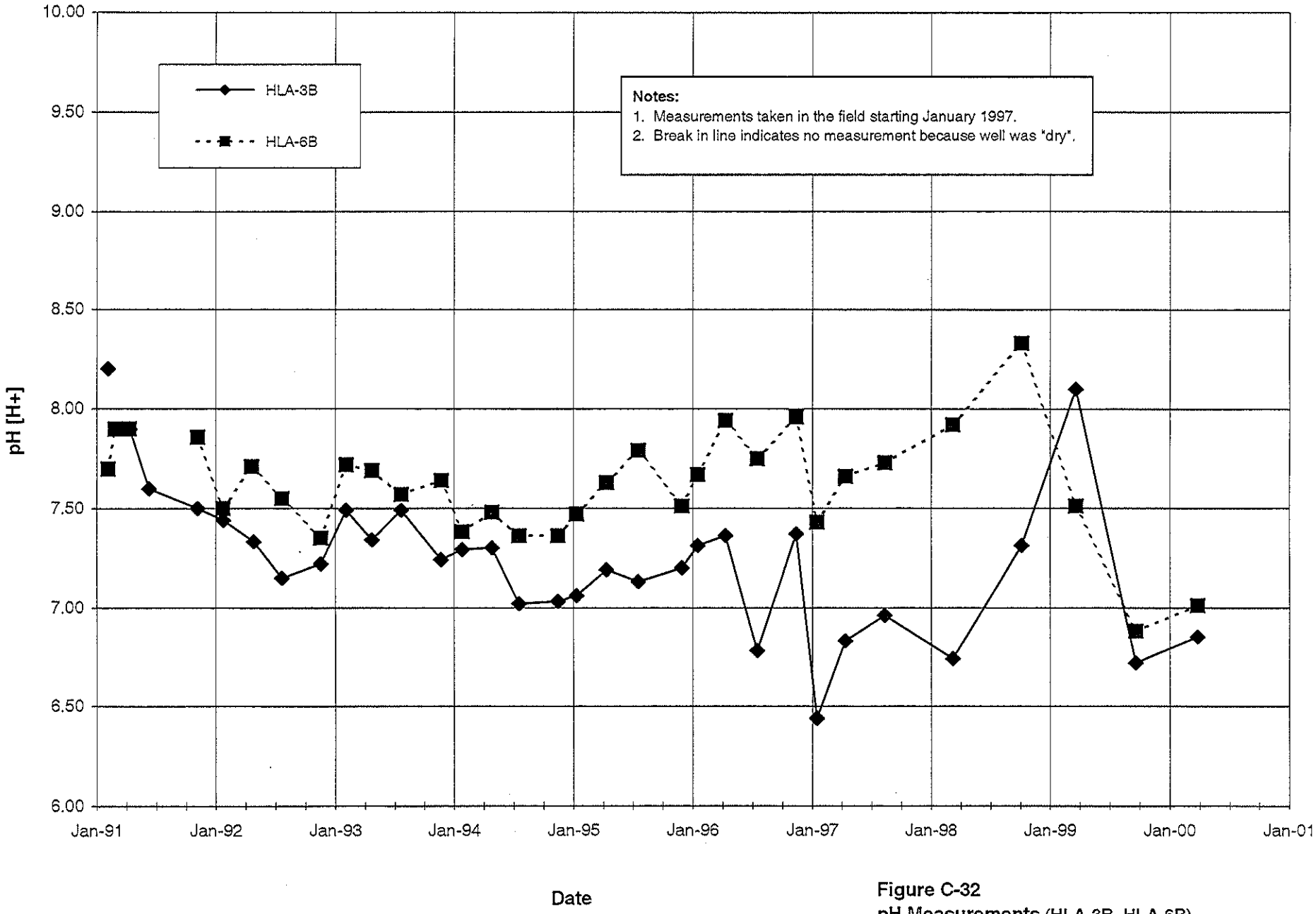


Figure C-32
pH Measurements (HLA-3B, HLA-6B)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

P:\Weyco\164539\GWMO\Annualrpt\GWMo2000\
HLAChem2000.xls\C-32 pH HLA3B,6B

Printed 07/23/2001

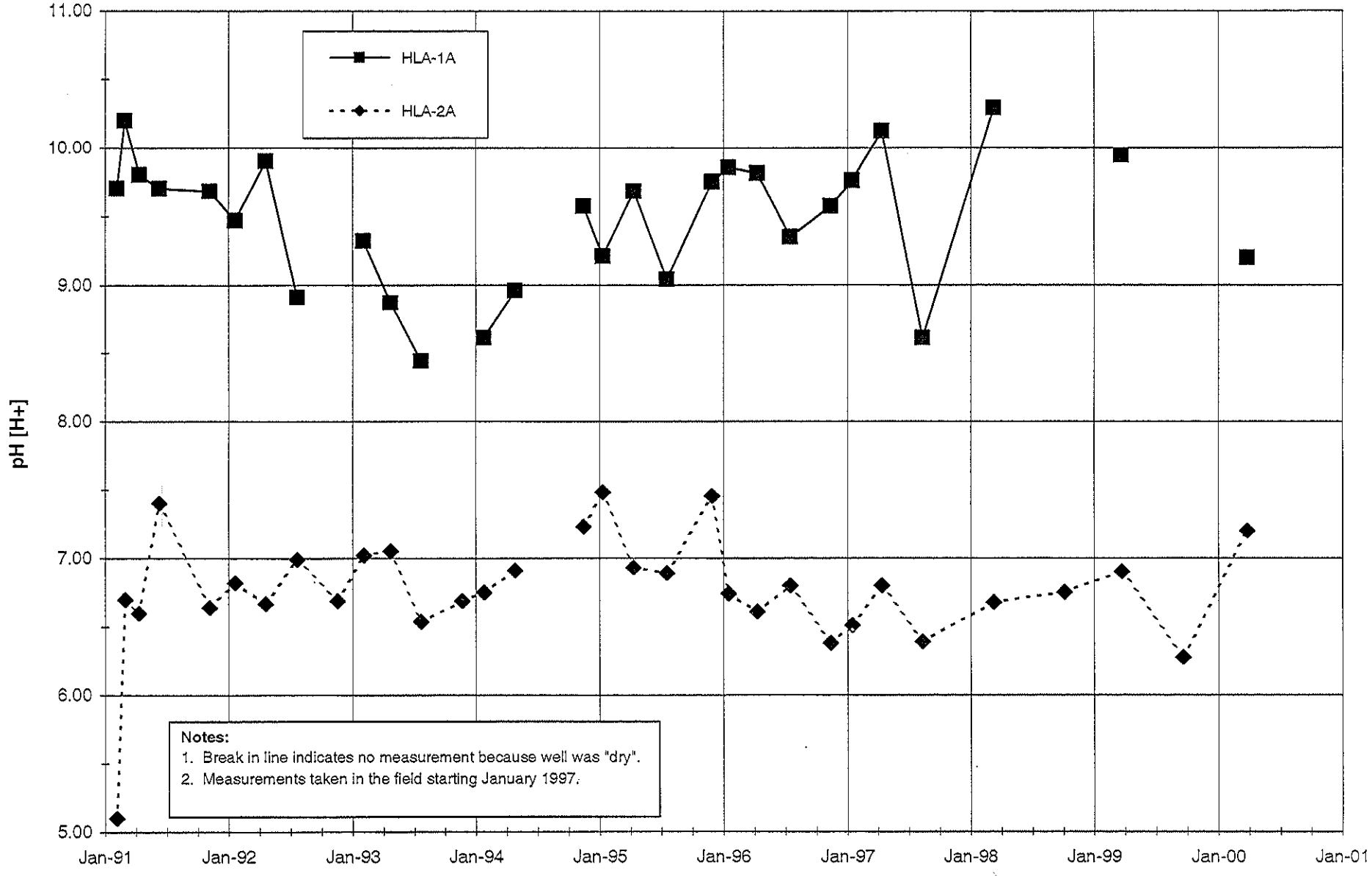


Figure C-33
pH Measurements (HLA-1A, HLA-2A)
Weyerhaeuser Chlor-Alkali Plant - Longview, Washington

P:\Weyco\164539\GWMO\Annualrpt\GWMo2000\
HLAChem2000.xls\C-33 pH HLA1A,2A

Printed 07/23/2001

Groundwater Laboratory Data Sheets and Chain-of-Custody Forms, 1998, 1999, and March 2000

Columbia Analytical Services, Inc.
An Employee-Owned Company

March 25, 1998

Service Request No: K9801530

Kira Sykes
CH2M Hill
825 NE Multnomah, Suite 1300
Portland, OR 97232

Re: Weyerhaeuser Chemical Plant

Dear Kira:

Enclosed are the results of the sample(s) submitted to our laboratory on March 11, 1998. For your reference, these analyses have been assigned our service request number K9801530.

All analyses were performed according to our laboratory's quality assurance program. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for use of less than the complete report. Results apply only to the samples analyzed.

Please call if you have any questions. My extension is 216.

Respectfully submitted,

Columbia Analytical Services, Inc.

Jeff Christian
Laboratory Director

JC/uj

C-98

1317 South 13th Avenue • P.O. Box 479 • Kelso, Washington 98626 • Telephone 360/577-7222 • Fax 360/636-1068

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
J	Estimated concentration. The value is less than the method reporting limit, but greater than the method detection limit.
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NAN	Not Analyzed
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected at or above the MRL
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: CH2M Hill Corporation
Project: Weyerhaeuser Chemical Plant
Sample Matrix: Water

Service Request: K9801530
Date Collected: 3/11/98
Date Received: 3/11/98
Date Extracted: 3/18/98
Date Analyzed: 3/18/98

Dissolved Mercury
EPA Method 7470A
Units: µg/L (ppb)

Sample Name	Lab Code	MRL	Result
WCP-HLA4A-07098-XX	K9801530-001	0.5	ND
WCP-CH2-0798-XX	K9801530-002	0.5	ND
WCP-HLA1B-07098-DU	K9801530-003	0.5	134
WCP-HLA1B-07098-XX	K9801530-004	0.5	146
WCP-HLA1A-07098-XX	K9801530-005	0.5	59.4
WCP-MW1-07098-XX	K9801530-006	0.5	ND
WCP-HLA2A-07098-XX	K9801530-007	0.5	42.0
WCP-CH1-07098-XX	K9801530-008	0.5	1.1
WCP-CH5-07098-XX	K9801530-009	0.5	ND
WCP-CH6-07098-XX	K9801530-010	0.5	<1 (C)
WCP-MW4-07098-XX	K9801530-011	0.5	ND
WCP-CH4-06998-XX	K9801530-012	0.5	0.7
WCP-HLA7B-06998-XX	K9801530-013	0.5	1.5
WCP-CH3-06998-XX	K9801530-014	0.5	3.2
WCP-CH3-06998-DU	K9801530-015	0.5	3.1
WCP-HLA6B-06998-XX	K9801530-016	0.5	2.1
WCP-HLA3A-06998-XX	K9801530-017	0.5	3.8
WCP-HLA3B-06998-XX	K9801530-018	0.5	5.0
WCP-MW3-06998-XX	K9801530-019	0.5	ND
WCP-MW2-06998-XX	K9801530-020	0.5	ND
Method Blank	K9801530-MB	0.5	ND

C The MRL is elevated because the sample required diluting.

Approved By: _____ Date: 3-25-98

00003

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: CH2M Hill Corporation
Project: Weyerhaeuser Chemical Plant
Sample Matrix: Water

Service Request: K9801530
Date Collected: 3/11/98
Date Received: 3/11/98
Date Extracted: 3/18/98
Date Analyzed: 3/18/98

Duplicate Summary
Dissolved Metals
Units: µg/L (ppb)

Sample Name: WCP-HLA4A-07098-XX
Lab Code: K9801530-001

Analyte	EPA Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
Mercury	7470A	0.5	ND	ND	ND	-

Approved By: _____ Date: 3/25/98

DUP1SEPA/102194
01530ICP.EA2 - DUP 3/24/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: CH2M Hill Corporation
Project: Weyerhaeuser Chemical Plant
Sample Matrix: Water

Service Request: K9801530
Date Collected: 3/11/98
Date Received: 3/11/98
Date Extracted: 3/18/98
Date Analyzed: 3/18/98

Matrix Spike Summary
Dissolved Metals
Units: µg/L (ppb)

Sample Name: WCP-HLA4A-07098-XX
Lab Code: K9801530-001

Analyte	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Mercury	0.5	1	ND	1.0	100	60-130

Approved By: _____ Date: 3/25/98

MS1S/102194

01530ICP.EA2 - Spike 3/24/98

CHAIN OF CUSTODY/LABORATORY ANALYSIS REQUEST FORM

Columbia Analytical Services, Inc. 1317 South 13th Ave. • Kelso, WA 98626 • (360) 577-7222 • (800) 695-7222 • FAX (360) 636-1068

DATE 3-11-98 PAGE 1 OF 2

PROJECT NAME Weyerhaeuser Chemical Plant #

PROJECT MANAGER Kira Sykes

COMPANY/ADDRESS 825 NE Multnomah Portland, OR 97232

FAX 235-2445 PHONE 235-5200

SAMPLERS SIGNATURE Mike Abbott

SAMPLE I.D.	DATE	TIME	LAB I.D.	SAMPLE MATRIX	NUMBER OF CONTAINERS	ANALYSIS REQUESTED	REMARKS
WCP-HLA4A-070[illegible]	3/11/98	0950	1	W	1	1	4°C
WCP-CH2-07098-XX		0854	2		1	1	
WCP-HLA1B-07098-DU		1033	3		1	1	labeled WCP-HLA-07098-DU.
WCP-HLA1B-07098-XX		1035	4		1	1	
WCP-HLA1A-07098-XX		1045	5		1	1	
WCP-MW1-07098-XX		1123	6		1	1	
WCP-HLA2A-07098-XX		1245	7		1	1	
WCP-CH1-07098-XX		1310	8		1	1	
WCP-CH5-07098XX		1342	9		1	1	
WCP-CH6-07098-XX	↓	1446	10	↓	1	1	↓

ANALYSIS REQUESTED: Base/Neu/Acid Organics GC/MS 625/8270; Volatile Organics GC/MS 624/8240; Halogenated or Aromatic Volatiles 601/8010 ☐ 602/8020 ☐; Pesticides/PCBs 608/8080; Total Petroleum Hydrocarbons EPA418.1 ☐ OR418.1 ☐ WA418.1 ☐; TPH/Gas/BTEX 5030/8015/8020 Gas ☐ BTEX ☐; TPH/8015 Modified Diesel ☐; TPH/HCID ☐ Hydrocarbon Scan ☐ WA/HCID ☐ OR/HCID ☐; TCLP Metals ☐ VOA ☐ Semi VOA ☐ Pest/Herb ☐; Metals (total or dissolved) List Below; Cyanide; pH, Cond, Cl, SO_4, PO_4, F, Br, NO_2, NO_3 (circle); NH_3-N, COD, Total-P, TKN, TOC; Total Organic Halides (TOX) 9020 ☐ (AOX) 1650A ☐; J.33 11a, EPA 747)

RELINQUISHED BY:
Signature: Mike Abbott
Printed Name: Mike Abbott
Firm: CAS
Date/Time: 3/11/98 1605

RECEIVED BY:
Signature: Amy Govan
Printed Name: Amy Govan
Firm: CAS
Date/Time: 3-11-98 4:02

TURNAROUND REQUIREMENTS
___ 24 hr ___ 48 hr. ___ 5 day
✓ Standard (10-15 working days)
___ Provide Verbal Preliminary Results
___ Provide FAX preliminary Results
Requested Report Date ___

REPORT REQUIREMENTS
___ I. Routine Report
___ II. Report (includes DUP.MS. MSD, as required, may be charged as samples)
___ III. Data Validation Report (includes All Raw Data)
___ IV. CLP Deliverable Report
Same As previous

INVOICE INFORMATION:
P.O.# ___
Bill To ___

SAMPLE RECEIPT:
Shipping VIA: ___
Shipping #: ___
Condition: ___
Lab No: 1530

RELINQUISHED BY:
Signature
Printed Name
Firm
Date/Time

RECEIVED BY:
Signature
Printed Name
Firm
Date/Time

SPECIAL INSTRUCTIONS/COMMENTS:
All Samples Are field filtered

WHITE - Return with Report YELLOW - [illegible]

CHAIN OF CUSTODY/LABORATORY ANALYSIS REQUEST FORM

Columbia Analytical Services, Inc. 1317 South 13th Ave. • Kelso, WA 98626 • (360) 577-7222 • (800) 695-7222 • FAX (360) 636-1068

DATE 3-11-98 PAGE 2 OF 2

PROJECT NAME Weyerhaeuser Chemical Plant #

PROJECT MANAGER Kira Sykes

COMPANY/ADDRESS 825 NE Multnomah Portland, OR 97232

FAX 235-2445 PHONE 235-5000

SAMPLERS SIGNATURE Mike Abbott

SAMPLE I.D.	DATE	TIME	LAB I.D.	SAMPLE MATRIX	NUMBER OF CONTAINERS	Base/Neu/Acid Organics GC/MS 625/8270	Volatile Organics GC/MS 624/8240	Halogenated or Aromatic Volatiles 601/8010 ☐ 602/8020 ☐	Pesticides/PCBs 608/8080	Total Petroleum Hydrocarbons EPA/418.1 ☐ OR/418.1 ☐ WA/418.1 ☐	TPH/Gas/BTEX 5030/8015/8020 Gas ☐ BTEX ☐	TPH/8015 Modified Diesel ☐ Hydrocarbon Scan ☐	TPH/HCID ☐ OR/HCID ☐ WA/HCID ☐	TCLP Metals ☐ VOA ☐ Semi VOA ☐ Pest/Herb ☐	Metals (total or dissolved) List Below	Cyanide	pH, Cond, Cl, SO_4, PO_4, F, Br NO_2, NO_3, (circle)	NH_3-N, COD, Total-P, TKN, TOC (circle)	Total Organic Halides (TOX) 9020 ☐ (AOX) 1650A ☐	Diss. Hg EPA 7470		REMARKS
WCP-MW4-070798-XX	3/11/98	1538	11	W	1															1		4°C

RELINQUISHED BY:
Signature: Mike Abbott
Printed Name: Mike Abbott
Firm: CH2M Hill
Date/Time: 3-11-98 1605

RECEIVED BY:
Signature: Amy Gowan
Printed Name: CAS
Firm: 3-11-98 4:00
Date/Time

TURNAROUND REQUIREMENTS
___ 24 hr ___ 48 hr. ___ 5 day
✓ Standard (10-15 working days)
___ Provide Verbal Preliminary Results
___ Provide FAX preliminary Results
Requested Report Date ___

REPORT REQUIREMENTS
___ I. Routine Report
___ II. Report (includes DUP, MS, MSD, as required, may be charged as samples)
___ III. Data Validation Report (includes All Raw Data)
___ IV. CLP Deliverable Report
As previous

INVOICE INFORMATION:
P.O.# ___
Bill To ___

SAMPLE RECEIPT:
Shipping VIA: ___
Shipping #: ___
Condition: ___
Lab No: 1530

RELINQUISHED BY:
Signature
Printed Name
Firm
Date/Time

RECEIVED BY:
Signature
Printed Name
Firm
Date/Time

SPECIAL INSTRUCTIONS/COMMENTS:
All Samples Are Field Filtered

DISTRIBUTION: WHITE - return to originator YELLOW - Lab PINK - [illegible]

Weyerhaeuser

32901 Weyerhaeuser Way South
Federal Way WA 98003
Tel (253) 924-6872
Fax (253) 924-6654

November 19, 1998

Ms. Kira Sykes
CH2M Hill
825 NE Multnomah Drive, Suite 1300
Portland, OR 97232

RE: Service Request 98-1285 Longview Chlor-alkali Plant Waters

Dear Kira:

Attached is a copy of the revised report pages for metals. This corrects the sample ID numbers that were typed incorrectly, per the telephone call from Tina Rice of your office. Also, we added dates of analysis on the metals, per your request.

Thank you for using our laboratory for this analysis and we look forward to working with you on future projects.

Sincerely,

Dennis Catalano, Project Manager
Weyerhaeuser Analytical and Testing Services

Attachments

Cc: Tina Rice CH2M Hill Portland

Weyerhaeuser Analytical & Testing Services
32901 Weyerhaeuser Way South
Federal Way, WA 98003

Service Request 98-1285

Report

CH2M Hill/Longview Chlor-Alkali Plant Waters

Client ID	Date/Time Sampled	Lab ID	Total Metals Ca (mg/L)	Fe (mg/L)	K (mg/L)	Mg (mg/L)	Mn (mg/L)	Na (mg/L)	Dissolved Si as SiO2 mg/L	Date Analyzed
CH7-27998-XX	10/06/98 1045	001	60.7	7.70	9.0	7.4	1.04	39.8	46.1	10/13/98
CH1-27998-XX	10/06/98 1200	003	4.6	2.97	1.6	0.9	0.176	248	69.0	10/13/98
CH8-27998-XX	10/06/98 1300	005	19.9	19.2	1.6	5.0	0.888	23.7	40.0	10/13/98
MW2-27998-XX	10/06/98 1350	007	29.7	8.75	7.3	12.2	1.27	2080	42.5	10/13/98
MW4-27998-XX	10/06/98 1440	009	20.2	2.94	12.0	7.1	0.087	698	100	10/13/98
HLA3A-28098-XX	10/07/98 0828	011	104	2.87	27.5	13.7	0.121	2230	77.9	10/20/98
HLA3B-28098-XX	10/07/98 0900	013	1390	0.14	238	36.4	0.101	7710	27.4	10/20/98
HLA6B-28098-XX	10/07/98 0930	015	34.0	0.44	13.3	7.8	0.539	828	37.5	10/20/98
HLA2A-28098-XX	10/07/98 1032	017	87.9	< 0.05	5.6	52.1	0.136	373	43.8	10/20/98
CH5-28098-XX	10/07/98 1155	019	17.4	< 0.05	3.2	2.5	< 0.005	173	34.2	10/20/98
CH3-28098-XX	10/07/98 1235	022	8.8	15.1	4.2	1.7	0.425	452	49.8	10/20/98
MW3-28098-XX	10/07/98 1345	024	274	0.55	73.7	101	0.410	82800	8.1	10/20/98
MW1-28098-XX	10/07/98 1437	026	65.0	< 0.05	13.6	11.2	0.169	38.8	34.2	10/20/98
CH6-28198-XX	10/08/98 0945	028	122	4.20	59.2	49.4	2.18	98300	7.5	10/20/98
HLA1B-28198-XX	10/08/98 1037	030	3.7	2.42	3.7	0.5	0.064	380	67.0	10/20/98
CH2-28198-XX	10/08/98 1115	033	1.1	3.64	0.9	0.7	0.090	33.4	46.2	10/20/98
CH4-28198-XX	10/08/98 1220	035	18.0	7.70	2.7	6.9	0.711	345	44.0	10/20/98
HLA7B-28198-XX	10/08/98 1310	037	11.2	1.57	4.8	1.0	0.032	256	108	10/20/98
	Method Blank 1		< 0.1	< 0.05	< 0.1	< 0.1	< 0.005	< 0.5	< 0.5	10/13/98
	Method Blank 2		< 0.1	< 0.05	< 0.1	< 0.1	< 0.005	< 0.5	-	10/21/98
	Quantitation Limit:		0.1	0.05	0.1	0.1	0.005	0.5	0.5	
	Method Number:		AM1-3010/6010	AM1-3010/6010	AM1-3010/7610	AM1-3010/6010	AM1-3010/6010	AM1-3010/6010	EPA 200.7	

Approved: Mary Beth Lanza Date: 11/13/98 Revised Date: 11/19/98
Telephone: (253) 924-6013

Weyerhaeuser Analytical & Testing Services
32901 Weyerhaeuser Way South
Federal Way, WA 98003

Service Request 98-1285

Report

CH2M Hill/Longview Chlor-Alkali Plant Waters

Client ID	Date/Time Sampled	Lab ID	Total Hg µg/L	Date Analyzed
CH7-27998-XX	10/06/98 1045	001	< 0.2	10/24/98
CH1-27998-XX	10/06/98 1200	003	1.9	10/24/98
CH8-27998-XX	10/06/98 1300	005	< 0.2	10/24/98
MW2-27998-XX	10/06/98 1350	007	< 0.2	10/24/98
MW4-27998-XX	10/06/98 1440	009	2.8	10/24/98
HLA3A-28098-XX	10/07/98 0828	011	25.1	11/09/98
HLA3B-28098-XX	10/07/98 0900	013	7.7	11/02/98
HLA6B-28098-XX	10/07/98 0930	015	0.7	11/02/98
HLA2A-28098-XX	10/07/98 1032	017	149	11/09/98
CH5-28098-XX	10/07/98 1155	019	1.5	11/02/98
CH3-28098-XX	10/07/98 1235	022	3.4	11/03/98
MW3-28098-XX	10/07/98 1345	024	< 0.2	11/03/98
MW1-28098-XX	10/07/98 1437	026	< 0.2	11/03/98
CH6-28198-XX	10/08/98 0945	028	< 0.2	11/03/98
HLA1B-28198-XX	10/08/98 1037	030	119	11/09/98
CH2-28198-XX	10/08/98 1115	033	3.7	11/02/98
CH4-28198-XX	10/08/98 1220	035	0.6	11/02/98
HLA7B-28198-XX	10/08/98 1310	037	40.1	11/09/98
		Quantitation Limit:	0.2	
		Method Number:	AM1-245.1	

Client ID	Date/Time Sampled	Lab ID	Dissolved Hg µg/L	
CH7-27998-XX	10/06/98 1045	002	< 0.2	10/24/98
CH1-27998-XX	10/06/98 1200	004	0.7	10/24/98
CH8-27998-XX	10/06/98 1300	006	< 0.2	10/24/98
MW2-27998-XX	10/06/98 1350	008	< 0.2	10/24/98
MW4-27998-XX	10/06/98 1440	010	2.7	10/24/98
HLA3A-28098-XX	10/07/98 0828	012	5.6	11/02/98
HLA3B-28098-XX	10/07/98 0900	014	6.6	11/02/98
HLA6B-28098-XX	10/07/98 0930	016	0.3	11/02/98
HLA2A-28098-XX	10/07/98 1032	018	142	11/09/98
CH5-28098-XX	10/07/98 1155	020	2.2	11/02/98
CH5-28098-DU	10/07/98 1200	021	1.5	11/03/98
CH3-28098-XX	10/07/98 1235	023	2.0	11/03/98
MW3-28098-XX	10/07/98 1345	025	1.1	11/03/98
MW1-28098-XX	10/07/98 1437	027	< 0.2	11/03/98
CH6-28198-XX	10/08/98 0945	029	< 0.2	11/02/98
HLA1B-28198-XX	10/08/98 1037	031	125	11/09/98
HLA1B-28198-DU	10/08/98 1040	032	125	11/09/98
CH2-28198-XX	10/08/98 1115	034	0.9	11/02/98
CH4-28198-XX	10/08/98 1220	036	0.6	11/02/98
HLA7B-28198-XX	10/08/98 1310	038	10.2	11/09/98
		Quantitation Limit:	0.2	
		Method Number:	AM1-245.1	

Note: Samples 011, 017, 018 were analyzed 5 days past the holding time for mercury. Samples 030, 031, 032, 037 and 038 were analyzed 4 days past the holding time for mercury. All samples were initially analyzed within the holding time but needed reanalysis since the results were outside the calibration range and required dilution.

