

REMEDIAL INVESTIGATION

**SCHWERIN CONCAVES, INC.
WALLA WALLA, WASHINGTON**

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1.0 INTRODUCTION

The Schwerin Concaves Site (Site) is a former hard chromium electroplating facility located about four miles north of Highway 12 on Sapolil Road in Walla Walla County, Washington and is situated on a farm within a rural area (Figure 1). The Site has been identified by the Washington Department of Ecology's (Ecology's) Toxics Cleanup Program as an orphan site. This means that the potentially liable person(s) are either financially unable or unavailable to conduct remedial action in an adequate or timely manner at this site. Therefore, Ecology will utilize Model Toxics Control Act (MTCA) Chapter 70.105D RCW funds to complete site investigation in accordance with MTCA requirements.

Ecology has completed a State-Lead Remedial Investigation (RI) at the Site. The purpose of the RI is to collect, develop, and evaluate the nature and extent of releases of hazardous substances (as defined by RCW 70.105D.020(7)) from a Facility (as defined in RCW 70.105D.020(4)), and to gather the necessary data to support the Feasibility Study (FS). Information was collected, developed, and evaluated with the intent to provide for the completion of a FS and subsequent selection of a cleanup action under WAC 173-340-360.

2.0 BACKGROUND

Schwerin Concaves, Inc. (Schwerin) owned and operated a hard chromium electroplating facility on this property from the late 1970s to 2000. Ecology understands the facility was part of a wheat farming operation prior to its use as a plating facility. The farming operation continues to be present on other portions of the property. Schwerin electroplated internal farm combine components called concaves that remove husks from grain kernels. The concaves were brought to the facility and refurbished by a process that involved three main work areas: the cleaning station, plating station, and the wastewater treatment station. The wastewater treatment consisted of a multi-step process that included the following:

- Addition of ferrous sulfate from small "addition" tank. Water was circulated from wastewater treatment tank through small addition tank back to a wastewater tank.
- When hexavalent chromium concentrations reached zero according to colorimetric tests, calcium hydroxide was added to the wastewater via the addition tank.
- When trivalent chromium concentrations reached zero according to colorimetric tests, the treated water was drained into the holding tank.
- The water was allowed to sit in the holding tank so sludge and particulate could settle to the bottom. The sludge was removed and placed into a filter press in order to remove most of the water.
- Filter-pressed sludge was placed into wooden boxes for temporary storage.

- The sludge was loaded onto a heated conveyor system for drying. The dried sludge was packaged and shipped as hazardous waste to Arlington, Oregon.
- The treated wastewater was periodically transported to a temporary storage tank for disposal in the industrial park whose drains were connected to the Walla Walla wastewater treatment through the sewer lines.

The precision and reliability of testing equipment most likely allowed chromium concentrations above zero to remain in the treated water. Prior to 1988, the wastewater was pumped to a 10,000-gallon holding tank. The tank was located in a below-ground containment north of the plating shop. The treated wastewater was periodically pumped to an unlined settling pond in the self-propelled shed.

Ecology's Hazardous Waste Toxics Reduction Program completed several inspection and technical assistance visits to the facility between 1988 and 2000. Compliance investigations noted several hazardous waste management violations and practices that resulted in site contamination. These violations included improper treatment of sludge and wastewater, chemical and sludge storage, and disposal practices. The Schwerin Concaves Site was placed on the Washington State Hazardous Sites List in August 2000. In addition, a site hazard assessment (SHA) was completed which resulted in a site ranking of 2. This site's ranking, on a scale of one to five with one being the highest, is relative to all other Washington State sites assessed at this time. This ranking indicates that the site is considered to pose a very high assessed risk to human health and the environment from confirmed and suspected site contamination.

2.1 Hazardous Waste Compliance

The first Ecology site inspection was conducted in June 1988. Nine areas of non-compliance were noted by the Ecology hazardous waste inspectors and a follow-up compliance letter was sent to correct the areas of general non-compliance. Another site inspection was conducted in April 1989, and six additional violations were noted during the visit. A letter was sent from Ecology to Schwerin in July 1989 to correct the non-compliance issues.

A consultant was hired by Schwerin to provide environmental services. The consultant completed a contaminant report that identified two areas of contamination and addressed other cleanup issues including RCRA closure (Technico, 1989). Correspondence between Ecology and Schwerin continued regarding hazardous waste violations that included a closure plan, worker training, waste water treatment, and sludge disposal.

In July 1991, EPA conducted a RCRA facility assessment at the Site. The EPA assessment identified ten solid waste management units (SWMUs) and violations at the site. A draft order was completed by EPA but never issued.

Ecology completed a site inspection in January 1992 and noted 13 violations. A letter and follow-up inspection was conducted in May 1993. Eight violations were observed in the May 1993 inspection. Six site inspections were conducted from 1994 through 1999

with continued violations noted. In March 2000, Ecology issued an Enforcement Order to Schwerin to conduct a study at the Site to define the extent of soil and groundwater contamination. Schwerin did not conduct the study prior to Ecology levying a \$221,000 penalty for the continued violations observed throughout the years. Given the financial condition of the business, Ecology elected not to pursue collection of the fine.

In addition to the violations noted by Ecology, the EPA conducted a criminal investigation regarding improper handling and storage of hazardous waste at the Site. The investigation led to criminal charges and the plating shop was closed. As part of the criminal settlement, the plating shop interior and its contents were dismantled and disposed in accordance with state and federal regulations. Additional information on Hazardous Waste compliance can be found in the Hazardous Waste Toxics Reduction administrative file at Ecology's Eastern Regional Office.

3.0 PHYSICAL SETTING

The Schwerin Concaves Site is located about four miles north of Highway 12 on Sapoliil Road in Walla Walla County, Washington. The property is located in Section 31, Township 8 North, Range 37 East, Willamette Meridian at 46° 04' 08" north latitude and 118° 21' 20" west longitude, and is situated on a farm within a rural area (Figure 1). Topographic map coverage of the Site and Site vicinity is provided by the Buroker Quadrangle, U.S. Geological Survey, 7.5 minute series dated 1966. The Site elevation is about 1220 feet above sea level using the National Geodetic Vertical Datum (NGVD) of 1929.

The Site is located along the north bank of Dry Creek, which is a tributary to the Walla Walla River. The immediate vicinity is rural and sparsely populated. Agricultural fields bound the Site on the north, west and east sides with Dry Creek forming the southern border. The Site is relatively flat with the topographic relief provided by the stream channel of Dry Creek. The topographic gradient is one percent or less from east to west across the Site. The elevation change ranges from 1224 feet at monitoring well MW-4 to 1218 feet at monitoring well MW-3 (Figure 2). The general land slope steepens to the north and south of the Site and drains across the Site and toward Dry Creek. The property is unpaved and surface water will pond in some areas and generally drains to the south toward the creek.

The plating operation was housed mainly in one large building with five auxiliary buildings that were used to store products and waste. A storage tank housed inside a subterranean covered shed was located to the north of the plating shop. The auxiliary buildings include an office/maintenance shop, self-propelled shed, long farm shed, a storage shed, and barn. A residence and garage are located west of the long farm shed (Figure 2).

3.1 Regional Geology

As described above, the site is situated near the Walla Walla River Valley. Geologic materials in the area are described as alluvial and glacial deposits. Generally, the alluvial deposits consist of unconsolidated silt, sand, and gravel valley fill. The glacial deposits of Pleistocene age are lacustrine in nature and include fine-grained sand and silt with some gravel.

The oldest, thickest and most extensive valley fill unit of these deposits consists of the “old clay”, up to 500 feet or more in thickness, which partially fills the Walla Walla Basin. The “old clay” is interfingering with the “old gravel”. The “old gravel” is composed largely of well-rounded, pebble, cobble, and boulder gravel derived principally of basaltic material. The gravel is typically set in a matrix of sandy and silty material. In some cases considerable calcareous cement is present. Successively younger deposits of Pleistocene age, known as the Palouse Formation, Touchet Beds, and recent alluvium overlie the “old gravel” and “old clay” in some areas, as well as the basalt.

The “old gravel” extends approximately from the foot of the Blue Mountains located east of the Site to Dry Creek near Buroker. It formed generally by the deposition of coalescent alluvial fans (Newcombe, 1965). The upper portion of this alluvial surface was covered by later unconsolidated materials and forms the present physiographic surface in the upper part of the valley; the unconsolidated deposits that overlie the original fan surface in the Sapolil area are comprised of silty clays possibly of the Palouse Formation. The lower part of the valley is principally covered with glaciofluvial and recent alluvial deposits.

The unconsolidated sediments overlie rocks of the Columbia River Basalt Supergroup. These basalt flows are grouped into different units. Each unit has varying thickness and depths throughout the Columbia Plateau and contains numerous individual flows. The basalt dips westward from the Blue Mountains, southward down the “Touchet Slope”, northward from the Horse Heaven ridge, and eastward from a divide ridge in the lower valley. These dips converge into a synclinal trough whose bedrock surface extends below sea level in at least two places west of Walla Walla. This trough defines a hydrologic sub basin of the Columbia Plateau known as the Walla Walla Basin.

The Columbia River Basalt Supergroup formations found in the area include the Saddle Mountains Basalt that overlies the Wanapum Basalt. The Wanapum overlies the Grande Ronde. Based on a review of well logs, a majority of the domestic and municipal supply wells in the area are completed in the Wanapum Basalt.

3.1.1 Site Geology

The site geologic interpretation is made from split spoon samples and drill cuttings collected from the monitoring wells installed on-site, temporary well point samples, and excavation activities (Figure 2). The upper soil profile consists of light brown, dry medium dense, sandy silt. The sand is mostly fine-grained and the silt is non-plastic to slightly plastic. An ash layer was encountered in one boring from about 11 to 13 feet

below ground surface (bgs). The sandy silt overlies sandy gravel with silt (5-15%) or gravelly sand. The contact of the two soil layers varies from 12 feet bgs in monitoring wells MW-4 and MW-5 to over 20 feet bgs in wells MW-7, 8, and 9. The gravel becomes sandier and less silty with depth. The site geology appears to correspond with the regional geology since the upper soil profile appears similar to loess of the Palouse Formation and the gravelly zone correlates to the “old gravel.”

Bedrock was encountered in five of the nine monitoring well borings. The surface of the basalt bedrock was encountered 35 to 39 feet bgs and was closer to surface in wells MW-4 and MW-5, which are closest in proximity to Dry Creek. Based on the drilling, the basalt appears to form a relatively flat surface that gently dips away from Dry Creek. Boring logs and geologic cross sections are presented in Appendix A.

3.2 Regional Hydrogeology

Groundwater occurrences in the Walla Walla Basin are developed in basalt bedrock, the “Old Gravels;” and the recent alluvium overlying the “old gravels,” which includes loess soil and glaciofluvial sands and gravels. The majority of groundwater is used for irrigation with the remainder used for domestic and industrial purposes.

The regional groundwater flow direction in the gravel aquifer is west with a southern or northern flow component relative to the main stem of the Walla Walla River. The regional groundwater flow direction in the basalt aquifer is west with a southerly flow from the Touchet River toward the Walla Walla River and a northerly flow from Oregon toward the Walla Walla River.

3.2.1 Site Hydrogeology

The Site hydrogeology is based on the nine monitoring wells that Ecology installed at the Site. Groundwater was encountered at varying depths based on the proximity to Dry Creek and the occurrence of bedrock. As shown in Figure 2, monitoring wells MW-1, MW-2, MW-3, and MW-7 encountered groundwater about 40 feet bgs. Monitoring wells MW-4, MW-5, MW-6, MW-8, and MW-9 encountered groundwater at approximately 30 feet bgs. Groundwater occurs in brown, gravelly sand or sandy gravel with silt.

Static water levels after monitoring well construction range from 17 feet bgs in MW-4 to 33 feet bgs in MW-2. Based on water level elevations, bedrock significantly controls the water table surface. Groundwater flows away from the creek to the northeast. The water levels and flow direction appear to be directly influenced by Dry Creek and bedrock. Due to a thickening of the gravel aquifer, monitoring wells MW-1, MW-2, MW-3, and MW-7 did not encounter bedrock. Water level measurements are presented in Table 1.

4.0 REMEDIAL INVESTIGATION

The remedial investigation (RI) scope of work was developed based on the available chemical and physical data and the site hydrogeologic conditions. The scope of work objectives were intended to characterize the Schwerin Concaves Site in order to provide sufficient information for a Feasibility Study (FS) and eventual cleanup. The purpose of the RI is to evaluate the physical and chemical characteristics associated with contaminants at the site, and determine their potential threat to human health and the environment.

4.1 Soil Investigation

Soil borings were used to assess the subsurface soil conditions. The drilling program was designed to characterize the nature, lateral and vertical extent, and approximate volume of contaminated soil. The borings were logged on-site and identified according to the Unified Soil Classification System (USCS).

Boring locations were selected to provide site coverage of known and potential soil contaminant locations, and provide a preliminary characterization of site conditions. Based on the distinct coloration typically associated with chromium contamination, it was anticipated that Ecology would be able to visually distinguish the existence of affected soil and its contact with clean or less impacted soil.

Soil samples were collected for lithologic description, field screening, and archiving. The samples were collected using a split-spoon sampler driven with a 140-pound hammer through a freefall of 30-inches per blow. Sample retrieval was very difficult with refusal conditions typical below 15 to 20 feet. Limited sample recovery resulted in minimal sample being available for observation and testing. Attempts at collecting samples were made at five foot intervals or apparent changes in geologic conditions. Visual observation of drill cuttings and drilling rate assisted in determining sample depths outside the five-foot interval sampling depths.

4.1.1 Soil Borings

Ecology executed a public works contract for the drilling services with Environmental West of Spokane, Washington. Drilling and field work at the Site was initiated in October 2000. A Mobile B-80 drill equipped with a six-inch Tubex system and auxiliary air compressor was used to complete the borings. Each of the soil borings were completed as monitoring wells. Four borings/monitoring wells were completed at the Site during the October 2000 effort.

The boring locations were selected to provide an initial insight into groundwater quality near known and possible contaminant sources (Figure 2). The location for monitoring well MW-1 was selected to provide an assumed upgradient well for the Site. Monitoring well MW-2 was located in a perceived downgradient location of the plating shop. Monitoring well MW-3 was placed downgradient of the maintenance shop and MW-4

was located in a presumed downgradient location of the self-propelled shed. Monitoring well MW-4 was the only boring that encountered bedrock during this phase of work.

In 2001, Ecology completed a second phase of drilling and field work at the Site. The work was designed to further define the soil and groundwater contamination at the Site. Field work was initiated in December 2001. Environmental West of Spokane, Washington provided drilling services with similar equipment as the initial investigation. As shown on Figure 5, five additional monitoring wells were completed at the Site with the Tubex drilling system. Monitoring well MW-5 was placed between MW-4 and Dry Creek in order to assess water quality near the creek. Monitoring well MW-8 was located east of the self-propelled shed to monitor groundwater conditions east of the shed as MW-4 does on the west side of the shed. Monitoring wells MW-6 and MW-9 were placed near the southwest and southeast corners of the plating shop to assess the presence of bedrock and groundwater conditions between the identified contamination sources. Monitoring well MW-7 was placed near the northeast corner of the plating shop in the proximity of the wastewater holding tank.

Of the five wells installed in 2001, four encountered bedrock during their completion. MW-7 did not to encounter bedrock during drilling. The bedrock that was encountered suggested the basalt has a relatively flat profile with a gentle slope away from the creek.

4.1.2 Geoprobe Borings

Based on the information generated from the soil borings and the difficulty in sample retrieval, additional exploration was needed to further assess the subsurface. The subsurface exploration was designed to provide additional lithologic information as well assist in developing a bedrock profile near the self-propelled shed.

In October 2001, a geoprobe drilling program was initiated to assess the subsurface. The direct push technology provides a quick, efficient drilling method that advances a 1.5-inch inside diameter steel sample barrel into the subsurface in four-foot intervals. The sampler is advanced utilizing hydraulic pressure and a hammer. The sample barrel is lined with clear PVC tubes and is advanced into the soil. The clear liners allow for full observation of a relatively undisturbed sample that is collected from various depths. Nine borings were completed with the Geoprobe and were mostly concentrated around the self-propelled shed (Figure 2). Two geoprobe borings were completed in the area near MW-2.

The geoprobe borings were designated TB-1 through TB-9 and were completed to varying depths based on refusal drilling conditions. In general depths ranged from 16 to 23 feet bgs. TB-9, which was located near MW-2, was advanced to 29 feet bgs. Soil samples were collected for laboratory analysis from probe borings TB-7 and TB-9. Groundwater samples were collected from four of the temporary borings. The temporary borings that were sampled for groundwater included TB-1, TB-4, TB-7, and TB-9.

4.2 Groundwater Investigation

As a precautionary step, Ecology sampled domestic water wells in the area. An inside faucet or outside spigot was used to retrieve the sample. As described above, two separate field efforts were conducted to install a network of nine monitoring wells, MW-1 through MW-9, to evaluate Site groundwater. Samples have been collected on a quarterly basis since the wells have been installed. As identified above, temporary borings were also used to monitor groundwater. The samples collected from the temporary wells provided a brief snapshot of perched water quality at the selected locations. Data collected from the wells were used to evaluate groundwater chemistry and elevations to determine flow direction and aquifer characteristics.

4.2.1 Domestic Wells

Ecology conducted a review of adjacent landowners and well logs. A one-mile radius was used to locate domestic wells that could be potentially affected by contaminants for sampling locations and eight domestic wells were identified for sampling. The wells are completed at varying depths in basalt bedrock. Landowners were contacted and permission was granted prior to the May 2000 sampling. The samples were collected and submitted to Ecology's Manchester Laboratory for total metals analysis. Samples were collected from an exterior faucet where the water was allowed to run for 3-5 minutes prior to sampling. Sample results indicated that the metal concentrations were below laboratory detection limits, Washington Department of Health Drinking Water Standards, or MTCA Method A cleanup levels.

