EXHIBIT 24
OREGON DEQ PERMIT WORK PLAN

DEVELOPMENT AREA HYDROGEOLOGIC AND GEOTECHNICAL CHARACTERIZATION WORKPLAN

COFFIN BUTTE LANDFILL

BENTON COUNTY, OREGON

Prepared for

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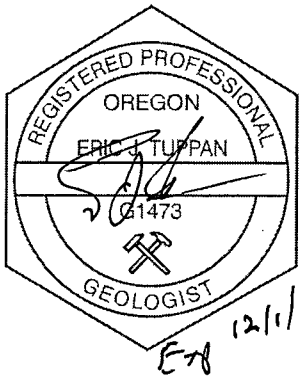
Development Area
Hydrogeologic and Geotechnical Characterization Workplan
Coffin Butte Landfill
Benton County, Oregon

The material and data in this report were prepared under the supervision and direction of the undersigned.



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1 INTRODUCTION

This document presents a plan for site characterization at the Coffin Butte Landfill in Benton County, Oregon, which is owned and operated by Valley Landfills, Inc., a subsidiary of Republic Services, Inc. Republic is in the process of permitting, site characterization, and preliminary planning and design to develop the landfill south of Coffin Butte Road. In addition to the landfill development, Republic is also planning to move or build new support areas and structures for the landfill, including: a new access road around the south side of the landfill, leachate ponds proposed for east of the landfill footprint, an employee building area, and pump stations.

1.1 Background and Plan Organization

Past investigations have extensively characterized site hydrogeology and geotechnical parameters for the area north of Coffin Butte Road, where a multiunit landfill has been operating since the mid 1970s. The area south of Coffin Butte Road is currently used for ancillary structures and buildings that support landfill operations. Hydrogeologic and geotechnical characterization has also occurred in the area south of the road, primarily as it relates to the construction and operations of the leachate holding ponds. Currently, characterization includes ongoing groundwater quality monitoring.

The workplan is organized in roughly three parts. The first describes the goals of site characterization as defined in Oregon Department of Environmental Quality's (DEQ) *Solid Waste Guidance, Municipal Solid Waste Landfills* (DEQ, 1996), including the elements specifically listed in Sections 2, 3, and 4 of that guidance. Second, the workplan summarizes information from past studies for Coffin Butte Landfill that focuses on the development area, and identifies elements where additional data are needed to refine our understanding of the site hydrogeology and geotechnical attributes of soil and bedrock. Last, we develop a scope of work that addresses the data gaps, provides the types of technical information that will be needed for a conceptual design for the landfill, and as appropriate, for developing design-level information that satisfies the permit requirement for hydrogeologic and geotechnical characterization.

1.2 Project Objectives

Over a period of over 40 years, consultants have studied the surface soils and subsurface geology of the site, as well as the groundwater hydrogeology and geochemistry. With this substantial historical record, at least for the area north of Coffin Butte Road, much of the site character for surface soils and for shallow and deep water-bearing zones, is known. However, south of Coffin Butte Road, less is known regarding the constructability of a landfill. Given this amount of known information, objectives for this study include:

- Update information to satisfy DEQ's Phase I site characterization elements which focus on regional and area-wide data needs.

- Evaluate the site geology and hydrogeology, including stratigraphic units and the water-bearing zones as part of Phase II site characterization. More specifically, this aspect will examine subsurface conditions that include the depth and extent of the water bearing hydrogeologic units, the hydraulic connection between units, the lithologic and hydraulic properties of these units, groundwater flow patterns, and other factors. It should be noted that the groundwater-related investigation will be phased later with a separate workplan as described in Section 4.3.

- Acquire geotechnical information about the site to satisfy both a Phase I and II geotechnical assessment, including design-level data on the distribution of overburden (i.e., alluvium), depth of bedrock, and competency of units in the south development area. This aspect of study will include:
  - Characterize the variability, depth, aerial extent and engineering properties of onsite soils and other overburden deposits.
  - Inventory soils and other overburden deposits suitable for use in construction, and identify a proposed use for these materials.
  - Identify geotechnical considerations (such as settlement and slope stability) which must be addressed in the engineering design.

- In a future phase, Republic will augment the groundwater monitoring network in the south development area. We anticipate that this will include installing upgradient, and cross- and down-gradient wells along the perimeter of the landfill footprint as well as decommissioning several wells along Coffin Butte Road that are within the planned footprint of the landfill.

1.3 Project Team

The characterization project will be overseen by Tuppan Consultant who will coordinate office and field tasks, and be the primary author of the site characterization report. The

Wallace Group, Inc., of Bend, Oregon, will provide field personnel for test pits and borings, in addition to performing geotechnical analyses necessary for the site characterization report. Civil & Environmental Consultants, Inc. (CEC) will provide CAD support for preparing figures for the report.

2 GOALS OF INVESTIGATION

This section provides background and context to the scope of work that will be developed later in the workplan. The primary goal of the site characterization report is to satisfy the various elements outlined in the DEQ's guidance on landfill characterization. In the guidance, these are organized into two phases that focus on geology and hydrogeology, plus another phase for the geotechnical evaluation.

2.1 Phase I Site Characterization

The main objectives of the Phase I site characterization study are to describe existing site conditions, determine if the site is suitable for landfill construction, provide sufficient base-line information for developing the facility design, construction program, operations plan, and the environmental monitoring program. As the site has already been zoned and developed as a landfill, many of the site suitability elements have been provided in past reports. Specific topics taken from the Section 2 of the DEQ guidance are described below.

2.1.1 Existing Conditions

Much of this information on existing conditions at the site has been presented in documents listed in the references. This includes:

- Site Location. Describe the site location with respect to known or easily identifiable landmarks, include the section, township, and range location for the site. Describe access to the site from the nearest U.S. or State Highway.

- Legal Description. Provide a legal description of the tract or tracts of land which have been or are proposed to be used for waste disposal activities.

- Vicinity Map. This will include a map or series of maps showing the facility and the area within at least a five-mile radius of the site boundary. Additional elements to be included on the vicinity map are provided in the guidance.

- Aerial Photographs. Prepare a stereo pair of standard size (9 inches by 9 inches) recent vertical aerial photographs with a scale up to 1:40,000, which

shows the site and the area within at least a one-mile radius of the site boundary.

- Adjacent Landowners. Show on a location map or on County Tax Lot map(s), the names and mailing addresses of all landowners within one-quarter mile of the property and any other landowners identified as being affected by the proposed facility.

- Site Map. Prepare a detailed site map scaled at not more than one inch equals 200 feet (or other scale approved by the Department) that shows existing conditions in addition to the proposed landfill development footprint, soil borrow areas, and wells.

2.1.2 Climate and Meteorology

Current information based on or extrapolated from data collected at the closest reporting weather station or stations including:

- Average annual precipitation and monthly distribution of precipitation.
- Average annual evaporation and monthly distribution of evaporation.
- Average annual prevailing wind direction and monthly variation in wind direction.
- Average and maximum wind velocities and monthly variations in wind velocity.
- Average annual temperature and monthly variations in temperature.

2.1.3 Hydrology

Evaluate and describe the surface water drainages of the site and of the surrounding area within at least a one-mile radius of the site. This information should include a map or maps at a scale of 1:24,000 showing major perennial, ephemeral and intermittent drainage channels, and their tributaries.

2.1.4 Water Balance

Analyze the average annual site water budget including precipitation, runoff, infiltration and evapotranspiration. Determine the monthly variations of each of these parameters for a one-year period. Acceptable water balance methods include Thornthwaite-Mather (1957), the EPA Water Balance (1975), the EPA Help Model (1984), and/or other methods approved in advance by the Department.

2.1.5 Water Use Inventory

Identify all active and inactive water wells, irrigation wells, and surface water usage points within the targeted radius. As needed, identify and field check water usages within this radius which are listed in the drillers' log files or other records of the Oregon Water Resources Department (WRD). Areas within the radius of investigation that are served by a municipal water supply should be included in the WRD well records search.

2.1.6 Geology and Hydrogeology Investigation

Conduct a preliminary geology and hydrogeology investigation. Evaluate the regional geology and hydrogeology based on geological reconnaissance field mapping and existing published or unpublished reports and data from state and federal agencies, universities, consultants or other sources.

