Groundwater Investigation
Proposed CBC Health Sciences Center
Richland, Washington

March 2005

SHANNON & WILSON, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

At Shannon & Wilson, our mission is to be a progressive, well-managed professional consulting firm in the fields of engineering and applied earth sciences. Our goal is to perform our services with the highest degree of professionalism with due consideration to the best interests of the public, our clients, and our employees.

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GROUNDWATER INVESTIGATION
PROPOSED CBC HEALTH SCIENCES CENTER SITE
RICHLAND, WASHINGTON

1.0 INTRODUCTION AND BACKGROUND

Shannon & Wilson, Inc. performed a groundwater investigation at a vacant property south of Mansfield Street that extends between Goethals and Northgate Drives in Richland, Washington. The assessment was requested by SCM Consultants, Inc. (SCM) on behalf of the Washington Department of Education, the proposed purchaser of the property. Ultimately, the proposed Health Sciences Center (HSC) would be owned and operated by Columbia Basin College (CBC). Mr. Bruce Schwan with SCM authorized the work on March 2, 2005.

In June 2003, Shannon & Wilson performed a Phase 1 and limited Phase 2 environmental site assessment (ESA) of the property. At that time, the current owner, General Services Administration (GSA), planned to build a childcare facility at the site. During the Phase 2 investigation, soil samples were collected from six test pits, and selected samples were analyzed for petroleum products, polychlorinated biphenyls (PCBs), metals, and volatile organic compounds (VOCs). The ESA did not reveal the presence of soil contamination from previous site use.

The childcare facility was not constructed, and the current proposal for site development involves the construction of an HSC as a collaborative venture between CBC and Kadlec Medical Center. Development would include the construction of a multi-story building and a paved parking lot.

The proposed purchaser requested that an investigation of groundwater quality be performed to meet the requirements of the Washington Administrative Code (WAC) pertaining to school facilities and site selection; specifically that the health and safety of the students will not be in jeopardy (WAC 180-26-020 [2][a]). The results of the study are intended for use in the evaluation of the site's suitability for development as a school campus.

2.0 SITE DESCRIPTION, SOILS, AND HYDROGEOLOGIC SETTING

2.1 Site Description and Location

The 3.1-acre site is located in the Richland downtown area that is almost exclusively occupied by offices, commercial businesses, medical facilities, and government buildings. The site dimensions are approximately 335 feet east-west, and 400 feet north-south. The property is bounded on the west by Goethals Drive, on the north by Mansfield Street, and on the east by Northgate Drive. Ben Franklin Transit's Knight Street bus transfer station is located south of the site.

The site is in the Southwest Quarter of Section 11, Township 9 North, Range 28 East Willamette Meridian, within the City of Richland, Washington. The general location of the site is shown on Figure 1, and a site plan is presented on Figure 2.

2.2 Subsurface Site Soils

The average ground surface elevation at the site is approximately 356 feet based on contours shown on a site survey prepared by Stratton Surveying & Mapping. The ground surface elevation along the southern boundary with the transit station is 360 feet. Overall, the topography is relatively flat with a slight depression toward the central area of the site where stormwater and snowmelt tend to pond.

The U.S. Department of Agriculture (USDA) Soil Conservation Service "Soil Survey of Benton County Area, Washington" (July 1971) indicates that the predominant soil type at the site is Finley fine sandy loam having 0 to 2 percent surface slopes. The soils occur on old alluvial terraces. In a representative profile, the surface layer is very dark grayish-brown fine sandy loam about 13 inches thick. The next layer is dark grayish-brown very gravelly loam to a depth of 28 inches below the ground surface (bgs). Sandy gravel and cobbles are present below this depth to a depth of at least 60 inches bgs.

The subsurface profile observed during this exploration and Shannon & Wilson's geotechnical explorations of the site include 1 to 2.5 feet of sandy gravel/cobble fill overlying loose to medium dense sandy silt and silty sand soils. Dense sandy gravel and cobbles are present beginning at depths between 8.5 and 11.5 feet bgs. Logs of the four GeoProbe explorations for this study are in Appendix A.

2.3 Regional and Site Groundwater

In addition to information regarding the depth to groundwater that was obtained during this study, we have also researched information regarding groundwater depths and flow direction in an area around the site. The following is a summary of groundwater information obtained from reports of investigations at nearby sites where groundwater monitoring wells are or have been located.

Facility Name and Location	Distance/Direction from Subject Site	Average Depth to Groundwater, feet	Typical Groundwater Flow Direction
Federal Building 825 Jadwin Avenue	500 feet/Southeast	13 – 17	Northeast
Former Richland Shop 1300 Mansfield Street	200 feet/Northwest	8 – 11	Northeast
New City Cleaners 747 Stevens Drive	1,000 feet/Southwest	10 – 12	Northeast

In much of the Richland area, the regional groundwater flow directions are toward the east or southeast. However, the predominant groundwater flow direction at the above-referenced locations surrounding the subject site is toward the northeast. This may be a result of the influence of a drainage ditch located north and west of the properties. The locations of the three facilities relative to the subject site are shown on Figure 1.

The data also indicates that groundwater is relatively shallow in this area of Richland. The groundwater surface elevation tends to be several feet higher than the Columbia River elevation, which has a normal pool elevation of 340 feet. The site is located approximately 1,770 feet west of the Columbia River. The typical static water levels in the monitoring wells referenced previously ranged between approximately 342 to 348 feet.

Water level measurements were taken on May 14, 2003, at two monitoring wells located near the subject site. One is a City of Richland well (MW-9) in Mansfield Street northwest of the site and the other is MW-1 located at the Federal Building southeast of the site. Depth to groundwater at the two locations was 11.2 and 15.1 feet, and groundwater elevations were 343.5 and 342.9 feet, respectively. Based on this information, groundwater at the subject site on the measurement date would have been approximately 12.5 feet bgs. Groundwater was encountered approximately 12 to 14 feet bgs during Shannon & Wilson's drilled explorations on January 20, 2005. Groundwater was encountered approximately 14 feet bgs during the current GeoProbe exploration on March 9, 2005.

Historically, groundwater elevations at the Federal Building site have been as much as 2.5 feet higher than on the May 2003 measurement date. Therefore, groundwater at the subject site can also be expected to be higher at different times of the year.

3.0 SITE HISTORY

The following is a summary of the historical data included in Shannon & Wilson's June 2003 report. The history of land use was evaluated to identify past uses that might have had adverse effects on the environmental conditions of the property, primarily through the use of potentially hazardous materials. The information was used to select areas of the site for exploration for both the soil sampling conducted in 2003 and the groundwater sampling conducted for this study. The historical information was obtained by reviewing readily available data from public agencies and library resources. The actual dates of first use may vary from that presented, and the history may not be complete. In addition, some aspects of land use and ownership may not be identified. Sources included historical maps, aerial photographs, city directories, and historical reports regarding the Hanford Site.

3.1 Historical Maps

A 1943 Metsker map predated the acquisition of Richland by the federal government for construction of the Hanford Site. The map indicates that the property where the subject site is located was divided into small parcels. Property ownership is not indicated on the map.

A U.S. Army Corps of Engineers (Corps) McNary Reservoir Topographic Map dated June 13, 1949 shows two railroad spurs entering the subject site from the west. The railroad is identified as the Atomic Energy Commission (AEC) Hanford Works Railroad. The south spur entered the site where a map symbol identified as "Richland Stack" was indicated.

An undated Kroll Atlas of Richland indicates the presence of several buildings at the subject site. It appears that all of buildings identified as 713 and 714 were on the property, and that parts of 707, 722C, and 784 (steam plant) were on the property. There were also two small, unidentified buildings on the property located south of Building 713 and north of Building 714. Comparing this map with the Corps map, it appears that the north railroad spur was adjacent to the south side of Building 713.

Two other Metsker maps, dated 1960 and 1976, were also reviewed. The 1960 map indicates that the street located west of the site was named Guthrie Avenue (now Goethals Drive). Mansfield Street did not go through the block where the subject site is located, but ended to the west at Guthrie Avenue. On the 1976 map, Goethals Drive is shown located west of the site, and Mansfield Street had been extended past the site to the north. Neither map indicated the presence of a street to the east of the site where Northgate Drive is now located.

Three editions of U.S. Geological Survey (USGS) topographic maps were reviewed (1951, 1978, and 1992). The 1951 map shows symbols for buildings at the site, but none are shown on the 1978 or 1992 editions.

3.2 Aerial Photographs

The sources and years of aerial photographs reviewed were:

Pamphlet titled *Richland – from 1943 to 1968*	1944 (oblique angle)
City of Richland	1948, 1952, 1968, 1971, 1976 (oblique angle), 1979
USGS	1996

The 1944 photograph shows approximately the north half of the block where the site is located. There is a railroad car parked along the south side of the main (largest) building at the site (Building 713). Doors along the two sides of the building that are visible in the photograph appear to be designed for freight loading and unloading, indicating that the building was probably a

warehouse. The two smaller buildings (referenced in the Kroll Atlas discussion) located south of Building 713 are not apparent in the 1944 photograph, nor is Building 714. A portion of a coal pile that would have been located north of the steam plant is apparent at the edge of the photograph.

The 1948 photograph indicates the presence of all of the buildings referenced in the Kroll Atlas discussion. This includes the coal-fired steam (heating) plant located at the south end of the block ("Richland Stack"). There was a large coal pile located north of the steam plant and south of Building 714. The 1940s and the 1952 photographs indicate the presence of aerial steam lines throughout the blocks surrounding the plant.

In the 1968 photograph, it appears that the steam plant and its smokestack had been dismantled, and only a concrete foundation was present. Also the buildings indicated as 707 and 722C on the Kroll Atlas were no longer present. A street at the present location of Northgate Drive is apparent in the photograph.

In the 1971 photograph, Building 714 appears to have been removed, but a concrete slab remained. Both the 1968 and 1971 photographs indicate that the eastern portion of the block, where former buildings had been removed, was used for parking.

The 1976 and 1979 photographs indicate that all of the buildings formerly located on the site, including the 713 Building, had been removed. The 1996 photograph shows the site similar to its present vacant condition. In addition, the Ben Franklin Transit transfer station at the south end of the block is apparent. The aerial photographs indicate that the eastern area of the block has continued to be used as a parking area for cars.

3.3 City Directories

Polk directories between the years of 1960 and 1978 were reviewed for listings of occupied buildings on Mansfield Street, Guthrie Avenue (earlier name for Goethals Drive), Goethals Drive, and Northgate Drive. The review began with the 1960 edition since earlier directories did not list Richland entries by street addresses. None of the directories included listings for the buildings at the site. The review did not extend beyond 1978 because the photographic evidence indicates no buildings on the site after 1976.

The only adjacent businesses indicated in that time period were the former City of Richland shops at 1300 Mansfield Street located northwest of the site, and the AEC's administrative offices located in a multi-building complex (Building 703) located southeast of the site. The former city shops were demolished in 1999, and new medical office buildings now occupy that property. The Federal Building at 825 Jadwin was constructed in the 1960s and replaced Building 703. Only the

westernmost wing of the old building is still present, and is used by the City of Richland as office space (840 Northgate Drive).

3.4 Historical Reports

A number of reports and publications chronicle the Hanford Site and Richland history. One report titled "The Hanford Site Historic District" indicates that the 700 Area in the City of Richland was the original location of the central administrative functions for the Hanford Site. Beside the administrative offices, the area also contained repair and maintenance shops, central supply houses, laundries, and a central heating plant. The 700 Area was bounded by Swift Boulevard on the north, Knight Street on the south, Jadwin Avenue on the east, and Stevens Drive on the west (Figure 1).

4.0 RESULTS OF PREVIOUS ENVIRONMENTAL RECORDS REVIEW

A review of regulatory agency records was conducted in 2003 for the subject property and nearby properties to identify known or potential sources of contamination that could adversely impact the subject property. Records were obtained using Environmental Data Resources, Inc. (EDR) system, which searches Ecology and U.S. Environmental Protection Agency (EPA) databases.

Thirteen facilities within 0.3 mile of the site are included on Ecology's lists as locations where soil and/or groundwater contamination has been detected or is suspected. They are listed below and categorized as to their potential gradient location relative to the subject site.

