Results of Pilot Study of Proposed Remedial Action

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Prepared for:

Sierra Pacific Industries
Arcata Division Sawmill
2593 New Navy Base Road
Arcata, California

July 2006

Project No. 9329.000, Task 23

Geomatrix

Geomatrix

July 27, 2006
Project 9329.000

Executive Officer
California Regional Water Quality Control Board
North Coast Region
5550 Skylane Boulevard, Suite A
Santa Rosa, California 95403

Attention: Kasey Ashley

Subject: Results of Pilot Study of Proposed Remedial Action
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Dear Ms. Ashley:

As requested by Sierra Pacific Industries, we have enclosed a copy of the subject report.

Sincerely yours,
GEOMATRIX CONSULTANTS, INC.

Mike Keim Edward P Conti

Mike Keim
Senior Environmental Scientist

Edward P. Conti, CEG, CHG
Principal Geologist

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Enclosure

cc: Bob Ellery, Sierra Pacific Industries (with enclosure)
Gordie Amos, Sierra Pacific Industries (with enclosure)
Fred Evenson, Law Offices of Frederic Evenson (with enclosure)
Jim Lamport, Ecological Rights Foundation (with enclosure)

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PROFESSIONAL CERTIFICATION

RESULTS OF PILOT STUDY OF PROPOSED REMEDIAL ACTION
Sierra Pacific Industries
Arcata Division Sawmill
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This report was prepared by Geomatrix Consultants, Inc., under the professional supervision of Edward P. Conti. The findings, recommendations, specifications and/or professional opinions presented in this report were prepared in accordance with generally accepted professional hydrogeologic practice, and within the scope of the project. There is no other warranty, either express or implied.

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Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

1.0 INTRODUCTION

This document presents the results of a pilot study of the proposed remedial action for wood surface protection chemicals that have been detected in groundwater and storm water runoff at the Sierra Pacific Industries (SPI) Arcata Division Sawmill located in Arcata, California (the site, Figure 1). The proposed remedial action was described and evaluated, along with other alternatives, in the Geomatrix Consultants, Inc. (Geomatrix) December 1, 2003, document *Final Feasibility Study for Remediation of Wood Surface Protection Chemicals* (Feasibility Study; Geomatrix, 2003c). Based on the results of the Feasibility Study, the RWQCB requested a pilot study work plan in a March 1, 2004 letter. This pilot study was performed in accordance with both Geomatrix's April 29, 2004 *Pilot Study Work Plan for Implementation of Proposed Remedial Action* (Geomatrix, 2004c), which was approved by the California Regional Water Quality Control Board, North Coast Region (RWQCB), in a letter dated June 9, 2004, and with Geomatrix's February 15, 2006 *Addendum to Pilot Study Work Plan* (Geomatrix, 2006a), which was approved by the RWQCB in a letter dated February 28, 2006.

The proposed final remedy for the site based on the results of the Feasibility Study is source removal and monitored natural attenuation. This remedial action includes: 1) excavation of soil, concrete, and woody debris containing elevated concentrations of chemicals of concern; 2) monitoring of groundwater to demonstrate that attenuation of contaminants is naturally occurring; 3) implementation of storm water Best Management Practices (BMPs) and storm water monitoring to demonstrate that discharges of wood surface protection chemicals to surface water have been abated; and 4) implementation of a Site Management Plan to minimize risks posed by chemicals of concern. Excavation activities (source removal) were performed in 2003. The source removal activities have been previously documented and are summarized in Section 2.2 of this report. This report also documents the additional site-specific monitoring and other activities performed to achieve the three objectives of the pilot study. Based on the results of this pilot study, source removal and monitored natural attenuation is an appropriate final remedy for the site.

2.0 SITE BACKGROUND

This section provides background information regarding the site setting and history, including current and historical site uses and previous environmental investigations performed at the site.

2.1 SITE HISTORY

The approximately 68-acre site is located on the Samoa Peninsula, along the northern shoreline of Humboldt Bay and approximately 4 miles west of the town of Arcata, California. The site is bounded to the east by the Mad River Slough, to the northwest by an old railroad grade, and to the south by New Navy Base Road and mud flats of Humboldt Bay (Figure 1).

The site is currently an active sawmill; features are shown on Figure 2. The sawmill has operated at the site since approximately 1950. Prior to construction of the mill facilities, the site consisted of pasture, undeveloped sand dunes, and mud flats. During construction of mill facilities in the 1950s and 1960s, portions of the Mad River Slough on the eastern, northern, and southern sides of the site were filled. The current mill facility consists of an administrative building, a main sawmill building, numerous wood-processing buildings, log storage areas, milled lumber storage areas, and loading/unloading areas.

Wood surface protection activities historically conducted at the site included the use of an anti-stain solution containing chlorinated phenols, including pentachlorophenol (PCP) and tetrachlorophenol, to control sap stain and mold on a small amount of milled lumber. The anti-stain solution was applied in an aboveground dip tank located in the middle of the former green chain, which was located immediately south of the eastern end of the current sorter building (Feature 49 on Figure 2). Use of the solution containing chlorinated phenols in the former green chain area of the site reportedly commenced in the early to mid-1960s and was discontinued in 1985 (EnviroNet, 2002). At the direction of the RWQCB, SPI stopped purchasing anti-stain solution containing chlorinated phenols in 1985 and commenced a process of relocating the remaining solution containing chlorinated phenols to a new dip tank facility for recycling (MFG, 2003). Due to the difficulty of disposing of the old solution containing chlorinated phenols, the remaining solution from the old dip tank was mixed with a new anti-stain solution that did not contain chlorinated phenols at the new dip tank facility (Feature 21 on Figure 2). Recycling of the solution containing chlorinated phenols in the new dip tank continued until 1987, at which time the drip basin adjacent to the old dip tank was cleaned out, filled with sand, and capped with 3 to 4 inches of concrete (MFG, 2003). The new dip tank has been cleaned three times since 1987.

2.2 SOURCE AREA REMOVAL

In April and May 2003, SPI staff found a shallow pit containing woody debris, sand, and water. The pit appears to have been located under the south end of the former aboveground dip tank. In June 2003, an initial excavation of woody debris was conducted to remove material with elevated chlorinated phenol, dioxin, and furan concentrations from the pit. Additional excavations were conducted in September and November 2003. The objective of this source area excavation was to remove soil, concrete, and woody material impacted by elevated concentrations of chlorinated phenols, dioxins, and furans that were serving as a contaminant source to groundwater and storm water at the site.

The final excavation area measured approximately 20 feet by 30 feet; total depth of the excavation ranged from 4 to 5.5 feet below the adjacent grade. The total volume of soil and other material removed was approximately 139 cubic yards. Approximately 1,750 gallons of groundwater were pumped from the excavations to facilitate the work. Post-excavation confirmation samples indicated that the majority of PCP affected soil has been removed. Excavation activities were summarized in the *Report on Interim Remedial Measures: Source Area Removal* (Geomatrix, 2003b).

3.0 PILOT STUDY

3.1 OBJECTIVES

The three primary objectives of the pilot study are to:

- Demonstrate that in-situ destruction of contaminants is occurring in the subsurface through natural attenuation processes.
- Demonstrate that discharges of wood surface protection chemicals to surface water have been abated.
- Implement risk management measures to protect current and future personnel working on-site from taking actions that would result in exposure to unacceptable risk.

3.2 DEMONSTRATION OF NATURAL ATTENUATION

Natural attenuation processes are physical, chemical, and microbiological processes that, without human intervention, cause a decrease in the mass, volume, concentration, toxicity, and/or mobility of a contaminant *in situ* (US EPA, 1998). These processes include biodegradation, dispersion, dilution, sorption, volatilization, chemical or biological stabilization, transformation, or abiotic destruction of contaminants (US EPA, 1998). Biological degradation, dispersion, dilution, and sorption are likely the major natural attenuation processes affecting the mass, concentration, and mobility of PCP, dioxins, and furans *in situ*. Of these processes, biological degradation, if occurring, would be important for meeting remedial goals in a reasonable timeframe. Therefore, an assessment of the relative importance of biodegradation as a naturally occurring attenuation process was conducted by considering both indirect and direct evidence for biodegradation.

Indirect evidence for biodegradation includes the following lines of evidence:

- Limited plume migration based on monitoring results;
- Decreasing concentration trends in monitoring well samples; and
- Geochemical conditions at the site similar to conditions associated with biodegradation.

Direct field evidence for biodegradation includes demonstrating an increase in the concentrations of breakdown products relative to parent compounds over time or with distance from the source area.

Groundwater sampling and analysis of PCP, dioxins and furans was conducted at eight monitoring wells to assess the spatial distribution and temporal changes in concentration over time. Additional groundwater samples were collected from temporary sampling points to assess the spatial distribution of PCP and breakdown products beneath the sawmill building. Groundwater samples were analyzed for additional parameters to assess whether conditions would likely be favorable for biodegradation of PCP. The spatial distribution of PCP was used in conjunction with an assessment of groundwater flow velocities and fate and transport modeling to assess apparent biodegradation rates.

3.2.1 Groundwater Sampling Program

Groundwater sampling and analysis was performed to assess spatial and temporal changes in the distribution of PCP and breakdown products and dioxins and furans. Three groundwater sampling events were conducted over a two-year period, with each event separated by approximately one year. Groundwater samples were collected from eight site monitoring wells (MW-1, MW-2, MW-3, MW-5, MW-7, MW-14, MW-20 and MW-21; Figure 3). Construction details of the monitoring wells are presented in Table 1. The wells were purged using a low-flow purging method suitable to accurate field measurement of parameters such as dissolved oxygen. The field and laboratory parameters analyzed in each sample are listed below:

- Natural attenuation parameters: (1) field measurements using a flow cell for pH, specific electrical conductance, temperature, oxidation-reduction potential (Eh), and dissolved oxygen (DO); (2) laboratory analysis for total organic carbon (TOC; Environmental Protection Agency [EPA] Method 415.1); calcium and magnesium (EPA Method 200.7); alkalinity (Standard Method 2320B); chloride, nitrate, and sulfate (EPA Method 300.0); iron (II) and manganese (II) (EPA Method 6010B), and dissolved methane and carbon dioxide (RSK 175);

- Pentachlorophenol and breakdown products, including tetrachlorophenols, trichlorophenols, dichlorophenols, and chlorophenols (EPA Method 8270 Selective Ion Monitoring [SIM] and Canadian Pulp Method);

- Phenol (EPA Method 8270 SIM); and,

- Dioxins and furans (EPA Method 1613).

The chemical analyses were performed by California Department of Health Services-certified analytical laboratories.

The results of natural attenuation parameter testing were evaluated to assess whether reducing conditions in the subsurface promote the natural destruction of PCP (Geomatrix, 2003c). The presence, concentration, and distribution of breakdown products resulting from the reductive dechlorination of PCP (tetra-, tri, di-, and chlorophenols, and phenol and chloride) were analyzed to assess natural attenuation processes. The monitoring results of dioxins and furans were evaluated to determine whether or not the concentrations of these compounds are decreasing over time.

A discussion of the results of the most recent groundwater sampling event are presented in *Groundwater Monitoring and Progress Report, March 2006 Sampling Event* (Geomatrix, 2006b). Historical groundwater monitoring results are presented in Table 2 (Summary of Water Quality Parameters), Table 3 (Laboratory Analytical Results for Chlorinated Phenols (Canadian Pulp Method)), Table 4 (Field Measurements and Laboratory Analytical Results for Natural Attenuation Parameters), Table 5 (Laboratory Analytical Results for Chlorinated Phenols and Phenol (8270 SIM Method)), and Table 6 (Laboratory Analytical Results for Dioxins and Furans).

3.2.1.1 Groundwater Sampling Beneath the Sawmill

Five temporary groundwater monitoring points (B-64 through B-68) were advanced beneath the sawmill building and sampled on March 15, 16, and 21, 2006. The monitoring points were installed in accordance with the *Addendum to Pilot Study Work Plan* (Geomatrix, 2006a) to obtain additional groundwater data from beneath the sawmill building to supplement other data being collected as part of the pilot study, and to provide additional delineation on the extent of PCP in groundwater.

Due to access constraints, the monitoring points were advanced by manually driving clean, ¾-inch galvanized steel pipe into the ground to depths of approximately eight feet below ground surface (bgs) using a fence post driver. The tip of the pipe contained a loose carriage bolt to prevent the soil from entering the pipe while it was being driven into the ground.

Following advancement of the pipe, a slotted piece of ¼-inch polyethylene tubing wrapped in 0.0035-inch nylon mesh was placed within the pipe. The pipe was then lifted out of the boring to expose one to four feet of slotted tubing to the surrounding soils.

A peristaltic pump was used to remove groundwater from the borings through the tubing. Field measurements of temperature, pH, and electrical conductance were taken from each boring using a handheld meter. The field measurements are summarized in Table 4. Field personnel used the peristaltic pump and tubing to fill laboratory-supplied containers, which were labeled and placed in an ice-cooled, insulated chest for transport to the laboratories for analysis. Chain-of-custody records were completed for the samples and accompanied the samples until received by the laboratories.

Groundwater samples collected from the borings were analyzed at the following laboratories: Alpha Analytical Laboratories, Inc. (Alpha), of Ukiah, California; and Friedman & Bruya, Inc. (Friedman & Bruya), of Seattle, Washington. Analytical laboratory results are presented in Tables 4 and 5. Copies of the chain-of-custody records and analytical laboratory reports are included in Appendix A. Groundwater samples from the borings were analyzed as follows:

- Total organic carbon by EPA Method 415.1;
- Pentachlorophenol and breakdown products, including tetrachlorophenols, trichlorophenols, dichlorophenols, and chlorophenols by EPA Method 8270 SIM; and
- Phenol by EPA Method 8270 SIM.

PCP was only detected in the groundwater sample collected from boring B-64, at a concentration of 18,000 micrograms per liter (μg/L). PCP degradation products (including tetra-, tri-, di-, and chloro-phenols) were detected in the groundwater samples collected from borings B-64 and B-68. No PCP or PCP degradation products were detected in the samples collected from borings B-65, B-66, and B-67. In boring B-64, tetrachlorophenol concentrations ranged from 45 to 670 μg/L, trichlorophenol concentrations ranged from non-detect to 550 μg/L, dichlorophenol concentrations ranged from non-detect to 960 μg/L, and chlorophenol concentrations ranged from non-detect to 1,300 μg/L. In the sample collected from boring B-68, only one degradation product, chlorophenol at a concentration of 19 µg/L, was detected. Phenol, the final product of reductive dechlorination of PCP, was only detected in the groundwater sample from B-64 at a concentration of 22 µg/L. Groundwater analytical results for chlorinated phenols and phenol are presented in Table 2.

Total organic carbon (TOC) was detected at concentrations ranging from 8.30 to 20.9 milligrams per liter (mg/L) in the samples from borings B-64 through B-67, and at a concentration of 322 mg/L in the sample from boring B-68. Field measurements and natural attenuation parameters are presented in Table 4.

Geomatrix reviewed the laboratory data generated for the pilot study temporary monitoring point groundwater sampling as discussed in Appendix B. Based on our review, the data generated appear to be accurate and representative.

3.2.1.2 Summary of Groundwater Sampling Results

The extent of PCP-affected groundwater is limited to an area approximately 30 feet wide by 210 feet long, in the downgradient direction from the source area, suggesting that it has not migrated very far over the past 45 years. Residual PCP in saturated soil and groundwater, based on concentrations near or above solubility in groundwater samples (the aqueous solubility of PCP is 14 mg/L), may exist in the vicinity of monitoring wells MW-7 and MW-21 and boring B-64. PCP and its breakdown products were not observed in groundwater samples collected downgradient from boring B-64, except in well MW-2, where PCP was detected at 2 µg/L using the EPA 8270C SIM Method and not detected (reporting limit of 1 µg/L) using the Canadian Pulp Method, and in boring B-68, which had a concentration of 19 µg/L of 3- and 4-chlorophenol. With the exception of one detection of PCP in a December 3, 2002 sample collected from well MW-16D (1.3 µg/L), PCP and its breakdown products have not been detected in deeper groundwater. The results of the March 2006 sampling are shown on Figure 4 and included in Tables 3 and 5.

Groundwater analytical results for dioxins and furans sampling indicate that remaining dioxins and furans in groundwater are located primarily in the vicinity of monitoring well MW-20, located in the area of the source area excavation. The concentration of the total dioxins and furans in monitoring well MW-20 has decreased from a total of 1,490,207.2 pg/L at the beginning of the pilot study (March 2004) to a total concentration of 65,434.6 pg/L at the end of the pilot study (March 2006). The concentration of total dioxins and furans in monitoring well MW-21 decreased from a total of 20,749.9 pg/L to a concentration of 396.8 pg/L. The initial concentration in MW-3 (1,338.07 pg/L) decreased to 23.5 pg/L at the end of the pilot study. Low concentrations of total dioxins and furans in monitoring wells MW-1, MW-2, and MW-14 (ranging from 70.72 to 100.5

pg/L) decreased to 11.7 pg/L (MW-1) or non-detectable levels (MW-2 and MW-14) at the completion of the pilot study. Concentrations of total dioxins and furans in monitoring well MW-7 increased slightly from a concentration of 297.63 pg/L (September 2002) to a concentration of 590.16 pg/L (March 2006). In monitoring well MW-5, located cross and upgradient of the former source area, total dioxins and furans increased from 206.86 pg/L (March 2004) to 984.2 pg/L (March 2006).

The toxicity of remaining dioxins and furans in site groundwater at the beginning of the pilot study was compared to the toxicity of dioxins and furans at the end of the pilot study. The relative toxicity of dioxin and furan congeners that have chlorine molecules in the 2, 3, 7, and 8 positions has been studied extensively, and toxicity equivalency factors (TEFs) have been developed to quantify the relative toxicity of the congeners (Van den Berg et al., 1998). The dioxin results are combined with TEFs, derived by the World Health Organization and endorsed by OEHHA (Cal-EPA OEHHA, 2003), to estimate toxic equivalency quotients (TEQs). The TEQs decreased in monitoring wells MW-1, MW-2, MW-3, MW-14, MW-20, and MW-21 from the beginning of the pilot study (March 2004) to the end of the pilot study (March 2006). The TEQ of dioxins and furans detected in monitoring well MW-7 increased slightly from March 2004 to March 2006. The TEQ of dioxins and furans detected in monitoring well MW-5 increased from March 2004 to March 2006, however, as discussed above, this well is located cross and upgradient of the former source area.

Overall, results indicate that dioxins and furans in groundwater are decreasing over time. Results of historic dioxin and furan sampling in groundwater are presented in Table 6.

Based on the natural attenuation parameters collected as part of the pilot study activities between 2004 and 2006, conditions in shallow groundwater beneath the site downgradient of the former source area appear to be strongly reducing, as indicated by:

- Low dissolved oxygen concentrations are present in shallow groundwater (concentrations of less than 1 mg/L), indicating that the groundwater beneath the site is an anaerobic environment.

- Oxidation/reduction potential ranges from 95 millivolts (mV) at downgradient well MW-21 to 293 mV at upgradient well MW-5, indicating that reducing conditions exist beneath the site.

- Dissolved concentrations of manganese and iron are higher in groundwater samples from downgradient wells compared to the upgradient well MW-5, suggesting that naturally-occurring iron- and manganese-containing minerals, which have a very low aqueous solubility, are being reduced (transformed) by microorganisms in soil and groundwater to soluble, reduced species (dissolved iron and manganese). These processes are called manganese and iron reduction, and generally occur where excess organic material or other source of electrons are present.

- Sulfate is depleted in downgradient wells as compared to concentrations in upgradient well MW-5, indicating that subsurface conditions downgradient of the source are reducing.

- Methane concentrations as high as 10.6 mg/L indicate methanogenic conditions prevail in the vicinity of well MW-7. Methane is produced by microbes under strongly reducing conditions.

- Alkalinity and carbon dioxide concentrations were higher in samples from downgradient wells compared to upgradient well MW-5, indicating the mineralization of organic carbon to inorganic carbon by naturally occurring microbes may be occurring.

- Total organic carbon concentrations are high in shallow groundwater beneath the site, indicating that reducing conditions can be sustained by the excess of organic carbon in the shallow groundwater system.

- Chloride concentrations are elevated in samples from monitoring wells MW-1, MW-2, MW-14, and MW-21 relative to background concentrations (MW-5). This increase in chloride concentrations may be related to degradation of PCP, but could also be related to infiltration of more saline water from the slough, or higher chloride content of pore-water due to the filling history of this part of the site.

3.2.2 Groundwater Flow Velocity

On August 19, 2004, tracer dilution testing was performed at three wells (MW-2, MW-7, and MW-8) to assess groundwater flow velocity in the former green chain area and downgradient of the former green chain area. The estimated rates of groundwater flow velocity on August 19, 2004 are 0.4 to 0.7 feet/day (ft/d; MW-2), 0.1 to 0.2 ft/d (MW-7), and 2 to 3 ft/d (MW-8). The approach, data collection, and evaluation for the tracer dilution testing were presented in *Groundwater*

Monitoring and Progress Report, Third Quarter 2004 (Geomatrix, 2004d) and are included in Appendix C of this report.

3.2.3 Indirect and Direct Evidence for Biodegradation

The following observations are interpreted as indirect evidence for biodegradation of PCP:

1. Assuming the source area was in place for approximately 45 years, and using a groundwater velocity of 0.2 feet per day, the expected distance for groundwater to travel over this timeframe is approximately 640 feet. Since the maximum reported extent of the plume appears to be 210 feet, significant natural attenuation appears to have limited migration, and biodegradation could be an important component of the overall attenuation process.

2. Geochemical conditions appear to be methanogenic, based on the natural attenuation parameters analyzed in groundwater samples, and PCP has been shown to degrade to phenol and chloride under these conditions (Nicholson, et *al.*, 1992 and Genthner, et *al.* 1988).

3. The increase in alkalinity and carbon dioxide concentrations downgradient of the former source area indicate an active microbial community and the utilization of organic carbon, including potentially PCP and its breakdown products (i.e. phenol).

The following observations are interpreted as direct evidence for biodegradation of PCP:

1. The detection of chlorophenol, a PCP breakdown product, but absence of polychlorinated phenols in the sample collected from boring B-67 suggests that PCP is degrading by reductive dechlorination. Phenol was also detected in this sample.

2. The elevated concentrations of chloride relative to background in samples from monitoring wells downgradient of the former source area could be related to the biodegradation of PCP, assuming that no other sources for chloride exist near the source area. However, the influence of mixing with water from the slough and/or the filling of the former shoreline may also contribute to the elevated chloride.

3.2.4 Assessment of Apparent Rates of Biodegradation

The U.S. EPA screening model, BIOCHLOR (Aziz et *al.*, 2000), was used to estimate a range of site-specific biodegradation rates (half lives) for PCP in groundwater. Site specific data, including recent analytical results for PCP in groundwater at well MW-2 and boring B-64, were used in the BIOCHLOR model. The results indicate a range of estimated half lives of 0.03 to 0.12 years. At these degradation rates, the plume has reached a steady condition. The lateral extent of PCP affected groundwater will not extend beyond approximately 200 to 250 feet from the source area (the eastern edge of the former dip tank area excavation).

The estimated range of half lives was used to assess the future reduction of PCP concentrations in groundwater over time. Based on the BIOCHLOR results for the less conservative scenario, 6 years after source removal the concentration of PCP in groundwater along the entire centerline of the plume will have attenuated to less than 1 μg/L. For the more conservative scenario, 20 years after source removal the concentration of PCP along the entire centerline of the plume will have attenuated to less than 1 μg/L. Detailed information regarding the BIOCHLOR simulations, including the assumptions used, is presented in Appendix D.

3.3 CONTROL OF DISCHARGES TO SURFACE WATER

Discharge of wood surface protection chemicals to surface water have been managed through the implementation of best management practices (BMPs), excavation of the chlorinated phenol source area, and storm water monitoring. This section summarizes the implemented actions.

3.3.1 Best Management Practices

Between 1983 and 1999, various BMPs were implemented to manage the quality of storm water at the site (MFG, 2003). These BMPs included removal of the dip tank from the former green chain area, clean out and concrete capping of the former green chain drip basin, and reducing materials to which chlorinated phenols tend to adsorb, such as woody debris and particulate matter, from storm water discharges. Measures to reduce woody debris and particulate matter in storm water included reducing woody debris across the site and periodic cleaning of exposed storm water drainage ditches.

Since 1999, additional BMPs have been implemented at the site to further reduce woody debris and particulate matter in storm water discharges, minimize commingling of groundwater and storm water, and improve the drainage system. Housekeeping practices have been improved so that woody debris is cleaned off the ground surface and removed from the entire mill site regularly, and screens, rock-filled bags, hay bales, and wattles have been placed at storm water inlets to intercept woody debris and particulate matter prior to discharge. Improvements to the drainage system included repair, lining, and replacement of degraded culverts, conversion of an open ditch to a culvert, and installation of settling basins to allow suspended sediments to settle out of the storm water prior to discharge. Leaks in water and condensate lines at the site also were repaired to reduce non-storm water inputs to the storm water drainage system. SPI continues to review its BMPs and monitoring results and make modifications as appropriate.

3.3.2 Source Area Removal

Source removal has been implemented as discussed in Section 2.2. Removal of impacted soil and woody material from the source area below the former dip tank at the former green chain is an effective control of discharges of chemicals of concern into surface water, as storm water exposure to soil with the highest concentrations of chemicals of concern is reduced significantly.

3.3.3 Storm Water Monitoring

Storm water monitoring is performed in accordance with the *Storm Water Pollution Prevention Plan* (Geomatrix, 2005a), and includes two sampling events per year. In addition, SPI has developed a protocol whereby if PCP is detected in a sampling event, the location will be resampled. If the new sample also indicates a detection of PCP, the potential source of the detection is identified, if possible. Appropriate actions are then taken to mitigate the potential source, such as ditch cleaning. Following completion of these actions, the surface water is resampled.

Historical storm water sampling results for chlorinated phenols are presented in Table 7. The following is a brief summary of the results for individual storm water monitoring points (Figure 2) sampled for chlorinated phenols:

<u>SL-1 (Ditch #1)</u>

PCP was detected at or above the laboratory detection limit in 12 out of 16 sample events from February 1997 through November 2000 (maximum concentration of 2.2 µg/L in November 1998 and February 1999). From February 2001 through November 2005, PCP was only detected in two samples (out of 13) collected at SL-1, both of which were collected in April of 2004. In response to the April 2004 detections, the drainage ditch inside the dry shed that discharges to Ditch #1 at SL-1 and Ditch #1 were cleaned out. No PCP was detected in the next three samples collected at SL-1. PCP was detected at a concentration of 1.6 µg/l in the most recent sample (May 2006). An additional sample will be collected at SL-1 near the beginning of the next storm water season to confirm the May 2006 result.

<u>SL-2 (Ditch #2)</u>

PCP was detected at or above the laboratory detection limit in nine out of ten samples (maximum concentration 13 µg/L in April 1998) from February 1997 through February 2004. PCP has not been detected at or above the laboratory detection limit in the six samples that have been collected from SL-2 since the last detection in February 2004.

SL-3 (Ditch #3)

PCP has not been detected at or above the laboratory detection limit in any of the ten samples collected from SL-3 since monitoring began in February 2001. Beginning in the 2005-2006 storm water monitoring season, chlorinated phenols were dropped from the list of storm water monitoring analytes at SL-3.

