Project No.: 070188-001-11

November 9, 2010

To:	Brian Sato, Department of Ecology Northwest Regional Office
	Charles San Juan, Department of Ecology Headquarters
cc:	Brian Gouran, Port of Bellingham
From:	**Jay W. Chennault, PE, LHG** Project Hydrologist
	Steve J. Germiat, LHG, CGWP Senior Associate Hydrogeologist
Re:	**Addendum 2 to RI/FS Work Plan** GP West Site, Bellingham, Washington

1 Introduction

We are submitting for Ecology review and discussion this Addendum 2 to the Remedial Investigation/Feasibility Study (RI/FS) Work Plan for the GP West Site (Site) in Bellingham, Washington.

Based on the findings of the draft remedial investigation (RI) (Aspect, 2010), prepared in accordance with Agreed Order No. 6834, the Port is proposing the following focused investigation to support scoping, cost estimating, and design of potential early interim remedial actions (IRAs) that would address areas of known contamination on the Site, and to further inform the RI/FS. If IRAs are determined to be warranted, they would be conducted under an amendment to Agreed Order No. 6834 with public comment.

This Addendum describes pre-design investigations in four areas of the Site (Figure 1):

- Mercury source area of the Caustic Plume Subarea;
- Law-1 area of the Confined Nearshore Fill/Chemfix Subarea;
- Million Gallon Tanks Subarea; and
- Bunker C Tank Subarea.

2 Project Management Strategy

The GP West Site RI/FS is being conducted by Aspect Consulting, LLC (Aspect) on behalf of the Port, in accordance with WAC 173-340-350 and Agreed Order No. 6834. Ecology is providing regulatory oversight of the RI/FS activities, including the investigation work proposed herein, in accordance with Agreed Order No. 6834.

2.1 Project Team

The project coordinators designated in the Agreed Order are Brian Sato, PE, for Ecology, and Brian Gouran, LG, for the Port.

The consultant project team consists of representatives from Aspect and its subconsultants and subcontractors, consistent with the RI work conducted to date. Aspect's lead personnel and their roles for this work include:

- Steve Germiat, LHG, is the project manager with final authority and responsibility for the consultant team's activities; and
- Jay Chennault, PE, LHG, is the investigation task manager, responsible for directing the field program and managing and reporting the data.

Aspect will also use other licensed hydrogeologists and engineers, and field geologists, for completion of this work.

Aspect's primary subconsultants for the IRA investigation include:

- Pyron Environmental, providing data quality validation for newly collected data; and
- Wilson Engineering, providing surveying.

Aspect's primary subcontractors for the project include:

- Columbia Analytical Services, providing analytical laboratory services for soil and water samples;
- Frontier Geosciences, providing analytical laboratory services for mercury in soil vapor samples;
- Air Toxics, providing analytical laboratory services for petroleum hydrocarbons in soil vapor samples; and
- Pacific Northwest Probe & Drilling, Inc., providing direct push drilling and construction of soil borings, monitoring wells, and soil vapor probes.

2.2 IRA Pre-Design Investigation Tasks

The IRA Investigation will consist of the following primary tasks:

- **Prepare RI/FS Work Plan Addendum Outlining the Proposed IRA Investigation.** This Addendum describes the planned tasks to be accomplished to complete investigations supporting evaluation and scoping of potential IRAs in the defined areas. The Addendum will be reviewed and approved by Ecology prior to initiating the tasks.
- **Conduct Field Data Collection Program.** Following Ecology approval of the proposed investigation, a soil, groundwater, and soil vapor (air) sampling and analysis program will be conducted to supplement the existing Site data and facilitate pre-design scoping and cost estimating of potential IRAs.

- **Evaluate New Data and Prepare IRA Pre-Remedial Design Investigation Report**. Following the completion of the field data collection program, an IRA Pre-Remedial Design Investigation Report will be prepared to document the investigation findings. A report will be submitted to Ecology for review. The investigation findings will be used to further evaluate the practicality and timing for conducting one or more IRAs, including environmental review (SEPA), permitting substantive requirements, Agreed Order amendment, and public participation.

2.3 Data Management

The new validated analytical data collected during the IRA investigation will be incorporated into the existing project RI/FS database maintained by Aspect. This will include exploration coordinates for horizontal position, monitoring well top-of-casing elevations, and field parameter measurements collected during groundwater sampling. The new data will be uploaded to Ecology's EIM database, in accordance with the Agreed Order. Field documentation will be conducted consistent with the RI/FS Work Plan Sampling and Analysis Plan (SAP; Appendix C of Aspect, 2009). The new data will also be incorporated into the Draft RI for Public Comment.

2.4 Schedule

The tentative schedule milestones for the IRA investigation are as follows:

- Finalize discussions with Ecology regarding the proposed investigation in November 2010;
- Conduct the first phase of field sampling and analysis in December 2010, and the second phase of sampling and analysis in January 2011;
- Submit to Ecology an IRA Pre-Remedial Design Investigation Report in March 2010; and
- In April 2010, begin incorporating information presented in the IRA Pre-Remedial Design Investigation Report, and Ecology comments on it, into the Draft RI for Public Comment.

