FINAL
MONITORING AND REPORTING PLAN – POST CONSTRUCTION

REMOVAL ACTION
NW NATURAL "GASCO" SITE

Prepared for Submittal to

U.S. Environmental Protection Agency, Region 10
1200 Sixth Avenue
Seattle, Washington 98101

Prepared by

Anchor Environmental, L.L.C.
6650 SW Redwood Lane Suite 110
Portland, Oregon 97224

On behalf of

NW Natural
220 NW Second Avenue
Portland, Oregon 97209

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%R	Percent recovery
Anchor	Anchor Environmental, L.L.C.
AST	Aboveground storage tank
ASTM	American Society for Testing of Materials
BTEX	benzene, toluene, ethylbenzene, and xylene
CAS	Columbia Analytical Service, Inc.
CCB	Continuing Calibration Blank
CCV	Continuous Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHASP	Construction Health and Safety Plan
COC	chain-of-custody
CQAP	Construction Quality Assurance Plan
DEQ	Oregon Department of Environmental Quality
DGPS	Differential Global Positioning System
DNAPL	Dense non-aqueous phase liquid
DQOs	Data Quality Objectives
ECL	Office of Environmental Cleanup
EPA	U.S. Environmental Protection Agency
EST	Environmental Sampling Technologies
FC	Field Coordinator
FSP	Field Sampling Plan
i.d.	inside diameter
ICV	Initial (or Independent) Calibration Verification
LDW	Lower Duwamish Waterway
LWG	Lower Willamette Group
MARP	Monitoring and Reporting Plan
MDL	Method Detection Limit
MRL	Method Reporting Limit
MS/MSD	Matrix Spikes and Matrix Spike Duplicate
NAVD	National Vertical Datum
Order	Administrative Order on Consent

OSC	On-Scene Coordinator
PAH	polycyclic aromatic hydrocarbons
PARCC	Precision, Accuracy, Representativeness, Comparability, and Completeness
ppb	parts per billion
PCB	polychlorinated biphenyl
PM	Project Manager
PRC	permeability/performance reference compound
PTFE	Polytetrafloroethylene
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RAO	Removal Action Objectives
RAPP	Removal Action Progress Plan
RAWP	Removal Action Work Plan
RI/FS	Remedial Investigation/Feasibility Study
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SDG	Sample delivery group
SOPs	Standard Operating Procedures
SOW	Statement of Work
SPMD	semipermeable membrane device
SVOC	semivolatile organic compound
TOC	total organic carbon
TPM	Technical Project Manager
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

1 INTRODUCTION

NW Natural entered into an Administrative Order on Consent (Order) with the U.S. Environmental Protection Agency (EPA) on April 28, 2004 to perform a time-critical removal action at the "Gasco site" (Site) (EPA 2004) (Figure 1). The Order requires that NW Natural perform a number of actions associated with removing a tar body (as defined in the Order) from the riverbank and nearshore sediment adjacent to the site. The extent of the tar body was defined during the design characterization sampling (Figure 2). In accordance with the EPA-approved Final Removal Action Project Plan (RAPP; Anchor 2005), removal of the tar body was initiated in August 2005 and was completed in late October 2005. This Monitoring and Reporting Plan (MARP) describes post-removal monitoring objectives and provides an overview of the monitoring approach, design of the monitoring program (e.g., sampling strategy, station locations and replication, field sampling methods, and laboratory methods), data analysis and interpretation, reporting requirements, post-removal site control, contingency response, and adaptive management. The field monitoring is required by the Order and will provide information necessary to evaluate the performance of the engineered pilot cap, as discussed below. The removal action was an interim action, and the information gathered pursuant to this MARP is not intended to monitor a permanent remedy. However, it is intended to provide information on whether this type of cap (or a similar cap) might be suitable for further evaluation as a permanent remedy here or elsewhere on the Site.

1.1 Project and Data Collection Objectives

1.1.1 RAOs Identified in the SOW

The Removal Action Objectives (RAOs) for the project are defined in Section II of the Statement of Work (SOW) and are reviewed in the RAPP. The objectives that are relevant to post-construction monitoring include evaluating the cap's ability to isolate any residual contamination, monitoring for seepage of product in the low spot created by the removal, and providing information that contributes to the efficient performance of any anticipated long-term remedial actions.

In addition to these RAOs, the capping was also designed to include an engineered pilot sediment remediation cap placed over a portion of the removal area following completion of the dredging (Figure 3). The objectives of the engineered pilot cap are discussed below.

1.1.2 Objectives for Engineered Pilot Cap Study

The purpose of the engineered pilot cap is to place a barrier over a portion of the removed tar body and monitor the performance of the cap until the Portland Harbor RI/FS is completed and EPA selects a final remedy for the Site. The monitoring information collected, as described in this MARP, will be used to help evaluate contaminant loading through the pilot cap due to residual contamination in sediments or any potential migration of contaminants from upland groundwater, and determine whether capping might be an effective remedy for future remediation at the Site. Information from the pilot study will be used in subsequent sediment remediation evaluations for shoreline sediments at the Site. The engineered pilot cap is designed to withstand erosive forces that might reasonably be expected over the next few years while the Site-wide remedial alternatives are evaluated. The engineered pilot cap is not intended as a long-term permanent remedy for this area, although it might be integrated into a wider capping approach should capping be determined to be an effective remedy for the Site.