In addition to the hydrogeology, describe the geologic hazards that may include seismic impacts, mass movement (e.g., landslides), unstable soils, flood inundation, shallow groundwater levels, tsunami, and volcanic eruptions. Location restrictions under OAR 340-94-030 address considerations such as Holocene fault zones, seismic impact areas and unstable areas.

Assessment of geologic hazards will also evaluate the earthquake safety of the site, including:

- A description of the seismotectonic setting and seismic history of the area, including size, frequency, and location of historic earthquakes. ·
- Potential for area to be affected by surface rupture, including sense and amount of displacement, and width of surface deformation zone.
- Probable response of site to likely earthquakes, including estimated ground motion, maximum ground acceleration, velocity and displacement.
- Potential for area to be affected by earthquake-induced landslides or soil liquefaction.
- Potential for area to be affected by regional tectonic deformation (subsidence or uplift).

Finally, to the extent possible, identify and evaluate other known or suspected geologic hazards which may affect the design, construction, and operation of the facility.

2.2 Phase II Characterization

The main objective of the Phase II site characterization is to describe and evaluate the site geology and hydrogeology, including stratigraphic units encountered, the uppermost

aquifer or water-bearing zone, and other potential zones of contaminant transport. Elements will include:

- Surface investigations such as surface geologic mapping and excavating test pits.
- Subsurface investigations will include geotechnical borings, and, in a later phase, groundwater monitoring wells.
- Hydrogeologic testing to provide aquifer parameters, also as part of subsequent phase for future monitoring wells.
- Environmental testing to assess groundwater and surface water quality.

2.3 Geotechnical Characterization

Section 4 of landfill guidance calls for characterizing the variability, depth, aerial extent, and engineering properties of onsite soils and other overburden deposits. This should include:

- Inventory soils and other overburden deposits suitable for use in construction, and identify the proposed use for these materials.
- Identify geotechnical considerations, such as settlement and slope stability as listed in Phase I geotechnical investigation guidance.
- Perform additional geotechnical investigations as required by a Phase II work scope that includes design calculations and analyses, and that could include:
  - Potentially unstable natural slopes and other on-site areas that could be destabilized by construction activities such as excavation, regrading or other site modifications.
  - Stability of the landfill foundation considering site-specific topographic and geologic conditions, static and dynamic loads, pore-water pressures at the subgrade-liner interface, and any other relevant factors.
  - Compressibility of underlying geologic units and potential settlement of the landfill unit. Estimate total and differential settlement based on appropriate field and laboratory methods and design parameters.

3 SITE BACKGROUND

The information summarized in this section provides the framework for identifying data needs and in developing the proposed scope of work. Technical details are provided in several reports cited in the references section. Much of the information discussed below was summarized in the *Site Characterization - Cell 3 Coffin Butte Landfill* (EMON, 1999), the *Environmental Monitoring Plan* (EMP)(Tuppan, 2014), and the *2020 Annual Environmental Monitoring Report* (Tuppan, 2021), and the reader is referred to those documents for more details.

3.1 Site Location and History

Coffin Butte Landfill is in the west-central Willamette Valley, eleven miles north of Corvallis, Oregon (see Figure 1). Topographic elevations in the area range from 220 to over 740 feet above mean sea level (msl) at the summit of Coffin Butte. The landfill is in a predominantly agricultural area. The land adjacent to the site is zoned exclusive farm use, forest conservation, and rural residential with either a 5- or 10-acre lot minimum.

Landfilling began in 1945 on the southwest flank of Coffin Butte and has continued to the east along the southern flank (Figure 2). The first area of landfilling (referred to as the Closed Landfill) was initially quarried for crushed rock after which it received waste from 1945 to 1977. In 1977, the Closed Landfill was capped with soil and closed. Subsequent landfill development progressed eastward across the site. Recently, in 2019, VLI began source removal of the Closed Landfill, which physically removed the old waste and hauled it to Cell 5 in the active part of the landfill. This process continued into 2021 at which time the entire waste mass of the Closed Landfill will have been removed.

In 1975, VLI began filling Cells 1 and 1A, with most waste being placed in Cell 1 beginning in 1977. Cell 1A (approximately 4 acres) primarily handled waste from Teledyne Wah Chang and was not used for disposal after 1988. Cell 1 (approximately 30 acres) has a clay bottom liner and leachate collection system that conveyed the leachate to an adjacent holding pond. Placement of waste in Cell 1 stopped in early 1993, when cell 2B was constructed. Cell 1A has gone through final closure, and Cell 1 has been closed along the southern, central, and western parts. A “piggyback” liner system was constructed over the east side of Cell 1 as part of the development of Cell 3D. The lower half was constructed in 2006, and the upper half constructed in 2008. Final stages of

filling Cell 2 ended in 2004 with final cover constructed along its southern flank in summer 2003.

Cell 3 has also been filled, and final closure construction has occurred over a portion of the south face of Cell 3. Cell 4 was constructed in summer 2011 with operations moving into the northern half of that cell in fall 2011. In summer 2012, the remaining features of Cell 4 were completed, including moving the primary and secondary leachate sumps to their locations on the southern perimeter of the cell. Cell 5A was excavated north of Cell 4 in summer 2012 with construction completed in 2013**.** Cells 5B, 5C, 5D and 5E were excavated over the summers of 2015 to 2017. Cell 5B was subsequently completed in the summer of 2017, Cell 5C during the summer of 2019, and Cell 5D completion is currently under construction. Filling operations are currently taking place in Cell 5C.

Coffin Butte serves Benton, Linn, Polk, Lincoln, and Tillamook counties. The facility is permitted as a municipal solid waste disposal site and is authorized under Section 5 of its solid waste permit to accept domestic, commercial, industrial, construction, demolition, and agricultural waste, sewage sludge and grit, petroleum contaminated soil, and asbestos.

3.2 Site Geology and Hydrogeology

The geology and hydrogeology of the site have been described in a number of documents. One of the most comprehensive was the site characterization report for Cell 3 (EMCON, 1999), which synthesized the regional and site geology and hydrogeology from a number of earlier reports and the scientific literature. Discussions of water quality conditions at the site are summarized in annual reports (since 1992), the remedial investigation and its addendum (EMCON, 1994, 1996b), the preliminary assessment for the area downgradient of the 1977-closed landfill (EMCON, 1996a), previous versions of the EMP (EMCON, 1997; TC, 2005, 2011a, 2012b) and the focused risk assessment and feasibility study (TC, 2003a). The following descriptions are taken primarily from the EMP, and has been updated to include information from more recent drilling associated with Cell 5, and with regard to current trends in groundwater quality at the site as it is relevant to the south development area.

3.2.1 Hydrogeologic Units

The current cells of the landfill are situated along the south flank of Coffin Butte (Figure 2). In undeveloped areas, the upper third (approximately) of the butte consists of steep grass-covered slopes, the middle third of exposed bedrock with little vegetation, and the lower third of gentle, soil-covered slopes. The development area borders an interior, north-facing drainage of Poison Oak Hill. The upper part of the hill is steeper, forest-covered slopes, with the lower areas either grassy or developed as part of the landfill infrastructure. Generally, the upper slopes from the top of Poison Oak Hill to

approximately the current locations of the leachate ponds are underlain by basalt bedrock and the lower, flatter slopes underlain by alluvium that generally consist of silty clay to clayey silt with variable amounts of thin, interbedded sands and silty to sandy gravel (commonly referred to as Willamette Silt). The lower slope transitions eastward to the relatively flat Willamette Valley where alluvium is transected by small drainages or creeks. For the current landfill, solid waste in Cells 1/1A and the Closed Landfill is generally inferred to rest on bedrock, which in places was lined with clay (e.g., in Cell 1). Cells 2 through 5 are constructed with composite liners and leak detection systems, with Cells 3 through 5 also designed with underdrains. The vertical relationship of alluvium, bedrock, and waste units in the east side of the landfill, Cell 2 and 4 area is illustrated in Appendix A, Figure 2-2 from the EMP.

There are two principal water-bearing units: unconsolidated alluvium and bedrock volcanics. Groundwater occurs in both units, although the alluvial deposits are absent or unsaturated over much of the site where the development area occurs. Where both units are present, they are not separated by a confining layer but are hydraulically interconnected. The two units are monitored separately by groundwater monitoring wells.