3 Pre-Design Investigations

This section describes the proposed investigations in the four areas of the Site being considered for potential early IRAs. The purpose of the work is to collect data as necessary to complete scoping, cost estimating, and design of IRAs, should the Port choose to conduct them. The investigation builds on previous data presented in the draft RI (Aspect, 2010). The sampling and analysis described below will be conducted in accordance with the procedures outlined in the Sampling and Analysis Plan and Quality Assurance Project Plan of the Site RI/FS Work Plan (Appendices C and D of Aspect, 2009).

3.1 Mercury Source Area of Caustic Plume Subarea

Elevated soil mercury concentrations occur below the water table in the area of the former Chlor-Alkali plant where process wastewaters and sludges were managed, notably at the location of the former 72 Catch Basin (up to 30,000 milligrams/kilograms [mg/kg] mercury). Soil vapor mercury concentrations in this area exceed the industrial air screening level by two orders of magnitude and the OSHA permissible exposure limit (PEL) by 6 times or more. Figure 2 shows this area of the Site, and displays the inferred areas of soil mercury above the 24 mg/kg unrestricted soil screening level and 1,050 mg/kg industrial soil screening level applied in the draft RI, and the inferred area of

mercury soil vapor concentrations above the 1.4 µg/m^3 unrestricted air screening level. The soil mercury in this area is also a source for elevated dissolved-phase mercury in groundwater (caustic plume). The RI data indicate that the areas with highest mercury concentrations in soil vapor versus groundwater do not overlap spatially, and the locations of highest dissolved-phase mercury do not have elevated vapor-phase mercury concentrations. The data suggest that elemental mercury serving as a vapor source may be present in shallow soils, or possibly buried process sumps etc., above the water table in this area. However, such a source is not currently identified.

The following investigation approach is proposed to further delineate the mercury source area, and, if warranted, support scoping/cost estimating for a potential early IRA in this area:

- Drill and sample soil[1] in 15 new soil borings (CP-SB02 through CP-SB13, CP-MW13, CP-MW-14, and CP-MW15; Figure 2) to a depth of 20 feet within and around the currently identified area of elevated mercury vapor concentrations, located as follows:
  - CP-SB02, CP-SB03, and CP-SB04 within the footprints of the Mercury Reclaim Storage Tank, Wastewater Collection Tank, and Wastewater Surge Storage Tank, respectively. If refusal on foundations etc. occurs during drilling, the exploration will be moved to the edge of the foundation etc. as necessary (true for all proposed explorations);
  - CP-MW13 in the approximate center of the former 72 Catch Basin, and CP-SB05, CP-SB06, and CP-SB07 on the north, east, and south sides of it (CP-SB06 within the footprint of the Mercury Recovery [Remerc] facility);
  - CP-SB08 at the Brine Saturators and CP-SB09 at the Sump northeast of them;
  - CP-SB10, CP-SB11, and CP-SB12 within the footprints of the Clarifier and the two Caustic Tanks;
  - CP-MW14 between the northern Caustic Tank and Clarifier, and CP-MW15 in the footprint of the Caustic Filter House; and
  - CP-SB13 in the area of former process tanks immediately west of the Mercury Cell Building.
- Analyze five soil samples from each boring for total mercury to document the vertical distribution of soil mercury (potential source soils). Collect soil samples for analysis from depths of 1 to 2, 2 to 3, 4 to 5, 8 to 9, and 12 to 14 feet below grade; the sample depths may be adjusted based on field screening/observations or sample recovery. Analyze the two samples with highest total mercury concentrations for TCLP mercury to help evaluate soil disposal options in a potential removal action.
- Complete three of the borings as Fill Unit monitoring wells within inferred mercury source areas, including the footprint of the 72 Catch Basin (CP-MW13), between the Caustic Tanks and Clarifier (CP-MW14), and the Caustic Filter House (CP-MW15). Sample groundwater once from the three new wells for dissolved mercury, sulfide, sulfate, dissolved organic carbon, dissolved iron and manganese, alkalinity, total dissolved solids

[1] Soils in the recovered core will also be screened in the field for soil pH.

(TDS), and field parameters to better evaluate the correlation of dissolved-phase mercury and vapor-phase mercury within the area of elevated vapor concentrations, and provide geochemical information to assist with mercury transport assessment. Monitoring wells will be 3/4-inch diameter with pre-packed 5-foot well screens set at a depth interval to intercept the highest soil pH (field screening) readings.

- In a second mobilization, install four soil vapor probes, located based on the collective soil and groundwater data. Frontier Geosciences will conduct the mercury vapor sampling and analyses, consistent with the RI data collection to date and in accordance with methodology presented in the RI/FS Work Plan (Aspect, 2009). There are no generic soil screening levels based on vapor intrusion; rather, Ecology's (2009) draft guidance for evaluating vapor intrusion recommends that empirical soil vapor data be used to assess vadose soil concentrations protective of vapor intrusion.

3.2 Law-1 Area

Monitoring well Law-1, on the Log Pond shoreline within the Confined Nearshore Fill Subarea, has anomalously high dissolved mercury concentrations in groundwater. A source for the dissolved mercury at Law-1 is currently uncertain, since soil mercury concentrations at that well location are low, and a well just upgradient, within the footprint of the former Wastewater Settling Basin, shows much lower dissolved mercury. Given its location, an early IRA may be warranted in this area to provide protection of the Log Pond's ecological environment. Therefore, the objective of the additional investigation is to document the source of elevated dissolved mercury at monitoring well Law-1, the extent of elevated dissolved mercury in groundwater around Law-1, and whether the groundwater poses a risk to the Log Pond's ecological environment.