1.1.3 Data Collection Objectives to Meet RAOs and Pilot Study Objectives

Post-removal action field monitoring is required by the Order and will provide information necessary to evaluate the performance of the engineered pilot cap. Field data collection activities will function to:

- Evaluate the nature and extent of potential seepage of non-aqueous phase liquid (e.g., tar oil and tar) in the bathymetric "low spot" created by the dredging activities
- Evaluate whether groundwater movement from upland sources or through residual sediments occurs that recontaminates the removal action area
- Monitor cap stability over the 3-year design life
- Determine the near-bottom surface water quality overlying the pilot cap for comparison with porewater concentrations within the cap

In addition, for the pilot study portion of the effort, as defined in the Army Corps of Engineers (USACE) Guidance for Subaquaeous Dredged Material Capping (USACE 1998), an engineered cap should function to provide physical isolation of contaminated sediments from biota, stabilize contaminated sediments such that they do not re-

suspend into the water column, and reduce the flux of dissolved contaminants to the water column. Consistent with these functions, monitoring of the engineered pilot cap's effectiveness over time would target the following field data collection objectives:

- Document variations in cap thickness
- Evaluate cap stability
- Document changes in surface sediment quality
- Determine cap porewater quality

2 MONITORING APPROACH

2.1 Monitoring Rationale

To achieve the data collection objectives defined in Section 1.1.3, a variety of field monitoring methods will be employed, as discussed below. Note that because of the placement of several feet of quarry spalls on top of the organo-clay mat, no cores, porewater and/or near-bottom surface water samples will be collected in the organoclay mat area. The effectiveness of the organo-clay mat isolation will be assessed through topside visual inspection (see Section 2.2.1) and documentation of potential seeps and/or sheen stemming from the area of the mat placement (visibility permitting).

2.1.1 Visual Inspection/Diver Survey (RAO specific)

Long-term visual monitoring will be conducted to identify any areas of sheen/product release. In addition, diver surveys will be performed within the pilot cap area and surrounding perimeter of fringe cover (extending to at least 50 feet beyond the cap) to visibly evaluate the nature and extent of potential seepage of product in the bathymetric "low spot" created by the dredging activities and to visibly evaluate the integrity of the engineered pilot cap and surrounding fringe cover areas.

2.1.2 Bathymetric Survey (RAO specific)

Bathymetry surveys will be performed within the entire area previously bounded by the outer area containment system to monitor changes in mudline elevation and assess changes in cap and fringe cover thickness. Physical cores will also be used to assess cap thickness directly. These cores will also fulfill other objectives as discussed below.

2.1.3 Product Seepage Monitoring (RAO specific)

Product seepage monitoring will be performed through the collection of sediment cores (the same cores as noted above), both within and just channelward of the pilot cap area. The subsurface cores collected from the pilot cap will be logged, observed for any signs of product, and subsampled for bulk chemical analyses to monitor temporal and spatial changes in sediment concentrations within the pilot cap. Logging is intended to determine the extent of mixing within the pilot cap (at both the sediment/cap and cap/mudline interfaces) and document whether seepage of non-aqueous phase liquid (e.g., tar oil and tar) is observable. The core samples will be horizontally and vertically

co-located with the porewater samples (discussed below) to facilitate direct comparison of the bulk sediment and porewater concentrations residing within the cap. Initially, each core sample will be analyzed for total solids, total organic carbon (TOC), grain size, cyanide, polycyclic aromatic hydrocarbons (PAHs), benzene, toluene, ethylbenzene, and xylene (BTEX), total metals (i.e., arsenic, chromium, copper, nickel, lead, and zinc), pesticides, and polychlorinated biphenyls (PCBs). This analyte list may be reduced based upon review of the post-dredge sediment characterization results in coordination with EPA. In addition, if a new depositional layer of surface sediment overlies the pilot cap armor layer, this material may be sampled (volume permitting) and analyzed to evaluate whether sediment transport and deposition on the pilot cap may be contributing chemicals to the cap. Samples of depositional sediment will be analyzed for the full list of Portland Harbor Superfund Site contaminants of interest (Integral et al. 2004).

Cores will also be collected through the fringe cap just channelward of the pilot cap to visibly monitor potential seepage of non-aqueous phase liquid (e.g., tar oil and tar) in the bathymetric "low spot" created by the dredging activities. No samples will be collected for chemical analyses from these channelward cores.

2.1.4 Porewater Migration Sampling (Pilot Study Specific)

Migration of chemicals via porewater advection and/or diffusion through the pilot cap will be monitored through the collection of porewater samples within the pilot cap. The porewater stations will be co-located with the core stations (see above). A single porewater sample will be collected at each station from the midpoint of the cap layer (as determined during the co-located core logging) to minimize potential collection of porewater from the underlying sediment-pilot cap mixed layer and the overlying surface water. The porewater analytical results will be evaluated to assess the following: temporal and spatial variations in porewater chemical concentrations within the cap, the relationship with bulk sediment chemistry results (obtained from co-located cores), and the relationship with discrete and time-integrated near-bottom surface water concentrations. This evaluation and comparison of porewater to sediment chemical, surface water chemical, and visual observation results will help determine whether the observed porewater concentrations are due to groundwater transport through the cap,

product seepage, mixing of underlying sediments with cap sediments, mixing of recently deposited sediments with cap sediments and/or surface water recharge or exchange. The porewater samples will be analyzed for TOC, cyanide, PAHs, and BTEX.

2.1.5 Near-Bottom Surface Water Sampling (Pilot Study Specific)

The surface water quality directly overlying the cap and at ambient stations upstream and downstream of the removal action area will be monitored through the collection of near-bottom surface water samples. Both discrete and time-integrated (approximately 1-month in duration) water samples will be collected. The observed discrete and time-integrated near-bottom analytical results will be evaluated to assess the following: temporal and spatial variations in surface water chemical concentrations, the relationship between the discrete and time-integrated concentrations, and the relationship with co-located porewater chemistry results. This evaluation will help identify whether porewater concentrations identified in the pilot cap are due to surface water recharge and/or exchange or other processes noted above. The discrete samples will be analyzed for TOC, cyanide, PAHs, and BTEX, whereas the time-integrated samples will be analyzed for PAHs (i.e., the sampling device is not capable of sampling for BTEX).

2.2 Monitoring Area and Locations

The monitoring area and locations for the visual, diver and bathymetry surveys, coring (observations and sediment chemistry), porewater, and near-bottom surface water monitoring are described below.

2.2.1 Visual Monitoring

Visual monitoring will be conducted from the top of bank, beach and/or the adjacent pipeline structure. These surveys will be conducted from a variety of vantage points to ensure visual coverage of the removal action area.