SL-4 (Ditch #4)

The first sample from SL-4 analyzed for chlorinated phenols (February 1997) resulted in a detection of PCP at a concentration of 1.2 µg/l. PCP was not detected at or above the laboratory detection limit in samples collected during the next eight sample events. Beginning in November 1998, PCP was detected in six consecutive events (maximum concentration of 9.2 µg/L) through November 1999. PCP has not been detected in 12 samples collected at SL-4 since November 2000. Beginning in the 2005-2006 storm water monitoring season, chlorinated phenols were dropped from the list of storm water monitoring analytes at SL-4.

SL-5

PCP was not detected at or above the laboratory detection limit in the four samples collected at SL-5 between November 2001 and March 2003. SL-5 has not discharged since March 2003. Beginning in the 2004-2005 storm water monitoring season, chlorinated phenols were dropped from the list of storm water monitoring analytes at SL-5.

SL-6 (Ditch #6)

PCP was not been detected at or above the laboratory detection limit in the six samples collected at SL-6 between February 2001 and December 2003. Beginning in the 2004-2005 storm water monitoring season, chlorinated phenols were dropped from the list of storm water monitoring analytes at SL-6.

With the exception of very low concentrations of PCP detected at SL-1 in April 2004 and May 2006, no chlorinated phenols have been detected in storm water samples since source removal activities were completed in November 2003. Based on these results, the proposed final remedy has been effective at controlling the discharge of wood surface protection chemicals to surface water.

3.4 DEVELOPMENT OF RISK MANAGEMENT MEASURES

Risk management measures were developed for site activities at the former green chain area and are being implemented in accordance with the *Site Management Plan* (Geomatrix, 2005b). The *Site Management Plan* presents the measures to be taken to minimize risks associated with residual chemicals of concern in site media and to control activities that could interfere with the effectiveness of the remedy or increase the extent of chemicals of concern at the site. The *Site Management Plan* documents existing environmental conditions, evaluates site data for potential health risk and threats to water quality, and provides guidance for risk management measures to be taken during subsurface maintenance or other activities during which exposure to chemicals could occur.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The results of the pilot study activities indicate:

- Chemicals of concern are naturally attenuating and are not migrating to the Mad River Slough and Humboldt Bay in groundwater;
- Storm water BMPs and source removal activities have essentially abated the discharge of wood surface protection chemicals to the Mad River Slough and Humboldt Bay; and
- The *Site Management Plan* has been implemented to mitigate the exposure of chemicals of concern to human receptors.

Based on the results of the pilot study, the implementation of the preferred remedy as proposed in the *Feasibility Study* (source removal, implementation of storm water BMPs, risk management measures, and monitored natural attenuation) is appropriate as the final remedy for the protection of human health and the environment at the site.

5.0 REFERENCES

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TABLES

TABLE 1

MONITORING WELL CONSTRUCTION DETAILS[1]

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Well No.	Date Installed	Total Boring Depth (ft bgs)	Total Well Depth (ft bgs)	Well Diameter (inches)	Latitude[2]	Longitude[2]	Ground Level Elevation[2] (ft msl)	Top of Casing Elevation[2] (ft msl)	Screened Interval (ft bgs)	Screen Slot Size (inches)	Filter Pack Interval (ft bgs)	Bentonite Seal Interval (ft bgs)	Surface Seal Interval[3] (ft bgs)
Shallow Wells													
MW-1	5-Mar-02	8	8	2	40.8661595	124.1521395	10.12	9.69	2.0 – 8.0	0.01	1.5 – 8.0	1.0 – 1.5	0 – 1.0
MW-2	5-Mar-02	9	8	2	40.8661024	124.1525276	10.41	9.61	2.0 – 8.0	0.01	1.5 – 9.0	1.0 – 1.5	0 – 1.0
MW-3	5-Mar-02	8.5	8	2	40.8662689	124.1530739	11.67	11.22	2.0 – 8.0	0.01	1.5 – 8.5	1.0 – 1.5	0 – 1.0
MW-4	5-Mar-02	8	8	2	40.8662303	124.1533599	11.17	10.74	2.0 – 8.0	0.01	1.5 – 8.0	1.0 – 1.5	0 – 1.0
MW-5	7-Mar-02	8	8	2	40.8660945	124.1536734	11.26	10.74	2.0 – 8.0	0.01	1.5 – 8.0	1.0 – 1.5	0 – 1.0
MW-6	7-Mar-02	8	8	2	40.8660710	124.1531061	10.13	9.83	2.0 – 8.0	0.01	1.5 – 8.0	1.0 – 1.5	0 – 1.0
MW-7	7-Mar-02	8	8	2	40.8659980	124.1531187	10.09	9.74	2.0 – 8.0	0.01	1.5 – 8.0	1.0 – 1.5	0 – 1.0
MW-8	8-Mar-02	8	8	2	40.8657492	124.1535343	10.55	10.33	2.0 – 8.0	0.01	1.5 – 8.0	1.0 – 1.5	0 – 1.0
MW-9	8-Mar-02	8	8	2	40.8657520	124.1532218	10.36	9.91	2.0 – 8.0	0.01	1.5 – 8.0	1.0 – 1.5	0 – 1.0
MW-10	11-Nov-02	9.5	8	2	40.8656910	124.1530670	10.08	9.85	2.0 – 8.0	0.01	1.5 – 9.5	1.0 – 1.5	0 – 1.0
MW-11	12-Nov-02	8.5	8	2	40.8655740	124.1533817	10.51	10.28	2.0 – 8.0	0.01	1.5 – 8.5	1.0 – 1.5	0 – 1.0
MW-12	12-Nov-02	9.5	8	2	40.8656625	124.1537231	11.01	10.76	2.0 – 8.0	0.01	1.5 – 9.5	1.0 – 1.5	0 – 1.0
MW-14	13-Nov-02	8	8	2	40.8657622	124.1523580	9.60	9.15	2.0 – 8.0	0.01	1.5 – 8.0	1.0 – 1.5	0 – 1.0
MW-17	14-Nov-02	9	8	2	40.8656690	124.1526420	9.46	9.16	2.0 – 8.0	0.01	1.5 – 9.0	1.0 – 1.5	0 – 1.0
MW-18	13-Nov-02	9.5	8	4	40.8657448	124.1531649	10.12	9.92	2.0 – 8.0	0.01	1.5 – 9.5	1.0 – 1.5	0 – 1.0
MW-20[4]	23-Jan-04	8	7	4	40.8658416	124.1532563	10.92	11.87	3.2 – 6.8	0.01	2.0 – 7.0	1.0 – 2.0	0 – 1.0
MW-21	12-Feb-04	8.3	8.3	0.75	40.8660161	124.1530089	10.11	12.89	2.1 – 8.1	0.01	1.5 – 8.3	1.0 – 1.5	0 – 1.0
MW-22	1-Aug-05	10	9.5	2	40.8631428	124.1555472	15.37	15.12	3.5 – 9.0	0.02	3.0 – 10	2.5 – 3.0	0 – 2.5
MW-23	1-Aug-05	10	9.5	2	40.8632724	124.1553765	15.34	15.11	2.5 – 9.0	0.02	2.0 – 10	1.5 – 2.0	0 – 1.5
P-24	1-Aug-05	10	9.5	2	40.8634773	124.1557306	15.56	15.33	3.5 – 9.0	0.02	3.0 – 10	2.5 – 3.0	0 – 2.5
P-25	1-Aug-05	10	9.5	2	40.8632884	124.1556166	16.04	15.75	3.5 – 9.0	0.02	3.0 – 10	2.5 – 3.0	0 – 2.5
Deep Wells													
MW-13D	12-Nov-02	21	20	2	40.8660809	124.1525231	10.26	9.96	15.0 – 20.0	0.01	13.5 – 21.0	12.0 – 13.5	0 – 12.0
MW-15D	13-Nov-02	21	20	2	40.8662658	124.1528255	11.59	11.19	15.0 – 20.0	0.01	14.0 – 21.0	12.0 – 14.0	0 – 12.0
MW-16D	14-Nov-02	21.5	20	2	40.8655571	124.1530363	10.13	9.83	15.0 – 20.0	0.01	14.0 – 21.5	12.0 – 14.0	0 – 12.0
MW-19D	14-Nov-02	21.5	20	2	40.8662419	124.1532744	11.21	11.06	15.0 – 20.0	0.01	14.0 – 21.0	12.0 – 14.0	0 – 12.0

Notes:

1. Construction details for wells MW-1 through MW-9 were obtained from Report on Recent Hydrogeologic Investigations at Sierra-Pacific Industries, Arcata Division Sawmill, dated April 19, 200 prepared by Environet Consulting. Construction details for wells MW-10 through MW-19D were obtained from Results of the Remedial Investigation for Sierra Pacific Industries – Arcata Divisio Sawmills, Arcata, California, dated January 30, 2003, prepared by EnviroNet Consulting. Construction details for wells MW-20 and MW-21 were obtained from the Monitoring Wells MW-20 and MW- Installation and Sampling Report dated April 7, 2004 prepared by Geomatrix, and details for wells and piezometers MW-22 through P-25 were obtained from the Truck Shop Area Monitoring Wells a Piezometers Installation and Sampling Report dated January 27, 2006 prepared by Geomatrix
2. Monitoring wells MW-1 through MW-21 were resurveyed by Omsberg and Company of Eureka, California on February 13, 2004, and monitoring wells and piezometers MW-22 through P-25 were surveye by Omsberg and Preston on August 11, 2005; latitude and longitude were surveyed relative to North American Datum (NAD) of 1983 and elevations were surveyed relative to North American Vertic Datum (NAVD) of 1988.
3. Surface seal interval consists of the concrete surface completion and a neat cement sanitary seal, if applicable
4. Well installed on a raised concrete pad of the former green chain. Depth measurements (ft bgs) are relative to the local ground surface of the concrete pad, which is approximately 1 foot abov the grade of the surrounding ground surface.

Abbreviations:

ft bgs = feet below ground surface
ft msl = feet mean sea level

TABLE 2

SUMMARY OF WATER QUALITY PARAMETERS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Well No.	Date Sampled	Field Measurements[1]				Laboratory Measurement[2]
		Temperature (ºC)	Specific Conductance (μmohs/cm)	pH (pH Units)	TDS (mg/L)	TDS (mg/L)
Shallow Wells						
MW-1	20-Mar-03	14	2,600	6.5	--	--
	22-May-03	14	2,700	6.7	--	1,400
	27-Aug-03	18	2,500	6.7	1,800	1,400
	04-Nov-03	17	2,400	6.6	1,800	1,300
	17-May-04	15	2,600	6.3	1,900	1,400
	15-Dec-04	15	3,800	6.6	2,500	--
	11-Mar-05	14	2,100	6.5	1,400	--
	07-Sep-05	18	2,400	6.5	1,700	--
	23-Mar-06	13	2,700	6.5	1,700	--
MW-2	20-Mar-03	13	2,100	6.2	--	--
	22-May-03	14	1,700	6.4	1,100	860
	27-Aug-03	18	1,500	6.6	1,100	760
	03-Nov-03	16	1,590	6.3	1,100	760
	24-Mar-04	13	1,390	6.3	970	740
	17-May-04	15	1,400	6.2	980	730
	30-Aug-04	19	1,200	--[3]	850	680
	15-Dec-04	14	1,100	6.4	740	--
	11-Mar-05	13	1,200	6.2	790	--
	07-Sep-05	18	1,300	6.4	900	--
	23-Mar-06	13	1,300	6.4	860	--
MW-3	20-Mar-03	13	1,100	6.4	--	--
	22-May-03	15	1,000	6.4	630	510
	27-Aug-03	20	1,000	6.5	720	470
	03-Nov-03	16	980	6.6	--	410
	17-May-04	16	1,100	6.2	750	510
	15-Dec-04	13	700	6.4	460	--
	10-Mar-05	13	600	6.4	390	--
	07-Sep-05	19	810	6.4	810	--
	23-Mar-06	12	540	6.7	350	--
MW-4	20-Mar-03	14	830	6.5	--	--
	22-May-03	16	730	6.4	440	420
	27-Aug-03	21	730	6.5	500	340
	03-Nov-03	18	760	6.6	520	310
	17-May-04	18	880	6.2	590	360
	15-Dec-04	14	640	6.4	410	--

TABLE 2

SUMMARY OF WATER QUALITY PARAMETERS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

		Field Measurements[1]				Laboratory Measurement[2]
Well No.	**Date Sampled**	**Temperature (ºC)**	**Specific Conductance (µmohs/cm)**	**pH (pH Units)**	**TDS (mg/L)**	**TDS (mg/L)**
MW-5	20-Mar-03	14	670	6.6	--	--
	22-May-03	14	690	6.6	410	360
	27-Aug-03	18	670	6.7	450	360
	03-Nov-03	17	660	6.6	450	380
	17-May-04	15	660	6.3	440	360
	15-Dec-04	15	470	6.4	310	--
	10-Mar-05	14	570	6.3	390	--
	07-Sep-05	18	660	6.5	450	--
	24-Mar-06	11	190	6.6	130	--
MW-6	20-Mar-03	11	950	6.6	--	--
	22-May-03	14	1,000	6.3	620	430
	27-Aug-03	17	890	6.4	620	410
	04-Nov-03	13	920	6.6	630	430
	24-Mar-04	11	920	6.5	640	410
	17-May-04	14	930	6.3	640	420
	30-Aug-04	17	880	--[3]	610	430
	15-Dec-04	11	700	6.4	460	--
	11-Mar-05	11	900	6.7	620	--
	07-Sep-05	16	900	6.4	610	--
	22-Mar-06	9	990	6.6	650	--
MW-7	20-Mar-03	11	910	6.6	--	--
	22-May-03	11	960	6.5	--	460
	27-Aug-03	14	840	6.6	580	400
	03-Nov-03	12	870	6.6	600	460
	24-Mar-04	11	960	6.4	--	440
	18-May-04	12	730	6.6	490	370
	30-Aug-04	14	840	--[3]	580	410
	15-Dec-04	11	700	6.4	460	--
	09-Mar-05	11	850	6.3	580	--
	07-Sep-05	13	920	6.4	630	--
	24-Mar-06	10	120	6.7	85	--
MW-8	18-Mar-03	14	730	6.4	--	--
	21-May-03	16	740	6.3	460	390
	27-Aug-03	21	730	6.2	500	370
	04-Nov-03	17	740	6.4	510	380
	24-Mar-04	14	780	6.2	530	400
	17-May-04	18	800	6.1	530	390
	30-Aug-04	21	760	--[3]	520	390
	14-Dec-04	14	650	6.3	420	--
	11-Mar-05	13	800	6.5	550	--
	07-Sep-05	20	810	6.4	540	--
	22-Mar-06	12	860	6.5	560	--

TABLE 2

SUMMARY OF WATER QUALITY PARAMETERS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Well No.	Date Sampled	Field Measurements[1]				Laboratory Measurement[2]
		Temperature (ºC)	Specific Conductance (µmohs/cm)	pH (pH Units)	TDS (mg/L)	TDS (mg/L)
MW-9	18-Mar-03	14	820	6.4	--	--
	23-May-03	16	870	6.6	550	400
	27-Aug-03	20	830	6.2	570	350
	04-Nov-03	17	820	6.6	560	350
	24-Mar-04	14	880	6.4	600	380
	17-May-04	16	930	6.1	620	380
	30-Aug-04	20	860	--[3]	550	440
	14-Dec-04	13	800	6.4	520	--
	11-Mar-05	13	900	6.7	620	--
	07-Sep-05	19	920	6.4	620	--
	22-Mar-06	12	930	6.6	600	--
MW-10	18-Mar-03	14	920	6.4	--	--
	23-May-03	17	970	6.7	--	460
	27-Aug-03	22	860	6.3	600	400
	04-Nov-03	18	880	6.6	600	430
	17-May-04	19	920	6.2	610	420
	14-Dec-04	14	700	6.4	450	--
MW-11	20-Mar-03	14	870	6.4	--	--
	21-May-03	17	890	6.4	560	460
	27-Aug-03	23	870	6.2	600	440
	04-Nov-03	19	880	6.6	600	450
	17-May-04	18	880	6.2	590	430
	14-Dec-04	15	740	6.4	480	--
MW-12	18-Mar-03	15	830	6.3	--	--
	21-May-03	18	840	6.1	--	460
	27-Aug-03	23	870	6.2	600	480
	04-Nov-03	18	920	6.5	630	480
	17-May-04	20	900	6.0	600	490
	14-Dec-04	14	710	6.4	460	--
MW-14	20-Mar-03	14	3,200	6.7	--	--
	22-May-03	15	3,400	6.6	--	2,100
	27-Aug-03	20	3,600	6.6	2,300	1,900
	04-Nov-03	16	3,300	6.6	2,500	2,100
	17-May-04	17	2,800	6.4	2,000	1,800
	15-Dec-04	14	2,500	6.6	1,300	--
	09-Mar-05	13	2,400	6.6	1,600	--
	07-Sep-05	20	2,700	6.4	2,000	--
	23-Mar-06	13	2,900	6.7	1,900	--

TABLE 2

SUMMARY OF WATER QUALITY PARAMETERS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Well No.	Date Sampled	Field Measurements[1]				Laboratory Measurement[2]
		Temperature (°C)	Specific Conductance (µmohs/cm)	pH (pH Units)	TDS (mg/L)	TDS (mg/L)
MW-17	20-Mar-03	13	980	6.4	--	--
	22-May-03	15	1,000	6.5	--	450
	27-Aug-03	19	860	7.0	600	420
	04-Nov-03	15	920	6.6	640	450
	17-May-04	15	940	6.5	620	440
	14-Dec-04	12	830	6.4	540	--
MW-18	18-Mar-03	14	1,000	6.5	--	--
	23-May-03	17	980	6.6	610	640
	27-Aug-03	23	1,100	6.3	780	520
	04-Nov-03	17	1,100	6.6	760	490
	17-May-04	19	1,000	6.3	670	430
	14-Dec-04	13	860	6.5	560	--
MW-20	24-Mar-04	14	420	6.9	280	250
	18-May-04	18	470	6.7	310	280
	30-Aug-04	21	500	--[3]	330	300
	15-Dec-04	12	370	6.5	240	--
	09-Mar-05	13	320	6.6	220	--
	07-Sep-05	19	510	6.6	340	--
	24-Mar-06	11	310	6.8	200	--
MW-21	24-Mar-04	12	990	6.3	680	460
	18-May-04	14	1,000	6.3	660	420
	30-Aug-04	16	960	--[3]	660	450
	15-Dec-04	11	760	6.2	500	--
	10-Mar-05	11	930	6.3	640	--
	07-Sep-05	15	1,000	6.4	690	--
	24-Mar-06	10	1,000	6.6	670	--
MW-22	08-Sep-05	19	740	6.6	--	--
	23-Mar-06	14	720	6.0	--	--
MW-23	08-Sep-05	18	4,400	6.7	--	--
	23-Mar-06	14	4,100	6.6	--	--
P-24	08-Sep-05	21	1,500	6.2	--	--
P-25	08-Sep-05	18	410	6.1	--	--

TABLE 2

SUMMARY OF WATER QUALITY PARAMETERS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Well No.	Date Sampled	Field Measurements[1]				Laboratory Measurement[2]
		Temperature (ºC)	Specific Conductance (µmohs/cm)	pH (pH Units)	TDS (mg/L)	TDS (mg/L)
Deep Wells						
MW-13D	20-Mar-03	14	1,200	6.2	--	--
	22-May-03	14	1,100	6.2	--	--
	27-Aug-03	15	1,100	6.1	750	690
	04-Nov-03	15	1,000	6.1	--	580
	17-May-04	14	1,000	5.8	700	610
	15-Dec-04	14	620	6.1	400	--
	11-Mar-05	14	900	6.2	620	--
	22-Mar-06	14	1,200	6.2	770	--
MW-15D	20-Mar-03	13	1,300	6.8	--	--
	22-May-03	13	1,300	6.8	--	800
	27-Aug-03	14	1,300	6.3	900	810
	04-Nov-03	14	1,300	6.8	--	790
	17-May-04	13	1,400	6.3	930	800
	15-Dec-04	14	1,000	6.7	650	--
	11-Mar-05	13	1,300	6.8	880	--
	22-Mar-06	13	1,300	6.6	840	--
MW-16D	18-Mar-03	14	5,200	7.7	--	--
	23-May-03	14	5,200	7.6	--	3,200
	27-Aug-03	16	5,000	7.4	3,400	3,000
	04-Nov-03	16	4,800	7.6	3,700	2,800
	17-May-04	15	4,600	7.3	3,500	2,800
	14-Dec-04	16	3,700	7.7	2,400	--
	11-Mar-05	15	4,400	7.8	3,400	--
	22-Mar-06	14	4,400	7.7	2,900	--
MW-19D	20-Mar-03	16	810	6.7	--	--
	22-May-03	16	860	6.6	520	480
	27-Aug-03	17	810	6.5	560	410
	03-Nov-03	17	760	6.7	520	370
	17-May-04	16	840	6.5	560	430
	15-Dec-04	17	490	6.5	320	--

Notes:

1. Water quality parameters measured in the field using an Ultrameter instrument or a YSI Model 55 instrument; reported measurements recorded towards end of purge after parameters stabilize or from the last purge volume if a well was repeatedly purged dry.
2. Water quality parameter analyzed in the laboratory; EPA Method 160.1. Laboratory analysis of TD was discontinued during the fourth quarter 2004.
3. pH meter inoperable.

Abbreviations:
ºC = degrees Celsius
µmhos/cm = micromhos per centimeter at 25 ºC
mg/L = milligrams per liter
-- = not measured or sample not collected for analysis
TDS = total dissolved solids
EPA = U.S. Environmental Protection Agency

TABLE 3

LABORATORY ANALYTICAL RESULTS FOR CHLORINATED PHENOLS (CANADIAN PULP METHOD)

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations in micrograms per liter (µg/L)

Monitoring Well Number	Date Sampled [1]	Penta-chlorophenol	2,4,6-trichloro-phenol	2,3,5,6-tetrachloro-phenol	2,3,4,6-tetrachloro-phenol	2,3,4,5-tetrachloro-phenol	Comments
Shallow Wells							
MW-1	14-Mar-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	18-Jul-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	16-Sep-02	1.8	< 1.0	< 1.0	< 1.0	< 1.0	
	03-Oct-02 [2]	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	02-Dec-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	20-Mar-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	22-May-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	27-Aug-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	04-Nov-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	17-May-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	15-Dec-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	11-Mar-05	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	low flow sample
	23-Mar-06	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	low flow sample
MW-2	14-Mar-02	7.4	< 1.0	< 1.0	< 1.0	< 1.0	
	18-Jul-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	16-Sep-02	2.5	< 1.0	< 1.0	< 1.0	< 1.0	
	03-Dec-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	20-Mar-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	22-May-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	27-Aug-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	4-Nov-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	24-Mar-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	17-May-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	30-Aug-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	15-Dec-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	11-Mar-05	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	low flow sample
	07-Sep-05	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	low flow sample
	23-Mar-06	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	low flow sample
MW-3	14-Mar-02	1.2	< 1.0	< 1.0	< 1.0	< 1.0	
	18-Jul-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	16-Sep-02	5.0	< 1.0	< 1.0	< 1.0	< 1.0	
	03-Dec-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	20-Mar-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	22-May-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	27-Aug-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	4-Nov-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	17-May-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	15-Dec-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	

TABLE 3

LABORATORY ANALYTICAL RESULTS FOR CHLORINATED PHENOLS (CANADIAN PULP METHOD)

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations in micrograms per liter (µg/L)

Monitoring Well Number	Date Sampled [1]	Penta-chlorophenol	2,4,6-trichloro-phenol	2,3,5,6-tetrachloro-phenol	2,3,4,6-tetrachloro-phenol	2,3,4,5-tetrachloro-phenol	Comments
MW-4	14-Mar-02	8.6	< 1.0	< 1.0	< 1.0	< 1.0	
	18-Jul-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	16-Sep-02	5.7	< 1.0	< 1.0	< 1.0	< 1.0	
	03-Dec-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	20-Mar-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	22-May-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	27-Aug-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	4-Nov-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	17-May-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	15-Dec-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
MW-5	14-Mar-02	4.3	< 1.0	< 1.0	< 1.0	< 1.0	
	18-Jul-02	9.1	< 1.0	< 1.0	< 1.0	< 1.0	
	16-Sep-02	25	< 1.0	< 1.0	< 1.0	< 1.0	
	03-Dec-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	20-Mar-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	20-Mar-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	duplicate sample
	22-May-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	27-Aug-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	4-Nov-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	17-May-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	15-Dec-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
MW-6	14-Mar-02	4.5	< 1.0	< 1.0	< 1.0	< 1.0	
	18-Jul-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	16-Sep-02	6.3	< 1.0	< 1.0	< 1.0	< 1.0	
	03-Dec-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	20-Mar-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	22-May-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	27-Aug-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	24-Mar-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	17-May-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	30-Aug-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	15-Dec-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	11-Mar-05	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	07-Sep-05	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	22-Mar-06	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	

TABLE 3

LABORATORY ANALYTICAL RESULTS FOR CHLORINATED PHENOLS (CANADIAN PULP METHOD)

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations in micrograms per liter (µg/L)

Monitoring Well Number	Date Sampled [1]	Penta-chlorophenol	2,4,6-trichloro-phenol	2,3,5,6-tetrachloro-phenol	2,3,4,6-tetrachloro-phenol	2,3,4,5-tetrachloro-phenol	Comments
MW-7	14-Mar-02	31,000	< 1.0	41	650	24	
	18-Jul-02	33,000	< 1.0	< 1.0	990	56	
	16-Sep-02	44,000	< 1.0	< 1.0	920	64	
	03-Dec-02	46,000	< 1.3	76	1,300	52	
	14-Jan-03 [3]	51,000	2.4	< 1.0	970	52	
	20-Mar-03	19,000	< 1.0	36	460	22	
	22-May-03	19,000	< 1.0	< 1.0	470	< 100	
	22-May-03	16,000	< 1.0	< 1.0	400	< 100	duplicate sample
	22-May-03	14,000	< 1.0	< 1.0	400	< 100	filtered
	27-Aug-03	31,000	< 1.5	41	710	39	
	27-Aug-03	18,000	< 1.0	28	450	26	duplicate sample
	3-Nov-03	28,000	< 5.0	36	580	35	bailer sample / unfiltered
	3-Nov-03	31,000	< 5.0	47	740	43	bailer sample / filtered
	3-Nov-03	20,000	< 5.0	28	450	24	low flow sample / unfiltered
	3-Nov-03	14,000	< 5.0	19	300	17	low flow sample / filtered
	24-Mar-04	19,000	< 1.5	19	450	19	
	24-Mar-04	7,400	< 1.0	8.7	150	9.9	duplicate sample
	18-May-04	25,000	< 2.5	86	480	41	
	30-Aug-04	13,000	< 1.0	54	200	17	
	15-Dec-04	22,000	1.7	57	310	42	
	09-Mar-05	24,000	< 1.0	39	420	32	low flow sample
	07-Sep-05	16,000	< 1.0	19	280	16	
	07-Sep-05	13,000	< 1.0	17	230	14	duplicate sample
	24-Mar-06	1,900	< 1.0	8.7	41	3.7	
MW-8	14-Mar-02	22	< 1.0	< 1.0	< 1.0	< 1.0	
	18-Jul-02	31	< 1.0	< 1.0	< 1.0	< 1.0	
	16-Sep-02	4.8	< 1.0	< 1.0	< 1.0	< 1.0	
	03-Dec-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	18-Mar-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	21-May-03	1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	27-Aug-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	4-Nov-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	24-Mar-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	17-May-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	30-Aug-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	14-Dec-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	11-Mar-05	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	07-Sep-05	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	22-Mar-06	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	