The following investigation will be conducted to better define the source(s), magnitude, and extent of mercury in groundwater at Law-1, and help determine whether an early IRA is warranted:

- Drill by direct push, sample soil[2], and install/develop five new Fill Unit monitoring wells around Law-1 (Figure 3) to better document the source and extent of dissolved-phase mercury. Install one well (L1-MW1) as close as practical to Law-1 to verify conditions in the immediate vicinity, and thereby assess whether the Law-1 groundwater data may be biased by faulty well construction or damage. Install two wells west and east (L1-MW2 and L1-MW3) to define the lateral extent cross gradient of Law-1, and two wells (L1-MW4 and L1-MW5) south (upgradient) of Law-1 to better assess conditions in the northern end of the former Settling Basin. Monitoring wells will be 3/4-inch diameter with pre-packed 5-foot well screens set at a depth interval to intercept the highest soil pH readings. Analyze five soil samples from each well boring for total mercury. Collect soil samples for analysis from depths of 4 to 5, 7 to 9, 11 to 12, 13 to 14, and 15 to 16 feet below grade; the sample depths may be adjusted based on field screening/observations or sample recovery. Analyze two soil samples with highest total mercury concentrations for TCLP mercury to help evaluate soil disposal options for a potential removal action.
- Manually install one temporary well point (L1-WP1) in the intertidal shoreline due north of Law-1 (Figure 3) to monitor groundwater quality just prior to its discharge to surface

[2] Soils in the recovered core will also be screened in the field for soil pH.

water. The well point will be constructed as a 3-foot segment of 1.25-inch-diameter stainless steel screen with steel riser pipe, connected with threaded coupler and topped with a steel drive cap. The well point will be driven with sledge hammer such that the top of well screen is approximately 1.5 feet below grade.

- Sample groundwater once during low tide from the five new wells, the new temporary well point, and four existing Fill Unit monitoring wells Law-1, CP-MW03, CP-MW10, and AMW-01. Analyze the ten groundwater samples for dissolved mercury, sulfide, sulfate, dissolved organic carbon, dissolved iron and manganese, alkalinity, TDS, and field parameters.

3.3 Million Gallon Tanks Subarea

The RI data for the Million Gallon Tanks subarea indicate a localized volume of soil containing total petroleum hydrocarbon (TPH) concentrations in the range of 10,000 mg/kg (the TPH concentration proposed in the draft RI as a screening level based on residual saturation), suggesting a possible source of mobile free product; however, free product is not observed in subarea monitoring wells. In addition, soil beneath and next to the former oil storage tank (Tank 2) contains naphthalenes concentrations above the RI soil screening level based on the soil-to-groundwater-to-vapor pathway. Figure 4 depicts inferred extents of soil with TPH and naphthalenes concentrations above the unrestricted soil screening levels applied in the RI. Although measured groundwater naphthalenes concentrations are below the 170 micrograms per liter (µg/L) RI screening level based on the groundwater-to-vapor pathway, Ecology has indicated that vapor intrusion in this subarea could drive more stringent soil cleanup levels than those based on protecting surface water or human direct contact. Furthermore, it appears the soils containing elevated hydrocarbon concentrations appear to be relatively localized and accessible, therefore a potential early IRA could also be considered for this subarea.

Consequently, the following investigation is proposed to support scoping/cost estimating for a potential early IRA in this subarea:

- Drill and sample soil in eight soil borings to a depth of 20 feet (MG-SB11 through MG-SB16, and MG-MW04 and MG-MW05; Figure 4) and analyze five soil samples from each boring for diesel- and oil-range petroleum (NWTPH-Dx) to better refine the volume of soil that may warrant removal. Select two soil samples from each boring for polycyclic aromatic hydrocarbon (PAH) analysis based on TPH results. Collect soil samples for analysis from depths of 2 to 3, 5 to 6, 7 to 8, 9 to 10, and 12 to 13 feet below grade; the sample depths may be adjusted based on field observations or sample recovery. Select six soil samples from the subarea (without obvious TPH contamination) for analysis of soil total organic carbon (TOC) to allow more accurate subarea-specific evaluation of the soil-leaching-to-groundwater pathway, and select three soil samples from the subarea for extractable petroleum hydrocarbon (EPH) analysis to refine the current analysis of risk-based soil cleanup levels.
- Complete two of the borings as Fill Unit monitoring wells MG-MW04 and MG-MW05 (3/4-inch diameter with pre-packed 5-foot well screens set at a depth interval based on field observations). Sample groundwater once from the two new wells and three existing

wells (MG-MW01, MG-MW03, EMW-16S) and analyze the five groundwater samples for TPH-Dx, EPH, PAHs, total suspended solids (TSS), and field parameters.