4.2.2 Monitoring Wells

The monitoring wells have been sampled on a quarterly basis at the Site. A quarterly sampling round was not completed during the interim action activities. The samples were submitted to the analytical laboratory for total metal analysis. The groundwater analytical program was based on knowledge of the Site operations and of similar industries.

Groundwater samples were collected from the monitoring wells using a submersible pump or a disposable bailer. Alconox detergent was used to decontaminate the pump between each sampling event.

Groundwater elevations were measured prior to each sampling event to the nearest 0.01 foot with an electronic water level indicator. To insure consistent data collection, water levels were measured to the reference point on the north side of the well casing. Monthly water level elevation measurements were conducted between January 2002 and August 2005. Water level measurements are tabulated in Table 1.

Parameters such as pH, temperature, conductivity, dissolved oxygen, and oxidation-reduction potential (ORP) were measured in the field with the appropriate electronic instrumentation. A groundwater sample was collected after three well volumes had been

purged. The parameters were measured during well purging and recorded prior to sampling. Samples were placed into laboratory-provided jars, placed in coolers with ice and submitted to the analytical laboratory via an overnight carrier.

4.2.3 Temporary Well Points

Water samples were collected from four temporary Geoprobe borings by allowing perched groundwater to accumulate at the boring terminus and collecting the accumulated groundwater with a peristaltic pump. New tubing was used at each sampling point to purge three well volumes of groundwater from the boring into a five-gallon bucket. Wells that were purged dry were allowed to recover prior to sampling. Since the temporary borings were not developed as monitoring wells to produce relatively sediment-free water, the samples were very silty. Since metals can be sediment particle adherent, the turbidity or suspended sediment may result in biased high sample results.

4.2.4 Piezometers

In October 2001, seven piezometers were installed by Ecology staff along Dry Creek and were designated as P1 through P7. The purpose of the installation was to assess the hydraulic interaction between shallow groundwater and Dry Creek. The piezometers were constructed of ½-inch diameter steel pipe with a crimped end. The crimped end was perforated with 1/8-inch diameter holes to allow for water infiltration. The end also served as a drive point for piezometer installation. The upper end of the piezometer was threaded and fitted with a cap for drive installation. The piezometers were located immediately adjacent to or in the creek and were installed using a fence post driver. Generally, the piezometers were hand driven to three to four feet bgs where refusal conditions were encountered. Following installation, the piezometers were developed using a hand pump.

Water levels were measured within the piezometer to the top of casing and from the casing top to the creek surface. The piezometers provide an indication of inferred flow relationships between Dry Creek and groundwater. The difference in elevation provides an indication of flow direction. When the creek elevation is higher than the water level in the piezometer the inferred flow direction is from the creek to groundwater. Likewise, when the water level within the piezometer is higher than the creek surface, the inferred flow direction is from groundwater to the creek.

Water level measurements were made from October 2001 to January 2003. These measurements indicated the creek recharges the shallow aquifer throughout most of the year at the majority of monitoring points. Piezometer P1 demonstrated an inferred flow direction from groundwater toward the creek. At times the creek and groundwater elevations were equivalent suggesting a parallel flow path between the creek and groundwater. These equivalent elevations occurred mostly during the late fall and early winter.

4.3 Seismic Survey

Ecology subcontracted with Aquila Geosciences, Inc. for geophysical services to be completed at the Site. A seismic refraction survey was completed at the Site in January 2002, with the purpose of determining bedrock depth at various locations since the bedrock profile developed from monitoring wells was incomplete. As shown as figure 6 in Appendix B, the survey consisted of five seismic refraction lines. Two of the five lines were completed in a west - east orientation and were 460 feet in length. Two of the lines were completed in a north - south orientation and were 460 feet and 220 feet in length, respectively. The remaining seismic line was oriented northwest - southeast and was 220 feet in length.

A Geometrics S-24 Engineering Seismograph connected with 10 hertz vertical component geophones was used to acquire data. The geophones were set at a 20 foot spacing interval. A twelve-pound hammer contacted against an aluminum plate provided the energy source necessary for data acquisition. The Generalized Reciprocal Method (GRM) was used to process and interpret data. Based on boring log information, the five seismic lines were interpreted as three layer cases. Intercept velocities were used to determine the depths of the two soil layers while the GRM velocity function was used to determine the depth to basalt bedrock. The seismic survey report is included as Appendix B.

The depth to bedrock calculated from the seismic survey corresponded with monitoring well information and in areas where the lines crossed. The bedrock depths ranged from 21 feet bgs to 70 feet bgs. The bedrock profile suggests that an elongated depression or trough feature trending generally west to east is positioned to the north of the shop operations north of monitoring well MW-2 (Figure 7, Appendix B).

4.4 Civil Survey

Following completion of the field activities, Ecology contracted with Tomkins Land Surveyors of Walla Walla, Washington to survey the monitoring wells, geoprobe locations, piezometers and seismic lines at the Site. The surveying was performed by a Washington State licensed professional surveyor and was conducted to determine relative locations and mean sea level elevations. Facility appurtenances were surveyed as appropriate to describe and map potential contaminant sources and sample collection locations. The survey was accurate to within 0.02 feet horizontally and vertically.

5.0 LABORATORY RESULTS

Soil and groundwater samples were analyzed at North Creek Analytical Laboratory which is Washington State certified. The analytical program was based on metal constituents typically used in chrome plating operations. The metals analyzed included arsenic, cadmium, chromium, hexavalent chromium, lead, and zinc. As a precautionary measure, groundwater was also analyzed for volatile organic compounds. Analysis for volatile organic compounds in soil was not conducted since the photo-ionization detector

(PID) field instrumentation did not indicate the presence of volatile organic vapors. Soil and groundwater samples were collected in laboratory provided jars, placed in coolers with ice, and submitted for analysis. North Creek Analytical was used because hexavalent chromium analysis in groundwater has a maximum 24-hour holding period that could not be met in-house.

5.1 Initial Investigation

The initial investigation completed in November 2000 included soil samples collected from monitoring well borings and groundwater samples from the four completed wells. As described in Section 4.1, sample retrieval was difficult; therefore, one soil sample near the soil/water interface was collected from each downgradient monitoring well. The soil samples were analyzed for total metals (Method 6000/7000 series) as arsenic, cadmium, chromium, lead, and zinc and volatile organic compounds (VOCs-Method 8260). Total metal results indicated sample concentrations were below MTCA Method A cleanup levels. VOC analyses showed sample concentrations were below detectable limits.

Groundwater samples were collected from the year 2000 installed wells designated as MW-1, MW-2, MW-3, and MW-4 and were analyzed for total metals as arsenic, cadmium, chromium, lead, zinc, hexavalent chromium, and volatile organic compounds. Samples MW-1, MW-2 and MW-4 indicated the presence of total chromium above Method A levels. Based on the analyses, the chromium was mostly in the hexavalent chromium form instead of the trivalent form. For screening purposes, groundwater laboratory results were compared to MTCA Method A cleanup levels. A summary of results are presented in Table 2.

5.2 Geoprobe Borings

During the geoprobe investigation, three soil samples and four groundwater samples were submitted for total metal and hexavalent chromium analysis. Soil samples were collected from probe boring TB-7 at 15 feet and 20 feet bgs near the soil/water interface. Probe TB-9 was sampled at 29 feet bgs. The groundwater encountered by the Geoprobe borings appeared to be perched on very dense soil that occurred at varying depths at the Site. Soil samples were analyzed for total arsenic, barium, chromium, hexavalent chromium, lead, mercury, selenium, and silver. Soil samples were below Method A cleanup levels.

Groundwater was collected from the temporary borings and analyzed for total arsenic, barium, chromium, hexavalent chromium, lead, mercury, selenium, and silver. Chromium and lead concentrations exceeded Method A cleanup levels in each of the temporary borings. The samples were very turbid and contained large amounts of sediment that may have contributed to the high metal concentrations.

5.3 Additional Groundwater Investigation

The five additional monitoring wells completed in December 2001, were designated Mw-5 through MW-9. The wells were first sampled in the scheduled quarterly sampling event in February 2002. Based on the limited soil sample retrieval, soil samples were not submitted for analysis. Samples were analyzed for total metals as arsenic, cadmium, chromium, lead, zinc, and hexavalent chromium. Samples MW-6, MW-7, and MW-9 indicated the presence of total chromium above Method A levels. Based on the analyses, the chromium was mostly in the hexavalent chromium form. The laboratory data sheets and data validation package are presented as Appendix C.

6.0 INTERIM ACTION

During remedial investigation (RI) activities, two suspected areas of contamination were confirmed. These areas, identified as the plating shop and the self-propelled shed, are believed to be the primary sources for groundwater contamination. Ecology conducted cleanup activities as an interim action because there was an immediate threat to human health and the environment in affected areas. The interim action was intended to provide rapid source control measures and limit groundwater contamination. Given the limited ability to retrieve subsurface characterization samples with a drill, Ecology believed that excavating the soil in the known contaminated areas was the most efficient use of funds. Ecology created a bid and specification package for excavation and disposal services. Aspen Environmental Ltd. of Mukilteo, Washington was the successful bidder for the remediation services.

A project kick-off meeting was held on-site on November 24, 2002. Prior to the interim action, two soil samples had been collected and analyzed from the self-propelled area to determine if the soil designated as dangerous waste. The soil did designate as dangerous waste by failure of the toxicity characteristics leaching procedure (TCLP) for chromium with concentrations of 30.7 and 160 parts per million (ppm) and thus was listed as D007 waste. Samples had not been retrieved from the plating shop area since the concrete access to the shop was needed for plating equipment removal. A portion of the soil in the plating shop area was assumed to designate as dangerous waste as well.

6.1 Self-Propelled Shed

Aspen Environmental mobilized to the site and began work on December 10, 2002 in the self-propelled shed area. The self-propelled shed dimensions are about 20 feet, west to east, by 30 feet, north to south. Prior to starting removal work, the structure was physically removed to allow access to the earthen floor and surrounding soils. The area was divided into six-10 foot by 10 foot grids to provide for sample location control during remediation.

The grids were designated SP1 through SP6, starting at the southeast corner and increasing in number in a clockwise direction (Figure 3). Test pits were excavated to about four feet below ground surface (bgs) in each of the grids to assess the depth that the

soil no longer designated as dangerous waste. Samples were collected and submitted for chromium and lead analysis by TCLP methods. Sample results indicated that the soil below four feet did not designate as dangerous waste and could be disposed at a subtitle D landfill. Given the leachable quantities of chromium in the soil, additional stabilization was required before final disposal.

The self-propelled shed excavation extended beyond the original footprint of 20 feet by 30 feet. The final excavation limits were about 46 feet, west to east, and 35 feet, north to south, to an overall depth of 12 feet. The excavation was expanded beyond the original footprint because contamination was observed beyond the configuration and the necessary slope layback for the excavation depth. Approximately 750 tons of dangerous waste soils from the upper four feet of the self-propelled shed area were disposed at the Waste Management facility in Arlington, Oregon. Approximately 1,200 tons of contaminated soil that did not designate as dangerous waste were removed and transported to the Subtitle D Rabanco Regional Landfill in Roosevelt, Washington for disposal.

Grid sizes were expanded to accommodate the new excavation configuration. Soil samples were collected from the grid to assess and confirm the efficacy of the remediation. One sample was collected from the grid sidewall and one sample was collected from the grid bottom. In the case where a grid had two sidewalls, a sample was collected from each grid sidewall. Soil sample results indicated the soil at the margins of the excavation were below Method A removal cleanup levels for the site established at 19 milligrams per kilogram (mg/kg).

6.2 Plating Shop

The plating shop exterior consisted of a concrete slab apron and the partially buried polyurethane tank that was used for wastewater storage and treatment. The tank was situated inside a concrete masonry unit (CMU) secondary containment structure with a roof. The roof and tank were removed from the area by the owner prior to field work.

Similar to the self-propelled shed, the plating shop exterior was separated into a grid. The grid, which included the partially buried tank, was divided into four-10 foot by 10 foot grids to provide for sample location control. Initial soil samples collected from below the concrete pad within the grid suggested that the soil did not designate as dangerous waste. However, samples beneath and adjacent to the buried tank were not collected in the initial screening. During the secondary containment demolition, the CMU and adjacent soil was observed to be stained and discolored. Soil sample results indicated the soil designated as dangerous waste based on chromium TCLP concentrations of 5.45 ppm. The soil and stained concrete were sent to Arlington, Oregon for disposal as dangerous waste. About 892 tons of dangerous waste soils were removed from the plating shop area.

The visibly discolored soil in the plating shop area dictated that the original grid configuration be expanded. The grid was expanded to include two additional sections to

the west where the concrete apron and entrance to the shop was located. As shown in figure 8, the final dimensions for the plating shop excavation were 42 feet, west to east, and 28 feet, north to south. The excavation depth varied from six feet deep along the western and northern portions and up to 19 feet below ground surface near the building.

Soil samples were collected from the grid to assess and confirm the efficacy of the remediation. One sample was collected from the grid sidewall and one sample was collected from the grid bottom. In the case where a grid had two sidewalls, a sample was collected from each grid sidewall. Samples results indicated the excavation soil were below Method A removal cleanup levels for the site.

7.0 DISCUSSIONS AND CONCLUSIONS

Based on the confirmation soil samples collected during the interim action, the contaminated soil was removed in the self-propelled shed and plating shop exterior areas at the Site. The soil was disposed at the appropriate permitted facilities based on the soil designation as either dangerous waste or contaminated soil. Additional soil removal in these areas does not appear to be warranted at this time.

Groundwater contamination continues to be present at the Site at concentrations well above cleanup levels. Using Method A cleanup levels as a preliminary screening tool, seven of the nine wells currently exceed the Method A levels of 50 parts per billion for total chromium. Method A cleanup levels were used to evaluate groundwater conditions since a single contaminant has been identified in a relative routine cleanup scenario and Method A cleanup levels are considered protective of human health and the environment.

Based on the monitoring well configuration and the groundwater contamination, it appears that releases from the two identified source have been distributed in the direction of groundwater flow. The contamination distribution in groundwater indicates the contamination is transported from the two identified source areas along multi-directional flow paths. The flow paths are created from groundwater elevations that are influenced by Dry Creek. In the area of monitoring well MW-8, groundwater flows north toward MW-6 and northeast toward MW-1. In addition, groundwater near MW-7 is at a higher elevation than adjacent wells MW-1 and MW-2 resulting in groundwater mounding near MW-7 and flowing west and east away from MW-7. The high contaminant concentration values in MW-7 appear to distribute and diminish as indicated by concentrations observed in MW-1 and MW-2, with higher concentrations in MW-2. A declining trend has been observed in the high contamination monitoring wells. Additional groundwater monitoring will be required to further assess the efficacy of the interim action. A feasibility study (FS) will be prepared to evaluate different alternatives to address groundwater contamination.

The two areas where plating activities and waste storage occurred were identified and soil removal activities completed. An investigation of the plating shop interior has not been conducted. Given the nature of plating operations and evidence of historic releases associated with operations, the plating shop interior represents a potential source area for soil and groundwater contamination. Further investigation may be warranted.