TABLE 3

LABORATORY ANALYTICAL RESULTS FOR CHLORINATED PHENOLS (CANADIAN PULP METHOD)

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations in micrograms per liter (µg/L)

Monitoring Well Number	Date Sampled [1]	Penta-chlorophenol	2,4,6-trichloro-phenol	2,3,5,6-tetrachloro-phenol	2,3,4,6-tetrachloro-phenol	2,3,4,5-tetrachloro-phenol	Comments
MW-9	14-Mar-02	94	3.1	21	130	5.5	
	18-Jul-02	2.1	< 1.0	< 1.0	< 1.0	< 1.0	
	16-Sep-02	3.1	< 1.0	< 1.0	< 1.0	< 1.0	
	03-Dec-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	18-Mar-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	23-May-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	27-Aug-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	04-Nov-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	24-Mar-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	17-May-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	30-Aug-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	14-Dec-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	11-Mar-05	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	07-Sep-05	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	22-Mar-06	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
MW-10	03-Dec-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	18-Mar-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	23-May-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	27-Aug-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	4-Nov-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	17-May-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	14-Dec-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
MW-11	03-Dec-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	20-Mar-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	21-May-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	27-Aug-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	4-Nov-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	17-May-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	14-Dec-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
MW-12	03-Dec-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	18-Mar-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	21-May-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	27-Aug-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	4-Nov-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	17-May-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	14-Dec-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	

TABLE 3

LABORATORY ANALYTICAL RESULTS FOR CHLORINATED PHENOLS (CANADIAN PULP METHOD)

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations in micrograms per liter (µg/L)

Monitoring Well Number	Date Sampled [1]	Penta-chlorophenol	2,4,6-trichloro-phenol	2,3,5,6-tetrachloro-phenol	2,3,4,6-tetrachloro-phenol	2,3,4,5-tetrachloro-phenol	Comments
MW-14	03-Dec-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	20-Mar-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	22-May-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	27-Aug-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	4-Nov-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	17-May-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	15-Dec-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	09-Mar-05	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	low flow sample
	23-Mar-06	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	low flow sample
MW-17	03-Dec-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	20-Mar-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	22-May-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	27-Aug-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	4-Nov-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	17-May-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	14-Dec-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
MW-18	03-Dec-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	18-Mar-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	23-May-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	27-Aug-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	4-Nov-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	17-May-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	14-Dec-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
MW-20	24-Mar-04	35	< 1.0	< 1.0	5.1	3.8	
	18-May-04	3.6	< 1.0	< 1.0	1.1	< 1.0	
	30-Aug-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	15-Dec-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	09-Mar-05	71	3.4	27	< 1.0	4.6	low flow sample
	07-Sep-05	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	22-Mar-06	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	low flow sample
MW-21	24-Mar-04	800	< 1.0	6.3	17	12	
	18-May-04	1,900	< 1.0	11	36	11	
	18-May-04	670	< 1.0	3.5	16	4.4	duplicate sample
	30-Aug-04	2,700	< 1.0	6.4	66	5.4	
	30-Aug-04	2,800	< 1.0	6.9	68	5.5	duplicate sample
	15-Dec-04	3,200	< 1.0	34	50	5.5	
	15-Dec-04	8,100	2.1	64	120	8.3	duplicate sample
	10-Mar-05	4,700	< 1.0	8.1	31	< 1.5	low flow sample
	10-Mar-05	4,600	2.7	26	86	6.5	low flow sample / duplicate
	07-Sep-05	4,900	< 1.0	11	170	4.8	
	24-Mar-06	13,000	1.5	41	180	8.9	low flow sample
	24-Mar-06	14,000	1.4	41	190	8.8	low flow sample / duplicate

TABLE 3

LABORATORY ANALYTICAL RESULTS FOR CHLORINATED PHENOLS (CANADIAN PULP METHOD)

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations in micrograms per liter (µg/L)

Monitoring Well Number	Date Sampled [1]	Penta-chlorophenol	2,4,6-trichloro-phenol	2,3,5,6-tetrachloro-phenol	2,3,4,6-tetrachloro-phenol	2,3,4,5-tetrachloro-phenol	Comments
Deep Wells							
MW-13D	03-Dec-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	20-Mar-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	22-May-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	27-Aug-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	4-Nov-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	17-May-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	15-Dec-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	11-Mar-05	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	22-Mar-06	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
MW-15D	03-Dec-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	20-Mar-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	22-May-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	27-Aug-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	4-Nov-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	17-May-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	15-Dec-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	11-Mar-05	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	22-Mar-06	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
MW-16D	03-Dec-02	1.3	< 1.0	< 1.0	< 1.0	< 1.0	
	18-Mar-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	23-May-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	27-Aug-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	4-Nov-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	17-May-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	14-Dec-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	11-Mar-05	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	22-Mar-06	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
MW-19D	03-Dec-02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	20-Mar-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	22-May-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	27-Aug-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	4-Nov-03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	17-May-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
	15-Dec-04	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	

Notes:

1. Data prior to March 18, 2003 were obtained from Results of the Remedial Investigation for Sierra Pacific Industries, Arcata Division Sawmill, Arcata, California, dated January 30, 2003, prepared by EnviroNet Consulting.
2. Confirmation sample collected due to detection of pentachlorophenol on September 16, 2002.
3. Sample also contained 280 mg/L of 2,3,4-trichlorophenol and 190 mg/L of 2,4,5-trichlorophenol.

Abbreviation:

< = target analyte was not detected at or above the laboratory reporting limit shown.
-- = not measured or sample not collected for analysis.

TABLE 4

FIELD MEASUREMENTS AND LABORATORY ANALYTICAL RESULTS FOR NATURAL ATTENUATION PARAMETERS

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Sample Location	Sample Date	Field Measurements[1]					Laboratory Analysis[2]										
		Eh[3] (mV)	DO (mg/L)	Specific Conductance (µS/cm)	Temperature (°C)	pH (pH Units)	Nitrate (N) (mg/L)	Manganese (mg/L)	Iron (mg/L)	Sulfate (SO_4) (mg/L)	Carbon Dioxide (mg/L)	Methane (mg/L)	TOC (mg/L)	Chloride (mg/L)	Total Alkalinity as $CaCO_3$ (mg/L)	Calcium (mg/L)	Magnesium (mg/L)
Shallow Monitoring Wells																	
MW-1	11/04/03	222	0.2	2,400	17	6.4	--	--	--	--	--	--	--	--	--	--	--
	03/24/04	173	0.1	2,400	15	6.5	0.42	1.8	42	0.71	255	6.9	36.6	320	830	41	63
	03/11/05	138	0.1	2,100	14	6.5	<0.20	1.6	50	<0.50	258	8.0	14.1	260	860	36	57
	03/23/06	94	1.2	2,700	13	6.5	<0.20	4.3	61	0.99	260	2.4	38.0	330	830	40	64
MW-2	11/03/03	226	0.4	1,600	16	6.2	2.8	6	30	<0.50	314	3.8	33.9	240	520	66	40
	03/24/04	219	0.2	1,400	13	6.2	<0.20	4	61	<0.50	232	4.5	35.7	160	550	65	39
	03/11/05	182	0.1	1,200	13	6.2	<0.20	4.6	53	<0.50	289	5.3	15.8	100	520	62	37
	03/23/06	132	0.5	1,300	13	6.4	<0.20	5.2	58	<0.50	272	2.0	31.7	100	480	77	39
MW-3	11/03/03	201	0.3	920	17	6.3	4.6	3.9	9.1	<0.50	174	5.4	18	37	460	55	36
	03/24/04	183	0.1	1,000	13	6.4	<0.20	5.3	66	<0.50	179	9.1	36.3	35	450	62	46
	03/10/05	169	0.1	600	13	6.4	<0.20	2.5	33	<0.50	116	5.7	16.5	33	280	31	28
	03/23/06	103	0.4	540	12	6.7	<0.20	1.9	25	2.2	84.5	2.8	12.3	25	210	24	18
MW-4	11/03/03	207	0.1	670	18	6.3	--	--	--	--	--	--	--	--	--	--	--
MW-5	11/03/03	255	0.3	660	17	6.3	<1.0	0.42	0.97	<0.50	125	9.2	9.36	25	350	28	45
	03/24/04	293	0.2	650	14	6.3	<0.20	0.48	4	<0.50	122	6.3	11.4	21	310	29	50
	03/10/05	232	0.1	570	14	6.3	<0.20	0.67	4.7	<0.50	136	6.4	7.34	18	320	29	48
	03/24/06	136	1.1	190	11	6.6	<0.20	0.29	2.2	<0.50	24.9	0.93	5.54	8.6	71	9.3	14
MW-6	11/04/03	236	0.2	890	13	6.3	--	--	--	--	--	--	--	--	--	--	--
MW-7	11/03/03	197	0.1	860	13	6.4	<1.0	13	2.3	<0.50	152	8.8	28.1	45	420	26	42
	03/24/04	189	0.2	880	11	6.4	<0.20	3	55	<0.50	147	10.6	20.8	46	410	31	47
	03/09/05	130	0.1	850	11	6.3	<0.20	3.5	56	<0.50	157	10.5	18.2	60	400	35	52
	03/24/06	197	3.4	120	10	6.7	<0.20	0.23	0.91	4.0	15	1.4	43.7	21	15	4.3	2.2
MW-8	11/04/03	237	0.3	740	17	6.2	--	--	--	--	--	--	--	--	--	--	--
MW-9	11/04/03	211	0.2	810	17	6.4	--	--	--	--	--	--	--	--	--	--	--
MW-10	11/04/03	215	0.1	880	18	6.4	--	--	--	--	--	--	--	--	--	--	--
MW-11	11/04/03	196	0.2	870	19	6.4	--	--	--	--	--	--	--	--	--	--	--
MW-12	11/04/03	251	0.4	810	18	6.2	--	--	--	--	--	--	--	--	--	--	--
MW-14	11/04/03	234	0.2	2,700	16	6.3	--	--	--	--	--	--	--	--	--	--	--
	03/24/04	212	0.1	2,400	14	6.4	<0.20	1.5	41	<0.50	290	5.2	106	460	1,100	23	50
	03/09/05	109	0.1	2,400	13	6.6	<0.20	0.73	18	<0.50	270	0.16	60.9	390	1,100	25	55
	03/23/06	98	0.4	2,900	13	6.7	<0.20	0.98	38	<0.50	310	2.6	71.3	410	1,000	29	56
MW-17	11/04/03	240	0.2	970	15	6.4	--	--	--	--	--	--	--	--	--	--	--
MW-18	11/04/03	198	0.2	950	17	6.4	--	--	--	--	--	--	--	--	--	--	--
MW-20	03/24/04	252	0.1	440	13	6.8	<0.20	1	0.2	1.6	30.5	<0.00158	9.48	21	210	32	32
	03/09/05	182	0.2	320	13	6.6	<0.20	1.5	2.2	1.2	41.4	0.015	7.25	17	180	23	23
	03/24/06	164	0.6	310	11	6.8	<0.20	0.92	0.62	2.6	25.1	<0.00158	5.11	8.6	140	27	15
MW-21	03/24/04	162	0.3	990	11	6.4	<0.20	2.7	67	<0.50	135	0.0043	21.4	54	380	30	50
	03/10/05	146	0.1	930	11	6.3	<0.20	2.7	69	<0.50	179	7.4	18.6	62	430	29	50
	03/10/05[4]						<0.20	2.7	69	<0.50	165	7.8	16.4	62	420	29	49
	03/24/06	95	0.5	1,000	10	6.6	<0.20	2.7	70	<0.50	156	5.1	17.7	84	360	28	47
	03/24/06[4]						<0.20	2.7	70	<0.50	150	5.8	18.1	84	360	27	47
Deep Monitoring Wells																	
MW-13D	11/04/03	253	0.1	670	16	5.9	--	--	--	--	--	--	--	--	--	--	--
MW-15D	11/04/03	255	0.3	1,200	14	6.5	--	--	--	--	--	--	--	--	--	--	--
MW-16D	11/04/03	246	0.1	4,600	16	7.5	--	--	--	--	--	--	--	--	--	--	--
MW-19D	11/03/03	197	0.3	730	18	6.5	--	--	--	--	--	--	--	--	--	--	--
Borings																	
B-64	03/15/06	--	--	990	11	6.4[5]	--	--	--	--	--	--	20.9	--	--	--	--
B-65	03/15/06	--	--	430	12	6.6[5]	--	--	--	--	--	--	10.8	--	--	--	--
B-66	03/16/06	--	--	320	12	7.1[5]	--	--	--	--	--	--	8.30	--	--	--	--
B-67	03/15/06	--	--	660	12	6.6[5]	--	--	--	--	--	--	10.1	--	--	--	--
B-68	03/21/06	--	--	7,000	13	7.6[5]	--	--	--	--	--	--	322	--	--	--	--

Notes:

1. Water quality parameters measured in the field with a YSI model 556 in a flow-through cell, except for borings B-64 through B-68, which were measured with an Ultrameter 6P.
2. Samples collected by Geomatrix and analyzed by EPA Method 415.1 (total organic carbon), EPA Method 200.7 (calcium and magnesium), EPA Method 300 (chloride, nitrate and sulfate), EPA Method 6010B (Iron (II) and Manganese (II)), Standard Methods 2320B (total alkalinity), RSK 175 (carbon dioxide and methane).
3. Reduction-oxidation potential standardized to hydrogen electrode for silver/silver-chloride electrode (199 millivolts was added to the field measurement).
4. Duplicate sample.
5. pH meter not operating properly and subsequently replaced after sample event. Recorded value may be incorrect.

Abbreviations:

Eh = reduction-oxidation potential
DO = dissolved oxygen
TOC = total organic carbon
$CaCO_3$ = calcium carbonate
mV = millivolts
mg/L = milligrams per liter
µS/cm = microSiemens per centimeter
ºC = degrees Celsius
< = target analyte was not detected at or above the laboratory reporting limit shown.
-- = not measured or sample not collected for analysis.

TABLE 5
LABORATORY ANALYTICAL RESULTS FOR CHLORINATED PHENOLS AND PHENOL (8270 SIM METHOD)

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations in micrograms per liter (µg/L)

Monitoring Wells	Date Sampled	PCP	3,4,5-TCP	2,3,5,6-TeCP	2,3,4,5-TeCP	2,3,4,6-TeCP	3,4-DCP	2,3,6-TCP	3,5-DCP	2,3,4-TCP	2,4,5-TCP	2,4,6-TCP	2,3,5-TCP	2,5-DCP	3-CP + 4-CP[2]	2,6-DCP	2,3-DCP	2,4-DCP	2-CP	Phenol
MW-1	24-Mar-04	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	3	<1	<1	<1	<1	<1
	11-Mar-05	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1
	07-Sep-05 [3]	<1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	07-Sep-05 [3, 4]	<1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	23-Mar-06	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<2	<1
MW-2	24-Mar-04	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1
	11-Mar-05	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1
	07-Sep-05 [3]	<1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	23-Mar-06	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<2	<1
MW-3	24-Mar-04	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1
	10-Mar-05	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1
	07-Sep-05 [3]	<1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	23-Mar-06	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<2	<1
MW-5	24-Mar-04	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1
	10-Mar-05	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1
	07-Sep-05 [3]	<1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	24-Mar-06	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<2	<1
MW-7	24-Mar-04	15,000	92	320	17	23	390	<1	18	1	56	<1	2	<1	460	<1	<1	4	<1	2
	09-Mar-05	12,000	290	490	37	17	610	1	28	2	75	1	2	<1	890	<1	1	5	<1	3
	24-Mar-06	1,200	15	24	4 J	8.9	41	<1	1.2	<1	4.5	<1	<1	<1	37	<1	<1	<1	<2	<1
MW-14	24-Mar-04	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1
	09-Mar-05	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1
	07-Sep-05 [3]	<1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	23-Mar-06	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<2	<1
MW-20	24-Mar-04	9	2	2	2	<1	8	<1	<1	<1	1	<1	<1	<1	2	<1	<1	<1	<1	<1
	09-Mar-05	100	4	2	4	12	15	<1	9	<1	<1	4	5	<1	9	<1	<1	1	<1	<1
	23-Mar-06	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<2	<1
MW-21	24-Mar-04	520	52 ve	16	16	7	130	<1	9	<1	3	<1	<1	<1	200	<1	<1	<1	<1	<1
	24-Mar-04 [4]	570	50 ve	17	14	6	120	<1	9	<1	3	<1	<1	<1	200	<1	<1	<1	<1	<1
	10-Mar-05	5,500	250	109	4	27	310	<1	19	<1	5	<1	<1	<1	270	<1	<1	2	<1	<1
	10-Mar-05 [4]	5,500	250	110	4	27	310	<1	20	<1	5	<1	<1	<1	270	<1	<1	2	<1	<1
	24-Mar-06	7,700	260	170	17	39	420	<1	17	<1	9.3 ve	1.1	<1	<1	650	<1	2.1	<1	<2	1.8
	24-Mar-06 [4]	8,000	270	180	20	44	450	<1	19	<1	9.0 ve	1.2	<1	<1	700	<1	2.2	<1	<2	1.9
Borings																				
B-64	15-Mar-06	18,000	550	670	45	84	960	<10	25	<10	42	<10	<10	<10	1,300	<10	<10	<10	<20	22
B-65	15-Mar-06	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<2	<1
B-66	16-Mar-06	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<2	<1
B-67	15-Mar-06	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<2	<1
B-68	21-Mar-06	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	19	<1	<1	<1	<2	<1

Notes:

1. EPA Method 8270 SIM analysis of groundwater samples.
2. Results shown are for both 3-CP and 4-CP (the sum of) since these compounds could not be separated for individual analysis in the laboratory.
3. Confirmation sample collected due to detection of pentachlorophenol on March 10 or 11, 2005.
4. Duplicate sample.

Abbreviations:

PCP = pentachlorophenol
TeCP = tetrachlorophenol
TCP = trichlorophenol
DCP = dichlorophenol
CP = chlorophenol
EPA = U.S. Environmental Protection Agency
SIM = select ion monitoring
-- = not measured or sample not collected for analysis
< = target analyte was not detected at or above the laboratory reporting limit shown.
J = the result is below the reporting limit and represents an estimated value.
ve = value exceeded the calibration range established for the instrument and is therefore considered an estimate; result upon dilution and re-analysis was not detected at or above the laboratory reporting limit..

TABLE 6

LABORATORY ANALYTICAL RESULTS FOR DIOXINS AND FURANS[1]

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations in picograms per liter (pg/L)

Monitoring Well Number	Date Sampled	2, 3, 7, 8-TCDD	1, 2, 3, 7, 8-PeCDD	1, 2, 3, 4, 7, 8-HxCDD	1, 2, 3, 6, 7, 8-HxCDD	1, 2, 3, 7, 8, 9-HxCDD	1, 2, 3, 4, 6, 7, 8-HpCDD	OCDD	Total Dioxins	2, 3, 7, 8-TCDF	1, 2, 3, 7, 8-PeCDF	2, 3, 4, 7, 8-PeCDF	1, 2, 3, 4, 7, 8-HxCDF	1, 2, 3, 6, 7, 8-HxCDF	2, 3, 4, 6, 7, 8-HxCDF	1, 2, 3, 7, 8, 9-HxCDF	1, 2, 3, 4, 6, 7, 8-HpCDF	1, 2, 3, 4, 7, 8, 9-HpCDF	OCDF	Total Furans	Total Dioxins & Furans	TOTAL TEQ[2, 3]	Comments
Shallow Wells																							
MW-1	24-Mar-04	<1.69	<2.85	<5.19	<6.00	<5.29	<4.87	87.0	100.5	<1.10	<3.21	<2.84	<1.20	<1.61	<1.47	<1.91	<2.21	<2.57	<7.41	<16.20	100.5	0.00870	
	11-Mar-05	<1.77	<2.88	<3.27	<4.25	<3.70	6.39 J	136	157.3	<1.33	<3.57	<3.70	<1.42	<1.26	<1.13	<1.73	<1.74	<2.36	<4.44	<13.62	157.3	0.0775	
	23-Mar-06	<1.75	<1.66	<3.92	<4.06	<5.06	<3.64	11.7 J	11.7 J	<1.48	<2.48	<2.48	<1.15	<1.29	<1.35	<1.50	<1.28	<2.20	<5.58	<13.26	11.7 J	0.00117	
MW-2	24-Mar-04	<1.63	<2.60	<4.86	<5.67	<4.89	<7.48	61.1	61.1	<1.37	<3.65	<3.00	<1.30	<1.79	<1.73	<2.42	<3.01	<3.67	<7.05	9.62	70.72	0.00611	
	11-Mar-05	<1.61	<2.85	<2.75	<3.59	<3.03	<4.61	18.8 J	18.8 J	<1.39	<3.37	<3.02	<1.46	<1.30	<1.29	<1.88	<1.71	<2.32	<3.16	<12.12	18.8 J	0.00188	
	23-Mar-06	<0.891	<1.80	<3.57	<3.69	<4.70	<4.99	<7.44	<19.821	<1.52	<2.05	<2.05	<1.10	<1.17	<1.30	<1.38	<0.729	<1.21	<4.62	<10.80	<30.621	0	
MW-3	24-Mar-04	<1.90	<2.46	<4.74	<6.23	<4.81	74.6	976	1,195.14 J	<1.46	<3.76	<2.88	<1.15	<1.53	<1.44	<1.99	21.6 J	<2.22	33.9 J	142.93 J	1,338.07 J	1.06	
	10-Mar-05	<1.85	<4.50	<4.51	<5.56	<4.59	<5.31	31.6 J	31.6 J	<1.72	<2.91	<2.77	<1.65	<1.51	<1.52	<1.92	<1.88	<2.40	<6.19	<15.14	31.6 J	0.00316	
	23-Mar-06	<1.56	<2.23	<4.45	<4.39	<5.37	<3.77	23.5 J	23.5 J	<1.41	<1.99	<1.95	<1.08	<1.18	<1.28	<1.51	<2.14	<4.14	<8.13	<17.18	23.5 J	0.00235	
MW-5	24-Mar-04	<1.45	<2.24	<3.67	<4.31	<3.72	19.5 J	121	157.9	<1.29	<3.17	<2.80	<0.747	<1.02	<1.05	<1.38	7.60 J	<2.45	20.2 J	48.96 J	206.86 J	0.286	
	10-Mar-05	<1.65	<4.20	<3.50	<4.31	<3.47	<6.54	59.7	59.7	<1.48	<3.04	<3.01	<1.92	<1.80	<1.74	<2.36	<2.26	<2.60	<6.19	8.02 J	67.72 J	0.00597	
	24-Mar-06	<1.33	<2.64	<4.30	<4.52	<5.65	51.9	553	685.7 J	<1.69	<4.19	<4.01	<2.05	<2.19	<2.47	<3.01	36.3	<3.89	124	298.5	984.2 J	0.950	
MW-7	16-Sep-02	<3.12	<3.45	<5.82	<6.31	<5.32	32.4	144	194.0	<3.36	<4.21	<4.59	<2.38	<2.81	<2.86	<2.99	6.59	<6.67	22.2	103.63 J	297.63 J	0.407	
	22-May-03	<1.62	<4.05	22.6 J	<3.83	<3.10	30.2	449	550.5	<1.26	<2.04	<2.02	<1.02	<1.17	<1.19	<1.15	4.97 J	<0.807	20.7 J	69.14 J	619.64 J	2.66	
	22-May-03	<1.27	<2.00	7.89 J	<2.47	<1.97	16.3	231	281.0	<1.01	<1.66	<1.64	<1.09	<1.28	<1.4	<1.67	2.09 J	<1.19	7.05 J	39.68 J	320.68 J	0.997	filtered
	03-Nov-03	<2.22	<4.82	<9.48	<10.4	<9.25	<9.54	41.1 J	41.1 J	<2.29	<7.96	<5.93	<2.11	<2.51	<2.63	<3.12	<3.03	<4.42	<10.6	<33.64	41.1 J	0.00411	filtered
	24-Mar-04	<1.76	46.5	56.4	<5.29	<4.61	71.4	1,370	1,659.3 M	<1.41	<3.57	<2.67	<1.13	<1.57	<1.28	<1.95	8.00 J	<3.17	31.3 J	188.6 J	1,847.9 J,M	53.0	
	09-Mar-05	<3.21	<4.66	<11.7	<9.57	<7.78	42.4	1,600	1,688.6	<4.83	<4.92	<4.87	<5.41	<4.70	<5.00	<4.88	<5.91	<6.93	32.1 J	113.6 J	1,802.2 J	0.587	
	24-Mar-06	<1.32	<2.23	<3.69	<3.84	<4.70	35.9	347	447.2 J	<1.00	<1.87	<1.79	<1.57	<1.79	<1.94	<2.20	15.0 J	<2.41	47.3 J	142.96 J	590.16 J	0.548	
MW-14	24-Mar-04	<1.74	<3.36	<5.32	<5.84	<5.15	10.2 J	70.4	90.3 J	<1.31	<3.96	<3.01	<1.13	<1.64	<1.33	<1.97	<2.42	<2.97	<8.53	<18.74	90.3 J	0.109	
	09-Mar-05	<2.18	<4.31	<4.54	<5.51	<4.31	<7.26	46.2 J	46.2 J	<2.05	<2.89	<2.59	<2.29	<2.12	<2.09	<2.78	<2.57	<3.13	<8.18	<19.03	46.2 J	0.00462	
	23-Mar-06	<1.56	<2.04	<3.38	<3.43	<4.30	<2.98	<9.73	<20.61	<1.06	<1.72	<1.80	<0.841	<0.942	<1.00	<1.07	<1.38	<2.30	<5.03	<11.26	<31.87	0	
MW-20	24-Mar-04	4.05 J	22.7 J	60.2	2,060	466	93,600	1,240,000	1,450,367.2	6.50 F	19.5 J	15.3 J	52.6	226 D,M	57.6	11.4 J	3,220 D,M	251	13,600	39,840 D,M	1,490,207.2 D,M	1430	
	09-Mar-05	<2.05	<4.69	<8.75	111	17.8 J	3,850	50,500	59,727	<4.81	<7.00	<6.29	14.8 J	22.2 J	16.5 J	4.42	832	57.9	3,000	9,192 D,M	68,919 D,M	71.0	
	24-Mar-06	<1.47	4.83 J	<9.85	138	20.1 J	3,770	45,300	53,652.1	<1.33	<4.70	<4.57	20.4 J	<3.93	16.9 J	<4.95	1,090	105	4,910	11,782.5	65,434.6	79.0	
MW-21	24-Mar-04	<1.82	<2.92	8.76 J	56.1	9.46 J	1,050	12,800	15,342.8	<1.39	<7.15	<3.28	6.89 J	20.9 J	10.3 J	<2.55	605	32.6	1,960	5,407.1 D,M	20,749.9 D,M	29.6	
	10-Mar-05	<3.78	<14.7	64.6	<9.98	<9.90	79.4	223	497.5 M	<6.15 F	<6.27	<7.06	1,640	<9.63	<8.08	26.0 J	<8.57	177	<24.7	2,687.4	3,184.9 M	176	
	10-Mar-05	<1.19	<4.39	<4.13	<5.51	<4.29	20.4 J	522	560.0	<1.15	<2.10	<2.20	<1.40	<1.27	<1.25	<1.58	9.20 J	<1.72	23.4 J	58.41 J	618.41 J	0.351	duplicate
	24-Mar-06	<1.45	<3.70	<5.73	<5.40	<6.54	24.1 J	314	359.2	<1.35	<1.97	<2.05	<1.09	<1.11	<1.16	<1.27	7.84 J	<1.94	23.0 J	60.96 J	420.16 J	0.353	
	24-Mar-06	<1.68	<3.45	<6.38	<6.11	<7.43	16.8 J	326	353.9	<1.14	<4.02	<4.17	<1.57	<1.77	<1.87	<1.98	3.24 J	<2.27	15.7 J	42.9 J	396.8 J	0.235	duplicate
	TEF 4:	1	1	0.1	0.1	0.1	0.01	0.0001	--	0.1	0.05	0.5	0.1	0.1	0.1	0.1	0.01	0.01	0.0001	--		--	

Notes:

1. Groundwater samples analyzed by EPA Method 1613.
2. Calculated as the sum of congener concentrations after each has been multiplied by its TEF.
3. Concentrations not detected above the laboratory reporting limit were assigned a concentration of 0 pg/g to calculate TEQ.
4. Toxicity equivalency factor (unitless) from the World Health Organization, 1997 (WHO-97), adopted from F.X.R. van Leeuwen, 1997.

