2010 Progress and Performance Evaluation
Troutdale Gravel Aquifer
Boeing Portland Facility
Gresham, Oregon

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Prepared for

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1.0 INTRODUCTION

This corrective measures progress and performance evaluation report documents performance of the Troutdale Gravel Aquifer (TGA) corrective measures currently being implemented by The Boeing Company (Boeing) at the Boeing Portland facility in Gresham, Oregon (Figure 1). This report covers activities conducted from July 1 through December 31, 2010 and provides a summary of TGA corrective measures implementation, operation, remedial progress, performance evaluation, and recommendations for modifications to the existing monitoring plan and remedy actions. This report also summarizes TGA investigations conducted during this reporting period, ongoing coolant release remediation response inside the 85-105 building, and activities associated with the 85-001 building expansion project.

This report is submitted as required under Order on Consent No. LQSR-NWR-04-12(h) issued to Boeing by the Oregon Department of Environmental Quality (DEQ 2008a). The DEQ Order on Consent requires Boeing to continue to perform the site remedial actions included within the final remedy specified in the U.S. Environmental Protection Agency (EPA) Order on Consent (EPA 1994), the Decision and Response to Comments (Final Decision; EPA 1997a), and the Statement of Basis (EPA 1997b).

2.0 REMEDY BACKGROUND

The current pump and treat system for the TGA has been operational since 1999. Below is a summary of the TGA remedy background.

2.1 TGA GROUNDWATER REMEDY BACKGROUND

Boeing has conducted investigations and implemented corrective actions relative to volatile organic compounds (VOCs) in soil and groundwater at the Boeing facility since 1986. Several interim corrective actions (ICAs) were undertaken by Boeing beginning in 1986 to stabilize VOCs in the soil and groundwater at the Boeing Portland facility and to address protection of human health and the environment. These actions included providing an alternate water supply to owners of impacted wells, abandonment of supply wells, soil excavation, installation and expansion of the ICA groundwater extraction and treatment system, and installation and testing of a soil vapor extraction (SVE) system. These interim measures are documented in the interim measures evaluation report (Landau Associates 1995a) and summarized in the Phase 2 corrective measures study (CMS; Landau Associates 1996).

2.1.1 CORRECTIVE ACTION OBJECTIVES AND CLEANUP LEVELS

The Phase 2 CMS, the EPA Statement of Basis, and the Final Decision identified areas of the Boeing Portland facility where corrective measures were to be implemented. These corrective action areas were based on the known or potential presence of VOCs in soil and groundwater, and on the evaluation of the source areas identified in the Phase III Resource Conservation and Recovery Act (RCRA) facility investigation report (Landau Associates 1995b). Corrective actions have been implemented at the Boeing Portland facility to address VOC groundwater contamination in the TGA, specifically to provide protection of human health and the environment from exposure to the TGA VOC plume through ingestion, dermal contact, or inhalation pathways. Cleanup levels were established and corrective action objectives (CAOs) were developed in the Phase 2 CMS to meet these goals. These objectives were confirmed in the EPA Final Decision and provided the basis for corrective action implementation (Landau Associates 1997).

Quarterly and semiannual groundwater quality samples are collected from TGA monitoring wells and extraction wells to evaluate the remedy progress. The TGA monitoring program, cleanup levels, and the corrective action areas are summarized in Table 1 and on Figure 2.

2.1.1.1 Selected Corrective Measures

The current groundwater extraction and treatment system is shown on Figure 3, which started full time operation in 1999. In 2000, the pumping of E-1 was suspended as part of the groundwater extraction system for the Downgradient Corrective Action Area(Landau Associates 2000). Extraction well E-1 was subsequently decommissioned in June 2004.

The operational shutdown of extraction wells E-5 through E-9 was recommended in the 2000 TGA annual performance evaluation report (Landau Associates 2001). The operational shutdown of E-5 through E-9 was approved by EPA and conducted in October 2002 (Landau Associates 2002); since the start of the shutdown period, the wells have operated periodically for maintenance and monitoring purposes. To compensate for the changes in the TGA groundwater capture, the pump rates at E-11 (West Corrective Action Area) and E-12 (Downgradient Corrective Action Area) were increased (Landau Associates 2003).

Extraction wells E-10, E-11, E-14, E-15, and E-16 have been in pilot shutdown mode since bioinjection activities in late 2008 to enhance the absorption of the biostrata to the formation (Landau Associates 2009a). Extraction wells E-10 and E-14 were decommissioned with DEQ approval (DEQ 2008b) during the first quarter of 2010 in preparations for the Building 85-001 expansion project.

Currently, the following wells are actively pumping as part of the TGA groundwater extraction and treatment system: E-2, E-3, E-4, E-12, and E-13 (located in the Downgradient Corrective Action Area); and DP-1 (located in the Central Correct Action Area). Extraction wells E-5 through E-9, E-11, E-15, and E-16 are currently shutdown and not actively pumping except for short periods of time for sampling and maintenance purposes.

2.2 COOLANT RELEASE REMEDY BACKGROUND

In August 2006, coolant material was discovered in the 85-105 building footing drain sump (sump). The sump is a collection location for both building footing drain water and shallow perched groundwater. The accumulated water is routed to the groundwater treatment system (GWTS) for treatment prior to discharge to the Storm Drain Creek and the city of Gresham stormwater facility. Upon discovery of the coolant release, Boeing immediately discontinued pumping accumulated water to the GWTS and started to collect the water in storage tanks for batch testing and disposal through the facility treatment system for disposal to the sanitary sewer. An investigation was conducted to evaluate the vertical and horizontal extent of the release to the TGA by monitoring existing nearby wells and installing eight monitoring wells (LAI-1 through LAI-8).

The results of the investigation indicated that coolant material did not migrate substantially horizontally because the building footing drain sump acted as a collection system for the released coolant.

The results of the investigation also indicated that nearby Upper Troutdale Sandstone Aquifer (TSA) wells did not show evidence of impacts due to the coolant release (Landau Associates 2007a).

To address the coolant impacts to the shallow TGA, five injection wells (IW-1 through IW-5) were installed directly upgradient of the release area to allow for aerobic biodegreadion as an interim remedial action measure (IRAM; Landau Associates 2007b). The DEQ-approved (DEQ 2007) interim remedial action plan detailed the process and procedures for using an oxygen releasing component (EHC-O^{TM}) and water slurry to enhance the aerobic biodegradation of the biological oxygen demand (BOD) of the petroleum-based contaminant. Two injections of EHC-O^{TM} were conducted in 2008. In June 2010, a third injection of EHC-O^{TM} slurry was conducted to continue treatment of coolant-impacted TGA groundwater. The third injection utilized the same EHC-O^{TM} mass and procedures that were utilized during the second injection.

Since August 2007, water collected in the 85-105 building footing sump has been recovered and treated using the Sump Treatment System (STS). The STS consists of a conveyance line that transports the accumulated water from the sump vault to Building 85-124, where the water is treated through an oil/water separator, then monitored by an in-line fats, oil, and grease (FOG) monitor. If FOG concentrations are below 75 parts per million (ppm), water is directed to the sanitary sewer. If FOG concentrations are above 75 ppm, water is automatically routed through a granular activated carbon (GAC) vessel prior to discharge. Quarterly groundwater samples, along with operation and maintenance (O&M) system compliance samples (influent and effluent), are collected to verify that the system operates below the sanitary sewer discharge permit limits.

2.3 BUILDING EXPANSION PROJECT BACKGROUND

Boeing is expanding their capabilities in the 85-001 building to allow for upgrades to the facility's plating shop and chemical processing operations. The footprint of the building expansion project is along the western portion of the existing 85-001 building, in the West Source Control Area, as defined in the Institutional Controls Plan (ICP; Landau Associates 2005). In preparation for the building construction effort, several actions and investigations were conducted.

In 2007, Boeing elected to conduct a tracer dye test within the West Control Source Area to evaluate if this portion of the TGA dissolved plume could be treated with *in situ* bioremediation prior to the planned building expansion. Two hydrofluorent dyes were injected into select wells and monitored downgradient. The results of the tracer dye test were utilized to design a soy-based vegetable oil injection program (Landau Associates 2008a).

Between November and December 2008, four existing wells and two newly installed injection wells were injected with a total of 217,478 gallons of injection solution. The injection solution was

created by mixing Textrol BR (90 percent food-grade soybean oil and 10 percent lecithin surfactant) with potable water or site groundwater through a centrifugal pump, resulting in an average 17 percent vegetable oil emulsion injected to the aquifer. Baseline groundwater sampling was conducted prior to the injection event and monthly sampling for a post-injection 3-month period. The results of the injection program and the 3-month post-injection monitoring phase indicated a reduction in trichloroethene (TCE) concentrations, which werepresentedin a Bioremediation Injection Completion Report (Landau Associates 2009a). Follow-up groundwater sampling has been conducted on a quarterly basis since the initial 3-month period sampling. Analytical data for the bioinjection treatment area are summarized in Table 2. The results of the post-injection monitoring indicate the injection of vegetable oil electron donor has resulted in an extensive aquifer treatment area where conditions are conducive to reductive dechlorination of TCE and its breakdown products. Since the injection, the treatment area has transitioned from aerobic to highly reducing. Decreased concentrations of TCE and increased concentrations of breakdown products and end products provide evidence of enhanced reductive dechlorination (Landau Associates 2009a). Modifications to sections of the underground conveyance lines associated with the GWTS were conducted during 2009 to facilitate the 85-001 expansion project. Modifications included rerouting the groundwater conveyance, communication, and electrical supply lines from extraction well E-13 to connect with lines servicing wells E-2, E-3, E-4, and E-12 (west of the expansion area) The former conveyance lines were decontaminated, capped, and abandoned in-place. The abandoned conveyance lines were removed during the earthwork portion of the building expansion activities. The final configuration of the GWTS and conveyance lines are shown on Figure 3.

In preparation for the building construction, a total of 14 wells were decommissioned in February and March 2010 to allow for the earthwork phase of the project. The decommissioned wells include three TGA monitoring wells [BOP-1(i), BOP-2(i), and BOP-4(i)]; two TGA extraction wells (E-10 and E-14); two TGA injection wells (IW-6 and IW-7); and three TGA vapor observation wells pairs [VOW-4(s,d), VOW-6(s,d), and VOW-9(s,d)]. In addition to the TGA wells, one TSA well (EW-22) was decommissioned. The decommissioning activities were completed in accordance with procedures described in the DEQ-approved (DEQ 2010a) work plan (Landau Associates 2010a). The locations of the wells are shown on Figure 2.

Several soil investigations were conducted to evaluate protection levels for construction workers. The results of the investigations indicated a limited amount of low-level TCE concentrations were present in the shallow soil near the southwest corner of the existing 85-001 building (Landau Associates 2008b and 2009b). The impacted soil was removed prior to the start of the building expansion project. Approximately 520 cubic yards (yd^3; 779 tons) of TCE-impacted soil were removed and transported offsite to the Hillsboro Landfill in May 2010. The observations and analytical testing of the remedial

excavation were presented in a summary report (Landau Associates 2010b), which was subsequently approved by DEQ (DEQ 2010b).

During this reporting period, Boeing conducted the majority of the earthwork phase for the 85-001 building expansion project. Boeing requested Landau Associates to provide environmental field screening while mass soil excavation work was taking place. Landau Associates provided periodic environmental field screening from July 16, through December 9, 1010. Soil was screened by using a photoionization detector (PID) to detect volatiles in soil, using a target action level of 20 parts per million (ppm) to inidicate the presence of potentially environmentally impacted soil. The results of the field screening indicated no detections above the site-specific action level were detected.

3.0 SOURCE AREA INVESTIGATIONS

Landau Associates has conducted various environmental investigations within potential source control areas, which are identified in the ICP. The locations of the ICP-identified source control areas are shown on Figure 4. These potential source control areas are areas onsite where activities involving disturbances to surface/subsurface need to be conducted under an approved health and safety plan (HASP) in order to restrict the potential exposure to workers. The findings of these environmental investigations will be utilized with findings from previous investigations to either redefine the source control areas or potentially remove the areas from the ICP. The findings of these investigations may also identify areas within the source control areas where additional remediation is warranted. Below is a summary of source control areas investigations that were conducted during this reporting period.

3.1 FORMER DEGREASER SOURCE CONTROL AREA

Prior to Boeing's purchase of the property in 1979, historical owners and/or tenants who sublet part of the facility operated a vapor degreaser from 1963 to 1968, which was believed to have leaked on at least one occasion (Landau Associates 1988). This degreaser was dismantled and, in 1974, a new degreaser was installed directly south of the former degreaser location. This new degreaser was subsequently dismantled in the late 1980's and is no longer in service. Prior to 1980, TCE was the solvent used in the degreaser; in early 1980, 1,1,1-trichloroethane (1,1,1-TCA) was used and the use of TCE was discontinued. TCE released in the vicinity of the first former vapor degreaser appears to be a primary source of TCE groundwater contamination observed in the West Corrective Action Area (Figure 2).

3.1.1 2009 INVESTIGATION

Between December 27, 2009 and January 3, 2010, Boeing conducted a focused investigation within the 85-001 building near two former vapor degreaser locations. The former degreaser area investigation provided the opportunity to evaluate the potential environmental impacts to the vadose zone by collecting sub-slab vapor samples and soil-vapor samples, and saturated zones by collecting groundwater samples of the Troutdale Gravel unit. Three monitoring wells [BOP-72(i), BOP-73(i), and BOP-74(i)] were constructed near the former vapor degreasers, with various characterization data collected during drilling and following well installation. The locations of the wells and the former vapor degreasers wells are shown on Figure 2.

Results of the investigation indicated the presence of VOCs (TCE as the most prominent compound) at concentrations above the respective cleanup levels for samples collected in the sub-slab and

soil vapor in the vadose zone, and in groundwater. The highest TCE concentration in the sub-slab vapor samples (3,860 part per billion vapor: ppbv) exceeded risk-based concentrations (RBCs) hot-spot evaluation (100 times the RBC). Vadose zone soil vapor results showed substantial vadose zone impacts, indicating additional investigations were needed to further delineate the lateral and vertical extent of impacts. The highest TCE concentration in the vadose zone was reported from borehole BOP-73(i) located approximately 30 ft north of the former degreasers; the maximum concentration (20,000 ppbv) was from the 30- to 35-ft interval. Vertical profile groundwater sample results from the three wells indicated TCE concentrations above the cleanup level of 5 micrograms per liter (µg/L). The highest TCE concentrations were detected at well BOP-73(i) (92 to 900 µg/L), with lower concentrations at BOP-72(i) (4.5 to 49 µg/L) and BOP-74(i) (15 to 38 µg/L). Contaminant distribution throughout both the vadose and saturated zones supports the conceptual model that the former degreasers inside the 85-001 building were a primary source of TCE contamination in this portion of the site. The results of the 2009 investigation were presented in a summary report (Landau Associates 2010b).

3.1.2 BIOREMEDIATION PILOT TEST

In May 2010, an injection test was conducted at the three former degreaser area wells [BOP-72(i), BOP-73(i), and BOP-74(i)] using potable water. The purpose of the potable water injection was to evaluate the use of the wells as possible future injection points for bioremediation. The results of the potable water injection indicated variable permeability in the vicinity of the former degreasers. The injection rates ranged from 55 gallon per minute (gpm) at BOP-74(i) to 5 to 8 gpm at both BOP-72(i) and BOP-73(i).

Based on the results of the potable water injection test, a pilot *in situ* bioremediation pilot test was conducted in November 2010. The objective of the test was to evaluate the implementability and effectiveness of *in situ* anaerobic bioremediation in the TGA beneath the former degreaser area. The pilot test was conducted utilizing the process and procedures outlined in the DEQ-approved (DEQ 2010c) Bioremediation Pilot Test Work Plan (Landau Associates 2010c). However, due to formation low permeability in the vicinity of the injection well [BOP-72(i)], the pilot test was shut down after injecting approximately 960 gallons of potable water followed by approximately 519 gallons of potable water and sodium lactate solution. The sodium lactate contained 60 percent lactate concentrate.