Potentially Upgradient Sites	Potentially Downgradient or Crossgradient Sites
Coffee Bean Espresso, 840 Stevens Drive	Former City Shop, 1300 Mansfield Street
New City Cleaners, 747 Stevens Drive	Medical Arts Facility, 750 Swift Boulevard
US Bank, 701 Stevens Drive	Federal Building, 825 Jadwin Avenue
Former Chevron #9, 1323 Lee Boulevard	Kadlec Medical Center, 888 Swift Boulevard
P & K Auto Service, 1415 Gillespie	Leo's Line-up & Tires Auto Express, 1315 Lee Blvd.
George A. Grant Co., 1333 Gillespie	Riverside Dental Facility, 750 George Washington Way
Columbia Oil Co., 1345 Lee Boulevard	

Information regarding off-site source(s) of contaminants in groundwater that have the potential to migrate to the subject site was obtained from Ecology and the City of Richland. New City Cleaners at 747 Stevens Drive is included on Ecology's Confirmed and Suspected Contaminated Sites List (C&SCSL) as a location where halogenated organic compounds (HOCs) (typically solvents) has been detected in the groundwater. The dry cleaner is located approximately 1,000 feet southwest of the subject site. Information was also obtained from the City of Richland regarding the former city shop site, which is adjacent to the northwest corner of the subject site.

4.1 New City Cleaners

Records regarding the New City Cleaners site were obtained from Ecology's Central Region Office in Yakima, Washington. Information in a report titled "Site History Report" (April 23, 1997) prepared by EMCON of Spokane, Washington, indicated that the dry cleaner facility was constructed in about 1949 or 1950. Four USTs at the site, probably installed with the initial construction, were removed in April 1992. Tank contents included Bunker C oil, kerosene, and stoddard solvents. Reportedly, the dry cleaner began using tetrachlorothylene (PCE) in 1974, which was stored in 55-gallon drums. The drums were stored outside until 1975 when vandalism caused a release, after which the drums were stored inside the facility. Prior to the early 1980s, the reported waste handling method involved placing filtrate cake and carbon canisters in dumpsters at the site. The PCE-containing waste was included in materials disposed of at the local landfill.

A groundwater assessment was conducted in 1991 at a site adjacent to the south side of the dry cleaners' property (identified as US Bank in the EDR report). Groundwater samples collected from wells located along the north side of the property contained PCE at a maximum concentration of 1,900 micrograms per liter (µg/L).

In April 1992 when USTs were removed from the dry cleaner's site, HOCs were detected in soil and groundwater samples collected during the UST closure site assessment. Additional sampling in June 1992 confirmed the earlier results.

In July 1996, Ecology issued an enforcement order to the owners of New City Cleaners requiring that a remedial investigation (RI) be performed to evaluate the nature and extent of dry cleaning chemicals and petroleum products in soil and groundwater. Following review of the RI report, Ecology issued an enforcement order requiring completion of a feasibility study (FS) to support the selection of a cleanup action for the site. The database information indicates that remedial cleanup action is currently in progress.

EMCON performed slug tests at two monitoring wells at the site and estimated the hydraulic conductivity to be 1×10^{-2} centimeters per second (cm/sec). With an average horizontal hydraulic gradient of 0.0033 foot per foot, the average horizontal groundwater velocity was calculated to be 0.3 foot per day. Based on the assumed average velocity, the theoretical time of travel between the New City Cleaners site and the subject site is approximately nine years.

4.2 Other Potential Off-Site Sources

Historical information obtained from the Kroll Atlas and from the EDR report indicates that there have been multiple service stations along Stevens Drive and Lee Boulevard west, southwest, and south of the subject site. Some of the facilities are still operating as gasoline stations or automotive repair shops, but others have been converted to other uses. Five of them are included in the above

list as "Potentially Upgradient Sites" (Coffee Bean Espresso, US Bank, former Chevron #9, P & K Auto Service, and Columbia Oil Company).

City of Richland representatives indicated that evidence of HOCs has been detected in groundwater samples from monitoring wells located south of the former city shop facility at 1300 Mansfield Street. Chloroform, trichloroethylene (TCE), and PCE were detected in groundwater samples. Water level measurements at the former city shop site indicate a northeasterly flow gradient. Therefore, the wells where contamination has been detected are believed to be crossgradient of the subject site, and are upgradient of the city's former shop site. The city representative indicated that he is not certain of the source of contamination. The location of the wells is shown on Figure 2.

5.0 FIELD RECONNAISSANCE AND ENVIRONMENTAL SAMPLING

The site is vacant of structures and is relatively flat with a slight slope toward the center area of the site. Part of the eastern area of the site is covered with weathered asphalt, and is used for parking. Most of the ground surface is covered with soil and crushed gravel. Columbia Basin College's Richland campus buildings are located north of Mansfield Street, adjacent to the site.

Four GeoProbe explorations were made at the site on March 9, 2005, by ESN Northwest under subcontract to Shannon & Wilson. The locations of the probes are shown on Figure 2 and logs are in Appendix A. Groundwater was encountered approximately 14 feet bgs.

The exploration locations were selected based on factors that were evaluated to have the highest potential for revealing contamination in groundwater, if present. Such factors include the locations of buildings and other facilities such as railroad spurs that were formerly at the site, the direction of groundwater flow, and the location of a known, upgradient, off-site contaminant source (New City Cleaners).

The GeoProbe equipment uses a direct push, hydraulic drive point system. Soil samples were collected during the probe exploration using two types of sampling techniques. The upper soil profile to approximately the 12-foot depth was sampled by inserting a disposable, rigid plastic liner inside the GeoProbe shaft. Problems were encountered in Probe No. 1 (P-1) below the 12-foot depth using this sampling equipment, where the soils are dense sandy gravel and cobbles. A split spoon sampler was used in P-2 through P-4 below the 12-foot depth. Selected soil samples were transferred to laboratory-clean jars, placed on ice in a cooler, and transported by ESN's representative under chain-of-custody procedures to their laboratory facility in Lacey, Washington. Non-disposable equipment was cleaned between each probe location.

To collect groundwater samples, the probe was used to drive a shielded screen point sampler approximately two feet below the water table. The outer drive casing was partially withdrawn,

exposing the stainless steel screen. Groundwater was allowed to flow passively into the screen. New 0.25-inch Nylaflow tubing was inserted into the screen, and water was pumped with a peristaltic pump. Groundwater was purged for a period of time to flush sand and fines prior to sample collection. Water samples were collected in laboratory-clean bottles, placed on ice in a cooler, and transported to ESN's laboratory.

6.0 RESULTS OF ANALYTICAL TESTING

During the site exploration, groundwater samples were collected from four locations for analytical testing. In addition, soil samples were collected and held for possible follow-up analyses.

6.1 Groundwater Samples

Some or all of the groundwater samples were analyzed for total petroleum hydrocarbons (TPH) by Method Northwest TPH – hydrocarbon identification (NWTPH-HCID), polychlorinated biphenyls (PCBs) by EPA Method 8082, total metals (arsenic, cadmium, chromium, mercury, lead, copper, and zinc) by EPA Method 6010B/7471A, volatile organic compounds (VOCs) by Method EPA 8260, and chlorinated acid herbicides by Method 8151M. Table 1 includes a summary of the analytical results, and the laboratory report is in Appendix B.

Petroleum hydrocarbons, PCBs, cadmium, mercury, and chlorinated acid herbicides were not detected in any of the groundwater samples at greater than the test detection limits. Arsenic was detected at concentrations that exceed the Model Toxics Control Act Method A (MTCA-A) cleanup level of 5 micrograms per liter (µg/L) at probe locations P-2, -3, and –4. Arsenic concentrations detected in samples were 5.94, 50.8, and 10.7 µg/L, respectively, at those locations. Chromium was detected in all of the groundwater samples, and exceeds the MTCA-A cleanup level of 50 µg/L in the sample from P-3 (78.4 µg/L). Lead was detected in groundwater samples from P-2, -3, and –4, and exceeds the MTCA-A cleanup level of 15 µg/L at P-3 (18.1 µg/L).

VOCs detected in some or all groundwater samples include tetrachloroethylene (PCE), trichloroethylene (TCE) and methyl-t-butyl ether (MTBE). Concentrations of PCE exceed the MTCA-A cleanup level of 5 µg/L in all four of the groundwater samples. PCE concentrations detected in groundwater samples from P-1 through P-4 were 55, 33, 10, and 12 µg/L, respectively. TCE was detected in all of the groundwater samples, but at concentrations below the MTCA-A cleanup level. MTBE was detected only in the sample from P-4, also at less than the potential regulatory cleanup level.

6.2 Soil Samples

After receiving the results of the groundwater analyses, additional analyses of soil samples for metals and VOCs were authorized. The objective of the soil analyses was to evaluate the soil at locations that would be likely to reveal whether or not the contamination observed in groundwater may be attributable to contaminated on-site soils. The samples analyzed were from the P-2, -3, and –4 locations, from depths of 9, 10, 11 feet bgs, respectively. The samples were selected based on observed soil types, moisture condition, and proximity to the groundwater table. In each case, the samples are from the zone located 3 to 5 feet above the groundwater at the time of sampling, and include wet, sandy silt soils. It is likely that the moisture in the samples primarily resulted from infiltration of surface water that moved through the more porous upper soils and was restricted by the silty soil layer. It was felt that, if on-site contamination were moving through the soil profile into the groundwater, this should be a good location for detection.

VOCs were not detected in any of the soil samples. Of the seven metals analyzed, only copper and zinc were detected in the soil samples at greater than the test detection limits. Copper concentrations ranged from 15 to 23 milligrams per kilogram (mg/kg) and zinc ranged from 45 to 76 mg/kg in the soil samples. Natural background concentrations for these metals in soil in Eastern Washington are 28 and 81 mg/kg, respectively. The background concentrations are the 90th percentile values from an Ecology report titled "Natural Background Soil Metals Concentrations in Washington State" October 1994 (Publication #94-115). The metals concentrations detected in samples from the site are within the normal background levels for this area of the state (less than the 90th percentile value). The results of the analyses of soil samples are summarized in Table 2, and the laboratory report is in Appendix B.

6.3 Soil Samples from 2003 Study

In May 2003, Shannon & Wilson conducted a subsurface investigation as part of a Phase 1 ESA conducted on behalf of GSA. Six test pits were excavated at the site using a rubber-tired backhoe. Five test pits (TP-1 through TP-5) were excavated at or near the locations of former buildings at the site. The sixth test pit (TP-6) was at or near the location of the former railroad spur onto the site. The locations of the test pits are indicated on Figure 2, and sample depths are indicated in Table 2. Groundwater was not encountered in any of the test pits. However, the soil was wet in the bottom of TP-2, which was 11 feet deep. The excavation was left open for approximately two hours, and no free water was observed to enter the excavation.

Thirteen soil samples were collected from depths ranging from 3 to 11 feet bgs from the six test pits and were field scanned for indications of volatile compounds with a photoionization detector (PID). The headspace measurement method was used. None of the samples registered on the PID.

During the site exploration, soil samples were collected for analytical testing. Four samples were analyzed for total petroleum hydrocarbons (TPH) by Method Northwest TPH – hydrocarbon identification (NWTPH-HCID), polychlorinated biphenyls (PCBs) by EPA Method 8082, and priority pollutant metals by EPA Method 6010B/7471A. Four additional samples were analyzed for volatile organic compounds (VOCs) by Method EPA 8260. Neither TPH nor PCBs were detected in any of the samples at greater than the test detection limits.

Of thirteen metals analyzed, chromium, copper, lead, nickel and zinc were detected in all of the soil samples. The following is a summary of the concentrations detected in soil samples, including the most recent investigation, and a comparison to natural background concentrations for these metals in Eastern Washington. All of the metals concentrations detected in samples from the site are within the normal background levels for this area of the state (less than the 90th percentile value).

Metal	Range of Concentrations (3/9/05 Samples), mg/kg	Range of Concentrations (5/14/03 Samples), mg/kg	Natural Background Concentration, mg/kg
Chromium	<5	13 – 19	32
Copper	15 - 23	14 – 20	28
Lead	<5	5.9 – 7.0	13
Nickel	Not tested	16 – 20	25
Zinc	45 - 76	43 - 54	81

One VOC (acetone) was detected in soil samples at concentrations ranging from 0.012 to 0.028 mg/kg. The concentrations detected are significantly below the potential regulatory cleanup criterion of 3.2 mg/kg (MTCA-Method B, soil concentration protective of groundwater). Acetone is a common laboratory contaminant, and its presence in the samples may have been caused by sampling or laboratory error.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 On-Site Findings, Conclusions, and Recommendations

Specific land use prior to 1943 or 1944 was not determined from the historical research. Beginning in 1943, the site was owned by the federal government and was within the area (known as the 700 Area) from which administrative and supply functions for the Hanford Site operated. The apparent land use at the site was to store and handle supplies destined for the Hanford Site. A large coal pile was located on the southern portion of the site to supply a steam plant that was partially on the site. Steam, for heat, was distributed through aboveground pipes to various buildings in the area.