2.2.2 Diver and Bathymetry Surveys

The diver surveys will encompass the entire pilot cap area plus an approximately 50-foot perimeter outside the pilot cap. The bathymetry survey will extend throughout the entire area previously bounded by the outer containment area (Figure 3).

2.2.3 Sediment Core and Porewater Monitoring

Nine sediment core and porewater monitoring stations will be co-located within the pilot cap area (Figure 4). These stations were selected to provide adequate spatial coverage and targeted areas where the post-dredge surface sediment samples contained the highest chemical concentrations. The number of proposed sediment core and porewater stations may be decreased (in consultation with EPA) following the Year 2 monitoring if the chemical concentration variability observed in the Year 0, Year 1, and Year 2 sampling events is low across the various sampling stations.

In addition, two cores will be collected within the bathymetric "low spot" in the fringe cover area just channelward of the pilot cap (Figure 4) and observed for potential seepage of non-aqueous phase liquid (e.g., tar oil and tar). These cores were placed in the direct vicinity of post-dredge surface sample RAA-PD12, which showed relatively elevated chemical concentrations.

2.2.4 Near-Bottom Surface Water Monitoring

Nine near-bottom discrete and time-integrated surface water samples will be co-located with the sediment core and porewater sampling stations (see above) within the pilot cap area (Figure 4). These stations were co-located to facilitate comparison between the observed porewater and near-bottom surface water concentrations. Based upon the observed relationships between the co-located porewater and near-bottom surface water analytical results, as well as the spatial variability of surface water chemical concentrations, the number of proposed near-bottom surface water stations following the Year 2 monitoring may be decreased (in consultation with EPA). In addition to the nine samples within the pilot cap area, surface water samples will be also be collected and analyzed from two ambient stations. One of the ambient stations will be located approximately 600 feet upstream of the pilot cap area and the other will be located approximately 600 feet downstream of the pilot cap area. These stations will be set at a similar elevation to the cap area and will be used to determine ambient surface water concentrations.

2.3 Monitoring Frequency

The following sections describe the proposed monitoring frequency for the various long-term monitoring activities. It is important to note that additional monitoring may be conducted if flow conditions exceed the design parameters or substantial evidence of other natural or anthropogenic activities indicates a potential for impacts to the engineered pilot cap. As requested by EPA, the proposed monitoring frequency is based on a tiered approach where the results of intensive initial monitoring will help guide the long-term sampling frequency.

2.3.1 Visual Monitoring

Initial visual monitoring will be conducted weekly for a period of 1 month (initiating following EPA-approval of this MARP). From March 2006 through July 2006, visual monitoring will be conducted on a monthly basis unless more frequent monitoring is warranted based on initial monitoring observations. As the river discharge decreases in August 2006, the monitoring frequency will be increased again to once per week to monitor for potential increased erosion due to wave action on the shoreline during low river elevations. Based on the observations gathered during the weekly monitoring, monitoring may be scaled back to monthly through November 2006 in consultation with EPA. The results of the first year of monitoring will be used to determine the appropriate visual monitoring frequency in subsequent years.

2.3.2 Diver and Bathymetry Surveys

Bathymetric changes are most likely to occur following periods of high and low river discharge and variations in river elevation. Mean annual discharges and elevations in the Willamette River in Portland are historically the highest from December through June. Therefore, bathymetry will be collected following the high discharge period and following the low discharge period. Diver surveys will also be conducted to confirm the bathymetric findings and provide visual observations. As requested by EPA, the initial survey frequency during these periods is proposed as follows:

- Year 0: February/March 2006 (diver survey and bathymetry), August 2006 (diver survey and bathymetry), and November 2006 (bathymetry)
- Year 1: August 2007 (diver survey and bathymetry) and November 2007 (bathymetry)

- Year 2: August 2008 (diver survey and bathymetry) and November 2008 (bathymetry).
- Year 3 through implementation of the site-wide remedy: the previous survey data will be reviewed in consultation with EPA to determine whether the current sampling frequency (i.e., semi-annual) can be reduced.

2.3.3 Sediment Core, Porewater, and Discrete and Time-Integrated Near-Bottom Surface Water Monitoring

As requested by EPA, the initial sediment core, porewater, and discrete and time-integrated near-bottom surface water monitoring frequency is proposed as follows during the appropriate hydrologic conditions (see above):

- Year 0: February/March 2006, August 2006, and November 2006
- Year 1: August 2007 and November 2007
- Year 2: August 2008 and November 2008
- Year 3 through implementation of the site-wide remedy: the previous monitoring data will be reviewed in consultation with EPA to determine whether the current sampling frequency (i.e., semi-annual) can be reduced.

Sediment core, porewater, and discrete surface water samples will all be collected at the same time during each sampling event. Integrated surface water sample equipment will be also deployed at these times. This equipment will be retrieved for analysis approximately 1 month later.

2.4 Monitoring Methods

The visual inspection/diver survey, bathymetry, sediment core, porewater, and near-bottom surface water monitoring activities will be conducted in accordance with the Sampling and Analysis Plan (SAP), which consists of the Field Sampling Plan (FSP; Appendix A) and Quality Assurance Project Plan (QAPP; Appendix B).

3 RESULTS REPORTING

3.1 Data Reduction, Analysis, Interpretation, and Reporting

3.1.1 Visual Inspections and Diver Surveys

The visual inspections will serve to identify any areas of sheen/product release from the removal action area. Detailed notes of any areas with sheen/product release and their relationship to the removal action area will be identified on a map (based on visual observations) and photographed. During the diver surveys, the dive crew will document the condition of the engineered cap and immediately surrounding fringe cover areas using video recording equipment and will keep detailed notes of areas, if any, that indicate the presence of subsurface seeps as well as areas with visible accretion or erosion. The information gathered during these surveys will help determine if additional monitoring is necessary to assess general conditions of the cap, stability of the cap material, and any observable product seepage. The visual inspection and diver monitoring results will be summarized in the monitoring reports.