Approved: Mary Beth Lanza Date: 11/13/98 Revised Date : 11/19/98
Telephone: (253) 924-6013

COC → Dalton 9: 285 Billing to LRA 903

CH2MHILL Analytical Services
CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

☐ **LMG** 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-1444 FAX (334) 271-3428
☐ **LRD** 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244-4109
☐ **LKW** Canviro Analytical Laboratories, Inc., 50 Bathurst, Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747-2575 FAX (519) 747-3806
☐ **CVO** 2300 NW Walnut Boulevard, Corvallis, OR 97330-3638, (541) 752-4271 FAX (541) 752-0276

COC # _____

Project # 107132.50	**Purchase Order #** —
Project Name WY66 Longview Chemical Plant	
Company Name CH2M/PDX	
Project Manager or Contact & Phone # 503-235-5000 King Sykes/PDX	**Report Copy to:** Joel Bowker/PDX
Requested Completion Date: STD	**Site ID** — **Sample Disposal:** Dispose ☒ Return ☐

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	LAB QC	TOTAL # OF CONTAINERS	Requested Analytical Method # / Preservative: Field Filtered Diss. Hg	Total Hg	Total metals	Silica	Sulfide	Gen Chem.
										HNO3	HNO3	HNO3	4 °C	Zinc Acetate NaOH	4 °C
10/6/98	1045	X		X			CH7-27998-XX		6	1	1	1	1	1	1
	1200						CH1-27998-XX			1	1	1	1	1	1
							CH8-27998-XX			1	1	1	1	1	1
	1350						MW2-27998-XX			1	1	1	1	1	1
	1440						MW4-27998-XX			1	1	1	1	1	1

THIS AREA FOR LAB USE ONLY

Lab #	Page ___ of ___
Lab PM	Custody Review
Log In	LIMS Verification
pH	Custody Seals Y N
	Ice Y N
QC Level 1 2 3 Other ___	
Cooler Temperature	

Alternate Description	Lab ID

Relinquished By Barry Collom 10-6-98	**Empty Bottles**	**Date/Time** 1575	**Received By** / **Empty Bottles**	**Date/Time**
Sampled By and Title Same (Please sign and print name)		**Date/Time**	**Relinquished By** (Please sign and print name)	**Date/Time**
Received By (Please sign and print name)		**Date/Time**	**Relinquished By** (Please sign and print name)	**Date/Time**
Received By (Please sign and print name)		**Date/Time**	**Shipped Via** UPS Fed-Ex Other ___	**Shipping #**

Special Instructions: Short hold on pH, NO_3^-

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 1/97 LAB FORM 340

COC 2

CH2MHILL Analytical Services
CHAIN OF CUSTODY RECORD
AND AGREEMENT TO PERFORM SERVICES

☐ **LMG** 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-1444 FAX (334) 271-3428
☐ **LRD** 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244-4109
☐ **LKW** Canviro Analytical Laboratories, Inc., 50 Bathurst, Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747-2575 FAX (519) 747-3806
☐ **CVO** 2300 NW Walnut Boulevard, Corvallis, OR 97330-3638, (541) 752-4271 FAX (541) 752-0276

COC #

Project #	Purchase Order #
146982.RI	
Project Name	
WeyCo Longview Chemical Plant	
Company Name	
CH2M/PDX	
Project Manager or Contact & Phone #	**Report Copy to:**
503-235-5000 Kira Sykes	503-235-5000 Joel Bowker
Requested Completion Date:	**Site ID** / **Sample Disposal:**
Std.	— / Dispose ☒ Return ☐

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	LAB QC	TOTAL # OF CONTAINERS	Requested Analytical Method # (Field filtered diss Hg / Total Hg / Total metals / Silica / Gen Chem / Sulfide)	Preservative (HNO_3 / HNO_3 / HNO_3 / 4°C / 4°C / Zinc acetate + NaOH)
10/7/98	0828	X	X				HLA3A-28098-XX		6	1 1 1 1 1 1	
	0900						HLA3B-28098-XX			1 1 1 1 1 1	
	0930						HLA6B-28098-XX			1 1 1 1 1 1	
	1032						HLA2A-28098-XX			1 1 1 1 1 1	
	1155						CH5-28098-XX			1 1 1 1 1 1	
	1200						CH5-28098-DU		1	# — — — — —	
	1235						CH3-28098-XX		6	1 1 1 1 1 1	
	1345						MW3-28098-XX		6	1 1 1 1 1 1	
	1437						MW1-28098-XX		6	1 1 1 1 1 1	

THIS AREA FOR LAB USE ONLY

Lab #	Page	of
Lab PM	Custody Review	
Log In	LIMS Verification	
pH	Custody Seals Y N	
	Ice Y N	

QC Level 1 2 3 Other ____

Cooler Temperature

Alternate Description	Lab ID

Relinquished By	Empty Bottles	Date/Time	Received By	Empty Bottles	Date/Time
Barry Collom 10-7-98		1515			
Sampled By and Title (Please sign and print name)		Date/Time	**Relinquished By** (Please sign and print name)		Date/Time
Received By (Please sign and print name)		Date/Time	**Relinquished By** (Please sign and print name)		Date/Time
Received By (Please sign and print name)		Date/Time	**Shipped Via** UPS Fed-Ex / Other WeyCo Courier	**Shipping #**	

Special Instructions: Short hold time on pH, NO_3, to WeyCo Lab Federal Way, WA

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

GAC-5

CH2MHILL Analytical Services
CHAIN OF CUSTODY RECORD
AND AGREEMENT TO PERFORM SERVICES

☐ **LMG** 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-1444 FAX (334) 271-3428

☐ **LRD** 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244-4109

☐ **LKW** Canviro Analytical Laboratories, Inc., 50 Bathurst, Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747-2575 FAX (519) 747-3806

☐ **CVO** 2300 NW Walnut Boulevard, Corvallis, OR 97330-3638, (541) 752-4271 FAX (541) 752-0276

COC # _____

Project # 146982.RI	Purchase Order # —
Project Name: WeyCo Longview Chemical Plant	
Company Name: CH2M/PDX	
Project Manager or Contact & Phone #: ~~503-235-5000~~ Kira Sykes/PDX	Report Copy to: Joel Bowker/PDX
Requested Completion Date: STD	Site ID: —
Sample Disposal: Dispose ☒ Return ☐	

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	LAB QC	TOTAL # OF CONTAINERS	Requested Analytical Method # / Preservative: Field Filtered	Diss. Hg	total Hg	total metals	Silica	Gen Chem	Sulfide
10/19/98	0945		X	X			CH6-28198-XX		6	/	/	/	/	/	/	
	1037						HLA1B-28198-XX		6	/	/	/	/	/	/	
	1040						HLA1B-28198-DU		1	/	—	—	—	—	—	
	1115						CH2-28198-XX		6	/	/	/	/	/	/	
	1220						CH4-28198-XX		6	/	/	/	/	/	/	
	1310						HLA7B-28198-XX		6	/	/	/	/	/	/	

THIS AREA FOR LAB USE ONLY

Lab #	Page	of
Lab PM	Custody Review	
Log In	LIMS Verification	
pH	Custody Seals Y N	
	Ice Y N	

QC Level 1 2 3 Other _____

Cooler Temperature

Alternate Description	Lab ID

Relinquished By: Barry Callow 10-8-98	Empty Bottles	Date/Time: 1515	Received By / Empty Bottles / Date/Time
Sampled By and Title: Same (Please sign and print name)		Date/Time	Relinquished By (Please sign and print name) / Date/Time
Received By (Please sign and print name)		Date/Time	Relinquished By (Please sign and print name) / Date/Time
Received By (Please sign and print name)		Date/Time	Shipped Via: WeyCo Courier (UPS Fed-Ex Other) / Shipping #

Special Instructions: Short hold time on pH + NO_3^-, to WeyCo Lab, Federal Way, WA.

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

Weyerhaeuser

32901 Weyerhaeuser Way South
Federal Way WA 98003
Tel (253) 924-6872
Fax (253) 924-6654

November 13, 1998

Ms. Kira Sykes
CH2M Hill
825 NE Multnomah Drive, Suite 1300
Portland, OR 97232

RE: Service Request 98-1285 Longview Chloralkali Plant Waters

Dear Kira:

Attached are the copies of our final report for the sample you requested we analyze. These are from our service request number 98-1285. Sorry that these are so late, however, these samples were extremely complicated and required numerous reruns and dilutions. Some of the total mercury samples were run six times in an effort to get all compounds on scale without interferences. Chlorine interferes with mercury as the absorbance is at the same wavelength, and some of these samples contained percent levels of Cl-. As a result of this, some of the samples were actually run outside the 28 day holding time for mercury. All of the initial runs were done within the holding time. Invoicing for this work will be directly to Weyerhaeuser. If you have any questions concerning this report, please feel free to contact me at (253) 924-6242.

Thank you for using our laboratory for this analysis and we look forward to working with you on future projects.

Sincerely,

Dennis Catalano, Project Manager
Weyerhaeuser Analytical and Testing Services

Attachments

Cc: Phyllis Rice CH2M Hill Portland

Weyerhaeuser Analytical and Testing Services
32901 Weyerhaeuser Way South
Federal Way, Washington 98003

Service Request 98-1285

Report

Longview Chlor-Alkali Plant Water
CH2M Hill

Client ID:		CH7 27998-XX 10/06/98 1045	CH1 27998-XX 10/06/98 1200	CH8 27998-XX 10/06/98 1300	MW2 27998-XX 10/06/98 1350	MW4 27998-XX 10/06/98 1440
Lab ID:		001	003	005	007	009
Test	Units					
Alkalinity	mg/L $CaCO_3$	200	420	100	700	1200
TDS	mg/L	370	780	210	5450	2010
TSS	mg/L	< 5	< 5	< 5	< 5	< 5
F	mg/L	0.32 (D10)	1.7 (D10)	0.41 (D10)	0.35*	1.4 (D10)
Cl	mg/L	51 (D100)	90 (D100)	7.7 (D10)	2700 (D10000)	120 (D1000)
SO_4	mg/L	6.1 (D10)	6.1 (D10)	11 (D10)	94 (D100)	330 (D100)
NO_3-N	mg/L	0.09	< 0.03	< 0.03	< 0.03	< 0.03
NO_2-N	mg/L	<0.03	< 0.03	< 0.03	< 0.03	< 0.03
Sulfide	mg/L	< 1	< 1	< 1	< 1	< 1

Client ID:		HLA3A 28098-XX 10/07/98 0828	HLA3B 28098-XX 10/07/98 0900	HLA6B 28098-XX 10/07/98 0930	HLA2A 28098-XX 10/07/98 1032
Lab ID:		011	013	015	017
Test	Units				
Alkalinity	mg/kg $CaCO_3$	250	27	420	200
TDS	mg/L	5410	25500	2350	1290
TSS	mg/L	300	9	6	< 5
F	mg/L	0.43*	1.0*	1.2 (D10)	0.36*
Cl	mg/L	3100 (D10000)	13800 (D1,000,000)	920 (D1000)	560 (D1000)
SO_4	mg/L	110 (D100)	270 (D100)	240 (D100)	92 (D100)
NO_3-N	mg/L	<0.03	0.22	0.10	0.60
NO_2-N	mg/L	<0.03	<0.03	<0.03	<0.03
Sulfide	mg/L	< 1	< 1	< 1	< 1

Approved: Maxine Ranta
Telephone: 253-924-6149

Date: 11/06/98

Weyerhaeuser Analytical and Testing Services
32901 Weyerhaeuser Way South
Federal Way, Washington 98003

Service Request 98-1285

Report

Longview Chlor-Alkali Plant Water
CH2M Hill

Client ID:		CH5 28098-XX 10/07/98 1155	CH3 28098-XX 10/07/98 1235	MW3 28098-XX 10/07/98 1345	MW1 28098-XX 10/07/98 1437	CH6 28198-XX 10/8/98 0945
Lab ID:		019	022	024	026	028
Test	Units					
Alkalinity	mg/L $CaCO_3$	93	790	160	420	84
TDS	mg/L	500	1400	21600	840	24800
TSS	mg/L	< 5	< 5	50	<5	20
F	mg/L	0.96 (D10)	0.84 (D10)	0.22*	0.38 (D10)	0.39*
CL	mg/L	200 (D1000)	140 (D1000)	146000 (D500000)	20 (D100)	154000 (D500000)
SO_4	mg/L	19 (D100)	0.19	800 (D10000)	52 (D100)	450 (D1000)
NO_3-N	mg/L	1.6	1.2	0.03	1.3	< 0.03
NO_2-N	mg/L	0.03	0.14	<0.03	<0.03	< 0.03
Sulfide	mg/L	< 1	< 1	< 1	< 1	< 1

Client ID:		HLA1B 28198-XX 10/08/98 1037	CH2 28198-XX 10/08/98 1115	CH4 28198-XX 10/08/98 1220	HLA7B 28198-XX 10/08/98 1310
Lab ID:		030	033	035	037
Test	Units				
Alkalinity	mg/kg $CaCO_3$	760	78	780	270
TDS	mg/L	1700	230	1100	810
TSS	mg/L	< 5	8	40	67
F	mg/L	0.54 (D10)	0.85 (D10)	0.95 (D10)	1.6 (D10)
Cl	mg/L	52 (D100)	5.5 (D10)	79 (D100)	170 (D1000)
SO_4	mg/L	31 (D100)	3.1 (D10)	0.23	74 (D100)
NO_3-N	mg/L	<0.03	0.04	<0.03	0.18
NO_2-N	mg/L	<0.03	<0.03	<0.03	<0.03
Sulfide	mg/L	< 1	< 1	< 1	< 1

Approved: Maxine Ranta
Telephone: 253-924-6149

Date: 11/06/98

C-98

Weyerhaeuser Analytical and Testing Services
32901 Weyerhaeuser Way South
Federal Way, Washington 98003

Service Request 98-1285

Report

Longview Chlor-Alkali Plant Water
CH2M Hill

Test	Units	Date	QL	Method
Alkalinity	mg/L $CaCO_3$	10/13/98	0.5	SM 2320
TDS	mg/L	10/09/98	10	AM1-160.1
TSS	mg/L	10/08-09/98	5	AM1-160.2
F	mg/L	10/22/98	0.05	EPA 300.0
F*	mg/L	11/01/98	0.05	AM1-340.2
Cl	mg/L	10/21-26/98	0.05	EPA 300.0
SO_4	mg/L	10/21/26/98	0.2	EPA 300.0
NO_3-N	mg/L	10/07-09/98	0.03	AM1-353.2
NO_2-N	mg/L	10/07-09/98	0.03	AM1-353.2
Sulfide	mg/L	10/12/98	1	SM 4500-S^{2-} E

*Fluoride run by method AM1-340.2 due to interferences in method EPA 300.0

Approved: Maxine Ranta
Telephone: 253-924-6149

Date: 11/06/98

Weyerhaeuser Analytical & Testing Services
32901 Weyerhaeuser Way South
Federal Way, WA 98003

Service Request 98-1285

Report

CH2M Hill/Longview Chlor-Alkali Plant Waters

Client ID	Date/Time Sampled	Lab ID	Total Metals Ca	Fe	K	Mg	Mn	Na	Dissolved Si as SiO2
			mg/L						mg/L
CH7-27998-XX	10/06/98 1045	001	60.7	7.70	9.0	7.4	1.04	39.8	46.1
CH1-27998-XX	10/06/98 1200	003	4.6	2.97	1.6	0.9	0.176	248	69.0
CH8-27998-XX	10/06/98 1300	005	19.9	19.2	1.6	5.0	0.888	23.7	40.0
MW2-27998-XX	10/06/98 1350	007	29.7	8.75	7.3	12.2	1.27	2080	42.5
MW4-27998-XX	10/06/98 1440	009	20.2	2.94	12.0	7.1	0.087	698	100
HLA3A-28098-XX	10/07/98 0828	011	104	2.87	27.5	13.7	0.121	2230	77.9
HLA3B-28098-XX	10/07/98 0900	013	1390	0.14	238	36.4	0.101	7710	27.4
HLA6B-28098-XX	10/07/98 0930	015	34.0	0.44	13.3	7.8	0.539	828	37.5
HLA2A-28098-XX	10/07/98 1032	017	87.9	< 0.05	5.6	52.1	0.136	373	43.8
CH5-28098-XX	10/07/98 1155	019	17.4	< 0.05	3.2	2.5	< 0.005	173	34.2
CH3-28098-XX	10/07/98 1235	022	8.8	15.1	4.2	1.7	0.425	452	49.8
MW3-28098-XX	10/07/98 1345	024	274	0.55	73.7	101	0.410	82800	8.1
MW1-28098-XX	10/07/98 1437	026	65.0	< 0.05	13.6	11.2	0.169	38.8	34.2
CH6-28198-XX	10/08/98 0945	028	122	4.20	59.2	49.4	2.18	98300	7.5
HLA1B-28198-XX	10/08/98 1037	030	3.7	2.42	3.7	0.5	0.064	380	67.0
CH2-28198-XX	10/08/98 1115	033	1.1	3.64	0.9	0.7	0.090	33.4	46.2
CH4-28198-XX	10/08/98 1220	035	18.0	7.70	2.7	6.9	0.711	345	44.0
HLA7B-28198-XX	10/08/98 1310	037	11.2	1.57	4.8	1.0	0.032	256	108
	Method Blank 1		< 0.1	< 0.05	< 0.1	< 0.1	< 0.005	< 0.5	< 0.5
	Method Blank 2		< 0.1	< 0.05	< 0.1	< 0.1	< 0.005	< 0.5	-
	Quantitation Limit:		0.1	0.05	0.1	0.1	0.005	0.5	0.5
	Method Number:		AM1-3010/6010	AM1-3010/6010	AM1-3010/7610	AM1-3010/6010	AM1-3010/6010	AM1-3010/6010	EPA 200.7

Approved: Mary Beth Lanza Date: 11/13/98
Telephone: (253) 924-6013

MBL

Weyerhaeuser Analytical & Testing Services
32901 Weyerhaeuser Way South
Federal Way, WA 98003

Service Request 98-1285

Report

CH2M Hill/Longview Chlor-Alkali Plant Waters

Client ID	Date/Time Sampled	Lab ID	Total Hg µg/L
CH7-27998-XX	10/06/98 1045	001	< 0.2
CH1-27998-XX	10/06/98 1200	003	1.9
CH8-27998-XX	10/06/98 1300	005	< 0.2
MW2-27998-XX	10/06/98 1350	007	< 0.2
MW4-27998-XX	10/06/98 1440	009	2.8
HLA3A-28098-XX	10/07/98 0828	011	25.1
HLA3B-28098-XX	10/07/98 0900	013	7.7
HLA6B-28098-XX	10/07/98 0930	015	0.7
HLA2A-28098-XX	10/07/98 1032	017	149
CH5-28098-XX	10/07/98 1155	019	1.5
CH3-28098-XX	10/07/98 1235	022	3.4
MW3-28098-XX	10/07/98 1345	024	< 0.2
MW1-28098-XX	10/07/98 1437	026	< 0.2
CH6-28198-XX	10/08/98 0945	028	< 0.2
HLA1B-28198-XX	10/08/98 1037	030	119
CH2-28198-XX	10/08/98 1115	033	3.7
CH4-28198-XX	10/08/98 1220	035	0.6
HLA7B-28198-XX	10/08/98 1310	037	40.1
		Quantitation Limit:	0.2
		Method Number:	AM1-245.1

Client ID	Date/Time Sampled	Lab ID	Dissolved Hg µg/L
CH7-27998-XX	10/06/98 1045	002	< 0.2
CH1-27998-XX	10/06/98 1200	004	0.7
CH8-27998-XX	10/06/98 1300	006	< 0.2
MW2-27998-XX	10/06/98 1350	008	< 0.2
MW4-27998-XX	10/06/98 1440	010	2.7
HLA3A-28098-XX	10/07/98 0828	012	5.6
HLA3B-28098-XX	10/07/98 0900	014	6.6
HLA6B-28098-XX	10/07/98 0930	016	0.3
HLA2A-28098-XX	10/07/98 1032	018	142
CH5-28098-XX	10/07/98 1155	020	2.2
CH5-28098-DU	10/07/98 1200	021	1.5
CH3-28098-XX	10/07/98 1235	023	2.0
MW3-28098-XX	10/07/98 1345	025	1.1
CH6-28198-XX	10/08/98 0945	027	< 0.2
HLA1B-28198-XX	10/08/98 0945	029	< 0.2
HLA1B-28198-XX	10/08/98 1037	031	125
HLA1B-28198-DU	10/08/98 1040	032	125
CH2-28198-XX	10/08/98 1115	034	0.9
CH4-28198-XX	10/08/98 1220	036	0.6
HLA7B-28198-XX	10/08/98 1310	038	10.2
		Quantitation Limit:	0.2
		Method Number:	AM1-245.1

Note: Samples 011, 017, 018 were analyzed 5 days past the holding time for mercury. Samples 030, 031, 032, 037 and 038 were analyzed 4 days past the holding time for mercury. All samples were initially analyzed within the holding time but needed reanalysis since the results were outside the calibration range and required dilution.

Approved: Mary Beth Lanza Date: 11/13/98
Telephone: (253) 924-6013

MBL

1-96

Weyerhaeuser Analytical & Testing Services
32901 Weyerhaeuser Way South
Federal Way, WA 98003

Service Request 98-1285

QC Report - Metals

CH2M Hill/Longview Chlor-Alkali Plant Waters

Duplicate Report

Element	Sample 001 Found	Duplicate 001 Found	RPD
	mg/L		
Sl as SiO2	46.1	47.2	2
	µg/L		
Hg	< 0.2	< 0.2	NA

Spike Recovery Report

Element	Sample 001 Found	Spike 001 Found	Net Spike	Spike Level	% Recovery
		µg/L			
Hg	< 0.2	3.2	3.2	3.0	107

Water Laboratory Control Sample Report

Element	Sample Found	True Value	Lower Limit	Upper Limit	% Recovery
		mg/L			
Ca 1	22.6	20.0	19.0	23.1	113
Ca 2	21.2	20.0	19.0	23.1	106
Fe 1	1.06	1.00	0.91	1.08	106
Fe 2	1.01	1.00	0.91	1.08	101
Mg 1	22.0	20.0	18.8	23.4	110
Mg 2	20.9	20.0	18.8	23.4	105
Mn 1	0.529	0.500	0.451	0.548	106
Mn 2	0.498	0.500	0.451	0.548	100
Na 1	20.3	20.0	17.6	22.3	102
Na 2	19.6	20.0	17.6	22.3	98
		µg/L			
Hg 1	1.4	1.5	1.1	1.9	93
Hg 2	1.3	1.5	1.1	1.9	87
Hg 3	1.5	1.5	1.1	1.9	100
Hg 4	1.6	1.5	1.1	1.9	107
Hg 5	1.4	1.5	1.1	1.9	93

Approved: Mary Beth Lanza Date: 11/13/98
Telephone: (253) 924-6013

Weyerhaeuser

32901 Weyerhaeuser Way South
Federal Way WA 98003
Tel (253) 924-6872
Fax (253) 924-6654

April 13, 1999

Ms. Kira Sykes
CH2M Hill
825 NE Multnomah, Suite 1300
Portland, OR 97232-2146

RE: Service Request 99-0713 Weyerhaeuser Longview Chlor-Alkali Plant/CH2M HILL
OOE# 7032071

Dear Kira:

Attached are the copies of our final report for the sample you requested we analyze. These are from our service request number 99-0713. Invoicing for this work will be directly to Weyerhaeuser. If you have any questions concerning this report, please feel free to contact me at (253) 924-6242.

Thank you for using our laboratory for this analysis and we look forward to working with you on future projects.

Sincerely,

Dennis Catalano, Project Manager
Weyerhaeuser Analytical and Testing Services

Attachments

cc: Tina Rice CH2M Hill

ANALYTICAL LABORATORY SERVICES REQUEST Service Request 99-0713
Weyerhaeuser Research and Development-Analysis and Testing

SR Title : Weyerhaeuser/CH2MHill Longview Chlor-Alkali Plant Waters
Number of Samples : 22

Submitter Name : Sykes, Kira.
Submitter Address : Portland, OR
Submitter Phone : 503-235-5000 x4510
Charge Number : 046-5648
PO Number : OOE# 7032071

Date Received : 03/26/99
Date Desired : 04/09/99
Cost Multiplier : 1.000
Hardcopy Format :
Disk Format :

Reviewer : Catalano, Dennis
Reviewer Address : WTC 2F25
Reviewer Phone : 6242

ORB Number :
Date Completed :

Copy to :
Comments/Notes : 0.2 PPB det. limit; all samples field filtered; BACKLOG WILL BE INCORRECT - SAMPLE DATES/TIMES WERE CORRECTED** Ch2MHill # - 146982.98-GW

Reference SR :

Revisions :

Test Name	Test Description	Component List
3-HG-W	Mercury Prep - Water	
HG	HG-DISS	Mercury	Dissolved Mercury in Water

Lab ID	Client Sample ID	Date Sampled	Test Name		
001	WCP-HLA7B-08299-xx	03/23/99 1254	3-HG-W		
			HG	HG-DISS	
002	WCP-CH3-08299-xx	03/23/99 1342	3-HG-W		
			HG	HG-DISS	
003	WCP-CH3-02399-du	03/23/99 1400	3-HG-W		
			HG	HG-DISS	
004	WCP-CH4-08299-xx	03/23/99 1440	3-HG-W		
			HG	HG-DISS	

005	WCP-HLA6B-08299-xx	03/23/99 1615	3-HG-W HG	 HG-DISS
006	WCP-HLA3B-08299-xx	03/23/99 1700	3-HG-W HG	 HG-DISS
007	WCP-HLA3A-08299-xx	03/23/99 1715	3-HG-W HG	 HG-DISS
008	WCP-CH8-08399-xx	03/24/99 1020	3-HG-W HG	 HG-DISS
009	WCP-CH7-08399-xx	03/24/99 1114	3-HG-W HG	 HG-DISS
010	WCP-CH7-08399-du	03/24/99 1130	3-HG-W HG	 HG-DISS
011	WCP-MW1-08399-xx	03/24/99 1203	3-HG-W HG	 HG-DISS
012	WCP-CH2-08399-xx	03/24/99 1316	3-HG-W HG	 HG-DISS
013	WCP-HLA4A-08399-xx	03/24/99 1408	3-HG-W HG	 HG-DISS
014	WCP-HLA1B-08399-xx	03/24/99 1520	3-HG-W HG	 HG-DISS
015	WCP-HLA1A-08399-xx	03/24/99 1535	3-HG-W HG	 HG-DISS
016	WCP-MW2-08399-xx	03/24/99 1633	3-HG-W HG	 HG-DISS
017	WCP-MW3-08399-xx	03/24/99 1711	3-HG-W HG	 HG-DISS
018	WCP-MW4-08499-xx	03/25/99 1012	3-HG-W HG	 HG-DISS
019	WCP-CH6-08499-xx	03/25/99 1114	3-HG-W HG	 HG-DISS
020	WCP-CH1-08499-xx	03/25/99 1210	3-HG-W HG	 HG-DISS
021	WCP-CH5-08499-xx	03/25/99 1249	3-HG-W HG	 HG-DISS
022	WCP-HLA2A-08499-xx	03/25/99 1329	3-HG-W HG	 HG-DISS

Group	Test Name	No. of Samples	Cost per Sample($)	Cost Mult	Line Total
METALS	3-HG-W	22	30.00	1.00	660.00
METALS	HG	HG-DISS	22	0.00	1.00	0.00
		Total METALS Charges ($)			660.00

Ref #	Group	Memo Charge Description	Notes/PO Number	Line Total($)

Cost Summary

Total Test Charges ($)	660.00
Total Memo Charges ($)	0.00
Total Charges for Service Request ($)	660.00

Weyerhaeuser

Sample Analysis Request and Chain of Custody Record

Date 3-23-99 | Facility Weyerhaeuser Chlor-Alkali Plant-Longview | Page 1 of 2

Sampler's Project Number: 146982.98.GW

Weyerhaeuser Account Number:

Sampled By: ☐ Facility ☐ E&AS/WTC ☐ E&AS/NB

Consultant's Name: CH2M Hill

Consultant's Address: 825 NE Multnomah Portland, OR 97232

Consultant's Phone Number: (503) 235-5000

Consultant's Fax: 235-2445

Project Manager (print): Kira Sykes

Sampler Name (print): Mike Abbott

Recorded By (signature): Mike Abbott

Method	Field Sample ID (15 characters max.) (required)	Date (mm/dd/yy) (required)	Time (hh:mm) (required)	Depth (ft/m)	MATRIX: Water	Soil/Sed	Oil	PRESERVATIVE: HCl	H_2SO_4	HNO_3	$Na_2S_2O_3$	Filtered	# of Containers
G	WCP-MLA7B-08299-XX	03/23/99	1254		X					X		X	1
	WCP-CH3-08299-XX		1342		X					X		X	1
	WCP-CH3-08299-DU		1400		X					X		X	1
	WCP-CH4-08299-XX		1440		X					X		X	1
	WCP-MLA6B-08299-XX		1615		X					X		X	1
	WCP-MLA3B-08299-XX		1700		X					X		X	1
	WCP-MLA3A-08299-XX	↓	1715		X					X		X	1
	WCP-CH8-08299-XX	03/24/99	1020		X					X		X	1
	WCP-CH7-08399-XX		1114		X					X		X	1
	WCP-CH7-08399-DU		1130		X					X		X	1
↓	WCP-MW1-08399-XX	↓	1203	↓	X					X		X	1

→ "G"rab, "D"epth composite, or "T"ime composite → Required for soil or sediment samples

ANALYSES REQUESTED (circle or write in parameters)

pH	Cond	TDS	TSS	Color	Tannins	Volatile Organics (8240, 8260) / BTEX	Semi-volatile organics	TPH: 418.1	TPH-G	TPH-D	O + G	Metals (list below)	NH_3 CO_3 Cl F NO_3 SO_4	AOX / AOX<1000	TCLP: Metals VOA SVOA Pest Herb PCBs	Dioxin: Total / 2,3,7,8-TCDD / 2,3,7,8-TCDF	CN	BOD	P-ortho	TKN	P-total	TOC	COD	Dissolved Hg EPA 7470	NOTES
																							1	
																							1	
																							1	
																							1	
																							1	
																							1	
																							1	
																							1	
																							1	
																							1	

Remarks/Detection Limit Requirements

0.2 PPB detection limit

All Samples Are Field Filtered

2 ml - HNO_3 added to each sample bottle. HNO_3 sent w/ Bottles.