3.2.2 Groundwater Occurrence and Flow

Depth to groundwater depends on season and topography. In site wells, the groundwater depths can range from over 80 feet below the ground surface midway up the slopes of Coffin Butte (in bedrock) to less than 1 foot in the flat lowland area southeast of the butte (in alluvium). For wells MW-8S, MW-8D, MW-15, and MW-16 (now decommissioned), which are within or adjacent to the development area, seasonal fluctuations vary, depending on the hydrogeologic position of the monitoring point (see Figure 3 for monitoring well locations). Typically, the lowest groundwater elevations are in late summer to fall and the highest in winter and spring. This is illustrated in Figure 4, which are historical hydrographs for those wells.

The direction of groundwater flow is controlled by the topographic setting of Coffin Butte and Poison Oak Hill and the intervening low areas. Groundwater in the bedrock generally flows downslope from the hills until it reaches a groundwater divide near the southeast corner of Cell 1 and southwest part of Cell 3. At the divide, groundwater flows toward the east and west, generally following the long axes of the valleys (Appendix A, Figure 2-3). Groundwater flow direction in the saturated portion of the alluvium mimics the underlying bedrock (Appendix A, Figure 2-4). In areas dissected by surface drainages, groundwater in the upper part of the alluvial aquifer discharges to surface creeks, such as Soap Creek west of the landfill, or Luckiamute Creek to the east, and during the summer months provides base flow. Near upland areas, groundwater in bedrock also can provide base flow to surface creeks, for instance, in Soap Creek, weathered basalt bedrock is exposed in the stream bed between surface water locations

S-2 and S-4. Groundwater contours for the entire site for the most recent sampling events in April and October 2020 are shown in Appendix A, Figures 3-5 and 3-6.

Estimates of horizontal groundwater velocity (Vh) are typically calculated at the Coffin Butte Landfill for the east side, beneath Cell 4. Beneath this part of the landfill, Vh is calculated at approximately 6.4 ft/yr, given a hydraulic conductivity of 0.22 ft/day for the alluvium, an estimated effective porosity of 25 percent (literature values in Morris and Johnson, 1967), and a hydraulic gradient of 0.02 ft/ft.[1] Current estimates of groundwater flow for other parts of the site can be found in the 2020 annual report (Tuppan, 2021).

3.3 Water Quality

The discussion of water quality focuses on the east side of the landfill, and includes current monitoring and underdrains in the development area. For the east side of the landfill, monitoring is in the detection mode, focusing on characteristics of the natural or baseline water quality and how to recognize impacts from the landfill. Additional water quality information and time-series concentration plots for groundwater and underdrains can be found in the 2020 annual report (Tuppan, 2021).

3.3.1 East Side – North of Coffin Butte Road

Cell 2 and Cell 3 – Detection Well MW-24. Wells near Cell 2 include detection well MW-24 at the southern intersection of Cells 2A and 3, and MW-23 discussed below. Well MW-24 is completed in shallow weathered bedrock (the alluvium is not saturated in this area). Trends for indicator parameters in MW-24 are stable and reflect natural water quality in the area.

Cell 2 – Detection Well MW-23. Early in its history, detection well MW-23 had shown increases for bicarbonate alkalinity, chloride, hardness, total dissolved solids (TDS), for five of the major dissolved metals, and for arsenic. This had been attributed to localized seepage of leachate from the south side of the landfill that was remedied soon thereafter. Since 2000 to 2001, the upward trends for indicator parameters have peaked, and after about 2009 to 2011, most of these constituents declined to within or just above the range of background concentrations. With the exception of chloride, which is a few milligrams per liter higher than background, the concentrations in 2020 were at these lower values near or within background levels.

Cell 4 – Compliance Wells MW-26 and MW-27. These wells were first sampled in November 2011 and accumulated quarterly baseline water quality data throughout 2013.

[1] The mean hydraulic conductivity for alluvium and bedrock was evaluated from pumping and slug test data collected from 1985 to 1993 as reported in the remedial investigation (EMCON, 1994). Geometric means were calculated for each unit after examining boring logs to verify hydrogeologic unit. Values used in annual reports are as follows: alluvium, 0.22 ft/day; bedrock, 2.7 ft/day.

Examination of the trends show relatively lower and stable concentrations at MW-26 than at MW-27, which typically has a wider range of concentrations. Concentrations for several parameters at MW-27 can be quite variable. This is likely caused by two conditions at MW-27. First, the water bearing zone that the well monitors has very low permeability, requiring the well to be purged one day and then sampled the following after it recharges adequately. This does not allow the purge water to stabilize during sampling, so that water samples can be affected unevenly from sampling event to sampling event. The second condition is the mineral composition of the formation opposite the screened interval, which is composed of organic clay with up to 10 percent fine sand. The presence of the organics is likely from an ancient bog that was mapped in the base of the Cell 4 excavation.

3.3.2 Development Area – North Slope of Poison Oak Hill

In wells MW-8S and MW-15, concentrations of inorganic indicators in 2020 continued longer-term trends of past years. At MW-8S, an earlier increasing trend for chloride peaked in 2001 and is now declining gradually, while at MW-15, chloride concentrations have been more variable to upward since 2010; other indicatory parameters have been relatively stable or declining. Trace metals were detected at low to trace concentrations, or were not detected in 2020 and no VOCs were detected. Before it was decommissioned in 2004, concentrations of chloride and sodium at MW-16, which was upgradient of MW-15, were typically lower than at MW-15. This is likely due to naturally occurring saline, connate water in the fine-grained sediments in this area, in which MW-15 is screened. This water quality contrasts with MW-16, which is screened in fresh bedrock, and has naturally lower concentrations for site indicator compounds than the alluvium.

3.3.3 Surface Water and Underdrains

Surface water is not sampled in the development area. However, underdrains that daylight to surface water are sampled in two location: S-U4 that drains from below the East Leachate Pond and S-U5, which drain from below the West Leachate Pond.

Water quality from underdrain S-U4 represents baseline concentrations, with values for inorganic compounds and dissolved metals comparable to or lower than concentrations at MW-16, which was the background well that monitored bedrock in the pond location before it was decommissioned in 2004. Since monitoring began, concentrations for the indictor parameters have been steady and exemplify a condition of no leakage from the overlying pond.

Beginning in October 2010, VLI began sampling S-U5, which drains from below the West Leachate Pond. The drain pipe also connects with another pipe that drains from below the concrete pad of the non-operational Leachate Treatment Plant. It should be noted that minor differences are expected between underdrain S-U5 water quality and

groundwater quality at MW-16, since these two monitoring points are not immediately proximal to each other. Nevertheless, trend plots illustrate that water quality at the two points is very close. Similar to water quality results at S-U4, the steady trends at S-U5 suggest no leakage from the overlying liner system for the West Leachate Pond.

3.4 Existing Monitoring Network

The water quality monitoring network at Coffin Butte Landfill has five components: (1) groundwater monitoring wells, which include compliance and detection wells, (2) water level observation wells and piezometers, (3) the secondary leachate collection system (SLCS), (4) leachate sumps, and (5) surface water monitoring points. In addition to water quality, landfill gas is monitored at probes surrounding the landfill, and in buildings or structures near the landfill. The rationale for the network design and the media monitored was presented in the EMP (Tuppan, 2014b). The water quality monitoring locations are summarized on Table 1. A summary of the well construction, survey information, and lithologic completion intervals is provided in Table 2. Boring logs and construction diagrams for wells in the development and adjacent area are provided in Appendix B.

3.5 Geotechnical Information

Information about geotechnical considerations and landfill liner designs can be found in design or characterization reports for Cell 3 (Thiel, 1999), Cell 4 (Tuppan, 2011), Cell 5A (Thiel, 2012), the west leachate pond (Thiel, 1998), and from site development reports completed in 2000 (Thiel, 2000), 2011 (Ausenco-Vector, 2011), with an amendment to the 2011 plan in 2013 (Thiel, 2013). These reports contain geotechnical data, calculations, stability analyses, groundwater seepage estimates, geotechnical laboratory testing results, logs for test pits and boring logs, and design drawings for the landfill cells or pond. While potentially relevant to the current development project, much of the specific data is for soil or areas outside the planned landfill footprint. Therefore, more site-specific data will be collected as part of the scope of work to be developed in Section 4 of this plan.

As part of locating the test pits and geotechnical borings, we will incorporate information from past site investigations, specifically for boring and test pits from the west leachate pond study which are shown on Figure 5 along with the proposed locations. We will also be using information from monitoring wells drilled within the development area or along Coffin Butte Road to assist with identifying potential depths of borings based on existing knowledge. Finally, surface geologic mapping of the subgrade of the East Leachate Pond will be used as the starting point for extending surface mapping to other areas of the development footprint.