3.1.3 2010 SUPPLEMENTAL INVESTIGATION

In December 2010, a supplemental environmental subsurface investigation was conducted near the former degreaser area inside the 85-001 building. The purpose of the supplemental investigation at the former degreaser area was to further identify both the lateral and vertical extent of the impacted

subsurface, in general accordance with the DEQ-approved (DEQ 2010d) Supplemental Work Plan (Landau Associates 2010d).

A total of 12 sub-slab vapor samples were collected from the vicinity of the former degreaser to assist in further delineating the potential impacts. Three vertical borings were advanced through the base of the Troutdale Gravel Formation and into the top of the second subunit (SU1b) of the confining layer (SU1). During drilling activities, three discrete depths in the vadose zone were selected for SVE testing and soil vapor sampling. Upon completion of drilling, the borings were completed as flush-mount groundwater monitoring wells for possible use as future bioinjection locations. The three wells [BOP-75(i), BOP-76(i), and BOP-77(i)] were installed with 25-ft screens with 0.020-inch slot size. Screens were placed at the base of the Troutdale Gravel Formation and extend past the static groundwater level, as observed during drilling at 55 ft below grade. Upon completion of well installation activities, the wells were developed to remove drilling-induced sediment. Five diffusion bag samplers (DBS) were installed during the February 2011 sampling event. The vertical profile groundwater sample data will be evaluated and utilized to further characterize potential environmental impacts. A summary report of the 2010 Supplemental Investigation will be submitted to DEQ upon the completion of the potable water injection at each of the newly installed wells and after the analytical data have been evaluated.

3.2 WEST SOURCE CONTROL AREA

The West Source Control Area was identified as a potential source area for the TGA dissolved VOC plume during the Phase III RCRA Facility Investigation (RFI; Landau Associates 1995b). The West Source Control Area (Figure 4) was identified based on elevated VOC concentrations in the groundwater and the vadose zone directly above the groundwater level.

3.2.1 PREVIOUS INVESTIGATION AND CLEANUP ACTION

In preparation for the building construction, a series of three subsurface investigations were conducted to determine the presence and extent of contaminants in the soil within the proposed excavation areas of the building footprint and to identify associated underground utilities. TCE was detected above the laboratory reporting limits in soil samples collected from six borings located in the southeastern corner of the proposed expansion area. TCE concentrations ranged from 1.0 to 120 micrograms per kilogram (µg/kg), with depths ranging from directly below the asphalt paving to 5 ft below ground surface (BGS). The three investigations are summarized in the Environmental Subsurface Investigation Report (Landau Associates 2009b).

Based on the results of these subsurface investigation activities, a remedial cleanup action was conducted prior to the beginning of construction excavation to allow the earthwork portion of the building

expansion to occur using standard (non-environmentally impacted) construction practices. The remedial cleanup action consisted of removing approximately 520 cubic yards (yd^3; 779 tons) of impacted soil. Based on analytical data, the excavation extended vertically 5 to 7 ft deep with one limited area of the excavation extended to 9 ft BGS. The results of the remedial cleanup action plan are summarized in the Remedial Cleanup Action Report (Landau Associates 2010e).

3.2.2 2010 INVESTIGATION

The southern portion of the West Source Control Area (Figure 4) is located in the main shipping and receiving area for the facility. Due to heavy traffic considerations, the investigation of the area was conducted during the annual week-long shutdown of the facility, which occurs in late December. The 2010 subsurface investigation was conducted by advancing four borings to 15 ft BGS using roto-sonic drilling methods and sampling procedures described in the DEQ-approved (DEQ 2010d) Work Plan (Landau Associates 2010f). Environmental field screening was conducted at each boring location for the presence of VOC contamination by using a PID meter. The results of the field screening indicated no signs of obvious contamination; therefore, in accordance with the work plan, no discrete soil samples were collected. A total of 11 composite soil samples were collected and submitted to Analytical Resources laboratory (ARI) for chemical analyses of VOCs using EPA Method 8260 and total metals (arsenic, barium, cadmium, chromium, lead, selenium, silver, and mercury) using Method 600/7000. Results from the West Source Control Area investigation will be submitted to DEQ in a pending summary document.

4.0 GROUNDWATER RELEASE AND ASSOCIATED REPAIRS

Standing water accumulation near E-3 (Figure 3) has been observed during the past year. In October 2010, a surface water analytical sample was collected of the accumulated water to assist with determining the source. The analytical results indicated a TCE concentration of 10.2 µg/L, which is above the cleanup level of 5 µg/L. Based on these results, the water was collected and contained in a 21,000-gallon capacity storage tank and routed to the GWTS for treatment. The subsequent investigation was conducted and summarized in a technical memorandum (Landau Associates 2010g). The DEQ-approved (DEQ 2010e) memorandum describes the results of the investigation, completed repairs, proposed future repairs to other extraction wells, and the process for conducting a shallow soil investigation in the area of the release.

The investigation and field observations indicated that the accumulated water was the result of a leak in the untreated groundwater conveyance pipe located directly north of the E-3 vault. Water was observed to be accumulating on the surface and in the E-3 vault through the annulus space between the well casing and the vault. An excavation was conducted along the north side of the vault to approximately 13 ft BGS (depth of vault) to expose the conveyance lines. Two corrosion holes were observed in a 2-inch-diameter galvanized pipe located on the exterior of the vault. The galvanized pipe was removed and replaced with HDPE. Upon completion of the pipe replacement, a camera was inserted into the open line. The results of the camera scan indicated pipe and pipe sections were clear of debris and no cracks or signs of corrosion were observed in the conveyance pipe between E-2 (west of E-3) and E-4 (east of E-3). An isolation valve was installed at the conveyance line near E-3 to facilitate any future repairs. Once the isolation valve was installed, the GWTS was activated. No leaks or water flow between the well annulus and the vault were observed and the excavation was backfilled. The annulus space between the well casing and the vault was repaired by a licensed driller and repair documents were reported to Oregon Water Resource Department (OWRD).

The GWTS has been in full-time operation for approximately 21 years and equipment/parts may be starting to show signs of wear. An engineering review of the air stripper was conducted in 2009 and the equipment was found to be adequate for the current pumping rates. Yearly inspections of the electrical system and extraction control panels have reported only minor repairs, all of which have been implemented. We propose the removal of galvanized pipes positioned in direct contact with the soil to be replaced with HDPE pipe for all active TGA extraction wells.

To evaluate the impacts to the subsurface near the E-3 vault due to the release, we propose to conduct a shallow soil investigation. This DEQ-approved investigation is currently schedule for summer 2011.

5.0 REMEDY PROGRESS DATA

This section of the report presents a summary of remedy progress monitoring data collected during 2010 with a focus on the later portion of the year (July through December), including TGA and Upper TSA groundwater quality data, groundwater level data, groundwater extraction well performance data, and GWTS effluent and influent water quality data. The TGA analytical results for the dissolved plume are summarized in Table 3. This section of the report also includes remedy progress data associated with the 85-105 building coolant release. Laboratory reports and data validation memorandums for data collected between July 1 and December 31, 2010 are provided in Appendix A. Historical TGA and select Upper TSA groundwater quality data is presented in Appendix B.

5.1 TGA GROUNDWATER QUALITY

Groundwater quality samples for TGA wells and select Upper TSA monitoring wells are conducted in accordance with the Performance Monitoring Program (Table 1). In addition, sampling and analysis of the discharge from groundwater extraction wells has been performed on a quarterly basis. Groundwater samples from each sampling event were analyzed for VOCs. The analytical results for the Constituents of Potential Concern (COPCs) at each monitoring well and extraction well, along with select Upper TSA water quality data, are presented in Table 3. The interpreted extent of TCE in the TGA, based on the results from August 2010 (more inclusive annual event) and November 2010 (quarterly event), are shown on Figure 5. Analytical results for the third and fourth quarters of 2010 indicate COPCs concentrations are below the respective maximum contaminant levels (MCLs) with the exception of TCE. For the purposes of this report, TCE concentrations will be used to benchmark remediation progress.

Due to the *in situ* bioremediation injection activities, several TGA extraction wells located within the West and Central Corrective Action Areas were temporarily shut down in late October of 2008. Wells E-10, E-11, E-14, E-15, and E-16 remained shut down through 2010 to facilitate the vegetable oil absorbing to the soil. Extraction wells E-10 and E-14 were decommissioned during the first quarter of 2010 as part of the building expansion process. Analytical results for samples collected from wells located within the West Corrective Action Area indicated a dramatic decrease in TCE concentrations initially following the 2008 *in situ* bioremediation injection activities. TCE concentrations downgradient of the 2008 *in situ* bioremediation injection area show fluctuations in the data; however, this is anticipated as the vegetable oil continues to be absorbed into the formation.

The TGA dissolved VOC plume continues to decrease in aerial extent and concentrations. Analytical results for the TGA wells indicate concentrations of TCE have steadily decreased since the start of full-time treatment in March 1989. The progress of the remedy was discussed in the latest Five-

year Evaluation Report (Landau Associates 2006); however, a few persistent areas have either not responded to the corrective measure or have responded, but not in a timely manner. Groundwater quality for each of the Corrective Action Areas is discussed below.

5.1.1 SOUTHWEST CORRECTIVE ACTION AREA

Groundwater quality in the Southwest Corrective Action Area is characterized at monitoring well BOP-9(i). Groundwater quality data suggests that continued monitoring at BOP-9(i) is warranted.

5.1.2 EAST CORRECTIVE ACTION AREA

Groundwater quality in the East Corrective Action Area is characterized at extraction well E-8. Historically, water quality samples were also collected from wells BOP-12(i) and BOP-58(i); however, COPC concentrations were consistently below the respective laboratory reporting limits and, subsequently, the wells were removed from the groundwater quality monitoring program in August 2009. Both BOP-12(i) and BOP-58(i) continue to be utilized for groundwater elevation and hydraulic control evaluations. Extraction well E-8 was installed to assist with remediation within the East Area; however, active operation of the extraction well was discontinued in 2002 and, since the shutdown, the well operated intermittently for groundwater quality monitoring purposes only. Analytical results for the August 2010 sampling event indicated a TCE concentration of 7.5 µg/L at E-8. Groundwater quality data suggests that continued monitoring at E-8 is warranted.

5.1.3 EAST YARD CORRECTIVE ACTION AREA

The groundwater quality data in the East Yard Corrective Action Area are currently evaluated at BOP-48(i) and extraction well E-9. TCE concentrations continued to remain below the MCL cleanup level during the August 2010 sampling event. Groundwater quality data continues to indicate remediation has been completed in this area. Extraction well E-9 was shut down in 2002 and has operated intermittently for groundwater quality sampling purposes only.

5.1.4 CENTRAL CORRECTIVE ACTION AREA

August 2010 groundwater quality data within the Central Corrective Action Area indicated the highest TCE concentrations were observed from samples collected at BOP-10(i) (87 µg/L). However, TCE concentrations at the other Central Corrective Action Area wells [BOP-56(i), BOP-59(i), E-6, E-7, and DP-1] were all above the MCL with concentrations ranging from 17 to 39 µg/L. Extraction pumping at DP-1 continues to operate to assist with the remediation within the Central Corrective Action Area.

The Central Corrective Action Area appears to be an area of the site where the dissolved plume has been resistant to the remedial activities. A subsurface investigation in the Central Corrective Action Area is anticipated to be conducted in 2011 to assist with characterization and possible alternative remedial actions, if warranted.

5.1.5 DOWNGRADIENT CORRECTIVE ACTION AREA

Groundwater quality data from wells within the Downgradient Corrective Action Area indicate BOP-7(i) as a persistent area with TCE concentrations. Detections of TCE ranged from 110 µg/L (August 2010) to 87 µg/L (November 2010). within this reporting period. BOP-7(i) is located between extraction wells E-12 (northwest of well) and E-2 (southeast of well). Boeing proposes to conduct an investigation in the soil source control area within the direct vicinity of BOP-7(i). This investigation will focus on soil and groundwater sources to evaluate additional corrective actions that can be utilized to increase the remediation of the dissolved plume. TCE concentrations at D-8(i) have steadily decreased from 570 µg/L (November 1988) to 14 µg/L in August 2010. TCE concentrations at other Downgradient Corrective Action Area wells [D-7(i), D-11(i), and D-12(i)] were either below the reporting limit or slightly above. Extraction wells E-2, E-3, E-12, and E-13 were installed and operated to assist in the remediation of the dissolved VOC plume in the Downgradient Corrective Action Area. The Downgradient Corrective Action Area wells operated throughout this reporting period, with TCE concentrations ranging from 5.7 to 95 µg/L at E-12 and E-4, respectively.

5.1.6 WEST CORRECTIVE ACTION AREA

The highest TCE concentrations within the West Corrective Action Area are demonstrated at BOP-57(ib), which is screened within the first layer of the Siltstone Unit (SUA) Subunit 1 (first of four layers within the Siltstone confining layer separating the TGA and the TSA). August 2010 data for BOP-57(ib) indicated a TCE concentration of 180 µg/L. Data suggest that the GWTS may not be effective at reducing TCE concentrations within the low-permeable layer and additional corrective actions, such as *in situ* bioremediation, may be beneficial in reducing concentrations. Groundwater quality in the more permeable TGA indicated TCE concentrations were below the cleanup level with the exception of BOP-57(ia) with an August 2010 TCE concentration of 13 µg/L.

5.2 TSA GROUNDWATER QUALITY MONITORING DATA

TSA groundwater quality data at four wells [BOP-22R(ds), BOP-60R(ds), BOP-61(ds), and BOP-65(ds)] were reviewed to assess whether the TGA is a source of VOCs to the Upper TSA. Table 3 summarizes VOC results between July and December 2010. TCE concentrations for the Upper TSA

wells are shown on Figure 5. Well BOP-61(ds) is typically dry due to the well proximity to the local unsaturated zone within the Upper TSA; however, groundwater was present during the August 2010 sampling event. The TCE concentration at BOP-61(ds) was 4.4 µg/L, which is below the MCL cleanup level in August 2010.

Well BOP-60R(ds) was installed to replace monitoring well BOP-60(ds) based on the findings of the DEQ-approved (DEQ 2009a) conceptual model report (Landau Associates 2009c) that indicate the increase in concentrations at BOP-60(ds) is likely a result of vertical leakage from the overlying TGA to the Upper TSA along the BOP-60(ds) borehole. A summary report was submitted to DEQ (Landau Associates 2010h) upon completion of replacement well BOP-60R(ds) installation and the decommissioning of well BOP-60(ds). Multiple DBS were installed in replacement well BOP-60R(ds) upon the completion of well installation and development. Groundwater samples collected from the multiple DBS during August and November 2010 indicated TCE concentrations ranging from 0.3 to 2.2 µg/L, which are below the MCL cleanup level (5µg/L). Since the installation of BOP-60R(ds), the results support the conceptual model that the increase in concentrations at BOP-60(ds) was likely a result of vertical leakage from the overlying TGA to the Upper TSA along the BOP-60(ds) borehole.

Groundwater sampling of replacement well BOP-22R(ds) started in November 2008 after the well was installed to replace BOP-22(ds), which showed signs of downward migration water from the TGA to the Upper TSA through the borehole. TCE concentrations at BOP-22R(ds) have consistently remained below the reporting limit and remained so during this reporting period.

5.3 TGA GROUNDWATER LEVEL MONITORING

Groundwater levels in the TGA monitoring wells were measured during the August 2010 annual sampling event, and the TGA extraction water levels were measured during both the August and November 2010 events (Table 1). The TGA groundwater level measurements and elevations are summarized in Table 4. The August 2010 data was utilized to develop water level contours; inferred groundwater flow directions based on the water level data are presented on Figure 6.