- In a second mobilization, install four soil vapor probes. The vapor locations are not shown on Figure 4 because they will be positioned to provide empirical soil vapor data, based on samples from the first mobilization with elevated TPH/naphthalenes concentrations in soil and/or groundwater. Analyze the soil vapor samples for petroleum fractions (C5-C6, C6-C8, C8-C10, C10-12 aliphatics; C8-10, C10-C12 aromatics) and naphthalene using Air Toxics laboratory's Method TO15-APH. Appendix A provides the Methods Manual Sections from Air Toxics' Standard Operating Procedure for the TO15-APH analytical method, which outlines their method modifications and quality control requirements. The soil vapor data will provide for empirical assessment of vapor intrusion risk and thereby establish appropriate soil and groundwater cleanup levels/remediation levels for the subarea.

3.4 Bunker C Tank Subarea

Bunker C oil-saturated soil exists beneath the former Bunker C storage tank, and soil TPH concentrations are high enough (above residual saturation) that it may continue to generate mobile free product. As evidence of this, there is a thin accumulation of free product on the water table at monitoring well BC-MW01 located next to the former tank. Lower soil concentrations of Bunker C extend away from the former tank. Figure 5 depicts the inferred extents of soil TPH above the 2,000 mg/kg unrestricted soil screening level applied in the draft RI, and above the 10,000 mg/kg concentration proposed in the draft RI as a screening level based on residual saturation.

Given the substantial mass of petroleum contamination beneath the former Bunker C storage tank, and its proximity to the Whatcom Waterway, an early IRA may be warranted for this subarea. However, design of such a removal action would require additional soil characterization to better estimate soil volumes and consideration of shoreline geotechnical and structural (bulkhead) issues as well as permitting. In addition, Ecology has indicated that potential vapor intrusion risks posed by the residual petroleum could drive more stringent soil cleanup levels than those based on protecting surface water or human direct contact. Consequently, the following investigation is proposed to support scoping/cost estimating for a potential early IRA in this subarea:

- Drill and sample soil in 12 new soil borings (BC-SB11 through BC-SB20, BC-MW04, and BC-MW05; Figure 5) to a depth of 20 feet and analyze six soil samples from each boring for diesel- and oil-range petroleum (NWTPH-Dx), to better refine soil volumes. Collect soil samples for analysis from depths of 3 to 4, 6 to 7, 9 to 10, 12 to 13, 15 to 16, and 18 to 19 feet below grade; the sample depths may be adjusted based on field observations or sample recovery. Select two soil samples from each boring for PAH analysis based on TPH results. In addition, select six soil samples from the subarea (without obvious TPH contamination) for analysis of soil TOC to allow more accurate subarea-specific evaluation of the soil-leaching-to-groundwater pathway, and select three soil samples from the subarea for EPH analysis to refine the current analysis of risk-based soil cleanup levels.
- Complete two of the borings as Fill Unit monitoring wells BC-MW04 and BC-MW05 (3/4-inch diameter with pre-packed 5-foot well screens) to provide additional empirical groundwater quality data to support assessment of the groundwater-to-air pathway. Sample

groundwater once during low tide from the two new wells and three existing wells (BC-MW01, BC-MW02, BC-MW03) and analyze the five groundwater samples for NWTPH-Dx, EPH, PAHs, TSS, and field parameters.

- In a second mobilization, install and sample four soil vapor probes, located based on the collective soil and groundwater data (thus locations not shown on Figure 5). Analyze the soil vapor samples for petroleum fractions and naphthalene using Air Toxics laboratory's Method TO15-APH. The soil vapor data will provide for empirical assessment of vapor intrusion risk and thereby establish appropriate soil and groundwater cleanup levels/remediation levels for the subarea.

3.5 Data Evaluation and Reporting

All new data will undergo independent data quality review, and the new analytical data will be imported into the existing Site database. The validated new data will be uploaded to Ecology's EIM database with the other RI/FS data, in accordance with the Agreed Order.

An IRA Pre-Remedial Design Investigation Report will be prepared to document the investigation activities and findings. The new data will be tabulated and, using the new and existing data, the refined contaminant distributions will be illustrated graphically. The new data will be integrated to propose revised TPH soil screening levels based on direct contact and leaching to groundwater, and the empirical soil vapor data for mercury and TPH will be used to refine soil and groundwater screening levels based on the vapor intrusion pathway. A draft report will be submitted to Ecology for review. Ecology comments will be addressed and a final version prepared. The new data and findings will also be incorporated into the Draft RI/FS for public comment.

4 References

Aspect, 2009, RI/FS Work Plan, Georgia Pacific West Site, Bellingham, Washington, September 10, 2009.

Aspect, 2010, Remedial Investigation, Georgia-Pacific West Site, Bellingham, Washington, Draft, September, 29, 2010.

Ecology, 2009, Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action, Review Draft, October 2009, Ecology publication no. 09-09-047.

Limitations

Work for this project was performed and this document prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. It is intended for the exclusive use of Port of Bellingham for specific application to the referenced property. This document does not represent a legal opinion. No other warranty, expressed or implied, is made.