APPENDIX A

BORING LOGS AND GEOLOGIC CROSS-SECTION



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: MW-1

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Bill Fees

Client: Washington Department of Ecology **Ecology PM:** Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
-3								
-1	1224.5 0.0		Ground Surface SILT with trace fine sand, ML, light brown, stiff, nonplastic, dry.					
1								
3								
5								
7								
9	1214.5 10.0		ASH					
11								
13	1211.5 13.0		SILT with trace fine sand, ML, light brown, nonplastic, stiff, dry.					
15								
17	1207.5 17.0		Silty GRAVEL, GM, light brown, medium dense to dense, gravels subrounded to subangular					
19								
21	1202.5 22.0							
23								

Drilled By: Environmental West Exploration

Hole Size: 6"

Drill Method: Air Rotary ODEX

Drill Date: 10/30/00

Sheet: 1 of 2



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: MW-1

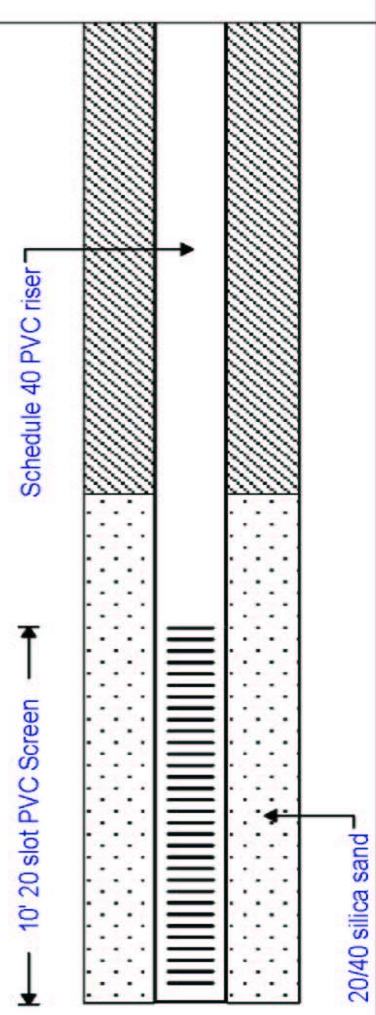
Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Bill Fees

Client: Washington Department of Ecology Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
26		[Gravel symbol]	Sandy GRAVEL with a little slightly plastic silt, GP to GM, very dense to dense, damp. Gravels are fine to coarse and subangular, sands fine with some coarse.	01	[Sample symbol]	36 50 for 5"		
28								
32	1191.5 33.0	[Silt symbol]	SILT with trace fine gravel, ML, brown, medium plastic, moist, grades into a sandy SILT, slightly plastic from 37 to 40 feet bgs.					
34								
36		[Sand symbol]	Gravelly SAND with a little silt, SP, brown, wet.					
38								
40	1184.5 40.0							
42								
44								
46								
48								
50	1174.5 50.0							



Drilled By: Environmental West Exploration

Hole Size: 6"

Drill Method: Air Rotary ODEX

Drill Date: 10/30/00

Sheet: 2 of 2



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: MW-2

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by:

Client: Washington Department of Ecology **Ecology PM:** Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
-3								
-1	1219.8		Ground Surface					
1	0.0		SILT with possibly a little clay, ML, brown, slightly plastic, damp. Grades to a sandy SILT from 10 to 17 feet bgs..					
3								
5								
7								
9								
11								
13								
15								
17	1202.8		Silty GRAVEL with some sand, GM, dry					
19	17.0							
21								

Drilled By: Environmental West Exploration

Hole Size: 6"

Drill Method: Air Rotary ODEX

Drill Date: 10/30/00

Sheet: 1 of 2



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: MW-2

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by:

Client: Washington Department of Ecology Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
24								
26								
28								
30	1189.8 30.0		Sandy GRAVEL with silt, GP					
32								
34	1186.8 33.0		Gravelly Sand with silt, SP					
36								
38								
40								
42								
44	1174.8 45.0							
46								

Drilled By: Environmental West Exploration

Hole Size: 6"

Drill Method: Air Rotary ODEX

Drill Date: 10/30/00

Sheet: 2 of 2



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: MW-3

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by:

Client: Washington Department of Ecology **Ecology PM:** Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
-3								
-1	1218.8		Ground Surface					
1	0.0		SILT with occasional subangular fine gravel and trace fine sand, ML, brown, damp, non-plastic. soft to loose. Fine sands at 10 feet bgs, and slightly moist and plastic silt at 13 feet bgs.					
13	1204.8		Silty GRAVEL with little fine sand, GM to clayey GRAVEL with silt and trace fine sand, GC, brown with some orange-brown mottling. Gravel mainly coarse subangular to subrounded.					
15	14.0							
17								
19								
21								

Drilled By: Environmental West Exploration

Hole Size:

Drill Method: Air Rotary ODEX

Drill Date: 10/31/00

Sheet: 1 of 2



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: MW-3

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by:

Client: Washington Department of Ecology **Ecology PM:** Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
24								<p>10 Slot PVC Screen</p> <p>10/20 silica sand</p>
26								
28								
30								
32								
34								
36								
38								
40	1178.8 40.0		Sandy GRAVEL with trace silt, GP, brown, sand is fine to coarse, gravel coarse and subangular, dry to slightly damp. wet at 45 feet bgs.					
42								
44	1173.8 45.0							
46								

Drilled By: Environmental West Exploration

Hole Size:

Drill Method: Air Rotary ODEX

Drill Date: 10/31/00

Sheet: 2 of 2



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: MW-4

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by:

Client: Washington Department of Ecology **Ecology PM:** Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
-3								
-1	1218.1		SILT, ML, dark brown, loose to soft, non-plastic					
1	0.0							
3								
5								
7								
9								
11	1207.1		Silty GRAVEL with trace to some fine sand, GP-GM, dry, gravels are fine subrounded to subangular.					
13	11.0							
15								
17								
19								
21								

Drilled By: Environmental West Exploration

Drill Method: Air Rotary ODEX

Drill Date: 10/31/00

Hole Size:

Sheet: 1 of 2



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: MW-4

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by:

Client: Washington Department of Ecology **Ecology PM:** Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
24								<p>10/20 silica sand</p> <p>3/8" bentonite holeplug</p> <p>10 slot PVC screen</p>
32	1186.1 32.0		Very hard drilling, maybe in rock. Drilling refusal at 37.5 feet bgs.					
35	1183.1 35.0							
40	1178.1 40.0							

Drilled By: Environmental West Exploration

Hole Size:

Drill Method: Air Rotary ODEX

Drill Date: 10/31/00

Sheet: 2 of 2



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: MW-5

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Glenn Haupt

Client: Washington Department of Ecology

Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
-3								
-1	1218.3		Ground Surface					
1	0.0		SILT with trace fine sand, ML, color mottled strong brown to olive brown, and oxidized yellowish red, slightly plastic and moist 10 Y/R 4/3 to 5/3 brown, loess deposits.					
3								
5								
7								
9								
11	1206.8			01		26		
13	11.5		GRAVEL supported in a matrix of very fine to fine silty sands and sandy silts, GM, mottled dark yellowish brown to reddish brown, fines are nonplastic with zones of slight plasticity, moist to wet, loose to hard. gravel round to subangular, mainly 20 to 40 mm in size, maximum size 80 mm.	02		56		
15								
17								

Drilled By: Environmental West Exploration

Drill Method: Air Rotary ODEX

Drill Date: 12/18/01

Hole Size:

Sheet: 1 of 2



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: MW-5

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Glenn Haupt

Client: Washington Department of Ecology

Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
19								
21								
23								
25				09		21		
27								
29				10				
31				11				
33								
35	1183.3 35.0	△	Weathered Basalt, very angular fragments of dark gray to black basalt.					
37	1181.3 37.0	△						

Drilled By: Environmental West Exploration

Hole Size:

Drill Method: Air Rotary ODEX

Drill Date: 12/18/01

Sheet: 2 of 2



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: MW-6

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Glenn Haupt

Client: Washington Department of Ecology

Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
-3								
-1	1219.2		Ground Surface					
1	0.0		SILT with trace fine sand, ML, light to strong brown and mottled to dark yellowish brown, soft, slightly plastic.					
3								
5								
7								
9								
11				01		4		
13								
15	1204.2			02		67		
17	15.0							
19								
21				03		82 for 9"		

Drilled By: Environmental West Exploration

Hole Size:

Drill Method: Air Rotary ODEX

Drill Date: 12/19/01

Sheet: 1 of 2



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: MW-6

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Glenn Haupt

Client: Washington Department of Ecology

Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
24			GRAVEL supported in a matrix of silty sand and sandy silt, GM, dark gray to black, very dense to hard, gravels are 10-30 mm in size, are subrounded to subangular, maximum grain size 35 mm, the sandy silt matrix is slightly plastic and soft, moist, brown, dark yellowish brown, and reddish brown. Sand content is fine to medium grained.					
26				04		63		
28								
30				05		73 for 9"		
32								
34				06		50 for 3"		
36								
38								
40	1179.2 40.0							
42								
44								
46								

Drilled By: Environmental West Exploration

Hole Size:

Drill Method: Air Rotary ODEX

Drill Date: 12/19/01

Sheet: 2 of 2



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: MW-7

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Glenn Haupt

Client: Washington Department of Ecology

Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
-3								
-1	1223.4		Ground Surface					
1	0.0		SILT with trace to little very fine sand, ML, light brown, reddish brown to dark yellowish brown, soft, moist, slightly plastic.					
3								
5								
7								
9								
11								
13								
15								
17								
19								
21				01	6			

Drilled By: Environmental West Exploration

Hole Size:

Drill Method: Air Rotary ODEX

Drill Date: 12/19/01

Sheet: 1 of 2



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: MW-7

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Glenn Haupt

Client: Washington Department of Ecology

Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
23								
25				02		4		
27								
29								
31	1193.4 30.0		Sandy GRAVEL and gravelly SAND with trace silt, GP-SP, dense to very dense, saturated, gravels are subrounded to subangular, 10-30 mm in size. sand in medium to coarse.	03		56		
33								
35	1188.4 35.0		Silty GRAVEL with trace very fine sand, GM, mottled dark yellowish brown to strong brown, very dense to hard, and slightly plastic fines, moist to wet.	04		74 for 9.5"		
37								
39	1183.4 40.0							
41								
43								
45								

Drilled By: Environmental West Exploration

Hole Size:

Drill Method: Air Rotary ODEX

Drill Date: 12/19/01

Sheet: 2 of 2



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: MW-8

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Glenn Haupt

Client: Washington Department of Ecology

Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
-3								
-1			Ground Surface					
1	1219.7	0.0	SILT with trace fine sand and occasional fine gravels, ML, light brown to yellowish brown, moist to damp, soft to medium stiff, nonplastic to slightly plastic.					concrete
3								
5								
7								
9								
11								3/8" Bentonite holeplug
13								
15								
17								Schedule 40 PVC riser

Drilled By: Environmental West Exploration

Hole Size:

Drill Method: Air Rotary ODEX

Drill Date: 12/19/01

Sheet: 1 of 2



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: MW-8

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Glenn Haupt

Client: Washington Department of Ecology

Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
19	1199.7 20.0		GRAVEL supported in a matrix of very fine sandy silt, GM, hard, basalt gravels are 10-30 mm in size and subrounded (70 to 85%) with trace subangular gravels 30-40 mm in size. The sandy silt matrix is dark yellowish brown to reddish brown and non-plastic, saturated.	01		74 for 11.5 "		<p>10 Slot PVC Screen</p> <p>10/20 Silica Sand</p>
21				02		66 for 10"		
23								
25								
27			GRAVEL supported in a matrix of silty sand, GM and SM, gravels are dark gray to black, subangular and 10-20 mm in size and compose 70% of the formation. Silty Sand are dark yellowish brown to reddish brown, fine to mediumgrained, nonplastic, hard and saturated. Sands become coarser graded with depth through this interval.	03		50 for 3"		
29	1189.7 30.0							
31				04		50 for 5"		
33								
35								
37	1182.7 37.0							

Drilled By: Environmental West Exploration

Hole Size:

Drill Method: Air Rotary ODEX

Drill Date: 12/19/01

Sheet: 2 of 2



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: MW-9

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Glenn Haupt

Client: Washington Department of Ecology

Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
-3								<p>concrete</p> <p>steel cover</p> <p>Schedule 40 PVC riser</p> <p>3/8 bentonite holeplug</p>
-1	1222.5		Ground Surface					
1	0.0		SILT with trace fine sand and occasional fine gravels, ML, light brown to yellowish brown, dry to moist, stiff, nonplastic to slightly plastic					
3								
5								
7								
9								
11								
13								
15								
17								
19	1202.5							
21	20.0			01	66 for 4"			

Drilled By: Environmental West Exploration

Hole Size:

Drill Method: Air Rotary ODEX

Drill Date: 12/20/01

Sheet: 1 of 2



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: MW-9

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Glenn Haupt

Client: Washington Department of Ecology

Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
24		[Gravel symbol]	GRAVEL (70 to 85%) in matrix of silty fine sand to sandy silt, GP-GM, gravels dark gray to black, subangular and 15-30 mm in size, maximum grain size 55 mm, silty sand, nonplastic to slightly plastic with increased fine material, mottled dark yellowish brown to yellowish brown, with some reddish brown oxidation on surface of gravels, hard to very hard, saturated.					<p>10 slot PVC screen</p> <p>10/20 silica sand</p>
26				02		64 for 4.5		
28								
30	1192.5 30.0	[Gravel symbol]	GRAVEL (80%) in matrix of fine to medium sand with trace silt, GP, gravels are subangular and 10-20mm in size, dark gray to black, with heavy reddish brown oxidation on surface of gravels, very hard, formation is getting "tight", saturated, sand coarsen with depth	03		72 for 4"		
32								
34				04		92 for 2"		
36								
38	1183.5 39.0							
40								
42								
44								
46								

Drilled By: Environmental West Exploration

Hole Size:

Drill Method: Air Rotary ODEX

Drill Date: 12/20/01

Sheet: 2 of 2



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave


Log of Borehole: TB-2

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by:

Client: Washington Department of Ecology Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
0	0.0		Ground Surface					 11.5' water level recorded during drilling
2	0.0		SILT, ML, with some leaves (organics) in the top 4" below ground surface, medium gray brown, slightly moist, becomes slightly reddish brown with mottling in bottom 6" at 3' to 3.5' bgs. Silt becomes slightly moist and "compressed" stiff at 4' bgs. Light brown interval 4" thick at 6.5' bgs with flour texture and increased clay content with depth to 10' bgs. Saturated clayey Silt from 10-11' bgs.	01			2'	
4				02			2.5'	
6				03			2.5'	
10			Clayey GRAVEL, GC-GM, with ironoxide staining, some unsaturated zones in gravel layer, gravels well rounded.					
12								
14			Silty SAND, SM, saturated Silty GRAVEL, with some clay, GM-GC, iron-oxide staining with alternating dry and slightly moist interbedded clayey silt layers.	04			27"	
16								
18			Medium light gray Basalt Bedrock. Refusal at 16' bgs.					
20								

Drilled By: Environmental West Exploration

Hole Size:

Drill Method: Geoprobe

Drill Date: 10/15/01

Sheet: 1 of 1



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: TB-3

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by:

Client: Washington Department of Ecology Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
0	1217.9		Ground Surface					
0	0.0							
2			SILT, ML, medium gray brown, slightly moist to moist, with some leaves (organic debris) from 0 to 4" bgs. Only slightly moist from 4' to 10.5' bgs.	01			2	
4								
6				02			12"	
8								
10				03			2.8"	
10.5	1207.4							
11.3	1206.7							
12	1205.9		GRAVEL and RUBBLE with silt, medium gray brown to medium orange.					
12	12.0		"Compacted" SILT, slightly moist					
14			Silty GRAVEL, GM, with sandy silt, medium gray brown with iron oxide staining, only slightly moist above and below a wet zone at 13" bgs.	04			32"	
15.5	1202.4							
16			Basalt bedrock. Refusal at 15.6"					
18								
20								

Drilled By: Environmental West Exploration

Hole Size:

Drill Method: **Geoprobe**

Drill Date: **10/15/01**

Sheet: **1 of 1**



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: TB-4

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by:

Client: Washington Department of Ecology Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
0	1218.1 0.0		Ground Surface					
0			SILT, ML, with leaves in upper 2" , medium brown, slightly moist	01			26"	
2								
4								
6				02			30"	
8								
10	1208.1 10.0		CLAY, CL, medium brown with iron oxide mottling	03			44"	
11.5	1206.6 11.5		GRAVEL, GM, well rounded, moist					
12.5	1205.6 12.5		Silty CLAY , CL, with trace gravels					
13.5	1204.6 13.5		Silty GRAVEL, GM, medium gray brown with some iron oxide staining and mottling.	04			32"	
16								
18				05			0	
19.2	1198.9 19.2		Basalt Bedrock, drilling refusal at 19.2' bgs					

Drilled By: Environmental West Exploration

Hole Size:

Drill Method: Geoprobe

Drill Date: 10/15/01

Sheet: 1 of 1



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: TB-6

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Andy Keim

Client: Washington Department of Ecology Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
0	1219.1 0.0		Ground Surface					
2			SILT, ML, medium brown, dry, organic, debris in upper 2", becomes slightly moist to moist medium silt with trace clay in bottom 3 inches. Iron mottling and black organic chips.	01			16"	
4				02			0	
6				03			4	
12	1207.1 12.0		Silty Clayey GRAVEL, GC-GM, moist, Iron oxide staining and mottling. gravels are subrounded with clayey angular gravel in bottom 6".	04			28"	
16	1203.1 16.0			05			29"	
17			Silty GRAVEL, GM, reddish brown and gray, 16-17' bgs, light brown (buff to pink gravel), 17-17.5' bgs, with medium gray-brown with dark gray basalt fragments that are subangular, slightly moist with some hard clay and gravel.	06			28"	
22	1197.1 22.0			07			3"	
24	1194.9 24.2		CLAY, CL, dark brown, moist, plastic					
26			Silty GRAVEL, GM, reddish-brown to gray, with some ironoxide staining and mottling, slightly moist, gravel composed of subangular basalt. "compressed" hard.					
28								
30								

Drilled By: Environmental West Exploration

Hole Size: 2"

Drill Method: Geoprobe

Drill Date: 10/15/01

Sheet: 1 of 1



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: TB-7

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Andy Keim

Client: Washington Department of Ecology Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
0	1218.3 0.0		Ground Surface					
2			Loamy SILT, ML, with organic leaf and root material, medium brown, moist, grades into a medium dark brown silt, very moist to wet at 6.5' bgs. Wet silt, medium to dark brown at 10'	01			2"	
4				02			46"	
6				03			28"	
10	1208.3 10.0		Silty GRAVEL, GM, slightly moist, gravels are rounded,					
11	1207.3 11.0		Silty CLAY, CL, light to medium brown, iron oxide staining, wet					
13	1205.0 13.3		GRAVEL with silt, GM, medium dark brown, very moist, iron oxide staining, compacted, subangular basalt fragments,	04			28"	
16	1202.3 126.08 16.5		SILT with some clay, ML, medium dark brown, very moist,	05			39"	
18			Silty GRAVEL, GM, medium brown to reddish brown and gray, areas of iron oxide staining and mottling, moist, gravels are subrounded to subangular	06			16"	
21	1197.3 21.0							

Drilled By: Environmental West Exploration

Hole Size: 2"

Drill Method: Geoprobe

Drill Date: 10/16/01

Sheet: 1 of 1



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: TB-8

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Andy Keim

Client: Washington Department of Ecology Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
0	1219.7		Ground Surface					
0	1219.2	•••••	Gravel driveway material (FILL)					
0.5			SILT, ML, medium brown, slightly moist	01			30"	
2								
4								
6				02			28"	
8								
10				03			46"	
11.1	1208.6		silty GRAVEL, GM, with some iron oxide staining, slightly moist to moist					
12.9	1206.8		CLAY with some silt, CL, medium light tannish gray, moist, plastic, with iron oxide mottling	04			32"	
15.5	1204.2		GRAVEL with silt, GM with interbedded GC, dry angular basalt fragments slightly moist, iron oxide stained silt and rounded pebbles, gray to medium dark brown with reddish brown mottling, with interbedded layers of plastic clay with some pebbles, and medium dark brown coarse sand.	05			39"	
23.8	1195.9			06			45"	
24								

Drilled By: Environmental West Exploration

Hole Size: 2"

Drill Method: Geoprobe

Drill Date: 10/16/01

Sheet: 1 of 1



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: TB-1

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Andy Keim

Client: Washington Department of Ecology Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
0	0.0		Ground Surface					
2			SILT, ML, with some leaves (organics) in the top 4" below ground surface, medium gray brown, slightly moist, becomes slightly reddish brown with mottling in bottom 6" at 3' to 3.5' bgs. Silt becomes slightly moist and "compressed" stiff at 4' bgs. Light brown interval 4" thick at 6.5' bgs with flour texture and increased clay content with depth to 10' bgs, moist, clayey Silt from 10-11' bgs.	01			2'	
4				02			2.5'	
6				03			2.5'	
12	-11.0		Clayey GRAVEL, GC-GM, with ironoxide staining, some unsaturated zones in gravel layer, gravels sub rounded.					
14	-13.0		Silty SAND, SM.					
16			Silty GRAVEL, with some clay, GM-GC, iron-oxide staining with alternating dry and slightly moist interbedded clayey silt layers.	04			27"	
18	-18.0			Refusal at 18' bgs.				