3.1.2 Bathymetry Surveys

The final construction (post-cap) bathymetric survey conducted to verify compliance with the capping design criteria will serve as the baseline to compare with the subsequent monitoring bathymetry surveys. Following completion of each bathymetry survey, an isopach surface and cross sections through the pilot cap area will be created to compare elevation changes of the cap, if any. Changes in bathymetry over time (allowing for the accuracy of the surveys, which will show some level of change that represents "noise" of the measurement technique) will be evaluated to identify areas of erosion, deposition, or consolidation of the engineered pilot cap. To the extent and accuracy possible, elevation changes will be discussed in the monitoring reports. General response actions based on bathymetry and other results are identified in Section 5. The isopach surveys and cross sections will be provided in the monitoring reports.

3.1.3 Sediment Core Characterization

Sediment core sample chemistry concentrations will be tabulated and compared to the first Year 0 sediment chemistry results (anticipated to be collected in February/March 2006). The data will be evaluated to determine if the pilot cap sediment chemical concentrations increase or otherwise change over time. This and other monitoring

information will be used to evaluate whether any changes in cap chemistry indicate groundwater transport through the cap, product seepage, mixing of underlying sediments with cap sediments, mixing of recently deposited sediments with cap sediments and/or surface water recharge or exchange.

In addition, if a layer of depositional surface sediment overlies the armor layer of the engineered pilot cap, this material will be sampled (volume permitting) and the surface sediment analytical results will be compared to the underlying subsurface sediment results to evaluate whether sediment transport and deposition on the engineered pilot cap may be contributing to contamination of the cap layer. The physical characteristics of the surface and subsurface sediments will also be compared over time to assess mixing into the cap layer either from above or below the cap layer. Response actions based on any observations of product seepage results are discussed in Section 5. The core monitoring results, observations, and evaluation will be summarized in the annual monitoring reports.

3.1.4 Porewater Sampling

Pilot cap porewater chemistry analytical results will be tabulated and compared to the concentrations detected in the first Year 0 co-located baseline porewater samples (anticipated to be collected in February/March 2006). This information will be evaluated along with other monitoring results to determine whether any changes in porewater concentrations may be due to groundwater transport through the cap, product seepage, mixing of underlying sediments with cap sediments, mixing of recently deposited sediments with cap sediments and/or surface water recharge or exchange. This evaluation will specifically include comparison of the porewater chemical results to the co-located sediment chemical concentrations. Similarly, the porewater chemical results will be compared to the co-located discrete and time-integrated near-bottom surface water chemical concentrations to assess the loading of dissolved contaminants into the overlying water and/or potential recontamination of the cap layer from the overlying surface water. The porewater migration sampling results and evaluation will be summarized in the annual monitoring reports.

It should be noted that representative porewater samples very close to a cap/underlying sediment interface can be very difficult to collect. Experience on past projects has shown that a number of potential sampling artifacts can occur. Porewater sampling results will always be evaluated in the context of the potential for such artifacts before conclusions are drawn about potential migration rates. Potential artifacts include: difficulty sampling a layer close to the underlying sediments' unobservable physical mixing with layers above or below the cap, inaccuracies in probe location due to small variations in cap thickness leading to collection of porewater from within the underlying sediments, pumping of porewater across the mixing layer (in cases where the probe tip is too close to the cap-sediment interface), pumping of overlying surface water, and disturbance of the cap caused by placement of the probe itself. The sampling protocols listed in the attached SAP (the FSP and QAPP, Appendices A and B, respectively) aim to reduce these sampling artifacts.

3.1.5 Near-Bottom Surface Water Monitoring

For each monitoring event, the discrete and time-integrated near-bottom surface water chemical concentrations will be compared to the co-located porewater chemical concentrations as discussed above to determine if dissolved contaminants are entering the surface water through the cap or if surface water is contributing to chemicals in the cap. In addition, the discrete and time-integrated near bottom surface water concentrations at each station will be compared to evaluate potential temporal variations of the near-bottom surface water chemical concentrations.

3.2 Report Contents

Monitoring reports will evaluate all data collected during the monitoring period and compare this data to previous long-term monitoring data, where applicable. The reports will provide an evaluation of data related to the RAOs and engineered pilot cap objectives as well as summarize comparisons of bulk sediment, porewater, and discrete and time-integrated near-bottom surface water chemical concentrations. At a minimum, the following will be included in each monitoring report:

- Summary of all field activities, including a description of any deviations from the EPA-approved SAP (FSP and QAPP) and/or MARP

- Locations of areas of erosion and/or accretion identified during the visual inspection/diver surveys
- Locations of any visible product or groundwater seeps
- Copy of dive survey video reconnaissance (as an appendix)
- Presentation of bathymetric data and comparison to baseline data
- Location of sediment core, porewater, and near-bottom sampling stations in latitude and longitude coordinates
- Project maps with actual sampling locations
- Final quality assurance/quality control (QA/QC) validation report
- Data results, including electronic copies of field logs, laboratory analysis results, and associated QA/QC data. All electronic data files will be stored in a data management system such as Equis®.
- Comparison of bulk sediment, porewater, and near-bottom surface chemical concentrations during each monitoring period and relative to the baseline conditions
- Recommendations of appropriate changes to the MARP, if necessary, to ensure the continued successful performance of the cap
- Any contingency actions implemented to better comply with the RAOs

3.3 Reporting Schedule

The reports will be prepared and submitted to EPA annually within 60 days of receipt of validated data results from the November monitoring conducted in Year 0 (2006), Year 1 (2007), and Year 2 (2008) monitoring phases, or on a date determined in consultation with EPA. If any results indicate failure of the cap to meet any of the RAO or engineered cap objectives, EPA will be immediately notified via email once the information is known to NW Natural. This will be followed up with results memos as necessary to fully inform EPA of the issue identified and the data relevant to the issue. Such information would also be presented in the annual report along with all other monitoring results for the year.