Abbreviations:

TCDD = tetrachlorodibenzo-p-dioxin
PeCDD = pentachlorodibenzo-p-dioxin
HxCDD = hexachlorodibenzo-p-dioxin
HpCDD = heptachlorodibenzo-p-dioxin
OCDD = octachlorodibenzo-p-dioxin
TCDF = tetrachlorodibenzofuran
PeCDF = pentachlorodibenzofuran
HxCDF = hexachlorodibenzofuran
HpCDF = heptachlorodibenzofuran

TEQ = toxicity equivalence
TEF = toxicity equivalency factor (unitless)
EPA = U.S. Environmental Protection Agency
-- = not measured or sample not collected for analysis.
< = target analyte was not detected at or above the laboratory reporting limit shown.
J = concentration detected was below the calibration range, as flagged by the laboratory.
M = maximum possible concentration, as flagged by the laboratory.
F = analyte confirmation on secondary column, as flagged by laboratory.
D = presence of diphenyl ethers detected, as flagged by laboratory.

TABLE 7

LABORATORY ANALYTICAL RESULTS FOR CHLORINATED PHENOLS IN STORM WATER

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

(results in micrograms per liter, µg/L)

Sample Location	Sample Date	Pentachloro phenol	Tetrachloro-phenol	2,3,4,6 - Tetrachloro-phenol	2,3,5,6- Tetrachloro-phenol	2,3,4,5- Tetrachloro-phenol	2,4,6- Trichloro-phenol
SL-1	27-Feb-97	1.5	<1.0	--	--	--	--
	16-Apr-97	0.99	<1.0	--	--	--	--
	23-May-97	0.43	<1.0	--	--	--	--
	17-Sep-97	1.3	<1.0	--	--	--	--
	9-Oct-97	0.41	<1.0	--	--	--	--
	5-Jan-98	<0.3	<1.0	--	--	--	--
	5-Feb-98	<0.3	<1.0	--	--	--	--
	10-Apr-98	1.7	<1.0	--	--	--	--
	13-Apr-98	<0.3	<1.0	--	--	--	--
	6-Nov-98	2.2	<1.0	--	--	--	--
	18-Jan-99	0.69	<1.0	--	--	--	--
	8-Feb-99	2.2	<1.0	--	--	--	--
	5-Apr-99	1.1	<1.0	--	--	--	--
	28-Oct-99	<0.3	<1.0	--	--	--	--
	19-Nov-99	2	<1.0	--	--	--	--
	13-Nov-00	0.99	<1.0	--	--	--	--
	9-Feb-01	<1.0	<1.0	--	--	--	--
	30-Oct-01	<1.0	<1.0	--	--	--	--
	31-Oct-01	<1.0	<1.0	--	--	--	--
	19-Feb-02	<1.0	<1.0	--	--	--	--
	7-Nov-02	<1.0	<1.0	--	--	--	--
	13-Mar-03	<1.0	<1.0	--	--	--	--
	8-Oct-03	<1.0	--	<1.0	<1.0	<1.0	<1.0
	6-Feb-04	<1.0	--	<1.0	<1.0	<1.0	<1.0
	6-Apr-04	0.42	<1.0	--	--	--	--
	14-Apr-04	0.7	--	<1.0	<1.0	<1.0	<1.0
	27-May-04	<1.0	--	<1.0	<1.0	<1.0	<1.0
	5-May-05	<1.0	--	<1.0	<1.0	<1.0	<1.0
	1-Nov-05	<1.0	--	<1.0	<1.0	<1.0	<1.0
	19-May-06	1.6	--	<1.0	<1.0	<1.0	<1.0
SL-2	23-May-97	10	<1.0	--	--	--	--
	10-Apr-98	13	2.5	--	--	--	--
	9-Feb-01	<1.0	<1.0	--	--	--	--
	30-Oct-01	1.2	1.2	--	--	--	--
	31-Oct-01	1.2	1.2	--	--	--	--
	19-Feb-02	2.2	<1.0	--	--	--	--
	7-Nov-02	2.4	<1.0	--	--	--	--

TABLE 7

LABORATORY ANALYTICAL RESULTS FOR CHLORINATED PHENOLS IN STORM WATER

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

(results in micrograms per liter, µg/L)

Sample Location	Sample Date	Pentachloro phenol	Tetrachloro-phenol	2,3,4,6 - Tetrachloro-phenol	2,3,5,6-Tetrachloro-phenol	2,3,4,5-Tetrachloro-phenol	2,4,6-Trichloro-phenol
SL-2	13-Mar-03	2.4	<1.0	--	--	--	--
	8-Oct-03	2.6	--	1.8	<1.0	<1.0	<1.0
	6-Feb-04	1.6	--	<1.0	<1.0	<1.0	<1.0
	6-Apr-04	<0.3	<1.0	--	--	--	--
	20-Apr-04	<1.0	--	<1.0	<1.0	<1.0	<1.0
	27-May-04	<1.0	--	<1.0	<1.0	<1.0	<1.0
	5-May-05	<1.0	--	<1.0	<1.0	<1.0	<1.0
	1-Nov-05	<1.0	--	<1.0	<1.0	<1.0	<1.0
	19-May-06	<1.0	--	<1.0	<1.0	<1.0	<1.0
SL-3	9-Feb-01	<1.0	<1.0	--	--	--	--
	30-Oct-01	<1.0	<1.0	--	--	--	--
	31-Oct-01	<1.0	<1.0	--	--	--	--
	19-Feb-02	<1.0	<1.0	--	--	--	--
	7-Nov-02	<1.0	<1.0	--	--	--	--
	13-Mar-03	<1.0	<1.0	--	--	--	--
	8-Oct-03	<1.0	--	<1.0	<1.0	<1.0	<1.0
	6-Feb-04	<1.0	--	<1.0	<1.0	<1.0	<1.0
	27-May-04	<1.0	--	<1.0	<1.0	<1.0	<1.0
	5-May-05	<1.0	--	<1.0	<1.0	<1.0	<1.0
SL-4	27-Feb-97	1.2	<1.0	--	--	--	--
	16-Apr-97	<0.3	<1.0	--	--	--	--
	23-May-97	<0.3	<1.0	--	--	--	--
	17-Sep-97	<0.3	<1.0	--	--	--	--
	9-Oct-97	<0.3	<1.0	--	--	--	--
	5-Jan-98	<0.3	<1.0	--	--	--	--
	5-Feb-98	<0.3	<1.0	--	--	--	--
	10-Apr-98	<0.3	<1.0	--	--	--	--
	13-Apr-98	<0.3	<1.0	--	--	--	--
	6-Nov-98	4.3	3.3	--	--	--	--
	18-Jan-99	2.0	<1.0	--	--	--	--
	8-Feb-99	9.2	3.3	--	--	--	--
	5-Apr-99	0.34	<1.0	--	--	--	--
	28-Oct-99	0.44	<1.0	--	--	--	--
	19-Nov-99	2.7	2.2	--	--	--	--
	13-Nov-00	<0.3	<1.0	--	--	--	--
	9-Feb-01	<1.0	<1.0	--	--	--	--
	30-Oct-01	<1.0	<1.0	--	--	--	--

TABLE 7

LABORATORY ANALYTICAL RESULTS FOR CHLORINATED PHENOLS IN STORM WATER

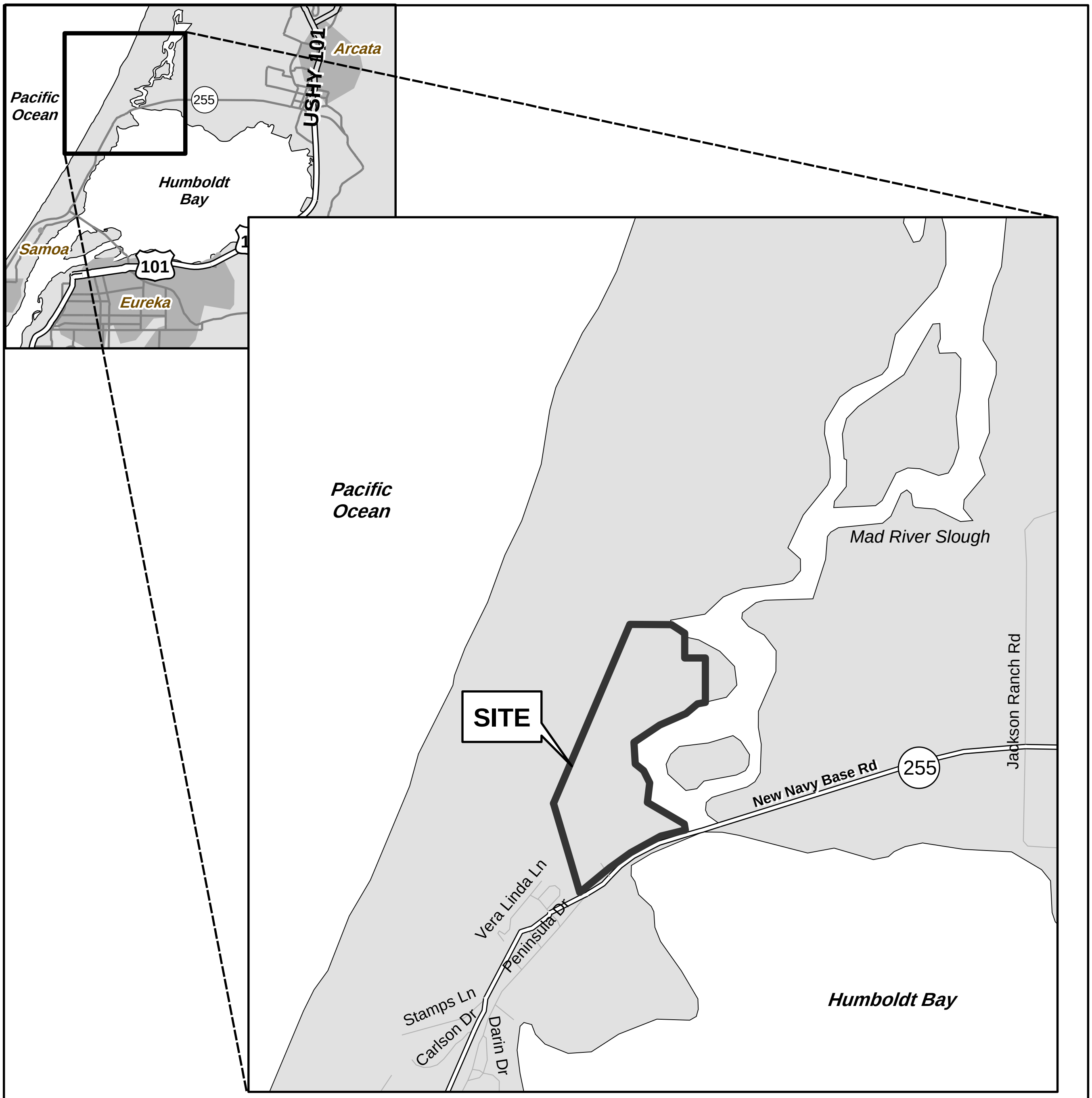
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

(results in micrograms per liter, µg/L)

Sample Location	Sample Date	Pentachloro phenol	Tetrachloro-phenol	2,3,4,6 - Tetrachloro-phenol	2,3,5,6-Tetrachloro-phenol	2,3,4,5-Tetrachloro-phenol	2,4,6-Trichloro-phenol
SL-4	31-Oct-01	<1.0	<1.0	--	--	--	--
	19-Feb-02	<1.0	<1.0	--	--	--	--
	7-Nov-02	<1.0	<1.0	--	--	--	--
	13-Mar-03	<1.0	<1.0	--	--	--	--
	8-Oct-03	<1.0	--	<1.0	<1.0	<1.0	<1.0
	6-Feb-04	<1.0	--	<1.0	<1.0	<1.0	<1.0
	6-Apr-04	<0.3	<1.0	--	--	--	--
	27-May-04	<1.0	--	<1.0	<1.0	<1.0	<1.0
	5-May-05	<1.0	--	<1.0	<1.0	<1.0	<1.0
SL-5	16-Nov-01	<1.0	<1.0	--	--	--	--
	19-Feb-02	<1.0	<1.0	--	--	--	--
	7-Nov-02	<1.0	<1.0	--	--	--	--
	13-Mar-03	<1.0	<1.0	--	--	--	--
SL-6	9-Feb-01	<1.0	<1.0	--	--	--	--
	30-Oct-01	<1.0	<1.0	--	--	--	--
	19-Feb-02	<1.0	<1.0	--	--	--	--
	7-Nov-02	<1.0	<1.0	--	--	--	--
	13-Mar-03	<1.0	<1.0	--	--	--	--
	1-Dec-03	<1.0	--	<1.0	<1.0	<1.0	<1.0

Abbreviations:
< = Not detected at or above the listed laboratory reporting limit
-- = Indicates data not collected

FIGURES



SITE LOCATION MAP
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

By: MAH	Date: 4/25/2006	Project No. 9329.000
Geomatrix		Figure 1

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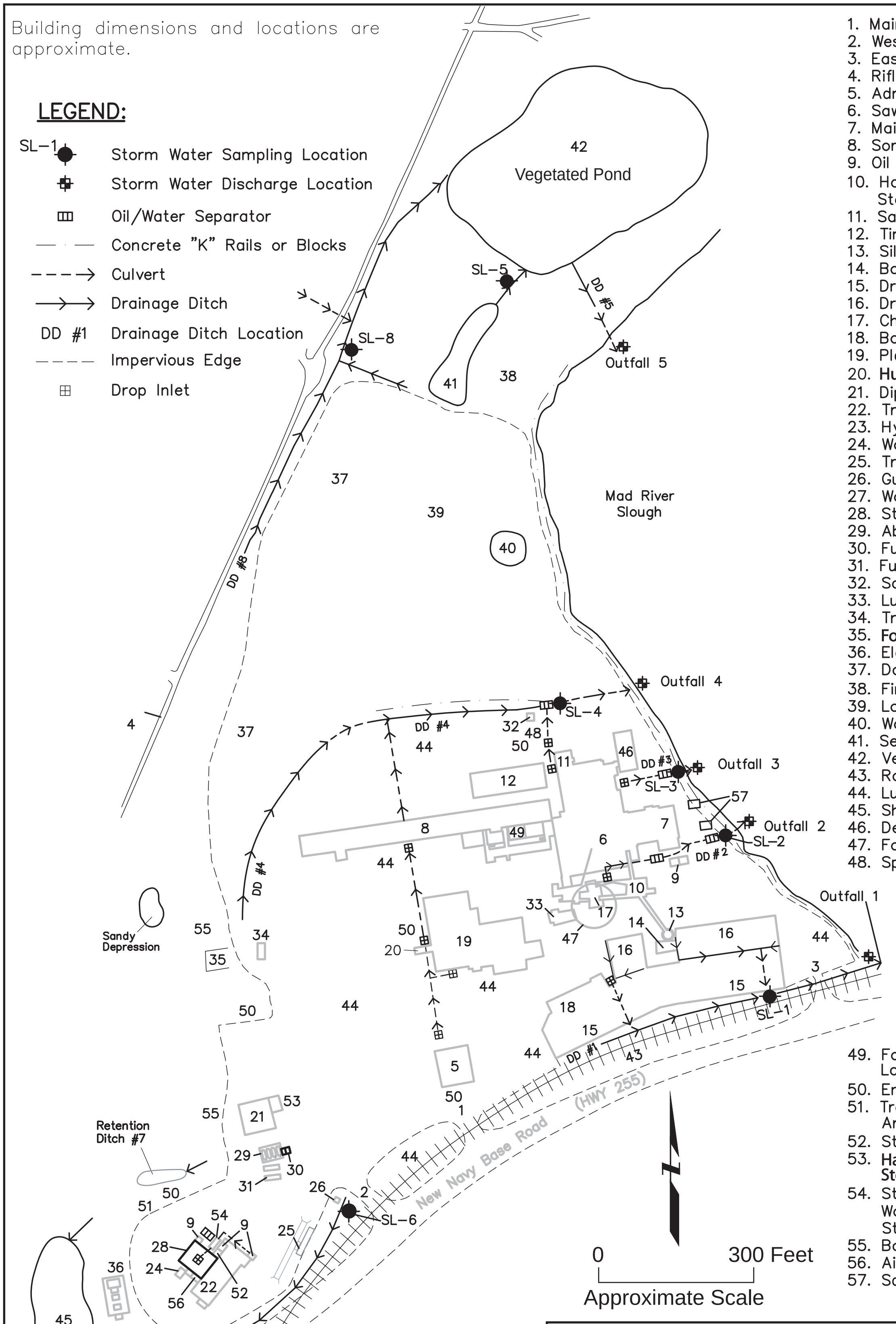


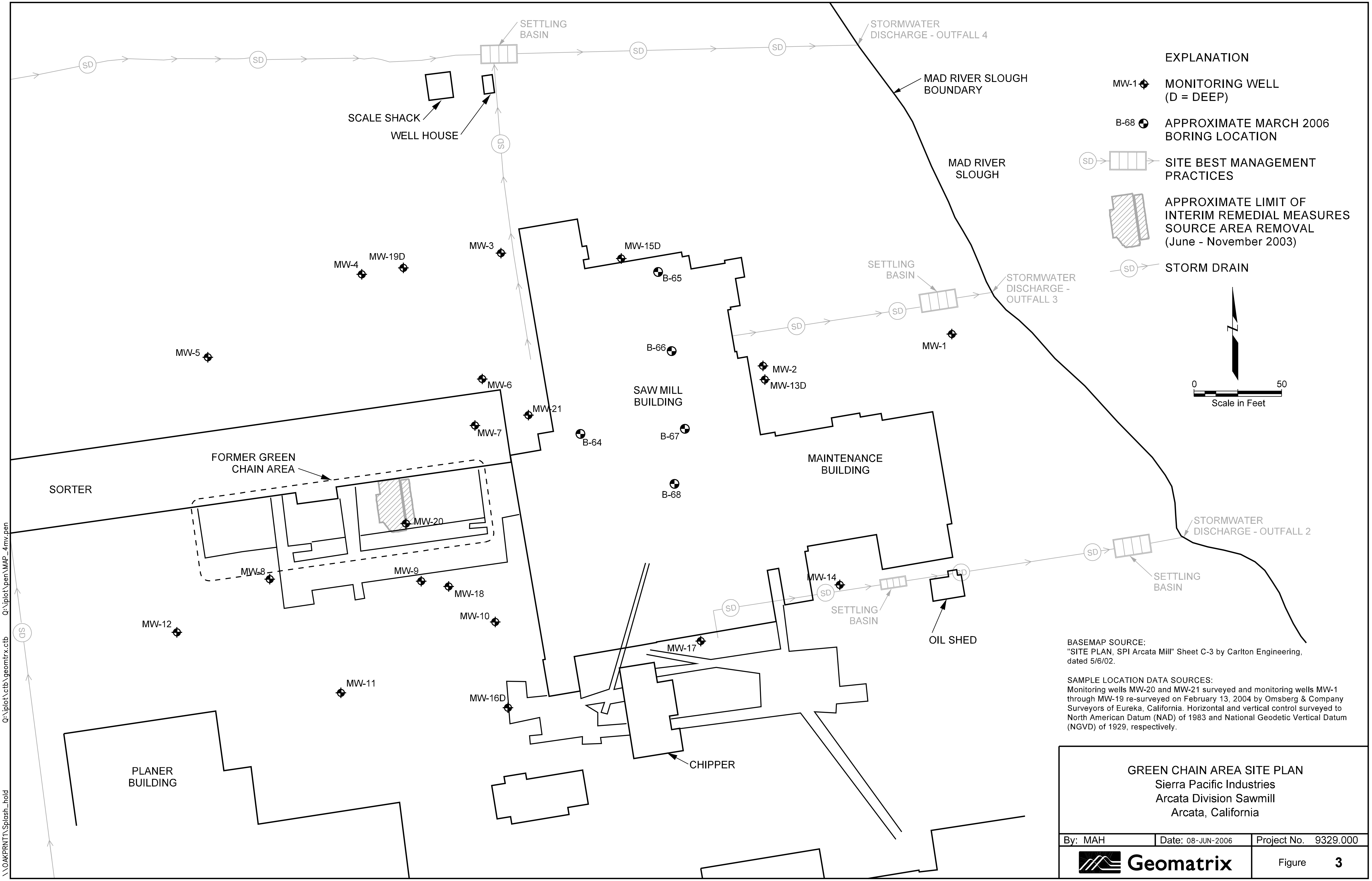
1. Main Entrance
2. West Entrance
3. East Entrance
4. Rifle Range Road
5. Administrative Office
6. Sawmill Building
7. Maintenance Building
8. Sorter Building
9. Oil Sheds
10. Hog Fuel/Wood Chip Storage Bins
11. Saw Shop
12. Timber Toter
13. Silo
14. Boilers
15. Dry Sheds
16. Dry Kiln
17. Chipper
18. Bander
19. Planer Building
20. **Hula Trim (removed)**
21. Dip Tank Building
22. Truck Shop
23. Hyster Shop
24. Waste Oil Shed
25. Truck Scale
26. Guard Shack
27. Wash Rack Area
28. Steam Cleaning Area
29. Aboveground Fuel Tanks
30. Fuel Shed
31. Fuel Dispenser Islands
32. Scale Shack
33. Lunchroom Building
34. Trailer Lift
35. **Former Ash Stockpile**
36. Electrical Substation
37. Douglas Fir Log Deck
38. Fir/Pine Log Deck
39. Log Unloading Area
40. Wood Waste Stockpile
41. Settling Basin
42. Vegetated Pond
43. Railroad Tracks
44. Lumber Storage Area
45. Shop Retention Pond
46. Debarker
47. Former Teepee Burner
48. Sprinkler Water Well
49. Former Dip Tank Location
50. Employee Parking Areas
51. Transport Truck Parking Area
52. Steam Cleaning Shed
53. **Hazardous Waste Removal Storage Shed**
54. Steam Cleaner Waste Water Underground Storage Tank
55. Bone Yard Area
56. Air Compressor Shed
57. Scrap Metal Bins

Site plan modified from Plate 2B in ***Results of the Remedial Investigation for Sierra Pacific Industries - Arcata Division Sawmills, Arcata, California,*** dated January 30, 2003, prepaerd by EnviroNet.

SITE PLAN
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

By: MAH	Date: 03-May-2006	Project No. 9329.000
Geomatrix		Figure 2

S:\9300\9329\task_32\06_0608_arc_fig_02.ai



BASEMAP SOURCE:
"SITE PLAN, SPI Arcata Mill" Sheet C-3 by Carlton Engineering, dated 5/6/02.

SAMPLE LOCATION DATA SOURCES:
Monitoring wells MW-20 and MW-21 surveyed and monitoring wells MW-1 through MW-19 re-surveyed on February 13, 2004 by Omsberg & Company Surveyors of Eureka, California. Horizontal and vertical control surveyed to North American Datum (NAD) of 1983 and National Geodetic Vertical Datum (NGVD) of 1929, respectively.

GREEN CHAIN AREA SITE PLAN
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

By: MAH	Date: 08-JUN-2006	Project No. 9329.000
Geomatrix		Figure 3

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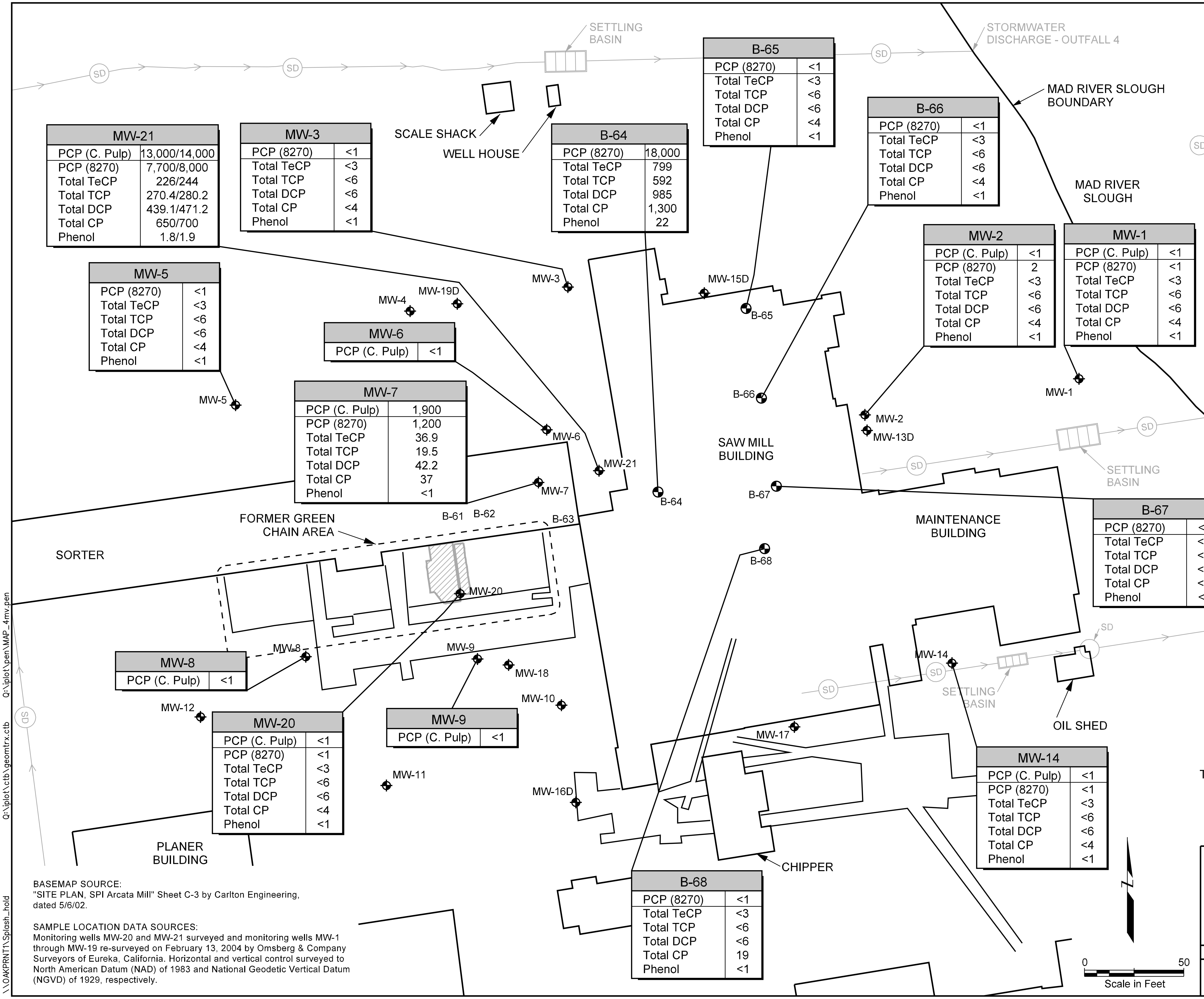

MW-21	
PCP (C. Pulp)	13,000/14,000
PCP (8270)	7,700/8,000
Total TeCP	226/244
Total TCP	270.4/280.2
Total DCP	439.1/471.2
Total CP	650/700
Phenol	1.8/1.9

MW-3	
PCP (8270)	<1
Total TeCP	<3
Total TCP	<6
Total DCP	<6
Total CP	<4
Phenol	<1

B-64	
PCP (8270)	18,000
Total TeCP	799
Total TCP	592
Total DCP	985
Total CP	1,300
Phenol	22

B-65	
PCP (8270)	<1
Total TeCP	<3
Total TCP	<6
Total DCP	<6
Total CP	<4
Phenol	<1

B-66	
PCP (8270)	<1
Total TeCP	<3
Total TCP	<6
Total DCP	<6
Total CP	<4
Phenol	<1

MW-5	
PCP (8270)	<1
Total TeCP	<3
Total TCP	<6
Total DCP	<6
Total CP	<4
Phenol	<1

MW-6	
PCP (C. Pulp)	<1

MW-2	
PCP (C. Pulp)	<1
PCP (8270)	2
Total TeCP	<3
Total TCP	<6
Total DCP	<6
Total CP	<4
Phenol	<1

MW-1	
PCP (C. Pulp)	<1
PCP (8270)	<1
Total TeCP	<3
Total TCP	<6
Total DCP	<6
Total CP	<4
Phenol	<1

MW-7	
PCP (C. Pulp)	1,900
PCP (8270)	1,200
Total TeCP	36.9
Total TCP	19.5
Total DCP	42.2
Total CP	37
Phenol	<1

B-67	
PCP (8270)	<1
Total TeCP	<3
Total TCP	<6
Total DCP	<6
Total CP	<4
Phenol	<1

MW-8	
PCP (C. Pulp)	<1

MW-20	
PCP (C. Pulp)	<1
PCP (8270)	<1
Total TeCP	<3
Total TCP	<6
Total DCP	<6
Total CP	<4
Phenol	<1

MW-9	
PCP (C. Pulp)	<1

MW-14	
PCP (C. Pulp)	<1
PCP (8270)	<1
Total TeCP	<3
Total TCP	<6
Total DCP	<6
Total CP	<4
Phenol	<1

B-68	
PCP (8270)	<1
Total TeCP	<3
Total TCP	<6
Total DCP	<6
Total CP	19
Phenol	<1

EXPLANATION

MW-1 ⊕ MONITORING WELL (D = DEEP)

SD SITE BEST MANAGEMENT PRACTICES

▨ APPROXIMATE LIMIT OF INTERIM REMEDIAL MEASURES SOURCE AREA REMOVAL (June - November 2003)

SD STORM DRAIN

CONCENTRATIONS IN MICROGRAMS PER LITER (µg/L), WITH "<" SYMBOL WERE NOT DETECTED ABOVE THE LABORATORY LIMIT SHOWN.