No specific information is available regarding the operations or waste disposal practices for the former warehouse and other buildings that were located at the site. During Shannon & Wilson's 2003 ESA, subsurface soil samples were analyzed for contaminants frequently associated with fueling, maintenance, printing, electrical equipment, and machining operations. Contaminants were either not detected at greater than test detection limits, or were at concentrations less than potential regulatory criteria.

During the current investigation, contaminants detected in groundwater that exceed MTCA Method A cleanup levels for unrestricted land uses include the metals arsenic, chromium, and lead, and the volatile organic compound PCE. Soil samples collected at the same locations during this investigation did not indicate the presence of any of these parameters at greater than the test detection limits.

A relatively common source of arsenic in the environment is treated wood, such as railroad ties. Soil samples were collected during the current and previous investigations from four locations that are in or near a former railroad spur alignment, including TP-3, TP-4, TP-6 and P-3 (Figure 2). The absence of detectible concentrations of arsenic in any of these soil samples suggests that arsenic detected in groundwater is not from an on-site source.

Chromium in the environment occurs mainly in two valence states. Trivalent chromium (CR[III]) occurs naturally in rocks and soil. Hexavalent chromium (CR[VI]) is produced industrially when CR(III) is heated in the presence of mineral bases and oxygen (for instance, during metal finishing processes). CR(VI) is the form that has proven to be of greatest environmental health concern. The MTCA Method A cleanup level of 50 µg/L for groundwater is based on a total value of CR(III) plus CR(VI). If only CR(III) is present at a site, a cleanup level of 100 µg/L may be used. The incidence of CR(VI) is almost exclusive to plating operations, which is highly unlikely to have occurred at the site. Therefore, the one incidence of chromium in a groundwater sample at a concentration greater than 50 µg/L (P-3, 78.4 µg/L) may not represent an excursion above the regulatory criterion.

The owner should be made aware of state regulations contained in WAC 173-340-300 that require notification of the Department of Ecology regarding discovery of contamination within 90 days.

Because of the presence of PCE in groundwater beneath the site and the relatively shallow depth at which groundwater occurs, it is recommended that a proper vapor barrier be installed beneath structures. This would reduce the potential for VOCs to enter occupied building spaces.

7.2 Off-Site Findings

Thirteen facilities within approximately one-third mile of the site are included on Ecology's lists as locations where soil and/or groundwater contamination have been detected or suspected. Based on an expected groundwater flow gradient toward the northeast, seven are located potentially upgradeient of the subject site. There is some potential for contamination from such locations to migrate in

groundwater to the site. One site where dry cleaner solvents (PCE) are known to have entered the groundwater currently is conducting a cleanup action (New City Cleaners located approximately 1,000 feet from the subject site). Washington's MTCA exempts owners of properties "where a hazardous substance has come to be located solely as a result of migration of the hazardous substance to the real property through the ground water from a source off the property..." Therefore, property owners who have not contributed to the contamination are not held liable for cleanup. The portion of the law that addresses sites contaminated by off-site sources can be found at RCW 70.105D0.20 (12) (iv). An exception to this policy, however, is if the responsible party cannot be found, property owners where groundwater contamination is present could become responsible for cleanup. It should be noted that the results of soil sampling conducted as part of this ESA did not indicate that past operations at the site would have caused or contributed to groundwater contamination.

8.0 CLOSURE

The data presented in this report are based on limited research at the site and should be considered representative at the time of our observations. Shannon & Wilson, Inc., performed this work within its best judgment to adequately describe site conditions. Changes in the conditions of the site can occur with time from both natural processes and human activities. In addition, changes in governmental codes, regulations, or law may occur. Such changes are beyond our control, and should they occur, our observations and recommendations applicable to this facility may need to be revised wholly or in part.

This report was prepared for the use of SCM Consultants, Inc., Columbia Basin College, and the Washington State Department of Education. Shannon & Wilson in no way guarantees that an agency or its staff will reach the same conclusions as Shannon & Wilson, Inc. We have prepared the attached "Important Information About Your Environmental Report" to assist you and others in understanding the use and limitations of our reports.

SHANNON & WILSON, INC.

Donna R. Parkes
Environmental Specialist

Dee J. Burrie, P.E.
Branch Manager

DRP:SWG:DJB/drp

REFERENCES

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TABLE 1

SUMMARY OF ANALYTICAL RESULTS
GROUNDWATER SAMPLES COLLECTED 3/9/05

Parameter	Sample Identification				MTCA-A[1]	MTCA-B[2]
	P-1 GW-1	P-2 GW-1	P-3 GW-1	P-4 GW-1		
TPH, µg/L						
Gasoline	<250	<250	<250	<250	1,000[3]	
Diesel	<500	<500	<500	<500	500	
Oil	<500	<500	<500	<500	500	
PCBs, µg/L	<0.1	<0.1	<0.1	<0.1	0.1	
Metals, µg/L						
Arsenic	3.77	**5.94**	**50.6**	**10.7**	5	
Cadmium	<2.5	<2.5	<2.5	<2.5	5	
Chromium	13.1	17.6	**78.4**	21.4	50	
Copper	3.26	11.1	116	15.2	--	592
Lead	<2.5	2.61	**18.1**	5.81	15	
Mercury	<0.2	<0.2	<0.2	<0.2	2	
Zinc	<10	10.1	128	17.8	--	4,800
Chlorinated Acid Herbicides, µg/L	NT	NT	ND	ND		
VOCs[4], µg/L						
MTBE	<1.0	<1.0	<1.0	1.7	20	
TCE	1.5	0.50J	0.41J	1.1	5	
PCE	**55**	**33**	**10**	**12**	5	

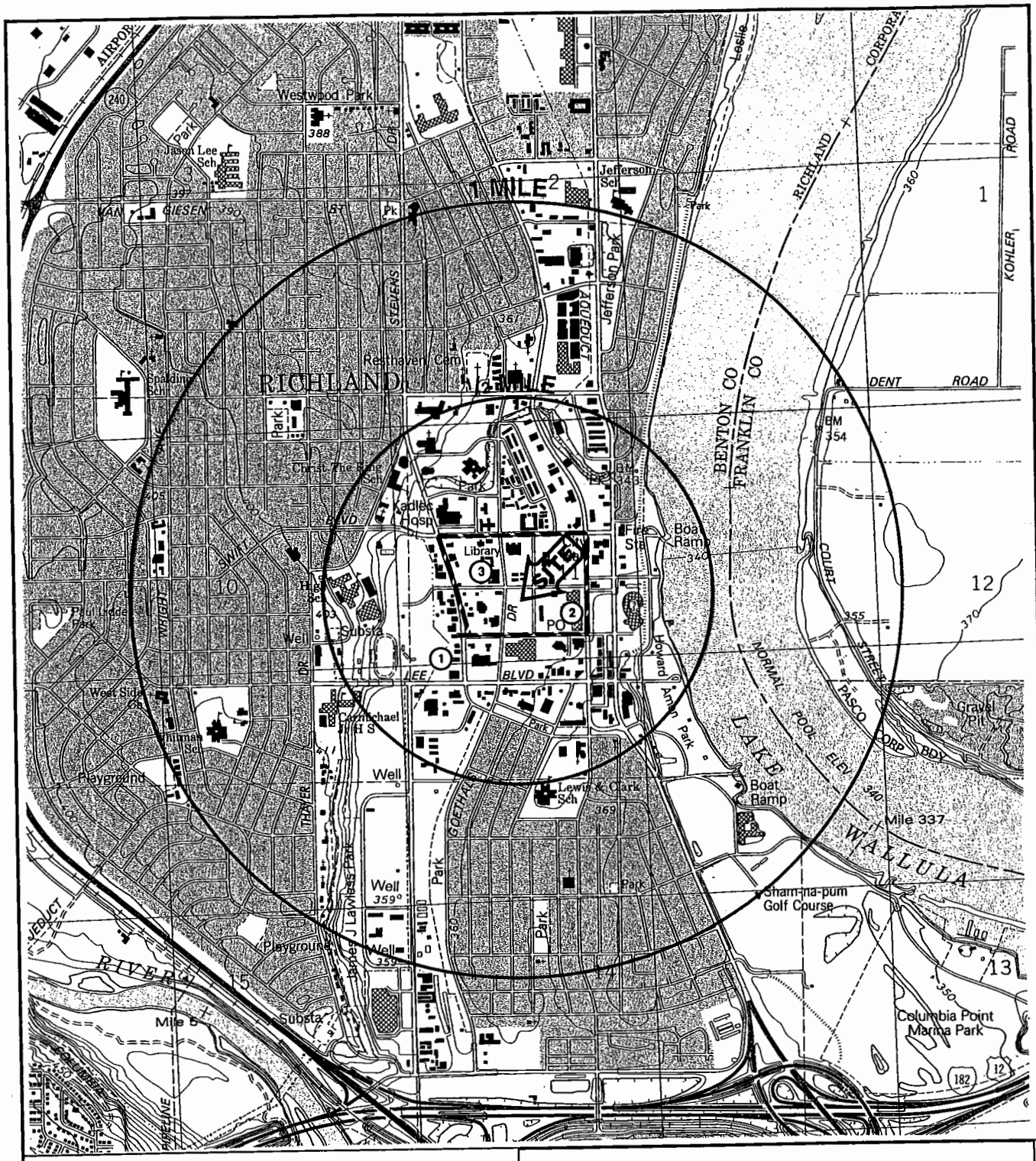
µg/L	Micrograms per liter
TPH	Total petroleum hydrocarbons
PCBs	Polychlorinated biphenyls
VOC	Volatile organic compounds
MTBE	Methyl-t-butyl ether
TCE	Trichloroethene
PCE	Tetrachloroethene
J	Estimated quantitation, below listed reporting limits
NT	Not tested
ND	Analyte not detected at greater than the test reporting limits
1	Model Toxics Control Act Method A Cleanup Levels for groundwater.
2	MTCA Method B standard formula values for groundwater.
3	Cleanup level when there is no detectable benzene in groundwater (which is the case for all four samples analyzed by Method 8260).
4	Only those analytes that were detected at greater than the test detection limits are shown. Refer to laboratory report for full list of analytes.

TABLE 2

SUMMARY OF ANALYTICAL RESULTS, SOIL SAMPLES

Parameter, mg/kg	Sample Designation and Depth (feet)											MTCA-A
	P-2 S-1 (9)	P-3 S-1 (10)	P-4 S-1 (11)	TP1-01 (3)	TP1-02 (8)	TP2-03 (11)	TP3-01 (3)	TP4-01 (3)	TP4-02 (9.5)	TP5-01 (3)	TP6-02 (11)	
	3/9/05			5/14/03								
TPH	NT	NT	NT		NT	NT			NT		NT	
Gasoline				<24			<24	<24		<24		100
Diesel				<59			<60	<60		<59		2,000
Oil				<120			<120	<120		<120		2,000
PCBs	NT	NT	NT	<0.059	NT	NT	<0.06	<0.06	NT	<0.059	NT	1
Metals[1]					NT	NT			NT		NT	
Chromium	<5	<5	<5	16			16	19		13		2,000
Copper	18	15	23	16			19	20		14		--
Lead	<5	<5	<5	6.2			7.0	6.0		5.9		250
Nickel	NT	NT	NT	18			18	20		16		--
Zinc	45	58	76	51			54	47		43		--
VOCs[1]				NT			NT	NT		NT		
Acetone	<0.50	<0.50	<0.50		0.019	0.028			0.016		0.012	--
PCE	<0.02	<0.02	<0.02		<0.0012	<0.0012			<0.0011		<0.0010	0.05
TCE	<0.02	<0.02	<0.02		<0.0012	<0.0012			<0.0011		<0.0010	0.03
MTBE	<0.05	<0.05	<0.05		<0.0012	<0.0012			<0.0011		<0.0010	0.1

MTCA-A Model Toxics Control Act Method A soil cleanup levels for unrestricted land uses
TPH Total petroleum hydrocarbons
PCBs Polychlorinated biphenyls
NT Not tested
VOCs Volatile organic compounds
PCE Tetrachloroethylene
TCE Trichloroethylene
MTBE Methyl-t butyl ether
[1] Only those analytes that were detected at greater than the test detection limits are shown. Refer to laboratory report for full list of anlaytes.