4 POST-CONSTRUCTION PROJECT CONTROLS

4.1 Proposed Controls

Given the industrial nature of the area, and the small aerial extent of the former tar body, future recreational use of the site is anticipated to be minimal. Thus, the proposed Site controls consist of the following for protection of the capped area:

- Written notification to NW Natural's tenants about the presence of the cap, which will include the following:
  - Instructions and maps that show areas where boat and ship traffic should be minimized and anchoring prohibited
  - Instructions for tugboat operators to direct propeller wash away from the capped area
  - Identification of a preferential tug use area on maps to show operators accessing the adjacent oil pipeline the location of tug work areas adjacent to the pipeline dock
  - Direction that all proposed work in the vicinity of the cap should be cleared with NW Natural prior to starting work
  - Direction that excavation and/or purposeful sediment disturbance shall not be conducted in the capped area
  - Direction that NW Natural shall be notified in the event of any possible damage to the engineered cap
- Posting signs on the beach and oil pipeline. The signs will delineate the general aerial extent of the engineered cap, and prohibit recreational use and boat anchorage in the capped area. The signs will also prescribe a no wake area around and over the cap.
- Placement of buoys with the "no wake" symbol and text surrounding the temporary cap
- As visual observations occur, NW Natural will assess the need for placement of an oil-absorbent boom around the capping area. A specific proposal for the type, configuration, and maintenance of such a boom will be submitted to EPA should this condition occur. It should be noted that the tenant currently leasing the NW Natural oil pipeline facilities has a permanent boom installed at the Site. This boom would act as a second containment barrier for sheens associated with the removal action area should they occur in the short term or over the longer term.

4.2 Documentation Procedures

NW Natural or its representatives will maintain a record of all correspondence with its tenants, if any, documenting any potential damage to the engineered cap. The condition of the engineered cap and ongoing monitoring results will be reported to EPA in the monitoring reports.

4.3 Notification Procedures

In the event of potential damage to the cap, NW Natural will notify EPA and provide EPA with a proposed response. EPA will also be involved in all levels of the tiered adaptive management process described in Section 5.2.

5 CONTINGENCY RESPONSE AND ADAPTIVE MANAGEMENT PROCESS

5.1 Contingency Response Approach

If a condition occurs that requires attention, a tiered adaptive management process will be implemented. The following conditions could occur in the capped area that would potentially lead to a contingency response:

- The physical integrity of the cap is compromised (such as identification of scour or other damage in the capped area).
- Identification of product seeps through the cap.

If either of these conditions is identified during the cap monitoring program, a tiered contingency response approach will be followed as described in this section. It should be noted that porewater and near-bottom surface water monitoring results will not be evaluated in the context of contingency response because these data are being collected solely for pilot cap evaluation purposes.

5.2 Tiered Adaptive Management Process

In the tiered adaptive management process, the contingency response would follow a sequence of actions once a trigger has been identified by the monitoring program. The adaptive management process is a hierarchy that describes the order in which each action would occur. The following levels of approach will be used when a trigger has been identified:

- Level 1: Once an issue has been identified (e.g., bathymetry survey or diver survey shows significant erosion of the cap), the data will be re-examined, and additional data analyses will be performed as necessary. EPA and NW Natural will evaluate the initial data and review any additional analyses performed.
- Level 2: If the issue is not resolved during the Level 1 response, additional data collection will be performed. For example, if a core sample through the cap indicates the cap has been eroded, another core sample would be collected to verify the condition identified, and to better delineate the area over which the condition is occurring if necessary. NW Natural and EPA would evaluate the original and new data to determine if the issue requires additional response.
- Level 3: If the Level 1 and Level 2 response tiers indicate that further action is necessary, appropriate actions will be coordinated with EPA. While the Level 3 tier

would typically follow the Level 1 and Level 2 actions, there could be times where it is appropriate to initiate a Level 3 action immediately without the additional analyses and data collection in Level 1 or Level 2.

Two scenarios that will require a contingency response following completion of the level 1 and level 2 response actions include: 1) the identification of non-aqueous phase liquid above the cap or in the bathymetric "low spot" created by the removal, and/or 2) significant erosion of the cap that compromises the cap's ability to provide an effective physical barrier to underlying contamination. If either of these scenarios are identified and documented through the Level 1 and Level 2 response actions, NW Natural will assess placement of additional cap material in the affected areas (in consultation with EPA).