ABBREVIATIONS:
PCP = Pentachlorophenol
(8270) = analyzed by EPA method 8270 SIM
(C. Pulp) = analyzed by Canadian Pulp Method
TeCP = Tetrachlorophenol (total of detected TeCP congeners)
TCP = Trichlorophenol (total of detected TCP congeners)
DCP = Dichlorophenol (total of detected DCP congeners)
CP = Chlorophenol (total of detected CP congeners)
-- = Sample not collected for laboratory analysis

BASEMAP SOURCE:
"SITE PLAN, SPI Arcata Mill" Sheet C-3 by Carlton Engineering, dated 5/6/02.

SAMPLE LOCATION DATA SOURCES:
Monitoring wells MW-20 and MW-21 surveyed and monitoring wells MW-1 through MW-19 re-surveyed on February 13, 2004 by Omsberg & Company Surveyors of Eureka, California. Horizontal and vertical control surveyed to North American Datum (NAD) of 1983 and National Geodetic Vertical Datum (NGVD) of 1929, respectively.

PENTACHLOROPHENOL AND DEGRADATION
CONSTITUENTS IN SHALLOW GROUNDWATER
MARCH 2006
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

By: MAH	Date: 16-JUN-2006	Project No. 9329.000
Geomatrix		Figure 4

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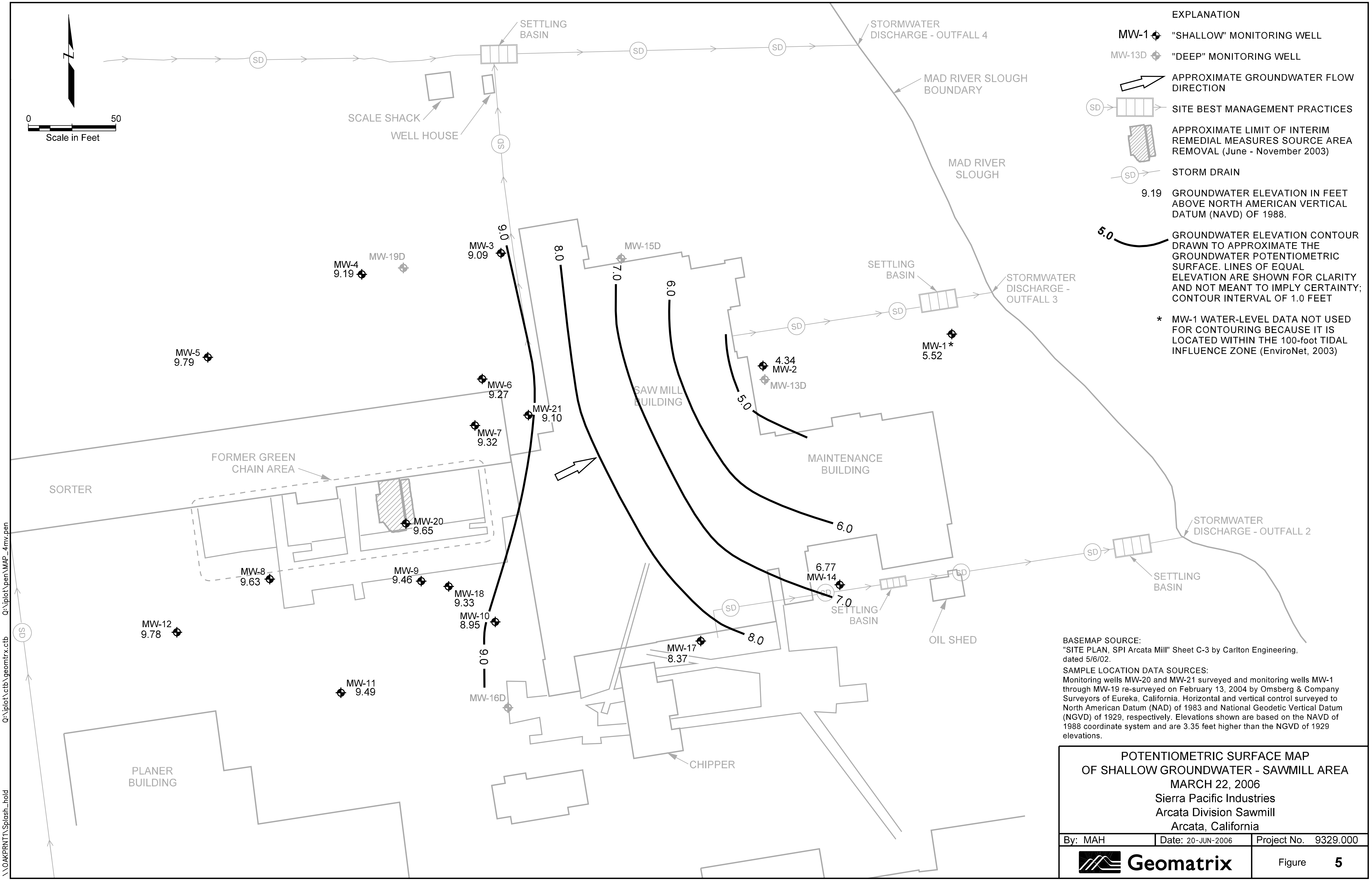

EXPLANATION

MW-1 ⊕	"SHALLOW" MONITORING WELL
MW-13D ⊕	"DEEP" MONITORING WELL
⇨	APPROXIMATE GROUNDWATER FLOW DIRECTION
SD ▭	SITE BEST MANAGEMENT PRACTICES
▨	APPROXIMATE LIMIT OF INTERIM REMEDIAL MEASURES SOURCE AREA REMOVAL (June - November 2003)
SD	STORM DRAIN
9.19	GROUNDWATER ELEVATION IN FEET ABOVE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.
5.0	GROUNDWATER ELEVATION CONTOUR DRAWN TO APPROXIMATE THE GROUNDWATER POTENTIOMETRIC SURFACE. LINES OF EQUAL ELEVATION ARE SHOWN FOR CLARITY AND NOT MEANT TO IMPLY CERTAINTY; CONTOUR INTERVAL OF 1.0 FEET
*	MW-1 WATER-LEVEL DATA NOT USED FOR CONTOURING BECAUSE IT IS LOCATED WITHIN THE 100-foot TIDAL INFLUENCE ZONE (EnviroNet, 2003)

BASEMAP SOURCE:
"SITE PLAN, SPI Arcata Mill" Sheet C-3 by Carlton Engineering, dated 5/6/02.

SAMPLE LOCATION DATA SOURCES:
Monitoring wells MW-20 and MW-21 surveyed and monitoring wells MW-1 through MW-19 re-surveyed on February 13, 2004 by Omsberg & Company Surveyors of Eureka, California. Horizontal and vertical control surveyed to North American Datum (NAD) of 1983 and National Geodetic Vertical Datum (NGVD) of 1929, respectively. Elevations shown are based on the NAVD of 1988 coordinate system and are 3.35 feet higher than the NGVD of 1929 elevations.

POTENTIOMETRIC SURFACE MAP
OF SHALLOW GROUNDWATER - SAWMILL AREA
MARCH 22, 2006
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

By: MAH | Date: 20-JUN-2006 | Project No. 9329.000

Geomatrix | Figure 5

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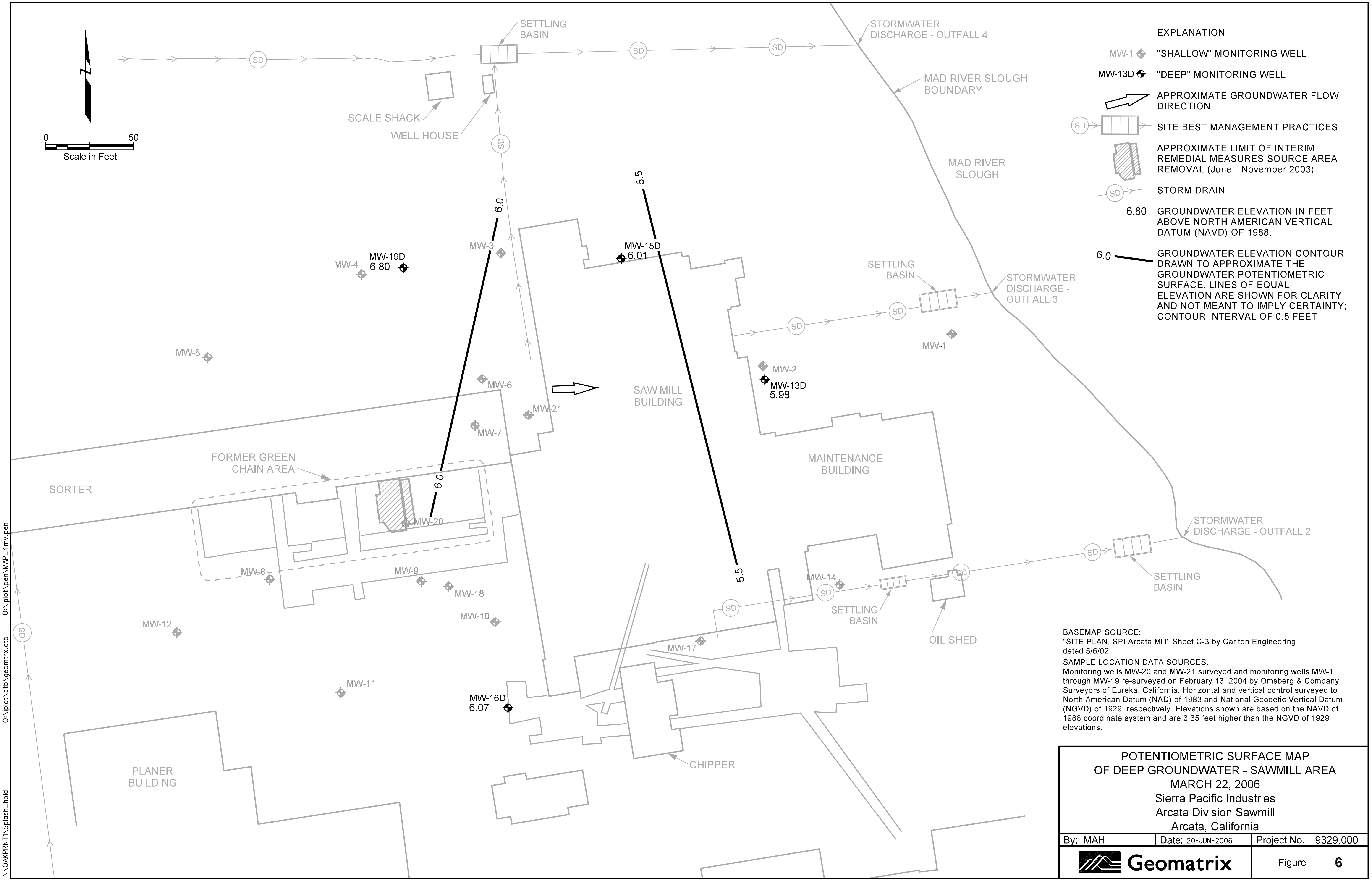

EXPLANATION

MW-1 ⊕	"SHALLOW" MONITORING WELL
MW-13D ⊕	"DEEP" MONITORING WELL
⇨	APPROXIMATE GROUNDWATER FLOW DIRECTION
SD	SITE BEST MANAGEMENT PRACTICES
▨	APPROXIMATE LIMIT OF INTERIM REMEDIAL MEASURES SOURCE AREA REMOVAL (June - November 2003)
SD	STORM DRAIN
6.80	GROUNDWATER ELEVATION IN FEET ABOVE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.
6.0	GROUNDWATER ELEVATION CONTOUR DRAWN TO APPROXIMATE THE GROUNDWATER POTENTIOMETRIC SURFACE. LINES OF EQUAL ELEVATION ARE SHOWN FOR CLARITY AND NOT MEANT TO IMPLY CERTAINTY; CONTOUR INTERVAL OF 0.5 FEET

BASEMAP SOURCE:
"SITE PLAN, SPI Arcata Mill" Sheet C-3 by Carlton Engineering, dated 5/6/02.

SAMPLE LOCATION DATA SOURCES:
Monitoring wells MW-20 and MW-21 surveyed and monitoring wells MW-1 through MW-19 re-surveyed on February 13, 2004 by Omsberg & Company Surveyors of Eureka, California. Horizontal and vertical control surveyed to North American Datum (NAD) of 1983 and National Geodetic Vertical Datum (NGVD) of 1929, respectively. Elevations shown are based on the NAVD of 1988 coordinate system and are 3.35 feet higher than the NGVD of 1929 elevations.

POTENTIOMETRIC SURFACE MAP
OF DEEP GROUNDWATER - SAWMILL AREA
MARCH 22, 2006
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

By: MAH | Date: 20-JUN-2006 | Project No. 9329.000

Geomatrix

Figure 6

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APPENDIX A

Laboratory Reports and Chain-of-Custody Records

Laboratory reports in order of appearance:

Alpha Analytical Work Order: A603562
Alpha Analytical Work Order: A603730
Friedman & Bruya Project: 603190
Friedman & Bruya Project: 603279

alpha
Alpha Analytical Laboratories Inc. 208 Mason Street, Ukiah, California 95482
e-mail: clientservices@alpha-labs.com • Phone: (707) 468-0401 • Fax: (707) 468-5267

27 March 2006

Geomatrix Consultants
Attn: Mike Keim
2101 Webster Street, 12th Floor
Oakland, CA 94612
RE: SPI - 9329 Task 23
Work Order: A603562

Enclosed are the results of analyses for samples received by the laboratory on 03/17/06 13:57. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Nena M. Burgess For Sheri L. Speaks
Project Manager

alpha
Alpha Analytical Laboratories Inc.
208 Mason Street, Ukiah, California 95482
e-mail: clientservices@alpha-labs.com • Phone: (707) 468-0401 • Fax: (707) 468-5267

CHEMICAL EXAMINATION REPORT

Geomatrix Consultants
2101 Webster Street, 12th Floor
Oakland, CA 94612
Attn: Mike Keim

Report Date: 03/27/06 11:00
Project No: 9329 Task 23
Project ID: SPI - 9329 Task 23

Order Number	Receipt Date/Time	Client Code	Client PO/Reference
A603562	03/17/2006 13:57	GEOMAT	

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
B-64	A603562-01	Water	03/15/06 11:45	03/17/06 13:57
B-65	A603562-02	Water	03/15/06 09:50	03/17/06 13:57
B-66	A603562-03	Water	03/16/06 10:00	03/17/06 13:57
B-67	A603562-04	Water	03/15/06 14:30	03/17/06 13:57

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Bruce Gove
Laboratory Director

3/27/2006

CHEMICAL EXAMINATION REPORT

Geomatrix Consultants
2101 Webster Street, 12th Floor
Oakland, CA 94612
Attn: Mike Keim

Report Date: 03/27/06 11:00
Project No: 9329 Task 23
Project ID: SPI - 9329 Task 23

Order Number	Receipt Date/Time	Client Code	Client PO/Reference
A603562	03/17/2006 13:57	GEOMAT	

Alpha Analytical Laboratories, Inc.

	METHOD	BATCH	PREPARED	ANALYZED	DILUTION	RESULT	PQL	NOTE
B-64 (A603562-01)			**Sample Type: Water**			**Sampled: 03/15/06 11:45**		
Conventional Chemistry Parameters by APHA/EPA Methods								
Total Organic Carbon	EPA 415.1	AC62212	03/22/06	03/23/06	1	**20.9 mg/l**	**1.00**	
B-65 (A603562-02)			**Sample Type: Water**			**Sampled: 03/15/06 09:50**		
Conventional Chemistry Parameters by APHA/EPA Methods								
Total Organic Carbon	EPA 415.1	AC62212	03/22/06	03/23/06	1	**10.8 mg/l**	**1.00**	
B-66 (A603562-03)			**Sample Type: Water**			**Sampled: 03/16/06 10:00**		
Conventional Chemistry Parameters by APHA/EPA Methods								
Total Organic Carbon	EPA 415.1	AC62212	03/22/06	03/23/06	1	**8.30 mg/l**	**1.00**	
B-67 (A603562-04)			**Sample Type: Water**			**Sampled: 03/15/06 14:30**		
Conventional Chemistry Parameters by APHA/EPA Methods								
Total Organic Carbon	EPA 415.1	AC62212	03/22/06	03/23/06	1	**10.1 mg/l**	**1.00**	

Bruce Gove
Laboratory Director

3/27/2006

CHEMICAL EXAMINATION REPORT

Geomatrix Consultants
2101 Webster Street, 12th Floor
Oakland, CA 94612
Attn: Mike Keim

Report Date: 03/27/06 11:00
Project No: 9329 Task 23
Project ID: SPI - 9329 Task 23

Order Number	Receipt Date/Time	Client Code	Client PO/Reference
A603562	03/17/2006 13:57	GEOMAT	

SourceResult

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

Analyte(s)	Result	PQL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AC62212 - General Prep										
Blank (AC62212-BLK1)				Prepared: 03/22/06 Analyzed: 03/23/06						
Total Organic Carbon	ND	1.00	mg/l							
LCS (AC62212-BS1)				Prepared: 03/22/06 Analyzed: 03/23/06						
Total Organic Carbon	10.0	1.00	mg/l	10.0		100	85-115			
LCS Dup (AC62212-BSD1)				Prepared: 03/22/06 Analyzed: 03/23/06						
Total Organic Carbon	10.0	1.00	mg/l	10.0		100	85-115	0.00	20	
Duplicate (AC62212-DUP1)	**Source: A603528-01**			Prepared: 03/22/06 Analyzed: 03/23/06						
Total Organic Carbon	0.510	1.00	mg/l		ND				20	
Matrix Spike (AC62212-MS1)	**Source: A603528-02**			Prepared: 03/22/06 Analyzed: 03/23/06						
Total Organic Carbon	22.1	2.00	mg/l	20.0	2.10	100	70-130			
Matrix Spike Dup (AC62212-MSD1)	**Source: A603528-02**			Prepared: 03/22/06 Analyzed: 03/23/06						
Total Organic Carbon	22.2	2.00	mg/l	20.0	2.10	100	70-130	0.451	20	

Bruce Gove
Laboratory Director

3/27/2006

CHEMICAL EXAMINATION REPORT

Geomatrix Consultants
2101 Webster Street, 12th Floor
Oakland, CA 94612
Attn: Mike Keim

Report Date: 03/27/06 11:00
Project No: 9329 Task 23
Project ID: SPI - 9329 Task 23

Order Number	Receipt Date/Time	Client Code	Client PO/Reference
A603562	03/17/2006 13:57	GEOMAT	

Notes and Definitions

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
PQL	Practical Quantitation Limit

CHAIN-OF-CUSTODY RECORD

EUR 10004

PROJECT NAME:

DATE: 3/16/06 PAGE 1 OF 1

PROJECT NUMBER: 9329 task 23

RESULTS TO: Mike Keim

TURNAROUND TIME: Std

SAMPLE SHIPMENT METHOD: Courier

LABORATORY NAME: Alpha

LABORATORY ADDRESS: 208 Mason St
Ukiah, CA 95482

LABORATORY CONTACT: Sheri Speaks

LABORATORY PHONE NUMBER: 707-468-0401

CLIENT INFORMATION:
Sierra Pacific Industries
Arcata Division

REPORTING REQUIREMENTS:

GEOTRACKER REQUIRED [✓ YES] NO

SITE SPECIFIC GLOBAL ID NO. T0602393344

SAMPLERS (SIGNATURE): Matt Hillyard

ANALYSES

DATE	TIME	SAMPLE NUMBER	TOC	PCP/TCP Canceled per [illegible]		CONTAINER TYPE AND SIZE	Soil (S), Water (W), Vapor (V), or Other (O)	Filtered	Preservative Type	Cooled	MS/MSD	No. of Containers	ADDITIONAL COMMENTS
3/15	1145	B-64	X		A603562-1	40 mL VOA	W		H3PO4	X		2	
3/15	950	B-65	X		2	↓	↓		↓	↓		2	
3/16	1000	B-66	X		3	↓	↓		↓	↓		2	
3/15	1430	B-67	X		4	↓	↓		↓	↓		2	
3/15	1600	B-68	X			↓	↓		↓	↓		2	Hold
3/15	1600	B-68		X		125 mL Amber	↓			↓		1	Hold

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME
SIGNATURE: Matt Hillyard PRINTED NAME: Matt Hillyard COMPANY: Geomatrix	3/17/06	827	SIGNATURE: Bruce Gore PRINTED NAME: Bruce Gore COMPANY: Alpha Labs	7/17/06	0827
SIGNATURE: PRINTED NAME: COMPANY:			SIGNATURE: PRINTED NAME: COMPANY:		
SIGNATURE: Bruce Gore PRINTED NAME: Bruce Gore COMPANY: Alpha	3/17/06	1357	SIGNATURE: Sheri Speaks PRINTED NAME: Sheri SPEAKS COMPANY: Alpha	3/17/06	1357

TOTAL NUMBER OF CONTAINERS: 11

SAMPLING COMMENTS:
Hold sample B-68 until further notice

2.0

525 Second Street, Suite 203
Eureka, California 95501-0488
Tel 707.444.7800 Fax 707.444.7848

Geomatrix

alpha
Alpha Analytical Laboratories Inc. 208 Mason Street, Ukiah, California 95482
e-mail: clientservices@alpha-labs.com • Phone: (707) 468-0401 • Fax: (707) 468-5267

30 March 2006

Geomatrix Consultants
Attn: Mike Keim
2101 Webster Street, 12th Floor
Oakland, CA 94612
RE: SPI - 9329 Task 23
Work Order: A603730

Enclosed are the results of analyses for samples received by the laboratory on 03/24/06 16:20. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Nena M. Burgess For Sheri L. Speaks
Project Manager

Alpha Analytical Laboratories Inc. 208 Mason Street, Ukiah, California 95482
e-mail: clientservices@alpha-labs.com • Phone: (707) 468-0401 • Fax: (707) 468-5267

CHEMICAL EXAMINATION REPORT

Geomatrix Consultants
2101 Webster Street, 12th Floor
Oakland, CA 94612
Attn: Mike Keim

Report Date: 03/30/06 11:01
Project No: 9329 Task 23
Project ID: SPI - 9329 Task 23

Order Number	Receipt Date/Time	Client Code	Client PO/Reference
A603730	03/24/2006 16:20	GEOMAT	

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
B-68	A603730-01	Water	03/21/06 13:50	03/24/06 16:20

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Bruce L. Gove

Bruce Gove
Laboratory Director

3/30/2006

CHEMICAL EXAMINATION REPORT

Geomatrix Consultants
2101 Webster Street, 12th Floor
Oakland, CA 94612
Attn: Mike Keim

Report Date: 03/30/06 11:01
Project No: 9329 Task 23
Project ID: SPI - 9329 Task 23

Order Number	Receipt Date/Time	Client Code	Client PO/Reference
A603730	03/24/2006 16:20	GEOMAT	

Alpha Analytical Laboratories, Inc.