Former Hanford 700 Area Boundary

① New City Cleaners
② Federal Building
③ Former Richland City Shop

From USGS Topographic Map, Richland Quadrangle (1992)

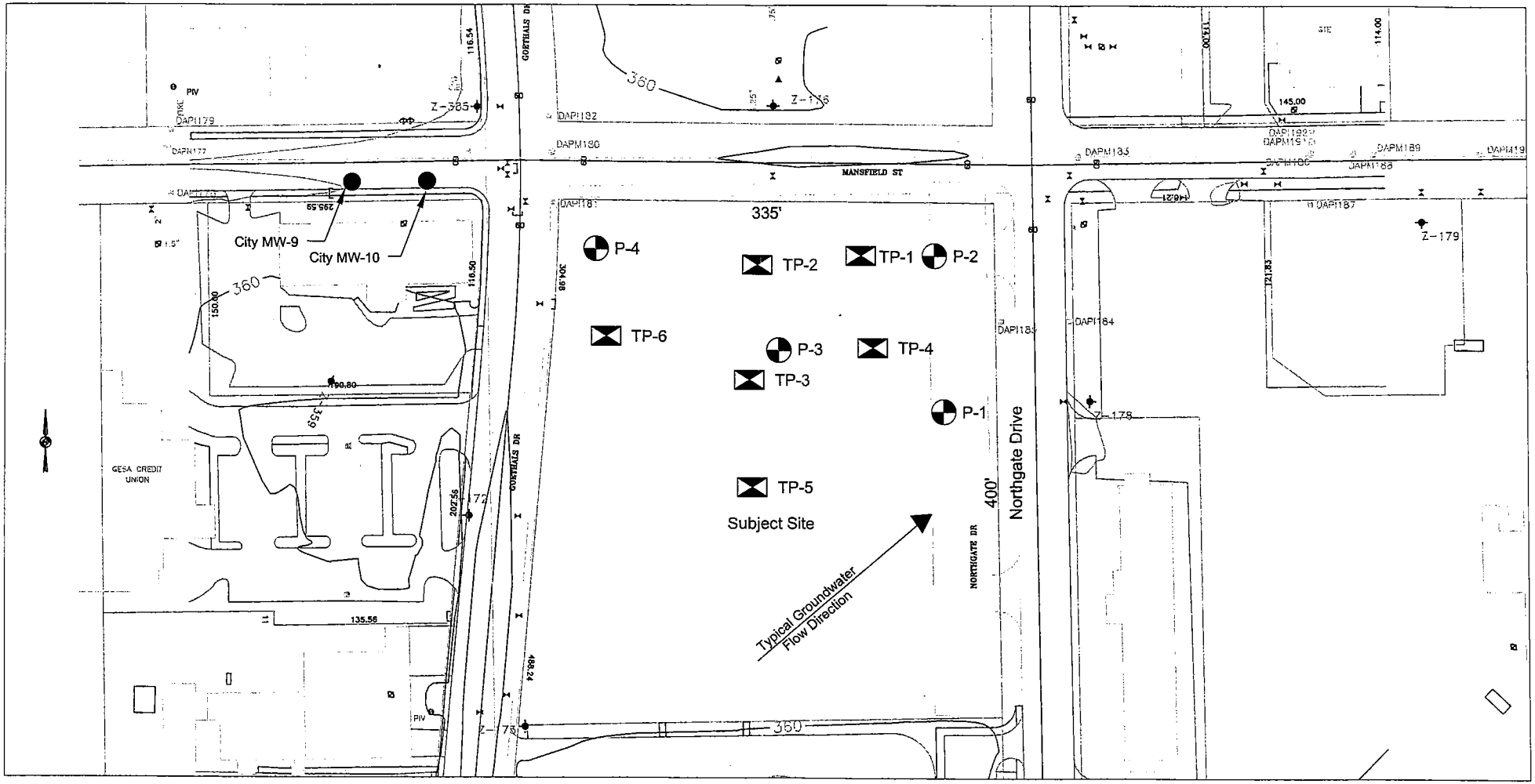
Groundwater Investigation
Proposed CBC Health Sciences Center Site
Richland, Washington

SITE LOCATION MAP

March 2005 22-1-11179-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 1



LEGEND

P-1 GeoProbe Location and Designation

TP-1 Test Pit Location and Designation (2003 Shannon & Wilson)

NOT TO SCALE

Base map from SCM Consultants, Inc.

Groundwater Investigation
Proposed CBC HSC Site
Richland, Washington

SITE PLAN AND SAMPLING LOCATIONS

March 2005 22-1-11179-001

SHANNON & WILSON, INC. Geotechnical and Environmental Consultants

FIG. 2

APPENDIX A

LOGS OF GEOPROBE EXPLORATIONS

ENVIRONMENTAL PROBE HOLE LOG

Date Started 3/9/05	Location	Ground Elev. (ft) NA	
Date Completed 3/9/05	Drilling Company ESN Northwest	Drilling Method Geoprobe	
Total Depth (ft) 16.0	Sampling Method	Borehole Diam. (in)	

Depth (ft)	Environmental Soil Sample: Sample Number	Interval	PID (ppm)	Time	Env. Water Sample: Sample Number	Interval	Time	Depth (ft)	Lithologic Description	Soil Log	Ground Water	Depth (ft)
									Ground Surface			
								0.3	Asphaltic pavement.			
									Loose, brown, sandy gravel, fill, damp, (GW).			
								1.5	Loose, brown, sandy silt, damp, (ML).			
								4.0	Loose, silty sand with gravel, damp, (GM).			
5								4.5	Loose, silty sand, moist, (SM).			5
								7.0	Loose, sandy silt, moist to wet, (ML).			
								8.0	Loose, silty sand to gravelly sand, damp, (SM).			
10								9.0	Dense, sandy gravel with cobbles, dry, (GW).			10
								14.0	Dense, sandy gravel, wet, (GW).		▽	
15					P-1, GW-1		9:10am	16.0	End of Probe at 16.0 ft.			15
20												20

Typ: CVM Rev: DRP Log: DRP 3/17/05 ENV_PROBE 22-1-11179 BORINGS.GPJ SHAN_WIL.GDT

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
3. Groundwater level, if indicated above, is for the date specified or ATD (at the time of drilling) and may vary.
4. Refer to KEY for explanation of "Symbols" and definitions.

LEGEND

Ⅱ Thin Wall Sample

▽ Ground Water Level Measured

CBC Health Sciences Center
Richland, Washington

LOG OF PROBE P-1

March 2005 22-1-11179-001

SHANNON & WILSON, INC.
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FIG. A-1

ENVIRONMENTAL PROBE HOLE LOG

Date Started: 3/9/05	Location:	Ground Elev. (ft): NA
Date Completed: 3/9/05	Drilling Company: ESN Northwest	Drilling Method: Geoprobe
Total Depth (ft): 16.5	Sampling Method:	Borehole Diam. (in):

Environmental Soil Sample					Env. Water Sample						
Depth (ft)	Sample Number	Interval	PID (ppm)	Time	Sample Number	Interval	Time	Depth (ft)	Lithologic Description	Soil Log	Ground Water	Depth (ft)
									Ground Surface			
								0.3	Asphaltic pavement.			
								1.0	Loose, sandy gravel, fill, dry, (GW).			
									Loose, brown, silty sand to sandy silt, damp, (SM to ML).			
								4.5	Loose, sandy gravel, damp, (GW).			
5								5.0	Loose, sandy silt, moist, (ML).			5
								6.0	Loose, silty sand, damp, (SM).			
								8.0	Loose, silty, gravelly sand, damp, (SM).			
								9.0	Loose, sandy silt, wet, (ML).			
	P2, S-1			9:50am				9.5	Medium dense, sandy gravel and cobbles, damp, (GW).			
10								11.0	Dense, grey, sandy gravel, damp, (GW).		▽	10
								14.0	Dense, grey, sandy gravel, damp, (GW).			
	P2, S-2			10:00am								
15					P-2, GW-1		10:20am					15
								16.5	End of Probe at 16.5 ft.			
20												20

Typ: CVM
Rev: DRP
ENV PROBE 22-1-11179 BORINGS.GPJ SHAN WIL.GDT 3/17/05 Log: DRP

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
3. Groundwater level, if indicated above, is for the date specified or ATD (at the time of drilling) and may vary.
4. Refer to KEY for explanation of "Symbols" and definitions.

LEGEND

Thin Wall Sample
Split Spoon
▽ Ground Water Level Measured

CBC Health Sciences Center
Richland, Washington

LOG OF PROBE P-2

March 2005 22-1-11179-001

SHANNON & WILSON, INC.
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FIG. A-2

ENVIRONMENTAL PROBE HOLE LOG

Date Started *3/9/05*	Location	Ground Elev. (ft) *NA*
Date Completed *3/9/05*	Drilling Company *ESN Northwest*	Drilling Method *Geoprobe*
Total Depth (ft) *16.5*	Sampling Method	Borehole Diam. (in)

Environmental Soil Sample					Env. Water Sample					
Depth (ft)	Sample Number	Interval	PID (ppm)	Time	Sample Number	Interval	Time	Depth (ft)	Lithologic Description	Soil Log / Ground Water
									Ground Surface	
									Loose, brown, sandy gravel, fill, dry to damp, (GW).	
								5.7	Loose, brown, silty sand interbedded with layers of sandy silt, damp to wet, (SM to ML).	
	P-3, S-1			10:55am				10.0	Dense, sandy gravel with cobbles, dry to damp, (GW).	
								14.0	Dense, sandy gravel, wet, (GW).	▽
					P-3, GW-1		11:40am	16.5	End of Probe at 16.5 ft.	

Depth (ft): 5, 10, 15, 20

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
3. Groundwater level, if indicated above, is for the date specified or ATD (at the time of drilling) and may vary.
4. Refer to KEY for explanation of "Symbols" and definitions.

LEGEND

- Thin Wall Sample
- Split Spoon
- ▽ Ground Water Level Measured

CBC Health Sciences Center
Richland, Washington

LOG OF PROBE P-3

March 2005 22-1-11179-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-3

ENV PROBE 22-1-11179 BORINGS.GPJ SHAN WIL.GDT 3/17/05 Log: DRP Rev: DRP Typ: CVM

ENVIRONMENTAL PROBE HOLE LOG

Date Started 3/9/05	**Location**	**Ground Elev. (ft)** NA	
Date Completed 3/9/05	**Drilling Company** ESN Northwest	**Drilling Method** Geoprobe	
Total Depth (ft) 16.5	**Sampling Method**	**Borehole Diam. (in)**	

Environmental Soil Sample					Env. Water Sample					
Depth (ft)	Sample Number	Interval	PID (ppm)	Time	Sample Number	Interval	Time	Depth (ft)	Lithologic Description	Soil Log / Ground Water / Depth (ft)
									Ground Surface	
									Loose, greyish brown, sandy gravel fill, dry, (GW).	
								1.5	Loose, brown, silty sand, damp, (SM).	
								4.0	Loose, silty, gravelly sand, damp, (SM)	
5								6.0	Loose, brown, sandy silt, moist, (ML).	
								8.0	Loose, brown, silty, gravelly, sand, damp, (SM).	
								9.0	Loose, brown, sandy silt, moist, (ML).	
10	P-4, S-1			12:10pm				11.0	Dense, greyish brown, sandy gravel, (GW).	
								12.0	Dense, brown, silty, gravelly sand, moist, (SM).	
								13.0	Dense, sandy gravel, moist, (GW).	▽
								14.0	Dense, sandy gravel, wet, (GW).	
15					P-4, GW-1		12:30pm			
								16.5	End of Probe at 16.5 ft.	
20										

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
3. Groundwater level, if indicated above, is for the date specified or ATD (at the time of drilling) and may vary.
4. Refer to KEY for explanation of "Symbols" and definitions.

LEGEND

Thin Wall Sample

Split Spoon

▽ Ground Water Level Measured

CBC Health Sciences Center
Richland, Washington

LOG OF PROBE P-4

March 2005 22-1-11179-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-4

ENV_PROBE 22-1-11179 BORINGS.GPJ SHAN_WIL.GDT 3/17/05 Log: DRP Rev: DRP Typ: CVM

Shannon & Wilson, Inc. (S&W), uses a soil classification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following page. Soil descriptions are based on visual-manual procedures (ASTM D 2488-93) unless otherwise noted.

S&W CLASSIFICATION OF SOIL CONSTITUENTS

- MAJOR constituents compose more than 50 percent, by weight, of the soil. Major constituents are capitalized (SAND).
- Minor constituents compose 12 to 50 percent of the soil and precede the major constituents (silty SAND). Minor constituents preceded by "slightly" compose 5 to 12 percent of the soil (slightly silty SAND).
- Trace constituents compose 0 to 5 percent of the soil (slightly silty SAND, trace of gravel).