Drilled By: Environmental West Exploration

Hole Size:

Drill Method: Geoprobe

Drill Date: 10/15/01

Sheet: 1 of 1



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave


Log of Borehole: TB-2

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by:

Client: Washington Department of Ecology Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
0	0.0		Ground Surface					 11.5' water level recorded during drilling
2	0.0		SILT, ML, with some leaves (organics) in the top 4" below ground surface, medium gray brown, slightly moist, becomes slightly reddish brown with mottling in bottom 6" at 3' to 3.5' bgs. Silt becomes slightly moist and "compressed" stiff at 4' bgs. Light brown interval 4" thick at 6.5' bgs with flour texture and increased clay content with depth to 10' bgs. Saturated clayey Silt from 10-11' bgs.	01			2'	
4				02			2.5'	
6				03			2.5'	
10			Clayey GRAVEL, GC-GM, with ironoxide staining, some unsaturated zones in gravel layer, gravels well rounded.					
12								
14			Silty SAND, SM, saturated Silty GRAVEL, with some clay, GM-GC, iron-oxide staining with alternating dry and slightly moist interbedded clayey silt layers.	04			27"	
16								
18			Medium light gray Basalt Bedrock. Refusal at 16' bgs.					
20								

Drilled By: Environmental West Exploration

Hole Size:

Drill Method: Geoprobe

Drill Date: 10/15/01

Sheet: 1 of 1



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: TB-3

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by:

Client: Washington Department of Ecology Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
0	1217.9		Ground Surface					
0	0.0		SILT, ML, medium gray brown, slightly moist to moist, with some leaves (organic debris) from 0 to 4" bgs. Only slightly moist from 4' to 10 5' bgs.	01			2	
2								
4								
6				02			12"	
8								
10				03			2 8"	
10.5	1207.4		GRAVEL and RUBBLE with silt, medium gray brown to medium orange.					
11.3	1206.7		"Compacted" SILT, slightly moist					
12.0	1205.9		Silty GRAVEL, GM, with sandy silt, medium gray brown with iron oxide staining, only slightly moist above and below a wet zone at 13" bgs.	04			32"	
13								
15.5	1202.4		Refusal at 15.6"					
16								
18								
20								

Drilled By: Environmental West Exploration

Hole Size:

Drill Method: Geoprobe

Drill Date: 10/15/01

Sheet: 1 of 1



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: TB-4

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by:

Client: Washington Department of Ecology Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
0	1218.1 0.0		Ground Surface					
0			SILT, ML, with leaves in upper 2", medium brown, slightly moist	01			26"	
2								
4								
6				02			30"	
8								
10	1208.1 10.0		CLAY, CL, medium brown with iron oxide mottling	03			44"	
11.5	1206.6 11.5		GRAVEL, GM, well rounded, moist					
12.5	1205.6 12.5		Silty CLAY, CL, with trace gravels					
13.5	1204.6 13.5		Silty GRAVEL, GM, medium gray brown with some iron oxide staining and mottling.	04			32"	
16								
18				05			0	
19.2	1198.9 19.2		Drilling refusal at 19.2' bgs					
20								

Drilled By: Environmental West Exploration

Hole Size:

Drill Method: Geoprobe

Drill Date: 10/15/01

Sheet: 1 of 1



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: TB-5

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Andy Keim

Client: Washington Department of Ecology Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
0	1219.1 0.0		Ground Surface					
2			SILT, ML, medium brown, dry, organic, debris in upper 2", becomes slightly moist to moist medium silt with trace clay in bottom 3 inches. Iron mottling and black organic chips.					
12	1207.1 12.0		Silty Clayey GRAVEL, GC-GM, moist, Iron oxide staining and mottling gravels are subrounded with clayey angular gravel in bottom 6".					
16	1203.1 16.0		Silty GRAVEL, GM, reddish brown and gray, 16-17' bgs, light brown (buff to pink gravel), 17-17.5' bgs, with medium gray-brown with dark gray basalt fragments that are subangular, slightly moist with some hard clay and gravel.					
22	1197.1 22.0							
24								
26								
28								
30								

Drilled By: Environmental West Exploration

Hole Size: 2"

Drill Method: Geoprobe

Drill Date: 10/15/01

Sheet: 1 of 1



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: TB-6

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Andy Keim

Client: Washington Department of Ecology Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
0	1219.1 0.0		Ground Surface					
2			SILT, ML, medium brown, dry, organic, debris in upper 2", becomes slightly moist to moist medium silt with trace clay in bottom 3 inches. Iron mottling and black organic chips.	01			16"	
4				02			0	
6				03			4	
12	1207.1 12.0		Silty Clayey GRAVEL, GC-GM, moist, Iron oxide staining and mottling. gravels are subrounded with clayey angular gravel in bottom 6".	04			28"	
16	1203.1 16.0			05			29"	
20			Silty GRAVEL, GM, reddish brown and gray, 16-17' bgs, light brown (buff to pink gravel), 17-17.5' bgs, with medium gray-brown with dark gray basalt fragments that are subangular, slightly moist with some hard clay and gravel.	06				28"
22	1197.1 22.0			07			3"	
24	1194.9 24.2		CLAY, CL, dark brown, moist, plastic					
26			Silty GRAVEL, GM, reddish-brown to gray, with some ironoxide staining and mottling, slightly moist, gravel composed of subangular basalt. "compressed" hard.					
28								
30								

Drilled By: Environmental West Exploration

Hole Size: 2"

Drill Method: Geoprobe

Drill Date: 10/15/01

Sheet: 1 of 1



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: TB-7

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Andy Keim

Client: Washington Department of Ecology Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
0	1218.3 0.0		Ground Surface					
2			Loamy SILT, ML, with organic leaf and root material, medium brown, moist, grades into a medium dark brown silt, very moist to wet at 6.5' bgs. Wet silt, medium to dark brown at 10'	01			2"	
6				02			46"	
10	1208.3 10.0		Silty GRAVEL, GM, slightly moist, gravels are rounded, Silty CLAY, CL, light to medium brown, iron oxide staining, wet	03			28"	
12	1207.3 11.0							
14	1205.0 13.3		GRAVEL with silt, GM, medium dark brown, very moist, iron oxide staining, compacted, subangular basalt fragments,	04			28"	
16	1202.3 126.08 16.5		SILT with some clay, ML, medium dark brown, very moist, Silty GRAVEL, GM, medium brown to reddish brown and gray, areas of iron oxide staining and mottling, moist, gravels are subrounded to subangular	05			39"	
20				06			16"	
22	1197.3 21.0							
24								

Drilled By: Environmental West Exploration

Hole Size: 2"

Drill Method: Geoprobe

Drill Date: 10/16/01

Sheet: 1 of 1



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: TB-8

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Andy Keim

Client: Washington Department of Ecology Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
0	1219.7		Ground Surface					
0	1219.2	•••••	Gravel driveway material (FILL)					
0.5			SILT, ML, medium brown, slightly moist	01			30"	
2								
4								
6				02			28"	
8								
10				03			46"	
11.1	1208.6		silty GRAVEL, GM, with some iron oxide staining, slightly moist to moist					
12.9	1206.8		CLAY with some silt, CL, medium light tannish gray, moist, plastic, with iron oxide mottling	04			32"	
15.5	1204.2		GRAVEL with silt, GM with interbedded GC, dry angular basalt fragments slightly moist, iron oxide stained silt and rounded pebbles, gray to medium dark brown with reddish brown mottling, with interbedded layers of plastic clay with some pebbles, and medium dark brown coarse sand.	05			39"	
20								
22				06			45"	
23.8	1195.9							

Drilled By: Environmental West Exploration

Hole Size: 2"

Drill Method: Geoprobe

Drill Date: 10/16/01

Sheet: 1 of 1



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: TB-9

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Andy Keim

Client: Washington Department of Ecology

Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
-3								
-1								
0	1222.5		Ground Surface					
1	0.0	Vertical lines	SILT with trace fine sand and occasional fine gravels, ML, light brown to yellowish brown, dry to moist, stiff, nonplastic to slightly plastic					
3								
5								
7								
9								
11								
13								
15		Diagonal lines	CLAY, CL, medium brown, slightly plastic					
17								
19								
21	1202.5							
	20.0	Stippled						

Drilled By: Environmental West Exploration

Hole Size:

Drill Method: Geoprobe

Drill Date: 10/15/01

Sheet: 1 of 2



18706 North Creek Parkway
Suite 110,
Bothell, Washington 98011

Project: Schwerin Concave

Log of Borehole: TB-9

Location: Walla Walla, WA

Project No.: 01-0817-00-2124-400

Logged by: Andy Keim

Client: Washington Department of Ecology

Ecology PM: Bill Fees

SUBSURFACE PROFILE				SAMPLE				Well Completion Details
feet (bgs)	feet (MSL)	Symbol	Description	Number	Type	N-Value	Recovery	
24			GRAVEL (70 to 85%) in matrix of silty fine sand to sandy silt, GP-GM, gravels dark gray to black, subangular and 15-30 mm in size, maximum grain size 55 mm, silty sand, nonplastic to slightly plastic with increased fine material, mottled dark yellowish brown to yellowish brown, with some reddish brown oxidization on surface of gravels, hard to very hard, saturated.					
30	1192.5 30.0							
32								
34								
36								
38								
40								
42								
44								
46								

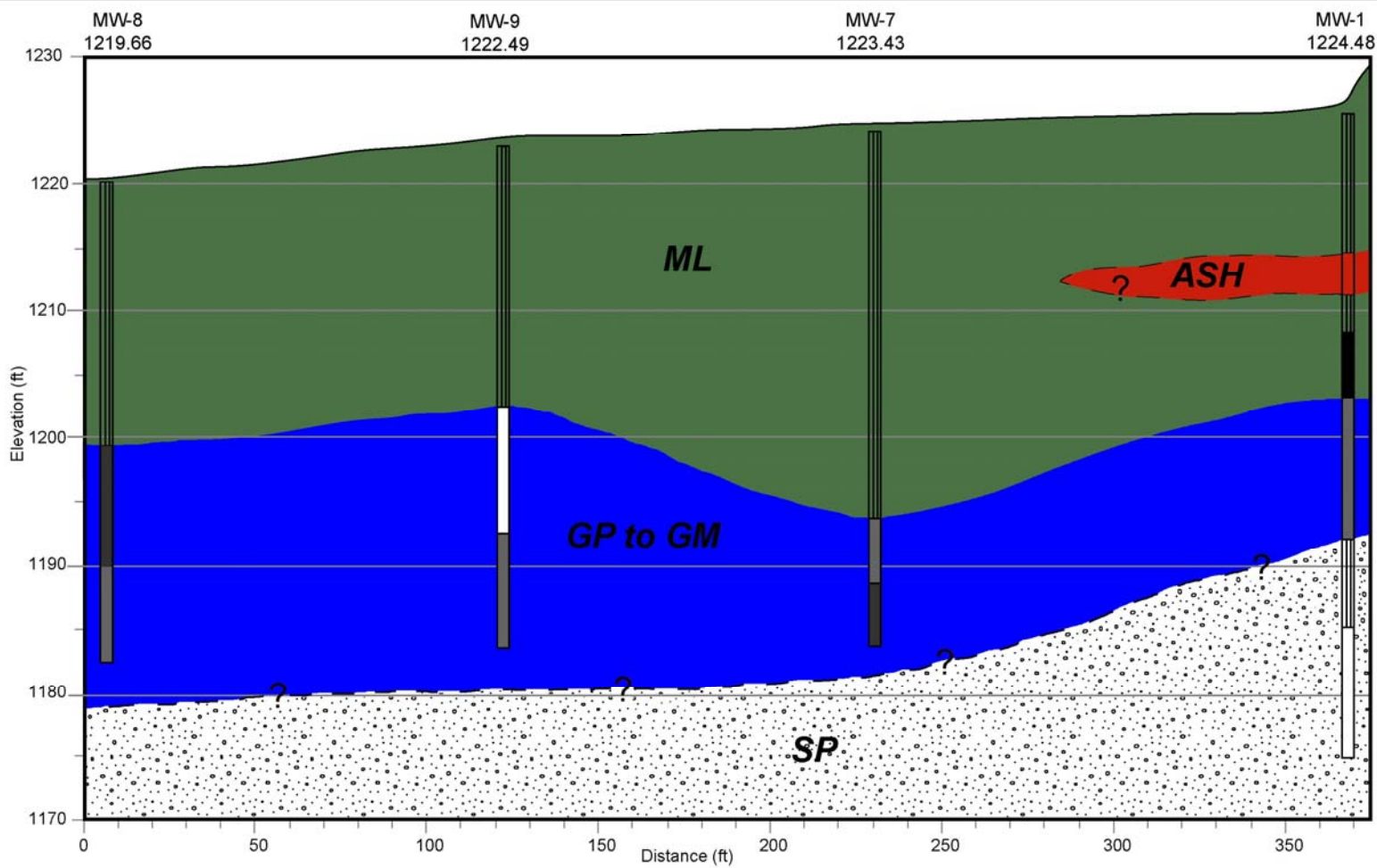
Drilled By: Environmental West Exploration

Hole Size:

Drill Method: Geoprobe

Drill Date: 10/15/01

Sheet: 2 of 2



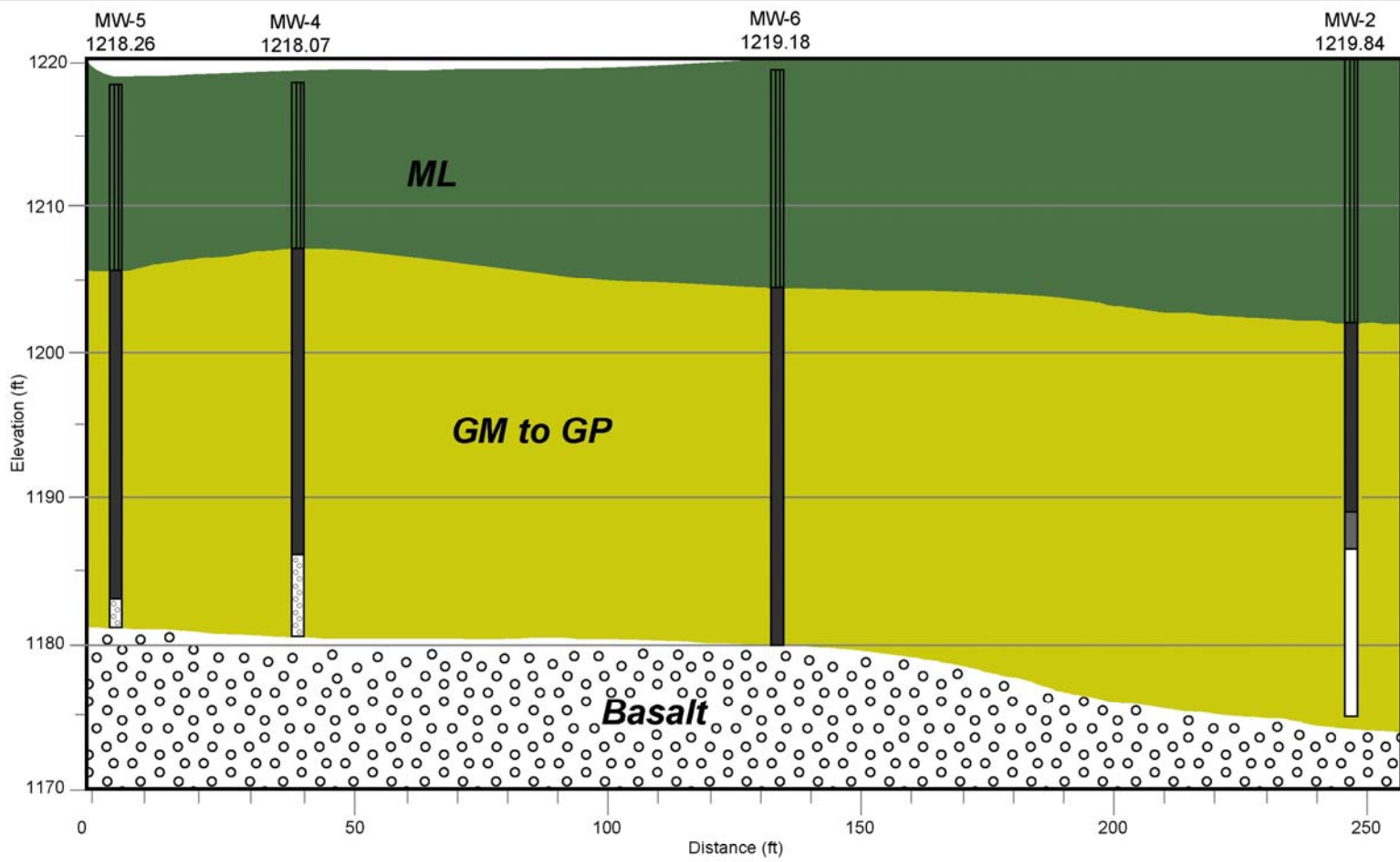
Project: Schwerin Concaves

Project Number: 01-0817-00-2124-400
 Location: Walla Walla, WA
 Drawn By: Ruth Otteman / Sandra Treccani
 Date: 6/20/03