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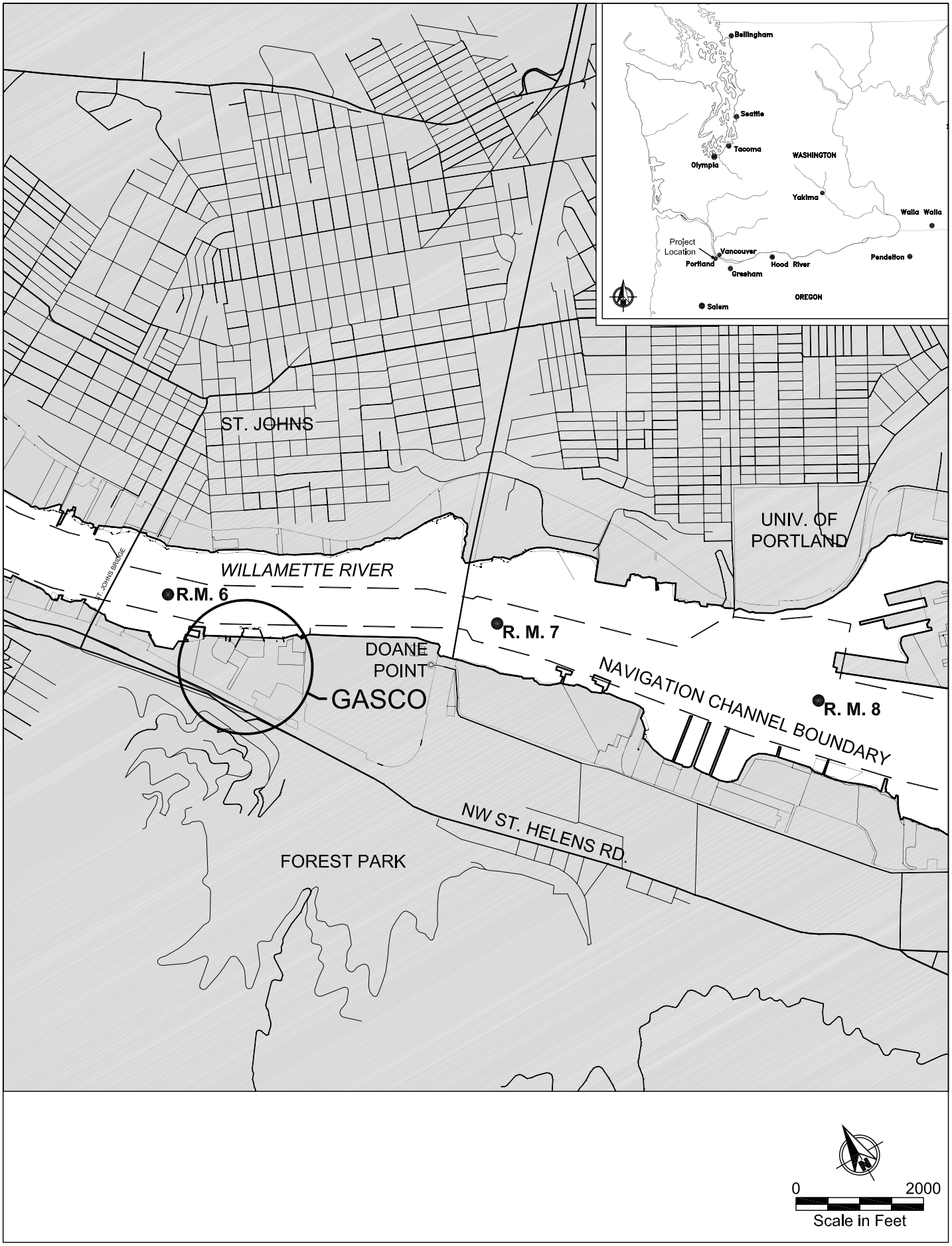
FIGURES



Oct 03, 2005 10:07am dholmer K:\Jobs\000029-GASCO\00002902\00002902-01.dwg FIG 1

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 1
Vicinity Map
NW Natural "Gasco" Site

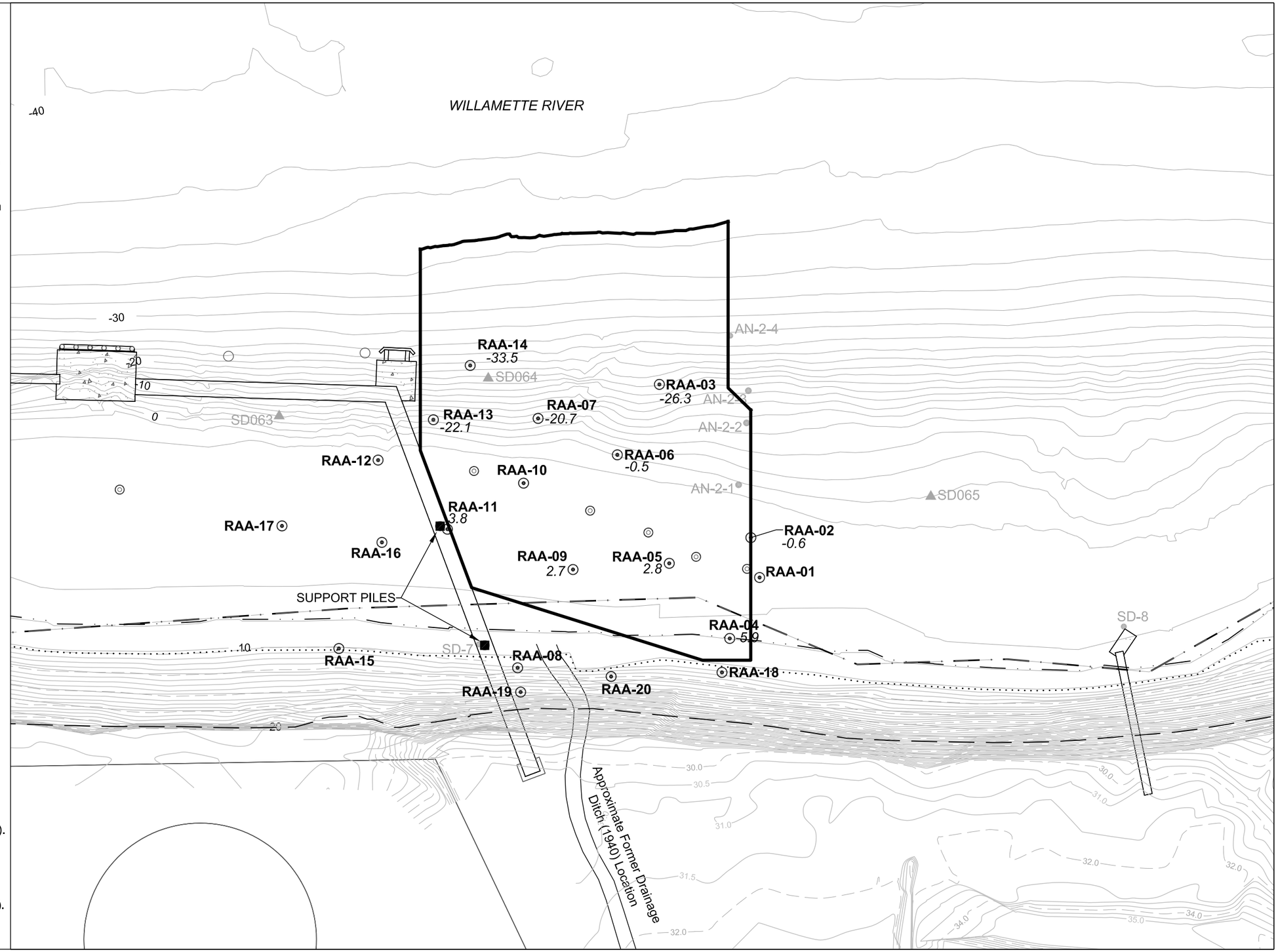
Legend:

- Lateral Extents of Suface Tar Body in Removal Action Area
- RAA-01 Design Characterization Sediment Core Location (Anchor 2004)
- -33.5 Bottom Elevation of Surface Tar Body in Removal Action Area (ft NAVD 88)
- Pile Location (surveyed August 2004)
- AN-2-1 Previous Sediment Core Location (Anchor 2002)
- SD063 Previous Sediment Core Location (Weston 1998)
- SD-7 Previous Sediment Core Location (HAI 1996)
- Support Pile Locations (to be protected during dredging)
- Property Line
- OHW = 20.41 ft NAVD 88
- OLW = 7.91 ft NAVD 88
- 50% River Stage Elevation = 10.23 ft NAVD 88

0 50
Scale in Feet

Notes:

1. Bathymetric contours provided by the Lower Willamette Group as part of the Portland Harbor Superfund Site study (2003).
2. Upland topography directed by Anchor Environmental as part of upland investigation (2002).
3. Horizontal Datum: Oregon State Plane North NAD 83 (ft).
4. Vertical Datum: NAVD 88 (ft).
5. Former Drainage Ditch location from Phase 1 Remedial Investigation Summary Report (HAI 1998).



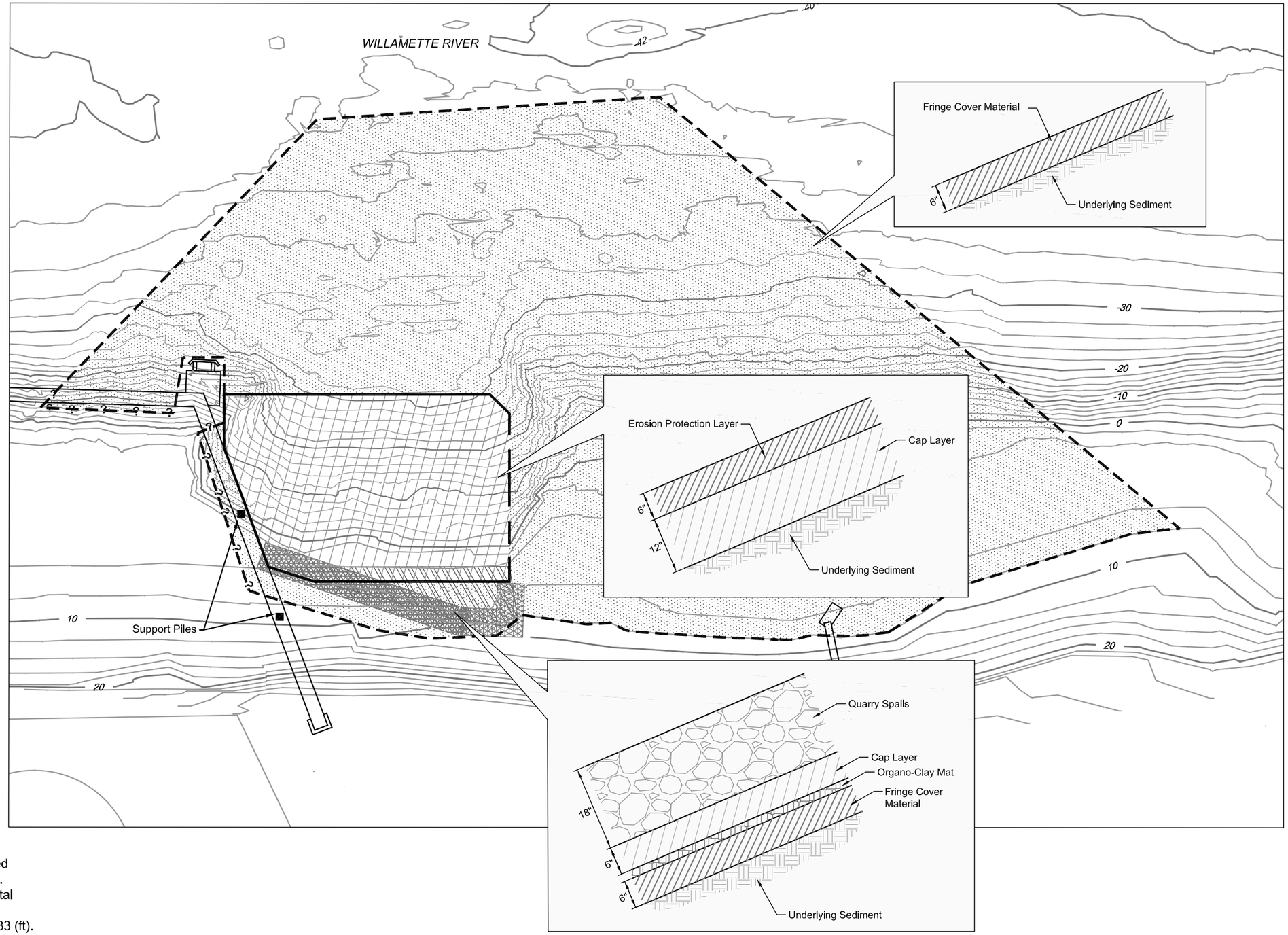
Feb 06, 2006 3:24pm dholmer K:\Jobs\000029-GASCO\0000290\0000290\0000290\2-62.dwg FIG 2

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 2
Former Pre-Removal Lateral and Vertical Extents of Surface Tar Body
NW Natural "Gasco" Site

Legend:

- Support Pile Location
- Extent and Elevation of 18 in Thick Cap
- Extent and Elevation of 6 in Thick Cover
- Reactive Core Geotextile Mat (RCM) Location
- Lateral Extents of Surf Zone Armoring d50 = 3 inches



0 60
Scale in Feet

Notes:
1. Bathymetric contours produced from survey provided by Blue Water Engineering dated October 31, 2005.
2. Upland topography directed by Anchor Environmental as part of upland investigation (2002).
3. Horizontal Datum: Oregon State Plane North NAD 83 (ft).
4. Vertical Datum: NAVD 88 (ft).