MOISTURE CONTENT DEFINITIONS

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

ABBREVIATIONS

ATD	At Time of Drilling
Elev.	Elevation
ft	feet
HSA	Hollow Stem Auger
ID	Inside Diameter
in	inches
lbs	pounds
Mon.	Monument cover
N	Blows for last two 6-inch increments
NA	Not Applicable or Not Available
OD	Outside Diameter
OVA	Organic Vapor Analyzer
PID	Photoionization Detector
ppm	parts per million
PVC	Polyvinyl Chloride
SS	Split Spoon sampler
SPT	Standard Penetration Test
USC	Unified Soil Classification
WLI	Water Level Indicator

GRAIN SIZE DEFINITIONS

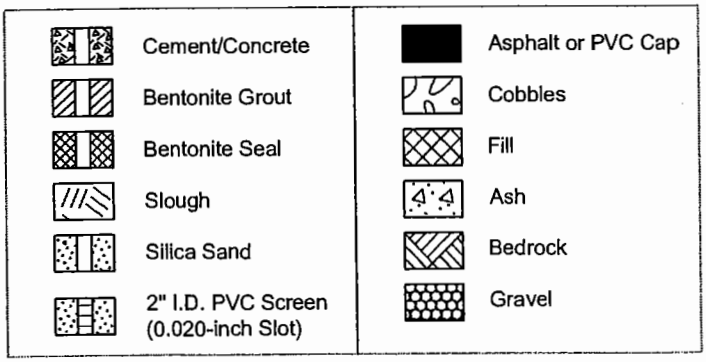
DESCRIPTION	SIEVE SIZE
FINES	< #200 (0.8 mm)
SAND*	
▪ Fine	#200 - #40 (0.4 mm)
▪ Medium	#40 - #10 (2 mm)
▪ Coarse	#10 - #4 (5 mm)
GRAVEL*	
▪ Fine	#4 - $\frac{3}{4}$ inch
▪ Coarse	$\frac{3}{4}$ - 3 inches
COBBLES	3 - 12 inches
BOULDERS	> 12 inches

* Unless otherwise noted, sand and gravel, when present, range from fine to coarse in grain size.

RELATIVE DENSITY / CONSISTENCY

COARSE-GRAINED SOILS		FINE-GRAINED/COHESIVE SOILS	
N, SPT, BLOWS/FT.	RELATIVE DENSITY	N, SPT, BLOWS/FT.	RELATIVE CONSISTENCY
0 - 4	Very loose	<2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
Over 50	Very dense	15 - 30	Very stiff
		Over 30	Hard

WELL AND OTHER SYMBOLS



CBC Health Sciences Center
Richland, Washington

SOIL CLASSIFICATION AND LOG KEY

March 2005 22-1-11179-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-5
Sheet 1 of 2

UNIFIED SOIL CLASSIFICATION SYSTEM (From ASTM D 2488-93 & 2487-93)

MAJOR DIVISIONS			GROUP/GRAPHIC SYMBOL ②		TYPICAL DESCRIPTION
Coarse-Grained Soils *(more than 50% retained on No. 200 sieve)* *[use Dual Symbols for 5 - 12% Fines (i.e. GP-GM)]* ①	Gravels *(more than 50% of coarse fraction retained on No. 4 sieve)*	Clean Gravels ① *(less than 5% fines)*	GW		Well-Graded Gravels, Gravel-Sand Mixtures, Little or No Fines
			GP		Poorly Graded Gravels, Gravel-Sand Mixtures, Little or No Fines
		Gravels with ① Fines *(more than 12% fines)*	GM		Silty Gravels, Gravel-Sand-Silt Mixtures
			GC		Clayey Gravels, Gravel-Sand-Clay Mixtures
	Sands *(50% or more of coarse fraction passes the No. 4 sieve)*	Clean sands ① *(less than 5% fines)*	SW		Well-Graded Sands, Gravelly Sands, Little or No Fines
			SP		Poorly Graded Sand, Gravelly Sands, Little or No Fines
		Sands with ① Fines *(more than 12% fines)*	SM		Silty Sands, Sand-Silt Mixtures
			SC		Clayey Sands, Sand-Silt Mixtures
Fine-Grained Soils *(50% or more passes the No. 200 sieve)*	Silts and Clays *(liquid limit less than 50)*	Inorganic	ML		Inorganic Silts of Low to Medium Plasticity, Rock Flour, or Clayey Silts With Slight Plasticity
			CL		Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
		Organic	OL		Organic Silts and Organic Silty Clays of Low Plasticity
	Silts and Clays *(liquid limit 50 or more)*	Inorganic	CH		Inorganic Clays of Medium to High Plasticity, Sandy Fat Clay, Gravelly Fat Clay
			MH		Inorganic Silts, Micaceous or Diatomaceous Fine Sands or Silty Soils, Elastic Silt
		Organic	OH		Organic Clays of Medium to High Plasticity, Organic Silts
Highly Organic Soils	Primarily organic matter, dark in color, and organic odor		PT		Peat, Humus, Swamp Soils with High Organic Content (See D 4427-92)

NOTES

1. Dual Symbols (symbols separated by a hyphen, i.e., SP-SM, slightly silty fine SAND) are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart.

2. Borderline symbols (symbols separated by a slash, i.e., CL/ML, silty CLAY/clayey SILT; GW/SW, sandy GRAVEL/gravelly SAND) indicate that the soil may fall into one of two possible basic groups.

CBC Health Sciences Center
Richland, Washington

SOIL CLASSIFICATION AND LOG KEY

March 2005 22-1-11179-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-5
Sheet 2 of 2

APPENDIX B

ESN NORTHWEST LABORATORY REPORT

ESN NORTHWEST
Environmental Services Network

March 29, 2005

Donna Parks
Shannon & Wilson
P.O. Box 967
Richland, WA 99352

Dear Ms. Parks:

Please find enclosed the analytical data report for the CBC HSC Project in Richland, Washington. Direct Push services were conducted on March 9, 2005. Soil and water samples were analyzed for Hydrocarbon Identification by NWTPH-HCID, VOC's by Method 8260, PCB's by Method 8082, Herbicides by Method 8151, and As, Cd, Cr, Hg, Pb, Zn & Cu by Methods 6000 and 7000 series on March 14 – 24, 2005.

The results of these analyses are summarized in the attached tables. All soil values are reported on a dry weight basis. Applicable detection limits and QA/QC data are included. An invoice for the sample collection and analytical work is also enclosed.

ESN Northwest appreciates the opportunity to have provided these services to Shannon and Wilson for this project. It was a pleasure working with you, and we are looking forward to the next opportunity to work together.

Sincerely,

Michael A Korosec

Michael A. Korosec
President

677 Woodland Square Lp. SE, Suite D ▪ Lacey, Washington 98503 ▪ 360.459.4670 ▪ FAX 360.459.3432
Web Site: *www.esnnw.com* E-Mail: *info@esnnw.com*

ESN NORTHWEST CHEMISTRY LABORATORY

CBC HSC PROJECT
Washington
Shannon & Wilson, Inc.
Client Project #22-1-11179-001

Hydrocarbon Identification by NWTPH-HCID for Waters

Sample Number	Date Analyzed	Surrogate Recovery (%)	Gasoline (ug/l)	Diesel (ug/l)	Heavy Oil (ug/l)	Mineral Oil (ug/l)
Method Blank	3/14/05	88	nd	nd	nd	nd
P-1 GW-1	3/14/05	107	nd	nd	nd	nd
P-2 GW-1	3/14/05	117	nd	nd	nd	nd
P-3 GW-1	3/14/05	104	nd	nd	nd	nd
P-4 GW-1	3/14/05	105	nd	nd	nd	nd
P-4 GW-1 Dup.	3/14/05	94	nd	nd	nd	nd
Method Detection Limits			250	500	500	500

"nd" Indicates not detected at listed detection limits.
"D" Indicates detected above the listed detection limit.
"int" Indicates that interference prevents determination.

ACCEPTABLE RECOVERY LIMITS FOR SURROGATE : 65% TO 135%

ANALYSES PERFORMED BY: Matthew Sebonia

ESN NORTHWEST CHEMISTRY LABORATORY

CBC HSC PROJECT
Washington
Shannon & Wilson, Inc.
Client Project #22-1-11179-001

PCB Analyses of Water (EPA Method 8082)

Sample Description		Method Blank	P-1 GW-1	P-1 GW-1 Dup.	P-2 GW-1	P-3 GW-1	P-4 GW-1	LCS
Date Sampled			3/9/05	3/9/05	3/9/05	3/9/05	3/9/05	
Date Analyzed		3/14/05	3/14/05	3/14/05	3/14/05	3/14/05	3/14/05	3/14/05
	MDL (ug/l)	(ug/l)	(ug/l)	(ug/l)	(ug/l)	(ug/l)	(ug/l)	(ug/l)
PCB-1016	0.1	nd	nd	nd	nd	nd	nd	
PCB-1221	0.1	nd	nd	nd	nd	nd	nd	
PCB-1232	0.1	nd	nd	nd	nd	nd	nd	
PCB-1242	0.1	nd	nd	nd	nd	nd	nd	
PCB-1248	0.1	nd	nd	nd	nd	nd	nd	
PCB-1254	0.1	nd	nd	nd	nd	nd	nd	
PCB-1260	0.1	nd	nd	nd	nd	nd	nd	107%
Total		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surrogate Recovery (TCMX) (%)		99	101	109	116	121	101	108
Surrogate Recovery (DCBP) (%)		96	96	113	116	119	100	99

"nd" Indicates not detected at listed detection limit.
"int" Indicates that interference prevents determination.

ACCEPTABLE RECOVERY LIMITS FOR SURROGATE (TCMX) AND (DCBP): 75% -125%

ANALYSES PERFORMED BY: Marilyn Farmer

ESN SEATTLE CHEMISTRY LABORATORY
(425) 957-9872, fax (425) 957-9904

ESN Job Number: S50311-1
Client: SHANNON AND WILSON
Client Job Name: CBC HSC
Client Job Number: 22-1-11179-001

Analytical Results

8260, µg/L		MTH BLK	LCS	P-1 GW-1	P-2 GW-1	P-3 GW-1	P-4 GW-1
Matrix	Water	Water	Water	Water	Water	Water	Water
	Reporting						
Date analyzed	Limits	03/11/05	03/11/05	03/11/05	03/11/05	03/11/05	03/11/05
Dichlorodifluoromethane	1.0	nd		nd	nd	nd	nd
Chloromethane	1.0	nd		nd	nd	nd	nd
Vinyl chloride	0.2	nd		nd	nd	nd	nd
Bromomethane	1.0	nd		nd	nd	nd	nd
Chloroethane	1.0	nd		nd	nd	nd	nd
Trichlorofluoromethane	1.0	nd		nd	nd	nd	nd
Acetone	10.0	nd		nd	nd	nd	nd
1,1-Dichloroethene	1.0	nd	98%	nd	nd	nd	nd
Methylene chloride	10.0	nd		nd	nd	nd	nd
Methyl-t-butyl ether (MTBE)	1.0	nd		nd	nd	nd	**1.7**
trans-1,2-Dichloroethene	1.0	nd		nd	nd	nd	nd
1,1-Dichloroethane	1.0	nd		nd	nd	nd	nd
2-Butanone (MEK)	10.0	nd		nd	nd	nd	nd
cis-1,2-Dichloroethene	1.0	nd		nd	nd	nd	nd
2,2-Dichloropropane	1.0	nd		nd	nd	nd	nd
Chloroform	1.0	nd		nd	nd	nd	nd
Bromochloromethane	1.0	nd		nd	nd	nd	nd
1,1,1-Trichloroethane	1.0	nd		nd	nd	nd	nd
1,2-Dichloroethane	1.0	nd		nd	nd	nd	nd
1,1-Dichloropropene	1.0	nd		nd	nd	nd	nd
Carbon tetrachloride	1.0	nd		nd	nd	nd	nd
Benzene	1.0	nd	109%	nd	nd	nd	nd
Trichloroethene (TCE)	1.0	nd	110%	**1.5**	**0.50 J**	**0.41 J**	**1.1**
1,2-Dichloropropane	1.0	nd		nd	nd	nd	nd
Dibromomethane	1.0	nd		nd	nd	nd	nd
Bromodichloromethane	1.0	nd		nd	nd	nd	nd
4-Methyl-2-pentanone	1.0	nd		nd	nd	nd	nd
cis-1,3-Dichloropropene	1.0	nd		nd	nd	nd	nd
Toluene	1.0	nd	115%	nd	nd	nd	nd
trans-1,3-Dichloropropene	1.0	nd		nd	nd	nd	nd
1,1,2-Trichloroethane	1.0	nd		nd	nd	nd	nd
2-Hexanone	1.0	nd		nd	nd	nd	nd
1,3-Dichloropropane	1.0	nd		nd	nd	nd	nd
Dibromochloromethane	1.0	nd		nd	nd	nd	nd
Tetrachloroethene (PCE)	1.0	nd		**55**	**33**	**10**	**12**
1,2-Dibromoethane (EDB)(*)	0.01	nd		nd	nd	nd	nd
Chlorobenzene	1.0	nd	119%	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	1.0	nd		nd	nd	nd	nd
Ethylbenzene	1.0	nd		nd	nd	nd	nd
Xylenes	1.0	nd		nd	nd	nd	nd
Styrene	1.0	nd		nd	nd	nd	nd
Bromoform	1.0	nd		nd	nd	nd	nd
1,1,2,2-Tetrachloroethane	1.0	nd		nd	nd	nd	nd
Isopropylbenzene	1.0	nd		nd	nd	nd	nd
1,2,3-Trichloropropane	1.0	nd		nd	nd	nd	nd
Bromobenzene	1.0	nd		nd	nd	nd	nd