Scale Bar
 0 50

Legend:

- SILT with trace fine sand - ML
- Sandy GRAVEL - GP to GM
- Gravely SAND with a little silt - SP

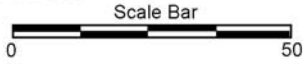


SAIC
 18705 North Creek Parkway, Suite 110
 Bothell, WA 98011



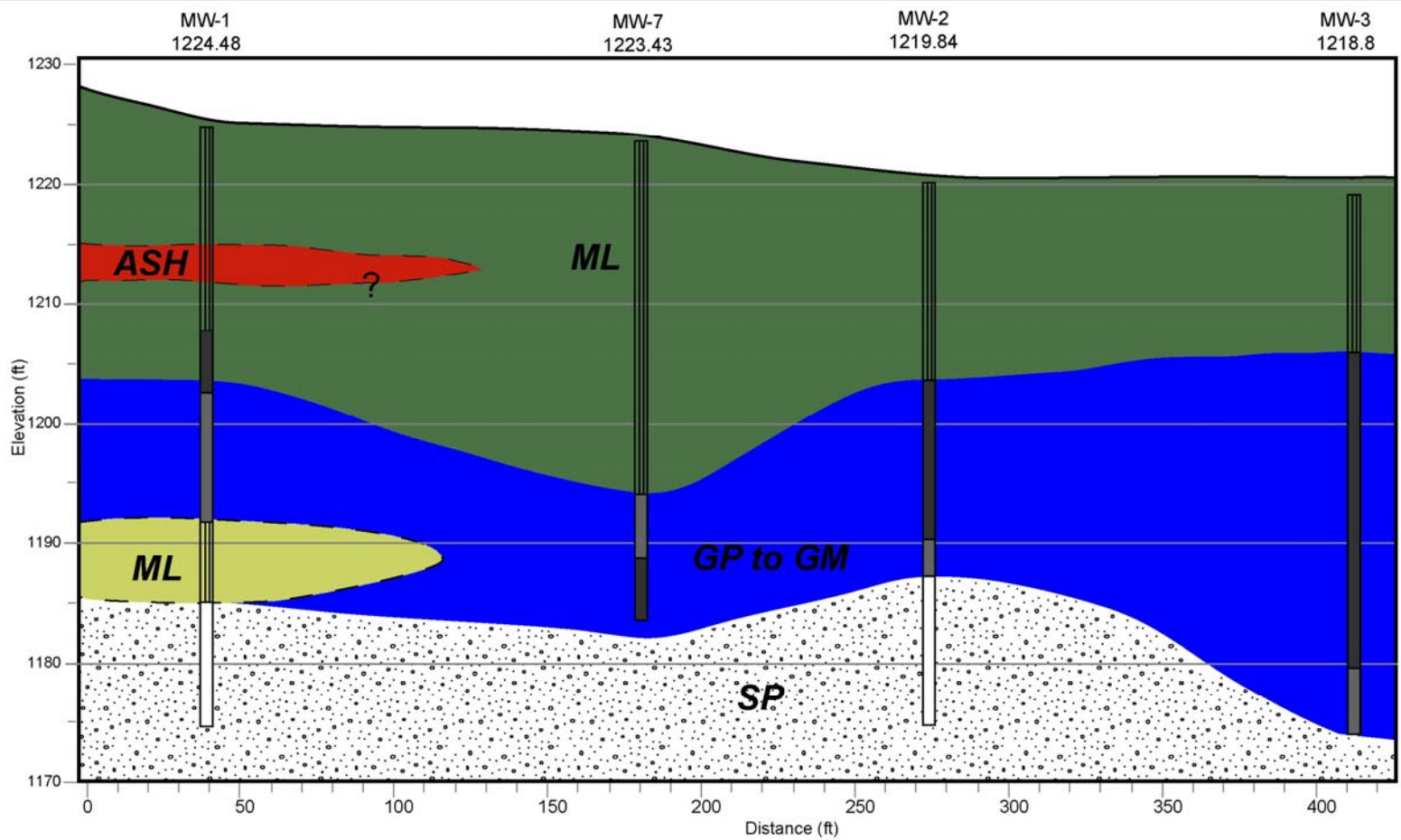
Project: Schwerin Concaves

Project Number: 01-0817-00-2124-400
 Location: Walla Walla, WA
 Drawn By: Ruth Otteman / Sandra Treccani
 Date: 6/20/03



Legend:

- SILT with trace fine sand, loess deposit - ML
- Silty GRAVEL with some sand - GM to GP
- Weathered Basalt



Project: Schwerin Concaves

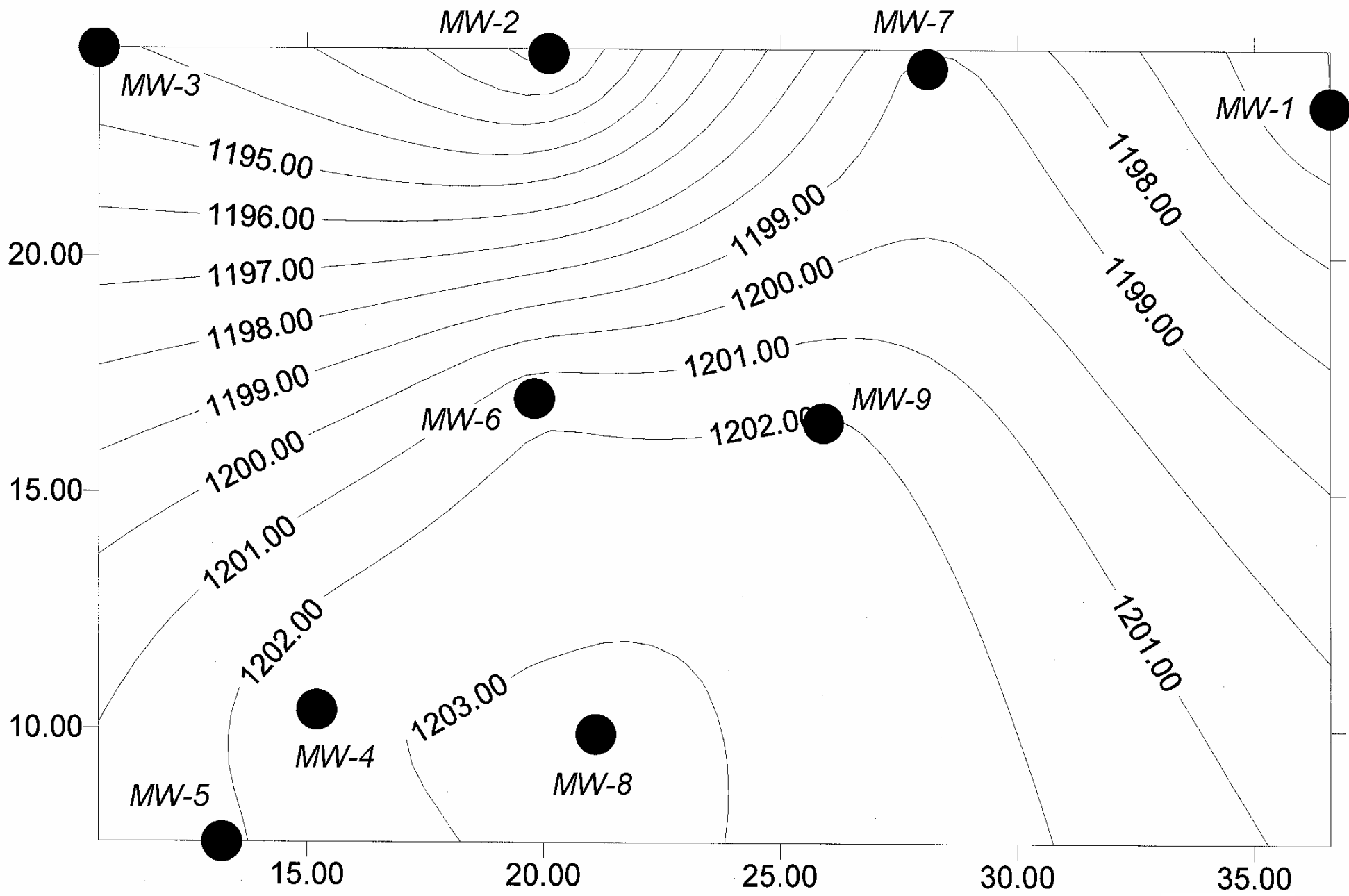
Project Number: 01-0817-00-2124-400
 Location: Walla Walla, WA
 Drawn By: Ruth Otteman / Sandra Treccani
 Date: 6/16/03

Scale Bar
 0 50

- Legend:**
- SILT with trace fine gravel - ML
 - Ash
 - Sandy Gravel - GP to GM
 - SILT with fine trace gravel - ML
 - Gravely SAND with Silt - SP

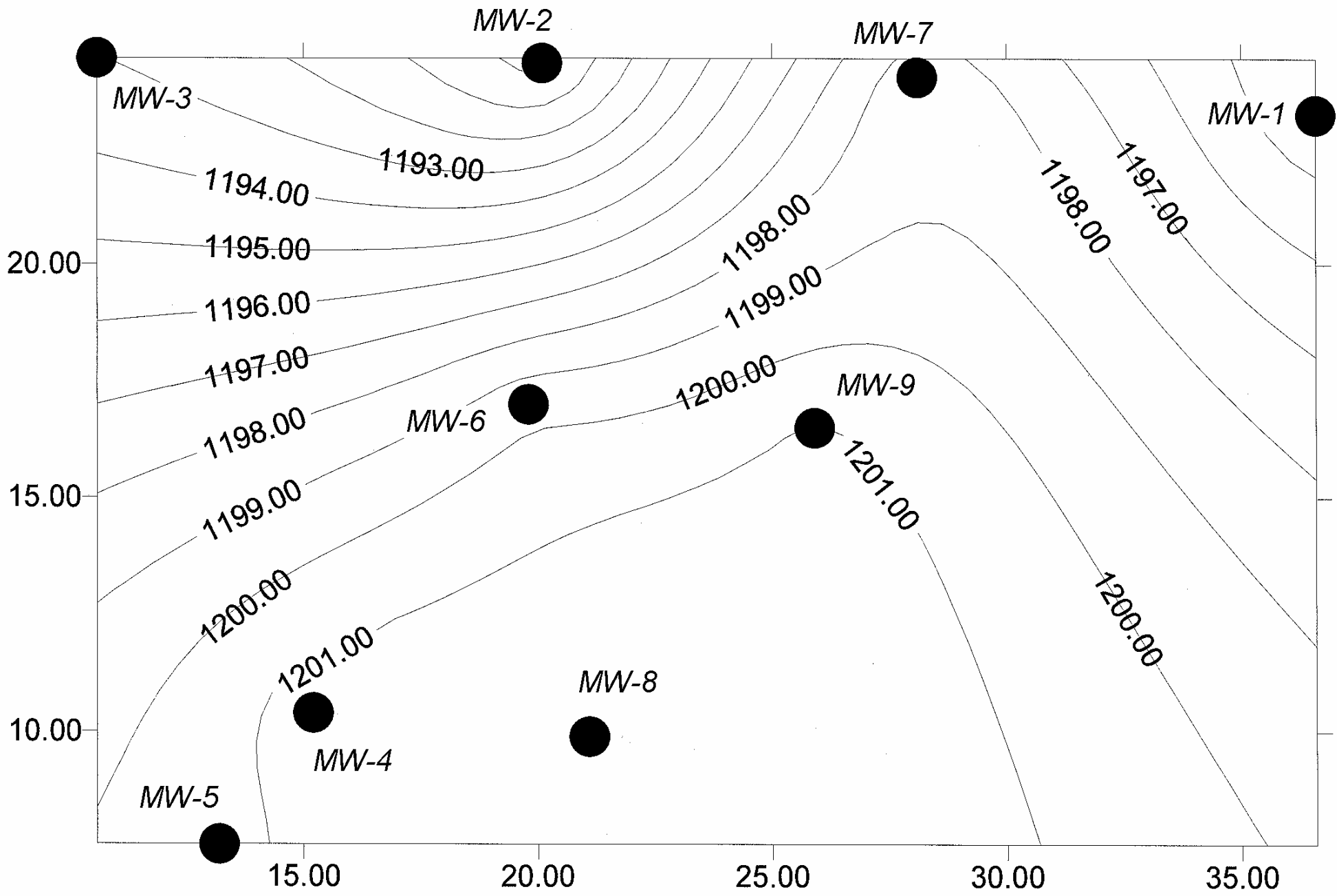
APPENDIX B

GROUNDWATER ELEVATION CONTOUR MAPS

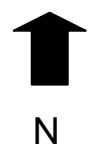


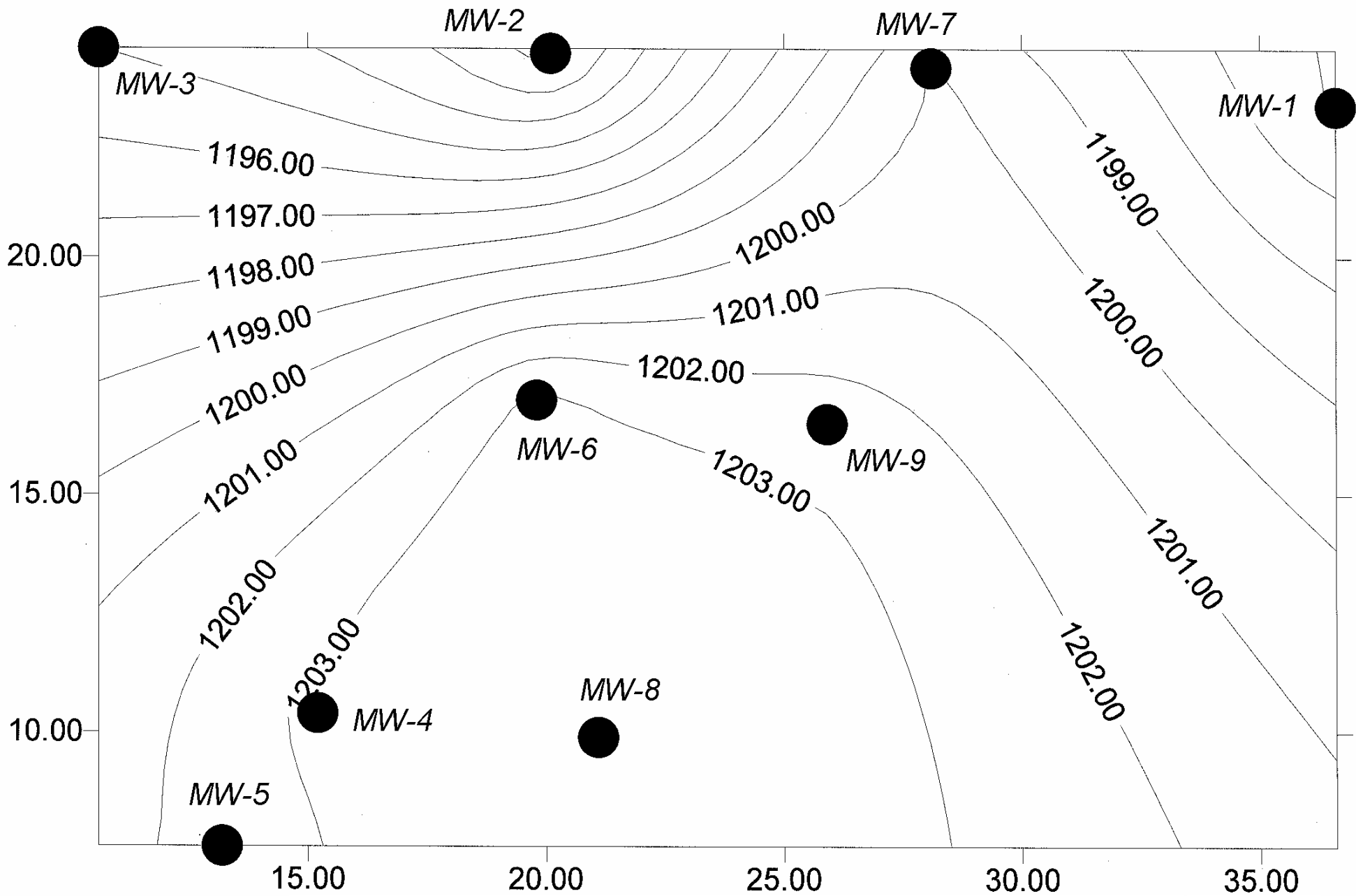
Groundwater Elevation Contour Map
March 2005