	METHOD	BATCH	PREPARED	ANALYZED	DILUTION	RESULT	PQL	NOTE
B-68 (A603730-01)		**Sample Type: Water**			**Sampled: 03/21/06 13:50**			
Conventional Chemistry Parameters by APHA/EPA Methods								
Total Organic Carbon	EPA 415.1	AC62710	03/27/06	03/29/06	16	**322 mg/l**	**16.0**	

Bruce Gove
Laboratory Director

3/30/2006

CHEMICAL EXAMINATION REPORT

Geomatrix Consultants
2101 Webster Street, 12th Floor
Oakland, CA 94612
Attn: Mike Keim

Report Date: 03/30/06 11:01
Project No: 9329 Task 23
Project ID: SPI - 9329 Task 23

Order Number	Receipt Date/Time	Client Code	Client PO/Reference
A603730	03/24/2006 16:20	GEOMAT	

SourceResult

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

Analyte(s)	Result	PQL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AC62710 - General Prep										
Blank (AC62710-BLK1)				Prepared: 03/27/06 Analyzed: 03/28/06						
Total Organic Carbon	ND	1.00	mg/l							
LCS (AC62710-BS1)				Prepared: 03/27/06 Analyzed: 03/28/06						
Total Organic Carbon	9.98	1.00	mg/l	10.0		99.8	85-115			
LCS Dup (AC62710-BSD1)				Prepared: 03/27/06 Analyzed: 03/28/06						
Total Organic Carbon	9.95	1.00	mg/l	10.0		99.5	85-115	0.301	20	
Duplicate (AC62710-DUP1)	**Source: A603719-01**			Prepared: 03/27/06 Analyzed: 03/28/06						
Total Organic Carbon	1.09	1.00	mg/l		1.13			3.60	20	
Matrix Spike (AC62710-MS1)	**Source: A603719-02**			Prepared: 03/27/06 Analyzed: 03/28/06						
Total Organic Carbon	21.1	2.00	mg/l	20.0	ND	100	70-130			
Matrix Spike Dup (AC62710-MSD1)	**Source: A603719-02**			Prepared: 03/27/06 Analyzed: 03/28/06						
Total Organic Carbon	21.4	2.00	mg/l	20.0	ND	102	70-130	1.41	20	

Bruce Gove
Laboratory Director

3/30/2006

CHEMICAL EXAMINATION REPORT

Geomatrix Consultants
2101 Webster Street, 12th Floor
Oakland, CA 94612
Attn: Mike Keim

Report Date: 03/30/06 11:01
Project No: 9329 Task 23
Project ID: SPI - 9329 Task 23

Order Number	Receipt Date/Time	Client Code	Client PO/Reference
A603730	03/24/2006 16:20	GEOMAT	

Notes and Definitions

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
PQL	Practical Quantitation Limit

CHAIN-OF-CUSTODY RECORD

EUR 10009

PROJECT NAME: SPI Arcata		DATE: 3/24/06	PAGE 1 OF 1
PROJECT NUMBER: 9329 task 23	LABORATORY NAME: Alpha	CLIENT INFORMATION: SPI Arcata	REPORTING REQUIREMENTS:
RESULTS TO: Mike Kerin	LABORATORY ADDRESS: Ukiah		
TURNAROUND TIME: Std			
SAMPLE SHIPMENT METHOD: Courier	LABORATORY CONTACT: Sheri		GEOTRACKER REQUIRED [✓ YES] NO
	LABORATORY PHONE NUMBER: 707-468-0401		SITE SPECIFIC GLOBAL ID NO. T0602393344

SAMPLERS (SIGNATURE):

DATE	TIME	SAMPLE NUMBER	ANALYSES: TOC															CONTAINER TYPE AND SIZE	Soil (S), Water (W), Vapor (V), or Other (O)	Filtered	Preservative Type	Cooled	MS/MSD	No. of Containers	ADDITIONAL COMMENTS
3/21/06	1350	B-68	X				A603730-1											40mL VOA	W		H_2SO_4	X		2	

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME
SIGNATURE: Matt Hillyard PRINTED NAME: Matt Hillyard COMPANY: Geomatrix	3/24/06	1300	SIGNATURE: PRINTED NAME: COMPANY:	3/24/06	1310
SIGNATURE: D. Morton PRINTED NAME: COMPANY:	3/24/06	1620	SIGNATURE: Shen Speaks PRINTED NAME: Shen Speaks COMPANY: Alpha	1620	
SIGNATURE: PRINTED NAME: COMPANY:			SIGNATURE: PRINTED NAME: COMPANY:		

TOTAL NUMBER OF CONTAINERS: 2

SAMPLING COMMENTS:

525 Second Street, Suite 203
Eureka, California 95501-0488
Tel 707.444.7800 Fax 707.444.7848

Geomatrix

5.6

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Charlene Morrow, M.S.
Yelena Aravkina, M.S.
Bradley T. Benson, B.S.
Kurt Johnson, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
TEL: (206) 285-8282
FAX: (206) 283-5044
e-mail: fbi@isomedia.com

April 10, 2006

Mike Keim, Project Manager
Geomatrix Consultants, Inc.
2101 Webster Street, 12th Floor
Oakland, CA 94612

Dear Mr. Keim:

Included are the results from the testing of material submitted on March 17, 2006 from the 9329 task 23, F&BI 603190 project. There are 10 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
GMC0410R.DOC

CASE NARRATIVE

This case narrative encompasses samples received on March 17, 2006 by Friedman & Bruya, Inc. from the Geomatrix Consultants, Inc. 9329 task 23 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	Geomatrix Consultants, Inc.
603190-01	B-64
603190-02	B-65
603190-03	B-66
603190-04	B-67

The recovery of phenol was outside the default control limits for the laboratory control spikes. All other quality control requirements were acceptable.

Analysis For Semivolatile Compounds By EPA Method 8270C Sim

Client Sample ID:	B-64	Client:	Geomatrix Consultants, Inc.
Date Received:	03/17/06	Project:	9329 task 23, F&BI 603190
Date Extracted:	03/22/06	Lab ID:	603190-01 1/10
Date Analyzed:	03/28/06	Data File:	032818.D
Matrix:	Water	Instrument:	GCMS3
Units:	ug/L (ppb)	Operator:	YA

Surrogates:	% Recovery	Lower Limit	Upper Limit
2-Fluorophenol	62	16	92
Phenol-d6	42	10	91
2,4,6-Tribromophenol	105	50	150

Compounds:	Concentration ug/L (ppb)
Phenol	22
2-Chlorophenol	<20
2,4-Dichlorophenol	<10
2,3-Dichlorophenol	<10
2,6-Dichlorophenol	<10
3-Chlorophenol+4-Chlorophenol	1,000 ve
2,5-Dichlorophenol	<10
2,3,5-Trichlorophenol	<10
2,4,6-Trichlorophenol	<10
2,4,5-Trichlorophenol	42
2,3,4-Trichlorophenol	<10
3,5-Dichlorophenol	25
2,3,6-Trichlorophenol	<10
3,4-Dichlorophenol	840 ve
2,3,4,6-Tetrachlorophenol	65 ve
2,3,4,5-Tetrachlorophenol	33
2,3,5,6-Tetrachlorophenol	550 ve
3,4,5-Trichlorophenol	510 ve
Pentachlorophenol	1,300 ve

Note: The sample was diluted due to high levels of interfering compounds. Detection limits are raised due to dilution and surrogate recoveries may not be meaningful.

ve - The value reported exceeded the calibration range established for the analyte. The reported concentration is an estimate.

Analysis For Semivolatile Compounds By EPA Method 8270C Sim

Client Sample ID:	B-64	Client:	Geomatrix Consultants, Inc.
Date Received:	03/17/06	Project:	9329 task 23, F&BI 603190
Date Extracted:	03/22/06	Lab ID:	603190-01 1/20
Date Analyzed:	04/06/06	Data File:	040608.D
Matrix:	Water	Instrument:	GCMS3
Units:	ug/L (ppb)	Operator:	YA

Surrogates:	% Recovery	Lower Limit	Upper Limit
2-Fluorophenol	60	16	92
Phenol-d6	44	10	91
2,4,6-Tribromophenol	107	50	150

Compounds:	Concentration ug/L (ppb)
Phenol	23
2-Chlorophenol	<40
2,4-Dichlorophenol	<20
2,3-Dichlorophenol	<20
2,6-Dichlorophenol	<20
3-Chlorophenol+4-Chlorophenol	1,200 ve
2,5-Dichlorophenol	<20
2,3,5-Trichlorophenol	<20
2,4,6-Trichlorophenol	<20
2,4,5-Trichlorophenol	45
2,3,4-Trichlorophenol	<20
3,5-Dichlorophenol	25
2,3,6-Trichlorophenol	<20
3,4-Dichlorophenol	990 ve
2,3,4,6-Tetrachlorophenol	84
2,3,4,5-Tetrachlorophenol	45
2,3,5,6-Tetrachlorophenol	640 ve
3,4,5-Trichlorophenol	590 ve
Pentachlorophenol	2,200 ve

Note: The sample was diluted due to the presence of high levels of material. Detection limits are raised due to dilution and surrogate recoveries may not be meaningful.

ve - The value reported exceeded the calibration range established for the analyte. The reported concentration is an estimate.

Analysis For Semivolatile Compounds By EPA Method 8270C Sim

Client Sample ID:	B-64	Client:	Geomatrix Consultants, Inc.
Date Received:	03/17/06	Project:	9329 task 23, F&BI 603190
Date Extracted:	03/22/06	Lab ID:	603190-01 1/200
Date Analyzed:	04/06/06	Data File:	040607.D
Matrix:	Water	Instrument:	GCMS3
Units:	ug/L (ppb)	Operator:	YA

Surrogates:	% Recovery	Lower Limit	Upper Limit
2-Fluorophenol	0 vo	16	92
Phenol-d6	0 vo	10	91
2,4,6-Tribromophenol	0 vo	50	150

Compounds:	Concentration ug/L (ppb)
Phenol	<200
2-Chlorophenol	<400
2,4-Dichlorophenol	<200
2,3-Dichlorophenol	<200
2,6-Dichlorophenol	<200
3-Chlorophenol+4-Chlorophenol	1,300
2,5-Dichlorophenol	<200
2,3,5-Trichlorophenol	<200
2,4,6-Trichlorophenol	<200
2,4,5-Trichlorophenol	<200
2,3,4-Trichlorophenol	<200
3,5-Dichlorophenol	<200
2,3,6-Trichlorophenol	<200
3,4-Dichlorophenol	960
2,3,4,6-Tetrachlorophenol	<200
2,3,4,5-Tetrachlorophenol	<200
2,3,5,6-Tetrachlorophenol	670
3,4,5-Trichlorophenol	550
Pentachlorophenol	7,300 ve

Note: The sample was diluted due to the presence of high levels of material. Detection limits are raised due to dilution and surrogate recoveries may not be meaningful.

ve - The value reported exceeded the calibration range established for the analyte. The reported concentration is an estimate.

vo - The value reported fell outside the control limits established for this analyte.

Analysis For Semivolatile Compounds By EPA Method 8270C Sim

Client Sample ID:	B-64	Client:	Geomatrix Consultants, Inc.
Date Received:	03/17/06	Project:	9329 task 23, F&BI 603190
Date Extracted:	03/22/06	Lab ID:	603190-01 1/5000
Date Analyzed:	03/30/06	Data File:	033019.D
Matrix:	Water	Instrument:	GCMS3
Units:	ug/L (ppb)	Operator:	YA

Surrogates:	% Recovery	Lower Limit	Upper Limit
2-Fluorophenol	0 vo	16	92
Phenol-d6	0 vo	10	91
2,4,6-Tribromophenol	0 vo	50	150

Compounds:	Concentration ug/L (ppb)
Phenol	<5,000
2-Chlorophenol	<10,000
2,4-Dichlorophenol	<5,000
2,3-Dichlorophenol	<5,000
2,6-Dichlorophenol	<5,000
3-Chlorophenol+4-Chlorophenol	<10,000
2,5-Dichlorophenol	<5,000
2,3,5-Trichlorophenol	<5,000
2,4,6-Trichlorophenol	<5,000
2,4,5-Trichlorophenol	<5,000
2,3,4-Trichlorophenol	<5,000
3,5-Dichlorophenol	<5,000
2,3,6-Trichlorophenol	<5,000
3,4-Dichlorophenol	<5,000
2,3,4,6-Tetrachlorophenol	<5,000
2,3,4,5-Tetrachlorophenol	<5,000
2,3,5,6-Tetrachlorophenol	<5,000
3,4,5-Trichlorophenol	<5,000
Pentachlorophenol	18,000

Note: The sample was diluted due to the presence of high levels of material. Detection limits are raised due to dilution and surrogate recoveries may not be meaningful.

vo - The value reported fell outside the control limits established for this analyte.

Analysis For Semivolatile Compounds By EPA Method 8270C Sim

Client Sample ID:	B-65	Client:	Geomatrix Consultants, Inc.
Date Received:	03/17/06	Project:	9329 task 23, F&BI 603190
Date Extracted:	03/22/06	Lab ID:	603190-02 rr
Date Analyzed:	03/28/06	Data File:	032817.D
Matrix:	Water	Instrument:	GCMS3
Units:	ug/L (ppb)	Operator:	YA

Surrogates:	% Recovery	Lower Limit	Upper Limit
2-Fluorophenol	61	16	92
Phenol-d6	42	10	91
2,4,6-Tribromophenol	101	50	150

Compounds:	Concentration ug/L (ppb)
Phenol	<1
2-Chlorophenol	<2
2,4-Dichlorophenol	<1
2,3-Dichlorophenol	<1
2,6-Dichlorophenol	<1
3-Chlorophenol+4-Chlorophenol	<2
2,5-Dichlorophenol	<1
2,3,5-Trichlorophenol	<1
2,4,6-Trichlorophenol	<1
2,4,5-Trichlorophenol	<1
2,3,4-Trichlorophenol	<1
3,5-Dichlorophenol	<1
2,3,6-Trichlorophenol	<1
3,4-Dichlorophenol	<1
2,3,4,6-Tetrachlorophenol	<1
2,3,4,5-Tetrachlorophenol	<1
2,3,5,6-Tetrachlorophenol	<1
3,4,5-Trichlorophenol	<1
Pentachlorophenol	<1

Analysis For Semivolatile Compounds By EPA Method 8270C Sim

Client Sample ID:	B-66	Client:	Geomatrix Consultants, Inc.
Date Received:	03/17/06	Project:	9329 task 23, F&BI 603190
Date Extracted:	03/22/06	Lab ID:	603190-03 rr
Date Analyzed:	03/28/06	Data File:	032816.D
Matrix:	Water	Instrument:	GCMS3
Units:	ug/L (ppb)	Operator:	YA

Surrogates:	% Recovery	Lower Limit	Upper Limit
2-Fluorophenol	59	16	92
Phenol-d6	39	10	91
2,4,6-Tribromophenol	80	50	150

Compounds:	Concentration ug/L (ppb)
Phenol	<1
2-Chlorophenol	<2
2,4-Dichlorophenol	<1
2,3-Dichlorophenol	<1
2,6-Dichlorophenol	<1
3-Chlorophenol+4-Chlorophenol	<2
2,5-Dichlorophenol	<1
2,3,5-Trichlorophenol	<1
2,4,6-Trichlorophenol	<1
2,4,5-Trichlorophenol	<1
2,3,4-Trichlorophenol	<1
3,5-Dichlorophenol	<1
2,3,6-Trichlorophenol	<1
3,4-Dichlorophenol	<1
2,3,4,6-Tetrachlorophenol	<1
2,3,4,5-Tetrachlorophenol	<1
2,3,5,6-Tetrachlorophenol	<1
3,4,5-Trichlorophenol	<1
Pentachlorophenol	<1

Analysis For Semivolatile Compounds By EPA Method 8270C Sim

Client Sample ID:	B-67	Client:	Geomatrix Consultants, Inc.
Date Received:	03/17/06	Project:	9329 task 23, F&BI 603190
Date Extracted:	03/22/06	Lab ID:	603190-04 rr
Date Analyzed:	03/28/06	Data File:	032815.D
Matrix:	Water	Instrument:	GCMS3
Units:	ug/L (ppb)	Operator:	YA

Surrogates:	% Recovery	Lower Limit	Upper Limit
2-Fluorophenol	60	16	92
Phenol-d6	39	10	91
2,4,6-Tribromophenol	106	50	150

Compounds:	Concentration ug/L (ppb)
Phenol	<1
2-Chlorophenol	<2
2,4-Dichlorophenol	<1
2,3-Dichlorophenol	<1
2,6-Dichlorophenol	<1
3-Chlorophenol+4-Chlorophenol	<2
2,5-Dichlorophenol	<1
2,3,5-Trichlorophenol	<1
2,4,6-Trichlorophenol	<1
2,4,5-Trichlorophenol	<1
2,3,4-Trichlorophenol	<1
3,5-Dichlorophenol	<1
2,3,6-Trichlorophenol	<1
3,4-Dichlorophenol	<1
2,3,4,6-Tetrachlorophenol	<1
2,3,4,5-Tetrachlorophenol	<1
2,3,5,6-Tetrachlorophenol	<1
3,4,5-Trichlorophenol	<1
Pentachlorophenol	<1

Analysis For Semivolatile Compounds By EPA Method 8270C Sim

Client Sample ID:	Method Blank	Client:	Geomatrix Consultants, Inc.
Date Received:	Not Applicable	Project:	9329 task 23, F&BI 603190
Date Extracted:	03/22/06	Lab ID:	06-488mb
Date Analyzed:	03/24/06	Data File:	032417.D
Matrix:	Water	Instrument:	GCMS3
Units:	ug/L (ppb)	Operator:	YA

Surrogates:	% Recovery	Lower Limit	Upper Limit
2-Fluorophenol	55	16	92
Phenol-d6	36	10	91
2,4,6-Tribromophenol	70	50	150

Compounds:	Concentration ug/L (ppb)
Phenol	<1
2-Chlorophenol	<2
2,4-Dichlorophenol	<1
2,3-Dichlorophenol	<1
2,6-Dichlorophenol	<1
3-Chlorophenol+4-Chlorophenol	<2
2,5-Dichlorophenol	<1
2,3,5-Trichlorophenol	<1
2,4,6-Trichlorophenol	<1
2,4,5-Trichlorophenol	<1
2,3,4-Trichlorophenol	<1
3,5-Dichlorophenol	<1
2,3,6-Trichlorophenol	<1
3,4-Dichlorophenol	<1
2,3,4,6-Tetrachlorophenol	<1
2,3,4,5-Tetrachlorophenol	<1
2,3,5,6-Tetrachlorophenol	<1
3,4,5-Trichlorophenol	<1
Pentachlorophenol	<1

Date of Report: 04/10/06
Date Received: 03/17/06
Project: 9329 task 23, F&BI 603190

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER SAMPLES FOR PNA'S BY EPA METHOD 8270C SIM

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Percent Recovery LCSD	Acceptance Criteria	RPD (Limit 20)
Phenol	µg/L (ppb)	7.5	39 vo	38 vo	70-130	4
2-Chlorophenol	µg/L (ppb)	15	84	85	70-130	1
2,3-Dichlorophenol	µg/L (ppb)	7.5	78	79	70-130	2
2,6-Dichlorophenol	µg/L (ppb)	7.5	85	87	70-130	3
3-+4-Chlorophenol	µg/L (ppb)	15	76	78	70-130	2
2,5-Dichlorophenol	µg/L (ppb)	7.5	92	95	70-130	3
2,3,5-Trichloropheno	µg/L (ppb)	7.5	102	105	70-130	3
2,4,6-Trichloropheno	µg/L (ppb)	7.5	97	99	70-130	3
2,4,5-Trichloropheno	µg/L (ppb)	7.5	98	98	70-130	0
2,3,4-Trichloropheno	µg/L (ppb)	7.5	92	96	70-130	4
3,5-Dichlorophenol	µg/L (ppb)	7.5	85	88	70-130	3
2,3,6-Trichloropheno	µg/L (ppb)	7.5	96	96	70-130	0
3,4-Dichlorophenol	µg/L (ppb)	7.5	95	98	70-130	2
2,3,4,6-Tetrachlorop	µg/L (ppb)	7.5	88	89	70-130	0
2,3,4,5-Tetrachlorop	µg/L (ppb)	7.5	87	90	70-130	2
2,3,5,6-Tetrachlorop	µg/L (ppb)	7.5	95	95	70-130	0
3,4,5-Trichloropheno	µg/L (ppb)	7.5	89	91	70-130	2
Pentachlorophenol	µg/L (ppb)	7.5	60	62	23-99	3

vo - The value reported fell outside the control limits established for this analyte.

CHAIN-OF-CUSTODY RECORD 603190 ME 03-17-06 EUR 10003 B05

PROJECT NAME:

DATE: 3/16/06 PAGE 1 OF 1

PROJECT NUMBER: 9329 task 23
RESULTS TO: Mike Keim
TURNAROUND TIME: Std
SAMPLE SHIPMENT METHOD: Fed Ex 7914 0999 6070
tracking #s 7914 0999 6025

LABORATORY NAME: Friedman + Bruya
LABORATORY ADDRESS: 3012 16th Ave W
LABORATORY CONTACT: Charlene Morrow
LABORATORY PHONE NUMBER: 206-285-8282

CLIENT INFORMATION: Sierra Pacific Industries
Arcata Division

REPORTING REQUIREMENTS:

GEOTRACKER REQUIRED [✓ YES] NO
SITE SPECIFIC GLOBAL ID NO. T0602393344

SAMPLERS (SIGNATURE):

ANALYSES

Lab ID	DATE	TIME	SAMPLE NUMBER	phenol, chlorinated phenols and breakdown products	EPA 8270C SIM	CONTAINER TYPE AND SIZE	Soil (S), Water (W), Vapor (V), or Other (O)	Filtered	Preservative Type	Cooled	MS/MSD	No. of Containers	ADDITIONAL COMMENTS
01 A-D	3/15	1145	B-64	X		1-Liter Amber	W			X		4	
02 A-D	3/15	950	B-65	X		↓	↓			↓		4	
03 A-D	3/16	1000	B-66	X		↓	↓			↓		4	
04 A-D	3/15	1430	B-67	X		↓	↓			↓		4	

TOTAL NUMBER OF CONTAINERS: 16

SAMPLING COMMENTS:

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME
SIGNATURE: Matt Hillyard PRINTED NAME: Matt Hillyard COMPANY: Geomatrix	3/16/06	1400	SIGNATURE: PRINTED NAME: Nhan Phan COMPANY: FeBI	3/17/06	09:30
SIGNATURE: PRINTED NAME: COMPANY:			SIGNATURE: PRINTED NAME: COMPANY:		
SIGNATURE: PRINTED NAME: COMPANY:			SIGNATURE: PRINTED NAME: COMPANY:		

525 Second Street, Suite 203
Eureka, California 95501-0488
Tel 707.444.7800 Fax 707.444.7848

Geomatrix

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
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3012 16th Avenue West
Seattle, WA 98119-2029
TEL: (206) 285-8282
FAX: (206) 283-5044
e-mail: fbi@isomedia.com

April 11, 2006

Mike Keim, Project Manager
Geomatrix Consultants, Inc.
2101 Webster Street, 12th Floor
Oakland, CA 94612

Dear Mr. Keim:

Included are the results from the testing of material submitted on March 27, 2006 from the 9329 task 23, F&BI 603279 project. There are 5 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
GMC0411R.DOC

CASE NARRATIVE

This case narrative encompasses samples received on March 27, 2006 by Friedman & Bruya, Inc. from the Geomatrix Consultants, Inc. 9329 task 23, F&BI 603279 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	Geomatrix Consultants, Inc.
603279-10	B-68

The recovery of phenol and 2,3 dichlorophenol were outside the default control limits for the laboratory control samples. All other quality control requirements were acceptable.

Analysis For Semivolatile Compounds By EPA Method 8270C Sim

Client Sample ID:	B-68	Client:	Geomatrix Consultants, Inc.
Date Received:	03/27/06	Project:	9329 task 23, F&BI 603279
Date Extracted:	03/27/06	Lab ID:	603279-10
Date Analyzed:	03/30/06	Data File:	033020.D
Matrix:	Water	Instrument:	GCMS3
Units:	ug/L (ppb)	Operator:	YA

Surrogates:	% Recovery	Lower Limit	Upper Limit
2-Fluorophenol	44	16	92
Phenol-d6	6 ip	10	91
2,4,6-Tribromophenol	65	50	150

Compounds:	Concentration ug/L (ppb)
Phenol	<1
2-Chlorophenol	<2
2,4-Dichlorophenol	<1
2,3-Dichlorophenol	<1
2,6-Dichlorophenol	<1
3-Chlorophenol+4-Chlorophenol	16 ve
2,5-Dichlorophenol	<1
2,3,5-Trichlorophenol	<1
2,4,6-Trichlorophenol	<1
2,4,5-Trichlorophenol	<1
2,3,4-Trichlorophenol	<1
3,5-Dichlorophenol	<1
2,3,6-Trichlorophenol	<1
3,4-Dichlorophenol	<1
2,3,4,6-Tetrachlorophenol	<1
2,3,4,5-Tetrachlorophenol	<1
2,3,5,6-Tetrachlorophenol	<1
3,4,5-Trichlorophenol	<1
Pentachlorophenol	<1

ve - The value reported exceeded the calibration range established for the analyte. The reported concentration is an estimate.

ip - Recovery fell outside of normal control limits. Compounds in the sample matrix interfered with the quantitation of the analyte.

Analysis For Semivolatile Compounds By EPA Method 8270C Sim

Client Sample ID:	B-68	Client:	Geomatrix Consultants, Inc.
Date Received:	03/27/06	Project:	9329 task 23, F&BI 603279
Date Extracted:	03/27/06	Lab ID:	603279-10 1/5
Date Analyzed:	04/04/06	Data File:	040406.D
Matrix:	Water	Instrument:	GCMS3
Units:	ug/L (ppb)	Operator:	YA

Surrogates:	% Recovery	Lower Limit	Upper Limit
2-Fluorophenol	45	16	92
Phenol-d6	40	10	91
2,4,6-Tribromophenol	63	50	150

Compounds:	Concentration ug/L (ppb)
Phenol	<5
2-Chlorophenol	<10
2,4-Dichlorophenol	<5
2,3-Dichlorophenol	<5
2,6-Dichlorophenol	<5
3-Chlorophenol+4-Chlorophenol	19
2,5-Dichlorophenol	<5
2,3,5-Trichlorophenol	<5
2,4,6-Trichlorophenol	<5
2,4,5-Trichlorophenol	<5
2,3,4-Trichlorophenol	<5
3,5-Dichlorophenol	<5
2,3,6-Trichlorophenol	<5
3,4-Dichlorophenol	<5
2,3,4,6-Tetrachlorophenol	<5
2,3,4,5-Tetrachlorophenol	<5
2,3,5,6-Tetrachlorophenol	<5
3,4,5-Trichlorophenol	<5
Pentachlorophenol	<5

Note: The sample was diluted due to high levels of interfering compounds. Detection limits are raised due to dilution and surrogate recoveries may not be meaningful.

Analysis For Semivolatile Compounds By EPA Method 8270C Sim

Client Sample ID:	Method Blank	Client:	Geomatrix Consultants, Inc.
Date Received:	Not Applicable	Project:	9329 task 23, F&BI 603279
Date Extracted:	03/27/06	Lab ID:	06-520mb
Date Analyzed:	03/28/06	Data File:	032810.D
Matrix:	Water	Instrument:	GCMS3
Units:	ug/L (ppb)	Operator:	YA

Surrogates:	% Recovery	Lower Limit	Upper Limit
2-Fluorophenol	75	16	92
Phenol-d6	50	10	91
2,4,6-Tribromophenol	102	50	150

Compounds:	Concentration ug/L (ppb)
Phenol	<1
2-Chlorophenol	<2
2,4-Dichlorophenol	<1
2,3-Dichlorophenol	<1
2,6-Dichlorophenol	<1
3-Chlorophenol+4-Chlorophenol	<2
2,5-Dichlorophenol	<1
2,3,5-Trichlorophenol	<1
2,4,6-Trichlorophenol	<1
2,4,5-Trichlorophenol	<1
2,3,4-Trichlorophenol	<1
3,5-Dichlorophenol	<1
2,3,6-Trichlorophenol	<1
3,4-Dichlorophenol	<1
2,3,4,6-Tetrachlorophenol	<1
2,3,4,5-Tetrachlorophenol	<1
2,3,5,6-Tetrachlorophenol	<1
3,4,5-Trichlorophenol	<1
Pentachlorophenol	<1

Date of Report: 04/11/06
Date Received: 03/27/06
Project: 9329 task 23, F&BI 603279

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER SAMPLES FOR PNA'S BY EPA METHOD 8270C SIM

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Percent Recovery LCSD	Acceptance Criteria	RPD (Limit 20)
Phenol	µg/L (ppb)	7.5	34 vo	33 vo	70-130	2
2-Chlorophenol	µg/L (ppb)	15	78	80	70-130	2
2,3-Dichlorophenol	µg/L (ppb)	7.5	65 vo	69 vo	70-130	5
2,6-Dichlorophenol	µg/L (ppb)	7.5	73	78	70-130	6
3-+4-Chlorophenol	µg/L (ppb)	15	70	71	70-130	1
2,5-Dichlorophenol	µg/L (ppb)	7.5	77	82	70-130	6
2,3,5-Trichloropheno	µg/L (ppb)	7.5	87	92	70-130	5
2,4,6-Trichloropheno	µg/L (ppb)	7.5	82	89	70-130	8
2,4,5-Trichloropheno	µg/L (ppb)	7.5	83	89	70-130	7
2,3,4-Trichloropheno	µg/L (ppb)	7.5	79	85	70-130	7
3,5-Dichlorophenol	µg/L (ppb)	7.5	72	76	70-130	5
2,3,6-Trichloropheno	µg/L (ppb)	7.5	79	85	70-130	7
3,4-Dichlorophenol	µg/L (ppb)	7.5	85	87	70-130	3
2,3,4,6-Tetrachlorop	µg/L (ppb)	7.5	76	81	70-130	6
2,3,4,5-Tetrachlorop	µg/L (ppb)	7.5	73	77	70-130	5
2,3,5,6-Tetrachlorop	µg/L (ppb)	7.5	76	81	70-130	7
3,4,5-Trichloropheno	µg/L (ppb)	7.5	79	84	70-130	6
Pentachlorophenol	µg/L (ppb)	7.5	63	63	23-99	1

vo - The value reported fell outside the control limits established for this analyte.