Laboratory Data

☒ Samples on ice or blue ice

Lab Turn-Around Time

☐ 24 hours
☐ 48 hours
☐ 7 days
☒ 2-3 weeks - date due: __/__/__

☐ WATS/WTC
☐ WATS/NB
☐ Other: _____

Lab SR#

Case ID

SDG ID

Reporting and QA/QC Requirements

☐ CLP Package
☐ NPDES Permit
☐ Other: ON File
☐ Electronic Report

Results To: Kira Sykes
CH2M Hill/PDX

CC: Kira Sykes
CH2M Hill/PDX

Sample Chain of Custody and Shipping Method Record

Relinquished By Sampler (signature)	Date	Time	Received By (signature)	Shipping Method
Mike Abbott	3/25/99	1500		
Relinquished By (signature)	Date	Time	Received By (signature)	Airbill Number
Relinquished By (signature)	Date	Time	Received For Laboratory By (signature)	Cooler Temp (°C)
	3/26/99	0730	Trapped	2/

Samples Received Intact: yes

Form 16307 (R 4-98)

Weyerhaeuser

Sample Analysis Request and Chain of Custody Record

Date: 3-24-99 | Facility: Weyerhaeuser-Chlor-Alkali Plant-Longview | Page 2 of 2

Sampler's Project Number: 146982.98.GW | Weyerhaeuser Account Number:

Sampled By: ☐ Facility ☐ E&AS/WTC ☐ E&AS/NB | Consultant's Name: CH2M Hill

Consultant's Address: 825 NE Multnomah Portland OR 97232 | Consultant's Phone Number: (503) 235-5000 | Consultant's Fax:

Project Manager (print): Kira Sykes | Sampler Name (print): Mike Abbott | Recorded By (signature): Mike Abbott

Method	Field Sample ID (15 characters max.) (required)	Date (mm/dd/yy) (required)	Time (hh:mm) (required)	Depth (ft/m)	Matrix: Water	Soil/Sed	Oil	Preservative: HCl	H_2SO_4	HNO_3	$Na_2S_2O_3$	Filtered	# of Containers	ANALYSES REQUESTED (circle or write in parameters)	NOTES
G	WCP-CH2-08399-XX	03/24/99	1316	—	X					X		X	1	pH Cond TDS TSS Color Tannins; Volatile Organics (8240, 8260) / BTEX; Semi-volatile organics; TPH: 418.1 TPH-G TPH-D; O + G; Metals (list below); NH_3 CO_3 Cl F NO_3 SO_4; AOX / AOX<1000; TCLP: Metals VOA SVOA Pest Herb PCBs; Dioxin: Total / 2,3,7,8-TCDD / 2,3,7,8-TCDF; CN; BOD P-ortho; TKN P-total TOC COD; Dissolved Hg EPA 7470	
	WCP-HLA4A-08399-XX		1408		X					X		X	1		
	WCP-HLA1B-08399-XX		1520		X					X		X	1		
	WCP-HLA1A-08399-XX		1535		X					X		X	1		
	WCP-MW2-08399-XX		1633		X					X		X	1		
	WCP-MW3-08399-XX	↓	1711		X					X		X	1		
	WCP-MW4-08499-XX	03/25/99	1012		X					X		X	1		
	WCP-CH6-08499-XX		1114		X					X		X	1		11:14
	WCP-CH1-08499-XX		1210		X					X		X	1		
	WCP-CH5-08499-XX		1249		X					X		X	1		
↓	WCP-HLA2A-08499-XX	↓	1329	↓	X					X		X	1		

→ "G"rab, "D"epth composite, or "T"ime composite → Required for soil or sediment samples

Remarks/Detection Limit Requirements:
0.2 PPB detection limit
All samples are field filtered
2 ml HNO_3 added to each sample bottle
HNO_3 supplied by Lab w/ bottles

Laboratory Data

☐ Samples on ice or blue ice

Lab Turn-Around Time
☐ 24 hours
☐ 48 hours
☐ 7 days
☒ 2-3 weeks - date due: __/__/__

☐ WATS/WTC
☐ WATS/NB
☐ Other: _____

Lab SR#:
Case ID:
SDG ID:

Reporting and QA/QC Requirements

☐ CLP Package
☐ NPDES Permit
☐ Other: On File
☐ Electronic Report

Results To: Kira Sykes
CH2M Hill - POX
CC: Phyllis Rice
CH2M Hill - POX

Sample Chain of Custody and Shipping Method Record

Relinquished By Sampler (signature)	Date	Time	Received By (signature)	Shipping Method
Mike Abbott	3/25/99	1500		
Relinquished By (signature)	**Date**	**Time**	**Received By (signature)**	**Airbill Number**
Relinquished By (signature)	**Date**	**Time**	**Received For Laboratory By (signature)**	**Cooler Temp (°C)**
	3/26/99	0730	D Chappel	4

Samples Received Intact: yes

Form 16307 (R 4/98)

Weyerhaeuser Analytical & Testing Services
32901 Weyerhaeuser Way South
Federal Way, WA 98003

Service Request 99-0713

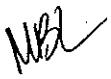
Report

Weyerhaeuser/CH2M Hill Longview Chlor-Alkali Plant Waters

Client ID	Date Sampled	Time Sampled	Lab ID	Dissolved Mercury Hg
				µg/L
WCP-HLA7B-08299-XX	03/23/99	1254	001	3.0
WCP-CH3-08299-XX	03/23/99	1342	002	3.4
WCP-CH3-02399-DU	03/23/99	1400	003	3.2
WCP-CH4-08299-XX	03/23/99	1440	004	0.6
WCP-HLA6B-08299-XX	03/23/99	1615	005	< 0.2
WCP-HLA3B-08299-XX	03/23/99	1700	006	2.8
WCP-HLA3A-08299-XX	03/23/99	1715	007	13.0
WCP-CH8-08399-XX	03/24/99	1020	008	< 0.2
WCP-CH7-08399-XX	03/24/99	1114	009	< 0.2
WCP-CH7-08399-DU	03/24/99	1130	010	< 0.2
WCP-MW1-08399-XX	03/24/99	1203	011	< 0.2
WCP-CH2-08399-XX	03/24/99	1316	012	0.2
WCP-HLA4A-08399-XX	03/24/99	1408	013	< 0.2
WCP-HLA1B-08399-XX	03/24/99	1520	014	13.5
WCP-HLA1A-08399-XX	03/24/99	1535	015	160
WCP-MW2-08399-XX	03/24/99	1633	016	< 0.2
WCP-MW3-08399-XX	03/24/99	1711	017	< 0.2
WCP-MW4-08499-XX	03/25/99	1012	018	< 0.2
WCP-CH6-08499-XX	03/25/99	1114	019	0.3
WCP-CH1-08499-XX	03/25/99	1210	020	0.4
WCP-CH5-08499-XX	03/25/99	1249	021	< 0.2
WCP-HLA2A-08499-XX	03/25/99	1329	022	0.7
		Quantitation Limit:		0.2
		Method Number:		AM1-245.1

Approved: Mary Beth Lanza
Telephone: (253) 924-6013

Date: 04/13/99



Weyerhaeuser Analytical & Testing Services
32901 Weyerhaeuser Way South
Federal Way, WA 98003

Service Request 99-0713

QC Report - Metals

Weyerhaeuser/CH2M Hill Longview Chlor-Alkali Plant Waters

Method Blank Report

Element	Method Blank Found
	µg/L
Hg	< 0.2

Duplicate Report

Element	Sample 001 Found	Duplicate 001 Found	RPD
	µg/L		
Hg	3.0	3.1	3

Spike Recovery Report

Element	Sample 003 Found	Spike 003 Found	Net Spike	Spike Level	% Recovery
	µg/L				
Hg	3.2	4.2	1.0	1.0	100

Water Laboratory Control Sample Report

Element	Sample Found	True Value	Lower Limit	Upper Limit	% Recovery
	µg/L				
Hg	1.5	1.5	1.3	1.7	100

Approved: Mary Beth Lanza
Telephone: (253) 924-6013

Date: 04/13/99

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-24-99

Project #: 146982.98.GW **Field Team: Mike Abbott** **Well I.D.:** MW1

Total Depth: (ft) 22	(-) DTW: (ft) 8.33 Time 11:35	= 13.67	(X) 0.17 gal/ft	= Well Casing Volume: 2.3
Field Conditions:				
Decontamination: Alconox + tap wash; Tap rinse; DI rinse				

PURGE INFORMATION

X	Purge Method : Peristaltic pump with ~~new~~ polyethylene tubing & C-flex head tubing
	Purge Method : New polyethylene bailer Dedicated
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [X] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
11:45	Pump On							Initial 8.33	30%, Clear, Colorless
13:47	~.3	294	10.7	6.15	—	—		—	" " "
11:50	2.3	384	10.7	6.44	-5	—		8.45	" " "
11:55	4.6	446	10.8	6.52	-9	—		8.46	" " "
12:01	7.0	470	10.8	6.55	-10	2		8.46	" " "
:									
:									
:									
:									
12:03	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 3/24/97		Time: 12:03					
Sampling Method:		From presurrized polyethylene bailer					
		From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP-HWI-08399-XY		(1)	500 mL	Poly	HNO3	3/25	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-24-99

Project #: 146982.98.GW **Field Team:** Mike Abbott **Well I.D.:** MW2

Total Depth: (ft)	(-) DTW: (ft)	Time	=	(X) gal/ft	= Well Casing Volume:
22.5	6.81 (3/24)	1602	15.69	0.17	2.7

Field Conditions:

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with ~~new~~ polyethylene tubing & C-flex head tubing
	Purge Method : New polyethylene bailer Dedicated
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [X] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
								Initial	
16:11	Pump On							6.81	20%, Clear Colorless
16:13	1	8,560	9.2	5.49	-42	—		—	" " "
16:18	2.7	7,880	9.3	6.00	-40	—		7.08	" " "
16:24	5.4	7,280	9.2	6.27	-43	—		7.11	" " "
16:31	8.1	6,980	9.2	6.38	-45	2		7.13	" " "
:									
:									
:									
:									
16:33	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 3/24/99		Time: 16 :33					
Sampling Method:		From presurrized polyethylene bailer					
		From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP- MW2-08399-XX		(1)	500 mL	Poly	HNO3	3/25	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-24-99

Project #: 146982.98.GW **Field Team:** Mike Abbott **Well I.D.:** MW3

Total Depth: 22.5 (ft)	(-) 3/24 DTW: 6.86 (ft)	Time 16:44	15.64 =	(X) 0.17 gal/ft	= Well Casing Volume: 2.7

Field Conditions: RAIN, 50° F

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with ~~new~~ polyethylene tubing & C-flex head tubing
	Purge Method : New polyethylene bailer Dedicated
Y	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: X 10 oz cup ☐ Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
16 ~~15~~:50	Pump On							Initial 6.86	20% clear Colorless
~~15~~:53	1	172	9.8	5.40	-31	—		—	" " "
~~15~~:57	~~3~~ 3	2400	9.9	6.24	-33	—		7.15	" " "
17:03	~5.5	2315	10.0	6.58	-38	—		7.16	" " "
17:09	-8.1	2175	10.1	6.71	-35	2		7.17	" " "
:									
:									
:									
:									
17:11	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 3/24/99		Time: 17:11					
Sampling Method:		From presurrized polyethylene bailer					
		From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP-MW3-08399-xy		(1)	500 mL	Poly	HNO3	3/25	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Comments:							
Lab: Weyerhaeuser - Tacoma, WA							

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-25-99

Project #: 146982.98.GW **Field Team: Mike Abbott** **Well I.D.:** MW4

Total Depth: (ft) 27.0	(-) DTW: (ft) 3/25 Time 13.29 0910	13.71 =	(X) 0.17 gal/ft	= Well Casing Volume: 2.3

Field Conditions:

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with ~~new~~ polyethylene tubing & C-flex head tubing
	Purge Method : New polyethylene bailer Dedicated
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [X] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
09:40	Pump On							Initial 13.29	20%, Clear, Colorless, lt. Amber sucking air
09:44	1	786	10.6	8.80	-86	—		—	" " "
09:49	2.3	557	10.2	7.46	-85	—		13.33	" " "
:	4.6	631	10.3	8.18	-184	—		—	" " "
10:07	7	729	10.3	8.97	-190	1		13.33	" " "
10:10	7.8	735	10.3	8.99	-199	1		13.33	" " "
:									
:									
:									
10:12	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 3 / 25 / 99		Time: 10 : 12					
Sampling Method:		From presurrized polyethylene bailer					
	X	From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP-MW4-08499-XX		(1)	500 mL	Poly	HNO3	3/25	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-25-99

Project #: 146982.98.GW **Field Team:** Mike Abbott **Well I.D.:** CH1

Total Depth: (ft) 17	(-) 3/25 DTW: (ft) 6.66 Time 11:32	10.34 =	(X) 0.17 gal\ft	= Well Casing Volume: 1.8

Field Conditions: Overcast, 50°F

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with ~~new~~ polyethylene tubing & C-flex head tubing
	Purge Method : New polyethylene bailer ~~dedicated~~
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [X] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
11:37	Pump On							Initial 6.66	20%, Dark Amber
11:40	~1	2853	12.3	8.77	-170			—	" " sucked Air
11:43	1.8	Pump off to extend tubing						—	" " "
11:45	2								15% Dark Amber
11:51	3.6	1441	14.3	7.75	-146	10		11.87	" "
11:58	5.5	1338	14.5	7.69	-156	9.5		11.83	" "
12:02	~~3.67~~	1295	14.5	7.69	~~-316~~ (N2 Gas)	9.5		11.84	" "
12:05		1258	14.6	7.70	-32	9.0		11.84	" "
12:08					-158	wrong probe			
12:10	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 3/25/99		Time: 12:10					
Sampling Method:		From presurrized polyethylene bailer					
		From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP-CHI-08499-XY		(1)	500 mL	Poly	HNO3	3/25	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-24-99

Project #: 146982.98.GW **Field Team:** Mike Abbott **Well I.D.:** CH2

Total Depth: (ft) 17	(-) 3/24 DTW: (ft) 2.53 Time 1235	14.47 =	(X) 0.17 gal/ft	= Well Casing Volume: 2.5

Field Conditions: RAIN, 50°F, Breezy

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with ~~new~~ polyethylene tubing & C-flex head tubing
	Purge Method : New polyethylene bailer Dedicated
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [ ] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
12:44	Pump On							Initial 2.53	15%, Light Amber, SC
12:46	~0.5	237	12.2	7.03	-24	—		—	" " "
12:53	2.5	232	12.0	6.90	+6	145		6.57	" " C
12:58	4.0	222	12.0	6.73	+18	—		6.85	" " "
13:01	5.0	223	12.0	6.77	+19	130		—	" " "
13:04	6.0	220	12.0	6.80	+20	125		6.97	" " "
13:07	6.5	209	11.9	6.77	+24	120		7.12	↓10% " "
13:11	7.0	215	11.9	6.79	+25	115		6.80	" " "
13:13	7.3	220	11.9	6.80	+27	109		6.37	" " "
13:16	1316 Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: / /		Time: :					
Sampling Method:		From presurrized polyethylene bailer					
		From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP-		1	500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

Dupe

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-23-99

Project #: 146982.98.GW **Field Team:** Mike Abbott **Well I.D.:** CH3

Total Depth: (ft)	(-) DTW: (ft)	Time	=	(X) gal/ft	= Well Casing Volume:
17.5	8.05	1014	9.45	0.17	1.6

Field Conditions: WINDY 50°F, P Cloudy

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with ~~new~~ polyethylene tubing & C-flex head tubing
	Purge Method : New polyethylene bailer ↓ Dedicated
	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: X 10 oz cup — Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
13:31	Pump On							Initial 8.05	30%, Dark Amber
13:32		1700	14.1	7.0	-181	—		—	" " "
13:34	1.6	1795	14.3	7.44	-199	10		8.19	" " "
13:37	3.2	1836	14.4	7.47	-202	7		—	" " "
13:41	5.0	1833	14.4	7.57	-192	8		8.21	" " "
:									
:									
:									
:									
13:42	Start Sampling								
:	End Sampling								
13:44		1821	14.5	7.57	-197	7		—	" " "

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

8.05

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 3/23/99		Time: 13:42					
Sampling Method:		From presurrized polyethylene bailer					
		From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP-CH3-08299-XY		(1)	500 mL	Poly	HNO3	3/25	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time WCP-CH3-08299-DU	(1)		500 mL	Poly	HNO3	"	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Comments:							
Lab: Weyerhaeuser - Tacoma, WA							

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

TD on 3/23/99 20.6 ft

Date: 3-23-99

Project #: 146982.98.GW **Field Team: Mike Abbott** **Well I.D.: CH4**

Total Depth: (ft)	(-) DTW: (ft)	Time	=	(X) gal/ft	= Well Casing Volume:
22	16.27 e 16.22	1414 1008	5.73	(0.17)	(1)

Field Conditions: WINDY, Overcast, 50°F

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with ~~new~~ polyethylene tubing & C-flex head tubing
	Purge Method : New polyethylene bailer ~~Dedicated~~
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [X] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
								Initial	
14:21	Pump On							16.27	10%, Medium Amber
14:25	~.2	1440	14.8	6.92	-146	38		—	10%, sucked AIR SAnd est? Worms!
14:29	~1	1611	14.9	7.20	-170	17		17.55	10%, S.Solids, Amber
14:32	~1.5	1668	14.9	7.20	-178	29		18.62	" " "
14:35	~2.1	1587	15.0	7.19	-179	20		19.30	" " "
14:38	~2.5	1580	14.9	7.19	-179	19		19.90	" " "
:									
:									
:									
14:40	Start Sampling								
14:41	End Sampling								
DRY								20.6	Well DRY

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 3/23/99		Time: 14 : 40					
Sampling Method:		From presurrized polyethylene bailer					
	X	From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP-CH4-08299-xy		(1)	500 mL	Poly	HNO3	3/25	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-25-99

Project #: 146982.98.GW **Field Team: Mike Abbott** **Well I.D.:** CH5

Total Depth: (ft) 17	(-) DTW: (ft) 3/25 Time 10.09 12:26	= 6.91	(X) 0.17 gal/ft	= Well Casing Volume: 1.2
Field Conditions: Overcast, 50°F				
Decontamination: Alconox + tap wash; Tap rinse; DI rinse				

PURGE INFORMATION

X	Purge Method : Peristaltic pump with ~~new~~ polyethylene tubing & C-flex head tubing
	Purge Method : New polyethylene bailer Dedicated
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: X 10 oz cup — Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
12:33	Pump On							Initial 10.09	20%, Cloudy - Grey-Brown
12:35	1.4	600	13.4	7.10	-61	~~67~~		—	" , Clear, Hint of Amber
12:36	1.2	2500↑	13.3	7.12	-68	—		10.22	" " #Colorless
12:40	2.4	3700	13.3	7.19	-86	—		10.33	" " " "
12:44	3.6	3750	13.4	7.28	-99	2		10.22	" " " "
12:47	4.6	3723	13.3	7.30	-106	2		10.22	" " " "
:									
:									
:									
12:49	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 3/25/99		Time: 12:49					
Sampling Method:		From presurrized polyethylene bailer					
		From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP-C45-08499-XY		(1)	500 mL	Poly	HNO3	3/25	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG
Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-25-99

Project #: 146982.98.GW **Field Team:** Mike Abbott **Well I.D.:** CH6

Total Depth: (ft) 32	(-) DTW: (ft) 3/25 14.61 Time 10:15	= 17.39	(X) 0.17 gal/ft	= Well Casing Volume: 3.0
Field Conditions:				
Decontamination: Alconox + tap wash; Tap rinse; DI rinse				

PURGE INFORMATION

X	Purge Method : Peristaltic pump with ~~new~~ polyethylene tubing & C-flex head tubing
	Purge Method : New polyethylene bailer Dedicated
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [X] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
10:43	Pump On							Initial 14.61	20%, Clear, Colorless,
10:44	~.5	170,000	16.5	6.64	-52	—		—	" " "
10:52	3	198,000	16.5	6.68	-79	—		14.89	" " "
11:04	6	198,000	16.5	6.70	-87	0.8		14.85	" " "
11:13	9	198,400	16.5	6.71	-91	0.7		14.84	" " "
:									
:									
:									
:									
11:14	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 3 / 25 / 99		Time: 11 : 14					
Sampling Method:		From presurrized polyethylene bailer					
	X	From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP-CHG-08499-XY		(1)	500 mL	Poly	HNO3	3/25	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

Dupe

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-24-99

Project #: 146982.98.GW **Field Team:** Mike Abbott **Well I.D.:** CH7

Total Depth: 24.00 (ft)	(-) DTW: (ft) 15.24	Time 10:38	8.76 =	(X) (0.17) gal/ft	= Well Casing Volume: 1.5
Field Conditions: RAIN, 50°F, lt. wind					
Decontamination: Alconox + tap wash; Tap rinse; DI rinse					

PURGE INFORMATION

X	Purge Method : Peristaltic pump with ~~new~~ polyethylene tubing & C-flex head tubing	
	Purge Method : New polyethylene bailer (Dedicated)	
X	Refer to calibration log this date.	
Pump Suction Depth(ft): Top of water column		Purge water disposal: Drums
Type of Flow Through Cell:	X 10 oz cup	Grab Sample
Comments/Exceptions to SAP:		

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
10:45	Pump On							Initial 15.24	20% Broken line Air in Discharge
10:48	1	534	13.9	6.98	-111	—		—	10% Medium Amber, Clear
10:52	1.6	530	13.9	7.00	-130	4		16.28	" " "
11:01	3.3	694	14.0	6.97	-147	5		16.28	" " "
11:08	4.5	720	14.0	6.97	-10	4		16.28	" " "
11:11	5	725	14.0	6.97	-10	4		16.29	" " "
11:13	5.5	730	14.0	6.97	-10	5		16.29	" " "
:									
:									
11:14	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 3 / 24 / 99		Time: 11 : 14					
Sampling Method:		From presurrized polyethylene bailer					
		From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP-CH7-08399-YY		(1)	500 mL	Poly	HNO3	3/25	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time 11:30 WCP-CH7-08399-DU	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Comments:							
Lab: Weyerhaeuser - Tacoma, WA							

CH2M HILL WELL SAMPLING FIELD LOG
Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-24-99

Project #: 146982.98.GW **Field Team:** Mike Abbott **Well I.D.:** C18

Total Depth: (ft) 25.48	(-) DTW: (ft) 3/24 Time 1403 0920	= 11.45	(X) 0.17 gal/ft	= Well Casing Volume: 1.9
Field Conditions: Overcast, lt. rain, 50°F				
Decontamination: Alconox + tap wash; Tap rinse; DI rinse				

PURGE INFORMATION

X	Purge Method : Peristaltic pump with new polyethylene tubing & C-flex head tubing			
	Purge Method : New polyethylene bailer Dedicated			
X	Refer to calibration log this date.			
Pump Suction Depth(ft): Top of water column			Purge water disposal: Drums	
Type of Flow Through Cell:	X	10 oz cup		Grab Sample
Comments/Exceptions to SAP: 2 full 35 gal. Weyco Drums filled @ well from development. Called Joel Bunker to Coordinate.				

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
								Initial	
09:38	Pump On Calibrating Instruments							14.03	10%, Cloudy, Orange
09:43	0.8	142	9.3	—	—	—		—	" , VSC , Amber tint
09:55	2.8	147	9.3	6.49	+173	—		14.85	" , AC , "
10:03	4.0	150	9.4	6.53	+147	4		14.90	" , C , "
10:15	6.0	150	9.4	6.57	+112	2		14.91	" , C , "
10:19	6.6	150	9.4	6.58	+106	2		14.91	" , C , "
:									
:									
:									
10:20	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 3/24/99		Time: 10:20					
Sampling Method:		From presurrized polyethylene bailer					
	X	From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP-CH8-08399-YY		(1)	~~500 mL~~ 250	Poly	HNO3	3/25	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-24-99

Project #: 146982.98.GW **Field Team:** Mike Abbott **Well I.D.:** HLA1A

Total Depth: (ft) 7.9	(-) Time DTW: (ft) 5.61	=	(X) 0.17 gal/ft	= Well Casing Volume:

Field Conditions: RAIN, 50°F

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with ~~new~~ polyethylene tubing & C-flex head tubing
	Purge Method : New polyethylene bailer Dedicated
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column Purge water disposal: Drums

Type of Flow Through Cell: [ ] 10 oz cup [X] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
14:30	Pump On							Initial 5.61	10% light Amber SC
14:34	DRY							DRY	
:									
15:26								5.63	
1':									
:									
:									
:									
:									
15:35	Start Sampling								
:	End Sampling								
15:35		520	10.9	9.94	—	—			light Amber SC

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Gregory Bean 360-578-4445 Clean 6.41

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 3 / 24 / 99		Time: :					
Sampling Method:		From presurrized polyethylene bailer					
	X	From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP- HLA 1A-08399-XX		(1)	500 mL	Poly	HNO3	3/25	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-24-99

Project #: 146982.98.GW **Field Team:** Mike Abbott **Well I.D.:** ~~3-37-99~~ HLA1B

Total Depth: (ft)	(-) DTW: (ft)	Time		(X) gal/ft	= Well Casing Volume:
35	4.95 5.	1436	3005 =	(0.17)	5-1

Field Conditions: RAIN, 50°F

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with ~~new~~ polyethylene tubing & C-flex head tubing
	Purge Method : New polyethylene bailer Dedicated
V	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [X] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
~~14:30~~ 1442	Pump On							Initial 4.95	~~30%~~ ~~LT~~ LT Amber VSC
~~14:34~~	~~ARY~~								
14:44	1	1657	13.6	9.39	-11	17		—	" " "
~~14:52~~ 14:52	6	1765	14.7	10.68	-63	19		7.11	" "
15:02	11	1609	14.7	10.50	-63	18		7.23	" " "
15:09	15	1548	14.6	10.40	-89	17		7.28	" " "
15:12	16.5	1526	14.6	10.38	-120	17		7.41	" " "
15:15	18	1538	14.6	10.42	-155	15		—	" " "
15:18	19.5	1522	14.6	10.33	-168	13		7.78	" " "
15:20	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 3 / 24 / 99		Time: 15 :20					
Sampling Method:		From presurrized polyethylene bailer					
	X	From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP- HLA1B-08399-XX		(1)	500 mL	Poly	HNO3	3/25	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-25-9

Project #: 146982.98.GW **Field Team:** Mike Abbott **Well I.D.:** HLA2A

Total Depth: (ft) 8.2	(-) DTW: (ft) 5.28	Time 3/25 13:03	= 2.92	(X) 0.17 gal/ft	= Well Casing Volume: 0.5

Field Conditions: Overcast, 50°F

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with ~~new~~ dedicated polyethylene tubing & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [X] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
13:08	Pump On							Initial 5.28	<5% Clear, Colorless
13:10		811	11.3	6.85	-51	—		5.85	" " "
13:17	~0.5	808	11.3	6.90	-54	—		5.90	" " "
13:22	~1.0	844	11.3	6.89	-55	—		5.88	" " "
13:28	~1.5	893	11.3	6.90	-57				
:									
:									
:									
:									
13:29	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: / /		Time: :					
Sampling Method:		From presurrized polyethylene bailer					
		From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP-		1	500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-23-99

Project #: 146982.98.GW **Field Team:** Mike Abbott **Well I.D.:** HLA3A

Total Depth: (ft) Measured 6.29	(-) DTW: (ft) 3.60 @ 1631	= 2.69	(X) 0.17 gal/ft	= Well Casing Volume: 0.45
Field Conditions:				
Decontamination: Alconox + tap wash; Tap rinse; DI rinse				

PURGE INFORMATION

X	Purge Method : Peristaltic pump with new polyethylene tubing & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: X 10 oz cup — Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
16:40	Pump On							Initial 3.60	5% VSC, Colorless
16:42	~0.2	797	12.0	8.73	-8	30		5.56	" " "
16:44	0.5	3,500	12.0	8.87	-44	14		5.93	" " "
16:47	0.9	8,740	12.1	—	-67	—	DRY	~~DRY~~	Pump ↑ 8% Speed
16:50	1.2	10,530	12.3	9.46	-80	2		DRY	
:									
17:06	Pump ON		~~12.3~~	9.74				3.77	5% Clear Colorless
17:09	1.5	13,200	12.4	9.74	-97	2		4.60	5%
17:12	1.7	13,180	12.3	9.70	-97	2		4.80	5%
17:13	Start Sampling								
17:15	End Sampling								
:									

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 3/23/99		Time: :					
Sampling Method:		From presurrized polyethylene bailer					
		From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP- HCA3A-08299-xy		(1)	500 mL	Poly	HNO3	3/25	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-24-99

Project #: ~~146982.98.GWC~~ AAP **Field Team:** Mike Abbott **Well I.D.:** HLA4A

Total Depth: (ft) 6.9	(-) Time DTW: (ft) 4.83	=	(X) 0.17 gal\ft	= Well Casing Volume:

Field Conditions: Heavy Rain, 50°F

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with ~~new~~ polyethylene tubing & C-flex head tubing
	Purge Method : New polyethylene bailer Dedicated
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [ ] 10 oz cup [X] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
13:57	Pump On							Initial 4.83	10%
13:54	DRY					Measured		DRY	
:									
14:08								5.9	
:									
:									
:									
:									
:									
14:08	Start Sampling								
:	End Sampling								
14:08		67	10.4	6.76	—	VSC		DRY	SC, Sand, Colorless

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 3 / 24 / 99		Time: 14 : 08					
Sampling Method:		From presurrized polyethylene bailer					
	X	From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP- HC4YA-08399-YY		(1)	500 mL	Poly	HNO3	3/25	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-23-99

Project #: 146982.98.GW **Field Team:** Mike Abbott **Well I.D.:** HLA3B

Total Depth: (ft)	(-) DTW: (ft)	Time	=	(X) gal\ft	= Well Casing Volume:
29	4.37	1022	2463	(0.17)	4.2

Field Conditions:

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

	Purge Method : Peristaltic pump with new polyethylene tubing & C-flex head tubing
X	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [ ] 10 oz cup [X] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
:	Pump On							Initial	
15:55	start								Clear Colorless
16:09	stop pumping	~7 gallons			DRY				"
:									
:									
:									
:									
:									
16:55								25.00	
17:00	Start Sampling								
~~17:02~~	End Sampling								
17:00		35,500	15.9	8.10	*-21				Clear Colorless

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

* not valid - reference only - filled cup from bottom up using Bailer

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 3/23/99		Time: 17:00					
Sampling Method:	X	From presurrized polyethylene bailer					
		From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP-HLA3B-08299-XX		(1)	500 mL	Poly	HNO3	3/25	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Comments:							
Lab: Weyerhaeuser - Tacoma, WA							

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-23-99

Project #: 146982.98.GW **Field Team:** Mike Abbott **Well I.D.:** ~~MW~~ HLA6B

Total Depth: (ft) 28.2	(-) DTW: (ft) 11.80	Time 1509	= 16.4	(X) (0.17) gal/ft	= Well Casing Volume: 2.8

Field Conditions:

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with (new) polyethylene tubing & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [X] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP: (ST Turning) Peristaltic Pump

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
15:19	Pump On							Initial 11.80	100% - Clear, Colorless
15:22		4,900	14.6	8.42	-132	2		14.40	100%, " "
15:28	1.1	6,400	14.4	8.17	-103	2		18.27	" " suction rate
15:42	2.0	11,480	14.6	7.54	-61	2		19.3	80% " " "
16:10	3.2	12,780	14.4	7.51	-60	0.7		19.45	" " " "
16:13	3.4	12,980	14.5	7.51	-59	0.6		19.45	" " " "
:									
:									
:									
16:15	Start Sampling								
16:17	End Sampling								
:									

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 3 / 23 / 99		Time: 16 : 15					
Sampling Method:		From presurrized polyethylene bailer					
		From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP- HLA6B-08299-XX		(1)	500 mL	Poly	HNO3	3/25	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time		(1)	500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Comments:							
Lab: Weyerhaeuser - Tacoma, WA							

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-23-99

Project #: 146982.98.GW **Field Team:** Mike Abbott **Well I.D.:** HCA7B

Total Depth: (ft)	(-) DTW: (ft)	Time	=	(X) gal/ft	= Well Casing Volume:
28.2	8.40 ~~8.35~~	10:00	19.8	(X) (0.17)	3.4

Field Conditions: P.Cloudy, 50°F, ~~Ht Breeze~~ Windy

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with new polyethylene tubing & C-flex head tubing
	Purge Method : New polyethylene bailer
	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [X] 10 oz cup [X] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
12:09	Pump On							Initial 8.40	10%, Clear, Colorless
12:11		204	13.1	9.71	—	4.6		—	" " " sucked Air
12:16	~1	176	14.1	10.31	42	9		14.05	" VSC "
12:28	~2.2	285	13.4	10.06	0.3	~~8~~ 8		16.15	" AC "
12:41	3.3	371	13.5	10.29	-45	18		16.97	" VSC "
12:44	3.5	362	13.5	10.28	-49	14		19.61	" VSC "
12:47	3.7	525	13.5	10.32	-30	13		20.18	" VSC "
12:50	3.9	1150	13.6	10.33	-26	12		20.60	"		"
12:53	4.1	1255	13.6	10.34	-27	9		20.88	"		"
12:54	Start Sampling							~~20.28~~	" " "
12:57	End Sampling								
12:58		1700	14.1	10.44	-37			20.24	" " "

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

31
28
23
82

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 3/23/99		Time: 12:54					
Sampling Method:		From presurrized polyethylene bailer					
	X	From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP- HLA7B-08299-XY		(1)	250 ~~500~~ mL	Poly	HNO3	3/25	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

First time Purged & Sampled w/Peristaltic Pump

Lab: Weyerhaeuser - Tacoma, WA

120899 memo

Weyerhaeuser

32901 Weyerhaeuser Way South
Federal Way WA 98003
Tel (253) 924-6872
Fax (253) 924-6654

October 13, 1999

Ms. Anne Bolling
CH2M Hill
825 NE Multnomah, Suite 1300
Portland, OR 97232-2146

RE: Service Request 99-2151 Weyerhaeuser Longview Chlor-Alkali Plant/CH2M HILL
OOE# 7032071

Dear Anne:

Attached are the copies of our final report for the sample you requested we analyze. These are from our service request number 99-2151. Invoicing for this work will be directly to Weyerhaeuser. If you have any questions concerning this report, please feel free to contact me at (253) 924-6242.