ESN SEATTLE CHEMISTRY LABORATORY
(425) 957-9872, fax (425) 957-9904

ESN Job Number: S50311-1
Client: SHANNON AND WILSON
Client Job Name: CBC HSC
Client Job Number: 22-1-11179-001

Analytical Results

8260, µg/L		MTH BLK	LCS	P-1 GW-1	P-2 GW-1	P-3 GW-1	P-4 GW-1
Matrix	Water	Water	Water	Water	Water	Water	Water
	Reporting						
Date analyzed	Limits	03/11/05	03/11/05	03/11/05	03/11/05	03/11/05	03/11/05
n-Propylbenzene	1.0	nd		nd	nd	nd	nd
2-Chlorotoluene	1.0	nd		nd	nd	nd	nd
4-Chlorotoluene	1.0	nd		nd	nd	nd	nd
1,3,5-Trimethylbenzene	1.0	nd		nd	nd	nd	nd
tert-Butylbenzene	1.0	nd		nd	nd	nd	nd
1,2,4-Trimethylbenzene	1.0	nd		nd	nd	nd	nd
sec-Butylbenzene	1.0	nd		nd	nd	nd	nd
1,3-Dichlorobenzene	1.0	nd		nd	nd	nd	nd
1,4-Dichlorobenzene	1.0	nd		nd	nd	nd	nd
Isopropyltoluene	1.0	nd		nd	nd	nd	nd
1,2-Dichlorobenzene	1.0	nd		nd	nd	nd	nd
n-Butylbenzene	1.0	nd		nd	nd	nd	nd
1,2-Dibromo-3-Chloropropane	1.0	nd		nd	nd	nd	nd
1,2,4-Trichlorobenzene	1.0	nd		nd	nd	nd	nd
Naphthalene	1.0	nd		nd	nd	nd	nd
Hexachloro-1,3-butadiene	1.0	nd		nd	nd	nd	nd
1,2,3-Trichlorobenzene	1.0	nd		nd	nd	nd	nd
*-instrument detection limits							
Surrogate recoveries							
Dibromofluoromethane		101%	98%	100%	101%	100%	102%
Toluene-d8		100%	99%	100%	99%	99%	98%
4-Bromofluorobenzene		98%	98%	97%	96%	95%	97%

Data Qualifiers and Analytical Comments

nd - not detected at listed reporting limits
J - estimated quantitation, below listed reporting limits
Acceptable Recovery limits: 65% TO 135%
Acceptable RPD limit: 35%

ESN SEATTLE CHEMISTRY LABORATORY
(425) 957-9872, fax (425) 957-9904

ESN Job Number: S50311-1
Client: SHANNON AND WI
Client Job Name: CBC HSC
Client Job Number: 22-1-11179-001

Analytical Results		P-2 GW-1	P-2 GW-1	
8260, µg/L		**MS**	**MSD**	**RPD**
Matrix	Water	Water	Water	
	Reporting			
Date analyzed	Limits	03/11/05	03/11/05	
Dichlorodifluoromethane	1.0			
Chloromethane	1.0			
Vinyl chloride	0.2			
Bromomethane	1.0			
Chloroethane	1.0			
Trichlorofluoromethane	1.0			
Acetone	10.0			
1,1-Dichloroethene	1.0	90%	94%	4%
Methylene chloride	10.0			
Methyl-t-butyl ether (MTBE)	1.0			
trans-1,2-Dichloroethene	1.0			
1,1-Dichloroethane	1.0			
2-Butanone (MEK)	10.0			
cis-1,2-Dichloroethene	1.0			
2,2-Dichloropropane	1.0			
Chloroform	1.0			
Bromochloromethane	1.0			
1,1,1-Trichloroethane	1.0			
1,2-Dichloroethane	1.0			
1,1-Dichloropropene	1.0			
Carbon tetrachloride	1.0			
Benzene	1.0	95%	102%	7%
Trichloroethene (TCE)	1.0	98%	103%	5%
1,2-Dichloropropane	1.0			
Dibromomethane	1.0			
Bromodichloromethane	1.0			
4-Methyl-2-pentanone	1.0			
cis-1,3-Dichloropropene	1.0			
Toluene	1.0	100%	107%	7%
trans-1,3-Dichloropropene	1.0			
1,1,2-Trichloroethane	1.0			
2-Hexanone	1.0			
1,3-Dichloropropane	1.0			
Dibromochloromethane	1.0			
Tetrachloroethene (PCE)	1.0			
1,2-Dibromoethane (EDB)(*)	0.01			
Chlorobenzene	1.0	103%	109%	6%
1,1,1,2-Tetrachloroethane	1.0			
Ethylbenzene	1.0			
Xylenes	1.0			
Styrene	1.0			
Bromoform	1.0			
1,1,2,2-Tetrachloroethane	1.0			
Isopropylbenzene	1.0			
1,2,3-Trichloropropane	1.0			
Bromobenzene	1.0			

ESN SEATTLE CHEMISTRY LABORATORY
(425) 957-9872, fax (425) 957-9904

ESN Job Number:	S50311-1
Client:	SHANNON AND WI
Client Job Name:	CBC HSC
Client Job Number:	22-1-11179-001

Analytical Results		P-2 GW-1	P-2 GW-1	
8260, µg/L		**MS**	**MSD**	**RPD**
Matrix	Water	Water	Water	
	Reporting			
Date analyzed	Limits	03/11/05	03/11/05	
n-Propylbenzene	1.0			
2-Chlorotoluene	1.0			
4-Chlorotoluene	1.0			
1,3,5-Trimethylbenzene	1.0			
tert-Butylbenzene	1.0			
1,2,4-Trimethylbenzene	1.0			
sec-Butylbenzene	1.0			
1,3-Dichlorobenzene	1.0			
1,4-Dichlorobenzene	1.0			
Isopropyltoluene	1.0			
1,2-Dichlorobenzene	1.0			
n-Butylbenzene	1.0			
1,2-Dibromo-3-Chloropropane	1.0			
1,2,4-Trichlorobenzene	1.0			
Naphthalene	1.0			
Hexachloro-1,3-butadiene	1.0			
1,2,3-Trichlorobenzene	1.0			
*-instrument detection limits				
Surrogate recoveries				
Dibromofluoromethane		100%	99%	
Toluene-d8		98%	98%	
4-Bromofluorobenzene		100%	99%	

Data Qualifiers and Analytical Comments

nd - not detected at listed reporting limits
J - estimated quantitation, below listed reporting limits
Acceptable Recovery limits: 65% TO 135%
Acceptable RPD limit: 35%

STL Seattle

Sample Identification:

Lab. No.	Client ID	Date/Time Sampled	Matrix
126730-1	P- 1 GW-1	03-09-05 09:10	Liquid
126730-2	P-2 GW-1	03-09-05 10:20	Liquid
126730-3	P-3 GW-1	03-09-05 11:40	Liquid
126730-4	P-4 GW-1	03-09-05 12:30	Liquid

STL Seattle

Client Name:	ESN Northwest, Inc.
Client ID:	P-3 GW-1
Lab ID:	126730-03
Date Received:	3/11/2005
Date Prepared:	3/14/2005
Date Analyzed:	3/16/2005
% Solids	-
Dilution Factor	1

Chlorinated Herbicides by USEPA Method 8151 GC/MS Modified

Surrogate	% Recovery	Flags	Recovery Limits Low	Recovery Limits High
2,4-Dichlorophenylacetic acid	82.2		42	131

Analyte	Result (ug/L)	RL	MDL	Flags
Dalapon	ND	0.249	0.103	
4-Nitrophenol	ND	0.249	0.0692	
Dicamba	ND	0.249	0.0749	
MCPP	ND	0.249	0.0503	
MCPA	ND	0.249	0.0471	
Dichloroprop	ND	0.249	0.128	
2,4-D	ND	0.249	0.0434	
Pentachlorophenol	ND	0.249	0.0784	
Silvex	ND	0.249	0.0586	
2,4,5-T	ND	0.249	0.101	
Dinoseb	ND	0.249	0.0658	
2,4-DB	ND	0.249	0.0734	

STL Seattle

Client Name:	ESN Northwest, Inc.
Client ID:	P-4 GW-1
Lab ID:	126730-04
Date Received:	3/11/2005
Date Prepared:	3/14/2005
Date Analyzed:	3/16/2005
% Solids	-
Dilution Factor	1

Chlorinated Herbicides by USEPA Method 8151 GC/MS Modified

Surrogate	% Recovery	Flags	Recovery Limits Low	Recovery Limits High
2,4-Dichlorophenylacetic acid	88.5		42	131

Analyte	Result (ug/L)	RL	MDL	Flags
Dalapon	ND	0.249	0.103	
4-Nitrophenol	ND	0.249	0.069	
Dicamba	ND	0.249	0.0747	
MCPP	ND	0.249	0.0502	
MCPA	ND	0.249	0.047	
Dichloroprop	ND	0.249	0.128	
2,4-D	ND	0.249	0.0433	
Pentachlorophenol	ND	0.249	0.0782	
Silvex	ND	0.249	0.0585	
2,4,5-T	ND	0.249	0.1	
Dinoseb	ND	0.249	0.0657	
2,4-DB	ND	0.249	0.0733	

STL Seattle

Client Name	ESN Northwest, Inc.
Client ID:	P- 1 GW-1
Lab ID:	126730-01
Date Received:	3/11/05
Date Prepared:	3/14/05
Date Analyzed:	3/14/05
Dilution Factor	5

Metals by ICP-MS - USEPA Method 6020

Analyte	Result (mg/L)	RL	Flags
Arsenic	0.00377	0.0025	
Cadmium	ND	0.0025	
Chromium	0.0131	0.0025	
Copper	0.00326	0.0025	
Lead	ND	0.0025	
Zinc	ND	0.01	

STL Seattle

Client Name	ESN Northwest, Inc.
Client ID:	P- 1 GW-1
Lab ID:	126730-01
Date Received:	3/11/05
Date Prepared:	3/14/05
Date Analyzed:	3/14/05
Dilution Factor	1

Mercury by CVAA - USEPA Method 7470

Analyte	Result (mg/L)	RL	Flags
Mercury	ND	0.0002	

STL Seattle

Client Name	ESN Northwest, Inc.
Client ID:	P-2 GW-1
Lab ID:	126730-02
Date Received:	3/11/05
Date Prepared:	3/14/05
Date Analyzed:	3/14/05
Dilution Factor	5

Metals by ICP-MS - USEPA Method 6020

Analyte	Result (mg/L)	RL	Flags
Arsenic	0.00594	0.0025	
Cadmium	ND	0.0025	
Chromium	0.0176	0.0025	
Copper	0.0111	0.0025	
Lead	0.00261	0.0025	
Zinc	0.0101	0.01	

STL Seattle

Client Name	ESN Northwest, Inc.
Client ID:	P-2 GW-1
Lab ID:	126730-02
Date Received:	3/11/05
Date Prepared:	3/14/05
Date Analyzed:	3/14/05
Dilution Factor	1