Groundwater contour data indicate that the active pumping at extraction wells in the Downgradient Corrective Action Area (E-2, E-3, E-4, E-12, E-13) and the Central Corrective Action Area (DP-1) has been sufficient to maintain an inward hydraulic capture of the TGA plume.

5.4 COOLANT RELEASE REMEDY PROGRESS

The latest injection of EHC-O™ slurry was conducted in June 2010 to continue treatment of coolant-impacted TGA groundwater. This third injection utilized the same EHC-O™ mass and procedures that were utilized during the previous injections.

To monitor the extent of the coolant release and to monitor the effects of the EHC-O™, groundwater samples were collected quarterly from the eight TGA coolant release wells (LAI-1 through LAI-8), and annually from groundwater monitoring wells (BOP-9(i), BOP-10(i,s), BOP-59(i), and DP-1). Groundwater sample results for total diesel- and motor oil-range petroleum hydrocarbons (total TPH-Dx) collected from the select wells are summarized in Table 5, and the August and November 2010 results are shown on Figure 7.

Due to the glycerin component to the coolant, a site-specific cleanup level of 1.35 milligrams per liter (mg/L) for total TPH-Dx was developed for groundwater using guidance from the RBCs (DEQ 2003).

The August and November 2010 sampling events indicate the following results:

- Analytical results for TGA wells BOP-9(i), BOP-10(i), BOP-59(i), and DP-1 continue to indicate no total TPH-Dx results above the laboratory reporting limits. Historical low-level total TPH-Dx has been periodically reported in samples collected from LAI-1, LAI-3, and LAI-5; however, the total TPH-Dx concentrations have decreased to below the reporting limit. This data indicate the horizontal migration of the coolant material has been isolated to the area near the reported release and indicate that the coolant has not migrated laterally through the TGA.
- Historical total TPH-Dx concentrations above the site-specific cleanup level (1.35 mg/L) have been reported at wells LAI-5, LAI-6, and LAI-7; however, the results from the August and November 2010 events indicate concentration trends have decreased to below the laboratory reporting limits at these wells. The total TPH-Dx concentration reported in LAI-8 fluctuates near the cleanup level and was above the cleanup level in November of 2010.
- Total TPH-Dx concentrations above the site-specific cleanup level (1.35 mg/L) have been consistently reported for LAI-4. Prior to the EHC-O™ injection, total TPH-Dx concentrations at LAI-4 ranged from 90 mg/L (August 2007) compared to the initial concentration of 31,800 mg/L (September 2006). Total TPH-Dx concentrations have ranged from 27 mg/L to 83 mg/L during this reporting period. Decreases in concentrations were seen after each of the EHC-O™ injections, followed by indications of rebounds in concentrations. This data indicate the horizontal migration of the coolant material has been isolated to the area near the reported release and support the evaluation that the coolant has not migrated laterally through the TGA.

Several of the coolant release wells are located within the interior of the 85-105 building, which had not been previously accessible until recent limited access drilling methods were advanced. The installation of these wells has allowed the opportunity to evaluate possible VOC impacts in previously inaccessible areas. Therefore, the coolant release wells (LAI-4, LAI-6, and LAI-7) are sampled for VOCs on a quarterly basis (Table 3). TCE concentrations from samples collected from LAI-4 and LAI-6 were below the MCL (5µg/L). TCE concentrations in samples from LAI-7 ranged from 12to 13 µg/L. The active extraction pumping at DP-1 is operated to assist with the hydraulic capture of the isolated TCE dissolved plume within the vicinity of the 85-105 building area (Central Corrective Action Area).

6.0 PERFORMANCE EVALUATION

This section presents a summary of the treatment system performance data collected between July and December 2010, and an evaluation of the performance of each extraction well.

6.1 GROUNDWATER EXTRACTION SYSTEM MONITORING DATA

Groundwater extraction system monitoring data includes VOC analytical data from sampling the discharge of each TGA extraction well and extraction well flow rate data. The extraction wells were sampled quarterly throughout the reporting period and flow rate data were collected monthly. These data are presented and evaluated in this section in terms of an average daily mass removal rate in pounds per day (lbs/day), total gallons extracted at each extraction well, and the average yield in gpm for each extraction well.

Average total mass removal rates (lbs/day) of VOCs [TCE, trichloroethane (TCA), total 1,2-dichloroethene (1,2-DCE), and 1,1,2-trichloro-1,2,2-trifluoroethane (Freon-TF)] from each TGA groundwater extraction well for 2010 are presented on Figure 8. The mass removed for other COPCs is not presented because the constituents contributed less than 10 percent of the total VOC mass removed.

The approximate average extraction rate (gallons/minute) at each extraction well for 2010 is summarized in Table 6. The average pump rates are based on the total gallons removed during each measurement period divided by the number of minutes in the measurement period that the well was actively pumping. DP-1 continues to pump at the lowest rate (typically less than 1 gpm), while E-13 continues to pump at the highest rate (between 166 and 173 gpm). Extraction wells E-5 through E-9 have been shut down since 2002, with the exception of brief operation time for sample collection and maintenance. Extraction wells E-10 and E-14 were decommissioned in the first quarter 2010 to facilitate the proposed building expansion project. Extraction wells E-11, E-15, and E-16 were utilized in the 2008 *in situ* bioremediation injection activities and have remained in shutdown mode to enhance the absorption of the vegetable oil to the formation. Currently, extraction wells E-2, E-3, E-4, E-12, E-13, and DP-1 are operating to provide hydraulic control of the dissolved VOC plume.

Per DEQ approvals (DEQ 2009b), TSA extraction wells EW-3 and EW-13 were shutdown in 2009. Upper TSA extraction well EW-3 was shut down to minimize downward vertical gradients from the TGA to the Upper TSA near BOP-60(ds). BOP-60(ds) was decommissioned in the first quarter 2010 and replacement monitoring well BOP-60R(ds) was installed. Lower extraction well EW-13 was shut down to minimize the hydraulic divide produced with both EW-13 and nearby EW-23 combined operations. Lower TSA extraction well EW-23, which is monitored and reported in the East Multnomah

Cleanup Project reports, will remain operational to enhance treatment along the eastern portion of the Boeing property.

In compliance with Boeing Portland's National Pollutant Discharge Elimination System (NPDES) permit (NPDES number 101761), quarterly samples of the GWTS effluent were collected for chemical analysis. The NPDES permit effluent water quality requirements and the analytical results for the August and November 2010 events are summarized in Table 3. TCE concentrations for the system influent ranged from 8.2 to 8.4 µg/L during this reporting period, while the system effluent remained below the reporting limits. All the NPDES permit requirements were met during this reporting period.

6.2 COOLANT RELEASE SYSTEM PERMFORANCE EVALUATION

Groundwater quality monitoring indicates that the injection of EHC-O™ material has resulted in enhanced treatment of total TPH-Dx associated with the 2006 coolant release at the 85-105 building. Enhanced treatment is evidenced by a general decrease in total TPH-Dx at the footing sump and well LAI-4 following both 2008 injections and the 2010 injection; a general increase in oxygen reductive potential (ORP) in LAI-4, LAI-7, and the footing sump; and an increase in sulfate concentrations at LAI-7. An increase in ORP at the above wells and the footing sump was apparent following the second injection in 2008 and most recent injection in 2010. Since the injection in early 2010, ORP values have steadily declined in these wells. This decline indicates the need for additional injections of EHC-O™ to maintain optimum treatment conditions.

Total TPH-Dx concentrations at LAI-4 and LAI-7 have fluctuated since the initial injection, but are generally trending downward. The fluctuations in total TPH-Dx concentrations can be attributed to a number of variables including seasonal groundwater level changes, as well as enhanced desorption and dissolution of the coolant material from soil to groundwater caused by aquifer disturbance in the source area from injection well installation and EHC-O™ injections.

The STS has continuously operated to treat the coolant-impacted water since the start of the system in 2007. Analytical samples have been collected from the in-line monitor and coolant treatment system influent and to monitor the system and verify sanitary discharge permit acceptance levels. Analytical results for water samples collected from the system influent and effluent, and two GAC vessels, are summarized in Table 7.

The results of the analytical tests indicate FOG and total diesel concentrations were below the laboratory reporting limit for both the influent and effluent sampling ports. Historical system performance data indicates influent sample FOG and total diesel concentrations for the system have been below the respective reporting limits consistently since August 2008. During 2010, a total of 5,013,418 gallons of water were treated by the STS and discharged to the sanitary sewer, with

approximately 724 gallons of water requiring treatment through the GAC system prior to discharge. Most of the water that passes through the GAC system was artificially simulated for sample collection purposes. Based on the analytical results and the minimal amount of water being trigger to be automatically routed through the GAC vessels, we recommend a pilot shutdown of the STS.

7.0 RECOMMENDATIONS

This section presents recommendations based on the data and evaluations. Recommendations include: continued operation of the groundwater extraction system, continued water quality monitoring, and approval of the proposed pilot shutdown of the STS.

7.1 COOLANT RELEASE REMEDY

Based on the consistent analytical result from the STS and the minimal amount of water being automatically bypassed through the GAC vessels prior to discharge, we recommend the pilot shutdown of the coolant release treatment system. We propose to pilot shutdown the STS upon DEQ approval. Upon approval by the NPDES permit administrators, the water accumulated in the 85-105 footing sump drain will be rerouted from the STS back to the original discharge point of the GWTS. Monthly analytical samples will be collected from the sump for FOG and total diesel for a 12-month period. Additional samples from the GWTS influent/effluent will be collected, as needed, per the NPDES permit. If monthly monitoring data indicates elevated concentrations above the NPDES permit, then the sump water will be redirected to the STS.

7.2 PERFORMANCE MONITORING PROGRAM

No modifications to the existing performance and monitoring program (Table 1) are proposed.

7.3 LONG-TERM CORRECTIVE MEASURES OPERATION PLAN MODIFICATION

No long-term corrective measures operation plan modifications are proposed. Boeing will continue to evaluate changes to the groundwater extraction and treatment system based on the most current operational data. As appropriate and as requested by the authorizing agency, Boeing will also continue to evaluate new technologies for possible implementation.

8.0 USE OF THIS REPORT

This report has been prepared for the exclusive use of Boeing for specific application to the TGA remedy at the Portland facility. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of Landau Associates. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Landau Associates, shall be at the user's sole risk. Landau Associates warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. We make no other warranty, either express or implied.

This document has been prepared under the supervision and direction of the following key staff

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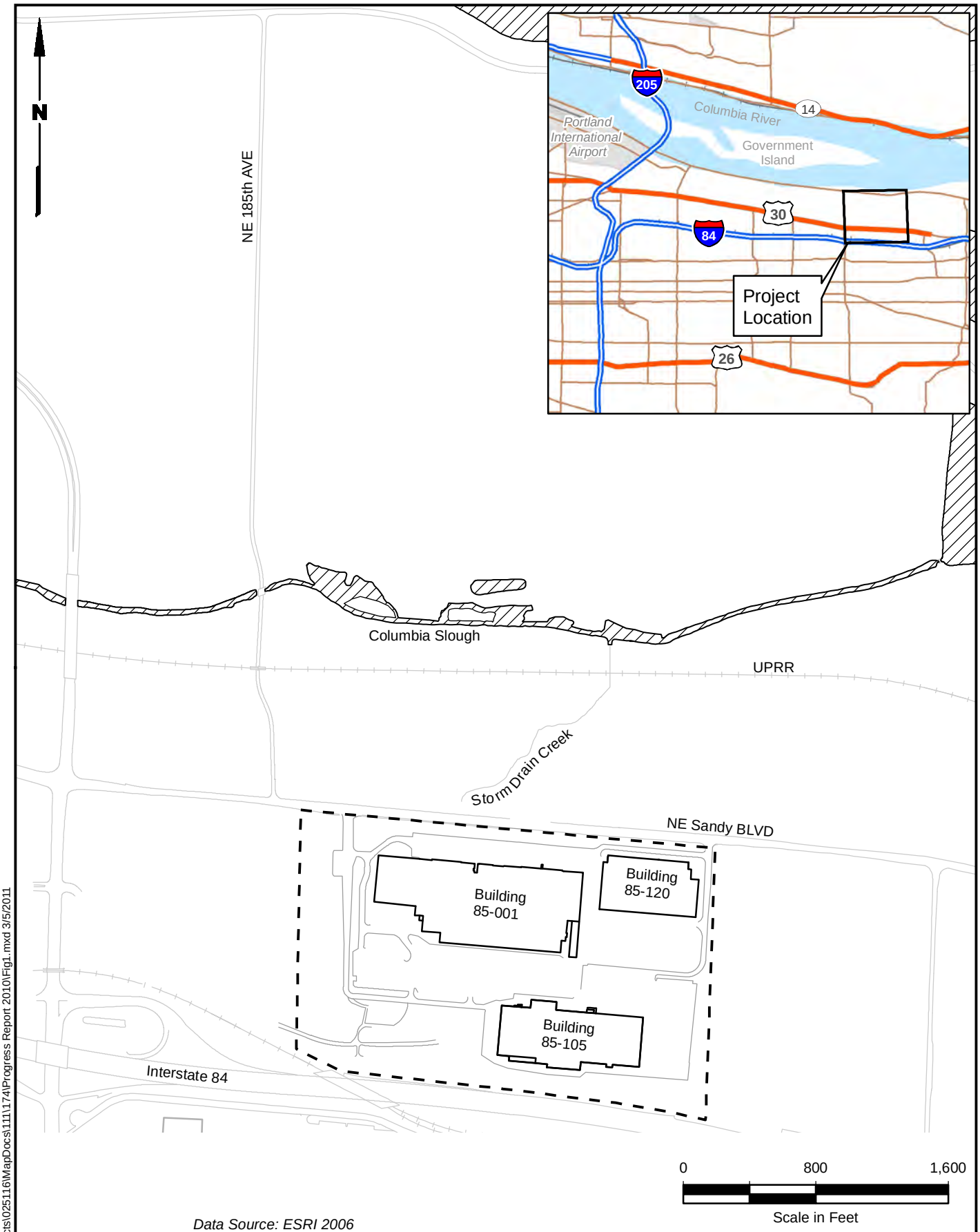

Data Source: ESRI 2006

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Boeing Portland	**Boeing Portland Site Map**	Figure 1

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Legend

- TGA Extraction Well
- TGA Injection Well
- TGA Monitoring Well
- Wells Decommissioned - March 2010
- TSA Monitoring Well
- TSA Extraction Well

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.
2. Corrective Action Areas defined in Phase 2 Corrective Measures Study (1996).