Thank you for using our laboratory for this analysis and we look forward to working with you on future projects.

Sincerely,

Dennis Catalano, Project Manager
Weyerhaeuser Analytical and Testing Services

Attachments

cc: Phyllis Rice CH2M Hill

H:\ADMIN\ADMIN\CVRLTR\bolling.doc

SR Title : Longview Chlor-Alkali Plant remediation waters
Number of Samples : 16

Submitter Name : Bolling, Anne
Submitter Address : Portland, OR
Submitter Phone : 503-235-5000 x4241
Charge Number : 046-5648
PO Number : OOE# 7032071

Date Received : 09/23/99
Date Desired : 10/14/99
Hardcopy Format :
Disk Format :

Reviewer : Catalano, Dennis
Reviewer Address : WTC 2F25
Reviewer Phone : 6242

ORB Number :
Date Completed :

Copy to :
Comments/Notes : samples are field filtered 0.2 PPB det. lmt

Reference SR : 99-1174

Revisions :

Test Name		Test Description	Component List	
3-HG-W		Mercury Prep - Water		
HG	HG-W	Mercury	Total Mercury in Water	

Lab ID	Client Sample ID	Date Sampled	Test Name	
001	WCP-CH6-26499-XX	09/21/99 1335	3-HG-W	
			HG	HG-W
002	WCP-CH5-26499-XX	09/21/99 1425	3-HG-W	
			HG	HG-W
003	WCP-CH5-26499-DU	09/21/99 1427	3-HG-W	
			HG	HG-W
004	WCP-CH1-26499-XX	09/21/99 1506	3-HG-W	
			HG	HG-W
005	WCP-HLA2A-26499-XX	09/21/99 1542	3-HG-W	
			HG	HG-W

006	WCP-CH3-26499-XX	09/21/99 1617	3-HG-W HG	 HG-W
007	WCP-CH4-26499-XX	09/21/99 1655	3-HG-W HG	 HG-W
008	WCP-CH8-26599-XX	09/22/99 0847	3-HG-W HG	 HG-W
009	WCP-HLA7B-26599-XX	09/22/99 0930	3-HG-W HG	 HG-W
010	WCP-HLA3A-26599-XX	09/22/99 0954	3-HG-W HG	 HG-W
011	WCP-HLA3B-26599-XX	09/22/99 1010	3-HG-W HG	 HG-W
012	WCP-HLA6B-26599-XX	09/22/99 1042	3-HG-W HG	 HG-W
013	WCP-CH2-26599-XX	09/22/99 1139	3-HG-W HG	 HG-W
014	WCP-HLA1B-26599-XX	09/22/99 1420	3-HG-W HG	 HG-W
015	WCP-HLA1B-26599-DU	09/22/99 1421	3-HG-W HG	 HG-W
016	WCP-CH7-26599-XX	09/22/99 1504	3-HG-W HG	 HG-W

Group	Test Name	No. of Samples	Cost per Sample($)	Cost Mult	Line Total
METALS	3-HG-W	16	30.00	1.00	480.00
METALS	HG	HG-W	16	0.00	1.00	0.00
		Total METALS Charges ($)			480.00

Ref #	Group	Memo Charge Description	Notes/PO Number	Line Total($)

Cost Summary

Total Test Charges ($)	480.00
Total Memo Charges ($)	0.00
Total Charges for Service Request ($)	480.00

Weyerhaeuser

Sample Analysis Request and Chain of Custody Record

Date	Facility	Page
9-21-99	Weyerhaeuser Chlor-Alkali Plant Longview, WA	Page 1 of 2

Sampler's Project Number	Weyerhaeuser Account Number
~~AR~~ 155027.FS.GW	

Sampled By	Consultant's Name
☐ Facility ☐ E&AS/WTC ☐ E&AS/NB	CH2M Hill

Consultant's Address	Consultant's Phone Number	Consultant's Fax
825 NE Multnomah, Portland, OR 97232	(503) 235-5000	235-2445

Project Manager (print)	Sampler Name (print)	Recorded By (signature)
Ann Bolling	Mike Abbott	Mike Abbott

SAMPLE DESCRIPTION					MATRIX				PRESERVATIVE						ANALYSES REQUESTED (circle or write in parameters)																				NOTES
Method	Field Sample ID (15 characters max.) (required)	Date (mm/dd/yy) (required)	Time (hh:mm) (required)	Depth (ft/m)	Water	Soil/Sed	Oil		HCl	H_2SO_4	HNO_3	NaS_2O_3		Filtered	# of Containers	pH Cond TDS TSS Color Tannins	Volatile Organics (8240, 8260) / BTEX	Semi-volatile organics	TPH: 418.1 TPH-G TPH-D	O+G	Metals (list below)	NH_3 CO_3 Cl F NO_3 SO_4	AOX / AOX<1000	TCLP: Metals VOA SVOA Pest Herb PCBs	Dioxin: Total / 2,3,7,8-TCDD / 2,3,7,8-TCDF	CN	BOD P-ortho	TKN P-total TOC COD	EPA 7470 Diss. Hg					
G	WCP-CH6-26499-XX	9/21/99	1335	—	X						X				1														X					
G	WCP-CH5-26499-XX	↓	1425	↓	X						X				1														X					
G	WCP-CH5-26499-DU		1427		X						X				1														X					
G	WCP-CH1-26499-XX		1506		X						X				1														X					
G	WCP-HLA2A-26499-XX		1542		X						X				1														X					
G	WCP-CH3-26499-XX		1617		X						X				1														X					
G	WCP-CH4-26499-XX	↓	1655	↓	X						X				1														X					

→ "G"rab, "D"epth composite, or "T"ime composite

→ Required for soil or sediment samples

Remarks/Detection Limit Requirements

0.2 PPB detection limit

All samples are field filtered

2-0-mL, 1:1, HNO_3 added to each sample.

Laboratory Data

- ☒ Samples on ice or blue ice

Lab Turn-Around Time

- ☐ 24 hours
- ☐ 48 hours
- ☐ 7 days
- ☒ 2-3 weeks - date due: __/__/__

- ☐ WATS/WTC
- ☐ WATS/NB
- ☐ Other: _____

Lab SR#

Case ID

SDG ID

Reporting and QA/QC Requirements

- ☐ CLP Package
- ☐ NPDES Permit
- ☒ Other: On File
- ☐ Electronic Report

Results To: Ann Bolling, CH2M Hill - PDX

CC: Phyllis Rice, CH2M Hill - PDX

Sample Chain of Custody and Shipping Method Record

Relinquished By Sampler (signature)	Date	Time	Received By (signature)	Shipping Method
Mike Abbott	9/22/99	1515		
Relinquished By (signature)	**Date**	**Time**	**Received By (signature)**	**Airbill Number**
Relinquished By (signature)	**Date**	**Time**	**Received For Laboratory By (signature)**	**Cooler Temp (°C)**
	9/23/99	0730	B Chappelear Samples Received Intact	4

Form 16307 (R 4/98)

Weyerhaeuser

Sample Analysis Request and Chain of Custody Record

Date: 9-22-99	Facility: Weyerhaeuser Chlor-Alkali Plant - Longview, WA	Page 2 of 2
Sampler's Project Number: 155027.FS.GW	Weyerhaeuser Account Number:	
Sampled By: ☐ Facility ☐ E&AS/WTC ☐ E&AS/NB	Consultant's Name: CH2M Hill	
Consultant's Address: 825 NE Multnomah, Portland, OR 97232	Consultant's Phone Number: (503) 235-5000	Consultant's Fax: 235-2445
Project Manager (print): Ann Bolling	Sampler Name (print): Mike Abbott	Recorded By (signature): Mike Abbott

Method	Field Sample ID (15 characters max.) (required)	Date (mm/dd/yy) (required)	Time (hh:mm) (required)	Depth (ft/m)	Matrix: Water	Soil/Sed	Oil	Preservative: HCl	H_2SO_4	HNO_3	$Na_2S_2O_3$	Filtered	# of Containers	ANALYSES REQUESTED (circle or write in parameters)	NOTES
G	WCP-CH8-26599-XX	9/22/99	0847	—	X					X			1		
	WCP-HLA7B-26599-XX		0930	—	X					X			1		
	WCP-HLA3A-26599-XX		0954	—	X					X			1		
	WCP-HLA3B-26599-XX		1010	—	X					X			1		
	WCP-HLA6B-26599-XX		1047	—	X					X			1	date on bottle = 9/21/99	
	WCP-CH2-26599-XX		1139	—	X					X			1		
	WCP-HLA1B-26599-XX		1420	—	X					X			1		
	WCP-HLA1B-26599-DU		1421	—	X					X			1		
↓	WCP-CH7-26599-XX	↓	1504	—	X					X			1		

ANALYSES REQUESTED columns: pH, Cond, TDS, TSS, Color, Tannins; Volatile Organics (8240, 8260) / BTEX; Semi-volatile organics; TPH: 418.1, TPH-G, TPH-D; O + G; Metals (list below); NH_3, CO_3, Cl, F, NO_3, SO_4; AOX / AOX<1000; TCLP: Metals, VOA, SVOA, Pest, Herb, PCBs; Dioxin: Total / 2,3,7,8-TCDD / 2,3,7,8-TCDF; CN; BOD, P-ortho; TKN, P-total, TOC, COD; EPA 7470 Hg

→ "G"rab, "D"epth composite, or "T"ime composite

→ Required for soil or sediment samples

Remarks/Detection Limit Requirements:
0.2 PPB detection Limit
All samples are field filtered
2.0 mL, 1:1, HNO_3 added to each sample

Laboratory Data

☒ Samples on ice or blue ice

Lab Turn-Around Time
- ☐ 24 hours
- ☐ 48 hours
- ☐ 7 days
- ☒ 2-3 weeks - date due: __/__/__

- ☐ WATS/WTC
- ☐ WATS/NB
- ☐ Other: _____

Lab SR#

Case ID

SDG ID

Reporting and QA/QC Requirements

- ☐ CLP Package
- ☐ NPDES Permit
- ☒ Other: on file
- ☐ Electronic Report

Results To: Ann Bolling
CH2M Hill - PDX
CC: Phyllis Rice - PDX
CH2M Hill

Sample Chain of Custody and Shipping Method Record

Relinquished By Sampler (signature)	Date	Time	Received By (signature)	Shipping Method
Mike Abbott	9/22/99	1515		
Relinquished By (signature)	Date	Time	Received By (signature)	Airbill Number
Relinquished By (signature)	Date	Time	Received For Laboratory By (signature)	Cooler Temp (°C)
	9/23/99	0730	BChappel	4
			Samples Received Intact: yes	

Form 16307 IR 4/98

Weyerhaeuser Analytical & Testing Services
32901 Weyerhaeuser Way South
Federal Way, WA 98003

Service Request 99-2151

12/15/99

Report

Longview Chlor-Alkali Plant Remediation Waters

Client ID	Date Sampled	Time Sampled	Lab ID	Dissolved Mercury Hg µg/L	
WCP-CH6-26499-XX	09/21/99	1335	001	0.2	J
WCP-CH5-26499-XX	09/21/99	1425	002	< 0.2	R
WCP-CH5-26499-DU	09/21/99	1427	003	< 0.2	R
WCP-CH1-26499-XX	09/21/99	1506	004	1.6	J
WCP-HLA2A-26499-XX	09/21/99	1542	005	32	J
WCP-CH3-26499-XX	09/21/99	1617	006	2.3	J
WCP-CH4-26499-XX	09/21/99	1655	007	0.6	J
WCP-CH8-26599-XX	09/22/99	0847	008	< 0.2	R
WCP-HLA7B-26599-XX	09/22/99	0930	009	0.8	J
WCP-HLA3A-26599-XX	09/22/99	0954	010	7.7	J
WCP-HLA3B-26599-XX	09/22/99	1010	011	3.9	J
WCP-HLA6B-26599-XX	09/22/99	1042	012	< 0.2	R
WCP-CH2-26599-XX	09/22/99	1139	013	1.3	J
WCP-HLA1B-26599-XX	09/22/99	1420	014	77	J
WCP-HLA1B-26599-DU	09/22/99	1421	015	75	J
WCP-CH7-26599-XX	09/22/99	1504	016	< 0.2	R

Quantitation Limit: 0.2
Method Number: AM1-245.1

Approved: Mary Beth Lanza Date: 10/12/99
Telephone: (253) 924-6013

Weyerhaeuser Analytical and Testing Services
32901 Weyerhaeuser Way South
Federal Way, Washington 98003

Service Request 99-2151

Report
Longview Chlor-Alkali Plant Remediation Waters

SPIKES

Compound	Sample Designation	Lab Code	Units	Sample + Spike Value	Sample Value	Spike Added	% Recovery
Dissolved Hg	WCP-CH5-26499-XX	002	µg/L	2.02	< 0.2	2.0	101
Dissolved Hg	WCP-HLA1B-26599-DU	015	µg/L	98	75	100	23

DUPLICATES

Compound	Sample Designation	Lab Code	Units	Sample Value	Duplicate Value	RPD
Dissolved Hg	WCP-CH6-26499-XX	001	µg/L	0.2	< 0.2	NA
Dissolved Hg	WCP-HLA1B-26599-XX	014	µg/L	77	77	0

CONTROL SAMPLES

Compound	Units	Measured Value	Known Value	Lower Limit	Upper Limit	% Recovery
Dissolved Hg	µg/L	1.43	1.50	1.26	1.76	95
Dissolved Hg	µg/L	1.52	1.50	1.26	1.76	101

Approved: Mary Beth Lanza Date: 10/12/99
Telephone: 253/924-6013

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 9-21-99

Project #: 155027.FS.GW Field Team: MDA/BEC Well I.D.: CH1

Total Depth: (ft) Measured BMP 17.15	(-) DTW: (ft) 4.25 Time 10.58	= 12.9	(X) (0.17) gal/ft	= Well Casing Volume: 2.2

Field Conditions: Sunny, 85°F

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, I new I.or I X dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column Purge water disposal: Drums

Type of Flow Through Cell: [X] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Colcr/Remarks
14 43	Pump On							Initial	
14 44	<1	2438	17.6	9.14	-310	—		8.16	very dark black - brown
14 :50	~2.2	1459	17.4	8.33	-310	9		12.12	suspended black particulate no change
14 :57	~4.5	1151	16.8	7.40	-295	5.6		12.45	trace part., no change
15 05	~6.6	1141	16.8	7.40	-298	6.5		12.43	" "
:									
:									
:									
:									
15 06	Start Sampling								
15:07	End Sampling								
:									

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 9/21/99		Time: 15:06					
Sampling Method:		From presurrized polyethylene bailer					
		From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP-CH1-26499-XX		(1)	500 mL	Poly	HNO3	9/23	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 9-22-99

Project #: 155027.FS.GW **Field Team:** MDA/BEC **Well I.D.:** CH2

Total Depth: (ft) Measured BMP 16.91	(-) DTW: (ft) 9/22 Time 10:54 5.40	11.51 =	(X) (0.17) gal/ft	1.96 = Well Casing Volume:
Field Conditions:				
Decontamination: Alconox + tap wash; Tap rinse; DI rinse				

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, ☐ new ☐ or ☒ dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: X 10 oz cup ☐ Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Colcr/Remarks
11:05	Pump On							Initial 5.40	15%
11:06	<1	320	19.5	7.79	-135	49		6.80	sl. cloudy, amber color
11:08	Sucking Air		lowered tubing			~~53~~			
11:11	~2	284	18.3	6.85	-128	~~128~~		11.87	10%, sl. Cloudy, light " "
11:19	~3	lowered to bottom of well				—		14.5	Sucking Air
11:28	~3.3	295	17.0	6.91	-125	123		16.91	well purges dry, ORP measured before aeration
:				6					
11:38		312	17.9	6.90	-135			15.49	
11:39				~~6.90~~					
11:39	Start Sampling								
11:4	End Sampling								
:				~~6.90~~					

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 9 / 22 / 99 | Time: :

Sampling Method:
- [ ] From presurrized polyethylene bailer
- [X] From polyethylene purge tubing

Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP- CH2-26599-XX		(1)	500 mL	Poly	HNO3	9/23	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 9-21-99

Project #: 155027.FS.GW **Field Team:** MDA/BEC **Well I.D.:** CH3

Total Depth: (ft)	(-) DTW: (ft)	Time	=	(X) 0.17 gal\ft	= Well Casing Volume:
17.5	9.2	11:12	8.3		1.4

Field Conditions: Sunny, 85°F, Lt Breeze

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, I Inew I or I X I dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [ ] 10 oz cup [X] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
								Initial	
16:00	Pump On							9.20	20%
16:01	<1	1155	18.3	7.44	-246	6.7		9.25	dk. amber color
16:08	~2	1674	16.9	7.53	-277	7.0		9.27	" " "
16:11	~3	1670	16.9	7.55	-278	7.1		9.28	" " "
16:16	~4.5	1665	17.0	7.53	-279	8.3		"	" " "
:									
:									
:									
:									
16:17	Start Sampling								
16:18	End Sampling								
:									

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 9/21/99 | Time: 16:17

Sampling Method:
- [ ] From presurrized polyethylene bailer
- [x] From polyethylene purge tubing

Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP-CH3-26499-XY		(1)	500 mL	Poly	HNO3	9/23	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments: Note: Duplicate taken @ CH5 because I did not believe I could get to CH3 today because of forklifts in lumberyard.

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 9-21-99

Project #: 155027.FS.GW **Field Team:** MDA/BEC **Well I.D.:** CH4

Total Depth: (ft)	(-) DTW: (ft)	Time	=	(X) 0.17 gal\ft	= Well Casing Volume:
measured 3/23 20.6	16.50	11:15	4.1		0.7

Field Conditions: Sunny, 85°F, lt wind

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, I Inew I.or I X dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: X 10 oz cup — Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Colcr/Remarks
16:36	Pump On							Initial 16.50	5%
16:37	<1	1460	18.8	6.96	-218	11		17.58	amber color, organics
16:42	~0.7	1503	18.9	6.98	-236	15		18.05	" " "
16:54	~1.5	1522	19.9	7.05	-246	—		19.75	" " "
:									
:									
:									
:									
16:55	Sample d before well went dry. 2 Volumes only. Stable parameters now								
16:55	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 9/21/99		Time: 16:55					
Sampling Method:		From presurrized polyethylene bailer					
	X	From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP-CHY-26499-XY		(1)	500 mL	Poly	HNO3	9/23	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

Dupe

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 9-21-99

Project #: 155027.FS.GW Field Team: MDA/BEC Well I.D.: CH5

Total Depth: (ft) 17	(-) Time DTW: 11:01 (ft) 10.30	= 6.7	(X) 0.17 gal\ft	= Well Casing Volume: 1.1

Field Conditions: Sunny, 80° F, Calm

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, I Inew I.or X dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column Purge water disposal: Drums

Type of Flow Through Cell: X 10 oz cup Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Colcr/Remarks
13 57	Pump On							Initial 10.30	pump at 20% cloudy, worms + organics
13:58	<1	159	23.3	6.99	-169	11		10.43	nearly clear, suspended organics
13:01	~1	259	22.3	6.57	-203	4.5		10.44	clear, colorless trace organics
14:06	~2.5	1270	22.1	6.71	-244	2.0		"	" " "
14:11	~3.5	1521	22.1	6.80	-251	1.3		"	" " —
14:16	~4.5	1883	22.1	6.83	-260	1.2		"	" " —
14:20	~5.5	2012	22.1	6.88	-268	"		"	" " —
14:24	~6.6	2041	22.1	6.89	-270	"		"	" " —
:									
14:25	Start Sampling								
14:26	End Sampling								
:									

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 9/21/99		Time: 14:25					
Sampling Method:		From presurrized polyethylene bailer					
	X	From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
14:25 WCP-CH5-26499-XX		(1)	500 mL	Poly	HNO3	9/23	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time @ 14:27 WCP-CH5-26499-XX	(1)		500 mL	Poly	HNO3	"	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 9-21-99

Project #: 155027.FS.GW Field Team: MDA/BEC Well I.D.: CH 6

Total Depth: (ft)	(-) DTW: (ft)	Time	=	(X) 0.17 gal/ft	= Well Casing Volume:
32	16.40	1048			2.7

Field Conditions: Sunny, 85° F, lt Breeze

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, I Inew I.or X dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column Purge water disposal: Drums

Type of Flow Through Cell: X 10 oz cup Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Colcr/Remarks
13.09	Pump On Calibrating Instruments							Initial 16.40	water is dk amber color pump run at 100%
13:18	~2.5	116	17.6	6.89	-184	5.0		16.72	lighter amber color
13:26	~5.5	133	17.6	6.86	-225	3.1		16.61	no change
13:34	~8.1	133	17.3	6.84	-223	2.9		16.80	"
:									
:									
:									
:									
:									
13:35	Start Sampling								
13:36	End Sampling								
:									

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 9/21/99		Time: 13:35					
Sampling Method:		From presurrized polyethylene bailer					
	X	From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP-CH6-26499-XX		(1)	500 mL	Poly	HNO3	9/23	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 9-22-99

Project #: 155027.FS.GW **Field Team:** MDA/BEC **Well I.D.:** CH7

Total Depth: (ft)	(-) DTW: (ft)	Time	=	(X) 0.17 gal\ft	= Well Casing Volume:
Measured 24.00	9/22 15.37	14:30	8.63		1.5

Field Conditions: Sunny, 80°F, Lt. Breeze

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, ☐ new ☐ or ☐ ☐ dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [X] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

* Next round purge at 30%

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Colcr/Remarks
								Initial	
14:36	Pump On							15.37	sl. cloudy, 20%
14:37	<1	610	18.1	6.79	-233	11		16.25	sl. cloudy, light amber color
14:45	~1.5	645	17.9	6.85	-239	2.1		16.25	clear, light amber color
14:54	~3	679	17.8	6.85	-250	3.8		16.17	" " "
13:03	~4.5	703	17.5	6.88	-250	3.6		16.21	" " "
:									
:									
:									
:									
13 04	Start Sampling								
13 05	End Sampling								
:									

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 9 / 22 / 99		Time: :					
Sampling Method:		From presurrized polyethylene bailer					
	X	From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP-CH7-26599-XX		(1)	500 mL	Poly	HNO3	9/22	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 9-22-99

Project #: 155027.FS.GW **Field Team:** MDA/BEC **Well I.D.:** CH 8

Total Depth: (ft) 25.48	(-) 9-22-99 DTW: 14.15 (ft) Time 0820	11.33 =	(X) 0.17 gal\ft	1.93 = Well Casing Volume:

Field Conditions: overcast ~60°F

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, I Inew I.or I ✓ dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [X] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Colcr/Remarks
								Initial	
0824	Pump On							14.15	pump at 20%
08:25	<1	238	14.3	6.75	+39	12		15.10	cloudy, amber, organics
08:31	~2	249	14.4	6.84	-120	8.9		15.55	less cloudy, amber
08:38	~4	246	14.3	6.88	-167	10		15.75	no change
08:46	~6	242	14.3	6.89	-181	8.7		15.76	"
:									
:									
:									
:									
0847	Start Sampling								
08:48	End Sampling								
:									

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 9/22/99 | Time: 08 : 47

Sampling Method:
- [ ] From presurrized polyethylene bailer
- [X] From polyethylene purge tubing

Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP-CH8-26599-XY		(1)	500 mL	Poly	HNO3	9/23	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 9/22/99

Project #: 155027.FS.GW **Field Team: MDA/BEC** **Well I.D.:** HCA1A

Total Depth: (ft) TD=7.9	(-) Time DTW: (ft) 7.85	=	(X) 0.17 gal\ft	= Well Casing Volume:
Field Conditions:				
Decontamination: Alconox + tap wash; Tap rinse; DI rinse				

PURGE INFORMATION

	Purge Method : Peristaltic pump with, I Inew I.or I I dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
	Refer to calibration log this date.
Pump Suction Depth(ft): Top of water column	Purge water disposal: Drums
Type of Flow Through Cell:	10 oz cup ☐ Grab Sample ☐
Comments/Exceptions to SAP:	

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Colcr/Remarks
:	Pump On							Initial	
:									
:									
:									
:									
:									
:									
:									
:									
:	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: / /		Time: :					
Sampling Method:		From presurrized polyethylene bailer					
		From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP-		1	500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

Dupe

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 9-22-99

Project #: 155027.FS.GW Field Team: MDA/BEC Well I.D.: HCA 1B

Total Depth: (ft) 35	(-) Time DTW: (ft) 7.67	27.33 =	(X) 0.17 gal\ft	= Well Casing Volume: 4.6
Field Conditions: Sunny, 80°F, L+Breeze				
Decontamination: Alconox + tap wash; Tap rinse; DI rinse				

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, [ ] new [ ] or [X] dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column Purge water disposal: Drums

Type of Flow Through Cell: [X] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Colcr/Remarks
13:56	Pump On							Initial 7.67	40%
13:57	<.1	1640	16.2	10.41	-158	30		10.40	sl. cloudy, amber color
14:04	~5	1873	15.3	11.38	-241	30		10.42	sl. cloudier, amber
14:11	~10	1723	15.4	10.71	-266	17		10.07	less cloudy, still amber
14:19	~15	1631	15.4	10.49	-295	14.4		9.94	sl. less cloudy, amber
:									
:									
:									
:									
14:20	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 9/22/99 Time: 14:20

Sampling Method:
- [ ] From presurrized polyethylene bailer
- [X] From polyethylene purge tubing

Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
* WCP-HLA1B-26599-XX		(1)	500 mL	Poly	HNO3	9/23	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time							
* WCP-HLA1B-26599-DU	(1)		500 mL	Poly	HNO3	9/23	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Preserved 1L poly bottle with 8.0mL, 1:1, HNO_3. Then filled w/ Sample & Mixed. Then filled parent-XX and dupe-DU bottles (250ml w/ no preservative). This is done to provide homogenous samples for analysis to the Lab. Past experience indicates highly variable duplicates if ~~the~~ taken sequentially.