Mercury by CVAA - USEPA Method 7470

Analyte	Result (mg/L)	RL	Flags
Mercury	ND	0.0002	

STL Seattle

Client Name	ESN Northwest, Inc.
Client ID:	P-3 GW-1
Lab ID:	126730-03
Date Received:	3/11/05
Date Prepared:	3/14/05
Date Analyzed:	3/14/05
Dilution Factor	5

Metals by ICP-MS - USEPA Method 6020

Analyte	Result (mg/L)	RL	Flags
Arsenic	0.0506	0.0025	
Cadmium	ND	0.0025	
Chromium	0.0784	0.0025	
Copper	0.116	0.0025	
Lead	0.0181	0.0025	
Zinc	0.128	0.01	

STL Seattle

Client Name	ESN Northwest, Inc.
Client ID:	P-3 GW-1
Lab ID:	126730-03
Date Received:	3/11/05
Date Prepared:	3/14/05
Date Analyzed:	3/14/05
Dilution Factor	1

Mercury by CVAA - USEPA Method 7470

Analyte	Result (mg/L)	RL	Flags
Mercury	ND	0.0002	

STL Seattle

Client Name	ESN Northwest, Inc.
Client ID:	P-4 GW-1
Lab ID:	126730-04
Date Received:	3/11/05
Date Prepared:	3/14/05
Date Analyzed:	3/14/05
Dilution Factor	5

Metals by ICP-MS - USEPA Method 6020

Analyte	Result (mg/L)	RL	Flags
Arsenic	0.0107	0.0025	
Cadmium	ND	0.0025	
Chromium	0.0214	0.0025	
Copper	0.0152	0.0025	
Lead	0.00581	0.0025	
Zinc	0.0178	0.01	

STL Seattle

Client Name	ESN Northwest, Inc.
Client ID:	P-4 GW-1
Lab ID:	126730-04
Date Received:	3/11/05
Date Prepared:	3/14/05
Date Analyzed:	3/14/05
Dilution Factor	1

Mercury by CVAA - USEPA Method 7470

Analyte	Result (mg/L)	RL	Flags
Mercury	ND	0.0002	

STL Seattle

Lab ID:	Method Blank - HW0407
Date Received:	-
Date Prepared:	3/14/2005
Date Analyzed:	3/16/2005
% Solids	-
Dilution Factor	1

Chlorinated Herbicides by USEPA Method 8151 GC/MS Modified

Surrogate	% Recovery	Flags	Recovery Limits Low	Recovery Limits High
2,4-Dichlorophenylacetic acid	99.7		42	131

Analyte	Result (ug/L)	RL	MDL	Flags
Dalapon	ND	0.1	0.0413	
4-Nitrophenol	ND	0.1	0.0277	
Dicamba	ND	0.1	0.03	
MCPP	ND	0.1	0.0202	
MCPA	ND	0.1	0.0189	
Dichloroprop	ND	0.1	0.0515	
2,4-D	ND	0.1	0.0174	
Pentachlorophenol	ND	0.1	0.0314	
Silvex	ND	0.1	0.0235	
2,4,5-T	ND	0.1	0.0403	
Dinoseb	ND	0.1	0.0264	
2,4-DB	ND	0.1	0.0295	

STL Seattle

Blank Spike/Blank Spike Duplicate Report

Lab ID:	HW0407
Date Prepared:	3/14/2005
Date Analyzed:	3/16/2005
QC Batch ID:	HW0407

Chlorinated Herbicides by USEPA Method 8151 GC/MS Modified

Compound Name	Blank Result (ug/L)	Spike Amount (ug/L)	BS Result (ug/L)	BS % Rec.	BSD Result (ug/L)	BSD % Rec.	RPD	Flag
Dalapon	0	10	4.17	41.7	3.99	39.9	-4.4	
Dicamba	0	10	9.39	93.9	9.45	94.5	0.64	
MCPP	0	10	9.68	96.8	11.2	112	15	
2,4-D	0	10	9.56	95.6	9.85	98.5	3	
Pentachlorophenol	0	10	8.21	82.1	9.02	90.2	9.4	
Silvex	0	10	9.19	91.9	10.2	102	10	
2,4-DB	0	10	9.31	93.1	10.4	104	11	

STL Seattle

Lab ID:	Method Blank - TP998
Date Received:	-
Date Prepared:	3/14/05
Date Analyzed:	3/14/05
Dilution Factor	1

Metals by ICP-MS - USEPA Method 6020

Analyte	Result (mg/L)	RL	Flags
Arsenic	ND	0.0005	
Cadmium	ND	0.0005	
Chromium	ND	0.0005	
Copper	ND	0.0005	
Lead	ND	0.0005	
Zinc	ND	0.002	

STL Seattle

Lab ID:	Method Blank - ZT301
Date Received:	-
Date Prepared:	3/14/05
Date Analyzed:	3/14/05
Dilution Factor	1

Mercury by CVAA - USEPA Method 7470

Analyte	Result (mg/L)	RL	Flags
Mercury	ND	0.0002	

STL Seattle

Matrix Spike Report

Client Sample ID:	P- 1 GW-1
Lab ID:	126730-01
Date Prepared:	3/14/05
Date Analyzed:	3/14/05
QC Batch ID:	TP998

Metals by ICP-MS - USEPA Method 6020

Parameter Name	Sample Result (mg/L)	Spike Amount (mg/L)	MS Result (mg/L)	MS % Rec.	Flag
Arsenic	0.00377	4	4.22	105	
Cadmium	0	0.1	0.106	106	
Chromium	0.0131	0.4	0.448	109	
Copper	0.00326	0.5	0.542	108	
Lead	0	1	1.07	107	
Zinc	0	1	1.02	102	

STL Seattle

Matrix Spike Report

Client Sample ID:	RA-12-006-050309-RB
Lab ID:	126727-06
Date Prepared:	3/14/05
Date Analyzed:	3/14/05
QC Batch ID:	ZT301

Mercury by CVAA - USEPA Method 7470

Parameter Name	Sample Result (mg/L)	Spike Amount (mg/L)	MS Result (mg/L)	MS % Rec.	Flag
Mercury	0	0.002	0.00194	97	

STL Seattle

Duplicate Report

Client Sample ID:	P- 1 GW-1
Lab ID:	126730-01
Date Prepared:	3/14/05
Date Analyzed:	3/14/05
QC Batch ID:	TP998

Metals by ICP-MS - USEPA Method 6020

Parameter Name	Sample Result (mg/L)	Duplicate Result (mg/L)	RPD %	Flag
Arsenic	0.0038	0.0038	0.0	
Cadmium	0	0	NC	
Chromium	0.013	0.012	8.0	
Copper	0.0033	0.0033	0.0	
Lead	0	0	NC	
Zinc	0	0	NC	

STL Seattle

Duplicate Report

Client Sample ID:	RA-12-006-050309-RB
Lab ID:	126727-06
Date Prepared:	3/14/05
Date Analyzed:	3/14/05
QC Batch ID:	ZT301

Mercury by CVAA - USEPA Method 7470

Parameter Name	Sample Result (mg/L)	Duplicate Result (mg/L)	RPD %	Flag
Mercury	0	0	NC	

SEVERN TRENT STL

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DATA QUALIFIERS AND ABBREVIATIONS

B1: This analyte was detected in the associated method blank. The analyte concentration was determined not to be significantly higher than the associated method blank (less than ten times the concentration reported in the blank).

B2: This analyte was detected in the associated method blank. The analyte concentration in the sample was determined to be significantly higher than the method blank (greater than ten times the concentration reported in the blank).

C1: Second column confirmation was performed. The relative percent difference value (RPD) between the results on the two columns was evaluated and determined to be < 40%.

C2: Second column confirmation was performed. The RPD between the results on the two columns was evaluated and determined to be > 40%. The higher result was reported unless anomalies were noted.

C3: Second analysis confirmation was performed. The relative percent difference value (RPD) between the results on the two columns was evaluated and determined to be ≤ 30%.

C4: Second analysis confirmation was performed. The RPD between the results on the two columns was evaluated and determined to be > 30%. The original analysis was reported unless anomalies were noted.

M: GC/MS confirmation was performed. The result derived from the original analysis was reported.

D: The reported result for this analyte was calculated based on a secondary dilution factor.

E: The concentration of this analyte exceeded the instrument calibration range and should be considered an estimated quantity.

The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.

MCL: Maximum Contaminant Level

MDL: Method Detection Limit

RL: Reporting Limit

N: See analytical narrative

ND: Not Detected

X1: Contaminant does not appear to be "typical" product. Elution pattern suggests it may be _____.

X2: Contaminant does not appear to be "typical" product.

X3: Identification and quantitation of the analyte or surrogate was complicated by matrix interference.

X4: RPD for duplicates was outside advisory QC limits. The sample was re-analyzed with similar results. The sample matrix may be nonhomogeneous.

X4a: RPD for duplicates outside advisory QC limits due to analyte concentration near the method practical quantitation limit/detection limit.

X5: Matrix spike recovery was not determined due to the required dilution.

X6: Recovery and/or RPD values for matrix spike(/matrix spike duplicate) outside advisory QC limits. Sample was re-analyzed with similar results.

X7: Recovery and/or RPD values for matrix spike(/matrix spike duplicate) outside advisory QC limits. Matrix interference may be indicated based on acceptable blank spike recovery and/or RPD.

X7a: Recovery and/or RPD values for this spiked analyte outside advisory QC limits due to high concentration of the analyte in the original sample.

X8: Surrogate recovery was not determined due to the required dilution.

X9: Surrogate recovery outside advisory QC limits due to matrix interference.

ESN NORTHWEST CHEMISTRY LABORATORY

CBC HSC PROJECT
Washington
Shannon & Wilson, Inc.
Client Project #22-1-11179-001

Heavy Metals in Soil by EPA-7000 Series

Sample Number	Date Analyzed	Lead (Pb) EPA 7420 (mg/kg)	Cadmium (Cd) EPA 7130 (mg/kg)	Chromium (Cr) EPA 7190 (mg/kg)	Arsenic (As) EPA 7061 (mg/kg)	Zinc (Zn) EPA 7950 (mg/kg)	Copper (Cu) EPA 7210 (mg/kg)	Mercury (Hg) EPA 7471 (mg/kg)
Method Blank	3/23/05	nd	nd	nd	nd	nd	nd	nd
P-2 S-1	3/23/05	nd	nd	nd	nd	45	18	nd
P-2 S-1 Dup.	3/23/05	nd	nd	nd	nd	65	18	nd
P-3 S-1	3/23/05	nd	nd	nd	nd	58	15	nd
P-4 S-1	3/23/05	nd	nd	nd	nd	76	23	nd
Method Detection Limits		5	1	5	5	1	1	0.5

"nd" Indicates not detected at listed detection limits.

ANALYSES PERFORMED BY:T. McCall

ESN NORTHWEST CHEMISTRY LABORATORY

CBC HSC PROJECT
Washington
Shannon & Wilson, Inc.
Client Project #22-1-11179-001

QA/QC Data - Total Metals EPA-7000 Series Analyses

Sample Number: P-4 S-1							
	Matrix Spike			Matrix Spike Duplicate			RPD
	Spiked Conc. (mg/kg)	Measured Conc. (mg/kg)	Spike Recovery (%)	Spiked Conc. (mg/kg)	Measured Conc. (mg/kg)	Spike Recovery (%)	(%)
Lead	250	251	100	250	254	102	1.19
Cadmium	25	26	104	25	27	108	3.77
Chromium	250	251	100	250	224	90	11.37
Arsenic	250	225	90	250	214	86	5.01

Laboratory Control Sample			
	Spiked Conc. (mg/kg)	Measured Conc. (mg/kg)	Spike Recovery (%)
Lead	250	255	102
Cadmium	25	25	100
Chromium	250	239	96
Arsenic	250	229	92