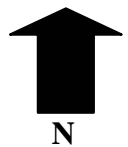


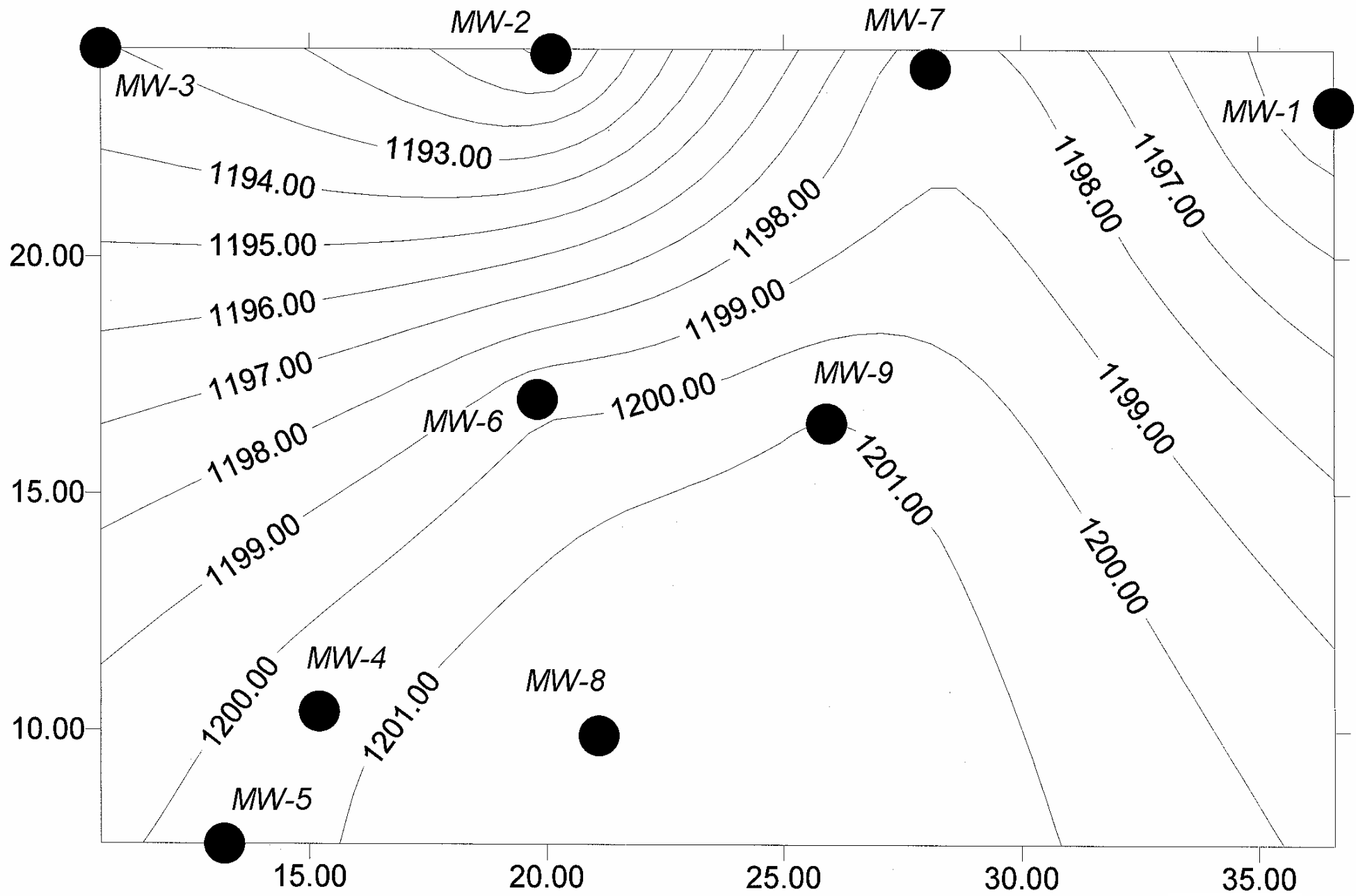
Groundwater Elevation Contour Map
November 2004





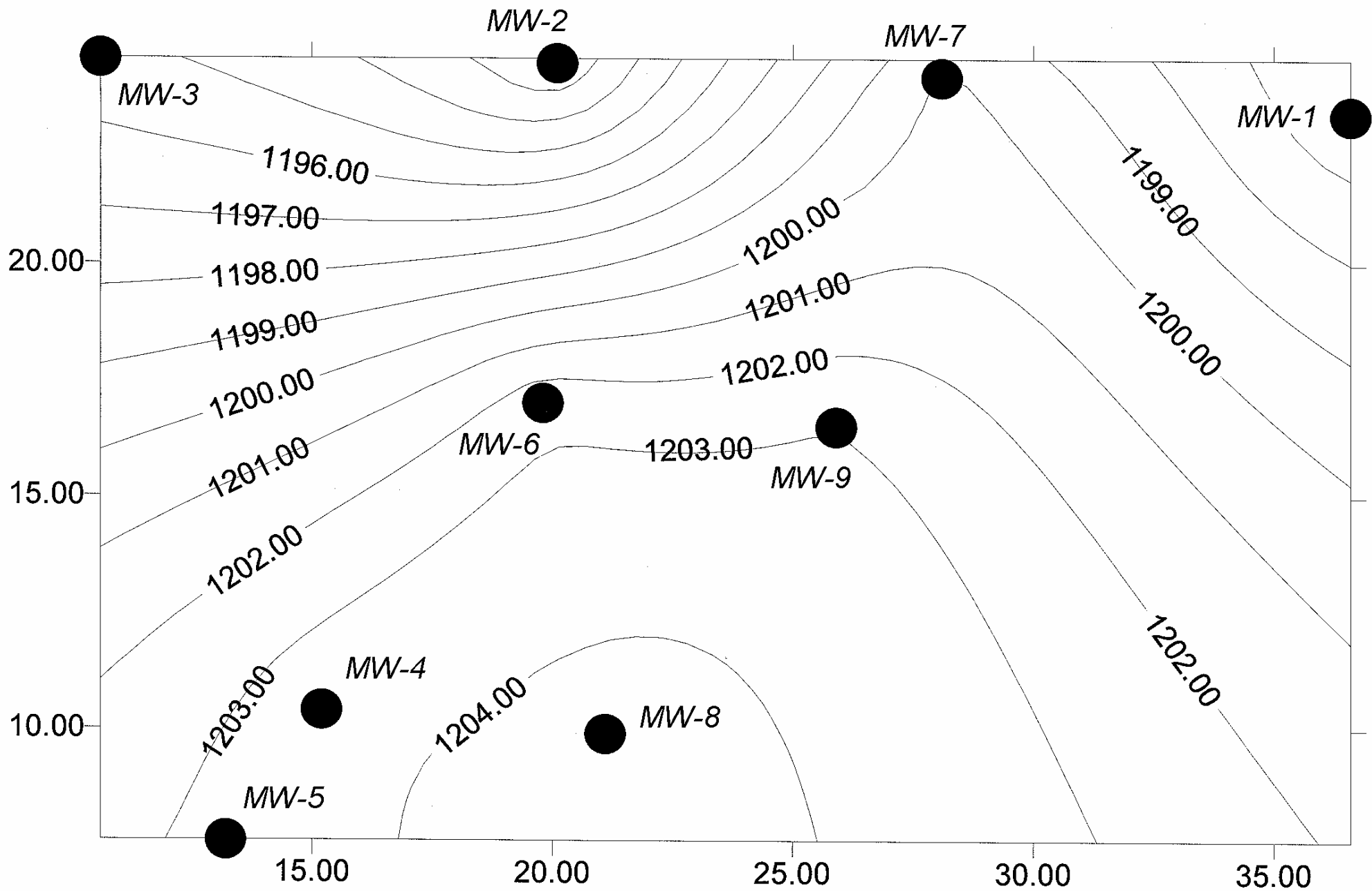
Groundwater Elevation Contour Map
April 2004





Groundwater Elevation Contour Map
August 2003





Groundwater Elevation Contour Map
April 2003



APPENDIX C
SEISMIC SURVEY REPORT

APPENDIX C
SEISMIC SURVEY REPORT

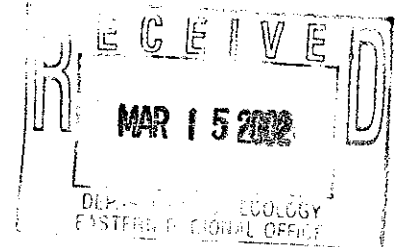


AQUILA GEOSCIENCES, INC.

P.O. Box 544
Potlatch, Idaho 83855
(208) 875-1175

March 12, 2002

Mr. Bill Fees, PE
Washington Department of Ecology
4601 North Monroe, Suite 202
Spokane, Washington 99205



Letter Report on a
Seismic Refraction Survey conducted
at the Schwerin Concaves Site near Walla Walla, Washington,
for Mr. Bill Fees, Washington Dept. of Ecology, Spokane Regional Office under
WDOE Field Order Number PF 286901
on January 29, 2002

Introduction

Aquila Geosciences performed a seismic refraction survey at the Schwerin Concaves site near Walla Walla, Washington, on January 29, 2002. The purpose of the survey was to determine the depth to bedrock profiles at various locations around the site.

Method of Investigation

The field work for this survey was done on January 29, 2002. Mr. Bill Fees and Ms. Sandy Treccani of the Washington Department of Ecology assisted in the field, including specifying line locations and orientations, and swinging the sledge hammer.

Five seismic refraction lines were acquired at this site. Two of these lines (2 and 4) were 460 feet long and oriented East-West. Two were oriented North-South, with line 1 being 460 feet long and line 5 is 220 feet long. Line 3 was a 220 foot long line oriented Southeast-Northwest. Figure 6 is a sketch map showing the line locations.

The data were acquired using a Geometrics S-24 Engineering Seismograph. Receivers were Geospace 10 Hz. vertical component geophones set at 20 foot spacings. The energy source was a 12-pound sledge hammer beaten against an aluminum plate. Data acquisition was done in a manner so that the data could be processed using the Generalized Reciprocal Method (GRM) of Palmer (1980). The "far" offset shots were acquired at locations that assured that first arrivals from the basalt bedrock target were received on all geophones on each line. Winter weather conditions combined with the depth of the target made data acquisition very slow.

Data Quality

The data collected for this survey varied in quality from good to poor, the result of frozen ground and noise. Frozen ground is one of the major problems with acquiring seismic data during the winter. Even with pilot holes punched for the geophone spikes, the "couple" (connection) between the geophones and the ground is poor, because it is not possible to get a significant part of the geophone case in contact with the ground. The received signals are weaker, and the geophones are much more susceptible to noise, especially noise carried through the air. The principal sources of noise at this site were work being done by employees at the site, some traffic noise, and wind noise. Noise was never bad enough to require filtering the data.

Data Processing and Interpretation

The seismic data were processed with both in-house software and Viewseis® software which uses the Generalized Reciprocal Method (GRM). All five lines were interpreted as three (3) layer cases. Intercept velocities were used for the first two layers, while the GRM velocity function was used to determine the velocity of the basalt.

Discussion

Figure 6 is a sketch map showing the locations of the seismic lines and the monitoring wells at the site. Figures 1 through 5 show the depth profiles for lines 1 through 5, respectively. The tables provide the depth to bedrock and velocity information in tabular form. **Please note that because we have no ground surface elevation data for these lines the ground surface appears flat. The bedrock topography represents a combination of the variations in the actual bedrock topography plus variations in ground surface elevation.**

As stated above, the subsurface was treated as a three-layer case for processing and interpretation purposes. The first layer is low velocity soil, with seismic velocities ranging from about 850 ft/sec to about 1,220 ft/sec. The second layer appears to correspond to the clayey to sandy gravel reported in the monitoring well logs. The seismic velocity of this layer ranges from a low of about 1,850 ft/sec to a high of about 4,900 ft/sec. The general range is between 2,500 ft/sec and 4,500 ft/sec. The third layer is interpreted to be the basalt bedrock. The velocity of this layer ranges from a low of about 5,450 ft/sec to a high of about 9,720 ft/sec. The low velocity occurs only at the southern end of line 5, the velocity for this layer is greater than 8,000 ft/sec everywhere else.

Calculated depths to basalt range from a minimum of about 21 feet below ground surface (bgs), near the East end of line 2, to a maximum of about 70 feet bgs, at station 03+40 on line 1. The general shape of the bedrock surface suggests that the basalt has a channel in it that enters from the east or northeast and then crosses the northern part of line 5 and the northern part of line 1. At this point the channel appears to turn toward the northwest and crosses line 4 between lines 1 and 3. This is shown in figure 7, which is a map of the interpreted depth to bedrock within the area of the seismic survey.

We wish to emphasize that the depths shown in the tables should be compared to the depth profiles for each line. The seismic refraction method we use determines the distance from the geophone to the target refractor. This is not necessarily the depth to the target refractor vertically below the geophone. Rather, this is what the arcs shown on the profiles represent. The actual profile of the refractor surface is best represented by a curve drawn tangent to these arcs. In areas where bedrock topography is relatively steep it is quite possible for bedrock to be deeper directly below the geophone than the "depth" (distance from the geophone) calculated by the method. This can be seen in the profiles. In areas where dips are relatively low the difference is not great.


Conclusions and Recommendations

The seismic refraction survey performed at the Schwerin Concaves site was able to determine depth to basalt "bedrock" along all five of the seismic lines surveyed. Ties to existing monitoring wells are good and depths at line crossings match within expected error. Should further delineation of the bedrock surface be required, the seismic refraction technique is a viable method for this site.

The results of this survey are intended for use in project planning and management. We consider data derived from geophysical surveys as useful for supplementing and augmenting observations made by direct sampling techniques such as drilling or trenching. The geophysical surveys we do are intended to guide direct sampling, not replace it. Surveys are designed based on information known about the survey area prior to conducting the survey. All interpretations are opinions based on inferences from electrical measurements and the accuracy or correctness of such interpretations cannot be guaranteed.

Please feel free to call should you have any questions.

Sincerely,


Kent R. Johnson, Ph.D., P.G.
Geologist/Geophysicist

attachments: 7 figures
5 tables

Table 1: Seismic Line 1

Line Position (feet)	Surface Elev. (feet)	Layer 1 Velocity (ft/sec)	Layer 2 Velocity (ft/sec)	Depth to Layer 2 (ft)	Elevation of Layer 2 (ft)	Layer 3 Velocity (ft/sec)	Depth to Layer 3 (ft)	Elevation of Layer 3 (ft)
0	0	1136	3,629	13	-13	9,194	35	-35
20	0	1136	3,690	13	-13	9,194	37	-37
40	0	1136	3,812	13	-13	9,194	39	-39
60	0	1136	3,934	12	-12	9,194	35	-35
80	0	1085	4,056	12	-12	9,194	32	-32
100	0	1034	4,178	12	-12	9,194	33	-33
120	0	999	4,300	12	-12	9,194	33	-33
140	0	978	4,422	12	-12	9,194	35	-35
160	0	973	4,544	13	-13	9,194	37	-37
180	0	968	4,666	13	-13	9,194	40	-40
200	0	963	4,788	14	-14	9,194	41	-41
220	0	958	4,909	14	-14	9,194	41	-41
240	0	958	4,912	15	-15	9,194	46	-46
260	0	964	4,794	15	-15	9,194	52	-52
280	0	975	4,558	16	-16	9,194	57	-57
300	0	986	4,321	16	-16	9,194	63	-63
320	0	998	4,085	16	-16	9,194	68	-68
340	0	1009	3,848	17	-17	9,194	70	-70
360	0	1003	3,675	17	-17	9,194	64	-64
380	0	978	3,567	17	-17	9,194	59	-59
400	0	935	3,523	16	-16	9,194	58	-58
420	0	893	3,479	16	-16	9,194	59	-59
440	0	850	3,435	15	-15	9,194	56	-56
460	0	829	3,413	15	-15	9,194	53	-53

Table 2: Seismic Line 2

Line Position (feet)	Surface Elev. (feet)	Layer 1 Velocity (ft/sec)	Layer 2 Velocity (ft/sec)	Depth to Layer 2 (ft)	Elevation of Layer 2 (ft)	Layer 3 Velocity (ft/sec)	Depth to Layer 3 (ft)	Elevation of Layer 3 (ft)
0	0	969	3,725	10	-10	9,658	31	-31
20	0	967	3,833	10	-10	9,658	30	-30
40	0	964	4,051	10	-10	9,658	27	-27
60	0	961	4,268	11	-11	9,658	28	-28
80	0	957	4,485	11	-11	9,658	31	-31
100	0	954	4,702	11	-11	9,658	33	-33
120	0	964	4,806	12	-12	9,658	33	-33
140	0	989	4,796	12	-12	9,658	32	-32
160	0	1027	4,672	13	-13	9,658	35	-35
180	0	1065	4,548	14	-14	9,658	40	-40
200	0	1104	4,424	15	-15	9,658	42	-42
220	0	1142	4,300	15	-15	9,658	43	-43
240	0	1158	4,213	16	-16	9,658	39	-39
260	0	1154	4,165	16	-16	9,658	39	-39
280	0	1127	4,155	15	-15	9,658	40	-40
300	0	1101	4,144	15	-15	9,658	41	-41
320	0	1074	4,134	14	-14	9,658	41	-41
340	0	1048	4,124	14	-14	9,658	39	-39
360	0	1045	4,084	14	-14	9,658	34	-34
380	0	1067	4,014	14	-14	9,658	27	-27
400	0	1112	3,914	15	-15	9,658	21	-21
420	0	1157	3,815	15	-15	9,658	22	-22
440	0	1202	3,715	16	-16	9,658	27	-27
460	0	1224	3,666	16	-16	9,658	31	-31