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 9-21-99

Project #: 155027.FS.GW **Field Team:** MDA/BEC **Well I.D.:** HCA2A

Total Depth: (ft) 8.2	(-) DTW: (ft) 7.39	Time 10:35	0.81 =	(X) 0.17 gal\ft	0.14 = Well Casing Volume:

Field Conditions: Sunny, 85°F, lt. Breeze

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, [ ] new [ ] or [X] dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [X] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Colcr/Remarks
								Initial	
15:30	Pump On							7.39	pump on 5%
15:31	~0.1	1590	22.2	6.43	-186	~~-186~~		8.01	clear, colorless
15:34	~0.2	1528	20.4	6.27	-182 *	11		8.06	" " suspended organics
15:38	~0.4	1716	20.4	6.30	-179	—		>8.06	" " "
15:41	~0.5	1840	20.5	6.28	-179	1.1		"	" " " "
:									
:									
:									
:									
15:42	Start Sampling								
15:44	End Sampling								
:									

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

* Use this ORP - Sucking Air After this point

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 9/21/99		Time: 15:42					
Sampling Method:		From presurrized polyethylene bailer					
	X	From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP- HLA2A-26499-XX		(1)	500 mL	Poly	HNO3	9/23	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 9-22-99

Project #: 155027.FS.GW **Field Team:** MDA/BEC **Well I.D.:** HCA3A

Total Depth: (ft) 6.29 measured	(-) DTW: (ft) 5.20	Time 0940	1.09 =	(X) 0.17 gal\ft	= Well Casing Volume: 0.2

Field Conditions:

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, I Inew I or IXI dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: X 10 oz cup — Grab Sample

Comments/Exceptions to SAP: Pump suction @ bottom of well

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Colcr/Remarks
								Initial	10% ~~0.5%~~
09:50	Pump On								
09:51		1114	21.4	7.54	*47				Clear Colorless
09:52	0.2	5,130	20.7	8.48	*93	1.5		DRY	removing water As it enters well
09:58	0.4	7,540	20.5	9.06	*130	1.3		"	" " "
:									
:									
:									
:									
:									
09:59	Start Sampling								
10:01	End Sampling								
:									

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

* Sucking Air do not use ORP readings. Info only

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 9/22/99		Time: :					
Sampling Method:		From presurrized polyethylene bailer					
		From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP- HLA3A-26599-YY		(1)	500 mL	Poly	HNO3	9/23	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 9-22-99

Project #: 155027.FS.GW **Field Team:** MDA/BEC **Well I.D.:** HLA3B

Total Depth: (ft) 29	(-) 9/22 DTW: (ft) 6.02 Time 0945	= 22.98	(X) 0.17 gal\ft	= Well Casing Volume: 3.9
Field Conditions:				
Decontamination: Alconox + tap wash; Tap rinse; DI rinse				

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, I Inew I.or I I dedicated, poly & C-flex head tubing
X	Purge Method : New polyethylene bailer
Y	Refer to calibration log this date.
Pump Suction Depth(ft): Top of water column	Purge water disposal: Drums
Type of Flow Through Cell: [ ] 10 oz cup	[X] Grab Sample
Comments/Exceptions to SAP:	

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
09:53	Pump On Start bailing							Initial	
09:59	6	36,820	16.1	7.82	-65*			DRY	
:		~~36,600~~							
:									
:									
:									
:									
:									
10:10		36,600	16.4	6.72	-34*				
10:10	Start Sampling								
10:12	End Sampling								
:									

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

*Do not use. Info only. From cup from bailer

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 9/22/99		Time: :					
Sampling Method:	X	From presurrized polyethylene bailer					
		From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP- HLA3B-26599-XY		(1)	500 mL	Poly	HNO3	9/23	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 9-22-99

Project #: 155027.FS.GW **Field Team:** MDA/BEC **Well I.D.:** MLA 6B

Total Depth: (ft) 28.2	(-) DTW: (ft) 9/22 12.10 Time 10:26	= 16.1	(X) 0.17 gal\ft	= Well Casing Volume: 2.7

Field Conditions:

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

	Purge Method : Peristaltic pump with, I Inew I.or I I dedicated, poly & C-flex head tubing
X	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [ ] 10 oz cup [X] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Colcr/Remarks
10:29	~~Pump On~~ start bailing							Initial 12.10	
10:39	DRY 5.5	18,320	15.2	~~6.60~~ 6.90 (mV)	-94 *	3	✓	DRY	Clear, Colorless
:									
:									
:									
:									
:									
:									
10:42		17,870	15.7	6.88	*28				Clear, Colorless
10:42	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

* Do not use info only. from bailer poured into cup

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 9/22/99		Time: 10:42					
Sampling Method:	X	From presurrized polyethylene bailer					
		From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP- HLA6B-26599-W		(1)	500 mL	Poly	HNO3	9/23	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 9-22-99

Project #: 155027.FS.GW **Field Team: MDA/BEC** **Well I.D.: HLA7B**

Total Depth: (ft) 28.2	(-) DTW: (ft) 9.45	Time 0903	= 18.75	(X) 0.17 gal\ft	= Well Casing Volume: 3.2

Field Conditions: Overcast, 60°F, Calm

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, New or Used dedicated, poly & C-flex head tubing
X	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [ ] 10 oz cup [X] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Colcr/Remarks
09:12	Start Bailing Pump On							Initial 9.45	
09:12		2,690	16.1	9.65		2		~~DRY~~	clear, Colorless
09:17	DRY ~3.	5,000	14.4	9.57	*154	38		DRY	VSC, Hint of Yellow
:									
:									
:									
:									
:									
09:30		4948	14.5	9.57	*157	8			Clear, Colorless
09:30	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

* Information only, Taken From bailer poured into Cup. Do not use

Laboratory Analytical Program
Weyerhaeuser Company Chlor-Alkali Plant
Sampling Information

Date: 9/22/99		Time: :					
Sampling Method:	X	From presurrized polyethylene bailer					
		From polyethylene purge tubing					
Sample I.D.	Duplicate	(Circle) Number of sample containers	Volume of each container	Container Type	Preservative	Shipping Date	Analytical Method
WCP-HLA78-26599-XY		1	500 mL	Poly	HNO3	9/23	Dissolved Hg (EPA 7470) Field filtered (0.45 micron)
Duplicate I.D./Time	1		500 mL	Poly	HNO3		Dissolved Hg (EPA 7470) Field filtered (0.45 micron)

Comments:

Lab: Weyerhaeuser - Tacoma, WA

Weyerhaeuser
The future is growing™

WTC 2F25
32901 Weyerhaeuser Way South
Federal Way WA 98003
Tel 253-924-6872
Fax 253-924-6654

April 28, 2000

Ms. Anne Bolling
CH2M Hill
825 NE Multnomah, Suite 1300
Portland, OR 97232-2146

RE: Service Request 00-1291 Weyerhaeuser Longview Chlor-Alkali Plant/CH2M HILL
OOE# 7032071

Dear Anne:

Attached are the copies of our final report for the sample you requested we analyze. These are from our service request number 00-1291. Invoicing for this work will be directly to Weyerhaeuser. If you have any questions concerning this report, please feel free to contact me at (253) 924-6242.

Thank you for using our laboratory for this analysis and we look forward to working with you on future projects.

Sincerely,

Dennis Catalano, Project Manager
Weyerhaeuser Analytical and Testing Services

Attachments

100th Anniversary

Weyerhaeuser

Sample Analysis Request and Chain of Custody Record

Date: 3/30/00 | Facility: Weyco Chlor-Alkali Plant - Longview, WA | Page 2 of 3

Sampler's Project Number: 55027.FS.GW | Weyerhaeuser Account Number:

Sampled By: ☐ Facility ☐ E&AS/WTC ☐ E&AS/NB | Consultant's Name: CH2M Hill

Consultant's Address: 825 NE Multnomah Portland OR 97232 | Consultant's Phone Number: (503) 235-5000 | Consultant's Fax: 235-2445

Project Manager (print): Ann Bolling | Sampler Name (print): Mike Abbott | Recorded By (signature): Mike Abbott

Method	Field Sample ID (15 characters max.) (required)	Date (mm/dd/yy) (required)	Time (hh:mm) (required)	Depth (ft/m)*	Matrix: Water	Soil/Sed	Oil	Preservative: HCl	H_2SO_4	HNO_3	$Na_2S_2O_3$	Filtered	# of Containers
G	WCP-CH8-08800-XX	03/28/00	0847	—	X					X		X	3
	WCP-CH8-08800-DU		0847	—	X					X		X	1
	WCP-HLA3A-08800-XX		0930	—	X					X		X	1
	WCP-HLA3B-08800-XX		1010	—	X					X		X	1
	WCP-HLA 6B-08800-XX		1045	—	X					X		X	1
	WCP-HLA 2A-08800-XX		1119	—	X					X		X	1
	WCP-HLA 4A-08800-XX		1455	—	X					X		X	1
	WCP-HLA 1B-08800-XX		1420	—	X					X		X	1
	WCP-HLA 1A-08800-XX		1440	—	X					X		X	1
	WCP-~~HLA~~ CH2-08800-XX		1612	—	X					X		X	1
	WCP-CH1-08800-XX		1709	—	X					X		X	1

ANALYSES REQUESTED (circle or write in parameters): pH, Cond, TDS, TSS, Color, Tannins; Volatile Organics (8240, 8260) / BTEX; Semi-volatile organics; TPH: 418.1, TPH-G, TPH-D; O+G; Metals (list below); NH_3, CO_3, Cl, F, NO_3, SO_4; AOX / AOX<1000; TCLP: Metals, VOA, SVOA, Pest, Herb, PCBs; Dioxin: Total / 2,3,7,8-TCDD / 2,3,7,8-TCDF; CN; BOD, P-ortho; TKN, P-total, TOC, COD; EPA 7470 Dissolved Hg

NOTES

*"G"rab, "D"epth composite, or "T"ime composite → Required for soil or sediment samples

Remarks/Detection Limit Requirements: 0.2 PPB detection Limits

Laboratory Data

☒ Samples on ice or blue ice

Lab Turn-Around Time
- ☐ 24 hours
- ☐ 48 hours
- ☐ 7 days
- ☒ 2-3 weeks - date due: __/__/__

- ☐ WATS/WTC
- ☐ WATS/NB
- ☐ Other: _____

Lab SRN:

Case ID:

SDG ID:

Reporting and QA/QC Requirements

- ☐ CLP Package
- ☐ NPDES Permit
- ☒ Other: ON File
- ☐ Electronic Report

Results To: Ann Bolling
CH2M Hill - PDX
CC: Tina Rice
CH2M Hill PDX Data Center

Sample Chain of Custody and Shipping Method Record

Relinquished By Sampler (signature)	Date	Time	Received By (signature)	Shipping Method
Mike Abbott	3/30/00	1200		
Relinquished By (signature)	**Date**	**Time**	**Received By (signature)**	**Air bill Number**
Relinquished By (signature)	**Date**	**Time**	**Received For Laboratory By (signature)**	**Cooler Temp (°C)**
			Samples Received Intact:	

Form 16307 IR 4/90

WATS/WTC: 32901 Weyerhaeuser Way S, Federal Way, WA 98003 (253-924-6293) WATS/NB: New Bern R&D Field Station, Hwy 43 N, New Bern, NC 28563 (919-633-7238)

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MAR 30 '00 15:01

Weyerhaeuser

Sample Analysis Request and Chain of Custody Record

Date	Facility	Page
3/30/00	Weyco Chlor-Alkali Plant - Longview, WA	3 of 3

Sampler's Project Number	Weyerhaeuser Account Number
155027.FS.GW	

Sampled By	Consultant's Name
☐ Facility ☐ E&AS/WTC ☐ E&AS/NB	CH2M Hill

Consultant's Address	Consultant's Phone Number	Consultant's Fax
825 NE Multnomah, Portland, OR 97232	(503) 235-5000	235-2445

Project Manager (print)	Sampler Name (print)	Recorded By (signature)
Ann Bolling	Mike Abbott	Mike Abbott

SAMPLE DESCRIPTION					MATRIX				PRESERVATIVE						
Method	Field Sample ID (15 characters max.) (required)	Date (mm/dd/yy) (required)	Time (hh:mm) (required)	Depth (ft/m)	Water	Soil/Sed	Oil		HCl	H_2SO_4	HNO_3	$NaHSO_3$		Filtered	# of Containers
G	WCP-CH5-08900-XY	03/29/00	1028	—	X						X			X	1
	WCP-MW3-08900-XY		1044	—	X						X			X	1
	WCP-MW4-08900-XY		1133	—	X						X			X	1
	WCP-MW2-08900-XY		1226	—	X						X			X	1
	WCP-CH6-08900-XY		1347	—	X						X			X	1
	WCP-MW1-08900-XY		1446	—	Y						X			Y	1
↓	WCP-CH7-08900-XX	↓	1532	—	Y						Y			Y	1

→ "G"rab, "D"epth composite, or "T"ime composite → Required for soil or sediment samples

ANALYSES REQUESTED (circle or write in parameters)	NOTES
pH Cond TDS TSS Color Tannins	
Volatile Organics (8240, 8260) / BTEX	
Semi-volatile organics	
TPH: 418.1 TPH-G TPH-D	
O + G	
Metals (list below)	
NH_3 CO_3 Cl F NO_3 SO_4	
AOX / AOX<1000	
TCLP: Metals VOA SVOA Pest Herb PCBs	
Dioxin: Total / 2,3,7,8-TCDD / 2,3,7,8-TCDF	
CN	
BOD P-ortho	
TKN P-total TOC COD	
EPA 7470 Dissolved Hg	

Remarks/Detection Limit Requirements

0.2 PPB Detection Limits

Laboratory Data

- ☒ Samples on ice or blue ice

Lab Turn-Around Time
- ☐ 24 hours
- ☐ 48 hours
- ☐ 7 days
- ☒ 2-3 weeks - date due: __/__/__

- ☐ WATS/WTC
- ☐ WATS/NB
- ☐ Other: _____

Lab SR#

Case ID

SDG ID

Reporting and QA/QC Requirements

- ☐ CLP Package
- ☐ NPDES Permit
- ☒ Other: ON File
- ☐ Electronic Report

Results To: Ann Bolling
CH2M Hill - PDX
CC: TINA Rice - PDX
Data Center

Sample Chain of Custody and Shipping Method Record

Relinquished By Sampler (signature)	Date	Time	Received By (signature)	Shipping Method
Mike Abbott	3/30/00	1200		
Relinquished By (signature)	**Date**	**Time**	**Received By (signature)**	**Airbill Number**
Relinquished By (signature)	**Date**	**Time**	**Received For Laboratory By (signature)**	**Cooler Temp (°C)**
			Samples Received Intact:	

Form 16307 (R 4/98)

WATS/WTC: 32901 Weyerhaeuser Way S, Federal Way, WA 98003 (253-924-6293)

WATS/NB: New Bern R&D Field Station, Hwy 43 N, New Bern, NC 28563 (919-633-7238)

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MAR 30 '00 15:01

Weyerhaeuser Analytical & Testing Services
32901 Weyerhaeuser Way South
Federal Way, WA 98003

Service Request 00-1291

Report

Client ID	Date Sampled	Time Sampled	Lab ID	Dissolved Mercury Hg
				µg/L
WCP-HLA7B-8700-XX	03/27/00	1607	001	0.5
WCP-CH4-08700-XX	03/27/00	1705	002	0.5
WCP-CH3-08700-XX	03/27/00	1736	003	3.5
WCP-CH3-8700-DU	03/27/00	1737	004	3.4
WCP-CH8-08800-XX	03/28/00	0847	005	< 0.2
WCP-CH8-08800-DU	03/28/00	0848	006	< 0.2
WCP-HLA3A-08800-XX	03/28/00	0930	007	4.0
WCP-HLA3B-08800-XX	03/28/00	1010	008	3.5
WCP-HLA6B-0880-XX	03/28/00	1045	009	< 0.2
WCP-HLA2A-0880-XX	03/28/00	1119	010	11.2
WCP-HLA4A-08800-XX	03/28/00	1455	011	< 0.2
WCP-HLA1B-08800-XX	03/28/00	1420	012	24.6
WCP-HLA1A-08800-XX	03/28/00	1440	013	149
WCP-CH2-08800-XX	03/28/00	1612	014	0.5
WCP-CH1-08800-XX	03/28/00	1709	015	1.8
WCP-CH5-08900-XX	03/29/00	1028	016	< 0.2
WCP-MW3-08900-XX	03/29/00	1044	017	< 0.2
WCP-MW4-08900-XX	03/29/00	1133	018	< 0.2
WCP-MW2-08900	03/29/00	1226	019	< 0.2
WCP-CH6-08900-XX	03/29/00	1347	020	< 0.2
WCP-MW1-08900-XX	03/29/00	1446	021	< 0.2
WCP-CH7-08900-XX	03/29/00	1532	022	< 0.2

Quantitation Limit: 0.2
Method Number: AM1-245.1

Approved: Mary Beth Lanza
Telephone: (253) 924-6013

Date: 4/28/00

Weyerhaeuser Analytical and Testing Services
32901 Weyerhaeuser Way South
Federal Way, Washington 98003

Service Request 00-1291

Report
Longview Chlor-Alkali Plant Remediation Waters

SPIKES

Element	Sample Designation	Lab Code	Units	Sample + Spike Value	Sample Value	Spike Added	% Recovery
Dissolved Hg	WCP-CH4-08700-XX	002	µg/L	2.44	0.46	2.0	99

DUPLICATES

Element	Sample Designation	Lab Code	Units	Sample Value	Duplicate Value	RPD
Dissolved Hg	WC0-HLA7B-08700-XX	001	µg/L	0.5	0.4	22

CONTROL SAMPLES

Element		Units	Measured Value	Known Value	Lower Limit	Upper Limit	% Recovery
Dissolved Hg	ICV1	µg/L	1.50	1.50	1.20	1.82	100
Dissolved Hg	ICV2	µg/L	1.51	1.50	1.20	1.82	101

Approved: Mary Beth Lanza Date: 4/28/00
Telephone: 253/924-6013

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-29-00

Project #: 155027.FS.GW **Field Team:** MDA **Well I.D.:** MW1

Total Depth: (ft)	(-) DTW: (ft)	Time	=	(X) gal\ft	= Well Casing Volume:
22	3/29 10.00	14:20	12	(0.17)	2.0

Field Conditions: Windy, 50°F, P.Cldy

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, I Inew I or I X dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [X] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
14:24	Pump On							Initial 10.00	10% Clear, Colorless
14:30	2	583	12.5	5.51	+65	~		10.17	" " "
14:36	4	539	12.4	6.62	+83	1		10.17	" " "
14:44	6.3	525	12.5	6.69	+82	<1		10.17	" " "
:									
:									
:									
:									
:									
14:46	Start Sampling								
:	End Sampling								
:									

* **VC**=Very cloudy **Cl**=Cloudy **SC**=Slightly Cloudy **VSC**=Very Slightly Cloudy **AC**=Almost Clear **C**=Clear **CC**=Crystal Clear

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-29-00

Project #: 155027.FS.GW **Field Team:** mda **Well I.D.:** MW2

Total Depth: (ft) 22.5	(-) DTW: (ft) 8.35 Time 12:00	14.15 =	(X) (0.17) gal\ft	2.4 = Well Casing Volume:
Field Conditions: P. Cloudy, 50°F, windy				
Decontamination: Alconox + tap wash; Tap rinse; DI rinse				

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, I Inew I or I X I dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [X] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
12:07	Pump On							Initial 8.35	20%, Clear Colorless
12:14	3	1412	12.8	6.41	-116	4		8.87	" " "
12:18	5	1427	12.7	6.56	-122	4		8.87	" " "
12:24	7.5	1443	12.7	6.59	-124	3.5		8.87	" " "
:									
:									
:									
:									
:									
12:26	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

0835

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-29-00

Project #: 155027.FS.GW **Field Team:** MDA **Well I.D.:** MW3

Total Depth: (ft) 22.5	(-) DTW: (ft) 8.35 3/29 Time 10.08	14.15 =	(X) 0.17 gal\ft	2.4 = Well Casing Volume:

Field Conditions: P. Cloudy 45°F, Lt Breeze

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, I Inew I or IX dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: X 10 oz cup ☐ Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
10:22	Pump On							Initial 8.35	20% Clear Colorless
10:23		172	11.8	—	—	—		—	" "
10:30	3	14,690	11.9	6.59	-134	85		8.60	" "
10:38	6	15,790	12.0	7.03	-139	12		8.58	" "
10:42	7.5	15,690	12.0	7.07	-140	14		8.58	" "
:									
:									
:									
:									
10:44	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-29-00

Project #: 155027.FS.GW **Field Team:** mAa **Well I.D.:** MW4

Total Depth: (ft) 27	(-) 3/29 Time DTW: (ft) 13.92 1106	= 13.08	(X) 0.17 gal/ft	2.2 = Well Casing Volume:

Field Conditions: P.Cloudy, 50°F, lt Breeze

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, I Inew I or I ✓ I dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [X] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
11:12	Pump On Replaced Head tube							Initial 13.92	20%, Clear Medium Amber
11:15	Pump ON							—	" " "
11:21	3	842	11.3	9.45	-260	—		13.98	" " "
11:25	4.4	848	11.3	9.46	-254	4		13.98	" " "
11:31	5.2	876		9.52	-256	4		13.99	" " "
:									
:									
:									
:									
11:33	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-28-00

Project #: 155027.FS.GW **Field Team:** mja; PPP **Well I.D.:** CH1

Total Depth: (ft) 17.15	(-) DTW: (ft) 4.03	Time 16:31	13.12 =	(X) (0.17) gal\ft	2.2 = Well Casing Volume:

Field Conditions: Cloudy, 50°F, lt Breeze

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, I Inew I or I X I dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column Purge water disposal: Drums

Type of Flow Through Cell: X 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
16:37	Pump On							Initial 4.03	10%/black grit/rock to
16:45	2	2179	12.0	7.64	-259	6.7		9.24	SC/black, brown color
16:54	4X	954	13.1	7.35	-278	5		12.34	
17:03	6	949	13.3	7.41	-295	5		12.68	
17:07	7	948	13.3	7.43	-297	4.8		12.7	SC
:									
:									
:									
:									
17:09	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-28-00

Project #: 155027.FS.GW **Field Team:** mda; PPP **Well I.D.:** ~~MW~~ CH2

Total Depth: (ft) 16.91	(-) Time DTW: (ft) 3.02 15:40	= 13.89	(X) 0.17 gal\ft	2.4 = Well Casing Volume:
Field Conditions:				
Decontamination: Alconox + tap wash; Tap rinse; DI rinse				

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, [ ]new [ ] or [X] dedicated, poly & C-flex head tubing	
	Purge Method : New polyethylene bailer	
X	Refer to calibration log this date.	
Pump Suction Depth(ft): Top of water column		Purge water disposal: Drums
Type of Flow Through Cell:	X 10 oz cup	[ ] Grab Sample
Comments/Exceptions to SAP:		

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
								Initial	
15:46	Pump On							3.03	1296 SC/ light brown
15:52	2.5	207	11.6	6.12↑	-40↑	181		7.60	1096 / SC / light brown
* 16:04	5.0	203	12.5	6.30	430*	162		14.50	" " " D24
16:08									D24
:									
:									
:									
:									
:									
16:12	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

* ORP moving up & Down ± Around Zero -20 to +20
* Do No fuse

Lupe

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-27-00

Project #: 155027.FS.GW Field Team: mak, PPP Well I.D.: CH3

Total Depth: (ft) 17.5	(-) DTW: (ft) 8.30	Time 3/27	= 9.2	(X) (0.17) gal/ft	= Well Casing Volume: 1.6
Field Conditions:					
Decontamination: Alconox + tap wash; Tap rinse; DI rinse					

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, I Inew I or I X dedicated, poly & C-flex head tubing	
	Purge Method : New polyethylene bailer	
X	Refer to calibration log this date.	
Pump Suction Depth(ft): Top of water column ✓		Purge water disposal: Drums
Type of Flow Through Cell:	X 10 oz cup	Grab Sample
Comments/Exceptions to SAP:		

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
17:28	Pump On							Initial 8.30	20% Darkhandle
17:27		1652	13.8	7.42	-235	—	—	8.47	11 "
17:32		1683	14.0	7.42	-246	18	~~18~~	8.46	" "
17:34		1659	13.9	7.43	-237	14	~~14~~	8.47	" "
:									
:									
:									
:									
:									
17:36	Start Sampling								
17:38	End Sampling								
:									

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-27-00

Project #: 155027.FS.GW **Field Team:** mda, PPP **Well I.D.:** CH4

Total Depth: (ft) 20.6	(-) DTW: (ft) 16.38	Time 3/27	4.22 =	(X) 0.17 gal/ft	= Well Casing Volume: 0.71

Field Conditions: RAIN, 50°F, Lt Breeze

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, I Inew I or X dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): ~~Top of water column~~ bottom of well Purge water disposal: Drums

Type of Flow Through Cell: X 10 oz cup \ Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
								Initial	Med Amber
16:30	Pump On							16.38	5%, Bottom Rock
16:36	0.7	1,454	13.9	6.41	-182	59		17.31	" lots of S.Solids
16:50	1.4	1,518	13.9	6.90	-204	18		17.63	" Amber CC SS S.S.
17:05	2.1	1548	13.7	6.86	-197	11		17.84	" Amber/almost clear
:									
:									
:									
:									
:									
17:07	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-29-00

Project #: 155027.FS.GW **Field Team:** mda **Well I.D.:** CH5

Total Depth: (ft) 17	(-) DTW: (ft) 10.32 3/29 Time 0900	6.68 =	(X) 0.17 gal/ft	1.1 = Well Casing Volume:
Field Conditions:				
Decontamination: Alconox + tap wash; Tap rinse; DI rinse				

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, I Inew I or I X dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: X 10 oz cup — Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
09:05	Pump On	Calibration Instruments						Initial 10.32	20% Clouds Hi's, S.S. ~~colorless~~
09:17	4	939	13.3	6.75	-197	16		10.55	" , Clear w/ S.S.
09:21	5	995	13.3	6.88	-204	10		10.53	"
09:25	6	1035	13.3	6.94	-202	6		10.53	" " w/ few S.S
:									
:									
:									
:									
:	Add'l Actual	0928							
10:28	Start Sampling								
:	End Sampling								
:									

Note: Sludge/Muck layer on top of water column. (Normal for this well)

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-29-00

Project #: 155027.FS.GW **Field Team:** **Well I.D.:** CH6

Total Depth: (ft) 32	(-) 3/29 Time DTW: (ft) 17.12 1309	14.88 =	(X) 0.17 gal/ft	2.5 = Well Casing Volume:
Field Conditions:				
Decontamination: Alconox + tap wash; Tap rinse; DI rinse				

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, ☐ new ☐ or ☐ ☐ dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [X] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
13:15	Pump On							Initial	10% 20%, Clear Colorless
13:26	3	71,300	16.4	5.98	-127	—		*16.87	" " "
13:35	5	69,300	16.3	6.00	-139	9		16.84	" " "
13:45	7.5	67,200	16.3	6.03	-134	3.5		16.85	" " "
:									
:									
:									
:									
:									
13:47	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

* Correct measurement Initial MAybe wrong Hard to measure w/ High Conductivity.

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-29-00

Project #: 155027.FS.GW **Field Team:** mja **Well I.D.:** CH7

Total Depth: (ft) 24.00	(-) 3/29 Time DTW: (ft) 15.24 15:08	= 8.76	(X) (0.17) gal\ft	1.5 = Well Casing Volume:
Field Conditions: Windy, 50°F, P.Cldy				
Decontamination: Alconox + tap wash; Tap rinse; DI rinse				

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, I Inew I or I X dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.
Pump Suction Depth(ft): Top of water column	Purge water disposal: Drums
Type of Flow Through Cell:	X 10 oz cup ☐ Grab Sample
Comments/Exceptions to SAP:	

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
15:08	Pump On							Initial 15.24	20%, Med. Amber, S.Silty
15:14	1.8	426	13.5	6.97	-187	5		—	11, Med Amber, Few S.S.
15:18	3	483	13.6	6.96	-189	5		16.22	11, 11, No S.S.
15:24	4.5	523	13.6	6.97	-185	4		16.22	11, 11, 11
15:30	5.5	526	13.7	6.97	-188	4		16.22	11, 11, 11
:									
:									
:									
:									
15:32	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Dupe

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-28-00

Project #: 155027.FS.GW Field Team: MJa, PPP Well I.D.: C48

Total Depth: (ft) 25.48	(-) DTW: (ft) 14.18	Time 3h27	= 11.3	(X) 0.17 gal\ft	= Well Casing Volume: ~2
Field Conditions: 50% overcast/light breeze ~48°					
Decontamination: Alconox + tap wash; Tap rinse; DI rinse					

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, I New I or I I dedicated poly & C-flex head tubing
	Purge Method : New polyethylene bailer
	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column Purge water disposal: Drums

Type of Flow Through Cell: X 10 oz cup Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft) Initial	Pump Speed/*Clarity/ Color/Remarks
08:18	Pump On Calibrating Instruments						10%		clear-muddy
08:25	2g	255	11.3			98	~.3g	15.94	clearing/still brownish.
08:33	4g	263	11.3			95	SIGW to 5%	16.28	" " "
08:41	6g	260	11.3	6.65	-127	55	10%	16.07	" / cloudy
08:45	7g	260	11.3	6.67	-131	76	.25g	16.25	" / cloudy
:									
:									
:									
:									
08:47	Start Sampling								
08:49	End Sampling								
:									

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3/28/00

Project #: 155027.FS.GW **Field Team:** mda, PPP **Well I.D.:** HLA1A

Total Depth: (ft) 7.9	(-) DTW: (ft) 6.24 Time 3/27	1.66 =	(X) 0.17 gal/ft	0.28 = Well Casing Volume:

Field Conditions:

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

Y	Purge Method : Peristaltic pump with, I Inew I or I X dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): ~~Top of water column~~ bottom Purge water disposal: Drums

Type of Flow Through Cell: [ ] 10 oz cup [X] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
14:26	Pump On Pump DR4							~~Initial~~ meter 7.45	10% / ~2 gals purged / clear
14:35								6.95	
:									
:									
:									
:									
:									
:									
:									
14:40	Start Sampling								
14:41	End Sampling								
14:41		462	12.0	9.20		—		DRY	Lt Amber, VSC

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-28-00

Project #: 155027.FS.GW **Field Team:** mAa; PP **Well I.D.:** HLA1B

Total Depth: (ft) 35	(-) DTW: (ft) 5.62	Time 13:41	29.38 =	(X) 0.17 gal/ft	= Well Casing Volume: 5

Field Conditions: P.Cloudy, windy, 50°F

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : (Peristaltic pump) with, I new I or I X dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [X] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
13:41	Pump On							Initial	10%/clear; golden color
13:52	5gal	1781	14.6	10.45	-204*	29.5		7.67	20%/clear; tea-brown
14:01	10	1683	14.6	10.61	-47*	15.8	~.5	7.73	"/clear(SC) light tea
14:11	15	1602	14.6	10.48	-239	14.2	~.5	7.80	
14:14	17	1569	14.5	10.49	-243	—	↓	7.51	clear/light tea color
:									
:									
:									
:									
14:20	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

* vented probe?

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3/28/00

Project #: 155027.FS.GW **Field Team:** **Well I.D.:** HLA2A

Total Depth: (ft) 8.2	(-) Time DTW: (ft) 6.12 3/27	= 2.08	(X) (0.17) gal\ft	0.35 = Well Casing Volume:

Field Conditions: Windy, 45°F, Cloudy

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, I Inew I or I✓ dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [ ] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
11:02	Pump On	Purge dry w/ pump						Initial 6.12	5% Clear Colorless
11:10	1.0	1673	11.7	6.63	-37	8.2		—	5% " "
11:14	1.4	1917	11.7	7.09	-35	—		7.50	" " "
11:17	1.7	2061	4.7	7.20	-36	2.86			" "
:									
:									
:									
:									
:									
11:19	Start Sampling								
:	End Sampling								
:									

* **VC**=Very cloudy **Cl**=Cloudy **SC**=Slightly Cloudy **VSC**=Very Slightly Cloudy **AC**=Almost Clear **C**=Clear **CC**=Crystal Clear

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-28-00

Project #: 155027.FS.GW **Field Team:** mSa, PPP **Well I.D.:** HLA3A

Total Depth: (ft) 6.29	(-) DTW: (ft) 9.19	Time 3/28	= 2.1	(X) 0.17 gal\ft	= Well Casing Volume: 0.36
Field Conditions:					
Decontamination: Alconox + tap wash; Tap rinse; DI rinse					

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, I Inew I or Iyl dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
	Refer to calibration log this date.