ACCEPTABLE RECOVERY LIMITS FOR MATRIX SPIKES: 65%-135%
ACCEPTABLE RPD IS 35%

ANALYSES PERFORMED BY:T. McCall

ESN SEATTLE CHEMISTRY LABORATORY
(425) 957-9872, fax (425) 957-9904

ESN Job Number: S50321-2
Client: SHANNON AND WILSON
Client Job Name: CBC HSC

Analytical Results

8260, mg/kg		MTH BLK	LCS	P-2 S-1	P-3 S-1	P-4 S-1
Matrix	Soil	Soil	Soil	Soil	Soil	Soil
Date extracted	Reporting	03/24/05		03/24/05	03/24/05	03/24/05
Date analyzed	Limits	03/24/05	03/24/05	03/24/05	03/24/05	03/24/05
Moisture, %				23%	24%	18%
Dichlorodifluoromethane	0.05	nd		nd	nd	nd
Chloromethane	0.05	nd		nd	nd	nd
Vinyl chloride	0.01	nd		nd	nd	nd
Bromomethane	0.05	nd		nd	nd	nd
Chloroethane	0.05	nd		nd	nd	nd
Trichlorofluoromethane	0.05	nd		nd	nd	nd
Acetone	0.50	nd		nd	nd	nd
1,1-Dichloroethene	0.05	nd	81%	nd	nd	nd
Methylene chloride	0.50	nd		nd	nd	nd
Methyl-t-butyl ether (MTBE)	0.05	nd		nd	nd	nd
trans-1,2-Dichloroethene	0.05	nd		nd	nd	nd
1,1-Dichloroethane	0.05	nd		nd	nd	nd
2-Butanone (MEK)	0.50	nd		nd	nd	nd
cis-1,2-Dichloroethene	0.05	nd		nd	nd	nd
2,2-Dichloropropane	0.05	nd		nd	nd	nd
Chloroform	0.05	nd		nd	nd	nd
Bromochloromethane	0.05	nd		nd	nd	nd
1,1,1-Trichloroethane	0.05	nd		nd	nd	nd
1,2-Dichloroethane	0.05	nd		nd	nd	nd
1,1-Dichloropropene	0.05	nd		nd	nd	nd
Carbon tetrachloride	0.05	nd		nd	nd	nd
Benzene	0.02	nd	91%	nd	nd	nd
Trichloroethene (TCE)	0.02	nd	92%	nd	nd	nd
1,2-Dichloropropane	0.05	nd		nd	nd	nd
Dibromomethane	0.05	nd		nd	nd	nd
Bromodichloromethane	0.05	nd		nd	nd	nd
4-Methyl-2-pentanone	0.05	nd		nd	nd	nd
cis-1,3-Dichloropropene	0.05	nd		nd	nd	nd
Toluene	0.05	nd	92%	nd	nd	nd
trans-1,3-Dichloropropene	0.05	nd		nd	nd	nd
1,1,2-Trichloroethane	0.05	nd		nd	nd	nd
2-Hexanone	0.05	nd		nd	nd	nd
1,3-Dichloropropane	0.05	nd		nd	nd	nd
Dibromochloromethane	0.05	nd		nd	nd	nd
Tetrachloroethene (PCE)	0.02	nd		nd	nd	nd
1,2-Dibromoethane (EDB)(*)	0.005	nd		nd	nd	nd
Chlorobenzene	0.05	nd	93%	nd	nd	nd
1,1,1,2-Tetrachloroethane	0.05	nd		nd	nd	nd
Ethylbenzene	0.05	nd		nd	nd	nd
Xylenes	0.05	nd		nd	nd	nd
Styrene	0.05	nd		nd	nd	nd
Bromoform	0.05	nd		nd	nd	nd
1,1,2,2-Tetrachloroethane	0.05	nd		nd	nd	nd
Isopropylbenzene	0.05	nd		nd	nd	nd
1,2,3-Trichloropropane	0.05	nd		nd	nd	nd
Bromobenzene	0.05	nd		nd	nd	nd
n-Propylbenzene	0.05	nd		nd	nd	nd
2-Chlorotoluene	0.05	nd		nd	nd	nd
4-Chlorotoluene	0.05	nd		nd	nd	nd
1,3,5-Trimethylbenzene	0.05	nd		nd	nd	nd
tert-Butylbenzene	0.05	nd		nd	nd	nd
1,2,4-Trimethylbenzene	0.05	nd		nd	nd	nd
sec-Butylbenzene	0.05	nd		nd	nd	nd
1,3-Dichlorobenzene	0.05	nd		nd	nd	nd
1,4-Dichlorobenzene	0.05	nd		nd	nd	nd
Isopropyltoluene	0.05	nd		nd	nd	nd
1,2-Dichlorobenzene	0.05	nd		nd	nd	nd
n-Butylbenzene	0.05	nd		nd	nd	nd
1,2-Dibromo-3-Chloropropane	0.05	nd		nd	nd	nd
1,2,4-Trichlorobenzene	0.05	nd		nd	nd	nd
Naphthalene	0.05	nd		nd	nd	nd
Hexachloro-1,3-butadiene	0.05	nd		nd	nd	nd
1,2,3-Trichlorobenzene	0.05	nd		nd	nd	nd

*-instrument detection limits

ESN SEATTLE CHEMISTRY LABORATORY
(425) 957-9872, fax (425) 957-9904

ESN Job Number: S50321-2
Client: SHANNON AND WILSON
Client Job Name: CBC HSC

Analytical Results

8260, mg/kg		MTH BLK	LCS	P-2 S-1	P-3 S-1	P-4 S-1
Matrix	Soil	Soil	Soil	Soil	Soil	Soil
Date extracted	Reporting	03/24/05		03/24/05	03/24/05	03/24/05
Date analyzed	Limits	03/24/05	03/24/05	03/24/05	03/24/05	03/24/05
Moisture, %				23%	24%	18%

Surrogate recoveries:						
Dibromofluoromethane		95%	100%	97%	97%	97%
Toluene-d8		100%	98%	100%	99%	100%
4-Bromofluorobenzene		97%	98%	98%	98%	99%

Data Qualifiers and Analytical Comments

nd - not detected at listed reporting limits
J - estimated quantitation, below listed reporting limits
Acceptable Recovery limits: 65% TO 135%
Acceptable RPD limit: 35%

ESN SEATTLE CHEMISTRY LABORATORY
(425) 957-9872, fax (425) 957-9904

ESN Job Number: S50321-2
Client: SHANNON AND WILSON
Client Job Name: CBC HSC

Analytical Results		P-4 S-1	P-4 S-1	
8260, mg/kg		**MS**	**MSD**	**RPD**
Matrix	Soil	Soil	Soil	
Date extracted	Reporting	03/24/05	03/24/05	
Date analyzed	Limits	03/24/05	03/24/05	
Moisture, %				
Dichlorodifluoromethane	0.05			
Chloromethane	0.05			
Vinyl chloride	0.01			
Bromomethane	0.05			
Chloroethane	0.05			
Trichlorofluoromethane	0.05			
Acetone	0.50			
1,1-Dichloroethene	0.05	87%	85%	2%
Methylene chloride	0.50			
Methyl-t-butyl ether (MTBE)	0.05			
trans-1,2-Dichloroethene	0.05			
1,1-Dichloroethane	0.05			
2-Butanone (MEK)	0.50			
cis-1,2-Dichloroethene	0.05			
2,2-Dichloropropane	0.05			
Chloroform	0.05			
Bromochloromethane	0.05			
1,1,1-Trichloroethane	0.05			
1,2-Dichloroethane	0.05			
1,1-Dichloropropene	0.05			
Carbon tetrachloride	0.05			
Benzene	0.02	97%	96%	1%
Trichloroethene (TCE)	0.02	96%	95%	1%
1,2-Dichloropropane	0.05			
Dibromomethane	0.05			
Bromodichloromethane	0.05			
4-Methyt-2-pentanone	0.05			
cis-1,3-Dichloropropene	0.05			
Toluene	0.05	98%	97%	1%
trans-1,3-Dichloropropene	0.05			
1,1,2-Trichloroethane	0.05			
2-Hexanone	0.05			
1,3-Dichloropropane	0.05			
Dibromochloromethane	0.05			
Tetrachloroethene (PCE)	0.02			
1,2-Dibromoethane (EDB)(*)	0.005			
Chlorobenzene	0.05	96%	97%	1%
1,1,1,2-Tetrachloroethane	0.05			
Ethylbenzene	0.05			
Xylenes	0.05			
Styrene	0.05			
Bromoform	0.05			
1,1,2,2-Tetrachloroethane	0.05			
Isopropylbenzene	0.05			
1,2,3-Trichloropropane	0.05			
Bromobenzene	0.05			
n-Propylbenzene	0.05			
2-Chlorotoluene	0.05			
4-Chlorotoluene	0.05			
1,3,5-Trimethylbenzene	0.05			
tert-Butylbenzene	0.05			
1,2,4-Trimethylbenzene	0.05			
sec-Butylbenzene	0.05			
1,3-Dichlorobenzene	0.05			
1,4-Dichlorobenzene	0.05			
Isopropyltoluene	0.05			
1,2-Dichlorobenzene	0.05			
n-Butylbenzene	0.05			
1,2-Dibromo-3-Chloropropane	0.05			
1,2,4-Trichlorobenzene	0.05			
Naphthalene	0.05			
Hexachloro-1,3-butadiene	0.05			
1,2,3-Trichlorobenzene	0.05			

*-instrument detection limits

ESN SEATTLE CHEMISTRY LABORATORY
(425) 957-9872, fax (425) 957-9904

ESN Job Number: S50321-2
Client: SHANNON AND WILSON
Client Job Name: CBC HSC

Analytical Results		P-4 S-1	P-4 S-1	
8260, mg/kg		**MS**	**MSD**	**RPD**
Matrix	Soil	Soil	Soil	
Date extracted	Reporting	03/24/05	03/24/05	
Date analyzed	Limits	03/24/05	03/24/05	
Moisture, %				

Surrogate recoveries:		
Dibromofluoromethane	96%	95%
Toluene-d8	100%	100%
4-Bromofluorobenzene	97%	97%

Data Qualifiers and Analytical Comments

nd - not detected at listed reporting limits
J - estimated quantitation, below listed reporting limits
Acceptable Recovery limits: 65% TO 135%
Acceptable RPD limit: 35%

Samples Packaged in 2 containers

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

CHAIN-OF-CUSTODY RECORD

Page ____ of ____

Laboratory: [illegible]

Attn: ____

400 N. 34th Street, Suite 100
Seattle, WA 98103
(206) 632-8020

2043 Westport Center Drive
St. Louis, MO 63146-3564
(314) 392-0050

303 Wellsian Way
Richland, WA 99352
(509) 946-6309

2055 Hill Road
Fairbanks, AK 99709
(907) 479-0600

5430 Fairbanks Street, Suite 3
Anchorage, AK 99518
(907) 561-2120

2255 S.W. Canyon Road
Portland, OR 97201-2498
(503) 223-6147

1200 17th Street, Suite 1024
Denver, Co 80202
(303) 825-3800

Analysis Parameters/Sample Container Description
(include preservative if used)

Sample Identity	Lab No.	Time	Date Sampled	Comp.	Grab	Nutrients	VOC	PCB	[illegible]	[illegible]	[illegible]	Total Number of Containers	Remarks/Matrix
P-1 GW-1		9:10	3/9/05			X	X	X	X			5	
P-1 S-1		9:50										2	
P-2 GW-2		10:00										2	
P-2 GW-1		10:20				X	X	X	X			5	
P-3 S-1		10:55										2	
P-3 GW-1		11:40				X	X	[illegible]	X	X		5	
P-4 S-1		12:10										2	
P-4 GW-1		12:30	↓			X	X	[illegible]	X	X		5	

Project Information		Sample Receipt	
Project Number:	2-1-11179-001	Total Number of Containers	
Project Name:	PC HSC	COC Seals/Intact? Y/N/NA	
Contact:	D. Parkes	Received Good Cond./Cold	
Ongoing Project?	Yes ☐ No ☑	Delivery Method:	
Sampler:	[illegible]	(attach shipping bill, if any)	

Instructions	
Requested Turnaround Time:	Standard
Special Instructions:	fax results to (509)946-1580 or email to dop@shanwil.com

Relinquished By: 1.	Relinquished By: 2.	Relinquished By: 3.
Signature: Donna Parkes Time: [illegible]	Signature: Time:	Signature: Time:
Printed Name: Donna Parkes Date: 3-9-05	Printed Name: Date:	Printed Name: Date:
Company: Shannon & Wilson	Company:	Company:

Received By: 1.	Received By: 2.	Received By: 3.
Signature: Time:	Signature: Time:	Signature: Time:
Printed Name: Date: 3-9-05	Printed Name: Date:	Printed Name: Date:
Company: [illegible]	Company:	Company:

Distribution: White - w/shipment - returned to Shannon & Wilson w/ laboratory report
Yellow - w/shipment - for consignee files
Pink - Shannon & Wilson - Job File

F-19-91/UR

No. 026148

APPENDIX C

IMPORTANT INFORMATION ABOUT YOUR ENVIRONMENTAL REPORT

APPENDIX C

IMPORTANT INFORMATION ABOUT YOUR ENVIRONMENTAL REPORT

Important Information About Your Geotechnical/Environmental Report

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors, which were considered in the development of report, have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your