Schwerin Concaves Site Seismic Survey

Table 3: Seismic Line 3

Line Position (feet)	Surface Elev (feet)	Layer 1 Velocity (ft/sec)	Layer 2 Velocity (ft/sec)	Depth to Layer 2 (ft)	Elevation of Layer 2 (ft)	Layer 3 Velocity (ft/sec)	Depth to Layer 3 (ft)	Elevation of Layer 3 (ft)
0	0	966	2,500	8	-8	8,550	29	-29
20	0	931	2,500	8	-8	8,550	28	-28
40	0	895	2,500	8	-8	8,550	28	-28
60	0	860	2,500	7	-7	8,550	30	-30
80	0	825	2,932	7	-7	8,550	32	-32
100	0	790	3,021	7	-7	8,550	31	-31
120	0	789	3,021	7	-7	8,550	31	-31
140	0	822	2,932	7	-7	8,550	33	-33
160	0	855	2,843	8	-8	8,550	33	-33
180	0	889	2,754	8	-8	8,550	35	-35
200	0	922	2,666	8	-8	8,550	40	-40
220	0	955	2,577	9	-9	8,550	42	-42

Table 4: Seismic Line 4

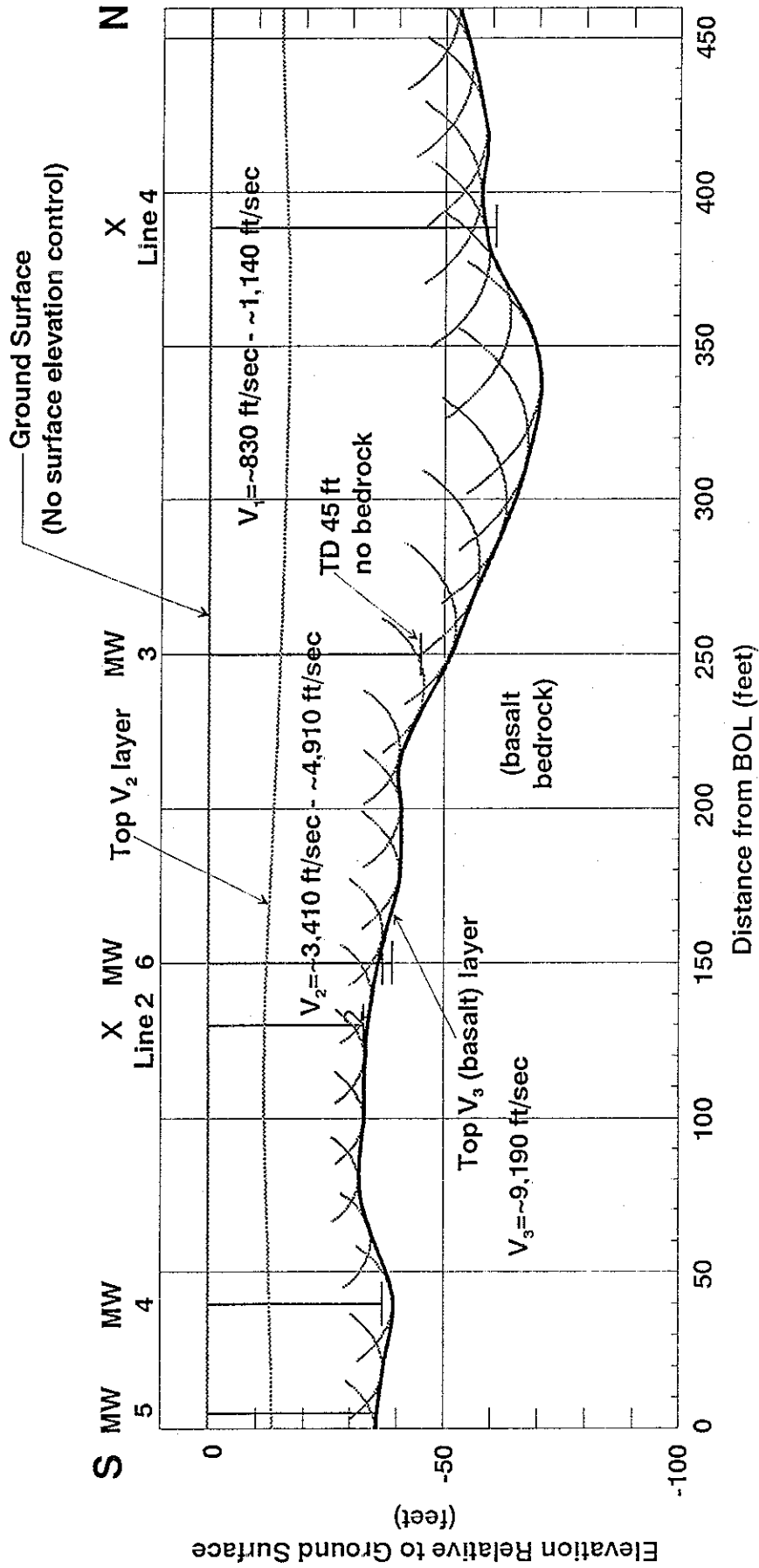
Line Position (feet)	Surface Elev (feet)	Layer 1 Velocity (ft/sec)	Layer 2 Velocity (ft/sec)	Depth to Layer 2 (ft)	Elevation of Layer 2 (ft)	Layer 3 Velocity (ft/sec)	Depth to Layer 3 (ft)	Elevation of Layer 3 (ft)
0	0	875	2,557	17	-17	9,719	31	-31
20	0	890	2,678	17	-17	9,719	34	-34
40	0	911	2,839	17	-17	9,719	35	-35
60	0	931	3,000	16	-16	9,719	43	-43
80	0	951	3,161	16	-16	9,719	50	-50
100	0	971	3,322	16	-16	9,719	56	-56
120	0	978	3,332	16	-16	9,719	60	-60
140	0	971	3,192	17	-17	9,719	64	-64
160	0	964	3,053	17	-17	9,719	64	-64
180	0	956	2,913	17	-17	9,719	64	-64
200	0	949	2,773	17	-17	9,719	64	-64
220	0	942	2,633	17	-17	9,719	64	-64
240	0	941	2,499	17	-17	9,719	61	-61
260	0	945	2,371	16	-16	9,719	58	-58
280	0	949	2,244	15	-15	9,719	55	-55
300	0	954	2,116	15	-15	9,719	53	-53
320	0	958	1,988	14	-14	9,719	50	-50
340	0	962	1,860	14	-14	9,719	49	-49
360	0	963	1,862	13	-13	9,719	46	-46
380	0	960	1,993	14	-14	9,719	45	-45
400	0	958	2,124	14	-14	9,719	43	-43
420	0	955	2,255	14	-14	9,719	44	-44
440	0	952	2,386	14	-14	9,719	47	-47
460	0	950	2,484	14	-14	9,719	48	-48

Table 5: Seismic Line 5

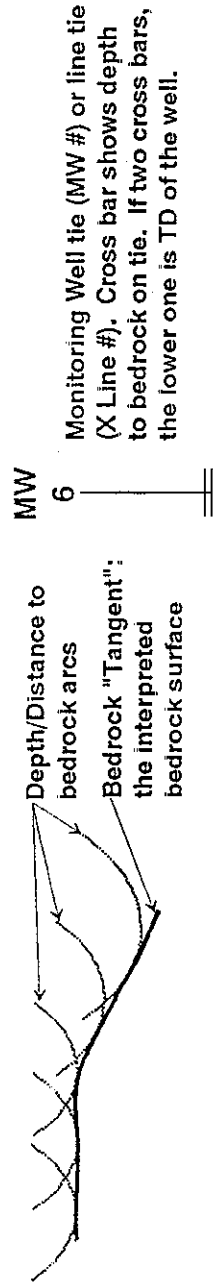
Line Position (feet)	Surface Elev (feet)	Layer 1 Velocity (ft/sec)	Layer 2 Velocity (ft/sec)	Depth to Layer 2 (ft)	Elevation of Layer 2 (ft)	Layer 3 Velocity (ft/sec)	Depth to Layer 3 (ft)	Elevation of Layer 3 (ft)
0	0	985	2,425	9	-9	NA	NA	NA
20	0	983	2,320	9	-9	5,455	41	-41
40	0	980	2,201	8	-8	5,455	40	-40
60	0	978	2,081	8	-8	5,455	40	-40
80	0	976	1,962	8	-8	5,455	42	-42
100	0	973	1,843	7	-7	6,595	48	-48
120	0	971	1,869	7	-7	8,116	56	-56
140	0	969	2,040	7	-7	8,877	61	-61
160	0	967	2,212	8	-8	8,877	64	-64
180	0	965	2,383	8	-8	8,877	65	-65
200	0	963	2,555	8	-8	8,877	NA	NA
220	0	961	2,705	9	-9	NA	NA	NA