603279 ME 03/27/06 EUR 10012 B05

CHAIN-OF-CUSTODY RECORD

PROJECT NAME: SPI Arcata		DATE: 3/24/06	PAGE 1 OF 1
PROJECT NUMBER: 9329 task 23	LABORATORY NAME: Friedman & Bruya	CLIENT INFORMATION: Sierra Pacific Industries	REPORTING REQUIREMENTS:
RESULTS TO: Mike Keim	LABORATORY ADDRESS: 3012 16th Ave W	Arcata Division	
TURNAROUND TIME: std			
SAMPLE SHIPMENT METHOD: Fed Ex	LABORATORY CONTACT: Mike		GEOTRACKER REQUIRED [✓ YES] NO
	LABORATORY PHONE NUMBER: 206-285-8282		SITE SPECIFIC GLOBAL ID NO. T0602393344

SAMPLERS (SIGNATURE): Matt Hillyard

ANALYSES

Lab ID	DATE	TIME	SAMPLE NUMBER	Chlorinated Phenol breakdown products	8270CSIM													CONTAINER TYPE AND SIZE	Soil (S), Water (W), Vapor (V), or Other (O)	Filtered	Preservative Type	Cooled	MS/MSD	No. of Containers	ADDITIONAL COMMENTS
10 A-C	3/21/06	1350	B-68	X														1-Liter Amber	W			x		3	

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME
SIGNATURE: Matt Hillyard PRINTED NAME: Matt Hillyard COMPANY: Geomatrix	3/24/06	1545	SIGNATURE: Nhan Phan PRINTED NAME: Nhan Phan COMPANY: F&BI	3/27/06	08:30
SIGNATURE: PRINTED NAME: COMPANY:			SIGNATURE: PRINTED NAME: COMPANY:		
SIGNATURE: PRINTED NAME: COMPANY:			SIGNATURE: PRINTED NAME: COMPANY:		

TOTAL NUMBER OF CONTAINERS:

SAMPLING COMMENTS:

525 Second Street, Suite 203
Eureka, California 95501-0488
Tel 707.444.7800 Fax 707.444.7848

Geomatrix

APPENDIX B

Laboratory Data Quality Review

APPENDIX B

LABORATORY DATA QUALITY REVIEW

Geomatrix reviewed quality assurance and quality control (QA/QC) procedures to assess the quality of the analytical results with respect to precision, accuracy, and completeness. Data quality was reviewed using U.S. Environmental Protection Agency *National Functional Guidelines for Organic Data Review* (U.S. EPA, 1999), *National Functional Guidelines for Chlorinated Dioxin/Furan Data Review* (U.S. EPA, 2002), and *National Functional Guidelines for Inorganic Data Review* (U.S. EPA, 2004).

PRECISION

Geomatrix evaluated data precision by comparing analytical results for the following:

- matrix spikes (MS) and matrix spike duplicates (MSD) concentrations, and
- laboratory control samples (LCS) and laboratory control sample duplicates (LCSD).

We compared the concentrations detected in the spiked samples with the respective concentrations in the duplicate spiked samples. We then reviewed the relative percent differences (RPDs) that the lab calculated using the following equation:

$$RPD = \frac{[S - D]}{(S + D)/2} \times 100$$

Where,

S = Sample concentration
D = Duplicate sample concentration

The RPDs for MS/MSD and LCS/LCSD analyses are within acceptance criteria and are reported in the laboratory analytical reports, included in Appendix A.

ACCURACY

Geomatrix assessed data accuracy by evaluating holding times required by analytical methods, sample preservation, laboratory method blank results, recovery of laboratory surrogates, MS/MSD results, and LCS/LCSD results. The results of our evaluation are summarized below.

- **Holding times.** Samples were analyzed within the holding time for each analytical method.
- **Preservation.** Samples were collected in laboratory-supplied containers with preservatives, if applicable. Samples were stored and transported to analytical laboratories in chilled coolers.
- **Method blanks.** No detections were observed in any of the method blanks analyzed by the laboratory.
- **Surrogate recoveries.** Laboratory surrogates were recovered at concentrations within acceptable ranges except when dilution prevented meaningful surrogate recoveries for the 8270C SIM method.
- **MS/MSD analysis.** RPDs were acceptable.
- **LCS/LCSD analysis.** Recovery for phenol and 2,3-dichlorophenol were below the default EPA acceptance range. However, this was not entirely unexpected because the lab had not run the analyses recently enough to establish their own in-house criteria. RPDs were acceptable.

COMPLETENESS

Laboratory completeness is a measure of the percent of valid measurements obtained from all the measurements taken in the project. Based on our laboratory data quality review, the data contained in this report are considered complete.

APPENDIX C

Tracer Dilution Tests

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APPENDIX C
TRACER DILUTION TESTS
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

1.0 BACKGROUND

Tracer dilution methods involve adding a "tracer" to the screened interval of a well, followed by monitoring the concentration of the tracer over time in the same well. Periodic measurements of the tracer concentration are performed as the tracer is flushed from the well screen under natural groundwater flow conditions. The rate of groundwater flow through the well screen (*Q)* is directly determined from the rate of tracer dilution (i.e., the change in tracer concentration with time).

Estimating *Q* (Dilution Phase): Dilution of the tracer occurs as groundwater moves through the well screen, and the rate of dilution is directly related to *Q* and inversely related to the test interval volume (V) as follows:

$$dC/dt = -\left(Q/V\right) \bullet C(t) \quad \text{Equation (1)}$$

where *V* = the volume of the test interval (volume of the well screen + casing where mixing and measurement of tracer concentration occurs). The tracer is added to the well screen and is well mixed, resulting in an initial tracer concentration (C_o) for the start of the test (time [t] = 0). Flow rate (Q) is calculated directly by integrating Equation 1 from time t = 0 to some elapsed time (t), where C_o decreases to a concentration C.

Q can be obtained graphically by plotting the natural logarithm of the tracer concentration versus time (i.e., ln[C] versus t). The graphical method results in an average value for all of the data collected over the test, rather than just 2-point measurements. The initial tracer concentration (C_o) can be extrapolated from the data (the Y-intercept of the plot is ln[C_o]), as a check on the test conditions. Q can be obtained from the slope of Equation 2 below:

$$\ln(C) = -\left(Q/V\right)t + \ln(C_o) \qquad \text{Equation (2)}$$

The flow rate through the well screen (Q) is converted to the linear groundwater velocity (v) through the permeable treatment media by dividing by the cross-sectional area of the well screen (A; well diameter x length of screen), a flow distortion factor (α) ranging from 2 to 3 for 2-inch polyvinylchloride wells[1], and the estimated effective porosity (n) of the aquifer system (assumed to be 0.25 for this work):

$$v = Q / (nA\alpha) \quad \text{Equation (3)}$$

2.0 FIELD METHODS

A total of three dilution tests were completed on August 19, 2004. The conditions of each test are summarized in Table D-1. This section describes the procedures for conducting the tracer dilution tests.

2.1 INSTRUMENT CALIBRATION

The tracer concentration (bromide ion) was monitored with submersible bromide-specific probes (TempHion Water Quality Sensors, Instrumentation Northwest) connected to a hand-held meter for manual measurements of tracer concentration over the course of the test. The probes were calibrated following the instructions provided by the manufacturer. A 10,000 milligram per liter solution of bromide ion (the standard solution) was diluted with groundwater from well MW-2 to prepare calibration standards that were of 200, 20, and 2 milligram per liter in bromide concentration. Each probe was calibrated before being inserted into the well. A review of the real-time bromide concentration data in the field indicated that the calibration curves for MW-7 and MW-8 were resulting in higher values than expected based on the amount of bromide added to each well at the start of the test. Therefore, at the end of the tests for MW-7 and MW-8, the probes were re-calibrated using water from the respective test well at the end of each test. The pre-test calibration curve for MW-2 and post-test calibration curves for MW-7 and MW-8 are attached as Figure D-1 to this Appendix.

2.2 TRACER RELEASE AND MONITORING

To start each test, a pre-determined volume of 10,000 milligram per liter stock of bromide solution was measured with a 100-milliliter Pyrex® graduated cylinder and added to the screened interval of the well using ¼-inch LDPE tubing connected to a peristaltic pump. The discharge point of the injection line was located below the water level in each well (Table D-1) for each test. Another length of LDPE tubing was installed at the bottom of the well screen and

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[1] Drost, W., D. Klotz, A. Koch, H. Moser, F. Neumaier, and W. Rauert, 1968, Point Dilution Methods of Investigating Ground Water Flow by Means of Radioisotopes. *Water Resources Research*, Vol. 4, No. 1, p. 125-146.

attached to the pump. When the pump was operating, groundwater was extracted from the bottom of the well screen and injected near the top of the well screen at a flow rate of approximately 600 milliliters per minute; the pump was operated for the duration of the test to keep the test interval well mixed. Tracer concentration was monitored in each well for the duration of the tests. Two water samples were collected from MW-2 and MW-7 and one sample was collected from MW-8 at different times during each test and submitted to Alpha Analytical Laboratories, Inc., for analysis of bromide by EPA Method 300.1 (ion chromatography). These results are discussed below.

3.0 RESULTS

Bromide concentration data (as the natural logarithm of bromide concentration) were plotted against time for each test (Figure D-2). The concentration of bromide initially increased as the tracer mixed within the test interval, and then decreased as tracer was flushed out of the interval due to groundwater flow through the well. A discussion of each test is provided below.

MW-2 Groundwater Velocity Range: 0.4 to 0.7 feet per day

The tracer dilution test at MW-2 was operated for approximately 8.75 hours after the tracer was released in the well; the field data are presented graphically in Figure D-2. The natural logarithm of tracer concentration plotted against time closely followed a linear trend, with an r-squared value of 0.998. This trend suggests that the tracer was well mixed, and the dilution rate (and therefore groundwater velocity) was relatively constant over the test duration. The flow rate through the well screen was 0.003 liter per minute, based on the slope of the linear best-fit line (-0.0017) and the test interval volume (1.61 liters). The flow rate was translated to a groundwater velocity using an assumed effective porosity of n=0.25 and the range of expected flow distortion (α=3 to 2). Based on the measured flow rate and assumed porosity and flow distortion, the calculated groundwater velocity ranged from 0.4 to 0.7 foot/day in the vicinity of MW-2 on August 19, 2004 (Table C-3).

The intercept of the trend line was used to extrapolate an initial bromide concentration of 183 milligram per liter, which differs from the expected initial concentration of 190 milligram per liter by a relative percent difference (RPD) of 4 percent (Table C-3). This difference is small, and the good agreement between the extrapolated and expected initial bromide concentrations suggests that the conditions of the test were satisfied. As a check on the field measurements, groundwater samples were collected at two different times during the test for laboratory analysis of bromide. These results are presented in Table C-2. The RPD between the reported bromide concentration for the sample collected at 13:49 hours and the in-well measurement using the bromide specific electrode was 27 percent; the RPD for the sample collected at 18:00 hours was 4 percent. Variation between these results is expected because the laboratory sample was extracted near the bottom of the well, and the bromide-specific probe measurement was obtained from close to the center of the test interval.

MW-7 Groundwater Velocity Range: 0.1 to 0.2 foot per day

The tracer dilution test at MW-7 was operated for approximately 7.9 hours after the tracer was released in the well; the field data are presented graphically in Figure C-2. The natural logarithm of tracer concentration plotted against time closely followed a linear trend, with an r-squared value of 0.990. The flow rate through the well screen was 0.002 liter per minute, based on the slope of the linear best-fit line (-0.0005) and the test interval volume (3.61 liters). The flow rate was translated to a groundwater velocity using an assumed effective porosity of n=0.25 and the range of expected flow distortion (α=3 to 2). Based on the measured flow rate and assumed porosity and flow distortion, the calculated groundwater velocity ranged from 0.1 to 0.2 foot/day in the vicinity of MW-7 on August 19, 2004 (Table C-3).

The intercept of the trend line was used to extrapolate an initial bromide concentration of 156 milligram per liter, which differs from the expected initial concentration of 208 milligram per liter by a RPD of 29 percent (Table C-3). This difference is larger than that observed for MW-2, suggesting that either the calculated test interval volume was larger than that expected based on the test setup (Table C-1) or mixing may have been insufficient during the early stages of the test. As a check on the field measurements, groundwater samples were collected at two different times during the test for laboratory analysis of bromide. These results are presented in Table C-2. The RPD between the reported bromide concentration for the sample collected at 14:00 hours, and the in-well measurement using the bromide-specific electrode was 1 percent; the RPD for the sample collected at 18:00 hours was 10 percent. The relatively small RPD for these samples suggests that the probe calibration was not compromised.

MW-8 Groundwater Velocity Range: 2 to 4 feet per day

The tracer dilution test at MW-8 was operated for approximately 4.5 hours after the tracer was released in the well; the field data are presented graphically in Figure C-2. The natural logarithm of tracer concentration plotted against time closely followed a linear trend, with an r-squared value of 0.998. The flow rate through the well screen was 0.031 liter per minute, based on the slope of the linear best-fit line (-0.0087) and the test interval volume (3.61 liters). The flow rate was translated to a groundwater velocity using an assumed effective porosity of n=0.25 and the range of expected flow distortion (α=3 to 2). Based on the measured flow rate and assumed porosity and flow distortion, the calculated groundwater velocity ranged from 2 to 3 feet/day in the vicinity of MW-8 on August 19, 2004 (Table C-3).

The intercept of the trend line was used to extrapolate an initial bromide concentration of 257 milligram per liter, which differs from the expected initial concentration of 208 milligram per liter by a RPD of 21 percent (Table C-3). This difference suggests that the probe calibration may have been compromised, the calculated test interval volume may have been smaller than that expected based on the test setup (Table C-1) or mixing may have been insufficient during the early stages of the test. As a check on the field measurements, a groundwater sample was collected at 14:10 hours for comparison with the field measurement (Table C-2). The RPD between the reported bromide concentration for the sample collected at 14:10 hours, and the in-well measurement using the bromide-specific electrode was 69 percent; suggesting that the probe calibration was not accurate.

Because the probe data were suspect, the rate of groundwater flow was calculated based on the laboratory results only, using Equation 2, and assuming an initial concentration (C_o) of 208 milligram per liter. The bromide concentration for the sample collected from MW-8 at 14:10 hours, 229 minutes after the start of the test, was reported to be 17 milligram per liter. Using C=17 milligrams per liter, t=229 minutes, and the same values for V, A, and *n*, the calculated groundwater velocity using Equations 2 and 4 is 3.9 feet/day (for α=2). Based on this analysis, the estimated range in groundwater velocity in the vicinity of MW-8 is expanded to 2 to 4 feet/day, based on the field data, laboratory data, and using a range in α from 3 to 2.

TABLE C-1
SUMMARY OF TRACER DILUTION TEST SETUP AND OPERATION

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Well ID	**MW-2**	**MW-7**	**MW-8**
Depth to Water (feet bTOC)[1]	5.29	0.91	0.90
Depth to Top of Well Screen (feet bTOC)[2]	2.00	2.00	2.00
Depth to Bottom of Well Screen (feet bTOC)[2]	8.00	8.00	8.00
Well Casing Internal Diameter (inches)[2]	2.05	2.05	2.05
Well Casing Volume per Foot (L)	0.65	0.65	0.65
Injection Depth (feet bTOC)[3]	5.30	2.10	2.10
Extraction Depth (feet bTOC)[4]	7.80	7.70	7.70
Test Interval Volume (V; L)[5]	1.61	3.61	3.61
Test Interval Area (ft^2)[6]	0.43	1.02	1.02
Recirculation Rate (mL/min)[7]	600	600	600
Mass of Bromide (Br) injected (mg)[8]	305	750	750
Date and Time of Tracer Release	8/19/04 9:15	8/19/04 10:27	8/19/04 10:21
Date and Time of Test Termination[9]	8/19/04 18:00	8/19/04 18:18	8/19/04 14:50
Duration of Test (minutes)	525	471	269
Calculated Initial Bromide concentration: C_o (mg/L)[10]	190	208	208

Notes:
1. Depth to water measured on August 19, 2004. bTOC = below top of casing.
2. Based on well construction information.
3. Depth of tubing connected to the discharge end of the peristaltic pump head.
4. Depth of tubing connected to the suction end of the peristaltic pump head.
5. Casing volume between the injection depth and bottom of the well screen in liters (L).
6. Cross-sectional area of the well screen in square feet (ft^2).
7. Rate at which groundwater was extracted and simultaneously re-injected into each well. mL/min = milliliters per minute.
8. 10,000 mg/L of an aqueous Bromide Standard solution was measured with volumetric glassware and added to MW-2, MW-7, and MW-8 at the start of the test; 30 mL was added to MW-2, 75 mL was added to MW-7 and MW-8.
9. Water samples were collected at this time for laboratory analysis of bromide concentration by EPA Method 300.0.
10. Calculated initial bromide concentration (mg of bromide/test interval volume).

TABLE C-2
LABORATORY ANALYTICAL RESULTS FOR BROMIDE

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Concentrations in milligrams per liter (mg/L)

Monitoring Well Number	Time Sampled [1]	Bromide Concentration (Downhole Field Measurement)	Bromide Concentration (Laboratory Analysis)	Relative % Difference
MW-2	13:49	114	150	27
	18:00	80	77	4
MW-7	14:00	139	140	1
	18:18	121	110	10
MW-8	14:10	35	17	69

Notes:

1. Sample collected from peristaltic pump discharge during test operation.
2. Sample submitted to Alpha Analytical Laboratories, Inc., for analysis of bromide using EPA Method 300.1.
3. Relative Percent Difference (RPD) is calculated by:

$$RPD\,\% = \left|\frac{2(S_1 - S_2)}{S_1 + S_2}\right| \times 100$$

TABLE C-3
SUMMARY OF TRACER DILUTION TEST RESULTS
Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

Calculation Summary	**MW-2**	**MW-7**	**MW-8**
Groundwater Velocity based on Field Measurements:			
Slope of ln[C] vs. time (-Q/V)[1]	-0.0017	-0.0005	-0.0087
Intercept of ln[C] vs. time (ln[C_o])[1]	5.21	5.05	5.55
Flow Rate (Q; L/min)[2]	0.003	0.002	0.031
Calculated Initial Bromide concentration: C_o (mg/L)[3]	190	208	208
Extrapolated Initial Bromide concentration: C_o (mg/L)[4]	183	156	257
Relative % Difference Between Expected and Extrapolated C_o (mg/L)[5]	4	29	21
Groundwater Velocity Range (feet per day)[6]	**0.4 - 0.7**	**0.1 - 0.2**	**2 - 4**

Notes:
1. Based on the ln[C] vs. time curve (Figure A-2)
2. Slope (Q/V) mulitiplied by the test interval volume (V; Table A-1).
3. Calculated initial bromide concentration (from Table A1)
4. Based on the linear regression of field data (Figure A-2)
5. Relative Percent Difference (RPD) is calculated by:

$$\text{RPD}\,\% = \left|\frac{2(S_1 - S_2)}{S_1 + S_2}\right| \times 100$$

6. Calculated using Equation 4; effective porosity (n=0.25), flow distortion (α=2 to 3) and test interval area (A) reported in Table A-1.

Abbreviations:
C = concentration
Q = rate of groundwater flow through the well screen
V = volume
C_o = initial concentration
L/min = liters per minute
mg/L = milligrams per liter

FIGURE C-1
CALIBRATION CURVES

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

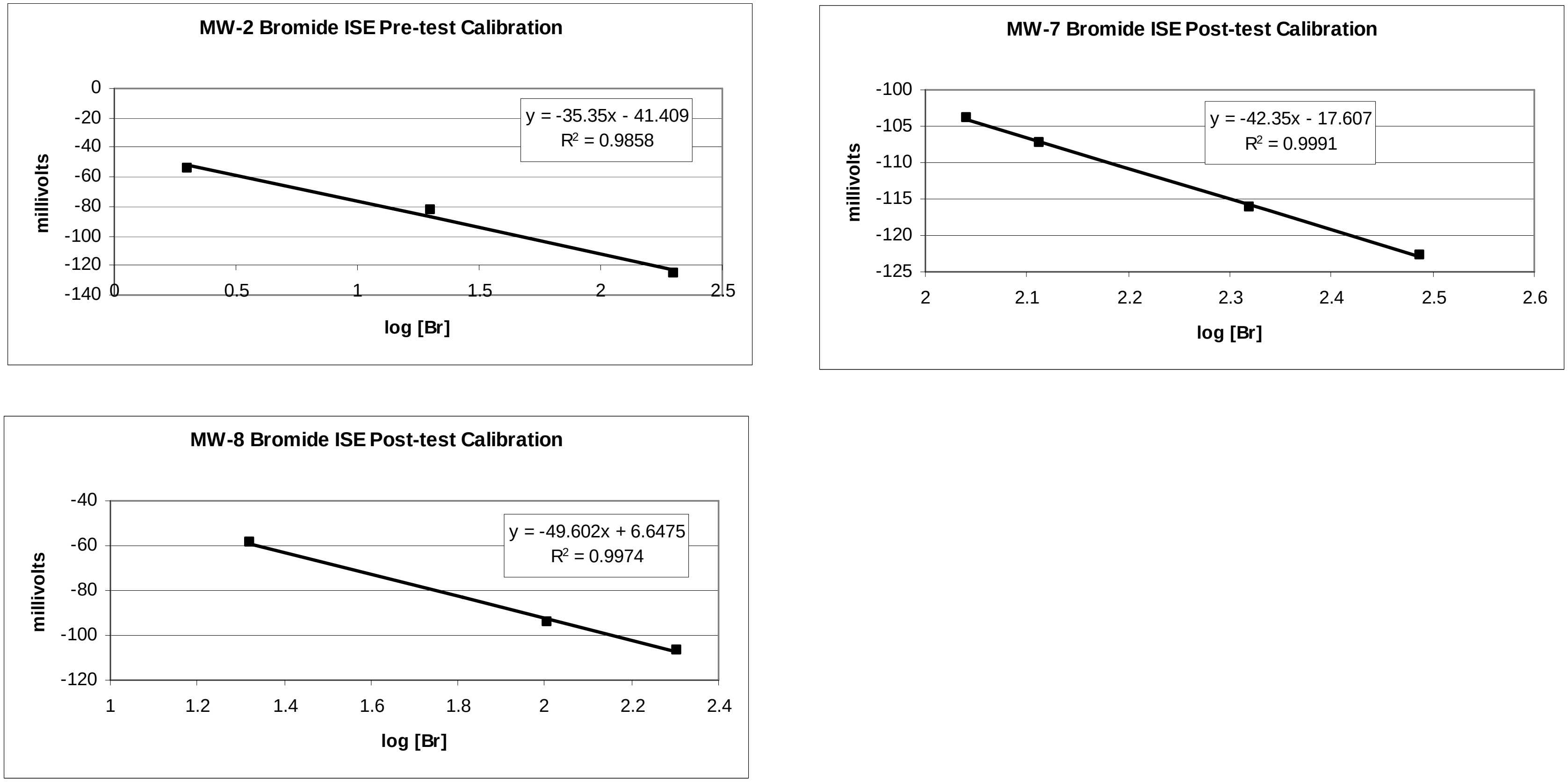

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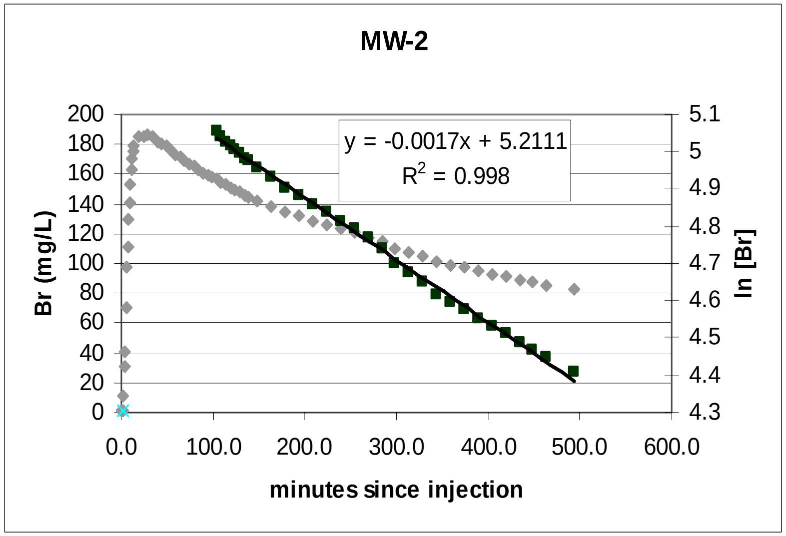
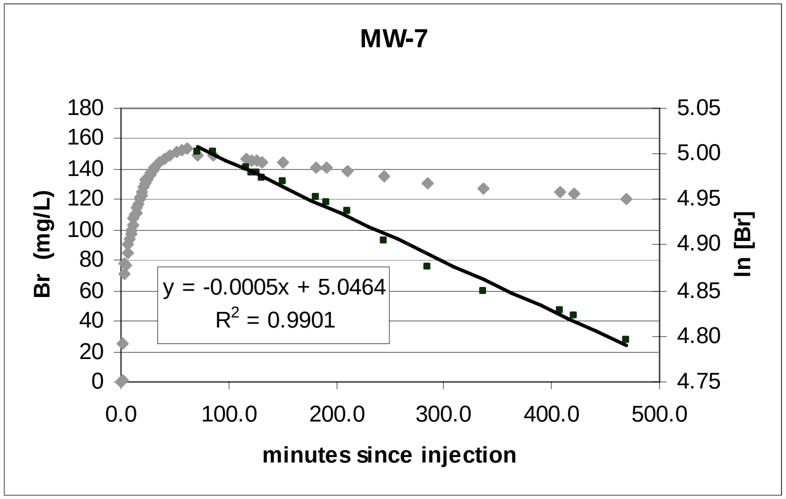
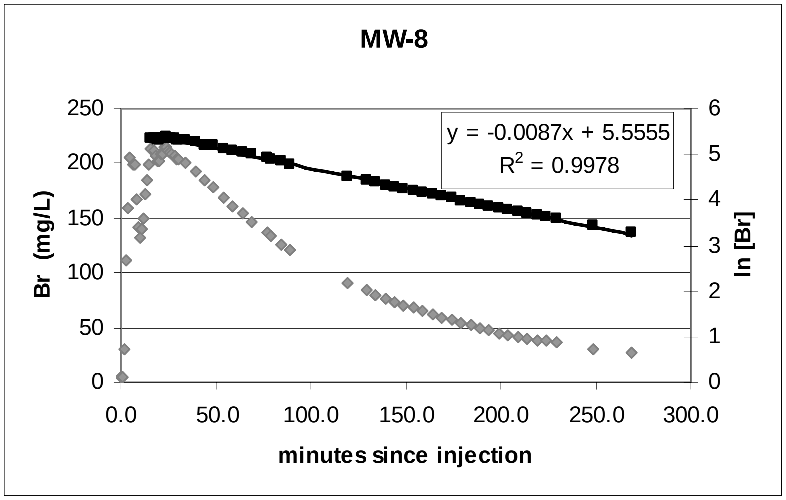
FIGURE C-2
PLOTS OF BROMIDE CONCENTRATIONS VERSUS TIME

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California







Notes:

1. Grey diamonds represent field measurements of bromide (Br) concentration in milligrams per liter (mg/L).
2. Black squares represent the natural logarithm of bromide concentration (ln[Br]).
3. Linear best-fit line to the ln[Br] vs. time (as minutes since injection of bromide) is shown as a straight black line. Equation of best-fit line and r-squared values are posted on each plot.