Approximate Limit of the TGA

Columbia Slough

Storm Drain Creek

NE SANDY BLVD

INTERSTATE 84

THE BOEING COMPANY

Downgradient Area

West Area

Southwest Area

Central Area

East Yard Area

East Area

D-2, D-7, D-8, D-12, E-13, D-13, D-11, E-12, BOP-7, BOP-22R(ds), E-2, E-4, E-3, BOP-8, BOP-77, BOP-73, BOP-74, BOP-76, IW-7, BOP-2, E-14, BOP-1, BOP-16, E-10, BOP-72, BOP-75, IW-6, BOP-4, E-15, BOP-60R(ds), BOP-6, BOP-60(ds), BOP-57, E-11, E-16, E-5, EW-3, BOP-56, E-9, BOP-19, BOP-36, BOP-48, E-8, BOP-61(ds), BOP-65(ds), LAI-2, LAI-1, EW-13, BOP-58, BOP-10, E-7, LAI-3, BOP-9, E-6, LAI-8, LAI-7, LAI-4, IW-2, BOP-62(ds), LAI-6, IW-3, BOP-59, DP-1, LAI-5, IW-1, IW-5, IW-4, BOP-11, BOP-12, BOP-13

0 350 700

Scale in Feet

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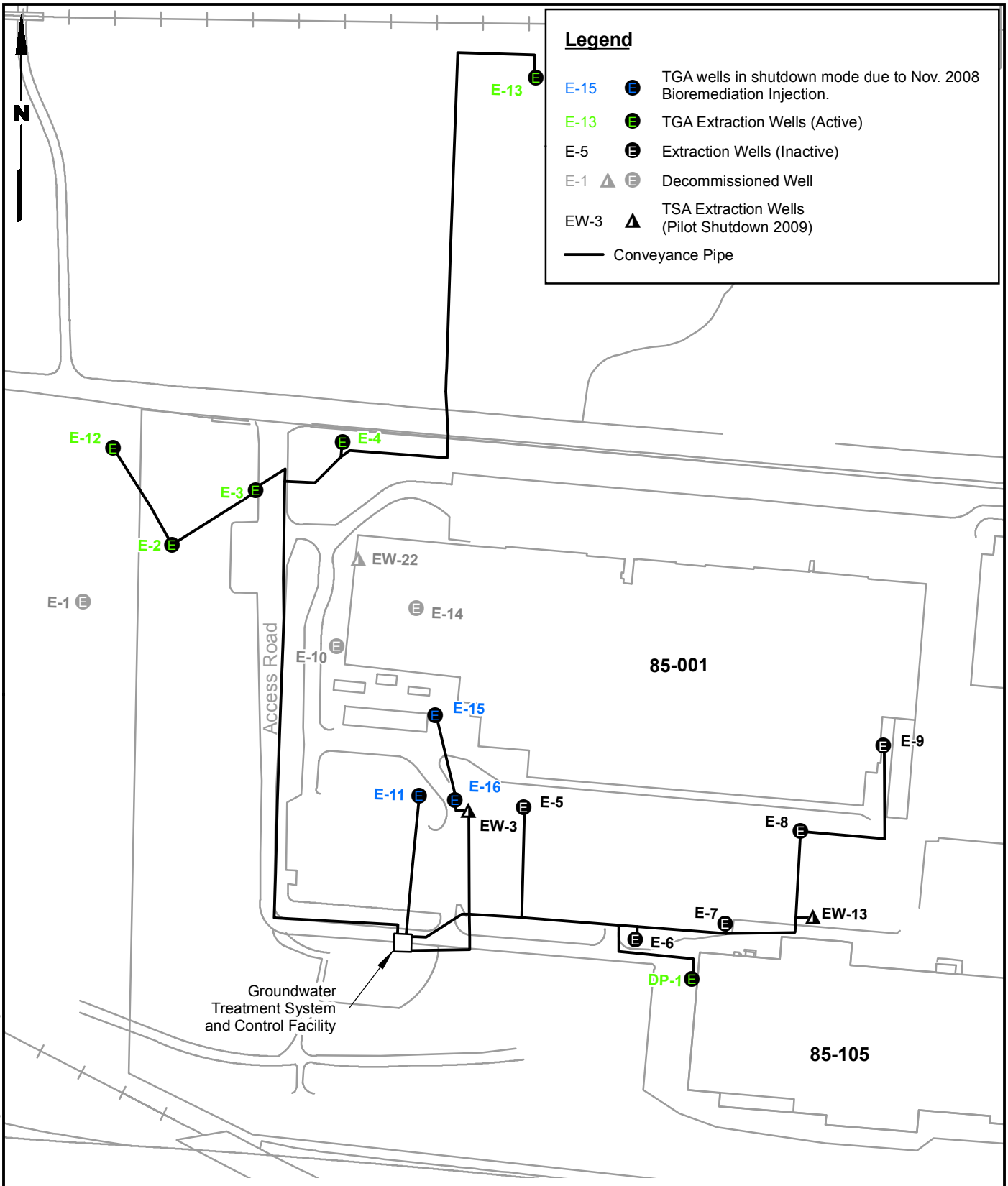
Boeing Portland

TGA Groundwater Monitoring Locations and Corrective Action Areas

Figure 2



Note
1. E-1 abandoned 6/04; E-10, E-14 and EW-22 abandoned 2/10.

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Boeing Portland	**Groundwater Extraction and Treatment System Configuration**	Figure 3

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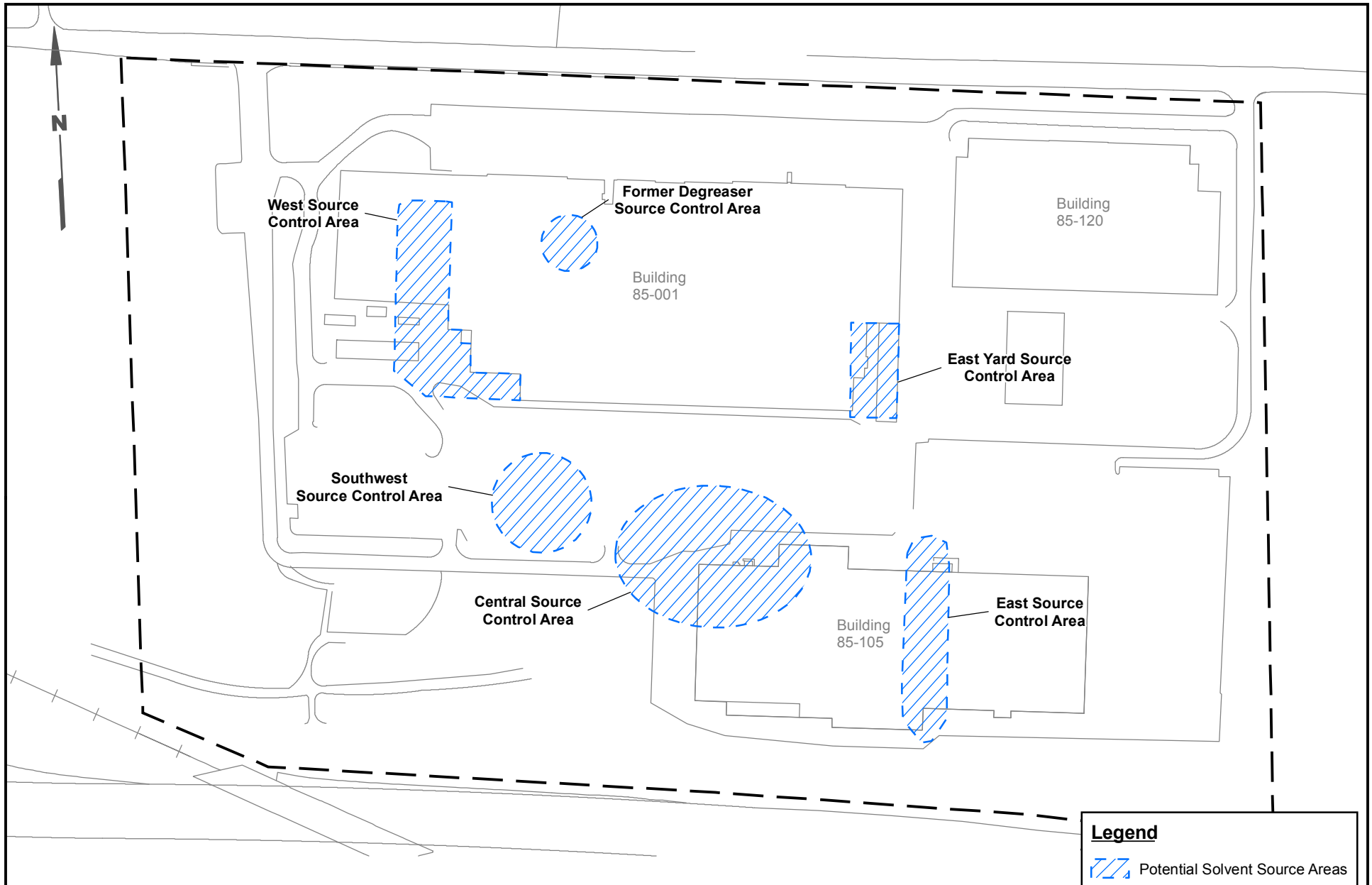

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ICP: Source Control Areas

Figure 4

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Legend

N

E-13 — TGA Extraction Well and TCE Concentration in Groundwater

D-12 — TGA Monitoring Well and TCE Concentration in Groundwater

BOP-62(ds) — Upper TSA Monitoring Well and TCE Concentration in Groundwater

BOP-75 — TGA Monitoring Well Installed December 2010

5 — Approximate August 2010 TCE Concentration Contour (µg/L) and MCL

E-15 (Well ID)	
Sample Date	TCE Concentration (µg/L)

Notes

ND = Not detected above the reporting limit
MCL for TCE = 5.0 µg/L
NS = Not Sampled

(a) TCE concentration for BOP-57 is the BOP-57(ia) result. Well BOP-57(ib) is screened with the confining layer, TCE concentration for BOP-57(ib)=180 µg/L.

1. TSA analytical results are shown as part of the CMI-specified evaluation of possible TGA activity affect on TSA water quality.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.
3. TCE concentration contours based on the more extensive annual sampling event (August 2010).

Approximate Limit of the TGA

NE SAND

INTERSTATE 84

D-7	
8/13/10	ND

D-8	
8/13/10	14

D-12	
8/13/10	2.2

E-4	
8/9/10	79
11/15/10	95

E-13	
8/11/10	6.4

BOP-7	
8/17/10	110
11/17/10	87

E-3	
8/9/10	35
11/15/10	35

D-11	
8/13/10	ND

E-12	
8/11/10	5.7

BOP-22R(ds)	
8/18/10	ND
11/11/10	ND

E-2	
8/9/10	16
11/15/10	14

BOP-74(i)						
	60 ft	66 ft	71 ft	78 ft	82 ft	DBS
8/15/10	50	53	52	55	24	NS
10/18/10	NS	NS	NS	NS	NS	38

BOP-73(i)						
	60 ft	66 ft	71 ft	78 ft	82 ft	DBS
8/15/10	14	46	210	520	3.2	NS
10/19/10	NS	NS	NS	NS	NS	560

BOP-72(i)						
	55 ft	61 ft	67 ft	73 ft	78 ft	DBS
8/15/10	20	30	33	6.6	ND	NS
10/18/10	NS	NS	NS	NS	NS	128

BOP-60R(ds)			
	155 ft	159 ft	163 ft
8/19/10	2.2	0.8	0.8
11/11/10	0.9	0.3	0.7

BOP-77 100
BOP-76
BOP-75

BOP-16	
8/11/10	ND
11/15/10	ND

E-15	
8/9/10	ND
11/15/10	ND

E-5	
8/6/10	5.2

BOP-65(ds)	
8/12/10	6.9

E-8	
8/6/10	7.5

E-9	
8/6/10	1.7

E-11	
8/9/10	ND
11/15/10	ND

BOP-56	
8/12/10	35

BOP-48	
5/10/10	1.8

BOP-61(ds)	
8/12/10	4.4

E-16	
8/9/10	2.8
11/15/10	ND

BOP-62(ds)	
8/12/10	0.3

BOP-57ia(a)	
8/15/10	13

BOP-59	
8/11/10	23

LAI-4	
8/10/10	1.2
11/16/10	ND

BOP-9	
8/11/10	15

E-6	
8/6/10	17

BOP-10	
8/11/10	87

DP1	
8/9/10	36

E-7	
8/6/10	39

LAI-7	
8/10/10	13
11/16/10	12

LAI-6	
8/10/10	3.4
11/16/10	3.0

0 360 720
Scale in Feet

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TCE Concentrations in TGA-August and November 2010

Figure 5

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Legend

N

- E-3 — TGA Extraction Well and Groundwater Elevation August 2010
- BOP-7 16.77 — TGA Monitoring Well and Groundwater Elevation August 2010
- BOP-22 11.51 — Upper TSA Monitoring Well and Groundwater Elevation August 2010
- 5 — Approximate Groundwater Elevation Contour (ft.MSL)

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Approximate TGA Capture Zone

Approximate Limit of the TGA

D-13 13.32

D-02 10.79

D-07 10.29

D-08 9.9

D-12 9.55

E-13 -15.5

D-11 10.94

NE SANDY BLVD

E-12 -17.86

BOP-07 16.77

E-4 5.19

E-3 0.12

E-2 -5.72

BOP-22Rds 11.51

BOP-16 25.82

BOP-73 34.21

BOP-74 34.26

BOP-72 34.26

BOP-19 77.38

E-15 32.8

BOP-60Rds 11.49

E-9 72.81

BOP-36 75.43

BOP-48 81.66

THE BOEING COMPANY

E-11 25.19

E-16 31.01

BOP-57 33.89

E-5 31.82

BOP-56 39.52

E-8 84

LAI-1 86.8

BOP-61ds 9.11

BOP-65ds 11.29

E-7 86.66

LAI-2 88.12

BOP-58 90.75

BOP-09 31.17

E-6 46.72

BOP-10 75.28

LAI-3 88.79

LAI-4 88.49

BOP-11 27.13

BOP-62ds 11.34

LAI-8 83.9

DP1 78.56

LAI-5 90.29

BOP-59 82.97

LAI-6 89.22

BOP-12 87.53

LAI-7 86.74

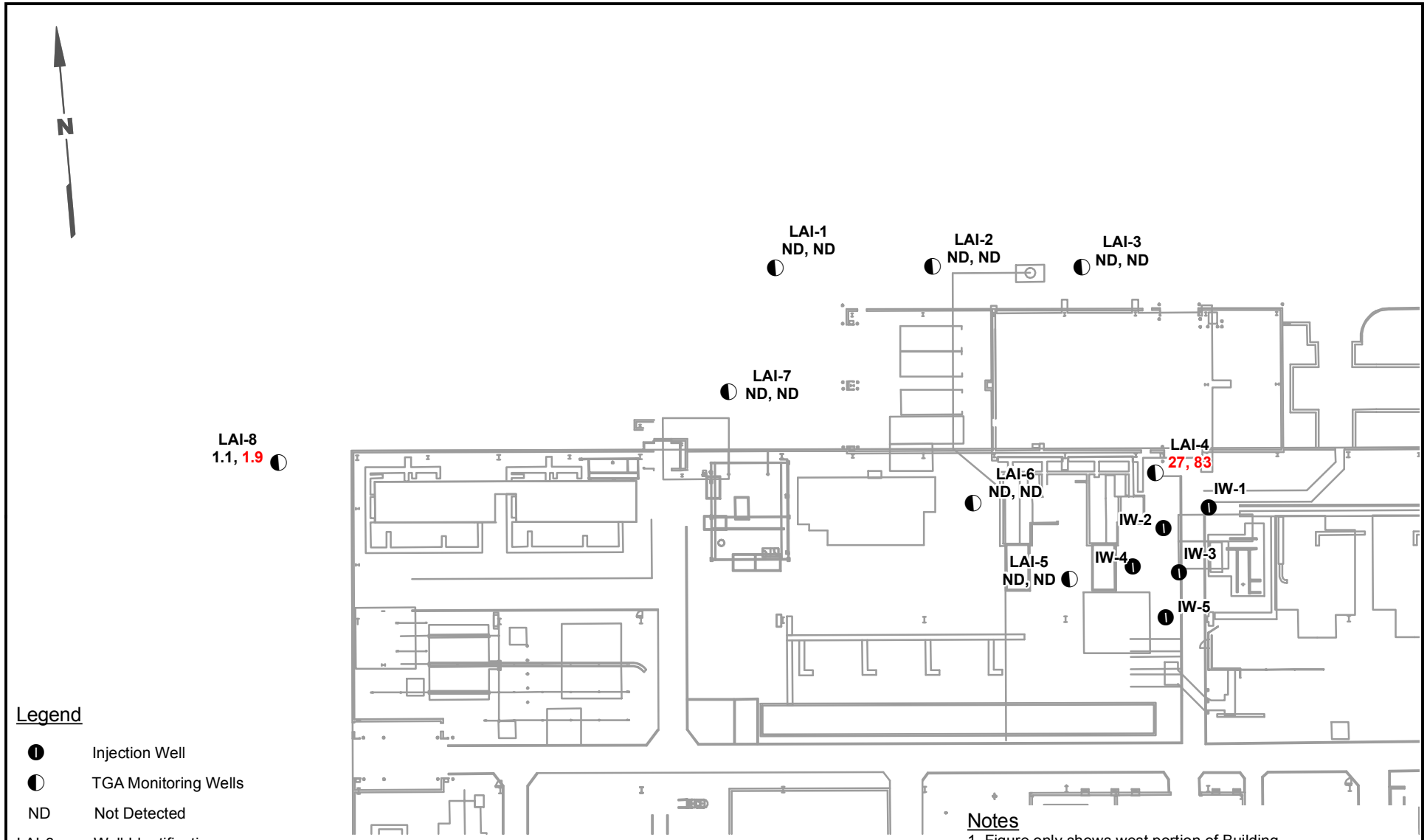
0 360 720

Scale in Feet

LANDAU ASSOCIATES

Boeing Portland	**TGA Groundwater Elevation Contours and Capture Zone- August 2010**	Figure 6