Dec 19, 2005 8:31am dholmer K:\Jobs\000029-GASCO\00002902\00002902-130.dwg FIG 3

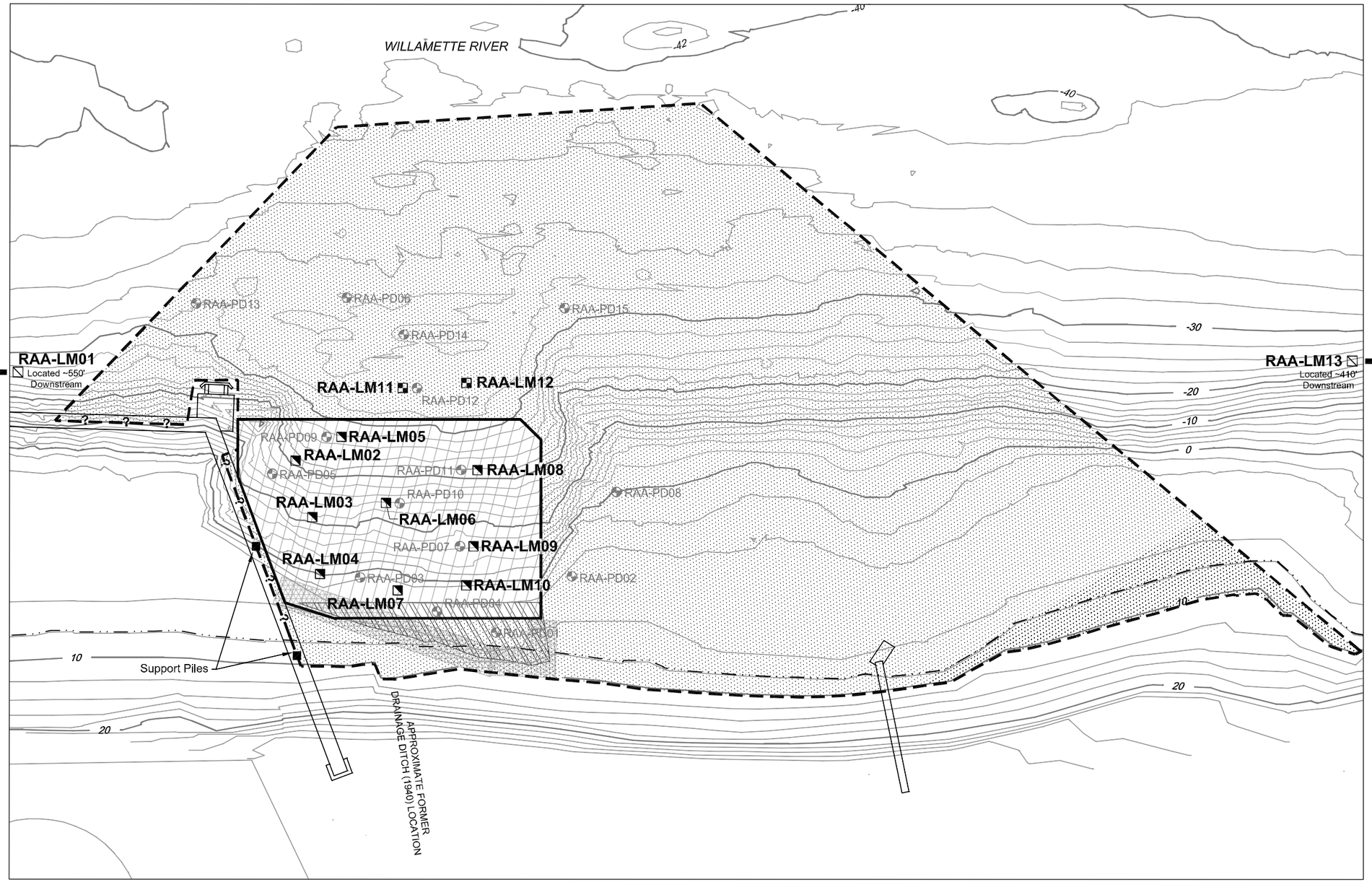
ANCHOR ENVIRONMENTAL, L.L.C.

Figure 3
Post-Cap and Cover Bathymetry and Organo-Clay Mat Location
NW Natural "Gasco" Site

Legend:

- Support Pile Location
- Extent and Elevation of 18 in Thick Cap
- Extent and Elevation of 6 in Thick Cover
- Reactive Organo-Clay Mat (RCM) Location
- Lateral Extents of Surf Zone Armoring d50 = 3 inches
- **RAA-LM02** Proposed Co-Located Core, Porewater & Near-Bottom Surface Water Samples
- **RAA-LM01** Proposed Background Near-Bottom Surface Water Sample
- **RAA-LM11** Proposed Seepage Monitoring Core
- RAA-PD13 Post-Dredge Surface Sediment Sample (October 2005)

0 60
Scale in Feet



Notes:
1. Post-cap bathymetric contours produced from survey provided by Blue Water Engineering dated October 31, 2005.
2. Upland topography directed by Anchor Environmental as part of upland investigation (2002).
3. Horizontal Datum: Oregon State Plane North NAD 83 (ft).
4. Vertical Datum: NAVD 88 (ft).
5. Former Drainage Ditch location from Phase 1 Remedial Investigation Summary Report (HAI 1998).

Jan 23, 2006 8:38am dholmer K:\Jobs\000029-GASCO\00002902\00002902-130.dwg LONG TERM SAMPLE

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 4
Proposed Long-Term Monitoring Sampling Stations
NW Natural "Gasco" Site