4 DATA GAPS AND PROPOSED CHARACTERIZATION

This section reviews the available hydrogeologic and geotechnical data reported in past investigations and compares it with the elements of DEQ's site characterization guidance to identify data gaps as the basis for the proposed scope of work and approach. We intend to mine the trove of available documents to meet these data needs where possible. In addition, this section discusses goals of the proposed characterization, the types of information to be gathered, and the rationale for the proposed work scope. The intent is to define general tasks that will be described in more detail in Section 5.

4.1 Phase I Data Elements Evaluation

4.1.1 Existing Conditions

Information from earlier documents, Benton County assessors office, and mapping done for previous studies will be consolidated for the development area. Tasks will include:

- Prepare the report sections on the site location, legal description, and the vicinity, including area and site maps, from earlier documents, as available. If information is out of date, then provide current data.

- Aerial photographs of the site are typically taken annually to evaluate amount of fill at the active landfill area. Depending on the year, these images also include areas outside the landfill area. For this task we will find recent aerial views of the site and vicinity, using either custom images or those from readily available sources such as from the University of Oregon or from Google.

4.1.2 Climate and Meteorology

This information has been included in both the Cell 3 report (EMCON, 1999) and West Leachate Pond report (Thiel, 1998). Tasks will include summarizing this earlier information and, if available from the Oregon Climate Service at Oregon State University's webpage, updating it to include data through the year 2020.

4.1.3 Hydrology

Information on surface water drainages at the site and of the surrounding area was included in the Cell 3 report and can be found as Figure 1 in Appendix A. Tasks for this element will be to include a figure similar to Figure 1, and in addition, include larger scale maps (1:24,000) from the U.S. Geological Survey. These topographic quadrangle maps (Airlie South and Lewisburg 7.5 minute quadrangles) show the drainages and topography of the surrounding area. The landfill development area will be indicated on the maps.

4.1.4 Water Balance

Analysis of the site area's water balance presented in the Cell 3 site characterization report (EMCON, 1999). The purpose of the water balance calculated in the report was to evaluate the landfill's predevelopment environment (i.e., if no landfill was present at the site), and to predict the relative amount of recharge to groundwater expected in the area. The Thornwaite and Mather (1957) method was used to estimate the average annual balance between precipitation, evapotranspiration, runoff, and percolation (groundwater recharge). This analysis is still valid for the area and will be used for the development area site characterization report. The task for this element will be to include the water balance as an appendix to the development area report.

4.1.5 Water Use Inventory

As part of the Cell 3 characterization, a door-to-door survey of water wells was performed for residences within a one-mile radius of the Coffin Butte Landfill in May and June 1999. That survey was an update of water well surveys previously submitted, which included the original survey conducted in 1986 by Sweet, Edwards & Associates (SEA, 1986), the Cell 2 site characterization report (EMCON, 1992) the response to review of Cell 2 site characterization report (EMCON, 1993a), and the remedial investigation and additional hydrogeologic report (EMCON, 1994). The 1999 survey consisted of obtaining copies of well logs from the Oregon WRD and interviewing the residences within a one-mile radius of the landfill. Interviews were documented in an appendix to that report.

Given that a door-to-door survey was already completed in 1999, and since then, documentation by drillers for the installation of new water supply wells is required, this new well information is part of the database kept by the WRD. Therefore, no door-to-door survey is proposed for this phase of development. However, the following tasks will be completed to update the older water use inventory:

- Search the WRD website for wells drilled since 1999 within the area of interest, and then download copies of those wells and create a table that lists the wells and information from both the earlier survey and the new well search.

- Develop a drawing that illustrates locations of wells by property within a one-mile radius of the development area. Well identifications will be cross-indexed to the compiled table with the well information.

- Compile an appendix with well logs and survey sheets from the 1999 survey, and well logs from the 2021 WRD database search. Because of its volume, this appendix will be in a portable document format (PDF) only.

4.1.6 Geology, Hydrogeology and Geologic Hazards Summary

Most of the information required for a preliminary geology and hydrogeology investigation is available from past studies at the site. Sections 3.2 and 3.3 briefly summarized some of the available information. Tasks for this part of the development area report will include:

- Describe the regional site setting for the landfill as augmented by available geologic and hydrogeologic maps from technical literature and from site specific studies completed for the site.

- Provide supporting documentation and figures illustrating the relationship between hydrogeologic units at the site and the proposed landfill.

Geologic hazards and earthquake safety have been discussed in site development plans (SDP) and a SDP amendment (Thiel, 2000; Ausenco, 2011; Thiel, 2013) as part of reviewing location criteria for siting municipal solid waste landfills. These reports found that there were no known Holocene faults within 200 feet of the landfill boundary, and that landfill cells have been, and will continue to be, designed for potential seismic events as described in the solid waste rules. In addition, there were no unusual unstable areas or foundation conditions known to exist that would adversely impact landfill development. Moreover, detailed geotechnical evaluations had been routinely conducted as part of each new cell development.

These earlier planning documents will be used to initially support our understanding for the geologic hazards analysis. Tasks for this element as they relate to the development area include:

- Discuss geologic hazards that could potentially be relevant to the site consistent with guidance Section 2.7 and that includes location restrictions under OAR 340-94-030 to address considerations such as Holocene fault zones, seismic impact areas and unstable areas.

- Evaluate the earthquake safety of the site, including relative to its seismotectonic setting and seismic history of the area, the potential for area to be affected by surface rupture, probable response of site to likely earthquakes, including estimated ground motion, maximum ground acceleration, velocity and displacement, the potential for area to be affected by earthquake-induced landslides or soil liquefaction, and the potential for the area to be affected by regional tectonic deformation (subsidence or uplift). This evaluation will be presented as part of the geotechnical investigation for the site.

4.2 Phase II Characterization Goals and Tasks

The Phase II site characterization will combine a compilation of the known data for the development area with a scope of work to acquire and assess new field data. Goals of the field work are to round out our knowledge of the geology and hydrogeology of this area, including stratigraphic units encountered; the depth to the uppermost water-bearing zone, and other potential zones of contaminant transport; and acquiring geotechnical data that will be used to support an engineering analysis for the landfill design. The following sections briefly summarize some the of existing information and then propose tasks to fill data gaps. A detailed scope of work that describes field tasks, including locations and depths of borings and test pits is provided in Section 5.

4.2.1 Distribution of Geologic and Hydrogeologic Units

The surficial soil in the development area is alluvium which is underlain by bedrock that is weathered to varying degrees. The goal of geologic characterization is to supplement existing lithologic information with regard to the horizontal and vertical extent of geologic units in the development area and to characterize their engineering properties. One of the products of this work will be to create an isopach map of the alluvium and identify the horizontal and vertical extent relative to the underlying bedrock. Another goal will be to further characterize the degree of weathering in the basalt bedrock. In areas across the site, the degree of bedrock weathering ranges from clay and silt to sand, gravel, a mix of sand and gravel, or a combination of weathered rock fine-grained rock and unweathered, hard rock.

Office and field tasks will include:

- Review lithologic data from test pits, boreholes, and surface mapping.

- Supplement surface geologic mapping as needed, beginning with existing mapping done for the east leachate pond.

- Log lithology of cores or cuttings from the proposed borings and test pits and test samples as described below.

- Note groundwater and moisture conditions in test pits and borings.

4.2.2 Geotechnical Evaluation

The site is founded on a firm, competent geologic formation comprised of fresh basalt, weathered basalt, and some thin veneers of alluvium in the flatter areas away from Poison Oak Hill. At other areas of landfill development north of Coffin Butte Road, the only geotechnical constraints at the site were global slope stability issues driven by the relative geometries of the bottom liner system, and the height and slope of the final landfill (Ausenco, 2011).

The proposed scope of work was developed to provide design-level data for relevant engineering analyses. The data will be used to assess the suitability of on-site material for facility construction and the integrity of the soil and underlying material for stability in constructing the landfill. Types of data collected during field tasks include mapping the types and distribution of soils at the site, as well as noting the engineering properties of soil structure in test pits and borings. Wallace Group staff will oversee tasks that will include:

- Review and evaluate available geologic, hydrogeologic, and geotechnical data for the Coffin Butte Landfill and surrounding Benton County area.