Y:\Projects\025116\MapDocs\111\174\Progress Report 2010\Fig7.mxd 3/11/2011 NAD 1983 StatePlane Oregon North FIPS 3601 Feet



Legend

- Injection Well
- TGA Monitoring Wells
- ND — Not Detected
- LAI-8 — Well Identification
- 3.8, 1.0 — Total diesel- and Motor Oil-Range Petroleum Hydrocarbons For August (1st Number) and November 2010 (2nd Number)

Notes

1. Figure only shows west portion of Building
2. Red values are above site-specific cleanup level (1.35 mg/L)
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation

Adapted from: Boeing 2006

0 50 100

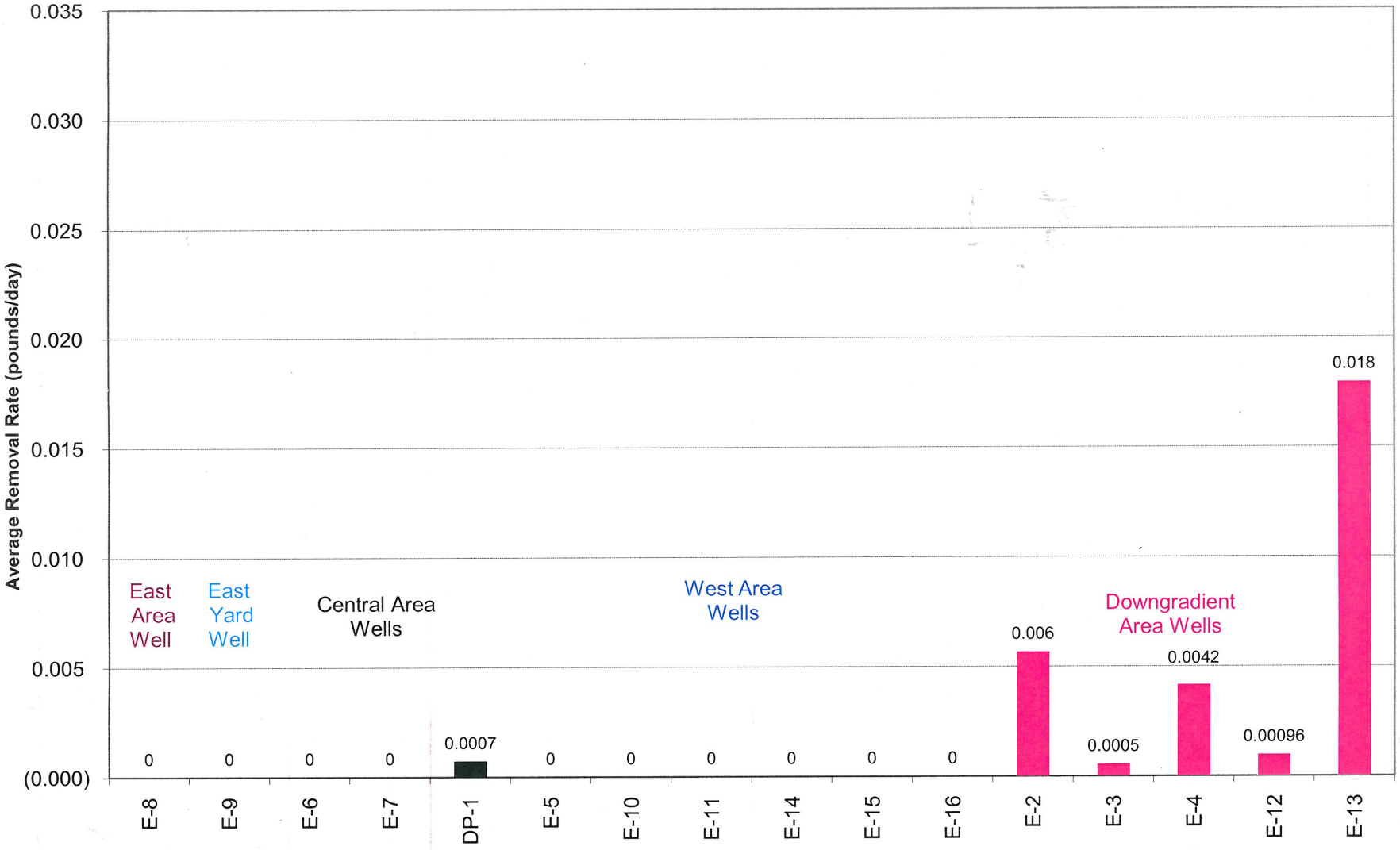
Scale in Feet

LANDAU ASSOCIATES

Portland, Oregon

Coolant Release Analytical Results August and November 2010

Figure 7



Notes: Total VOCs include the following constituents: TCA, TCE, total 1,2-DCE, PCE, 1,1-DCE, and Freon-TF.
Pumping operations at Well E-1 were suspended on 4/13/00, at Well E-10 on 3/29/2010, and at Well E-14 on 4/1/2010.

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Boeing Portland	**Average Total Mass Removal Rates for 2010**	Figure 8

TABLE 1
PERFORMANCE MONITORING LOCATIONS (a)

Aquifer and Well Use	Location	Sampling Frequency July - December 2010		Sampling Frequency Proposed	
		Groundwater Elevation	Groundwater Quality	Groundwater Elevation	Groundwater Quality
West Area					
TGA Well	BOP-16(i)	S	Q	S	Q
TGA Well	BOP-57(ia)	S	S	S	S
TGA Well	BOP-57(ib)	S	S	S	S
TGA Extraction Well	E-5	Q	A	Q	A
TGA Extraction Well	E-11	Q	Q	Q	Q
TGA Extraction Well	E-15	Q	Q	Q	Q
TGA Extraction Well	E-16	Q	Q	Q	Q
Upper TSA Well	BOP-60R(ds) (b)	S	Q	S	Q
Central Area					
TGA Well	BOP-10(i)	S	S/C-A	S	S/C-A
TGA Well	BOP-56(i)	S	S/C-D	S	S/C-D
TGA Well	BOP-59(i)	S	S/C-A	S	S/C-A
TGA Extraction Well	E-6	Q	A	Q	A
TGA Extraction Well	E-7	Q	A	Q	A
TGA Extraction Well	DP-1	Q	S/C-A	Q	S/C-A
Upper TSA Well	BOP-65(ds) (b)	S	S	S	S
East Yard					
TGA Well	BOP-19(i)	S	D	S	D
TGA Well	BOP-48(i)	S	A	S	A
TGA Well	BOP-36(i)	S	D	S	D
TGA Extraction Well	E-9	Q	A	Q	A
Upper TSA Well	BOP-61(ds) (b)	S	S	S	S
East Area					
TGA Well	BOP-12(i)	S	Q-D	S	Q-D
TGA Well	BOP-58(i)	S	D	S	D
TGA Extraction Well	E-8	Q	A	Q	A
Southwest Area					
TGA Well	BOP-9(i)	S	S/C-A	S	S/C-A
TGA Well	BOP-11(i)	A	D	A	D
Upper TSA Well	BOP-62(ds) (b)	S	S/C-D	S	S/C-D

TABLE 1
PERFORMANCE MONITORING LOCATIONS (a)

Aquifer and Well Use	Location	Sampling Frequency July - December 2010		Sampling Frequency Proposed	
		Groundwater Elevation	Groundwater Quality	Groundwater Elevation	Groundwater Quality
Downgradient Area					
TGA Well	BOP-7(i)	S	Q	S	Q
TGA Well	D-7(i)	S	A	S	A
TGA Well	D-8(i)	S	S	S	S
TGA Well	D-11(i)	S	A	S	A
TGA Well	D-12(i)	S	S	S	S
TGA Extraction Well	E-2	Q	Q	Q	Q
TGA Extraction Well	E-3	Q	Q	Q	Q
TGA Extraction Well	E-4	Q	Q	Q	Q
TGA Extraction Well	E-12	Q	S	Q	S
TGA Extraction Well	E-13	Q	S	Q	S
Upper TSA Well	BOP-22R(ds) (b)	Q	Q	Q	Q
Former Degreaser Source Control Area					
	BOP-72(i)	Q	Q	Q	Q
	BOP-73(i)	Q	Q	Q	Q
	BOP-74(i)	Q	Q	Q	Q
	BOP-75(i)	Q	Q	Q	Q
	BOP-76(i)	Q	Q	Q	Q
	BOP-77(i)	Q	Q	Q	Q
Coolant Release					
	LAI-1	Q	Q	Q	Q
	LAI-2	Q	Q	Q	Q
	LAI-3	Q	Q	Q	Q
	LAI-4	Q	Q	Q	Q
	LAI-5	Q	Q	Q	Q
	LAI-6	Q	Q	Q	Q
	LAI-7	Q	Q	Q	Q
	LAI-8	Q	Q	Q	Q

S = Semiannual; Q = Quarterly; A = Annual; D = Discontinue Monitoring; -- = No Data; C = Coolant
S/C-A = Well sampled for multiple purposes. First abbreviation indicates sampling frequency for VOC remedy/second abbreviation indicates sampline frequency for coolant release.
Shaded cells indicate wells with proposed modification to monitoring frequency.

(a) From Table 3-3 of Five-Year Performance Evaluation, January 2001 through December 2005, based on Phase 2 Corrective Measures Study (1996).
(b) TSA water quality data collected to evaluate remedy performance as part of TGA corrective measure performance. Diffusion Bag Samples (DBS) to be utilized for TSA sample collection.

TABLE 2
GROUNDWATER ANALYTICAL RESULTS
BIOREMEDIATION INJECTION TREATMENT AREA
BOEING OF PORTLAND

	Baseline									
Sample ID	BOP-7i	BOP-7i	BOP-7i	BOP-7i	BOP-7i	BOP-07i	BOP-07i	BOP-7i	BOP-7i	BOP-7i-Dup
Lab ID	MJ92J	NK54H	OM49B	PA04A	PM02A	PX48A	QJ01A	QV63A	RJ19A	RJ19B
Sample Date	2/20/2008	8/13/2008	2/12/2009	5/21/2009	8/26/2009	11/12/2009	2/5/2010	5/6//10	8/17/2010	8/17/2010
VOLATILES (µg/L)										
Method SW8260B/SW8260C										
Vinyl Chloride	1.0 U	1.0 U	1.0 U	1.0 U	0.2 U	3.0 U	0.6 U	3.0 U	1.0 U	1.0 U
Acetone	5.0 U	5.0 U	5.0 U	10 U	5.0 U	30 U	15 U	30 U	10 U	10 U
1,1-Dichloroethene	**6.8**	**5.0**	**8.1**	**9.6**	**9.5**	**6.6**	**5.6**	**11**	**6.3**	**6.5**
trans-1,2-Dichloroethene	1.0 U	1.0 U	1.0 U	1.0 U	**0.2**	3.0 U	0.6 U	3.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	**5.2**	**3.7**	**6.0** J	**6.1**	**24**	**12**	**7.7**	**8.0**	**4.2**	**4.4**
2-Butanone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	15 U	15 U	15 U	5.0 U	5.0 U
1,1,1-Trichloroethane	**2.5**	**1.8**	**2.8**	**2.6**	**2.8** J	3.0 U	**1.6**	3.0 U	**1.5**	**1.6**
Trichloroethene	**100**	**82**	**160**	**170**	**130**	**130**	**90**	**220**	**110**	**100**
4-Methyl-2-Pentanone (MIBK)	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	15 U	15 U	15 U	5.0 UJ	5.0 UJ
2-Hexanone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	15 U	15 U	15 U	5.0 U	5.0 U
Tetrachloroethene	**3.2**	**2.4**	**3.6**	**3.9**	**4.5**	**3.4**	**2.7**	**4.0**	**2.9**	**2.9**
CONVENTIONALS (mg/L)										
Nitrate (EPA300.0/EPA353.2)	NA	NA	NA	**1.7**	**1.1**	**1.1**	NA	**1.8**	**1.7**	NA
Sulfate (EPA300.0/EPA375.2)	NA	NA	NA	**7.4**	**7.5**	**8.4**	NA	**6.6**	**9.4**	NA
Total Organic Carbon (EPA415.1)	NA	NA	NA	NA	1.50 U	1.50 U	NA	1.50 U	1.50 U	NA
DISSOLVED GASES (µg/L)										
Method RSK-175										
Methane	NA	NA	NA	0.7 U	**212**	NA	NA	NA	**5.5**	NA
Ethane	NA	NA	NA	1.2 U	1.2 U	NA	NA	NA	1.2 U	NA
Ethene	NA	NA	NA	1.1 U	1.1 U	NA	NA	NA	1.1 U	NA
Acetylene	NA	NA	NA	1.1 U	1.1 U	NA	NA	NA	1.1 U	NA
FIELD PARAMETERS										
pH	6.66	6.23	6.95	6.61	6.90	7.04	7.65	7.25	7.49	7.50
Dissolved oxygen (mg/L)	3.26	3.42	0.01	2.95	3.32	2.07	3.25	2.60	2.70	2.68
ORP (mv)	83.5	99.3	210.2	91.0	31.3	57.0	26.5	149.6	19.6	21.3
Ferrous iron (mg/L)	NM	NM	NM	0.6	0.8	0.6	NM	0.4	0.4	NM

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TABLE 2
GROUNDWATER ANALYTICAL RESULTS
BIOREMEDIATION INJECTION TREATMENT AREA
BOEING OF PORTLAND