Attachments

Figure 1 - Potential Areas for Interim Remedial Actions
Figure 2 - Proposed Explorations for Mercury Source Area
Figure 3 - Proposed Explorations for Law-1 Area
Figure 4 - Proposed Explorations, Million Gallon Tanks Subarea
Figure 5 - Proposed Explorations, Bunker C Tank Subarea
Appendix A - Quality Control Information for Air Toxics LTD's TO15-APH Analytical Method (Air-Phase Petroleum Hydrocarbons)

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Whatcom Waterway

WHATCOM CREEK WATERWAY

Law-1 Area

Mercury Source Area of Caustic Plume Subarea

Million Gallon Tanks Subarea

Bunker C Tank Subarea

"ENCOGEN NW" 160 MW CO-GENERATION PLANT

CORNWALL AVENUE

LAUREL STREET

0 100 200 400 600 800 Feet

Areas Considered for Interim Remedial Action

DRAFT

MILL NORTH

TRUE NORTH

45°

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Potential Areas for Interim Remedial Actions

Interim Action Investigation, GP West Site - Bellingham, WA

DATE: Oct 2010	PROJECT NO. 070188
DESIGNED BY: SJG	
DRAWN BY: PPW	FIGURE NO. 1
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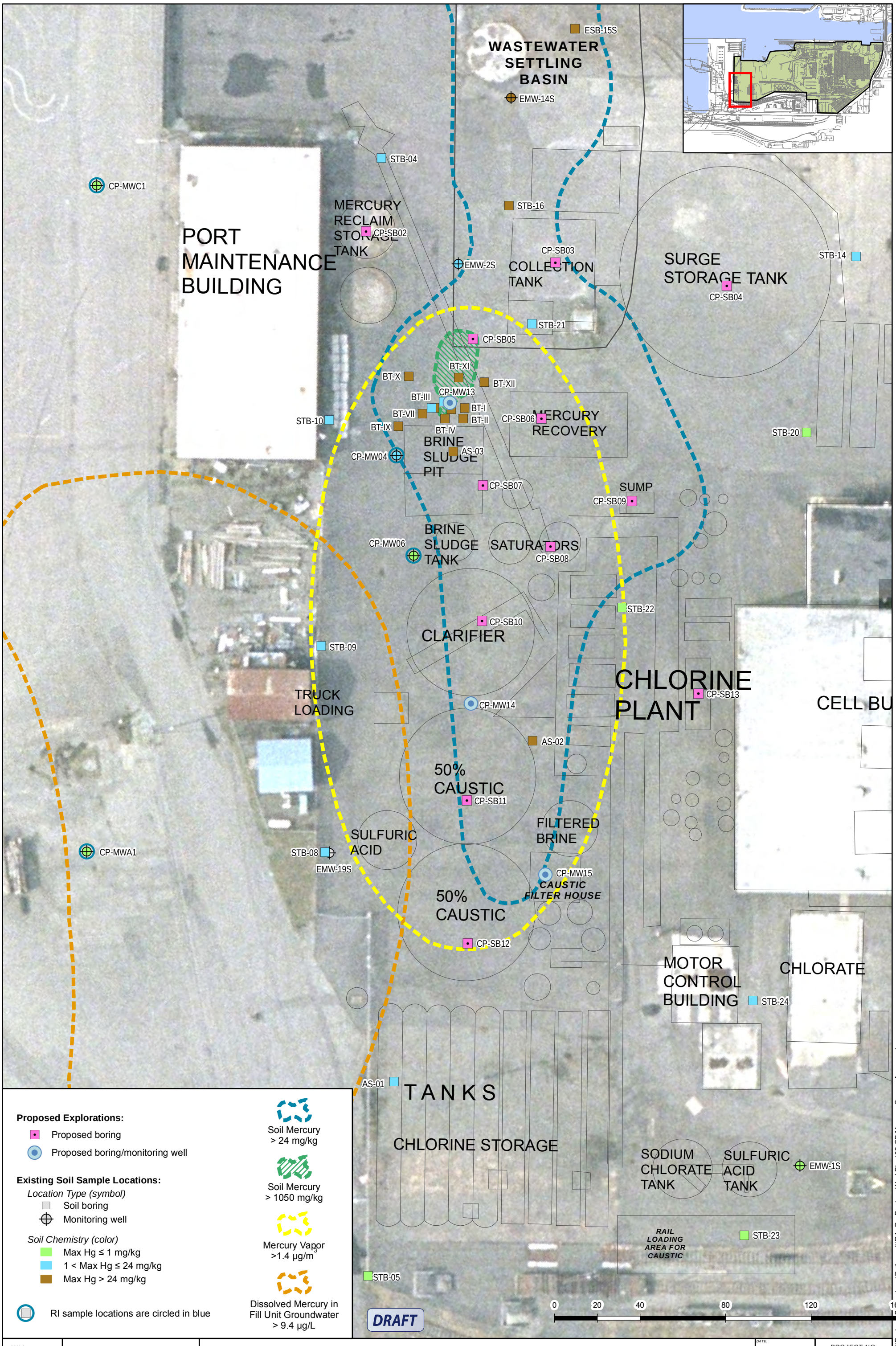

Proposed Explorations:

- Proposed boring
- Proposed boring/monitoring well

Existing Soil Sample Locations:

Location Type (symbol)

- Soil boring
- Monitoring well

Soil Chemistry (color)