- Drill borings within the proposed landfill footprint, proposed leachate ponds area, and a new access road. The borings will be drilled to depths of approximately 25 to 150 feet below ground surface (bgs).

- Excavate test pits within the proposed landfill footprint and leachate ponds area. Exploration depth(s) are estimated at 10 to 12 feet bgs.

- Measure and record the depth to groundwater, if encountered, at each exploration location.

- Perform laboratory testing to evaluate and confirm the engineering and index properties of the soil and rock materials encountered. We anticipate laboratory testing will include grain-size analysis, moisture content, Atterberg limits, hydraulic conductivity, consolidation, unconsolidated undrained triaxial testing (TxUU), and consolidated undrained triaxial testing (TxICU).

- Conduct a design-level geotechnical engineering analyses focused on providing site-specific design criteria based on the project design documents.

4.3 Groundwater Characterization Elements

The solid waste guidance provides for characterization of the groundwater aspects of the proposed landfill development. Objectives of tasks typically include determining the direction and rate of groundwater flow beneath the site, as well as testing the water quality. While not included with this workplan, these site characterization elements are planned for future phases as described below.

4.3.1 Monitoring Network Modifications

The scope of work and details for modifying the groundwater monitoring network in the development area are contingent on the design for the landfill and ancillary structures. After these designs are further along and the timing (e.g., for earthwork and construction) has been finalized, we will be able to better determine the phasing and details of the tasks, such as well installation or decommissioning, and water quality sampling.

Having said that, in general we anticipate the following changes to the monitoring network:

- Install upgradient piezometers. Up to four piezometers will be installed along the new access road that is planned south of the landfill footprint. These piezometers will provide piezometric control along the upgradient boundary of the landfill.

- Install one cross/downgradient well along the eastern side of the landfill, approximately 500 feet upslope of existing wells MW-8S/8D.

- Re-designate wells MW-8S/8D, on the northeast perimeter of the development area, as compliance wells.

- Install one downgradient compliance well on the west side of the landfill, at the approximate location of the landfill office.

- Potentially re-designate MW-14S/14D, which are along the northwest edge of the development footprint, as compliance wells.

- Decommission wells along Coffin Butte Road that are within the development area footprint. These include: MW-23 and MW-24, and methane probes GP-5A, and GP-6.

4.3.2 Water Quality Monitoring

As noted earlier, installation of new groundwater monitoring wells is not proposed for this phase of site characterization for several reasons. First, the locations being considered for upgradient wells are along the new access road that will be constructed south of the landfill footprint. The wells can only be installed after the road is constructed because of the amount of excavation (over 100 feet vertical) from the current topography to the proposed road elevation. Second, cross gradient to potentially downgradient locations will be in the way of earthwork activities if they are installed too soon—and could be destroyed. Therefore we advise to install these wells after most of the landfill construction is complete. And last, two wells that we are considering at a downgradient location (MW-8S and MW-8D) will hopefully be preserved during landfill and infrastructure construction. During the interim, we will continue to monitor them consistent with the current monitoring program.

4.3.3 Hydraulic Testing

Hydraulic properties of site hydrogeologic units have been estimated in the past from pumping tests and slug tests. Pumping tests indicate that shallow (weathered) and deeper (unweathered) parts of the bedrock hydrogeologic unit are hydraulically interconnected. During the remedial investigation, slug tests were conducted in seven site wells. Results for horizontal hydraulic conductivity were consistent with those estimated from earlier pumping tests.

The differences in hydraulic properties between units can be accounted for by observing variations in site lithology (EMCON, 1999). In wells completed in alluvial sediments, soils consist of clays and clayey gravels or sands, and the associated hydraulic conductivity is relatively low. The range of values for bedrock can be attributed to the degree of weathering and fracturing in the bedrock. In wells completed in basalt that is intensely fractured with deep to moderate weathering, and where fractures are not filled with clays, the hydraulic conductivity values are higher. In wells completed in rocks that are deeply weathered or decomposed to clay and sand, and that are intensely fractured with clay minerals filling the fractures, the values for hydraulic conductivity are lower.

It is expected that the hydraulic properties from the existing landfill wells will be similar to those proposed for the development area because of the comparable range of rock types. Therefore, on a preliminary basis, values for hydraulic conductivity from the site will be assumed for the development area. However, as part of future scope of work after new upgradient and cross/down gradient wells are installed, we will develop a testing program to verify that this assumption is valid.

5 SCOPE OF WORK

The scope of work outlined in this section describes tasks that will be completed during the 2021 field season in anticipation of site development in subsequent years. Expanding into the area south of Coffin Butte Road is currently planned for summers of 2023 (earthwork) and 2024 (liner construction). The first two sections below provide the rationale and criteria for lateral distribution and depths of geotechnical borings in the investigation areas. Later sections described in more detail the procedures for field activities and laboratory testing. Data collected during field tasks include mapping the types and distribution of soils, as well as noting the presence of soil structure in test pits and borings.

5.1 Distribution of Test Pits and Geotechnical Borings

Objectives of the field work will be to identify thickness of alluvium and soil conditions at depth, provide information on the types of soils in areas of cut or fill, and better understand limits of bedrock weathering and soil stability at depth. Findings will be used to develop geologic cross sections that can then be used to identify what to expect with earthwork excavation, design of the engineered excavation, and road construction phases of development, as well feed into design considerations for the landfill.

The proposed distribution of new borings and test pits balances the need for equally-spaced locations across the development area with existing information from borings, test pits, and mapping. We also considered access and the presence of existing structures or soil stockpile, which occupies an area along Coffin Butte Road in the northeast sector of the landfill footprint. The locations shown in Figure 5 are preliminary, and may be moved depending on access issues such as steepness of existing slopes and forest cover. In addition, the depth of the borings may be adjusted depending on the formation, resistance to drilling, and soil moisture content noted during drilling.

Overall, fourteen geotechnical borings from approximately 20- to 140-feet deep and at least 10 test pits are planned in the following areas:

- **Landfill Footprint Borings.** Seven geotechnical borings are spaced throughout the area consistent with existing information from geotechnical borings and wells previously constructed. Borings are shown for areas with

both saturated and unsaturated alluvium, as well as uphill of the surface contact with alluvium in basalt.

- **Landfill Footprint Test Pits.** Up to seven test pits are planned for this area. The locations focus on defining the thickness of the alluvium and competence of soils below alluvial clay, as well as thickness of colluvium or weathered soil above competent bedrock.

- **Leachate Pond Borings.** Three geotechnical borings are spaced throughout the area, with one of the borings (BH-12) also serving to inform the conditions below the new access road.

- **Leachate Pond Test Pits.** Three test pits are planned for this area, one of which also will be placed along the new access road.

- **Access Road Boring.** Along the new access road located on the south side of the development area, cuts are planned for over 100 feet. To better understand the rock quality at these depths, in addition to other locations along the road, four geotechnical borings are planned.

5.2 Proposed Boring Depths

The anticipated depths are based on existing borehole information that indicates depth to basalt bedrock (i.e., to competent soils or rock) below alluvium within the footprint could be up to 23 feet deep. As needed, the borings will be extended deeper until competent soils, or refusal, are encountered, or to more fully characterize rock conditions potentially associated with cut slopes associated with the new access road.

The borings will be drilled to the approximate depths shown on Table 3, which lists the existing ground elevation and the design elevation, the expected boring depth, as well as coordinates. The table is meant to provide borehole details relative to the landfill liner, but also to assist the field geologist with regard to the depth at which to expect lithologic units. Several criteria were considered in estimating borehole depth. These include:

- For boreholes within areas of cut/excavation, based on our current understanding of site geology, it is likely that the cut will be in bedrock, which could be hard basalt or weathered to varying degrees. The target depth is to drill at least 20 feet below the estimated liner base and penetrate deep enough to encounter competent soil or rock.

- For boreholes in areas of fill, drill through the thickness of alluvium into underlying bedrock until competent soils are encountered or refusal at bedrock, this is estimated at approximately 25 feet. This will allow estimating the

thickness of the underlying hydrogeologic unit (alluvium) below the fill and liner, as well as note groundwater conditions within the underlying unit.

- For the borings along the access road or deepest cut, drill to the elevation of the proposed road or cut, which is estimated at a depth of 140 feet (e.g., BH-5).

5.3 Field Activities

Preliminary locations for test pits and borings may be moved as field conditions dictate on the basis of access or the presence of overhead obstructions. In addition, the depth of the borings may be adjusted depending on the formation and soil moisture content noted during drilling.