Pump Suction Depth(ft): ~~Top~~ of water column Bottom Purge water disposal: Drums

Type of Flow Through Cell: [ ] 10 oz cup [ ] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
								Initial	
09:17	Pump On ~~Bailer~~ mpa							9.19	cc/some sand particles
09:25	0.5							~~545~~	cc, Colorless DRY
09:27	1.0								DRY
09:28	1.1	13.62 m	12.3	9.10		2.62			CC
:		↑ units?							CC
:									
:									
:									
:									
09:30	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy Cl=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-28-00

Project #: 155027.FS.GW Field Team: MDa, PBP Well I.D.: HLA 3B

Total Depth: (ft) 29	(-) DTW: (ft) 5.05	Time 3/28	23.95 =	(X) 0.17 gal/ft	= Well Casing Volume: 4.1

Field Conditions: P.Cloudy, 50°F, lt breeze

Decontamination: Alconox + tap wash; Tap rinse; DI rinse

PURGE INFORMATION

	Purge Method : Peristaltic pump with, I Inew I or I I dedicated, poly & C-flex head tubing
X	Purge Method : New polyethylene bailer
	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column Purge water disposal: Drums

Type of Flow Through Cell: [ ] 10 oz cup [X] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
09:50	~~Pump On~~	Bailing well dry						Initial 5.05	Clear, Colorless
:	6.5	37,55m	15.3	6.78		2.6			" "
10:10		37.94m	15,4	6.85		2.8			" "
:		↑ Units ?							
:									
:									
:									
:									
:									
10:10	Start Sampling								
:	End Sampling								
:									

Bailing Well

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-28-00

Project #: 155027.FS.GW **Field Team:** mor, PPP **Well I.D.:** ~~MW~~ HLA4A

Total Depth: (ft) 6.9	(-) DTW: (ft) 5.63 Time 3/27	1.27 =	(X) 0.17 gal\ft	0.2 = Well Casing Volume:
Field Conditions:				
Decontamination: Alconox + tap wash; Tap rinse; DI rinse				

PURGE INFORMATION

X	Purge Method : Peristaltic pump with, I Inew I or I X dedicated, poly & C-flex head tubing
	Purge Method : New polyethylene bailer
	Refer to calibration log this date.

Pump Suction Depth(ft): ~~Top~~ of water column Bottom Purge water disposal: Drums

Type of Flow Through Cell: [ ] 10 oz cup [X] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
13:14	~~Pump On~~ Pump Well Dry							Initial	DRY, VSC, Colorless
13:15	< 0.2 Dry Pump								
13:30	Still Dry		Move to		HLA	B			
14:54								5.80	
:									
:									
:									
:									
:									
14:55	Start Sampling								
14:55	End Sampling								
14:56		121	10.7	6.27	—	12			Very light Amber, VSC

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3/28/00

Project #: 155027.FS.GW **Field Team:** mdg, ppp **Well I.D.:** HLA6B

Total Depth: (ft) 28.2	(-) Time DTW: (ft) 11.76 3/27	= 16.44	(X) 0.17 gal/ft	= Well Casing Volume: 2.8
Field Conditions: P, Cloudy, 50°F, Lt wind				
Decontamination: Alconox + tap wash; Tap rinse; DI rinse				

PURGE INFORMATION

	Purge Method : Peristaltic pump with, I Inew I or I I dedicated, poly & C-flex head tubing
X	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.
Pump Suction Depth(ft): Top of water column	Purge water disposal: Drums
Type of Flow Through Cell: [ ] 10 oz cup	[X] Grab Sample
Comments/Exceptions to SAP:	

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
								Initial	
10:26	~~Pump~~ On Start Bailing DRY								
10:41	5.5	15,430	14.6	7.01		< 1		DRY	Clear, Colorless
:									
:									
:									
:									
:									
:									
10:45	6	14,130	14.8	7.10		< 1		-	Clear, Colorless
10:45	Start Sampling								
:	End Sampling								
:									

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

CH2M HILL WELL SAMPLING FIELD LOG

Weyerhaeuser Company Chlor-Alkali Plant

Date: 3-27-00

Project #: 155027.FS.GW **Field Team:** MSA PAP **Well I.D.:** HLA7B

Total Depth: (ft) 28.2	(-) Time DTW: (ft) 11.00	= 17.2	(X) 0.17 gal\ft	= Well Casing Volume: 2.9
Field Conditions: RAIN, 50°F, ~~Calm~~ lt wind				
Decontamination: Alconox + tap wash; Tap rinse; DI rinse				

PURGE INFORMATION

	Purge Method : Peristaltic pump with, I Inew I or I I dedicated, poly & C-flex head tubing
X	Purge Method : New polyethylene bailer
X	Refer to calibration log this date.

Pump Suction Depth(ft): Top of water column — Purge water disposal: Drums

Type of Flow Through Cell: [X] 10 oz cup [X] Grab Sample

Comments/Exceptions to SAP:

Time	Purge Volume (gallons)	Specific Conductance (uS/cm)	Temp. (oC)	Ph	ORP (mV)	Turbidity (NTU's)	Purge Rate (gpm)	DTW (ft)	Pump Speed/*Clarity/ Color/Remarks
15:44	~~Pump On~~ start bailing							Initial 11.00	
15:55	3	7,630	14.3	9.02		15			AC, Bailer ½ fill
16:00	3.5	7,444	13.9	9.18		13			DRY
:									
:									
:									
:									
:									
:									
16:07	Start Sampling								
16:08	End Sampling								
:									

Note: Allow well goes dry

* VC=Very cloudy CI=Cloudy SC=Slightly Cloudy VSC=Very Slightly Cloudy AC=Almost Clear C=Clear CC=Crystal Clear

Sediment Summary Table

Table C-5
Columbia River Sediment Results
Weyerhaeuser Chlor-Alkali Plant - Longview, WA

Sample ID	Station ID	Latitude	Longitude	Date Sampled	Mercury (mg/Kg)		TOC (%)	Total Solids (%)	Clay (%)	Gravel (%)	Sand (%)	Silt (%)
Former No. 1 Cell Room Sediment Sample Results												
H001-001-SD-27298-XX	H001	46 07 44.972	122 59 28.289	09/29/98	0.2		0.12	73.6	1.8	1.1	92.9	4.1
H001-002-SD-27298-XX	H002	46 07 44.530	122 59 29.247	09/29/98	0.1	U	4.21	39.2	NA	NA	NA	NA
H001-003-SD-27298-XX	H003	46 07 44.324	122 59 30.186	09/29/98	0.1	U	2.78	42.8	33	2	26.4	38.5
H001-004-SD-27298-XX	H004	46 07 43.299	122 59 25.353	09/29/98	0.2		0.18	71.4	2	0.2	89.9	8
H001-005-SD-27298-XX	H005	46 07 42.945	122 59 26.296	09/29/98	0.1	U	4.53	36.1	42.1	0	6.6	51.3
H001-006-SD-27298-XX	H006	46 07 42.500	120 59 27.009	09/29/98	0.1	U	2.12	48	36.9	0	19.9	43.2
H001-007-SD-27298-XX	H007	NM	NM	09/29/98	0.1	U	0.48	68.7	4.9	0.1	57.3	37.6
H001-008-SD-27298-XX	H008	46 07 42.378	122 59 23.855	09/29/98	0.1	U	0.12	73.4	2.4	0	90.6	7
H001-010-SD-27298-XX	H010	46 07 41.201	122 59 25.880	09/29/98	0.1	U	0.17	73.9	1.9	1	93.8	3.3
H001-011-SD-27298-DU	H011	46 07 42.037	122 59 22.548	09/29/98	0.1	U	0.16	74.7	2.2	4	83.7	10
H001-011-SD-27298-XX	H011	46 07 42.037	122 59 22.548	09/29/98	0.1	U	0.09	77.5	1.4	2.6	88.1	8
H001-014-SD-27398-DU	H014	46 07 39.932	122 59 25.685	09/30/98	0.1	U	0.04	74.4	0.8	0.2	98.3	0.7
H001-014-SD-27398-XX	H014	46 07 39.932	122 59 25.685	09/30/98	0.1	U	0.03	70	1.1	0	98.3	0.5
H001-015-SD-27398-XX	H015	46 07 41.016	122 59 21.850	09/30/98	0.1	U	0.13	73	2.3	0.3	85.2	12.2
H001-016-SD-27398-XX	H016	46 07 40.173	122 59 22.933	09/30/98	0.1	U	0.08	76.4	1.6	5.3	91.4	1.7
H001-017-SD-27398-XX	H017	46 07 39.363	122 59 23.751	09/30/98	0.1	U	0.03	78.8	1	1.6	97.1	0.3
H001-018-SD-27398-XX	H018	46 07 39.529	122 59 16.404	09/30/98	0.1	U	0.15	73.6	2.3	0	92.2	5.4
H001-019-SD-27398-XX	H019	46 07 38.939	122 59 16.321	09/30/98	0.1	U	0.11	72.2	2.2	0	90.2	7.6
H001-020-SD-27398-XX	H020	46 07 38.160	122 59 16.369	09/30/98	0.1	U	0.32	65.8	5.9	0.2	66.3	27.7
Abandoned No. 2 Cell Room Diffuser Sediment Sample Results												
H-001-021-SD-13999-xx	H021	46 07 46.168	122 59 27.906	05/19/99	0.1	U	0.54	71.4	3.8	0	33.4	62.8
H-001-022-SD-13999-xx	H022	46 07 46.377	122 59 28.147	05/19/99	0.1	U	0.61	61.8	2.8	0	45.2	52
H-001-023-SD-13999-xx	H023	46 07 45.929	122 59 28.575	05/19/99	0.1	U	0.35	64.7	2.6	0.4	55.3	41.7
H-001-024-SD-14099-xx	H024	46 07 46.192	122 59 28.810	05/20/99	0.1	U	0.17	71.2	0.3	0.4	85	14.4
H-001-025-SD-13999-xx	H025	46 07 47.540	122 59 29.600	05/19/99	0.1	U	0.18	66.7	0	0	71.3	28.7
H-001-026-SD-13999-xx	H026	46 07 47.297	122 59 29.915	05/19/99	0.1		1.81	55	4.0	10	60.2	25.7
H-001-027-SD-14099-xx	H027	46 07 47.069	122 59 30.224	05/20/99	0.1		0.05	U 71.9	0	7.2	86.6	6.2
H-001-028-SD-13999-xx	H028	46 07 49.648	122 59 32.217	05/19/99	0.1	U	0.05	U 70	0	0	79	21
H-001-028-SD-13999-DU	H028	46 07 49.648	122 59 32.217	05/19/99	0.1	U	0.06	69.8	0	0	79.1	20.9
H-001-029-SD-13999-xx	H029	46 07 49.430	122 59 32.912	05/19/99	0.1	U	0.06	69.6	0	1.9	88	10.2
H-001-030-SD-13999-xx	H030	46 07 48.996	122 59 33.4856	05/19/99	0.4		0.05	U 70.2	0	0.4	95.7	4.0
H-001-031-SD-14099-xx	H031	46 07 45.514	122 59 29.403	05/20/99	0.1	U	0.31	68.6	2.2	13.6	70.3	13.9
H-001-032-SD-14099-xx	H032	46 07 45.902	122 59 28.601	05/20/99	0.2		0.57	61.7	2.2	11	58.9	27.9
H-001-033-SD-14099-xx	H033	46 07 46.068	122 59 28.886	05/20/99	0.1	U	0.68	67.3	4.4	3.0	58.4	34.2
H-001-027-SD-14099-EB	H027	46 07 47.069	122 59 30.224	05/20/99	0.2	U	--	--	--	--	--	--

Notes:

NM = Not available. Too few SVs, GPS would not operate. Station located 40 feet toward shore from C008.

NA = Not analyzed. Adequate volume was not collected.

See Figure 4-16 for sample Locations. Data sheets presented in Appendix C.

-- = Not applicable.

Sediment Laboratory Data Sheets and Chain-of-Custody Forms, 1998 and 1999

Weyerhaeuser

32901 Weyerhaeuser Way South
Federal Way WA 98003
Tel (253) 924-6872
Fax (253) 924-6654

October 30, 1998

Ms. Kira Sykes
CH2M Hill
825 NE Multnomah Drive, Suite 1300
Portland, OR 97232

RE: Service Request 98-1240 Longview Chloralkali Plant Soils

Dear Kira:

Attached are the copies of our final report for the sample you requested we analyze. These are from our service request number 98-1240. Invoicing for this work will be directly to Weyerhaeuser. If you have any questions concerning this report, please feel free to contact me at (253) 924-6242.

Thank you for using our laboratory for this analysis and we look forward to working with you on future projects.

Sincerely,

Dennis Catalano, Project Manager
Weyerhaeuser Analytical and Testing Services

Attachments

Cc: Phyllis Rice CH2M Hill Portland

Weyerhaeuser Analytical & Testing Services
32901 Weyerhaeuser Way South
Federal Way, WA 98003

Service Request 98-1240

Report

CH2M Hill/Longview Chlor-Alkali Plant Soils/Waters

Client ID	Date Sampled	Time Sampled	Lab ID	Total Solids % @ 105°C	Soil TOC %	Total Mercury mg/kg O.D. Basis
H-001-001SD-27298-XX	09/29/98	0900	001	73.6	0.12	0.2
H-001-002SD-27298-XX	09/29/98	0930	002	39.2	4.21	< 0.1
H-001-003SD-27298-XX	09/29/98	1000	003	42.8	2.78	< 0.1
H-001-004SD-27298-XX	09/29/98	1030	004	71.4	0.18	0.2
H-001-005SD-27298-XX	09/29/98	1045	005	36.1	4.53	< 0.1
H-001-006SD-27298-XX	09/29/98	1100	006	48.0	2.12	< 0.1
H-001-007SD-27298-XX	09/29/98	1600	007	68.7	0.48	< 0.1
H-001-008SD-27298-XX	09/29/98	1130	008	73.4	0.12	< 0.1
H-001-010SD-27298-XX	09/29/98	1245	009	73.9	0.17	< 0.1
H-001-011SD-27298-DU	09/29/98	1300	010	74.7	0.16	< 0.1
H-001-011SD-27298-XX	09/29/98	1250	011	77.5	0.09	< 0.1
H-001-014SD-27398-XX	09/30/98	0830	012	70.0	0.03	< 0.1
H-001-014SD-27398-DU	09/30/98	0840	013	74.4	0.04	< 0.1
H-001-015SD-27398-XX	09/30/98	0845	014	73.0	0.13	< 0.1
H-001-016SD-27398-XX	09/30/98	0910	015	76.4	0.08	< 0.1
H-001-017SD-27398-XX	09/30/98	0935	016	78.8	0.03	< 0.1
H-001-018SD-27398-XX	09/30/98	0945	017	73.6	0.15	< 0.1
H-001-019SD-27398-XX	09/30/98	1015	018	72.2	0.11	< 0.1
H-001-020SD-27398-XX	09/30/98	1030	019	65.8	0.32	< 0.1
				Quantitation Limit:		0.1

						µg/L
H-000-013SD-27298-EB	09/29/98	1440	020	-	-	< 0.2
H-000-018SD-27398-EB	09/30/98	1200	021	-	-	< 0.2
				Quantitation Limit:		0.2

Approved: Mary Beth Lanza Date: 10/29/98
Telephone: (253) 924-6013

MBL

Weyerhaeuser Analytical and Testing Services
32901 Weyerhaeuser Way South
Federal Way, Washington 98003

Service Request 98-1240

QC Report

CH2M Hill/Longview Chlor-Alkali Plant Soils/Waters

SPIKES

Compound	Matrix	Sample Designation	Lab Code	Units	Sample + Spike Value	Sample Value	Spike Added	% Recovery
Total Hg	Soil	H-001-001SD-27298-XX	001	mg/kg O.D.	1.29	0.23	0.89	107
Total Hg	Soil	H-001-002SD-27298-XX	002	mg/kg O.D.	0.91	< 0.1	0.84	108
Total Hg	Water	H-000-013SD-27298-EB	020	µg/L	2.03	< 0.2	2.00	102

DUPLICATES

Compound	Matrix	Sample Designation	Lab Code	Units	Sample Value	Duplicate Value	RPD
TOC	Soil	H-001-001SD-27298-XX	001	%	0.12	0.12	0
TOC	Soil	H-001-002SD-27298-XX	002	%	0.12	0.12	4
Total Hg	Soil	H-001-002SD-27298-XX	001	mg/kg O.D.	0.2	< 0.1	NA
Total Hg	Soil	H-001-003SD-27298-XX	002	mg/kg O.D.	< 0.1	< 0.1	NA
Total Hg	Water	H-000-013SD-27298-EB	020	µg/L	< 0.2	< 0.2	NA

CONTROL SAMPLES

Compound	Matrix	Source of LCS	Units	Measured Value	Known Value	% Recovery
TOC	Soil	NIST 1646	%	1.7	1.6	104
Total Hg	Soil	NIST SRM 2704	mg/kg	1.50	1.64	91

BLANKS

Compound	Matrix	Type of Blank	Units	Measured Value
TOC	Soil	Method	%	<0.05
Total Hg	Soil	Method	mg/kg	< 0.1
Total Hg	Water	Method	µg/L	< 0.2

Approved: Mary Beth Lanza Date: 10/29/98
Telephone: (253) 924-6013

Weyerhaeuser Analytical & Testing Services
32901 Weyerhaeuser Way South
Federal Way, WA 98003

Service Request 98-1240

Report

CH2M Hill/Longview Chlor-Alkali Plant Soils/Waters

Test	Units	Samples	Date Analyzed	QL	Method
Total Solids	% @ 105°C	1, 3-19	10/14/98	-	AM 1-160.3
Total Solids	% @ 105°C	2	10/15/98	-	AM 1-160.3
TOC	%, O.D. Basis	All	10/20/98	0.05	PSEP
Total Hg	mg/kg O.D. Basis	1,4,7-19	10/16/98	0.1	AM 1-245.5
Total Hg	mg/kg O.D. Basis	2,3,5,6	10/24/98	0.1	AM 1-245.5
Total Hg	µg/L	20-21	10/16/98	0.2	AM 1-245.5

Approved: Mary Beth Lanza Date: 10/29/98
Telephone: (253) 924-6013

ALITY ANALYTICAL
BORATORIES, INC.

Weyerhaeuser LAB

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

Project # 148834.AI.FW | Purchase Order #

Project Name: Weyerhaeuser - Columbia River Sediment Sampling

Company Name: CH2M HILL

Project Manager or Contact & Phone #: Joel Bowker (503)235-5002 ext. 4219

Report Copy to: Joel Bowker & Phyllis Rice

Requested Completion Date: Std

Site ID:

Sample Disposal: Dispose ☐ Return ☐

☐ LGN — One Innovation Drive, Suite C, Alachua, FL 32615-9586, (904) 462-3050 FAX (904) 462-1670

☐ LRD — 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244 4109

☐ LMG — 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-2440 FAX (334) 271-3428

☐ LKW — Canviro Analytical Laboratories, Inc., 50 Bathurst, Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747-2575 FAX (519) 747 3806

THIS AREA FOR LAB USE ONLY

Lab # | Page | of

Client Service | Price Source (A P Q S)

Acct Code | Test Group

Project Code | Ack. Gen.

LIMS Ver | Login | Mult.

COC Review

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOLID	CLIENT SAMPLE ID (9 CHARACTERS)	QC ID (3 CHAR)	# OF CONTAINERS	Hg EPA 7471	TOC	Grain size	SAMPLE REMARKS	LAB 1 ID	LAB 2 ID
9/29/98	0900		X		X	H-001-001-SD-27298-XX		2	X	X	X			
~~9/29/98~~	~~0930~~		~~X~~		~~X~~	~~H-001-002-SD-27298-XX~~		~~1~~	~~X~~	~~X~~				
9/30/98	0930		X		X	H-001-002-SD-27298-XX		1	X	X				
9/30/98	1000		X		X	H-001-003-SD-27298-XX		2	X	X	X			
9/30/98	1030		X		X	H-001-004-SD-27298-XX		2	X	X	X			
9/30/98	1045		X		X	H-001-005-SD-27298-XX		2	X	X	X			
	1100		X		X	H-001-006-SD-27298-XX		2	X	X	X			
	1600		X		X	H-001-007-SD-27298-XX		2	X	X	X			
	1130		X		X	H-001-008-SD-27298-XX		2	X	X	X			
	1245		X		X	H-001-010-SD-27298-XX		2	X	X	X			
	1300		X		X	H-001-011-SD-27298-DV		2	X	X	X	(Time = 1250 on bottles ds)		

Sampled By & Title: Janey Ireland — (Please sign and print name) — Date/Time: 9/30/98 1400

Received By — (Please sign and print name) — Date/Time

Received By — (Please sign and print name) — Date/Time

Received By: Dana L. Schafer DANA L. SCHAFER — (Please sign and print name) — Date/Time: 10/1/98 0800

Relinquished By: Janey Ireland — (Please sign and print name) — Date/Time: 9/30/98 1400

Relinquished By — (Please sign and print name) — Date/Time

Relinquished By — (Please sign and print name) — Date/Time

Shipped Via: UPS ☐ Fed-Ex ☐ Other courier — Shipping #

HAZWRAP/NESSA: Y N

EDATA: Y N

QC LEVEL 1 2 3 OTHER

pH | Ice

Custody Seal | Temp

Batch Remarks:

Note: Detection Limit for Mercury = 0.1 ppm for Sediment 0.2 ppb for water

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 5/95 LAB FORM 340

QUALITY ANALYTICAL LABORATORIES, INC.

Weyerhaeuser

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

Project # 148834.RI.FW | Purchase Order #

Project Name: Columbia River Weyerhaeuser - Sediment Sampling

Company Name: CH2M Hill

Project Manager or Contact & Phone #: Joel Bowker (503) 235-5002 ext 4219

Report Copy to: Joel Bowker, Phyllis Rice

Requested Completion Date: Std | Site ID | Sample Disposal: Dispose ☐ Return ☐

☐ LGN — One Innovation Drive, Suite C, Alachua, FL 32615-9586, (904) 462-3050 FAX (904) 462-1670

☐ LRD — 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244 4109

☐ LMG — 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-2440 FAX (334) 271-3428

☐ LKW — Canviro Analytical Laboratories, Inc., 50 Bathurst, Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747-2575 FAX (519) 747-3806

THIS AREA FOR LAB USE ONLY

Lab # | Page | of

Client Service | Price Source A P Q S

Acct Code | Test Group

Project Code | Ack. Gen.

LIMS Ver | Login | Mult.

COC Review

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SED	CLIENT SAMPLE ID (9 CHARACTERS)	QC ID (3 CHAR)	# OF CONTAINERS	ANALYSES REQUESTED: Hg EPA 7471	TOL	Grain Size	SAMPLE REMARKS	LAB 1 ID	LAB 2 ID
9/29	~~1220~~ 850		X		X	H-001-011-SD-27398-XX		2	X	X	X			
9/30	~~0830~~ 830		X		X	H-001-014-SD-27398-XX		2	X	X	X			
9/30	840		X		X	H-001-014-SD-27398-DU		2	X	X	X			
	845		X		X	H-001-015-SD-27398-XX		2	X	X	X			
	910		X		X	H-001-016-SD-27398-XX		2	X	X	X			
	935		X		X	H-001-017-SD-27398-XX		2	X	X	X			
	945		X		X	H-001-018-SD-27398-XX		2	X	X	X			
	~~1015~~					~~H-001-018-SD-27~~						JT		
	1015		X		X	H-001-019-SD-27398-XX		2	X	X	X			
	1030		X		X	H-001-020-SD-27398-XX		2	X	X	X			
9/29	1440	X	X			H-000-013-SD-27398-EB		1	X			EAA 7470 method		

Sampled By & Title (Please sign and print name): James Tickner James Tickner 9/30/98 1400 — Date/Time

Relinquished By (Please sign and print name): James Tickner James Tickner 9/30/98 1400 — Date/Time

Received By (Please sign and print name) — Date/Time

Relinquished By (Please sign and print name) — Date/Time

Received By (Please sign and print name) — Date/Time

Relinquished By (Please sign and print name) — Date/Time

Received By (Please sign and print name): Daniel Schafer DANIEL SCHAFER 10/1/98 0800 — Date/Time

Shipped Via: UPS Fed-Ex Other courier | Shipping #

HAZWRAP/NESSA: Y N

EDATA: Y N

QC LEVEL 1 2 3 OTHER

pH | Ice

Custody Seal | Temp

Batch Remarks: Detection Limit for Mercury = 0.1 ppm for Sediment, 0.2 ppb for Water

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - [illegible] Yello[illegible] B, Pi[illegible]ient

Rev 3.95 LAB FORM 340

QUALITY ANALYTICAL LABORATORIES, INC.

Weyerhaeuser

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

Project # 148834.RI.FW	Purchase Order #
Project Name Weyerhaeuser - Columbia River Sediment Sampling	
Company Name CH2M HILL	
Project Manager or Contact & Phone # Joel Bowker (503)235-5022 ext.4219	Report Copy to: Joel Bowker Phyllis Rice
Requested Completion Date: STD	Site ID
Sample Disposal: Dispose ☐ Return ☐	

☐ LGN — One Innovation Drive, Suite C, Alachua, FL 32615-9586, (904) 462-3050 FAX (904) 462-1670

☐ LRD — 5090 Caterpillar Road, Redding, CA 96003-1412, (916) 244-5227 FAX (916) 244 4109

☐ LMG — 2567 Fairlane Drive, Montgomery, AL 36116-1622, (334) 271-2440 FAX (334) 271-3428

☐ LKW — Canviro Analytical Laboratories, Inc., 50 Bathurst, Unit 12, Waterloo, Ontario, Canada N2V 2C5, (519) 747-2575 FAX (519) 747-3806

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Lab #	Page	of
Client Service	Price Source A P Q S	
Acct Code	Test Group	
Project Code	Ack. Gen.	
LIMS Ver	Login	Mult.
COC Review		

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	QC ID (3 CHAR)	# OF CONTAINERS	ANALYSES REQUESTED: Hg EPA 7470	SAMPLE REMARKS	LAB 1 ID	LAB 2 ID
9/30/98	1000		X	X		H-000-018-SD-27398-EB		1	X			

Sampled By & Title: James Tucker — (Please sign and print name) — Date/Time: 9/30/98 1400

Relinquished By: James Tucker — (Please sign and print name) — Date/Time: 9/30/98 1400

Received By — (Please sign and print name) — Date/Time

Relinquished By — (Please sign and print name) — Date/Time

Received By — (Please sign and print name) — Date/Time

Relinquished By — (Please sign and print name) — Date/Time

Received By: Dana L. Schafer DANA L. SCHAFER 10/1/98 0800 — (Please sign and print name) — Date/Time

Shipped Via: UPS Fed-Ex Other Courier

Shipping #

HAZWRAP/NESSA: Y N

EDATA: Y N

QC LEVEL 1 2 3 OTHER

pH

Ice

Custody Seal

Temp

Batch Remarks:

Note: Detection Limit for Hg in water = 0.2 ppb

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 5/95 LAB FORM 340

Weyerhaeuser

32901 Weyerhaeuser Way South
Federal Way WA 98003
Tel (253) 924-6872
Fax (253) 924-6654

July 16, 1999

Ms. Kira Sykes
CH2M Hill
825 NE Multnomah, Suite 1300
Portland, OR 97232-2146

RE: Service Request 99-1174 Weyerhaeuser Longview Chlor-Alkali Plant/CH2M HILL
OOE# 7032071

Dear Kira:

Attached are the copies of our final report for the sample you requested we analyze. These are from our service request number 99-1174. The Mercury results for this request were sent to you on 5/26 as rush results. Invoicing for this work will be directly to Weyerhaeuser. If you have any questions concerning this report, please feel free to contact me at (253) 924-6242.

Thank you for using our laboratory for this analysis and we look forward to working with you on future projects.

Sincerely,

Dennis Catalano, Project Manager
Weyerhaeuser Analytical and Testing Services

Attachments

cc: Tina Rice CH2M Hill

H:\ADMIN\ADMIN\CVRLTR\sykes.doc

ANALYTICAL LABORATORY SERVICE REQUEST
Weyerhaeuser Research and Development-Analysis and Testing

Service Request 99-1174

SR Title : CH2MHill/Longview Chlor-Alkali Plant soils 148834.RI.FW
Number of Samples : 15

Submitter Name : Sykes, Kira
Submitter Address : Portland, OR
Submitter Phone : 503-235-5000 x4510
Charge Number : 046-5648
PO Number : 7032071

Date Received : 05/21/99
Date Desired : 06/18/99
Hardcopy Format :
Disk Format :

Reviewer : Catalano, Dennis
Reviewer Address : WTC 2F25
Reviewer Phone : 6242

ORB Number :
Date Completed :

Copy to :
Comments/Notes : see DMC/workplan/ref SR 98-1157 for methods or other requirements - Hg det. lmt = .1

Reference SR : 98-1157

Revisions : 5/24 - updated due date for Hg to 5/26

Test Name	Test Description	Component List
3-HG-S	Mercury Prep - Solid	
3-HG-W	Mercury Prep - Water	
HG	HG-S Mercury	Total Mercury in a Solid
HG	HG-W Mercury	Total Mercury in Water
PART-HYD	Particle Size-Hydro	
SL-OD-3	105C Solids (Solid)	
TOC-CARLO	Soil TOC (CHN)	

Lab ID	Client Sample ID	Date Sampled	Test Name	
001	H-001-021-SD-13999-xx	05/19/99 0930	3-HG-S	
			HG	HG-S
			PART-HYD	
			SL-OD-3	

Weyerhaeuser

Analytical & Testing Services

Sample Analysis Request/Chain of Custody Form

Date 5/20/99

Page 2 of 2

Facility Longview

Sampler's Project No. 148834.RI.FW

Weyerhaeuser Account No.

Project Manager (print) Kira Sykes

Sampled by: Consultant CH2M Hill

☐ Facility Address 825 NE Multnomah Suite 1300 PDX

☐ E&AS/WTC (503) 235-5000 Phone No. 235-2445 FAX

☐ E&AS/NB

Sampler Name (print) Jamey Trekels

Recorded By (signed)

Sample Description (ID, Date, Time are Required)

Method	Field Sample ID (15 characters max.)	Date (m/d/y)	Time (hh:mm)	Depth (ft / m)	Matrix: Water	Soil/Sed	Oil	Preservative: HCl	H_2SO_4	HNO_3	$Na_2S_2O_3$		Filtered	Number of Containers
G	H-001-031-SD-14099-KK	5/20/99	0630			X								1
G	H-001-032-SD-14099-KK	5/20	0750			X								2
G	H-001-033-SD-14099-KK	5/20	0800			X								2
G	H-001-027-SD-14099-EB	5/20	0900		X									1

Method: G, grab; D, depth composite; T, time composite. Depth required for soil or sediment samples.