Schwerin Concaves Site Seismic Refraction Line 1

Figure 1



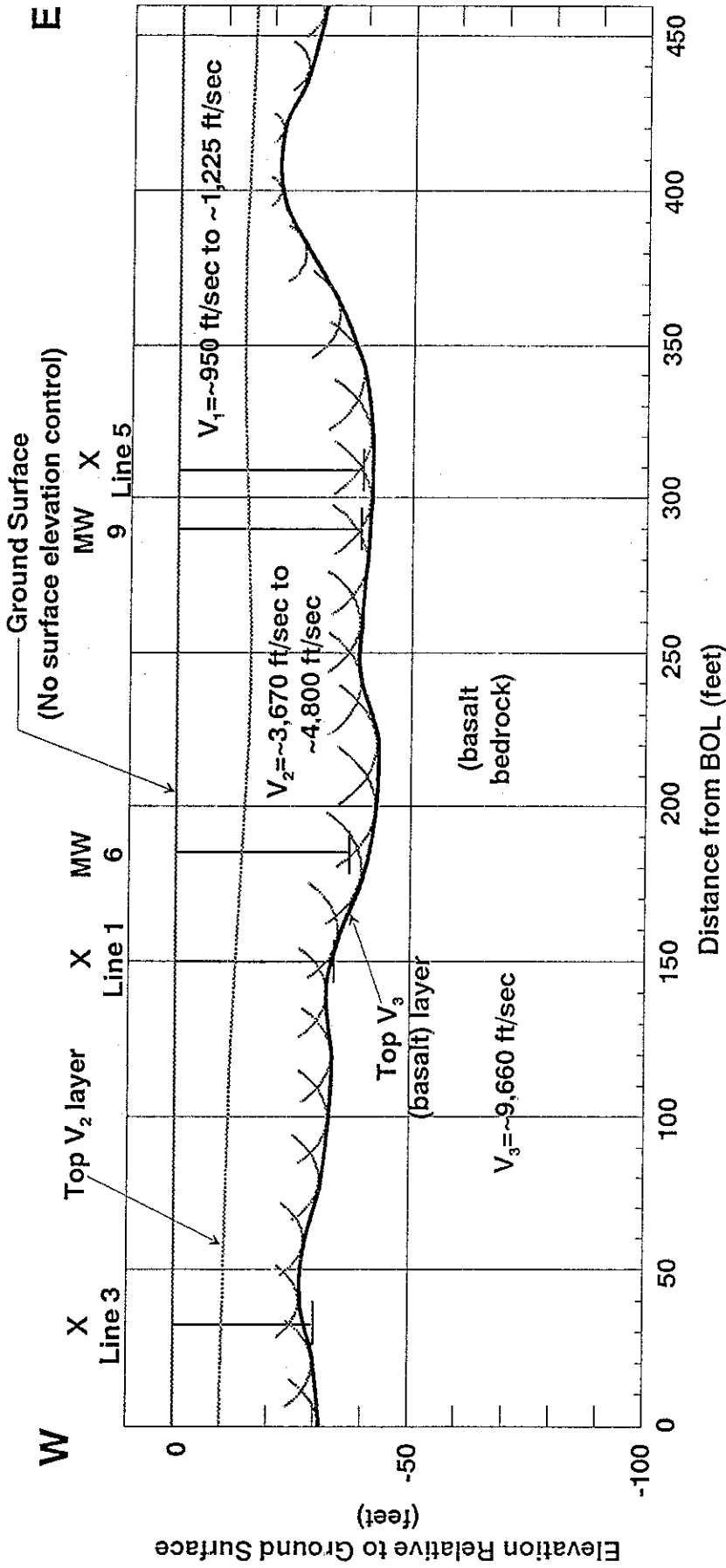
EXPLANATION



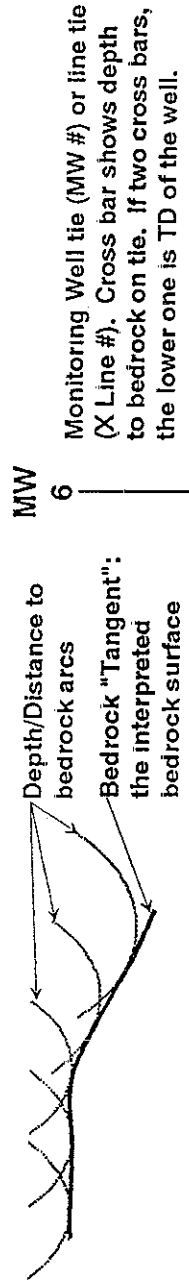
Vertical
Exaggeration:
1.54:1

Schwerin Concaves Site Seismic Refraction Line 2

Figure 2



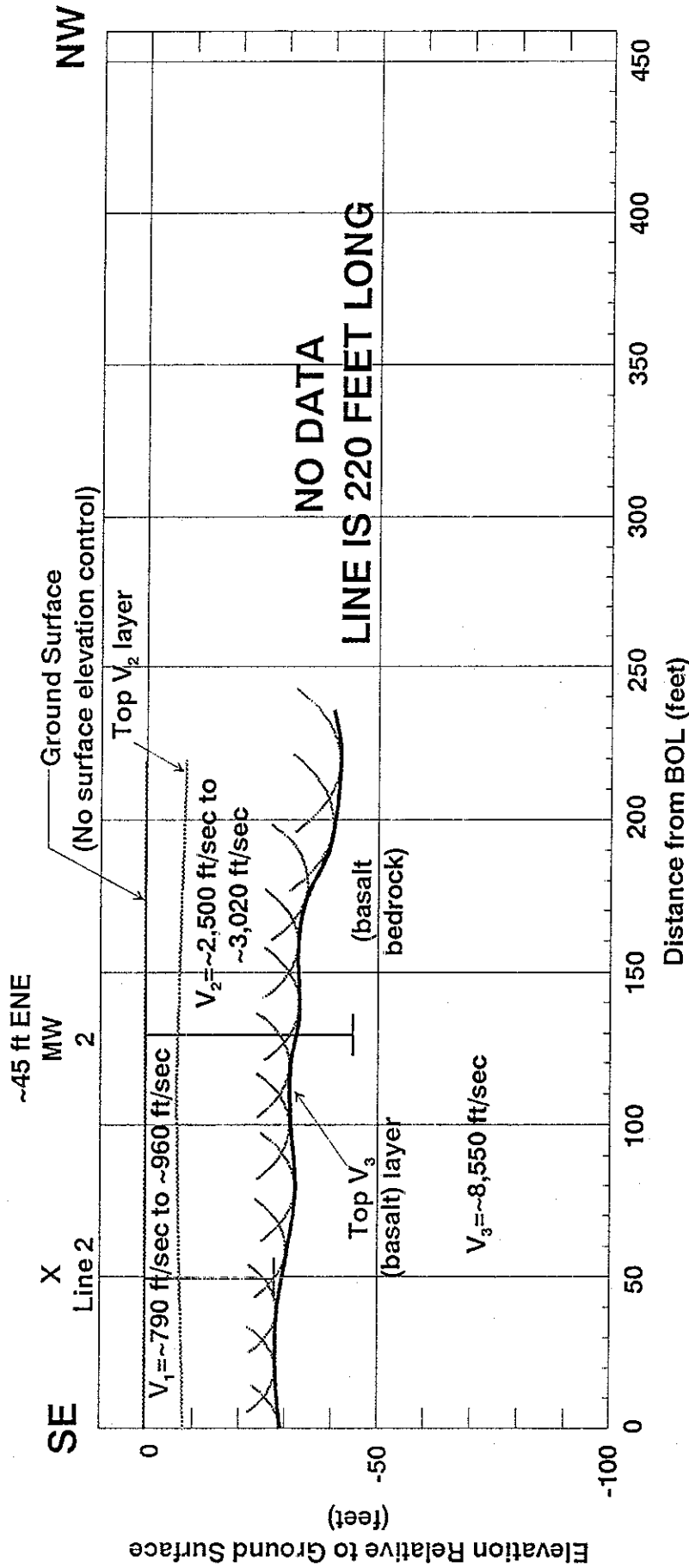
EXPLANATION



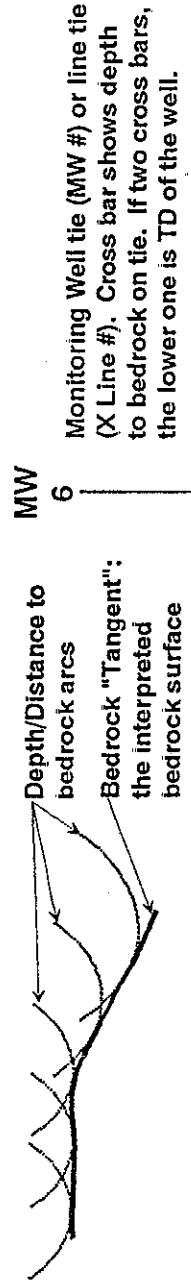
Vertical
Exaggeration:
1.54:1

Schwerin Concaves Site Seismic Refraction Line 3

Figure 3



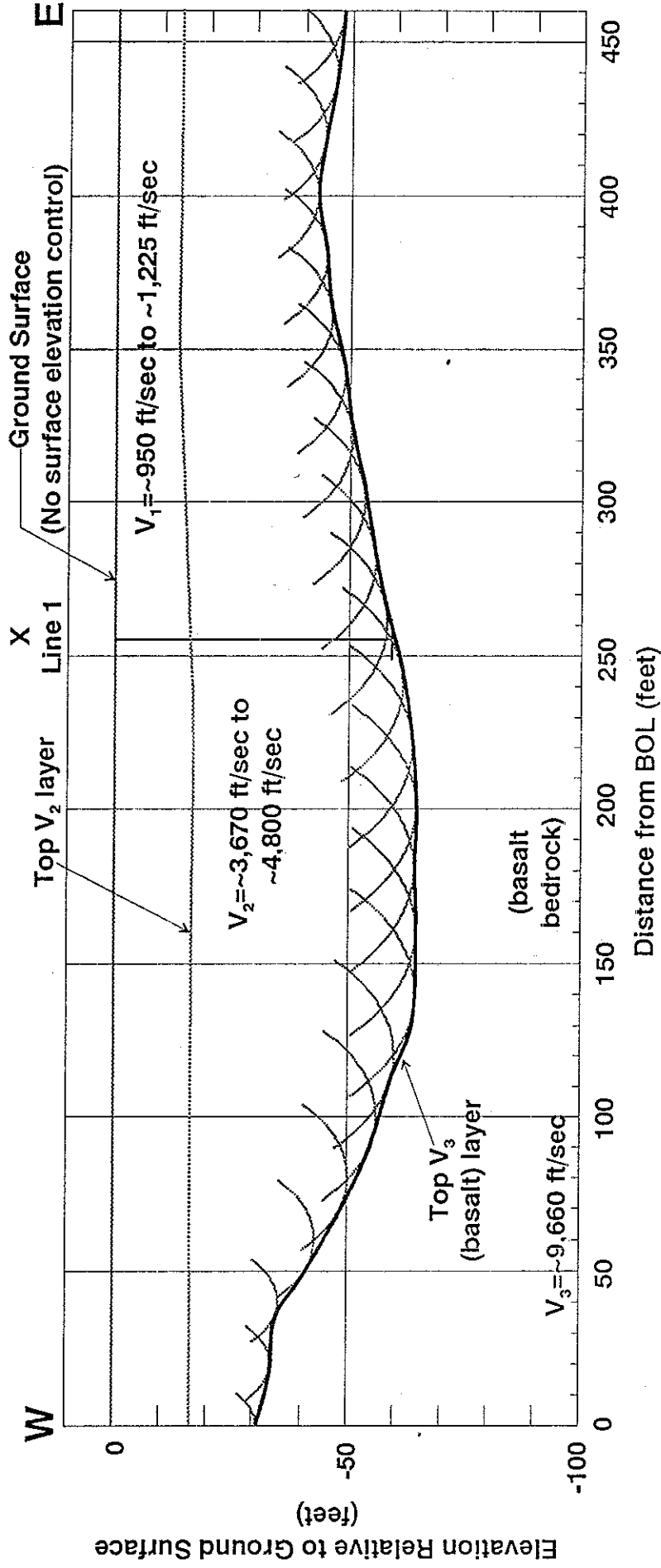
EXPLANATION



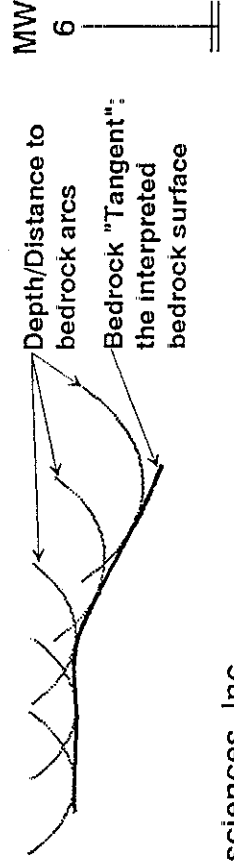
Vertical Exaggeration: 1.54:1

Schwerin Concaves Site Seismic Refraction Line 4

Figure 4



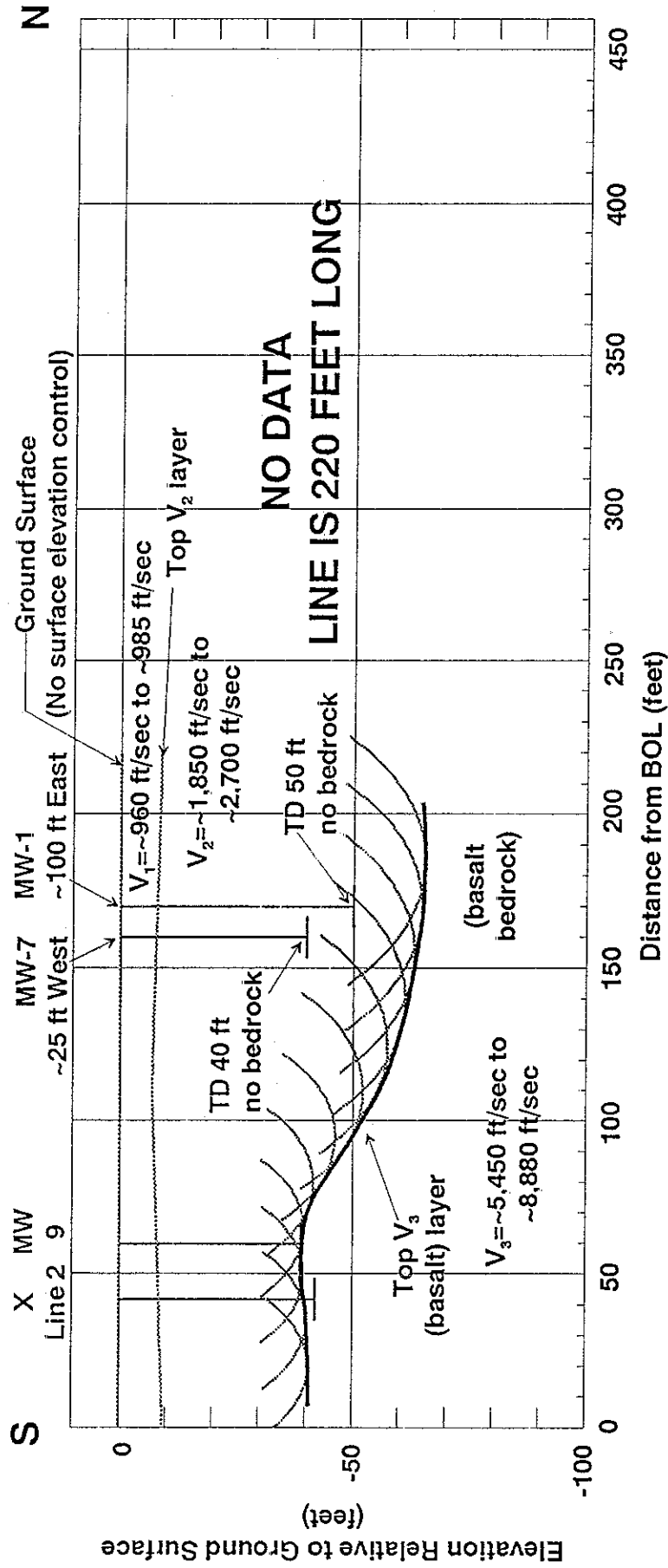
EXPLANATION



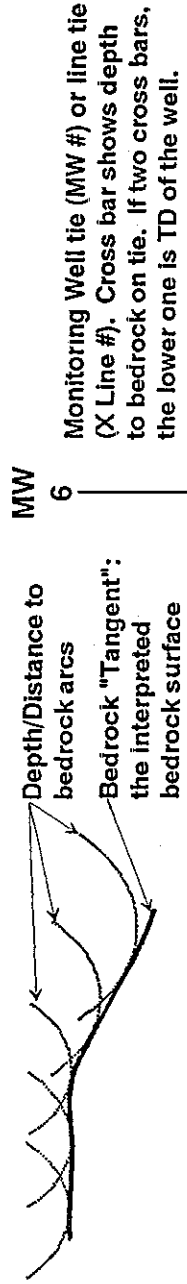
Vertical
Exaggeration:
1.54:1

Schwerin Concaves Site Seismic Refraction Line 5

Figure 5

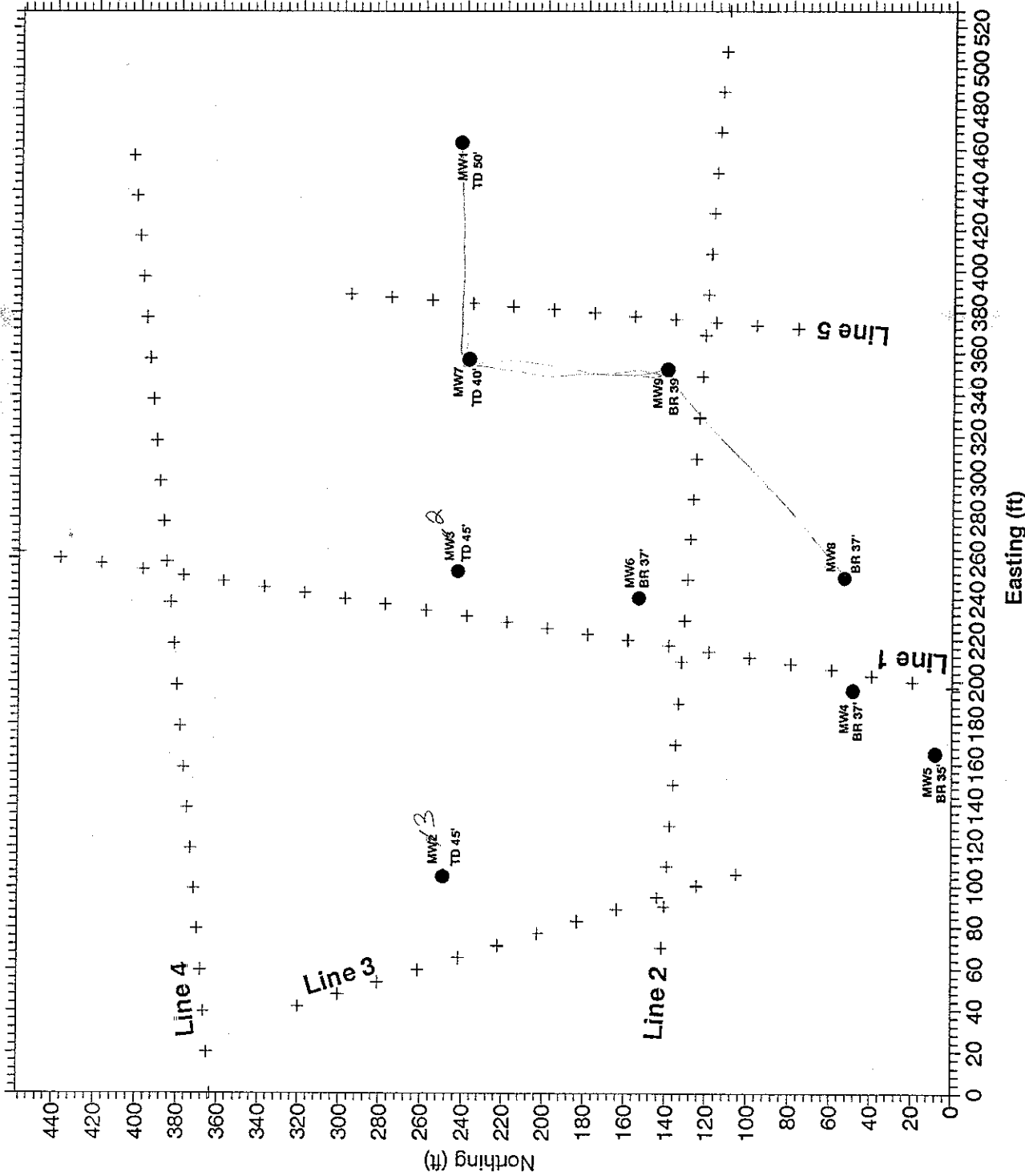


EXPLANATION



Seismic Line Location Map Schwerin Concaves Site

Figure 6



Explanation

Monitoring Wells

- MW7 TD 40'
- MW6 BR 37'
- MW5 BR 35'
- MW4 BR 37'
- MW3 TD 45'
- MW2 TD 45'
- MW1 TD 50'

Seismic Lines

- Data points
- Line Number

Basalt Bedrock

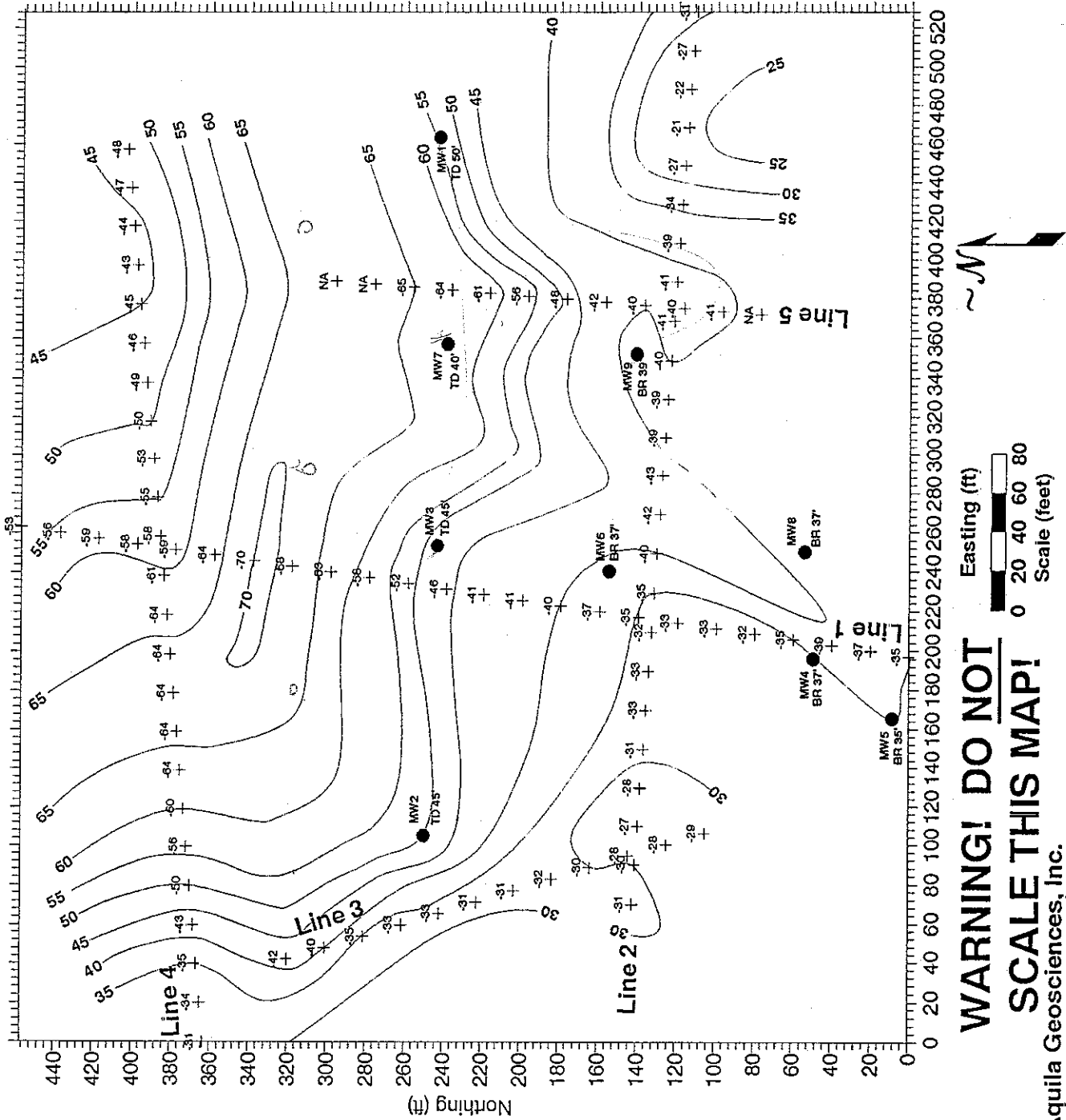
Scale (feet)

0 20 40 60 80

WARNING! DO NOT SCALE THIS MAP!

Interpreted Depth to Bedrock Map Schwerin Concaves Site

Figure 7



Explanation

Monitoring Wells

● MW7
TD 40' — Total Depth (feet)
of Well (No Bedrock)

● MW6
BR 37' — Well Number
Depth (feet) to
Basalt Bedrock

Seismic Results

+64 — Data point with calculated
depth to basalt in feet
below ground surface.

—40 — Contour showing interpreted
depth to basalt based on
both seismic data and
monitoring wells.

NOTE: Monitoring well depths and
depths on bedrock contours are
shown as positive numbers. Depths
to bedrock on seismic data are
shown as negative numbers due to
sign conventions in the processing
software. All depths are referred to
the ground surface.

NOTE: This map is an interpretation
based on both the seismic and the
well data. As such it does NOT
strictly honor the seismic data. This
map is intended for use in project
planning and management and as an
aid in guiding direct sampling efforts.
This map is NOT intended to replace
direct sampling. All interpretations
are inferences from borehole data
and electrical measurements and, as
such, the accuracy or correctness of
the interpretation presented here
cannot be guaranteed.

**WARNING! DO NOT
SCALE THIS MAP!**



Easting (ft)
Scale (feet)
0 20 40 60 80

APPENDIX D

LABORATORY DATA AND DATA VALIDATION

(Due to the Volume of these records, they will need to be reviewed at the Repositories in Walla Walla or Spokane, see Fact Sheet for addresses)