5.3.1 Geologic Mapping

The purpose of geologic mapping will be to better understand the lateral continuity of lithologic units, the transition laterally between units, and how geologic material and structural fabric could affect the flow of groundwater in the subsurface. In the development area, exposures of weathered basalt pillow structures are present along southwest embankment of the West Leachate Pond. Mapping of the East Leachate Pond subgrade in 2004 found basalt weathered to varying degrees: from extremely weathered zones consisting of plastic clay with abundant secondary minerals, to less weathered zones that contained fine- to coarse-grained sand with cobbles. The weathered zones transition from clay above sandy and friable soil, which is underlain by fresh basalt that is hard.

A geologist will map the surface geology of the northern side of Poison Oak Hill to identify any features of geologic interest and to help optimize placement of geotechnical borings or test pits. The mapping will extend from existing surface mapping that was completed in 2004. Ultimately, the goal of surface mapping will be integrate this information with subsurface exploration that includes the test pits and borings.

5.3.2 Test Pits

The primary purpose of test pits is to acquire information on the engineering properties of shallow soils in a rapid fashion to assess the distribution, character, and geotechnical properties of shallow soil. For the development project, the test pits will be excavated with three goals: (1) define the upper limit of alluvium against Poison Oak Hill, (2) explore the geotechnical properties of the alluvium in landfill areas that will be founded on alluvium, and (3) explore the area where the new leachate ponds will be constructed.

Up to ten test pits will be excavated with a backhoe within the proposed landfill and leachate pond areas. Total exploration depth(s) are estimated at 10 to 12 feet bgs. The geologist will log the soil and collect bulk samples for geotechnical evaluation and lab testing. Soil and rock conditions logged during excavation will be recorded in the field on test pit logs. If groundwater is encountered during excavation, the level at which the water was first encountered and the water level at the end of excavation activities will be recorded. We will also perform Dynamic Cone Penetrometer (DCP) tests to evaluate relative density or strength of near-surface alluvial soils. An example of a test pit log can be found in Appendix C.

5.3.3 Borehole Drilling and Soil Sampling

Borings will be drilled within the proposed landfill development and proposed leachate pond areas using a track-mounted drilling rig equipped with mud-rotary drilling/rock coring equipment. The field geologist will collect soil samples during drilling using Shelby tube, modified California, and standard penetration testing (SPT). Sampling and SPT testing will be performed at approximate 2.0-foot intervals until auger refusal is encountered.

Boreholes will be abandoned consistent with applicable rules and guidelines described in "Construction, Maintenance and Abandonment of Monitoring Wells and Other Holes in Oregon" (OAR 690-240; 1995) and the DEQ guidelines for Groundwater monitoring well drilling, construction, and decommissioning (DEQ, 1992).

The borings will be drilled with 6-inch-outside diameter solid-flight auger or using rotary wash methods to a minimum depth of 25 feet. This depth should adequately penetrate the alluvium in all areas of proposed exploration. The borings will be sampled at an approximately 2.0-foot interval using one of four sampling techniques, depending on the depth interval, soil type, and requirements of the geotechnical testing program. These include:

- Standard penetration test (SPT) split spoon samples with autohammer: test every 2 feet as conditions allow or until refusal.
- 2.5-inch-diameter modified California sampler: test every 2 feet as conditions allow or until refusal.
- Undisturbed 3-inch-diameter Shelby Tube samples: test as needed where soft to medium stiff silt and clay are encountered.
- HQ-wireline rock coring: advance after auger refusal is encountered to the proposed boring refusal depth.

A geologist or professional engineer, registered in Oregon, will log the soil samples or cores consistent with the procedures of the American Society for Testing and Materials. The logging will describe texture, color, mineralogy, moisture content, degree of weathering, or other relevant characteristics of the sampled material. Field procedures will follow Wallace quality assurance and quality control standards. Drilling and soils information will be recorded in the field on boring-log forms (example of the form can be found in Appendix C). The borehole will be backfilled with bentonite chips and hydrated with clean water.

5.3.4 Laboratory Testing

Table 4 outlines the proposed geotechnical laboratory testing program for test pit soil and borehole core samples. The testing will used to evaluate and confirm the engineering and index properties of the soil and rock materials encountered. We anticipate laboratory testing will include grain-size analysis, moisture content, Atterberg limits, hydraulic conductivity, consolidation, unconsolidated undrained triaxial testing (TxUU), and consolidated undrained triaxial testing (TxICU).

Test Pits. Tests will be assigned by the engineer based on a review of the test pit logs. A typical suite of tests could include grain size (ASTM D422), Atterberg limits (ASTM D4318), and moisture content (ASTM D2216). If the material will be used for fills, then it is possible that moisture-density relations testing will be performed ("proctor" curve, ASTM D1557). If a local deposit of soft soil is encountered, it is possible that the engineer may assign additional testing from test pit samples.

Soil Borings. At a minimum, samples from each lithologic unit from each boring will be tested for the following:

- Particle size distribution by both sieve and hydrometer following ASTM methods D422 and D1140
- Atterberg limits following ASTM method D4318
- Classification by unified soil classification system following ASTM standard D2487.

In the event that soft soils are encountered that may affect foundation settlement and strength, additional sampling may be performed so that samples can be tested for consolidation and shear strength, as deemed appropriate by the geotechnical engineer. This may require deepening borings beyond the prescribed depths.

5.3.5 Surveying

Locations for borings and test pits will initially be laid out as described above on Figure 5. The northing and easting coordinates referenced to the Oregon State Plane Coordinate System will be estimated from the base map and then the locations surveyed and staked in the field for the drilling and test pit exploration. These locations can then be used to create site-specific cross sections that depict the geology of the development area.

6 REPORTING

A report documenting the investigation's findings will be submitted after completing site characterization activities and data interpretation. Hydrogeologic aspects, geotechnical findings, and laboratory testing results of the study will be reported in the following general format:

- Introduction
- Site background
- Investigation methods and procedures
- Discussion of findings
- Summary and conclusion

The report will be supported by necessary tables, figures, and appendices to provide detailed information. This will include boring logs and test pit logs, a geologic map and cross sections, piezometric map of the site as estimated from existing wells, hydrographs for site wells in the area of interest. The Wallace Group will prepare a separate report documenting the field and laboratory testing and providing geotechnical analyses or conclusions. The Wallace report will be an appendix to the site characterization report.

The geotechnical exploration report will include the following elements:

- Report text that characterizes and describes subsurface conditions and engineering properties of overburden deposits and on-site soils.
- Discussion of regional geology and seismicity.
- Vicinity and site maps illustrating development plans and exploration locations.
- Test pit and boring logs.
- Results of the laboratory testing program.
- Seismic site class, and discussion of seismic-induced hazards per 2019 OSSC Section 1803.7.

- Slope stability and settlement analysis.
- Retaining wall and lateral load design criteria.
- Guidelines for earthwork construction including recommendations for engineered excavations, site preparation, fill placement, and compaction.
- Site drainage recommendations.
- Supplemental Phase II Geotechnical Investigation scope recommendations, if warranted.

One bound copy of the report and a PDF version will be submitted to the DEQ.

7 SCHEDULE

The field activities are staged depending on the type of activity. In general, drilling activities are scheduled for drier summer months to avoid saturated surface soil. Tentative schedule is as follows, but will depend on the availability of the driller and constructing road access to the locations on the northern slope of Poison Oak Hill.

- Excavate test pits: mid August 2021
- Drill geotechnical borings: late August – early September 2021
- Laboratory testing: fall and winter of 2021

A report will be submitted to the DEQ within 180 days of completing the 2021 field activities.

REFERENCES

Ausenco Vector. 2011. Valley Landfills, Inc., Year 2011 Site Development Plan. Prepared for Valley Landfills, Inc., by Ausenco Vector, Grass Valley, California. Draft, November.

DEQ. 1992. Groundwater Monitoring Well Drilling, Construction, and Decommissioning. State of Oregon, Department of Environmental Quality. August 24.

DEQ. 1996. Solid Waste Guidance, Municipal Solid Waste Landfills. State of Oregon, Department of Environmental Quality. September 1.

DEQ. 2020. Solid Waste Disposal Site Permit No. 306. Issued by the Oregon Department of Environmental Quality, Western Region. Signed by Brian Fuller, July 28.