PROJECT 9329

BSK ANALYTICAL LABORATORIES

BSK Submission Number: 2004081699

09/08/2004

Sheri L. Speaks
Alpha Analytical Laboratories Inc
208 Mason Street
Ukiah, CA 95482

RECEIVED 9/15/04

ACCREDITED IN ACCORDANCE WITH nelac

TASK 23 REMED. PILOT STUDY

BOREHOLE DIL. TESTS

Dear Sheri L. Speaks,

Thank you for selecting BSK Analytical Laboratories for your analytical testing needs. We have prepared this report in response to your request for analytical services. Please find enclosed the following sections for your complete laboratory report, each uniquely paginated:

CASE NARRATIVE: An overview of the work performed.
CERTIFICATE OF ANALYSIS: Analytical results.
REPORT OF SAMPLE INTEGRITY
CHAIN OF CUSTODY FORM

Certification: I certify that this data package is in compliance with NELAC Standards for applicable analyses under NELAP Certificate #04227CA, and is in compliance with ELAP Standards for applicable certified analyses under ELAP Certificate #1180, except for the conditions listed.

If additional clarification of any information is required, please contact your Client Services Representative, Laura Quiring, at (800) 877-8310 or (559) 497-2888.

BSK ANALYTICAL LABORATORIES

Laura

Laura Quiring
Client Services Representative

BSK ANALYTICAL LABORATORIES

Case Narrative

BSK Submission Number: 2004081699

SAMPLE AND RECEIPT INFORMATION

The sample(s) was received, prepared, and analyzed within the method specified holding times unless otherwise noted on the Certificate of Analysis. Samples, when shipped, arrived within acceptable temperature requirements of 0° to 6° Celsius unless otherwise noted on the Report of Sample Integrity. Samples collected by BSK Analytical Laboratories were collected in accordance with the BSK Sampling and Collection Standard Operating Procedures.

QUALITY CONTROL

All analytical quality controls are within established method criteria except when noted in the Quality Control section or on the Certificate of Analysis. All positive results for EPA Methods 504.1, 502.2, and 524.2 require the analysis of a Field Reagent Blank (FRB) to confirm that the results are not a contamination error from field sampling steps. If Field Reagent Blanks were not submitted with the samples, this method requirement has not been performed. QC samples may include analytes not requested in this submission.

RUN	ORDER	TEST	ANALYTE	COMMENT
78947	492147	EPA 300.1	Bromide (Br)	LCSD recovery was out of the acceptance range, however the LCS recovery was within the acceptance range, therefore the data were reported.
78947	492147	EPA 300.1	Bromate (BrO3)	LCSD recovery was out of the acceptance range, however the LCS recovery was within the acceptance range, therefore the data were reported.
78947	492147	EPA 300.1	Chlorite (ClO2)	LCSD recovery was out of the acceptance range, however the LCS recovery was within the acceptance range, therefore the data were reported.
78947	492147	EPA 300.1	Chlorate (ClO3)	LCSD recovery was out of the acceptance range, however the LCS recovery was within the acceptance range, therefore the data were reported.

SAMPLE RESULT INFORMATION

Samples are analyzed as received (wet weight basis) unless noted here. The results relate only to the items tested. Any exceptions to be considered when evaluating these results are also listed here, if applicable. Results contained in this package shall not be reproduced, except in full, without written approval of BSK Analytical Laboratories.

ORDER	TEST	ANALYTE	COMMENT

Certificate of Analysis

NELAP Certificate #04227CA
ELAP Certificate #1180

Sheri L. Speaks
Alpha Analytical Laboratories Inc
208 Mason Street
Ukiah, CA 95482

ACCREDITED IN ACCORDANCE WITH nela

Report Issue Date: 09/08/2004

BSK Submission #: 2004081699
BSK Sample ID #: 487407

Project ID: A408430
Project Desc:
Submission Comments:

Sample Type:	Liquid	Date Sampled:	08/19/2004
Sample Description:	MW-2-1349	Time Sampled:	1349
Sample Comments:	A408430-01	Date Received:	08/24/2004

Inorganics

Analyte	Method	Result	Units	PQL	Dilution	DLR	Prep Date/Time	Analysis Date/Time
Bromide (Br)	EPA 300.1	**150**	mg/L	0.005	900	4.500	09/02/04	09/02/04

---

mg/L: Milligrams/Liter (ppm)
mg/Kg: Milligrams/Kilogram (ppm)
µg/L: Micrograms/Liter (ppb)
µg/Kg: Micrograms/Kilogram (ppb)
%Rec: Percent Recovered (surrogates)

PQL: Practical Quantitation Limit
DLR: Detection Limit for Reporting
: PQL x Dilution
ND: None Detected at DLR

H: Analyzed outside of hold time
P: Preliminary result
S: Suspect result. See Case Narrative for comments.
E: Analysis performed by External laboratory.
See External Laboratory Report attachments.

Report Authentication Code:

BSK ANALYTICAL LABORATORIES

Certificate of Analysis

NELAP Certificate #04227CA
ELAP Certificate #1180

Sheri L. Speaks
Alpha Analytical Laboratories Inc
208 Mason Street
Ukiah, CA 95482

BSK Submission #: 2004081699
BSK Sample ID #: 487408

Report Issue Date: 09/08/2004

Project ID: A408430
Project Desc:
Submission Comments:
Sample Type: Liquid
Sample Description: MW-7-1400
Sample Comments: A408430-02

Date Sampled: 08/19/2004
Time Sampled: 1400
Date Received: 08/24/2004

Inorganics

Analyte	Method	Result	Units	PQL	Dilution	DLR	Prep Date/Time	Analysis Date/Time
Bromide (Br)	EPA 300.1	**140**	mg/L	0.005	800	4.000	09/02/04	09/02/04

mg/L: Milligrams/Liter (ppm)
mg/Kg: Milligrams/Kilogram (ppm)
µg/L: Micrograms/Liter (ppb)
µg/Kg: Micrograms/Kilogram (ppb)
%Rec: Percent Recovered (surrogates)

PQL: Practical Quantitation Limit
DLR: Detection Limit for Reporting
: PQL x Dilution
ND: None Detected at DLR

H: Analyzed outside of hold time
P: Preliminary result
S: Suspect result. See Case Narrative for comments.
E: Analysis performed by External laboratory.
See External Laboratory Report attachments.

Report Authentication Code:

BSK ANALYTICAL LABORATORIES

Certificate of Analysis

NELAP Certificate #04227CA
ELAP Certificate #1180

Sheri L. Speaks
Alpha Analytical Laboratories Inc
208 Mason Street
Ukiah, CA 95482

Report Issue Date: 09/08/2004

BSK Submission #: 2004081699
BSK Sample ID #: 487409

Project ID: A408430 Project Desc:

Submission Comments:

Sample Type:	Liquid	Date Sampled:	08/19/2004
Sample Description:	MW-8-1410	Time Sampled:	1410
Sample Comments:	A408430-03	Date Received:	08/24/2004

Inorganics

Analyte	Method	Result	Units	PQL	Dilution	DLR	Prep Date/Time	Analysis Date/Time
Bromide (Br)	EPA 300.1	**17**	mg/L	0.005	100	0.500	09/02/04	09/02/04

---

mg/L: Milligrams/Liter (ppm)
mg/Kg: Milligrams/Kilogram (ppm)
µg/L: Micrograms/Liter (ppb)
µg/Kg: Micrograms/Kilogram (ppb)
%Rec: Percent Recovered (surrogates)

PQL: Practical Quantitation Limit
DLR: Detection Limit for Reporting
: PQL x Dilution
ND: None Detected at DLR

H: Analyzed outside of hold time
P: Preliminary result
S: Suspect result. See Case Narrative for comments.
E: Analysis performed by External laboratory.
See External Laboratory Report attachments.

Report Authentication Code:

BSK ANALYTICAL LABORATORIES

Certificate of Analysis

NELAP Certificate #04227CA
ELAP Certificate #1180

Report Issue Date: 09/08/2004

Sheri L. Speaks
Alpha Analytical Laboratories Inc
208 Mason Street
Ukiah, CA 95482

BSK Submission #: 2004081699
BSK Sample ID #: 487410

Project ID: A408430
Project Desc:
Submission Comments:
Sample Type: Liquid
Sample Description: MW-2-1800
Sample Comments: A408430-04

Date Sampled: 08/19/2004
Time Sampled: 1800
Date Received: 08/24/2004

Inorganics

Analyte	Method	Result	Units	PQL	Dilution	DLR	Prep Date/Time	Analysis Date/Time
Bromide (Br)	EPA 300.1	**77**	mg/L	0.005	500	2.500	09/02/04	09/02/04

---

mg/L: Milligrams/Liter (ppm)
mg/Kg: Milligrams/Kilogram (ppm)
µg/L: Micrograms/Liter (ppb)
µg/Kg: Micrograms/Kilogram (ppb)
%Rec: Percent Recovered (surrogates)

PQL: Practical Quantitation Limit
DLR: Detection Limit for Reporting
: PQL x Dilution
ND: None Detected at DLR

H: Analyzed outside of hold time
P: Preliminary result
S: Suspect result. See Case Narrative for comments.
E: Analysis performed by External laboratory.
See External Laboratory Report attachments.

Report Authentication Code:

BSK ANALYTICAL LABORATORIES

Certificate of Analysis

NELAP Certificate #04227CA
ELAP Certificate #1180

Sheri L. Speaks
Alpha Analytical Laboratories Inc
208 Mason Street
Ukiah, CA 95482

Report Issue Date: 09/08/2004

BSK Submission #: 2004081699
BSK Sample ID #: 487411
Project ID: A408430
Project Desc:
Submission Comments:

Sample Type:	Liquid	Date Sampled:	08/19/2004
Sample Description:	MW-7-1818	Time Sampled:	1818
Sample Comments:	A408430-05	Date Received:	08/24/2004

Inorganics

Analyte	Method	Result	Units	PQL	Dilution	DLR	Prep Date/Time	Analysis Date/Time
Bromide (Br)	EPA 300.1	**110**	mg/L	0.005	600	3.000	09/02/04	09/02/04

mg/L: Milligrams/Liter (ppm)
mg/Kg: Milligrams/Kilogram (ppm)
µg/L: Micrograms/Liter (ppb)
µg/Kg: Micrograms/Kilogram (ppb)
%Rec: Percent Recovered (surrogates)

PQL: Practical Quantitation Limit
DLR: Detection Limit for Reporting
: PQL x Dilution
ND: None Detected at DLR

H: Analyzed outside of hold time
P: Preliminary result
S: Suspect result. See Case Narrative for comments.
E: Analysis performed by External laboratory.
See External Laboratory Report attachments.

Report Authentication Code:

14.4

Chain-of-Custody Record

004389

Date: 8/1

Page 1 of 1

Project No.: 9329

Samplers (Signature:) P. B

Date	Time	Sample Number	EPA Method 8021 (Full Scan)	EPA Method 8021 (Hal. VOCs only)	EPA Method 8021 (BETX only)	EPA Method 8260	EPA Method 8270 (Full Scan)	EPA Method 8270 SIM (PAHS only)	Method 8015M (Gasoline)	Method 8015M (Diesel)	Method 8015M (Motor Oil)	Silica Gel Cleanup	Br by EPA 300	Soil (S), Water (W) Vapor (V), or Other (O)	Filtered	Preserved	Cooled	No. of Containers	Additional Comments
8/19/04	1349	MW-2-1349	A408430-01										X	W	N	N	N	1	ANALYSE FOR BROMIDE ONLY!
8/19/04	1400	MW-7-1400						2					X	W	N	N	N	1	"
8/19/04	1410	MW-8-1410						3					X	W	N	N	N	1	"
8/19/04	1800	MW-2-1800						4					X	W	N	N	N	2	"
8/19/04	1818	MW-7-1818						5					X	W	N	N	N	2	"

OK to dilute
Per Client -NB

Per Peter project name
is SPI-Arcata

Laboratory: Alpha Analytical

Turnaround Time: Standard

Results to: Peter Bennet

Total No. of Containers 7

Relinquished by (Signature): P. B
Printed Name: Peter Bennett
Company: GMX.
Date: 8/20
Time: 9:50

Received by: Nena Burgess
Printed Name:
Company: alpha
Date: 8/20/04
Time: 950

Relinquished by (Signature):
Printed Name:
Company:
Date:
Time:

Received by:
Printed Name:
Company:
Date:
Time:

Relinquished by (Signature):
Printed Name:
Company:
Date:
Time:

Received by:
Printed Name:
Company:
Date:
Time:

Method of Shipment: Drop off

Laboratory Comments and Log No.:

Geometrix Consultants
2101 Webster Street, 12th Floor • Oakland, CA 94612
Phone: 510-663-4100 • Fax: 510-663-4141

APPENDIX D

Natural Attenuation Evaluation using BIOCHLOR

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APPENDIX D
NATURAL ATTENUATION EVALUATION USING BIOCHLOR

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

1.0 BACKGROUND

The U.S. EPA screening model BIOCHLOR was used to model biodegradation of pentachlorophenol (PCP) at the project site. BIOCHLOR is an analytical computer program that is intended for use as a screening-level model to determine if remediation by natural attenuation is feasible at a chlorinated chemical site (Aziz et *al.*, 2000). This public domain model is programmed in a Microsoft EXCEL spreadsheet environment and has the ability to simulate advection, dispersion, adsorption, and biodegradation of chlorinated compounds from parent compounds to daughter products. Reductive dechlorination is assumed to occur under anaerobic conditions and dissolved chlorinated chemical degradation is assumed to follow a first-order decay process.

The elevated concentrations of PCP in groundwater observed at well MW-21 and boring B-64 suggest that biodegradation is slow and dispersion is small upgradient of these locations. In contrast, the low concentration of PCP in groundwater observed at well MW-2 indicates that significant biodegradation occurs downgradient of well MW-21 and boring B-64. Based on the assumption that advection is the predominant mechanism of PCP transport in groundwater between the PCP source area and well MW-21 and boring B-64, we first used BIOCHLOR to estimate the biodegradation rates downgradient of these locations, assuming that there are no preferential pathways of groundwater flow. The estimated biodegradation rates were then used to assess the potential reduction of PCP concentrations in the future. A similar assessment for dioxins and furans was not conducted because these compounds are relatively immobile in the subsurface due to their strong sorption to soil and low water solubility. For example, even when biodegradation is ignored, the octachlorodibenzo-p-dioxin (the dioxin with the highest detected concentration at the site in March 2006) plume length simulated by BIOCHLOR is approximately 20 feet. We anticipate that most of the mass of these compounds was removed during the source area excavation.

2.0 BIOCHLOR MODEL PARAMETERS

The model input parameters were selected based on the following available documents:

- Report on Interim Remedial Measures: Source Area Removal, (Geomatrix 2003),
- Groundwater Monitoring and Progress Report, Third Quarter 2004 (Geomatrix, 2004a),
- Monitoring Wells MW-20 and MW-21 Installation and Soil Sampling Report (Geomatrix, 2004b), and
- Groundwater Monitoring and Progress Report, March 2006 Sampling Event (Geomatrix, 2006).

The values of the selected flow and transport parameters and the rationales for selecting these values are presented in Table D-1. Because site specific data suggest that biodegradation is slow and dispersion is small upgradient of well MW-21 and boring B-64, these are assumed to be in an area with constant PCP concentration in the BIOCHLOR model. The biodegradation rate downgradient of these locations was estimated by matching the model results to the PCP concentration detected in the groundwater sample collected from well MW-2 during the March 2006 sampling event. Based on the assumption that the PCP source was removed 42 years after the initial release, BIOCHLOR was used to simulate the potential reduction of the dissolved PCP concentration in the future.

When the source concentration and seepage velocity were conservatively assumed to be 8 milligrams per liter (mg/L) and 73 feet per year (ft/yr), respectively, the estimated PCP half-life was 0.12 year. Sensitivity analysis was performed to examine the impact of seepage velocity and source concentration on the biodegradation rate. When the source concentration was assumed to be equal to the PCP solubility (14 mg/L), the estimated half-live of PCP was shortened to 0.1 year. With an additional assumption that the seepage velocity was increased to 256 ft/yr, the estimated half-life was further shortened to 0.03 year. These degradation rates indicate that the plume has reached a steady state condition. The lateral extent of PCP affected groundwater will not extend beyond approximately 200 to 250 feet from the source area (the eastern edge of the former dip tank area excavation).

3.0 POTENTIAL PCP CONCENTRATION REDUCTION

The assessment of potential PCP concentration reduction downgradient of well MW-21 and boring B-64 after source removal (based on source removal in 2003) was performed using BIOCHLOR. The potential PCP concentration reduction upgradient of these locations was assessed by considering advective transport and ignoring both biodegradation and dispersion. Retardation due to sorption of PCP on soil was accounted for.

Although BIOCHLOR cannot directly simulate source removal, the PCP distribution after instantaneous source removal was estimated by applying the principle of superposition. This approach is appropriate because the fate and transport processes considered in BIOCHLOR are linear. For example, to simulate the PCP distribution 5 years subsequent to the instantaneous source removal 42 years after initial release, BIOCHLOR was run twice. The first run computed the PCP distribution 47 years (42 years plus 5 years) after initial release and the second run computed the PCP distribution 5 years after release. The PCP distribution after source removal was calculated by subtracting the results of the second run from the results of the first run.

The analysis was performed for two cases. The first case (Case 1) is less conservative and assumes that the groundwater seepage velocity is 256 ft/yr and the PCP half-life value is 0.03 year. The second case (Case 2) is more conservative and assumes that the groundwater seepage velocity is 73 ft/yr and the PCP half-life is 0.12 year. In Case 1, based on a retardation factor of 8.78 (Table D-1), a seepage velocity of 256 ft/yr, and a travel distance of 100 ft, we estimate that it will require approximately 4 years for the PCP concentration in groundwater to reduce to less than 1 μg/L upgradient of well MW-21 and boring B-64. An additional approximately 2 years (a total of approximately 6 years after PCP source removal) will be needed for the PCP concentration in groundwater to reduce to less than 1 μg/L downgradient of well MW-21 and boring B-64. Figure D-1 shows the PCP concentrations along the centerline of the plume downgradient of well MW-21 and boring B-64 for this case. In Case 2, it will require approximately 12 years for the PCP concentration in groundwater to reduce to less than 1 μg/L upgradient of well MW-21 and boring B-64 and an additional approximately 8 years (a total of approximately 20 years after PCP source removal) will be needed for the PCP concentration in groundwater to reduce to less than 1 μg/L downgradient of well MW-21 and boring B-64. Figure D-2 shows the PCP concentrations along the centerline of the plume downgradient of well MW-21 and boring B-64 for the second case.

4.0 REFERENCES

Aziz, C.E., CJ. Newell, J.R. Gonzales, P.E. Haas, T.P. Clement, and Y. Sun, 2000, "BIOCHLOR Natural Attenuation Decision Support System, User's Manual, Version 1.0," U.S. EPA Office of Research and Development, EPA/600/R-00/008, January.

Geomatrix, 2003, *Report on Interim Remedial Measures: Source Area Removal*, Arcata Division Sawmill, prepared for Sierra Pacific Industries, Arcata, California, December 1.

Geomatrix, 2004a, *Groundwater Monitoring and Progress Report*, *Third Quarter 2004*, Arcata Division Sawmill, prepared for Sierra Pacific Industries, Arcata, California, October 14.

Geomatrix, 2004b, *Monitoring Wells MW-20 and MW-21 Installation and Soil Sampling Report*, Arcata Division Sawmill, prepared for Sierra Pacific Industries, Arcata, California, April 7.

Geomatrix, 2006, *Groundwater Monitoring and Progress Report*, *March 2006 Sampling Event,* Arcata Division Sawmill, prepared for Sierra Pacific Industries, Arcata, California, April 28.

TABLE D-1

FLOW AND TRANSPORT PARAMETERS FOR BIOCHLOR

Sierra Pacific Industries
Arcata Division Sawmill
Arcata, California

	Values	*Remarks*
Advection Parameters		
Groundwater Seepage Velocity	73 and 256 ft/yr	73 ft/yr is based on the high range of the seepage velocity measured for well MW-7 of 0.2 ft/day and 256 ft/yr is based on the high range of the seepage velocity measured for well MW-2 of 0.7 ft/day (Groundwater Monitoring and Progress Report, Third Quarter 2004).
Dispersion Parameters		
Longitudinal Dispersivity	10 ft	Approximately 1/10 of longitudinal travel distance which is equal to the distance from boring B-64 to MW-2 (Groundwater Monitoring and Progress Report, March 2006 Sampling Event). This value is on the high side of typical ranges of dispersivity, in impacted areas of this size, to account for tidal fluctuations which increase dispersion effects.
Transverse Dispersivity	1 ft	1/10 of longitudinal dispersivity.
Vertical Dispersivity	0.01 ft	1/100 of longitudinal dispersivity.
Retardation Factor		
PCP Retardation Factor	8.78	Based on an estimated soil bulk density of 1.93 kg/L, an estimated effective porosity of 0.25, organic carbon partition coefficient of 1000 L/kg, and a fraction of organic matter of 0.001 (average of total organic carbon measured in soil samples from MW-21 at depths of 5 and 7 feet below ground surface).
Biodegradation Parameters		
PCP Half Life Time	0.12 years 0.1 years 0.03 years	Rate for which model results simulated the concentration of PCP at MW-2 to equal the concentration measured in March 2006 (0.002 mg/L). Half lives of 0.1 and 0.03 years were calculated for source concentration of 14 mg/L and seepage velocities of 73 and 256 ft/yr, respectively. Half life of 0.12 years was calculated for a source concentration of 8 mg/L and seepage velocity of 73 ft/yr.
General		
Simulation Time	42 years	Based on the estimated date of when the release began (1961) to the time of source removal (2003).
Source Data		
Source Concentration	14 and 8 mg/L	14 mg/L is based on the water solubility of PCP at 20 degrees Celsius; 8 mg/L was the PCP concentration in the groundwater sample from MW-21 collected in March 2006.
Source Thickness	8 ft	Based on field data.
Width of Source	30 ft	Based on limits of the 2003 source area excavation.

Notes:
1. Estimated values are based on typical values for the similar sites.
2. Chemical properties of PCP were obtained from Environmental Contaminants Encyclopedia, Pentachlorophenol Entry, published July 1, 1997 by the National Park Service.

Abbreviations:

PCP = pentachlorophenol
kg = kilograms
mg = milligrams
L = liters
ft = feet
yr = year

Figure D-1
Pentachlorophenol Concentration along Plume Centerline
Half-life = 0.03 year

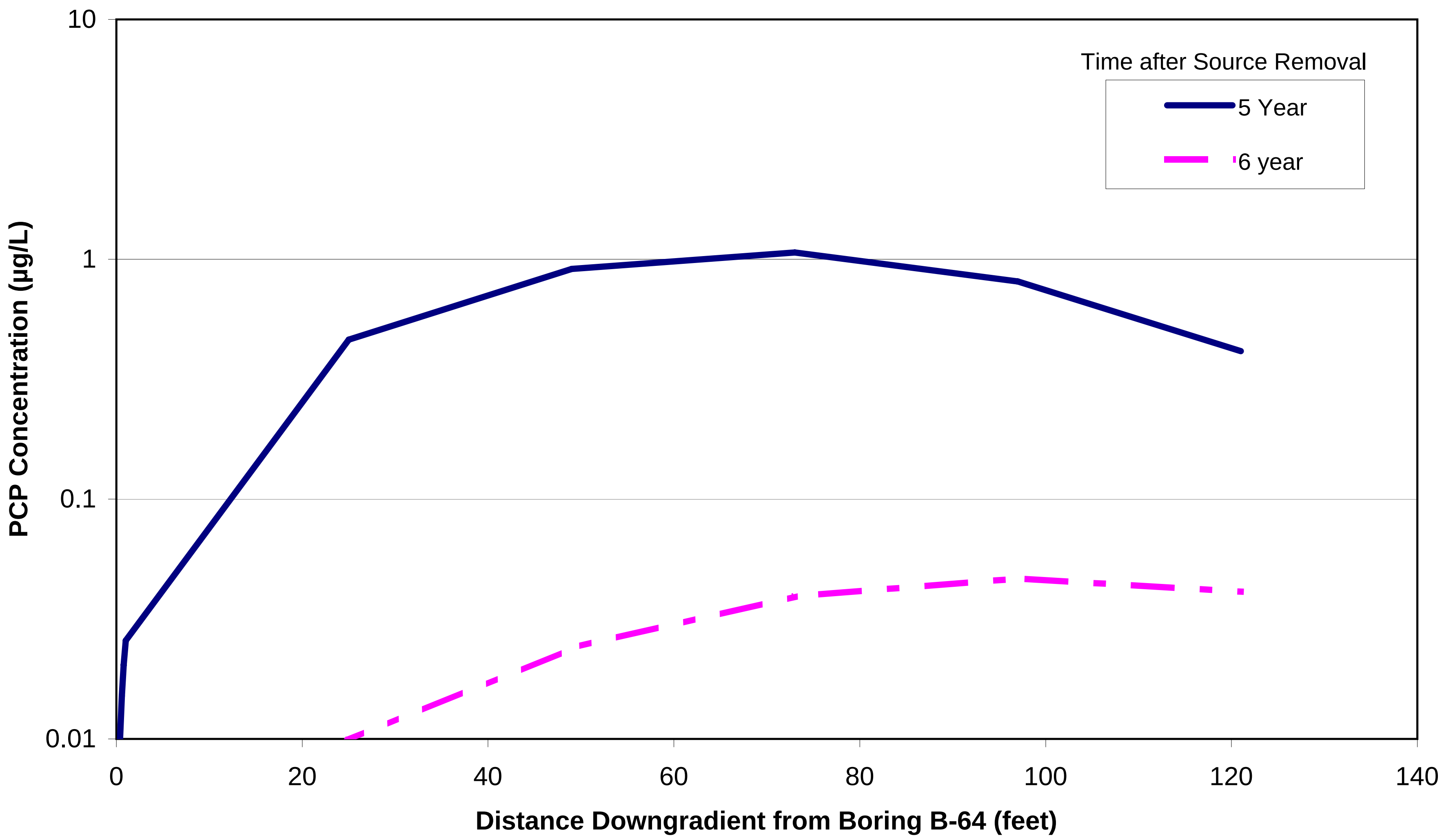

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Figure D-2
Pentachlorophenol Concentration along Plume Centerline
Half-life = 0.12 year