			Baseline							
Sample ID	BOP-7i	BOP-7i-Dup	BOP-16i	BOP-16i	BOP-16i	BOP-16i	BOP-16i	BOP-16i	BOP-16i	BOP-16i
Lab ID	RX31C	RX31D	NT51H	OM10A	OY77A	PL19E	PX21C	QJ28B	QV49G	RI21C
Sample Date	11/17/2010	11/17/2010	10/8/2008	2/11/2009	5/12/2009	8/19/2009	11/11/2009	2/9/2010	5/5/2010	8/11/2010
VOLATILES (µg/L)										
Method SW8260B/SW8260C										
Vinyl Chloride	3.0 U	3.0 U	0.2 U	1.0 U	1.0 U	1.0 U	**5.3** J	**14**	**15**	**16**
Acetone	30 U	30 U	3.0 U	**29**	**81**	**30**	**38** J	**24**	10 UJ	10 U
1,1-Dichloroethene	**4.7**	**4.5**	**1.6**	1.0 U	**1.0**	**1.2**	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	3.0 U	3.0 U	0.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	**3.4**	**3.2**	**2.1**	**1.2**	**11**	**14**	**8.1**	1.0 U	1.0 U	1.0 U
2-Butanone	15 U	15 U	2.5 U	**69**	**70**	**24**	**20**	**13**	5.0 U	5.0 U
1,1,1-Trichloroethane	3.0 U	3.0 U	**1.2**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	**87**	**86**	**7.9**	**2.7**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Methyl-2-Pentanone (MIBK)	15 U	15 U	2.5 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Hexanone	15 U	15 U	2.5 U	**23**	5.0 U	**10**	**7.9**	5.0 U	5.0 U	5.0 U
Tetrachloroethene	3.0 U	3.0 U	**0.4**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CONVENTIONALS (mg/L)										
Nitrate (EPA300.0/EPA353.2)	**1.8**	NA	**2.7**	0.1 U	1.0 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Sulfate (EPA300.0/EPA375.2)	**9.4**	NA	**10.0**	0.1 U	**7.4**	0.1 U	0.2 U	0.1 U	**0.1**	**0.6**
Total Organic Carbon (EPA415.1)	1.5 U	NA	1.5 U	**358**	**142**	**38.6**	**41.6**	**4.74**	**3.11**	**1.67**
DISSOLVED GASES (µg/L)										
Method RSK-175										
Methane	NA	NA	**4.2**	0.7 U	**20,700**	**23400**	NA	NA	NA	**23200**
Ethane	NA	NA	**2.0**	1.2 U	1.2 U	1.2 U	NA	NA	NA	1.2 U
Ethene	NA	NA	1.1 U	1.1 U	1.1 U	1.1 U	NA	NA	NA	1.1 U
Acetylene	NA	NA	NA	1.1 U	1.1 U	1.1 U	NA	NA	NA	1.1 U
FIELD PARAMETERS										
pH	6.34	NM	6.74	6.15	6.98	6.40	6.97	7.18	6.86	8.84
Dissolved oxygen (mg/L)	3.60	NM	7.42	0.01	0.42	0.76	1.70	0.56	0.03	0.32
ORP (mv)	-11.5	NM	159.2	153.9	20.7	-29.5	44.0	-3.6	-128.7	-92.8
Ferrous iron (mg/L)	NM	NM	0.0	2.2	0.6	2.4	2.6	5.4	2.2	2.0

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TABLE 2
GROUNDWATER ANALYTICAL RESULTS
BIOREMEDIATION INJECTION TREATMENT AREA
BOEING OF PORTLAND

		Baseline								
Sample ID	BOP-16i	E-2	E-2	E-2	E-2	E-2	E-2	E-2	E2	E2
Lab ID	RW72I	NT51E	OL09A	OY04C	PJ65A	PV97A	QH99A	QV49F	RH82I	RW72C
Sample Date	11/15/2010	10/8/2008	2/3/2009	5/6/2009	8/6/2009	11/4/2009	2/2/2010	5/5/2010	8/9/2010	11/15/2010
VOLATILES (µg/L)										
Method SW8260B/SW8260C										
Vinyl Chloride	**13**	0.2 U	1.0 U	1.0 U	1.0 U	**1.9** J	**1.0**	1.0 U	1.0 U	1.0 U
Acetone	10 U	3.0 U	**14**	**16**	**13**	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethene	1.0 U	**1.5**	1.0 U	**1.2**	**2.0**	**1.4**	**1.9**	**2.6**	**2.0**	**1.9**
trans-1,2-Dichloroethene	1.0 U	0.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	1.0 U	**0.7**	1.0 U	**5.9**	**5.8**	**3.1**	**1.3**	**1.5**	1.0 U	1.0 U
2-Butanone	5.0 U	2.5 U	**34**	**8.3**	**5.8** U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,1,1-Trichloroethane	1.0 U	**0.8**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	1.0 U	**11**	1.0 U	**2.5**	**10**	**3.8**	**13**	**22**	**16**	**14**
4-Methyl-2-Pentanone (MIBK)	5.0 U	2.5 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Hexanone	5.0 U	2.5 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Tetrachloroethene	1.0 U	**0.5**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CONVENTIONALS (mg/L)										
Nitrate (EPA300.0/EPA353.2)	0.1 U	**3.2**	0.1 U	0.1 U	**1.3** J	**1.3**	**6.2**	**1.8**	**2.0**	**1.8**
Sulfate (EPA300.0/EPA375.2)	**0.9**	**11.7**	0.1 U	**7.4**	**10.3**	**8.2**	**11.3**	**8.8**	**9.4**	**9.3**
Total Organic Carbon (EPA415.1)	NA (b)	1.5 U	**254**	**11.1**	**4.62**	**2.65**	**12.8** J	1.50 U	**11.7**	1.50 U
DISSOLVED GASES (µg/L)										
Method RSK-175										
Methane	NA	0.7 U	NA	NA	**5270**	NA	NA	NA	**8100**	NA
Ethane	NA	1.2 U	NA	NA	1.2 U	NA	NA	NA	1.2 U	NA
Ethene	NA	1.1 U	NA	NA	1.1 U	NA	NA	NA	1.1 U	NA
Acetylene	NA	NA	NA	NA	1.1 U	NA	NA	NA	1.1 U	NA
FIELD PARAMETERS										
pH	6.14	6.99	6.69	7.27	6.65	7.56	7.23	6.51	6.40	6.44
Dissolved oxygen (mg/L)	1.05	5.71	0.01	1.60	3.96	5.09	8.57	3.21	0.94	2.70
ORP (mv)	106.0	153.7	30.5	-69.7	-50.3	10.2	143.4	-130.6	86.7	-12.0
Ferrous iron (mg/L)	1.6	0.0	1.6	1.2	1.8	1.6	1.2	1.2	1.4	1.8

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TABLE 2
GROUNDWATER ANALYTICAL RESULTS
BIOREMEDIATION INJECTION TREATMENT AREA
BOEING OF PORTLAND

	Baseline									Baseline
Sample ID	E-3	E-3	E-3	E-3	E-3	E-3	E-3	E3	E3	E-4
Lab ID	NT51F	OM12A	OY04D	PJ65B	PV97B	QH99B	QV49E	RH82J	RW72D/RX31A	NT51G
Sample Date	10/8/2008	2/11/2009	5/6/2009	8/6/2009	11/4/2009	2/2/2010	5/5/2010	8/9/2010	11/15-17/2010	10/8/2008
VOLATILES (µg/L)										
Method SW8260B/SW8260C										
Vinyl Chloride	0.2 U	1.0 U	1.0 U	1.0 U	**2.3** J	**2.8**	**1.2**	**3.5**	**2.6**	0.2 U
Acetone	**3.5**	5.0 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	3.0 U
1,1-Dichloroethene	**12**	**7.7**	**2.6**	**3.4**	**4.4**	**1.6**	**2.1**	**4.8**	**4.3**	**30**
trans-1,2-Dichloroethene	**0.2**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.2 U
cis-1,2-Dichloroethene	**5.2**	**32**	**5.9**	**9.2**	**11**	**1.8**	**2.3**	**3.9**	**3.1**	**2.7**
2-Butanone	2.5 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.5 U
1,1,1-Trichloroethane	**3.0**	**2.0**	1.0 U	1.0 U	**1.2**	1.0 U	1.0 U	**1.3**	**1.0**	**4.1**
Trichloroethene	**89**	**34**	**18**	**20**	**23**	**11**	**14**	**35**	**35**	**180**
4-Methyl-2-Pentanone (MIBK)	2.5 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.5 U
2-Hexanone	2.5 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.5 U
Tetrachloroethene	**2.8**	**1.4**	1.0 U	1.0 U	**1.1**	1.0 U	1.0 U	**1.5**	**1.4**	**5.5**
CONVENTIONALS (mg/L)										
Nitrate (EPA300.0/EPA353.2)	**2.8**	0.1 U	**2.6**	**2.4** J	**2.2**	**6.4**	**2.3**	**1.9**	**1.8**	**2.8**
Sulfate (EPA300.0/EPA375.2)	**10.6**	**2.1**	**11.6**	**10.1**	**8.5**	**12.8**	**9.8**	**9.5**	**9.9**	**10.2**
Total Organic Carbon (EPA415.1)	1.5 U	**54.4**	1.50 U	1.50 U	1.50 U	**14.8**	1.50 U	**2.85**	1.50 U	1.5 U
DISSOLVED GASES (µg/L)										
Method RSK-175										
Methane	**0.9**	NA	NA	0.7 U	NA	NA	NA	**4160**	NA	**2.0**
Ethane	1.2 U	NA	NA	1.2 U	NA	NA	NA	1.2 U	NA	1.2 U
Ethene	1.1 U	NA	NA	1.1 U	NA	NA	NA	1.1 U	NA	1.1 U
Acetylene	NA	NA	NA	1.1 U	NA	NA	NA	1.1 U	NA	NA
FIELD PARAMETERS										
pH	6.74	6.89	6.93	6.58	7.41	8.11	6.59	6.45	6.30	6.75
Dissolved oxygen (mg/L)	6.76	0.01	0.96	5.80	2.17	3.78	1.78	2.43	2.64	3.39
ORP (mv)	147.0	100.4	1.0	-9.0	57.6	0.4	-131.2	118.3	9.1	146.5
Ferrous iron (mg/L)	0.0	NM	0.6	0.6	2.2	0.8	0.0	0.2	0.4	0.0

`

TABLE 2
GROUNDWATER ANALYTICAL RESULTS
BIOREMEDIATION INJECTION TREATMENT AREA
BOEING OF PORTLAND

Sample ID	E-4	E-4	E-4	E-4	E-4	E-4	E4	E4	E-11	Baseline E-11
Lab ID	OL09B	OY04E	PJ65C	PV97C	QH99C	QV49D	RH82K	RW72E/RX31B	MI92C	MW38J
Sample Date	2/3/2009	5/6/2009	8/6/2009	11/4/2009	2/2/2010	5/5/2010	8/9/2010	11/15-17/2010	2/12/2008	5/12/2008
VOLATILES (µg/L)										
Method SW8260B/SW8260C										
Vinyl Chloride	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.0 U	3.0 U	1.0 U	1.0 U
Acetone	5.0 U	10 U	10 UJ	10 U	10 U	10 UJ	30 U	30 U	5.0 U	5.0 U
1,1-Dichloroethene	**43**	**18**	**22**	**23**	**16**	**10**	**14**	**17**	**5.8**	**5.7**
trans-1,2-Dichloroethene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.0 U	3.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	**3.0**	1.0 U	**1.1**	**1.3**	**1.5**	**1.7**	3.0 U	3.0 U	**7.1**	**7.0**
2-Butanone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	15 U	15 U	5.0 U	5.0 U
1,1,1-Trichloroethane	1.0 U	**1.3**	**1.4**	**1.6**	**1.9**	**1.6**	3.0 U	3.0 U	**8.3**	**7.8**
Trichloroethene	**260**	**66**	**86**	**85**	**100**	**100**	**79**	**95**	**34**	**35**
4-Methyl-2-Pentanone (MIBK)	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	15 U	15 U	5.0 U	5.0 U
2-Hexanone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	15 U	15 U	5.0 U	5.0 U
Tetrachloroethene	**7.4**	**2.2**	**2.8**	**3.1**	**3.3**	**3.3**	3.0 U	**3.1**	**2.6**	**2.8**
CONVENTIONALS (mg/L)										
Nitrate (EPA300.0/EPA353.2)	0.1 U	**2.8**	**2.4** J	**2.9**	**7.2**	**2.7**	**2.9**	**2.9**	NA	NA
Sulfate (EPA300.0/EPA375.2)	**5.7**	**9.3**	**8.9**	**9.1**	**11.8**	**8.6**	**9.1**	**9.2**	NA	NA
Total Organic Carbon (EPA415.1)	**3.18**	1.50 U	1.50 U	1.50 U	**11.4**	**4.06**	**1.57**	1.5 U	NA	NA
DISSOLVED GASES (µg/L)										
Method RSK-175										
Methane	NA	NA	**25**	NA	NA	NA	**7.9**	NA	NA	NA
Ethane	NA	NA	1.2 U	NA	NA	NA	1.2 U	NA	NA	NA
Ethene	NA	NA	1.1 U	NA	NA	NA	1.1 U	NA	NA	NA
Acetylene	NA	NA	1.1 U	NA	NA	NA	1.1 U	NA	NA	NA
FIELD PARAMETERS										
pH	7.16	6.84	6.54	7.34	8.04	6.58	6.36	6.27	6.71	7.52
Dissolved oxygen (mg/L)	0.00	1.84	7.34	3.72	8.03	3.07	1.65	4.28	13.51	6.47
ORP (mv)	-24.0	28.8	22.3	70.4	34.4	-131.1	159.3	24.5	26.0	123.1
Ferrous iron (mg/L)	2.2	0.6	0.8	1.2	0.0	0.0	0.0	0.2	NM	NM

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TABLE 2
GROUNDWATER ANALYTICAL RESULTS
BIOREMEDIATION INJECTION TREATMENT AREA
BOEING OF PORTLAND

Sample ID	E-11	E-11	E-11	E-11	E-11	E-11	E11	E11	E-15	Baseline E-15
Lab ID	NK21O	OY28B	PL01A	PW28B	QH99E	QV49B	RH82H	RW72F	MI92J	MW38N
Sample Date	8/8/2008	5/7/2009	8/18/2009	11/5/2009	2/2/2010	5/5/2010	8/9/2010	11/15/2010	2/14/2008	5/12/2008
VOLATILES (µg/L)										
Method SW8260B/SW8260C										
Vinyl Chloride	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Acetone	5.0 U	**46**	**98**	**180**	**180**	**41** J	**37**	**92**	5.0 U	5.0 U
1,1-Dichloroethene	**6.6**	1.0 U	1.0 U	1.0 U	**1.2**	1.0 U	1.0 U	1.0 U	**12**	**9.9**
trans-1,2-Dichloroethene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	**6.8**	1.0 U	1.0 U	**1.7**	**31**	1.0 U	1.0 U	**5.5**	**5.6**	**4.7**
2-Butanone	5.0 U	**30**	**230**	**190**	**110**	**36**	**22**	**46**	5.0 U	5.0 U
1,1,1-Trichloroethane	**8.9**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**9.7**	**8.1**
Trichloroethene	**34**	1.0 U	1.0 U	1.0 U	**2.1**	1.0 U	1.0 U	1.0 U	**32**	**30**
4-Methyl-2-Pentanone (MIBK)	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Hexanone	5.0 U	5.0 U	**31**	**32**	**25**	**180**	5.0 U	**50**	5.0 U	5.0 U
Tetrachloroethene	**2.5**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**2.7**	**3.0**
CONVENTIONALS (mg/L)										
Nitrate (EPA300.0/EPA353.2)	NA	1.00 U	1.0 U	100 UJ	NA	1.0 U	0.1 U	0.1 U	**2.04**	NA
Sulfate (EPA300.0/EPA375.2)	NA	**4.9**	1.0 U	100 U	NA	1.0 U	**0.3**	**0.3**	**6.2**	NA
Total Organic Carbon (EPA415.1)	NA	**940**	**864**	**316**	NA	**282**	**382**	**66.0**	1.5 U	NA
DISSOLVED GASES (µg/L)										
Method RSK-175										
Methane	NA	**742**	**16300**	NA	NA	**15600**	**16200**	NA	NA	NA
Ethane	NA	**4.7**	1.2 U	NA	NA	**16.3**	**11.6**	NA	NA	NA
Ethene	NA	**3.1**	1.1 U	NA	NA	1.1 U	**2.0**	NA	NA	NA
Acetylene	NA	1.1 U	1.1 U	NA	NA	1.1 U	1.1 U	NA	NA	NA
FIELD PARAMETERS										
pH	6.83	6.24	NM (a)	NM (a)	8.64	6.02	5.55	6.23	6.80	7.11
Dissolved oxygen (mg/L)	6.81	6.87	NM (a)	NM (a)	3.05	2.13	4.51	2.58	2.53	6.05
ORP (mv)	59.5	133.8	NM (a)	NM (a)	-68.5	-131.9	70.6	111.1	82.9	127.4
Ferrous iron (mg/L)	NM	1.8	NM (a)	NM (a)	NM	1.8	1.8	2.2	0.1	NM

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TABLE 2
GROUNDWATER ANALYTICAL RESULTS
BIOREMEDIATION INJECTION TREATMENT AREA
BOEING OF PORTLAND