Analyses Requested (circle or write in parameters)

pH Cond TDS TSS Color Tannins | Volatile Organics / BTEX | Semi-volatile Organics | TPH: 418.1 TPH-G TPH-D | Ca Mg Na K Fe Mn | Metals (list below) Hg | NH_3 HCO_3 CO_3 Cl F NO_3 SO_4 | AOX | TCLP: Metals VOA SVOA Pest Herb PCBs | Dioxin: Total / 2,3,7,8-TCDD / 2,3,7,8-TCDF | CN | BOD P-ortho | TKN P-total COD | COD | Grain size

Notes: * see below

☒ Samples on Ice or Blue Ice

Lab Turn-Around Time

☐ 24 Hr ☒ 48 Hr ☐ 7 Day

☐ 2-3 wk Date Due:

Reporting and QA/QC Requirements

RESULTS TO: by fax Kira Sykes

CC: Anne Boling

☐ CLP Package

☐ NPDES Permit

☐ Other:

☐ Electronic Report

Remarks/Detection Limit Requirements

Hg - total metals → see work order for proper detection limit.

* Sample H-001-031-SD-14099-KK → analyze for Hg + TOC 1ST. Grain size last if enough sample

Laboratory

☐ WATS/WTC ☐ WATS/NB

☐ Other:

Lab SR#:

Case ID:

SDG ID:

Sample Chain of Custody and Shipping Method Record

Relinquished By Sampler (signature):	Date	Time	Received By (signature):	Shipping Method
Jamey Trekels	5/20/99	0945		
Relinquished By (signature):	Date	Time	Received By (signature):	Airbill No.
Relinquished By (signature):	Date	Time	Received For Laboratory By (signature):	
	5/21/99	07:00		

Samples Received Intact:

Cooler Temp: 4° °C

WATS/WTC: 32901 Weyerhaeuser Way South, Federal Way, WA 98003 (206-924-6293)

WATS/NB: New Bern R&D Field Station, Highway 43 North, New Bern, NC 28563 (919-633-7238)

Form 10007-(2/96) Analytical Services Trans...ma

Weyerhaeuser Analytical and Testing Services
32901 Weyerhaeuser Way South
Federal Way, Washington 98003

Service Request 99-1174

Report

Longview Chlor-Alkali Plant Soils
CH2M Hill

Client ID:		H-001-021-SD-13999-xx 05/19/99 0930	H-001-022-SD-13999-xx 05/19/99 0945	H-001-023-SD-13999-xx 05/19/99 1000	H-001-024-SD-14099-xx 05/20/99 0720	H-001-025-SD-13999-xx 05/19/99 1045
Lab ID:		001	002	003	004	005
Test	Units					
TOC	%	0.54	0.61	0.35	0.17	0.18
Total Solids	% @ 105°C	71.4	61.8	64.7	71.2	66.7
Total Hg	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Client ID:		H-001-026-SD-13999-xx 05/19/99 1100	H-001-027-SD-14099-xx 05/20/99 0830	H-001-028-SD-13999-xx 05/19/99 1115	H-001-028-SD-13999-DU 05/19/99 1115	H-001-029-SD-13999-xx 05/19/99 1140
Lab ID:		006	007	008	009	010
Test	Units					
TOC	%	1.81	< 0.05	< 0.05	0.06	0.06
Total Solids	% @ 105°C	55.0	71.9	70.0	69.8	69.6
Total Hg	mg/kg	0.1	0.1	< 0.1	< 0.1	< 0.1

Client ID:		H-001-030-SD-13999-xx 05/19/99 1200	H-001-031-SD-14099-xx 05/20/99 0630	H-001-032-SD-14099-xx 05/20/99 0750	H-001-033-SD-14099-xx 05/20/99 0800	H-001-027-SD-14099-EB 05/20/99 0900
Lab ID:		011	012	013	014	015
Test	Units					
TOC	%	< 0.05	0.31	0.57	0.68	-
Total Solids	% @ 105°C	70.2	68.6	61.7	67.3	-
Total Hg	mg/kg	0.4	< 0.1	0.2	< 0.1	< 0.2

Test	Units	Samples	Date Analyzed	QL	Method
TOC	% O.D.	All except 015	06/22/99	0.05	PSEP
Total Solids	% @ 105°C	All except 015	05/25/99	0.1	AM 1-TS-CLP
Total Hg	mg/kg O.D.	All except 015	05/25/99	0.1	AM 1-245.5
Total Hg	mg/kg O.D.	015	05/25/99	0.2	AM 1-245.1

Approved: Bill Trout Date: 07/16/99
Telephone: 253/924-6157

Weyerhaeuser Analytical and Testing Services
32901 Weyerhaeuser Way South
Federal Way, Washington 98003

Service Request 99-1174

Longview Chlor-Alkali Plant Soils
CH2M Hill

SPIKES

Compound	Matrix	Sample Designation	Lab Code	Units	Sample + Spike Value	Sample Value	Spike Added	% Recovery
Total Hg	Soil	H-001-022	002	mg/kg	0.99	0.00	0.89	111

DUPLICATES

Compound	Matrix	Sample Designation	Lab Code	Units	Sample Value	Duplicate Value	RPD
Total Hg	Soil	H-001-021	001	mg/kg	< 0.1	< 0.1	NA
TOC	Soil	H-001-021	001	%	0.54	0.51	6%
TOC	Soil	H-001-021	001	%	0.54	0.53	2%
TOC	Soil	H-001-030	011	%	< 0.05	< 0.05	NA
TOC	Soil	H-001-030	011	%	< 0.05	< 0.05	NA

CONTROL SAMPLES

Compound	Matrix	Source of LCS	Units	Measured Value	Known Value	% Recovery	
Total Hg	Sed.	NIST SRM 2704	mg/kg	1.46	1.43	102	05/25/99
TOC	Sed.	NIST SRM 1646	%	1.67	1.67	100	06/22/99

Approved: Bill Trout BT Date: 07/16/99
Telephone: 253/924-6157

WEYERHAEUSER COMPANY
Analytical Laboratory
Tacoma, Washington

Grain Size Report
Method - ASTM D422-63

SAMPLE - H-001-021-SD-13999-XX
Lab Code 99-1174-001

Less than (mm)	Less than (phi)	Greater than (mm)	Greater than (phi)	Weight (%)	Cumulative (%)
		75.000	-6.229		0.0
75.000	-6.229	50.000	-5.644		0.0
50.000	-5.644	37.500	-5.229		0.0
37.500	-5.229	25.000	-4.644		0.0
25.000	-4.644	19.000	-4.248		0.0
19.000	-4.248	9.500	-3.248		0.0
9.500	-3.248	4.750	-2.248		0.0
TOTAL FOR CLASS GRAVEL --				0.0	
4.750	-2.248	2.000	-1.000		0.0
2.000	-1.000	0.850	0.234		0.0
0.850	0.234	0.425	1.234	0.0	0.0
0.425	1.234	0.250	2.000	0.2	0.2
0.250	2.000	0.106	3.238	18.0	18.2
0.106	3.238	0.075	3.737	15.2	33.4
TOTAL FOR CLASS SAND --				33.4	
0.075	3.737	0.035	4.850	37.2	70.6
0.035	4.850	0.023	5.471	8.9	79.5
0.023	5.471	0.013	6.222	9.9	89.4
0.013	6.222	0.010	6.709	3.9	93.2
0.010	6.709	0.007	7.198	2.9	96.2
TOTAL FOR CLASS SILT --				62.8	
0.007	7.198	0.003	8.230	2.4	98.6
0.003	8.230	0.001	9.478	1.4	100.0
0.001	9.478				100.0
TOTAL FOR CLASS CLAY --				3.8	

All above results based on a density of 2.65

Notebook _____

Approved 11/05 Date 13-JUL-99 Page Number _____

WEYERHAEUSER COMPANY
Analytical Laboratory
Tacoma, Washington

Grain Size Report
Method - ASTM D422-63

SAMPLE - H-001-021-SD-13999-XX
Lab Code 99-1174-001 - Duplicate

Less than (mm)	Less than (phi)	Greater than (mm)	Greater than (phi)	Weight (%)	Cumulative (%)
		75.000	-6.229		0.0
75.000	-6.229	50.000	-5.644		0.0
50.000	-5.644	37.500	-5.229		0.0
37.500	-5.229	25.000	-4.644		0.0
25.000	-4.644	19.000	-4.248		0.0
19.000	-4.248	9.500	-3.248		0.0
9.500	-3.248	4.750	-2.248		0.0
TOTAL FOR CLASS GRAVEL --				0.0	
4.750	-2.248	2.000	-1.000		0.0
2.000	-1.000	0.850	0.234		0.0
0.850	0.234	0.425	1.234	0.0	0.0
0.425	1.234	0.250	2.000	0.4	0.4
0.250	2.000	0.106	3.238	15.3	15.7
0.106	3.238	0.075	3.737	18.7	34.3
TOTAL FOR CLASS SAND --				34.3	
0.075	3.737	0.035	4.848	35.2	69.5
0.035	4.848	0.023	5.467	9.9	79.5
0.023	5.467	0.013	6.222	9.8	89.3
0.013	6.222	0.010	6.705	4.0	93.3
0.010	6.705	0.007	7.200	1.9	95.2
TOTAL FOR CLASS SILT --				60.9	
0.007	7.200	0.003	8.230	2.5	97.8
0.003	8.230	0.001	9.478	2.2	100.0
0.001	9.478				100.0
TOTAL FOR CLASS CLAY --				4.8	

All above results based on a density of 2.65

Notebook _____

Approved AWS Date 13-JUL-99 Page Number _____

WEYERHAEUSER COMPANY
Analytical Laboratory
Tacoma, Washington

Grain Size Report
Method - ASTM D422-63

SAMPLE - H-001-022-SD-13999-XX
Lab Code 99-1174-002

Less than (mm)	Less than (phi)	Greater than (mm)	Greater than (phi)	Weight (%)	Cumulative (%)
		75.000	-6.229		0.0
75.000	-6.229	50.000	-5.644		0.0
50.000	-5.644	37.500	-5.229		0.0
37.500	-5.229	25.000	-4.644		0.0
25.000	-4.644	19.000	-4.248		0.0
19.000	-4.248	9.500	-3.248		0.0
9.500	-3.248	4.750	-2.248		0.0
TOTAL FOR CLASS GRAVEL --				0.0	
4.750	-2.248	2.000	-1.000		0.0
2.000	-1.000	0.850	0.234	0.0	0.0
0.850	0.234	0.425	1.234	0.1	0.1
0.425	1.234	0.250	2.000	0.6	0.6
0.250	2.000	0.106	3.238	26.4	27.0
0.106	3.238	0.075	3.737	18.2	45.2
TOTAL FOR CLASS SAND --				45.2	
0.075	3.737	0.036	4.808	33.9	79.1
0.036	4.808	0.023	5.438	8.0	87.1
0.023	5.438	0.014	6.207	6.0	93.2
0.014	6.207	0.010	6.700	2.0	95.2
0.010	6.700	0.007	7.192	2.0	97.2
TOTAL FOR CLASS SILT --				52.0	
0.007	7.192	0.003	8.228	1.5	98.7
0.003	8.228	0.001	9.476	1.3	100.0
0.001	9.476				100.0
TOTAL FOR CLASS CLAY --				2.8	

All above results based on a density of 2.65

Notebook _____

Approved WS Date 13-JUL-99 Page Number _____

WEYERHAEUSER COMPANY
Analytical Laboratory
Tacoma, Washington

Grain Size Report
Method - ASTM D422-63

SAMPLE - H-001-023-SD-13999-XX
Lab Code 99-1174-003

Less than (mm)	Less than (phi)	Greater than (mm)	Greater than (phi)	Weight (%)	Cumulative (%)
		75.000	-6.229		0.0
75.000	-6.229	50.000	-5.644		0.0
50.000	-5.644	37.500	-5.229		0.0
37.500	-5.229	25.000	-4.644		0.0
25.000	-4.644	19.000	-4.248		0.0
19.000	-4.248	9.500	-3.248		0.0
9.500	-3.248	4.750	-2.248	0.4	0.4
TOTAL FOR CLASS GRAVEL --				0.4	
4.750	-2.248	2.000	-1.000	0.8	1.2
2.000	-1.000	0.850	0.234	0.2	1.4
0.850	0.234	0.425	1.234	1.5	2.9
0.425	1.234	0.250	2.000	5.1	8.0
0.250	2.000	0.106	3.238	29.6	37.6
0.106	3.238	0.075	3.737	18.1	55.7
TOTAL FOR CLASS SAND --				55.3	
0.075	3.737	0.036	4.808	23.8	79.5
0.036	4.808	0.023	5.443	6.0	85.5
0.023	5.443	0.014	6.211	6.0	91.5
0.014	6.211	0.010	6.700	2.9	94.4
0.010	6.700	0.007	7.188	2.9	97.4
TOTAL FOR CLASS SILT --				41.7	
0.007	7.188	0.003	8.205	2.6	100.0
0.003	8.205	0.001	9.476		100.0
0.001	9.476				100.0
TOTAL FOR CLASS CLAY --				2.6	

All above results based on a density of 2.65

Notebook _____

Approved MWS Date 13-JUL-99 Page Number _____

WEYERHAEUSER COMPANY
Analytical Laboratory
Tacoma, Washington

Grain Size Report
Method - ASTM D422-63

SAMPLE - H-001-024-SD-13999-XX
Lab Code 99-1174-004

Less than (mm)	Less than (phi)	Greater than (mm)	Greater than (phi)	Weight (%)	Cumulative (%)
		75.000	-6.229		0.0
75.000	-6.229	50.000	-5.644		0.0
50.000	-5.644	37.500	-5.229		0.0
37.500	-5.229	25.000	-4.644		0.0
25.000	-4.644	19.000	-4.248		0.0
19.000	-4.248	9.500	-3.248		0.0
9.500	-3.248	4.750	-2.248	0.4	0.4
TOTAL FOR CLASS GRAVEL --				0.4	
4.750	-2.248	2.000	-1.000	0.5	0.9
2.000	-1.000	0.850	0.234	0.4	1.2
0.850	0.234	0.425	1.234	4.1	5.3
0.425	1.234	0.250	2.000	7.8	13.2
0.250	2.000	0.106	3.238	60.3	73.5
0.106	3.238	0.075	3.737	11.8	85.3
TOTAL FOR CLASS SAND --				85.0	
0.075	3.737	0.037	4.763	9.9	95.2
0.037	4.763	0.023	5.416	1.0	96.2
0.023	5.416	0.014	6.196	1.5	97.7
0.014	6.196	0.010	6.688	1.0	98.7
0.010	6.688	0.007	7.181	1.0	99.7
TOTAL FOR CLASS SILT --				14.4	
0.007	7.181	0.003	8.223	0.2	99.9
0.003	8.223	0.001	9.473	0.1	100.0
0.001	9.473				100.0
TOTAL FOR CLASS CLAY --				0.3	

All above results based on a density of 2.65

Notebook _____

Approved WS Date 13-JUL-99 Page Number _____

WEYERHAEUSER COMPANY
Analytical Laboratory
Tacoma, Washington

Grain Size Report
Method - ASTM D422-63

SAMPLE - H-001-025-SD-13999-XX
Lab Code 99-1174-005

Less than (mm)	Less than (phi)	Greater than (mm)	Greater than (phi)	Weight (%)	Cumulative (%)
		75.000	-6.229		0.0
75.000	-6.229	50.000	-5.644		0.0
50.000	-5.644	37.500	-5.229		0.0
37.500	-5.229	25.000	-4.644		0.0
25.000	-4.644	19.000	-4.248		0.0
19.000	-4.248	9.500	-3.248		0.0
9.500	-3.248	4.750	-2.248		0.0
TOTAL FOR CLASS GRAVEL --				0.0	
4.750	-2.248	2.000	-1.000		0.0
2.000	-1.000	0.850	0.234	0.0	0.0
0.850	0.234	0.425	1.234	1.0	1.0
0.425	1.234	0.250	2.000	3.6	4.6
0.250	2.000	0.106	3.238	34.2	38.8
0.106	3.238	0.075	3.737	32.5	71.3
TOTAL FOR CLASS SAND --				71.3	
0.075	3.737	0.037	4.742	24.1	95.4
0.037	4.742	0.024	5.392	2.1	97.5
0.024	5.392	0.014	6.179	1.9	99.4
0.014	6.179	0.010	6.677	0.6	100.0
0.010	6.677	0.007	7.179		100.0
TOTAL FOR CLASS SILT --				28.7	
0.007	7.179	0.003	8.218		100.0
0.003	8.218	0.001	9.473		100.0
0.001	9.473				100.0
TOTAL FOR CLASS CLAY --				0.0	

All above results based on a density of 2.65

Notebook _____

Approved MWS Date 13-JUL-99 Page Number _____

WEYERHAEUSER COMPANY
Analytical Laboratory
Tacoma, Washington

Grain Size Report
Method - ASTM D422-63

SAMPLE - H-001-026-SD-13999-XX
Lab Code 99-1174-006

Less than (mm)	Less than (phi)	Greater than (mm)	Greater than (phi)	Weight (%)	Cumulative (%)
		75.000	-6.229		0.0
75.000	-6.229	50.000	-5.644		0.0
50.000	-5.644	37.500	-5.229		0.0
37.500	-5.229	25.000	-4.644		0.0
25.000	-4.644	19.000	-4.248	3.1	3.1
19.000	-4.248	9.500	-3.248	2.5	5.6
9.500	-3.248	4.750	-2.248	4.4	10.0
TOTAL FOR CLASS GRAVEL --				10.0	
4.750	-2.248	2.000	-1.000	2.0	12.0
2.000	-1.000	0.850	0.234	0.8	12.9
0.850	0.234	0.425	1.234	2.8	15.6
0.425	1.234	0.250	2.000	7.1	22.8
0.250	2.000	0.106	3.238	39.7	62.5
0.106	3.238	0.075	3.737	7.8	70.2
TOTAL FOR CLASS SAND --				60.2	
0.075	3.737	0.036	4.808	11.7	81.9
0.036	4.808	0.023	5.432	7.2	89.1
0.023	5.432	0.014	6.209	3.5	92.5
0.014	6.209	0.010	6.698	2.6	95.1
0.010	6.698	0.007	7.196	0.8	96.0
TOTAL FOR CLASS SILT --				25.7	
0.007	7.196	0.003	8.224	3.0	99.0
0.003	8.224	0.001	9.475	0.4	99.4
0.001	9.475			0.6	100.0
TOTAL FOR CLASS CLAY --				4.0	

All above results based on a density of 2.65

Notebook _____

Approved MS Date 13-JUL-99 Page Number _____

WEYERHAEUSER COMPANY
Analytical Laboratory
Tacoma, Washington

Grain Size Report
Method - ASTM D422-63

SAMPLE - H-001-027-SD-13999-XX
Lab Code 99-1174-007

Less than (mm)	Less than (phi)	Greater than (mm)	Greater than (phi)	Weight (%)	Cumulative (%)
		75.000	-6.229		0.0
75.000	-6.229	50.000	-5.644		0.0
50.000	-5.644	37.500	-5.229		0.0
37.500	-5.229	25.000	-4.644		0.0
25.000	-4.644	19.000	-4.248		0.0
19.000	-4.248	9.500	-3.248	2.9	2.9
9.500	-3.248	4.750	-2.248	4.3	7.2
TOTAL FOR CLASS GRAVEL --				7.2	
4.750	-2.248	2.000	-1.000	4.6	11.8
2.000	-1.000	0.850	0.234	2.3	14.1
0.850	0.234	0.425	1.234	16.0	30.1
0.425	1.234	0.250	2.000	16.2	46.4
0.250	2.000	0.106	3.238	39.2	85.6
0.106	3.238	0.075	3.737	8.3	93.8
TOTAL FOR CLASS SAND --				86.6	
0.075	3.737	0.038	4.733	5.1	98.9
0.038	4.733	0.024	5.394		98.9
0.038	4.733	0.014	6.183	0.4	99.3
0.014	6.183	0.010	6.679	0.4	99.8
0.010	6.679	0.007	7.177	0.2	100.0
TOTAL FOR CLASS SILT --				6.2	
0.007	7.177	0.003	8.218		100.0
0.003	8.218	0.001	9.471		100.0
0.001	9.471				100.0
TOTAL FOR CLASS CLAY --				0.0	

All above results based on a density of 2.65

Notebook _____

Approved MS Date 13-JUL-99 Page Number _____

WEYERHAEUSER COMPANY
Analytical Laboratory
Tacoma, Washington

Grain Size Report
Method - ASTM D422-63

SAMPLE - H-001-028-SD-13999-XX
Lab Code 99-1174-008

Less than (mm)	Less than (phi)	Greater than (mm)	Greater than (phi)	Weight (%)	Cumulative (%)
		75.000	-6.229		0.0
75.000	-6.229	50.000	-5.644		0.0
50.000	-5.644	37.500	-5.229		0.0
37.500	-5.229	25.000	-4.644		0.0
25.000	-4.644	19.000	-4.248		0.0
19.000	-4.248	9.500	-3.248		0.0
9.500	-3.248	4.750	-2.248		0.0
TOTAL FOR CLASS GRAVEL --				0.0	
4.750	-2.248	2.000	-1.000		0.0
2.000	-1.000	0.850	0.234	0.0	0.0
0.850	0.234	0.425	1.234	0.1	0.2
0.425	1.234	0.250	2.000	0.5	0.7
0.250	2.000	0.106	3.238	49.0	49.7
0.106	3.238	0.075	3.737	29.3	79.0
TOTAL FOR CLASS SAND --				79.0	
0.075	3.737	0.038	4.724	20.6	99.5
0.038	4.724	0.024	5.385		99.5
0.038	4.724	0.014	6.175	0.5	100.0
0.014	6.175	0.010	6.675		100.0
0.010	6.675	0.007	7.174		100.0
TOTAL FOR CLASS SILT --				21.0	
0.007	7.174	0.003	8.216		100.0
0.003	8.216	0.001	9.470		100.0
0.001	9.470				100.0
TOTAL FOR CLASS CLAY --				0.0	

All above results based on a density of 2.65

Notebook _____

Approved MS Date 13-JUL-99 Page Number _____

WEYERHAEUSER COMPANY
Analytical Laboratory
Tacoma, Washington

Grain Size Report
Method - ASTM D422-63

SAMPLE - H-001-028-SD-13999-DU
Lab Code 99-1174-009

Less than (mm)	Less than (phi)	Greater than (mm)	Greater than (phi)	Weight (%)	Cumulative (%)
		75.000	-6.229		0.0
75.000	-6.229	50.000	-5.644		0.0
50.000	-5.644	37.500	-5.229		0.0
37.500	-5.229	25.000	-4.644		0.0
25.000	-4.644	19.000	-4.248		0.0
19.000	-4.248	9.500	-3.248		0.0
9.500	-3.248	4.750	-2.248		0.0
TOTAL FOR CLASS GRAVEL --				0.0	
4.750	-2.248	2.000	-1.000		0.0
2.000	-1.000	0.850	0.234	0.0	0.0
0.850	0.234	0.425	1.234	0.1	0.1
0.425	1.234	0.250	2.000	0.4	0.5
0.250	2.000	0.106	3.238	39.0	39.5
0.106	3.238	0.075	3.737	39.6	79.1
TOTAL FOR CLASS SAND --				79.1	
0.075	3.737	0.038	4.726	19.6	98.6
0.038	4.726	0.024	5.383	1.0	99.6
0.024	5.383	0.014	6.177	0.4	100.0
0.014	6.177	0.010	6.674		100.0
0.010	6.674	0.007	7.179		100.0
TOTAL FOR CLASS SILT --				20.9	
0.007	7.179	0.003	8.215		100.0
0.003	8.215	0.001	9.470		100.0
0.001	9.470				100.0
TOTAL FOR CLASS CLAY --				0.0	

All above results based on a density of 2.65

Notebook _____

Approved WWS Date 13-JUL-99 Page Number _____

WEYERHAEUSER COMPANY
Analytical Laboratory
Tacoma, Washington

Grain Size Report
Method - ASTM D422-63

SAMPLE - H-001-029-SD-13999-XX
Lab Code 99-1174-010

Less than (mm)	Less than (phi)	Greater than (mm)	Greater than (phi)	Weight (%)	Cumulative (%)
		75.000	-6.229		0.0
75.000	-6.229	50.000	-5.644		0.0
50.000	-5.644	37.500	-5.229		0.0
37.500	-5.229	25.000	-4.644		0.0
25.000	-4.644	19.000	-4.248	1.8	1.8
19.000	-4.248	9.500	-3.248		1.8
9.500	-3.248	4.750	-2.248	0.1	1.9
TOTAL FOR CLASS GRAVEL --				1.9	
4.750	-2.248	2.000	-1.000		1.9
2.000	-1.000	0.850	0.234	0.0	1.9
0.850	0.234	0.425	1.234	0.3	2.2
0.425	1.234	0.250	2.000	2.0	4.3
0.250	2.000	0.106	3.238	62.8	67.0
0.106	3.238	0.075	3.737	22.8	89.8
TOTAL FOR CLASS SAND --				88.0	
0.075	3.737	0.038	4.722	10.2	100.0
0.038	4.722	0.024	5.383		100.0
0.024	5.383	0.014	6.174		100.0
0.014	6.174	0.010	6.675		100.0
0.010	6.675	0.007	7.175		100.0
TOTAL FOR CLASS SILT --				10.2	
0.007	7.175	0.003	8.215		100.0
0.003	8.215	0.001	9.470		100.0
0.001	9.470				100.0
TOTAL FOR CLASS CLAY --				0.0	

All above results based on a density of 2.65

Notebook _____

Approved WS Date 13-JUL-99 Page Number _____

WEYERHAEUSER COMPANY
Analytical Laboratory
Tacoma, Washington

Grain Size Report
Method - ASTM D422-63

SAMPLE - H-001-030-SD-13999-XX
Lab Code 99-1174-011

Less than (mm)	Less than (phi)	Greater than (mm)	Greater than (phi)	Weight (%)	Cumulative (%)
		75.000	-6.229		0.0
75.000	-6.229	50.000	-5.644		0.0
50.000	-5.644	37.500	-5.229		0.0
37.500	-5.229	25.000	-4.644		0.0
25.000	-4.644	19.000	-4.248		0.0
19.000	-4.248	9.500	-3.248	0.2	0.2
9.500	-3.248	4.750	-2.248	0.1	0.4
TOTAL FOR CLASS GRAVEL --				0.4	
4.750	-2.248	2.000	-1.000	0.3	0.7
2.000	-1.000	0.850	0.234	3.0	3.6
0.850	0.234	0.425	1.234	19.1	22.7
0.425	1.234	0.250	2.000	24.4	47.1
0.250	2.000	0.106	3.238	45.3	92.5
0.106	3.238	0.075	3.737	3.6	96.0
TOTAL FOR CLASS SAND --				95.7	
0.075	3.737	0.038	4.733	2.7	98.7
0.038	4.733	0.024	5.394		98.7
0.038	4.733	0.014	6.177	1.0	99.7
0.014	6.177	0.010	6.679	0.3	100.0
0.010	6.679	0.007	7.175		100.0
TOTAL FOR CLASS SILT --				4.0	
0.007	7.175	0.003	8.213		100.0
0.003	8.213	0.001	9.470		100.0
0.001	9.470				100.0
TOTAL FOR CLASS CLAY --				0.0	

All above results based on a density of 2.65

Notebook _____

Approved WS Date 13-JUL-99 Page Number _____

WEYERHAEUSER COMPANY
Analytical Laboratory
Tacoma, Washington

Grain Size Report
Method - ASTM D422-63

SAMPLE - H-001-031-SD-13999-XX
Lab Code 99-1174-012

Less than (mm)	Less than (phi)	Greater than (mm)	Greater than (phi)	Weight (%)	Cumulative (%)
		75.000	-6.229		0.0
75.000	-6.229	50.000	-5.644		0.0
50.000	-5.644	37.500	-5.229		0.0
37.500	-5.229	25.000	-4.644		0.0
25.000	-4.644	19.000	-4.248	6.0	6.0
19.000	-4.248	9.500	-3.248	4.5	10.4
9.500	-3.248	4.750	-2.248	3.2	13.6
TOTAL FOR CLASS GRAVEL --				13.6	
4.750	-2.248	2.000	-1.000	2.7	16.3
2.000	-1.000	0.850	0.234	6.5	22.8
0.850	0.234	0.425	1.234	23.7	46.5
0.425	1.234	0.250	2.000	11.2	57.8
0.250	2.000	0.106	3.238	23.0	80.8
0.106	3.238	0.075	3.737	3.1	83.9
TOTAL FOR CLASS SAND --				70.3	
0.075	3.737	0.037	4.773	5.5	89.4
0.037	4.773	0.023	5.420	2.6	92.0
0.023	5.420	0.014	6.201	2.5	94.5
0.014	6.201	0.010	6.694	1.7	96.2
0.010	6.694	0.007	7.186	1.7	97.8
TOTAL FOR CLASS SILT --				13.9	
0.007	7.186	0.003	8.218	1.4	99.2
0.003	8.218	0.001	9.470	0.8	100.0
0.001	9.470				100.0
TOTAL FOR CLASS CLAY --				2.2	

All above results based on a density of 2.65

Notebook _____

Approved 7/7/05 Date 13-JUL-99 Page Number _____

WEYERHAEUSER COMPANY
Analytical Laboratory
Tacoma, Washington

Grain Size Report
Method - ASTM D422-63

SAMPLE - H-001-032-SD-13999-XX
Lab Code 99-1174-013

Less than (mm)	Less than (phi)	Greater than (mm)	Greater than (phi)	Weight (%)	Cumulative (%)
		75.000	-6.229		0.0
75.000	-6.229	50.000	-5.644		0.0
50.000	-5.644	37.500	-5.229		0.0
37.500	-5.229	25.000	-4.644		0.0
25.000	-4.644	19.000	-4.248		0.0
19.000	-4.248	9.500	-3.248	5.9	5.9
9.500	-3.248	4.750	-2.248	5.2	11.0
TOTAL FOR CLASS GRAVEL --				11.0	
4.750	-2.248	2.000	-1.000	3.0	14.0
2.000	-1.000	0.850	0.234	0.9	14.9
0.850	0.234	0.425	1.234	2.6	17.5
0.425	1.234	0.250	2.000	7.4	24.9
0.250	2.000	0.106	3.238	35.3	60.2
0.106	3.238	0.075	3.737	9.7	69.9
TOTAL FOR CLASS SAND --				58.9	
0.075	3.737	0.036	4.792	14.2	84.1
0.036	4.792	0.023	5.434	4.3	88.4
0.023	5.434	0.014	6.209	4.2	92.6
0.014	6.209	0.010	6.694	3.4	96.1
0.010	6.694	0.007	7.186	1.7	97.8
TOTAL FOR CLASS SILT --				27.9	
0.007	7.186	0.003	8.218	1.4	99.2
0.003	8.218	0.001	9.468	0.8	100.0
0.001	9.468				100.0
TOTAL FOR CLASS CLAY --				2.2	

All above results based on a density of 2.65

Notebook _____

Approved WMS Date 13-JUL-99 Page Number _____

WEYERHAEUSER COMPANY
Analytical Laboratory
Tacoma, Washington

Grain Size Report
Method - ASTM D422-63

SAMPLE - H-001-033-SD-13999-XX
Lab Code 99-1174-014

Less than (mm)	Less than (phi)	Greater than (mm)	Greater than (phi)	Weight (%)	Cumulative (%)
		75.000	-6.229		0.0
75.000	-6.229	50.000	-5.644		0.0
50.000	-5.644	37.500	-5.229		0.0
37.500	-5.229	25.000	-4.644		0.0
25.000	-4.644	19.000	-4.248		0.0
19.000	-4.248	9.500	-3.248	2.6	2.6
9.500	-3.248	4.750	-2.248	0.4	3.0
TOTAL FOR CLASS GRAVEL --				3.0	
4.750	-2.248	2.000	-1.000	1.4	4.3
2.000	-1.000	0.850	0.234	0.5	4.9
0.850	0.234	0.425	1.234	4.9	9.8
0.425	1.234	0.250	2.000	10.9	20.7
0.250	2.000	0.106	3.238	32.5	53.2
0.106	3.238	0.075	3.737	8.2	61.4
TOTAL FOR CLASS SAND --				58.4	
0.075	3.737	0.035	4.819	15.1	76.4
0.035	4.819	0.023	5.455	5.8	82.2
0.023	5.455	0.013	6.222	5.8	88.0
0.013	6.222	0.010	6.699	5.8	93.8
0.010	6.699	0.007	7.194	1.8	95.6
TOTAL FOR CLASS SILT --				34.2	
0.007	7.194	0.003	8.224	1.6	97.2
0.003	8.224	0.001	9.470	2.3	99.5
0.001	9.470			0.5	100.0
TOTAL FOR CLASS CLAY --				4.4	

All above results based on a density of 2.65

Notebook _____

Approved WJS Date 13-JUL-99 Page Number _____

Surface Water Summary Table

Table C-6 Chemical Properties of Surface Water				
Sample ID	Date Sampled	Analyte	Units	Result
G000-001-SW-31998-XX	11/15/98	Mercury	mg/L	0.0002 U
G000-002-SW-32998-XX	11/25/98	Mercury	mg/L	0.0002 U
G000-003-SW-01999-XX	01/19/99	Mercury	mg/L	0.0002 U
U = Not detected at specified detection limit. See Section 2, Figure 2-3.				