- Max Hg ≤ 1 mg/kg
- 1 < Max Hg ≤ 24 mg/kg
- Max Hg > 24 mg/kg

RI sample locations are circled in blue

- Soil Mercury > 24 mg/kg
- Soil Mercury > 1050 mg/kg
- Mercury Vapor >1.4 µg/m^3
- Dissolved Mercury in Fill Unit Groundwater > 9.4 µg/L

MILL NORTH / TRUE NORTH 45°

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Proposed Explorations, Mercury Source Area of Caustic Plume Subarea

Interim Action Investigation, GP West Site - Bellingham, WA

DATE: Oct 2010	PROJECT NO. 070188
DESIGNED BY: SJG	
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Proposed Explorations:

L1-MW02 — Proposed boring/monitoring well

L1-WP1 — Proposed temporary well point

Existing Wells by Completion Unit:

CP-MW01 — Fill Unit monitoring well

CP-MW04 — Lower Sand monitoring well

Dissolved Mercury in Fill Unit Groundwater:

Mercury <= 0.94 ug/L

Mercury > 0.94 ug/L

RI sample locations are circled in blue

Fill Unit Groundwater pH:

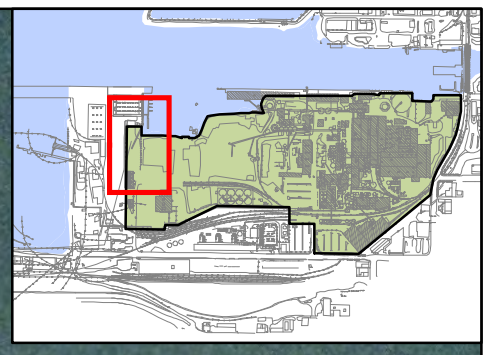
> 8.5

> 10

Dissolved Mercury in Fill Unit Groundwater:

> 0.94 µg/L

> 9.4 µg/L



AMW-01
L1-WP1
LAW-1
L1-MW02
L1-MW01
L1-MW03
CP-MW10
L1-MW05
L1-MW04
SALT STORAGE PAD
CP-MW02
CP-MW03
CP-MW05
WASTEWATER SETTLING BASIN
EMW-14S
CP-MWC1
PORT MAINTENANCE BUILDING
MERCURY RECLAIM STORAGE TANK
EMW-2S
COLLECTION TANK
SURGE STORAGE TANK
MERCURY RECOVERY
BRINE
0 25 50 100 150 200 Feet

MILL NORTH
TRUE NORTH
45°

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Proposed Explorations
Law-1 Area

Interim Action Investigation, GP West Site - Bellingham, WA

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DATE: Oct 2010	PROJECT NO. 070188
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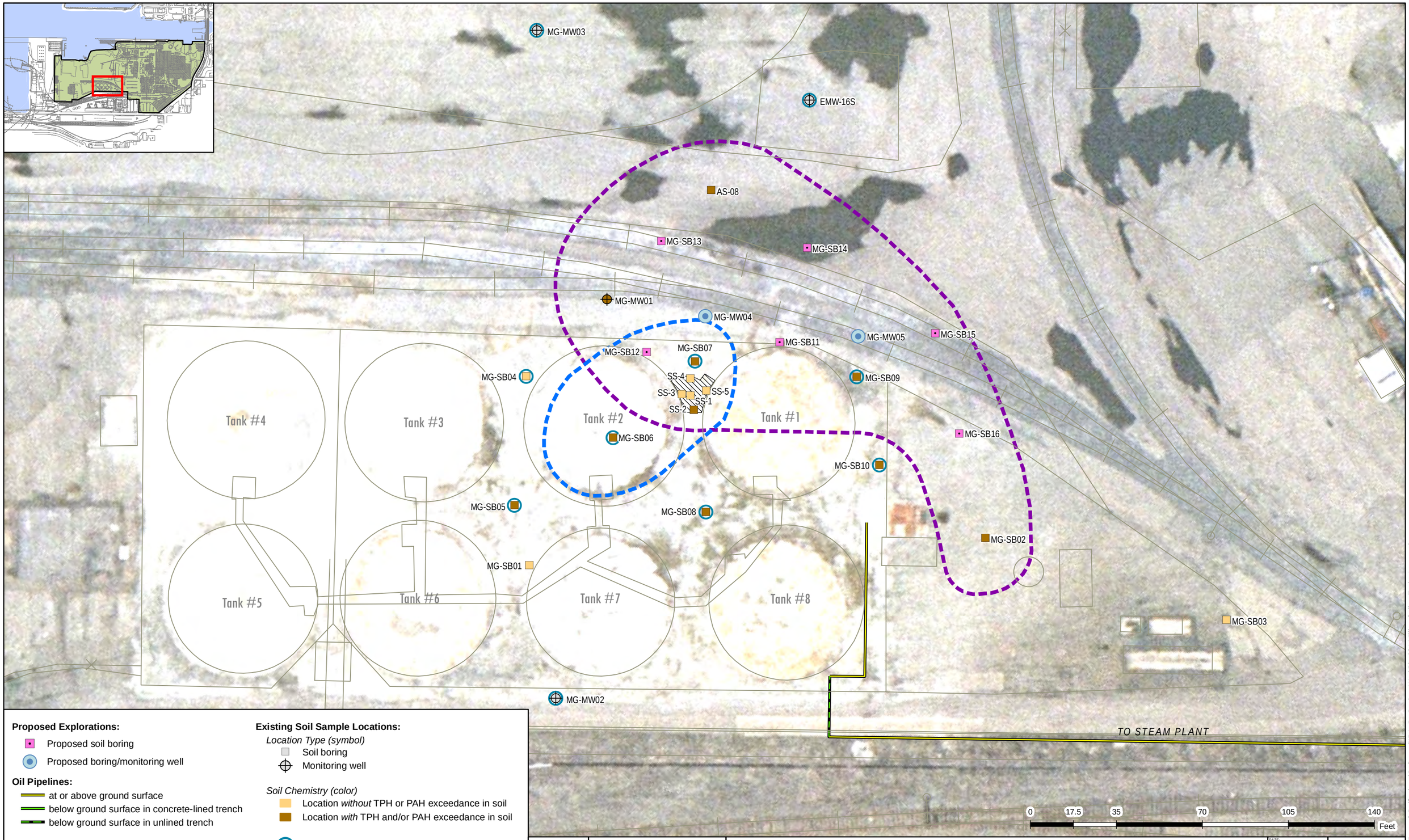