									Baseline	
Sample ID	E-15	E-15	E-15	E-15	E-15	E-15	E15	E15	E-16	E-16
Lab ID	NK21M	OY28D	PL01C	PW28D	QH99I	QV49C	RH82G	RW72G	NT51I	OL09H
Sample Date	8/8/2008	5/7/2009	8/18/2009	11/5/2009	2/2/2010	5/5/2010	8/9/2010	11/15/2010	10/8/2008	2/3/2009
VOLATILES (µg/L)										
Method SW8260B/SW8260C										
Vinyl Chloride	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**8.5**	**1.9**	0.2 U	1.0 U
Acetone	5.0 U	**590**	**220**	**680**	**460**	**65** J	**140**	**65**	3.0 U	**17**
1,1-Dichloroethene	**9.8**	1.0 U	**1.3**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**2.2**	**2.2**
trans-1,2-Dichloroethene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.2 U	1.0 U
cis-1,2-Dichloroethene	**5.3**	1.0 U	**1.1**	**5.7**	**7.8**	**6.0**	**1.3**	1.0 U	**4.4**	1.0 U
2-Butanone	5.0 U	**540**	**230**	**400**	**330**	**26**	**54**	**26**	2.5 U	5.0 U
1,1,1-Trichloroethane	**8.7**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**3.6**	1.0 U
Trichloroethene	**33**	**4.6**	**8.8**	1.0 U	**1.4**	**1.6**	1.0 U	1.0 U	**20**	**8.8**
4-Methyl-2-Pentanone (MIBK)	5.0 U	**5.9**	**18**	**260**	**420**	**53**	**72**	**41**	2.5 U	5.0 U
2-Hexanone	5.0 U	**160**	**110**	**150**	**120**	**12**	**16**	**9.0**	2.5 U	5.0 U
Tetrachloroethene	**2.7**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**2.7**	1.0 U
CONVENTIONALS (mg/L)										
Nitrate (EPA300.0/EPA353.2)	NA	1.00 U	1.0 U	100 UJ	**5.1**	1.0 U	0.1 U	0.1 U	**2.6**	NA
Sulfate (EPA300.0/EPA375.2)	NA	**45.4**	1.0 U	100 U	5.0 U	1.0 U	**0.1**	**1.4**	**8.0**	NA
Total Organic Carbon (EPA415.1)	NA	**540**	**381**	**386**	**344**	**124**	**24.2**	**12.6**	1.5 U	NA
DISSOLVED GASES (µg/L)										
Method RSK-175										
Methane	NA	**103**	**19900**	NA	NA	**19500**	**22200**	NA	0.7 U	NA
Ethane	NA	**4.0**	1.2 U	NA	NA	1.2 U	1.2 U	NA	1.2 U	NA
Ethene	NA	**8.8**	**8.8**	NA	NA	1.1 U	1.1 U	NA	1.1 U	NA
Acetylene	NA	1.1 U	1.1 U	NA	NA	1.1 U	1.1 U	NA	NA	NA
FIELD PARAMETERS										
pH	6.64	6.90	6.65	NM (a)	8.49	6.66	6.55	6.46	6.90	6.96
Dissolved oxygen (mg/L)	7.72	4.13	1.42	NM (a)	5.46	3.43	4.12	1.67	7.95	0.01
ORP (mv)	156.6	-44.9	-126.3	NM (a)	7.9	-130.3	-43.2	-117.3	175.8	-12.2
Ferrous iron (mg/L)	NM	5.2	2.2	NM (a)	2.4	2.0	4.8	4.2	0.0	NM

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TABLE 2
GROUNDWATER ANALYTICAL RESULTS
BIOREMEDIATION INJECTION TREATMENT AREA
BOEING OF PORTLAND

Sample ID	E-16	E-16	E-16	E-16	E-16	E16	E16
Lab ID	OY28E	PL01B	PW28E	QH99J	QV49A	RH82F	RW72H
Sample Date	5/7/2009	8/18/2009	11/5/2009	2/2/2010	5/5/2010	8/9/2010	11/15/2010
VOLATILES (µg/L)							
Method SW8260B/SW8260C							
Vinyl Chloride	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Acetone	**49**	**21**	**42**	**30**	**15** J	10 U	10 U
1,1-Dichloroethene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	**6.0**	**2.2**	**3.1**	**4.0**	**3.0**	**6.8**	**3.6**
2-Butanone	**7.3**	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,1,1-Trichloroethane	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	**1.7**	1.0 U	1.0 U	1.0 U	1.0 U	**2.8**	1.0 U
4-Methyl-2-Pentanone (MIBK)	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Hexanone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Tetrachloroethene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CONVENTIONALS (mg/L)							
Nitrate (EPA300.0/EPA353.2)	1.00 U	0.1 U	100 UJ	NA	**0.2**	0.1 U	**0.1**
Sulfate (EPA300.0/EPA375.2)	**2.0**	**0.5**	100 U	NA	**0.3**	**0.6**	**0.5**
Total Organic Carbon (EPA415.1)	**41.2**	**63.7**	**57.6**	NA	**26.9**	**3.74**	**3.37**
DISSOLVED GASES (µg/L)							
Method RSK-175							
Methane	**12,200**	**21900**	NA	NA	**19400**	**21900**	NA
Ethane	1.2 U	1.2 U	NA	NA	1.2 U	1.2 U	NA
Ethene	1.1 U	1.1 U	NA	NA	1.1 U	1.1 U	NA
Acetylene	1.1 U	1.1 U	NA	NA	1.1 U	1.1 U	NA
FIELD PARAMETERS							
pH	6.59	NM (a)	NM (a)	8.45	6.62	6.63	6.13
Dissolved oxygen (mg/L)	5.12	NM (a)	NM (a)	5.94	2.87	2.56	1.36
ORP (mv)	31.0	NM (a)	NM (a)	-16.4	-133.5	-12.7	73.0
Ferrous iron (mg/L)	1.4	NM (a)	NM (a)	NM	1.6	1.6	3.0

U = Indicates the compound was undetected at the reported concentration.
UJ = The analyte was not detected in the sample; the reported sample reporting limit is an estimate.
J = Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
NA = Not analyzed.
NM = Not measured.
Bold = Detected compound.

(a) High vegetable oil content.

TABLE 3
GROUNDWATER QUALITY SUMMARY
TGA AND SELECT TSA WELLS
JULY 1 THROUGH DECEMBER 31, 2010

Area	Location	Sample Type	Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	1,1,1-TCA	PCE	TCE	Vinyl chloride
		MCL Cleanup Level:		**7**	**70**	**70**	**200**	**5**	**5**	**2**
East Area-TGA										
	E-8	Grab	8/6/2010	ND	1.5	ND	ND	4.0	7.5	ND
East Yard-TGA										
	BOP-48(i)	Purge	8/15/2010	ND	ND	ND	ND	ND	1.8	ND
	E-9	Grab	8/6/2010	ND	ND	ND	ND	ND	1.7	ND
Central Area-TGA										
	BOP-10(i)	Purge	8/11/2010	ND	15	ND	ND	130	87	ND
	BOP-56(i)	Purge	8/12/2010	ND	4.9	ND	ND	7.9	35	ND
	BOP-59(i)	Purge	8/11/2010	ND	20	ND	ND	1.1	23	ND
	BOP-59(i)-Dup	Purge	8/11/2010	ND	21	ND	ND	1.1	22	ND
	E-6	Grab	8/6/2010	ND	3.4	ND	ND	10	17	ND
	E-7	Grab	8/6/2010	ND	12	ND	ND	120	39	ND
	DP-1	Grab	8/9/2010	ND	95	ND	ND	ND	36	ND
West Area-TGA										
	BOP-16(i)	Purge	8/11/2010	ND	ND	ND	ND	ND	ND	16
	BOP-16(i)	Purge	11/15/2010	ND	ND	ND	ND	ND	ND	13
	BOP-57(ia) (a)	Purge	8/15/2010	ND	3.0	ND	ND	5.5	13	ND
	BOP-57(ib) (a)	Purge	8/15/2010	56	46	ND	26	2.2	180	ND
	E-5	Grab	8/6/2010	ND	ND	ND	ND	1.4	5.2	ND
	E-11	Grab	8/9/2010	ND	ND	ND	ND	ND	ND	ND
	E-11	Grab	11/15/2010	ND	5.5	ND	ND	ND	ND	ND
	E-15	Grab	8/9/2010	ND	1.3	ND	ND	ND	ND	8.5
	E-15	Grab	11/15/2010	ND	ND	ND	ND	ND	ND	1.9
	E-16	Grab	8/9/2010	ND	6.8	ND	ND	ND	2.8	ND
	E-16	Grab	11/15/2010	ND	3.6	ND	ND	ND	ND	ND
Southwest Area - TGA										
	BOP-9(i)	Purge	8/11/2010	ND	4.2	ND	ND	4.2	15	ND
Downgradient Area TGA										
	BOP-7(i)	Purge	8/17/2010	6.3	4.2	ND	1.5	2.9	110	ND
	BOP-7(i)-Dup	Purge	8/17/2010	6.5	4.4	ND	1.6	2.9	100	ND
	BOP-7(i)	Purge	11/17/2010	4.7	3.4	ND	ND	ND	87	ND
	BOP-7(i)-Dup	Purge	11/17/2010	4.5	3.2	ND	ND	ND	86	ND
	D-7(i)	Purge	8/13/2010	ND	ND	ND	ND	ND	ND	ND
	D-8(i)	Purge	8/13/2010	ND	ND	ND	ND	ND	14	ND
	D-11(i)	Purge	8/13/2010	ND	ND	ND	ND	ND	ND	ND
	D-12(i)	Purge	8/13/2010	ND	ND	ND	ND	ND	2.2	ND
	E-2	Grab	8/9/2010	2.0	ND	ND	ND	ND	16	ND
	E-2	Grab	11/15/2010	1.9	ND	ND	ND	ND	14	ND

TABLE 3
GROUNDWATER QUALITY SUMMARY
TGA AND SELECT TSA WELLS
JULY 1 THROUGH DECEMBER 31, 2010

Area	Location	Sample Type	Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	1,1,1-TCA	PCE	TCE	Vinyl chloride
	MCL Cleanup Level:			**7**	**70**	**70**	**200**	**5**	**5**	**2**
	E-3	Grab	8/9/2010	4.8	3.9	ND	1.3	1.5	35	3.5 J
	E-3	Grab	11/15/2010	4.3	3.1	ND	1.0	1.4	35	2.6
	E-4	Grab	8/9/2010	14	ND	ND	ND	ND	79	ND
	E-4	Grab	11/15/2010	17	ND	ND	ND	3.1	95	ND
	E-12	Grab	8/11/2010	ND	ND	ND	ND	ND	5.7	ND
	E-13	Grab	8/11/2010	1.2	ND	ND	ND	ND	6.4	ND
GWTS Influent/Effluent										
	Tower Influent	Grab	8/9/2010	1.3	ND	ND	ND	ND	8.2	ND
	Tower Influent Dup	Grab	8/9/2010	1.5	ND	ND	ND	ND	8.2	ND
	Tower Influent	Grab	11/15/2010	1.5	ND	ND	ND	ND	8.2	ND
	Tower Influent Dup	Grab	11/15/2010	1.6	ND	ND	ND	ND	8.4	ND
	Tower Efflulent	Grab	8/9/2010	ND	ND	ND	ND	ND	ND	ND
	Tower Efflulent Dup	Grab	8/9/2010	ND	ND	ND	ND	ND	ND	ND
	Tower Efflulent	Grab	11/15/2010	ND	ND	ND	ND	ND	ND	ND
	Tower Efflulent Dup	Grab	11/15/2010	ND	ND	ND	ND	ND	ND	ND
TSA Monitoring Wells										
	BOP-22R(ds)	DBS	8/18/2010	ND	ND	ND	ND	ND	ND	ND
	BOP-22R(ds)	DBS	11/11/2010	ND	ND	ND	ND	ND	ND	ND
	BOP-60R(ds)-155	DBS	8/19/2010	ND	0.3	ND	ND	ND	2.2	ND
	BOP-60R(ds)-159	DBS	8/19/2010	ND	ND	ND	ND	ND	0.8	ND
	BOP-60R(ds)-163	DBS	8/19/2010	ND	ND	ND	ND	ND	0.8	ND
	BOP-60R(ds)-155	DBS	11/11/2010	ND	ND	ND	ND	ND	0.9	ND
	BOP-60R(ds)-159	DBS	11/11/2010	ND	ND	ND	ND	ND	0.3	ND
	BOP-60R(ds)-163	DBS	11/11/2010	ND	ND	ND	ND	ND	0.7	ND
	BOP-61(ds)	Purge	8/12/2010	ND	0.4	ND	ND	0.2	4.4	ND
	BOP-62(ds)	Purge	8/12/2010	ND	ND	ND	ND	ND	0.3	ND
	BOP-65(ds)	Purge	8/12/2010	ND	1.8	ND	ND	0.3	6.9	ND
	BOP-66(ds)	Purge	8/12/2010	ND	ND	ND	ND	ND	1.3	ND
Coolant Release Wells										
	LAI-4	Purge	8/10/2010	ND	2.2	ND	ND	ND	1.2	ND
	LAI-4	Purge	11/16/2010	ND	1.5	ND	ND	ND	ND	ND
	LAI-6	Purge	8/10/2010	ND	3.1	ND	ND	ND	3.4	ND
	LAI-6	Purge	11/16/2010	ND	3.1	ND	ND	ND	3.0	ND
	LAI-7	Purge	8/10/2010	ND	10	ND	ND	12	13	ND
	LAI-7	Purge	11/16/2010	ND	14	ND	ND	11	12	ND

TABLE 3
GROUNDWATER QUALITY SUMMARY
TGA AND SELECT TSA WELLS
JULY 1 THROUGH DECEMBER 31, 2010

Area	Location	Sample Type	Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	1,1,1-TCA	PCE	TCE	Vinyl chloride
	MCL Cleanup Level:			**7**	**70**	**70**	**200**	**5**	**5**	**2**
Former Degreaser Source Control Area										
	BOP-72(i)-55	DBS	8/15/2010	ND	16	ND	ND	2.4	20	ND
	BOP-72(i)-61	DBS	8/15/2010	2.8	17	ND	ND	5.6	30	ND
	BOP-72(i)-67	DBS	8/15/2010	2.8	14	ND	ND	8.2	33	ND
	BOP-72(i)-73	DBS	8/15/2010	3.2	42	ND	ND	1.0	6.6	ND
	BOP-72(i)-78	DBS	8/15/2010	1.2	23	ND	ND	ND	ND	ND
	BOP-72(i)	DBS	10/19/2010	2.7	10	ND	ND	3.1	28	ND
	BOP-72(i)	DBS	12/6/2010	ND	ND	ND	ND	ND	3.6	ND
	BOP-73(i)-60	DBS	8/15/2010	ND	12	ND	ND	ND	14	ND
	BOP-73(i)-66	DBS	8/15/2010	1.1	22	ND	ND	2.1	46	ND
	BOP-73(i)-71	DBS	8/15/2010	2.3	60 J	ND	ND	7.3	210	ND
	BOP-73(i)-78	DBS	8/15/2010	2.9	180	ND	ND	14	520	ND
	BOP-73(i)-82	DBS	8/15/2010	1.7	520	ND	ND	ND	3.2	2.9
	BOP-73(i)	DBS	10/19/2010	2.4	90	ND	ND	12	560 J	ND
	BOP-73(i)	DBS	12/6/2010	2.6	59	ND	ND	19	520	ND
	BOP-74(i)-60	DBS	8/15/2010	4.6	6.6	ND	1.0	1.7	50	ND
	BOP-74(i)-66	DBS	8/15/2010	5.1	7.0	ND	1.1	1.6	53	ND
	BOP-74(i)-71	DBS	8/15/2010	5.0	6.6	ND	1.1	1.6	52	ND
	BOP-74(i)-78	DBS	8/15/2010	5.2	7.0	ND	ND	1.6	55	ND
	BOP-74(i)-82	DBS	8/15/2010	4.0	28	ND	ND	ND	24	ND
	BOP-74(i)	DBS	10/19/2010	3.9	8.0	ND	ND	1.0	38	ND
	BOP-74(i)	DBS	12/6/2010	1.6	6.5	ND	ND	ND	24	ND

DBS = Diffusion Bag Sampler Type.
ND = Not detected.
J = Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
Boxed value indicates concentration above the screening level.