Surface Water Laboratory Data Sheets and Chain-of-Custody Forms

Weyerhaeuser

32901 Weyerhaeuser Way South
Federal Way WA 98003
Tel (253) 924-6872
Fax (253) 924-6654

February 24, 1999

Ms. Kira Sykes
CH2M Hill
825 NE Multnomah, Suite 1300
Portland, OR 97232-2146

RE: Service Request 99-0196 Weyerhaeuser Longview Chlor-Alkali Plant/CH2M HILL
OOE# 7032071

Dear Kira:

Attached are the copies of our final report for the sample you requested we analyze. These are from our service request number 99-0196. Invoicing for this work will be directly to Weyerhaeuser. If you have any questions concerning this report, please feel free to contact me at (253) 924-6242.

Thank you for using our laboratory for this analysis and we look forward to working with you on future projects.

Sincerely,

Dennis Catalano, Project Manager
Weyerhaeuser Analytical and Testing Services

Attachments

cc: Tina Rice CH2M Hill

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Weyerhaeuser Analytical & Testing Services
32901 Weyerhaeuser Way South
Federal Way, WA 98003

Service Request 99-0196

Report

CH2M Hill/Longview Chlor-Alkali Plant Waters

Date of Analysis: 1/29/99

Client ID:	G000-003-SW-01999-XX		
Date Sampled:	01/19/99		
Time Sampled:	1225	**Quantitation Limit**	**Method Number**
Lab ID:	001		
	µg/L		
Total Hg	< 0.2	0.2	AM1-245.1

QC Report

Blank

Element	
	µg/L
Hg	< 0.2

Water Laboratory Control Sample Report

Element	Sample Found	True Value (Mean)	Lower Limit	Upper Limit	% Recovery
		µg/L			
Hg	1.51	1.48	1.06	1.90	102

Approved: Mary Beth Lanza
Telephone: (253) 924-6013

Date: 02/23/99

Weyerhaeuser Analytical & Testing Services
32901 Weyerhaeuser Way South
Federal Way, WA 98003

Service Request 99-0196

Report

CH2M Hill/Longview Chlor-Alkali Plant Waters

Date of Analysis: 1/29/99

Client ID:	G000-003-SW-01999-XX		
Date Sampled:	01/19/99		
Time Sampled:	1225	Quantitation Limit	Method Number
Lab ID:	001		
	µg/L		
Total Hg	< 0.2	0.2	AM1-245.1

QC Report

Blank

Element	
	µg/L
Hg	< 0.2

Water Laboratory Control Sample Report

Element	Sample Found	True Value (Mean)	Lower Limit	Upper Limit	% Recovery
		µg/L			
Hg	1.51	1.48	1.06	1.90	102

Approved: Mary Beth Lanza Date: 02/23/99
Telephone: (253) 924-6013

Weyerhaeuser

Sample Analysis Request and Chain of Custody Record

Date: 1/21/99 | Facility: Chlor-Alkali Plant-Longview, WA | Page 1 of 1

Sampler's Project Number: 148834.RI.FW | Weyerhaeuser Account Number:

Sampled By: ☐ Facility ☐ E&AS/WTC ☐ E&AS/NB | Consultant's Name: CH2M Hill

Consultant's Address: 825 NE Multnomah, Portland OR 97232 | Consultant's Phone Number: 503-235-5000 | Consultant's Fax: 503-235-2445

Project Manager (print): Kira Sykes | Sampler Name (print): Mike Abbott | Recorded By (signature): Mike Abbott

Method	Field Sample ID (15 characters max.) (required)	Date (mm/dd/yy) (required)	Time (hh:mm) (required)	Depth (ft/m)	Matrix: Water	Soil/Sed	Oil	Preservative: HCl	H_2SO_4	HNO_3	$Na_2S_2O_3$	Filtered	# of Containers	Analyses Requested: Metals (list below) Total Mercury	NOTES
G	G000-003-SW-01999-XX	01/19/99	1225	0	X					X			1	X	

→ "G"rab, "D"epth composite, or "T"ime composite → Required for soil or sediment samples

Analyses Requested (circle or write in parameters): pH Cond TDS TSS Color Tannins; Volatile Organics (8240, 8260) / BTEX; Semi-volatile organics; TPH: 418.1 TPH-G TPH-D; O + G; Metals (list below) Total Mercury; NH_3 CO_3 Cl F NO_3 SO_4; AOX / AOX<1000; TCLP: Metals VOA SVOA Pest Herb PCBs; Dioxin: Total / 2,3,7,8-TCDD / 2,3,7,8-TCDF; CN; BOD P-ortho; TKN P-total TOC COD

Remarks/Detection Limit Requirements:
Total Mercury
EPA 7470
0.2 PPB detection limits

Samples stored & shipped on ice

Laboratory Data

☒ Samples on ice or blue ice

Lab Turn-Around Time
- ☐ 24 hours
- ☐ 48 hours
- ☐ 7 days
- ☒ 2-3 weeks - date due: __/__/__

- ☐ WATS/WTC
- ☐ WATS/NB
- ☐ Other: _____

Lab SR#

Case ID

SDG ID

Reporting and QA/QC Requirements

- ☐ CLP Package
- ☐ NPDES Permit
- ☐ Other: _____
- ☐ Electronic Report

Results To: Kira Sykes
Kim Sykes - CH2M Hill / PDX
CC: Phyllis Rice
CH2M Hill / PDX

Sample Chain of Custody and Shipping Method Record

Relinquished By Sampler (signature)	Date	Time	Received By (signature)	Shipping Method
Mike Abbott	1/21/99	1600		
Relinquished By (signature)	Date	Time	Received By (signature)	Airbill Number
Relinquished By (signature)	Date	Time	Received For Laboratory By (signature)	Cooler Temp (°C)
			Samples Received Intact:	

Form 16307 (R 4/98)

WATS/WTC: 32901 Weyerhaeuser Way S, Federal Way, WA 98003 (253-924-6293) WATS/NB: New Bern R&D Field Station, Hwy 43 N, New Bern, NC 28563 (919-638-723[illegible]

Weyerhaeuser

32901 Weyerhaeuser Way South
Federal Way WA 98003
Tel (253) 924-6872
Fax (253) 924-6654

December 23, 1998

Ms. Kira Sykes
CH2M Hill
825 NE Multnomah, Suite 1300
Portland, OR 97232-2146

RE: Service Request 98-1709 Weyerhaeuser Longview Chlor-Alkali Plant/CH2M HILL
OOE# 7032071

Dear Kira:

Attached are the copies of our final report for the sample you requested we analyze. These are from our service request number 98-1709. Invoicing for this work will be directly to Weyerhaeuser. If you have any questions concerning this report, please feel free to contact me at (253) 924-6242.

Thank you for using our laboratory for this analysis and we look forward to working with you on future projects.

Sincerely,

Dennis Catalano, Project Manager
Weyerhaeuser Analytical and Testing Services

Attachments

cc: Tina Rice CH2M Hill

Weyerhaeuser Analytical & Testing Services
32901 Weyerhaeuser Way South
Federal Way, WA 98003

Service Request 98-1709

Report

CH2M Hill/Longview Chlor-Alkali Plant Waters

Date of Analysis: 12/14/98

Client ID: / Lab ID:	G000-001-SW-31998-XX 001	G000-002-SW-32998-XX 002	Quantitation Limit	Method Number
		µg/L		
Total Hg	< 0.2	< 0.2	0.2	AM1-245.1

QC Report

Blank

Element	Method Blank
	µg/L
Hg	< 0.2

Water Laboratory Control Sample Report

Element	Sample Found	True Value	Lower Limit	Upper Limit	% Recovery
		µg/L			
Hg	1.60	1.48	1.06	1.90	108

Approved: Mary Beth Lanza Date: 12/17/98
Telephone: (253) 924-6013

Case # 15
Batch 98-1709
Filing ID WCA-013

Weyerhaeuser

Sample Analysis Request and Chain of Custody Record

Date: 11/15/98	Facility: Chlor-Alkali Plant-Longview, WA	Page 1 of 1
Sampler's Project Number: 148834.RI.FW	Weyerhaeuser Account Number:	
Sampled By: ☐ Facility ☐ E&AS/WTC ☐ E&AS/NB	Consultant's Name: CH2M Hill	
Consultant's Address: 825 NE Multnomah, Portland OR 97232	Consultant's Phone Number: (503) 235-5000	Consultant's Fax: 235-2445
Project Manager (print): Kira Sykes	Sampler Name (print): Mike Abbott	Recorded By (signature): Mike Abbott

Method	Field Sample ID (15 characters max.) (required)	Date (mm/dd/yy) (required)	Time (hh:mm) (required)	Depth (ft/m)	Matrix: Water	Soil/Sed	Oil	Preservative: HCl	H_2SO_4	HNO_3	$Na_2S_2O_3$	Filtered	# of Containers	pH	Cond	TDS	TSS	Color	Tannins	Volatile Organics (8240, 8260) / BTEX	Semi-volatile organics	TPH: 418.1	TPH-G	TPH-D	O + G	Metals (list below) Total Hg	NH_3	CO_3	Cl	F	NO_3	SO_4	AOX / AOX<1000	TCLP: Metals VOA SVOA Pest Herb PCBs	Dioxin: Total / 2,3,7,8-TCDD / 2,3,7,8-TCDF	CN	BOD	P-ortho	TKN	P-total	TOC	COD	NOTES
G	G000-001-SW-31998-XX	11/15/98	0900	0	X					X			1																													

→ "G"rab, "D"epth composite, or "T"ime composite → Required for soil or sediment samples

Remarks/Detection Limit Requirements:
Total Mercury
EPA 7470
0.2 PPB detection limits
Sample was kept refridgerated since sample obtained & shipped with blue ice

Laboratory Data

- ☑ Samples on ice or blue ice

Lab Turn-Around Time
- ☐ 24 hours
- ☐ 48 hours
- ☐ 7 days
- ☑ 2-3 weeks - date due: 12/14/98

- ☐ WATS/WTC
- ☐ WATS/NB
- ☐ Other:

Lab SR#:
Case ID:
SDG ID:

Reporting and QA/QC Requirements

- ☐ CLP Package
- ☐ NPDES Permit
- ☐ Other:
- ☑ Electronic Report

Results To: Kira Sykes
CH2M Hill / PDX
CC: Phyllis Rice
CH2M Hill / PDX

Sample Chain of Custody and Shipping Method Record

Relinquished By Sampler (signature)	Date	Time	Received By (signature)	Shipping Method
Mike Abbott	11/24/98	1600		
Relinquished By (signature)	Date	Time	Received By (signature)	Airbill Number
Relinquished By (signature)	Date	Time	Received For Laboratory By (signature)	Cooler Temp (°C)
			Samples Received Intact:	

Form 16307 (R 4/98)

WATS/WTC: 32901 Weyerhaeuser Way S, Federal Way, WA 98003 (253-924-6293)

WATS/NB: New Bern R&D Field Station, Hwy 43 N, New Bern, NC 28563 (919-633-7238)

Weyerhaeuser

Sample Analysis Request and Chain of Custody Record

Date	Facility	Page
11/25/98	Chlor-Alkali Plant - Longview, WA	1 of 1

Sampler's Project Number	Weyerhaeuser Account Number
148834.RI.FW	

Sampled By	Consultant's Name
☐ Facility ☐ E&AS/WTC ☐ E&AS/NB	CH2M Hill

Consultant's Address	Consultant's Phone Number	Consultant's Fax
825 NE Multnomah Portland OR 97232	(503) 235-5000	235-2445

Project Manager (print)	Sampler Name (print)	Recorded By (signature)
Kira Sykes	Mike Abbott	Mike Abbott

Method	Field Sample ID (15 characters max.) (required)	Date (mm/dd/yy) (required)	Time (hh:mm) (required)	Depth (ft/m)	MATRIX: Water	Soil/Sed	Oil	PRESERVATIVE: HCl	H_2SO_4	HNO_3	$Na_2S_2O_3$	Filtered	# of Containers	pH	Cond	TDS	TSS	Color	Tannins	Volatile Organics (8240, 8260) / BTEX	Semi-volatile organics	TPH: 418.1	TPH-G	TPH-D	O + G	Metals (list below) Total Hg	NH_3	CO_3	Cl	F	NO_3	SO_4	AOX / AOX<1000	TCLP: Metals VOA SVOA Pest Herb PCBs	Dioxin: Total / 2,3,7,8-TCDD / 2,3,7,8-TCDF	CN	BOD	P-ortho	TKN	P-total	TOC	COD	NOTES
G	R000-002-SW-32998-XX	11-25-98	1230	0	X					X			1												X																	

→ "G"rab, "D"epth composite, or "T"ime composite → Required for soil or sediment samples

Remarks/Detection Limit Requirements

Total Mercury
EPA 7470
0.2 PPB detection limits

Sample stored & shipped w/ blue ice

Laboratory Data

- ☒ Samples on ice or blue ice

Lab Turn-Around Time
- ☐ 24 hours
- ☐ 48 hours
- ☐ 7 days
- ☒ 2-3 weeks - date due: 12/14/98

- ☐ WATS/WTC
- ☐ WATS/NB
- ☐ Other:

Lab SR#

Case ID

SDG ID

Reporting and QA/QC Requirements

- ☐ CLP Package
- ☐ NPDES Permit
- ☐ Other:
- ☐ Electronic Report

Results To: Kira Sykes
CH2M Hill/PDX
CC: Phyllis Rice
CH2M Hill/PDX

Sample Chain of Custody and Shipping Method Record

Relinquished By Sampler (signature)	Date	Time	Received By (signature)	Shipping Method
Mike Abbott	11/30/98	1600		
Relinquished By (signature)	**Date**	**Time**	**Received By (signature)**	**Airbill Number**
Relinquished By (signature)	**Date**	**Time**	**Received For Laboratory By (signature)**	**Cooler Temp (°C)**
			Samples Received Intact:	

Form 16307 (R 4/98)

WATS/WTC-2000-01 Weyerhaeuser S, F--- Way 980(---)3-92--3) WAT New R&D Static ...y 43 ...ew B ... C 28 ...919-6 ...238)

APPENDIX D

QA/QC Results

Review of Quality Assurance/Quality Control (QA/QC) Data for Weyerhaeuser Longview Chlor-Alkali Plant, Groundwater, Surface Soil, Sediment, and Surface Water Sampling, September, 1998

TO: Kira Sykes

COPIES: Project File

FROM: Donna Morgans/CVO

DATE: February 10, 1999

Summary

The majority of the data have met the QA/QC acceptance criteria and all data are usable for the purposes outlined in the Weyerhaeuser Chlor-Alkali Plant Remedial Investigation Work Plan. Nonconformances with QA/QC criteria are discussed, identified, and qualified in this report. The following is a brief summary of the overall quality of the sample results.

The majority of mercury results for all samples met all QA/QC criteria for the selected QC parameters. A completeness objective of 95 percent was achieved for all samples analyzed for all parameters based on precision and accuracy. Nonconformances with the QA/QC criteria were observed as follows:

- Four dissolved mercury and three total mercury results for groundwater samples were qualified as estimates and flagged with a "J" for positive results or with a "UJ" for nondetected results because the analysis holding times were exceeded.
- Two total mercury results for sediment samples were qualified as estimates and flagged with a "J" for positive results because the analysis holding times were exceeded.
- Five total mercury results for soil samples were qualified as biased high and flagged with a "K" for positive results because the matrix spike recovery was reported above the QC acceptance criteria.

All metals and general chemical results for all samples met all QA/QC criteria for the selected QC parameters. A completeness objective of 95 percent was achieved for all samples analyzed for all parameters based on precision and accuracy.

Introduction

Four soil, five sediment, one soil field duplicate, and one sediment field duplicate were collected on September 21 and 22, 1998. Seventeen sediment, two sediment field duplicates,

and two equipment blanks were collected between September 29 and 30, 1998. Eighteen groundwater samples and two groundwater field duplicate samples were collected between October 6 and October 8, 1998. Two surface water samples were collected on November 25, 1998. Groundwater and surface water samples were analyzed for total and dissolved mercury and soil and sediment samples were analyzed for total mercury. All analyses were performed by the Weyerhaeuser Analytical Testing Services (WATS) Laboratory located in Federal Way, Washington.

Data Review Criteria

Analytical results and QA/QC summary information were provided for all sample analyses.

EPA Contract Laboratory Program (CLP) *National Functional Guidelines (NFG) for Inorganic Data Review* (February 1994) provided guidelines for data qualification.

This QA review focuses on criteria for the QA/QC parameters and their overall effect on the data:

- Holding time compliance
- Method reporting limits (MRLs)
- Method blanks
- Precision and Accuracy (matrix spikes, laboratory duplicates, and LCSs)
- Field QA/QC (equipment blanks and field duplicates)

Analytical Methods

All samples were analyzed by and QA/QC criteria were taken from one of the of the following sources:

- U.S. EPA. Methods for Chemical Analysis of Water and Wastes. 600/4-79-200, March 1983.
- Standard Methods for the Examination of Water and Wastewater. 18th Edition. 1992.

Table 1 lists the analytical method used for each parameter and the number and type of samples analyzed.

Qualifiers

The following definitions provide brief explanations of the data qualifiers that may be assigned to results in the data review process.

U - The analyte was analyzed for, but the analyte was not detected above the reported sample quantitation limit.

J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

K - The analyte concentration is biased high; the result may actually be lower.

The laboratory may have assigned additional data qualifiers. Laboratory data qualifiers are defined in each laboratory report.

Holding Time Compliance

Except for four dissolved mercury and three total mercury results for groundwater, all groundwater and surface water samples were analyzed within the 28-day holding time requirement. The analysis of total mercury in HLA3A-28098 and total and dissolved mercury detected in HLA 2A-28098 was performed five days past the holding time requirement. The analysis of total and dissolved mercury in HLA1B-28198 and HLA7B-28198 was performed four days past the holding time requirement. Dissolved and total mercury results for these samples were qualified as estimates and flagged with an "J" for positive results or with a "UJ" for nondetected results.

Except for two total mercury results for sediment, all sediment samples were analyzed within the 28-day holding time requirement. The analysis of total mercury in sediment samples G006-002-SD and G006-003-SD was performed three days past the holding time requirement. Total mercury results for these samples were qualified as estimates and flagged with an "J" for positive results.

All remaining analyses for groundwater, soil, and sediment samples were performed within their respective holding times.

Method Reporting Limits

Table 2 lists the MRLs achieved by WATS for all parameters analyzed. The MRLs shown in Table 2 are independent of any dilution that may have been performed in conjunction with sample analysis.

Method Blanks

Method blanks and preparation blanks monitor contamination that may be introduced during analysis.

A method blank or preparation blank was analyzed with each analytical batch, therefore meeting frequency QC acceptance criteria. With the exception of sulfide, all method blanks were contamination-free, therefore meeting QC acceptance criteria.

Sulfide was detected at a concentration of 11 mg/kg in the soil preparation blank associated with service request number 98-1157. Sulfide was detected at a concentration slightly above the method reporting limit of 10 mg/kg. Because there are no criteria for qualifying sulfide

results for preparation blank contamination, sulfide results associated with this preparation blank were not qualified as a result of contamination.

Matrix Spikes and Laboratory Duplicates

Precision and accuracy of laboratory performance are evaluated by the analysis of laboratory control samples (LCS), matrix spike, and laboratory duplicates. A matrix spike, laboratory duplicate, and an LCS should be performed at a frequency of five percent or once per analytical batch, whichever is more frequent. Matrix spike recoveries should be within the control limits of 75 to 125 percent to meet accuracy QC acceptance criteria. LCS recoveries should be within the control limits of 80 to 120 percent to meet accuracy QC acceptance criteria. Relative percent difference (RPD) results should be within the control limits of ± 20 for water samples and ± 35 for soil samples to meet precision QC acceptance criteria.

Matrix spike, laboratory duplicate, and LCS frequency criteria were met for each analytical batch. With the exception of one matrix spike recovery, all matrix spike, laboratory duplicate, and LCS recoveries and RPD results were within the QC control limits for all samples analyzed. Therefore, the majority of samples met precision and accuracy QC acceptance criteria.

The matrix spike recovery associated with analytical batch 98-1157 was reported with a recovery of 129 percent. Soil sample results for F036-001, F036-002, F036-002, and F036-003 were qualified as biased high and flagged with a "K".

A matrix spike and laboratory duplicate were not reported with surface water samples analyzed (analytical batch 98-1709).

Field QA/QC

Equipment Blanks

Equipment blanks are used primarily to indicate if contamination has occurred as a result of sample collection or handling procedures.

An equipment blank was collected on September 29 and 30 in association with sediment samples and analyzed for total mercury. Equipment blank samples were not analyzed for any additional parameters. Total mercury was not detected in any of the equipment blanks collected, therefore indicating that contamination was not introduced as a result of sample collection or handling procedures.

Field Duplicates

Field duplicates are another measure of reproducibility by duplicate analysis.

Field duplicate results are used to determine the precision of field sampling and laboratory techniques. There are no criteria or control limits for the RPD of field duplicates; therefore laboratory duplicate criteria are applied. This allows control limits of ±20 RPD for water samples and ±35 RPD for soil samples with the provisional control limit of plus or minus the MRL when sample concentrations are less than five times the MRL. These control limits

may be too stringent, however, since precision in this case involves both sampling and laboratory precision. There are no specific review criteria used to compare field sample result comparability. Qualifiers are not assigned when field duplicate results do not meet QC acceptance criteria.

Groundwater sample CH5 and HLA1B were collected in duplicate and analyzed for dissolved mercury. Soil sample F036-002-SO and sediment G006-004-SD were collected in duplicate and analyzed for total mercury, alkalinity, chloride, pH, sulfide, and total solids. Sediment samples H001-011-SD and H001-014-SD were collected in duplicate and analyzed for total mercury, total organic carbon, and total solids. Tables 3 and 4 show field duplicate RPD results for compounds that were detected in one or both of the samples analyzed.

The RPD results for groundwater sample CH5, sediment samples H001-011-SD, H001-014-SD, and G006-004-SD met the QC acceptance criteria of ±20 RPD for water samples or ±35 RPD for soil samples for field precision.

The RPD result for groundwater sample HLA1B did not meet the QC acceptance criteria of ±20 RPD for field precision or the provisional criteria .

The RPD results for total mercury, alkalinity, and chloride for soil sample FO36-002-S0 did not meet the QC acceptance criteria of ±35 RPD for field precision or the provisional criteria. However, the RPD results for pH, sulfide, and total solids met the QC acceptance criteria for field precision.

TABLE 1
Summary of Analyses

Parameter	Method	No. of Field Samples	No. of Field Duplicates	No. of Equipment Blanks
Total Mercury	EPA 245.1	18 groundwater 2 surface water	NC	2
Dissolved Mercury	EPA 245.1	18 groundwater	2 groundwater	NC
Total Mercury	EPA 245.5	22 sediment 4 soil	3 sediment 1 soil	NC
Total Metals[1]	EPA 6010	18 groundwater	NC	NC
Dissolved Metals[2]	EPA 200.7	18 groundwater	NC	NC
Alkalinity as CaCO3	1-0015-LMG	20 sediment 8 soil	3 sediment 1 soil	NC
Alkalinity as CaCO3	SM2320	18 groundwater	NC	NC
Chloride	EPA 300.0	18 groundwater	NC	NC
Chloride	Mod. EPA 300.0	8 soil	1 soil	NC
Fluoride	EPA 300.0	18 groundwater	NC	NC
Grain Size	ASTM D422-63	17 sediment	2 sediment	NC
Nitrate/Nitrite as N	EPA 353.2	18 groundwater	NC	NC
pH	Mod. EPA 150.1	8 soil 3 sediment	1 soil 1 sediment	NC
Sulfate	EPA 300.0	18 groundwater		NC
Sulfide	SM4500-E1	18 groundwater		NC
Sulfide	1-0045-LMG	8 soil 3 sediment	1 soil 1 sediment	NC
TOC	PSEP	17 sediment	2 sediment	NC
TDS	EPA 160.1	18 groundwater	NC	NC
TSS	EPA 160.2	18 groundwater	NC	NC
Total Solids	EPA 160.3	10 soil 22 sediment	1 soil 3 sediment	NC

Notes:
1. Total metals include: calcium, iron, potassium, magnesium, manganese, and sodium
2. Dissolved metals include: silicon as SiO2
NC - None collected
NA - None analyzed

TABLE 2
Method Reporting Limits

Method	Reporting Limit for Water (mg/L)	Reporting Limit for Soil (mg /kg)
Dissolved mercury (EPA 245.1)	0.002	NA
Total mercury (EPA 245.1)	0.002	NA
Total mercury (EPA 245.5)	NA	0.0001
Total calcium (EPA 6010)	0.1	NA
Total iron (EPA 6010)	0.05	NA
Total potassium (EPA 6010)	0.1	NA
Total magnesium (EPA 6010)	0.1	NA
Total manganese (EPA 6010)	0.005	NA
Total sodium (EPA 6010)	0.5	NA
Dissolved silicon (EPA 200.7)	0.5	NA
Alkalinity (SM 2320 or 0015-LMG)	0.5	50
Fluoride (EPA 300.0 & EPA 340.2)	0.05	NA
Chloride (EPA 300.0)	0.05	0.1
Sulfate (EPA 300.0)	0.2	NA
Nitrate – Nitrite	0.03	NA
Sulfide (SM4500 – E or 0045-LMG)	1	10
Total organic carbon (PSEP)	NA	0.05
Total dissolved solids (EPA 160.1)	10	NA
Total suspended solids (EPA 160.2)	5	NA

Notes:
NA - Not applicable

TABLE 3
Field Duplicate Results for Water Samples

Chemical	Parent Sample (µg/L)	Duplicate Sample (µg/L)	RPD
	CH5		
Dissolved mercury	2.2	1.5	37.8
	HLA1B		
Dissolved mercury	125	125	0.0

Notes:
NC - Not calculated
U - Not detected

TABLE 4
Field Duplicate Results for Sediment and Soil Samples

Chemical	Parent Sample (mg/kg)	Duplicate Sample (mg/kg)	RPD
	H001-011-SD		
Total mercury	0.1 U	0.1 U	NC
Total organic carbon	0.09	0.16	56
Total solids	77.5	74.7	3.7
	H001-014-SD		
Total mercury	0.1 U	0.1 U	NC
Total organic carbon	0.03	0.04	29
Total solids	70.0	74.4	6.1
	G006-004-SD		
Total mercury	0.7	0.7	0.0
Alkalinity	380	450	17
Chloride	6.7	6.8	1.5
pH	7.4	7.4	0.0
Sulfide	23	25	8.3
Total solids	83.6	82.8	1.0
	FO36-002-SO		
Total mercury	0.5	0.9	57
Alkalinity	1900	3500	59
Chloride	770	420	59
pH	9.0	9.0	0.0
Sulfide	40	45	12
Total solids	83.8	84	0.2

Notes:
NC - Not calculated
U - Not detected