EMCON. 1992. Cell 2 Site Characterization Report. Prepared for Valley Landfills, Inc., by EMCON Northwest, Inc., Portland, Oregon. August.

EMCON. 1993. Letter (re: Response to Review of Cell 2 Site Characterization Report for the Coffin Butte Landfill) to A. Eldridge, Oregon Department of Environmental Quality, Portland, from E. Tuppan and D. Atwood, EMCON Northwest, Inc., Portland, Oregon. May 21.

EMCON. 1994. Remedial Investigation and Additional Hydrogeologic Investigation Report, Coffin Butte Landfill, Benton County, Oregon. Prepared for Valley Landfills, Inc., by EMCON Northwest, Inc., Portland, Oregon. February 4.

EMCON. 1996a. Preliminary Assessment, Coffin Butte Landfill, Benton County, Oregon. Prepared for Valley Landfills, Inc., by EMCON, Portland, Oregon. February 28.

EMCON. 1996b. Remedial Investigation Addendum, Coffin Butte Landfill, Benton County, Oregon. Prepared for Valley Landfills, Inc., by EMCON, Portland, Oregon. February 28.

EMCON. 1997. Environmental Monitoring Plan, Coffin Butte Landfill, Benton County, Oregon. Prepared for Valley Landfills, Inc., by EMCON, Portland, Oregon. February 25.

EMCON. 1999. Site Characterization – Cell 3, Coffin Butte Landfill, Benton County, Oregon. Prepared for Valley Landfills, Inc., by EMCON, Portland, Oregon. June 11.

EPA. 1975. Use of the Water Balance Method for Predicting Leachate Generation from Solid Waste Disposal Sites. U.S. Environmental Protection Agency, Office of Solid Waste Management Programs. Report SW-168.

EPA. 1984. The Hydrologic Evaluation of Landfill Performance (HELP) Model. U.S. Environmental Protection Agency, Office of Solid Waste & Emergency Response. EPA/530-SW-84-009. June.

OWRD. 1995. Administrative Rules for Construction, Maintenance and Abandonment of Monitoring Wells and Other Holes in Oregon, Chapter 690, Division 240. July.

SEA. 1986. Coffin Butte Landfill, Geotechnical Investigation. Prepared for Valley Landfills, Inc., by Sweet, Edwards & Associates, Inc., Kelso, Washington. May 19.

Thiel. 1998. Design Report, Leachate Surge Pond, Coffin Butte Landfill, Benton County, Oregon. Prepared for Valley Landfills, Inc., by Thiel Engineering, Oregon House, California. March 16.

Thiel. 1999. Design Report, Cell 3A, Coffin Butte Landfill, Benton County, Oregon. Prepared for Valley Landfills, Inc., by Thiel Engineering, Oregon House, California. March 25.

Thiel. 2000. Year 2000 Site Development Plan, Coffin Butte Landfill, Benton County, Oregon. Prepared for Valley Landfills, Inc., by Thiel Engineering, Oregon House, California. February 29.

Thiel. 2012. Coffin Butte Landfill Cell 5A Expansion Construction Drawings (Earthworks Only). Prepared for Valley Landfills, Inc., by Thiel Engineering, Oregon House, California. May 10.

Thiel. 2013. Year 2011 Site Development Plan Amendment 1, Coffin Butte Landfill, Benton County, Oregon. Prepared for Valley Landfills, Inc., by Thiel Engineering, Oregon House, California. November.

Tuppan. 2003. Focused risk assessment and feasibility study, Coffin Butte Landfill, Benton County, Oregon. Prepared for Valley Landfills, Inc. Corvallis, by Tuppan Consultants LLC, Lake Oswego, Oregon. September 23.

Tuppan. 2005. Environmental Monitoring Plan, Coffin Butte Landfill, Benton County, Oregon. Prepared for Valley Landfills, Inc., by Tuppan Consultants LLC, Lake Oswego, Oregon. December 16.

Tuppan. 2011a. Letter (re: Site Characterization, Cell 4, Coffin Butte Landfill) to H. Gao, Oregon Department of Environmental Quality, Salem, from E. Tuppan, Tuppan Consultants LLC, Lake Oswego, Oregon. March 22.

Tuppan. 2011b. Environmental Monitoring Plan, Coffin Butte Landfill, Benton County, Oregon. Prepared for Valley Landfills, Inc., by Tuppan Consultants LLC, Lake Oswego, Oregon. March 23.

Tuppan. 2012. Environmental Monitoring Plan, Coffin Butte Landfill, Benton County, Oregon. Prepared for Valley Landfills, Inc., by Tuppan Consultants LLC, Lake Oswego, Oregon. October 26 (Rev. 2).

Tuppan. 2014. Environmental Monitoring Plan, Coffin Butte Landfill, Benton County, Oregon, Revision 3. Prepared for Valley Landfills, Inc., by Tuppan Consultants LLC, Lake Oswego, Oregon. June 27.

Tuppan. 2021. 2020 Annual Environmental Monitoring Report, Coffin Butte Landfill, Benton County, Oregon. Prepared for Valley Landfills, Inc., by Tuppan Consultants LLC, Lake Oswego, Oregon. March 4.

Thornwaite, C. W., and J. R. Mather. 1957. The Water Balance. Centerton, N.J.: Laboratory of Climatology Publication 8.

Vector. 2010. Year 2010 site development plan, Coffin Butte Landfill, Benton County, Oregon. Prepared for Valley Landfills, Inc., by Vector Engineering, Inc., Grass Valley, California. Draft, January.

LIMITATIONS

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, nor the use of segregated portions of this report.

The purpose of a geologic/hydrogeologic study is to reasonably characterize existing site conditions based on the geology/hydrogeology of the area. In performing such a study, it is understood that a balance must be struck between a reasonable inquiry into the site conditions and an exhaustive analysis of each conceivable environmental characteristic. The following paragraphs discuss the assumptions and parameters under which such an opinion is rendered.

No investigation is thorough enough to describe all geologic/ hydrogeologic conditions of interest at a given site. If conditions have not been identified during the study, such a finding should not therefore be construed as a guarantee of the absence of such conditions at the site, but rather as the result of the services performed within the scope, limitations, and cost of the work performed.

We are unable to report on or accurately predict events that may change the site conditions after the described services are performed, whether occurring naturally or caused by external forces. We assume no responsibility for conditions we were not authorized to evaluate, or conditions not generally recognized as predictable when services were performed.

Geologic/hydrogeologic conditions may exist at the site that cannot be identified solely by visual observation. Where subsurface exploratory work was performed, our professional opinions are based in part on interpretation of data from discrete sampling locations that may not represent actual conditions at unsampled locations.

TABLES

Table 1
Description of Monitoring Network
Hydrogeologic and Geotechnical Characterization Workplan
Coffin Butte Landfill

Monitoring Program	Monitored Area	Position
Landfill Water Quality Monitoring Program		
Compliance Wells		
MW-1D, MW-3D, MW-12S, MW-12D	Cell 1	Downgradient
MW-10S, MW-10D, MW-11S, MW-11D	Cell 1A	Downgradient
MW-20, MW-21	Closed Landfill	Downgradient
MW-26, MW-27	Cells 2/3/4/5	Downgradient
Detection Wells		
MW-8S, MW-15	Former Leachate Irrigation Fields A/B	Downgradient
MW-17, MW-18, MW-19	Cells 1/1A	Downgradient
MW-23	Cell 2	Crossgradient
MW-24	Cells 2/3	Crossgradient
P-8	Cell 1	
Phillips	Domestic Water Quality	—
Other Monitoring Well Sites		
MW-9S	East boundary of property	—
Observation Wells/Piezometers		
MW-1S, MW-3S, MW-8D, MW-14S, MW-14D, PW-2, P-8, P-9, P-10, P-19, P-22, P-23 Duplex, Merril, Berkland	Various	—
Wetland Piezometers		
WP-1, WP-3, WP-5, WP-6, WP-8, WP-9	Fields South of Coffin Butte Road	Various
Quarry Piezometers		
QP-3S, QP-4S, QP-5N, QP-6N, QP-7N	Knife River Quarry and Coffin Butte	Various
Secondary Leachate Collection System		
LDS-2B	Cells 2B, 2C	Underneath
LDS-3	Cell 3	Underneath
LDS-4	Cell 4	Underneath
LDS-5	Cell 5	Underneath
LDS-WLP (formerly LDS-SP)	West Leachate Pond	Underneath
LDS-ELP	East Leachate Pond	Underneath
Leachate		
L-1	Cell 1	—
L-2B	Cells 2A, 2B, 2C, 2D	—
L-3	Cell 3	—
L-4	Cell 4	—
L-5	Cell 5	—
L-Pond	Active Leachate Pond (composite of cells)	
Surface Water		
S-1	Background (Soap Creek)	Upstream
S-2, S-4	Cell 1, 1A, Closed Landfill	Downstream
Underdrains		
S-U2 (end of pipe not accessible for sampling)	Cell 2C/D & Cell 4 (north half)	Underneath
S-U3	Cell 3	Underneath
S-U4	East Leachate Pond	Underneath
S-U5	West Leachate Pond	Underneath
S-U6 (typically dry-disharges to ditch)	Cell 4 (south half)	Underneath
S-U7 (Manhole east of cell-not accessible)	Cell 5A	Underneath
Stormwater Monitoring Program (1200Z Permit)		
Outfall (monitored by rock quarry operator)	Quarry/part of Cell 1A & Closed Landfill	Downstream
Outfall 001 (west end of western bioswale)	Cell 1	Downstream
Outfall 002 (northeast end of eastern bioswale)	Cells 2/3/4/5	Downstream