(a) West Area wells BOP-57(ia, ib) are installed with short (5 ft) screens. BOP-57(ia) is screened at the base of the TGA, while BOP-57(ib) is screene within the first layer of the Confining Unit 1 (CU1).

Notes:
1. TSA water quality data collected as part of the TGA remedy implementation.
2. Data are parts per billion (µg/L).
3. Box indicates exceedance of MCL Cleanup Level.

TABLE 4
GROUNDWATER ELEVATION DATA
TGA MONITORING WELLS
JULY 1 THROUGH DECEMBER 31, 2010

	Date	Time	Reference Elev. (a) (ft, MSL)	Depth to Water (ft)	Groundwater Elevation (ft)
TGA WELLS					
BOP-7(i)	8/5/2010	6:45	83.08	66.31	16.77
BOP-9(i)	8/5/2010	13:15	114.74	83.57	31.17
BOP-10(i)	8/5/2010	7:10	109.19	33.91	75.28
BOP-11(i)	8/5/2010	15:45	135.44	108.31	27.13
BOP-12(i)	8/5/2010	12:20	128.84	41.31	87.53
BOP-13(i)	8/5/2010	12:40	129.52	21.56	107.96
BOP-16(i)	8/5/2010	13:25	89.08	63.26	25.82
BOP-19(i)	8/5/2010	7:45	84.37	6.99	77.38
BOP-36(i)	8/5/2010	7:35	84.82	9.39	75.43
BOP-48(i)	8/5/2010	7:40	94.17	12.51	81.66
BOP-56(i)	8/5/2010	15:10	99.07	59.55	39.52
BOP-57(ia)	8/5/2010	14:30	95.45	61.56	33.89
BOP-57(ib)	8/5/2010	14:25	94.57	62.42	32.15
BOP-58(i)	8/5/2010	7:50	103.79	13.04	90.75
BOP-59(i)	8/5/2010	8:05	110.20	27.23	82.97
D-2(i)	8/5/2010	11:00	18.77	7.98	10.79
D-7(i)	8/5/2010	11:45	45.38	35.09	10.29
D-8(i)	8/5/2010	12:00	29.30	19.40	9.90
D-11(i)	8/5/2010	11:15	77.11	66.17	10.94
D-12(i)	8/5/2010	11:30	33.51	23.96	9.55
D-13(i)	8/5/2010	8:30	13.73	0.41	13.32
COOLANT RELEASE WELLS					
LAI-1	8/5/2010	16:00	109.86	23.06	86.80
LAI-1	11/10/2010	13:00	109.86	23.82	86.04
LAI-2	8/5/2010	16:05	109.89	21.77	88.12
LAI-2	11/10/2010	13:10	109.89	22.04	87.85
LAI-3	8/5/2010	16:10	109.85	21.06	88.79
LAI-3	11/10/2010	13:30	109.85	21.05	88.80
LAI-4	8/5/2010	16:15	110.71	22.22	88.49
LAI-4	11/10/2010	14:10	110.71	22.24	88.47
LAI-5	8/5/2010	16:20	110.56	20.27	90.29
LAI-5	11/10/2010	14:20	110.56	20.33	90.23
LAI-6	8/5/2010	16:25	110.65	21.43	89.22
LAI-6	11/10/2010	14:30	110.65	21.50	89.15
LAI-7	8/5/2010	15:45	109.90	23.16	86.74
LAI-7	11/10/2010	13:40	109.90	24.11	85.79
LAI-8	8/5/2010	15:40	110.59	26.69	83.90
LAI-8	11/10/2010	13:50	110.59	28.23	82.36

TABLE 4
GROUNDWATER ELEVATION DATA
TGA MONITORING WELLS
JULY 1 THROUGH DECEMBER 31, 2010

	Date	Time	Reference Elev. (a) (ft, MSL)	Depth to Water (ft)	Groundwater Elevation (ft)
TSA WELLS					
BOP-22R(ds)	8/5/2010	6:50	82.91	71.40	11.51
BOP-22R(ds)	11/10/2010	12:12	82.91	71.79	11.12
BOP-60R(ds)	8/5/2010	15:00	82.80	71.31	11.49
BOP-60R(ds)	11/10/2010	9:42	82.80	72.05	10.75
BOP-61(ds)	8/5/2010	7:25	94.64	85.53	9.11
BOP-62(ds)	8/5/2010	13:10	114.32	102.98	11.34
BOP-65(ds)	8/5/2010	7:15	104.22	92.93	11.29
BOP-66(ds)	8/5/2010	7:55	102.97	92.11	10.86
FORMER DEGREASER AREA WELLS					
BOP-72(i)	8/5/2010	14:45	82.63	48.37	34.26
BOP-72(i)	11/10/2010	12:20	82.63	49.52	33.11
BOP-73(i)	8/5/2010	14:50	83.32	49.11	34.21
BOP-73(i)	11/10/2010	12:30	83.32	50.43	32.89
BOP-74(i)	8/5/2010	14:55	82.9	48.64	34.26
BOP-74(i)	11/10/2010	12:40	82.9	49.82	33.08

(a) Reference Elevation for the top of PVC well casing.

(b) West Area wells BOP-57(ia, ib) are installed with short (5 ft) screens. BOP-57(ia) is screened at the base of the TGA, while BOP-57(ib) is screened within the first layer of the Confining Unit 1 (CU1).

TABLE 5
WATER ANALYTICAL RESULTS
TPH-Dx AND FIELD PARAMETERS
COOLANT RELEASE INVESTIGATION
BOEING PORTLAND FACILITY

			NWTPH-Dx (mg/L) (a)			Field Parameters		
			Diesel	Motor Oil	Total TPH-Dx	pH	Dissolved Oxygen (mg/L)	ORP (mV)
TGA Wells								
BOP-9(i)	RI22A	8/11/2010	0.10 U	0.20 U	ND	8.50	7.41	145.0
BOP-10(i)	RI22B	8/11/2010	0.10 U	0.20 U	ND	8.83	3.99	77.3
BOP59(i)	RI22C	8/11/2010	0.10 U	0.20 U	ND	7.19	4.45	60.9
DP1	RI00A	8/9/2010	0.25 U	0.50 U	ND	6.44	4.78	172.5
LAI-1	RI00C	8/10/2010	0.25 U	0.50 U	ND	6.51	4.47	156.9
LAI-1	RW94A	11/16/2010	0.25 U	0.50 U	ND	5.96	3.94	49.8
LAI-2	RI00D	8/10/2010	0.25 U	0.50 U	ND	6.51	2.47	147.3
LAI-2	RW94B	11/16/2010	0.25 U	0.50 U	ND	5.98	3.00	43.6
LAI-3	RI00E	8/10/2010	0.25 U	0.50 U	ND	6.66	4.25	127.6
LAI-3	RW94C	11/16/2010	0.25 U	0.50 U	ND	6.23	3.97	50.1
LAI-4	RI00F	8/10/2010	11	16	27	6.74	1.13	-74.73
LAI-4	RW94D	11/16/2010	34	49	83	6.68	1.91	86.0
LAI-5	RI00G	8/10/2010	0.25 U	0.50 U	ND	6.75	4.64	76.7
LAI-5	RW94E	11/16/2010	0.25 U	0.50 U	ND	6.26	4.23	18.9
LAI-6	RI00H	8/10/2010	0.25 U	0.50 U	ND	6.66	4.55	78.8
LAI-6	RW94F	11/16/2010	0.25 U	0.50 U	ND	6.31	3.99	14.6
LAI-7	RI00B	8/10/2010	0.25 U	0.50 U	ND	6.64	1.44	69.1
LAI-7	RW94G	11/16/2010	0.25 U	0.50 U	ND	6.09	1.80	28.3
LAI-8	RI00I	8/10/2010	1.1	0.50 U	1.1	6.94	1.42	-98.7
LAI-8	RW94H	11/16/2010	1.1	0.78	1.9	6.34	1.60	-94.5
				Cleanup Level (b)	1.35			

U = Indicates compound was analyzed for, but was not detected at the given reporting limit.
ND = Not detected.
Boxed value indicates concentration above the cleanup level.

(a) Samples analyzed after September 27, 2006 had silica gel and acid wash preparation steps conducted.
(b) Site-specific DEQ Risk-Based cleanup standard based on sum of diesel and motor oil components

TABLE 6
EXTRACTION WELL SUMMARY
GROUNDWATER TREATMENT SYSTEM

	July 2010				August 2010				September 2010			
Location	Gallons Pumped	Run Time Operational Minutes	Pump Rate (gpm)	Avg. Yield (gpm)	Gallons Pumped	Run Time Operational Minutes	Pump Rate (gpm)	Avg. Yield (gpm)	Gallons Pumped	Run Time Operational Minutes	Pump Rate (gpm)	Avg. Yield (gpm)
E-2	1,160,735	44,627	26.01	26.00	1,036,712	44,155	23.48	23.22	995,938	43,198	23.06	23.05
E-3	58,759	44,627	1.32	1.32	70,405	44,155	1.59	1.58	70,412	43,198	1.63	1.63
E-4	114,483	44,627	2.57	2.56	101,223	44,155	2.29	2.27	89,419	43,198	2.07	2.07
E-5	0	0	0.00	0.00	0	0	0.00	0.00	0	0	0.00	0.00
E-6	0	0	0.00	0.00	0	0	0.00	0.00	0	0	0.00	0.00
E-7	0	0	0.00	0.00	0	0	0.00	0.00	0	0	0.00	0.00
E-8	0	0	0.00	0.00	0	0	0.00	0.00	0	0	0.00	0.00
E-9	0	0	0.00	0.00	0	0	0.00	0.00	0	0	0.00	0.00
E-11	0	0	0.00	0.00	0	0	0.00	0.00	0	0	0.00	0.00
E-12	501,817	44,627	11.24	11.24	494,955	44,155	11.21	11.09	481,224	43,198	11.14	11.14
E-13	7,727,332	44,627	173.15	173.10	7,644,335	44,155	173.12	171.24	7,447,301	43,198	172.40	172.39
E-15	0	0	0.00	0.00	0	0	0.00	0.00	0	0	0.00	0.00
E-16	0	0	0.00	0.00	0	7	0.00	0.00	0	0	0.00	0.00
EW-3	0	0	0.00	0.00	0	12	0.00	0.00	0	0	0.00	0.00
EW-13	0	0	0.00	0.00	0	12	0.00	0.00	0	0	0.00	0.00
DP-1	17,153	44,627	0.38	0.38	15,800	44,155	0.36	0.35	14,687	43,198	0.34	0.34
Total	**9,580,278**				**9,363,429**				**9,098,982**			

TABLE 6
EXTRACTION WELL SUMMARY
GROUNDWATER TREATMENT SYSTEM

	October 2010				November 2010				December 2010			
Location	Gallons Pumped	Run Time Operational Minutes	Pump Rate (gpm)	Avg. Yield (gpm)	Gallons Pumped	Run Time Operational Minutes	Pump Rate (gpm)	Avg. Yield (gpm)	Gallons Pumped	Run Time Operational Minutes	Pump Rate (gpm)	Avg. Yield (gpm)
E-2	914,457	40,378	22.65	20.49	894,917	41,787	21.42	20.72	963,374	44,578	21.61	21.58
E-3	95,155	40,378	2.36	2.13	98,554	41,787	2.36	2.28	104,317	44,578	2.34	2.34
E-4	141,120	40,378	3.49	3.16	151,171	41,787	3.62	3.50	165,392	44,578	3.71	3.71
E-5	0	0	0.00	0.00	0	0	0.00	0.00	0	0	0.00	0.00
E-6	0	0	0.00	0.00	0	0	0.00	0.00	0	0	0.00	0.00
E-7	0	0	0.00	0.00	0	0	0.00	0.00	0	0	0.00	0.00
E-8	0	0	0.00	0.00	0	0	0.00	0.00	0	0	0.00	0.00
E-9	0	0	0.00	0.00	0	0	0.00	0.00	0	0	0.00	0.00
E-11	0	0	0.00	0.00	0	0	0.00	0.00	0	0	0.00	0.00
E-12	353,606	40,378	8.76	7.92	369,158	41,787	8.83	8.55	392,750	44,578	8.81	8.80
E-13	6,955,200	40,378	172.25	155.81	7,208,193	41,787	172.50	166.86	7,730,172	44,578	173.41	173.17
E-15	0	0	0.00	0.00	0	0	0.00	0.00	0	0	0.00	0.00
E-16	0	0	0.00	0.00	0	0	0.00	0.00	0	0	0.00	0.00
EW-3	0	0	0.00	0.00	0	0	0.00	0.00	0	0	0.00	0.00
EW-13	0	0	0.00	0.00	0	0	0.00	0.00	0	0	0.00	0.00
DP-1	20,160	40,378	0.50	0.45	17,957	41,787	0.43	0.42	20,160	44,578	0.45	0.45
Total	**8,479,698**				**8,739,950**				**9,376,165**			

NOTES:

1. Average yield reflects total gallons pumped divided by total minutes for the measuring period.
2. Well E-1 was abandoned in June 2004 and is no longer shown.
3. EW-3 and EW-13 are TSA extraction wells.
4. Wells E-5 through E-9 were not operated except for sampling.
5. Wells E-11, E-15, and E-16 were offline through December 2010.
6. Well E-10 was abandoned on 3/29/10 and is no longer shown.
7. Well E-14 was abandoned on 4/1/10 and is no longer shown.
8. DEQ approved the pilot shutdown of EW-3. The pump was shut off on 12/12/09. The well will remain in pilot shutdown for 2 years and then be eligible for decommissioning.
9. DEQ approved the pilot shutdown of EW-13. The pump was shut off on 11/25/09. The well will remain in pilot shutdown for 2 years and then be eligible for decommissioning.
10. Well EW-22 was converted to a monitoring well, abandoned on 3/26/10, and is no longer shown.

TABLE 7
COOLANT RELEASE TREATMENT SYSTEM PERMANCE EVALUATION
BOEING PORTLAND FACILITY

			POLAR/NON-POLAR OIL AND GREASE (mg/L) Method E1664			NWTPH-Dx (mg/L)	
Location	Lab ID	Date Collected	Total Hexane Extractable Material (HEM)	Non-Polar Extractable Material (SGT)	HEM Polar Oil & Grease	Diesel	Motor Oil
OWS Inf	RI00K	8/10/2010	4.8 U	4.8 UJ	4.8 U	0.25 U	0.50 U
GAC 1 Inf	RI00L	8/10/2010	4.7 U	4.7 UJ	4.7 U		
GAC 2 Inf	RI00M	8/10/2010	4.7 U	4.7 UJ	4.7 U		
System Eff	RI04A	8/10/2010	4.6 U	4.6 UJ	4.6 U		
OWS Inf	RW73B	11/11/2010	4.7 U	4.7 U	4.7 U	0.25 U	0.50 U
GAC 1 Inf	RW73C	11/11/2010	4.8 U	4.8 U	4.8 U		
GAC 2 Inf	RW73D	11/11/2010	4.6 U	4.6 U	4.6 U		
System Eff	RW75A	11/11/2010	4.6 U	4.6 U	4.6 U		

U = Indicates compound was analyzed for, but was not detected at the given reporting limit.

UJ = The analyte was not detected in the sample; the reported sample reporting limit is an estimate.