Proposed Explorations:

- Proposed soil boring
- Proposed boring/monitoring well

Oil Pipelines:

- at or above ground surface
- below ground surface in concrete-lined trench
- below ground surface in unlined trench

- Soil TPH > 2000 mg/kg
- Soil Naphthalenes > 5.3 mg/kg

Existing Soil Sample Locations:

Location Type (symbol)

- Soil boring
- Monitoring well

Soil Chemistry (color)

- Location *without* TPH or PAH exceedance in soil
- Location *with* TPH and/or PAH exceedance in soil

- RI sample locations are circled in blue
- Million Gallon Tanks Excavation Area (RETEC, 2007)

MILL NORTH
TRUE NORTH
45°

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Proposed Explorations, Million Gallon Tanks Subarea

Interim Action Investigation, GP West Site - Bellingham, WA

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DATE: Oct 2010	PROJECT NO. 070188
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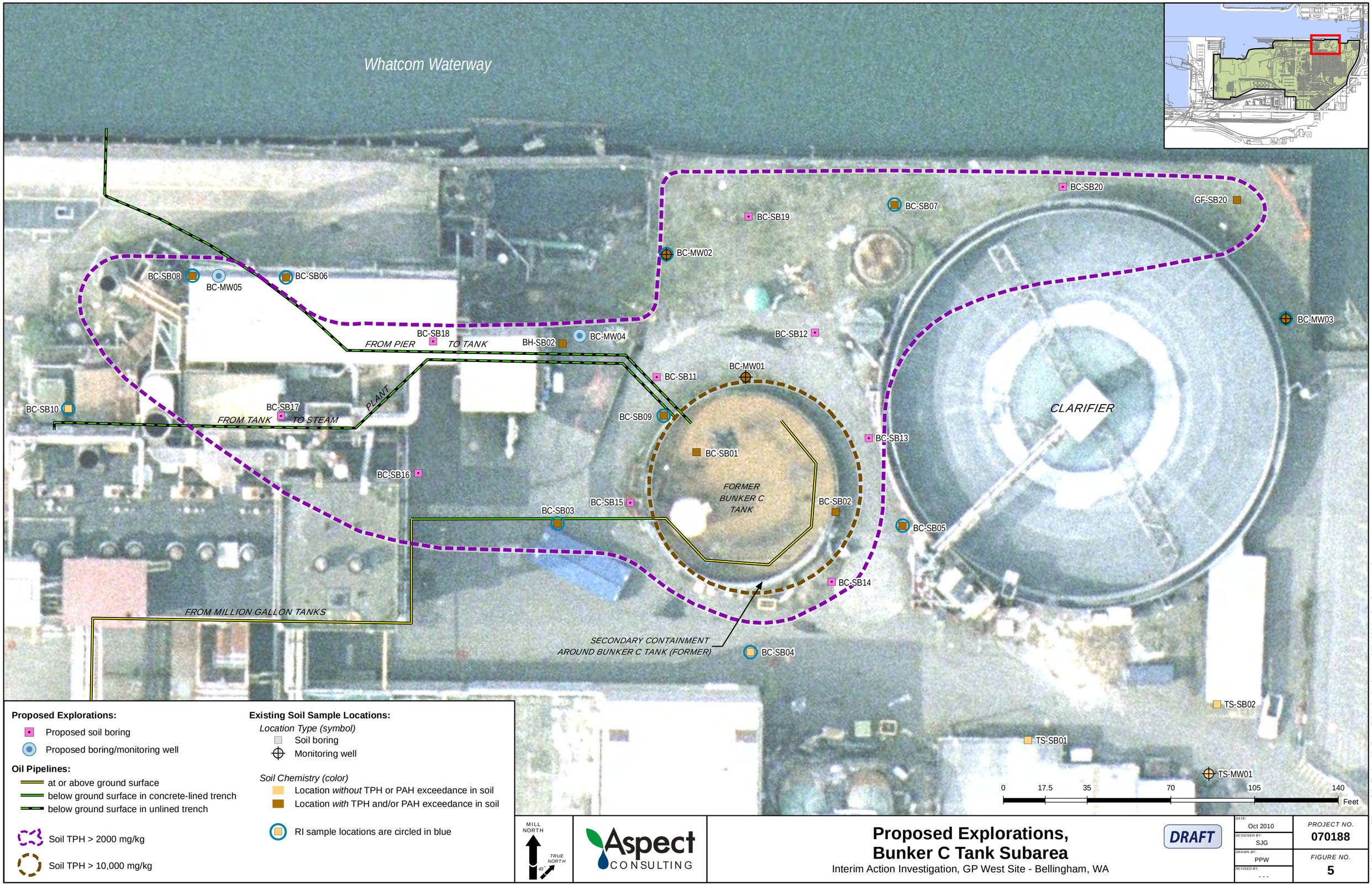

Proposed Explorations:

- Proposed soil boring
- Proposed boring/monitoring well

Oil Pipelines:

- at or above ground surface
- below ground surface in concrete-lined trench
- below ground surface in unlined trench

- Soil TPH > 2000 mg/kg
- Soil TPH > 10,000 mg/kg

Existing Soil Sample Locations:

Location Type (symbol)

- Soil boring
- Monitoring well

Soil Chemistry (color)

- Location *without* TPH or PAH exceedance in soil
- Location *with* TPH and/or PAH exceedance in soil

- RI sample locations are circled in blue

MILL NORTH
TRUE NORTH
45°

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Proposed Explorations, Bunker C Tank Subarea

Interim Action Investigation, GP West Site - Bellingham, WA

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DATE: Oct 2010	PROJECT NO. 070188
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APPENDIX A

Quality Control Information for Air Toxics LTD's TO15-APH Analytical Method (Air-Phase Petroleum Hydrocarbons)

15.0 AIR PHASE PETROLEUM HYDROCARBONS (APH) FRACTIONS BY GC/MS

APH is an Air Toxics internally developed Method that is a hybrid of TO-15, Massachusetts Department of Environmental Protection Method For The Determination of Air Phase Petroleum Hydrocarbons (APH) and Washington State Department of Ecology (WADOE) Method for the Determination of Volatile Petroleum Hydrocarbons (VPH). Results are derived from raw data acquired during TO-15 analysis thus providing the data user savings in both cost and time as only one run is required. The analytical procedures are based on Massachusetts APH. Air Toxics has refined APH by incorporation of the Aliphatic and Aromatic Hydrocarbon ranges incorporated in WADOE VPH which are comparatively more precise than Massachusetts APH and thus provide the data user with more a detailed identification of the materials present in their samples. The volatile aliphatic hydrocarbons are collectively grouped within four carbon ranges with no distinction between aliphatic and aromatic peaks and are quantified using the total ion chromatogram referenced to an appropriate alkane compound (or in the case of C5-C6 Aliphatics Pentane and Hexane). As long as they do not coelute with target species, non-Aliphatic peaks are identified in the TO-15 raw data and are subtracted from the carbon range summations prior to quantification. The volatile aromatic hydrocarbons are collectively identified within the C8 to C10 range and the C10 to C12 ranges and are quantified using the designated characteristic mass ion (120/134) extracted from the mass spectrometer according to TO-15. Individual quantitations for Ethylbenzene, m/p-Xylene and o-Xylene are added to the summed peaks for C8-C10 Aromatic Hydrocarbons. Additionally the quantitation for Naphthalene is added to the summed result for the C10 to C12 Aromatic Hydrocarbons.

Table 15-1. VPH Analyte List

Analyte	RL		Acceptance Criteria		
	ppbv	µg/m^3	RSD	ICV	CCV
C5-C6 Aliphatic Hydrocarbons (ref. to Pentane + Hexane)	10	32			70-130%
C6-C8 Aliphatic Hydrocarbons (ref. to Heptane)	10	41			70-130%
C8-C10 Aliphatic Hydrocarbons (ref. to Decane)	10	58			60-140%
C10-C12 Aliphatic Hydrocarbons (ref. to Dodecane)	10	70			60-140%
C8-C10 Aromatic Hydrocarbons (ref. to 1,2,3-TMB)	10	49			70-130%
C10-C12 Aromatic Hydrocarbons (ref. to 1,2,4,5-Tetramethybenzene)	10	88			60-140%
Ethylbenzene*	10		≤ 30%	70-130%	70-130%
m/p-Xylene*	10		≤ 30%	70-130%	70-130%
o-Xylene*	10		≤ 30%	70-130%	70-130%
Naphthalene *	10		≤ 40%	60-140%	60-140%
Pentane**			≤ 30%	70-130%	
Hexane**			≤ 30%	70-130%	
Heptane**			≤ 30%	70-130%	
Decane**			≤ 40%	60-140%	
Dodecane**			≤ 40%	60-140%	

1,2,3-Trimethylbenzene**			≤ 30%	70-130%	
1,2,4,5-Tetramethylbenzene**			≤ 40%	60-140%	

* Not present on the final report. When present in a sample, quantitated as a separate compound and the concentration (ppbv) is added to either C8-C10 or C10-C12 Aromatic Hydrocarbons per method
**Not present on the final report. Calibrated and used as a reference compound only

Table 15-2. Internal Standards

Analyte	Accuracy % R
1,4-Difluorobenzene	60-140%