Table 2
Well Construction Summary
Hydrogeologic and Geotechnical Characterization Workplan
Coffin Butte Landfill

Location	Status	Northing	Easting	Ground Surface Elevation (ft msl)	Surveyed Reference Elevation (ft msl)	Casing Total Depth (ft bgs)	Screened Interval (ft bgs)	Filter Pack Interval (ft bgs)	Seal (ft bgs)	Well Casing Diameter (Inches)	Drilling Method	Date Well Installed	Lithology Screened
MONITORING/OBSERVATION WELLS													
MW-1S[a]		387,416.66	7,491,201.90	288.50	289.87	23.0	18-23	16-23	0-16	2	Air Rotary	1977	Weathered basalt
MW-1D[a]		387,416.66	7,491,201.90	288.50	289.89[b]	40.0	35-40	34-40	23-34	2	Air Rotary	1977	Weathered/fresh basalt
MW-3S[a]		387,396.95	7,490,459.59	284.70	285.86	26.0	21-26	20-26	0-20	2	Air Rotary	1977	Weathered basalt
MW-3D[a]		387,396.95	7,490,459.59	284.70	285.94[b]	54.3	49-54	47-54	26-47	2	Air Rotary	1977	Weathered/fresh basalt
MW-8S		388,038.13	7,493,295.09	240.63	244.01[b]	30.8	21-31	16-31	0-16	2	Air Rotary	07/30/85	Weathered basalt
MW-8D		388,052.73	7,493,306.08	240.50	244.04	75.0	65-75	60-75	0-60	2	Air Rotary	07/30/85	Fresh basalt
MW-9S		388,845.65	7,494,648.37	221.50	223.27	35.0	25-35	20-35	0-20	2	Air Rotary	08/02/85	Clay
MW-10S[c]		387,660.77	7,489,746.08	289.03	291.42[b]	41.1	30.1-40.1	25.8-41.1	0-25.8	2	Air Rotary	08/02/85	Weathered basalt
MW-10D[c]		387,643.53	7,489,746.11	289.02	291.38[b]	82.2	73.0-82.2	60.1-82.2	0-60.1	2	Air Rotary	08/02/85	Fresh basalt
MW-11S		387,680.08	7,489,428.44	274.80	274.71[b]	31.8	22-32	20-32	0-20	2	Air Rotary	08/05/85	Weathered basalt
MW-11D		387,686.42	7,489,409.28	274.80	274.96[b]	75.0	65-75	55-75	0-55	2	Air Rotary	08/05/85	Fresh basalt
MW-12S		387,336.24	7,490,830.96	283.80	285.59[b]	26.1	21-26	18.9-26.2	2-18.9	2	Air Rotary	09/19/91	Weathered/fresh basalt
MW-12D		387,334.96	7,490,848.71	283.80	285.43[b]	60.3	55-60	52.6-61.3	1.5-52.6	2	Air Rotary	09/19/91	Fresh basalt
MW-14S		387,482.52	7,491,484.81	287.50	289.58	30.1	19.5-29.5	16.5-30	1.5-16.5	4	Air Rotary	07/27/92	Weathered basalt
MW-14D		387,479.36	7,491,474.42	287.80	290.27	70.6	60-70	57.5-71	1-57.5	2	Air Rotary	07/24/92	Fresh basalt
MW-15		387,833.16	7,493,923.82	233.45	235.66[b]	28.9	19.0-28.0	16.5-29.0	0-16.5	2	HSA	07/14/93	Silt and gravel
MW-16	Decom. 5/24/04	113.19	2,052.21	281.70	284.03[b]	27.3	17.2-26.6	15.6-27.3	0-15.6	2	HSA	07/19/93	Fresh basalt
MW-17		387,070.74	7,490,136.83	277.45	279.67[b]	26.9	16.7-26.2	15.0-27.0	0-15.0	2	HSA	07/15/93	Weathered basalt and silt
MW-18		387,375.30	7,489,529.13	267.70	269.90[b]	20.9	11.2-20.8	9.0-21.4	0-9.0	2	HSA	07/15/93	Weathered basalt
MW-19		387,488.50	7,489,035.48	261.00	263.29[b]	23.0	13.5-23.0	11.7-24.1	0-11.7	2	HSA	07/16/93	Weathered basalt
MW-20		388,119.00	7,488,673.03	256.81	259.22[b]	21.4	11.3-20.7	9.5-22.5	0-9.5	2	HSA	07/15/93	Clay and gravel
MW-21		388,628.80	7,488,408.71	254.25	256.67[b]	16.9	11.0-16.7	9.0-17.0	0-9.0	2	HSA	07/15/93	Fresh basalt
MW-22	Decom. 5/24/11	1,275.42	2,857.32	232.73	235.30[b]	24.2	14.0-23.6	11.0-24.2	0-11.0	2	HSA	07/22/94	Silt
MW-23		388,063.30	7,493,044.16	242.81	244.76[b]	22.7	12.4-22.1	9.6-22.7	0-9.6	2	HSA	08/02/94	Silt, clay, and gravel
MW-24		387,649.83	7,492,104.33	273.94	276.76[b]	34.9	19.5-34.5	18.0-35.0	0-18.0	2	HSA	08/31/98	Weathered basalt
MW-25	Decom. 5/24/11	1,181.50	2,626.80	240.39	242.79[b]	32.5	13.5-23.5	11.0-24.0	0-11.0	2	HSA	06/04/99	Silt and clayey silt
MW-26		388,531.15	7,493,967.51	235.18	237.91	27.2	17.1-26.9	15.5-28.0	0-15.5	2	Sonic	10/17/11	Silt
MW-27		388,887.59	7,493,881.47	252.12	254.76	35.1	25.0-34.8	23.5-35.5	0-23.5	2	Sonic	10/17/11	Clay with organics
LANDFILL WATER SUPPLY													
PW-2		390,336.45	7,494,030.76	248.90	250.27	199.0	95-199 OH	none	0-95	8	Air Rotary	07/30/92	Fresh basalt
PRIVATE WATER SUPPLY													
Duplex		387,387.70	7,491,474.23	289.01	289.01	74.0	26-74 OH	none	0-20	6	Rotary	07/17/72	Basalt (?)
Berkland		386,460.23	7,491,290.65	327.63	327.63	220.0	20-220 OH	none	0-20	6	Rotary	05/01/78	Basalt and sandstone
Phillips		386,788.95	7,490,951.64	291.00	291.00	—	—	—	—	—	—	—	(?)
PIEZOMETERS													
P-8		387,080.97	7,490,932.94	282.40	284.02	28.4	18.7-27.6	16.4-29.0	0-16.4	2	HSA	07/13/93	Weathered basalt
P-9		388,471.86	7,488,728.28	273.66	276.01	23.3	17.2-23.0	15.0-23.3	0-15.0	2	HSA	07/15/93	Fresh basalt

Table 2
Well Construction Summary
Hydrogeologic and Geotechnical Characterization Workplan
Coffin Butte Landfill

Location	Status	Northing	Easting	Ground Surface Elevation (ft msl)	Surveyed Reference Elevation (ft msl)	Casing Total Depth (ft bgs)	Screened Interval (ft bgs)	Filter Pack Interval (ft bgs)	Seal (ft bgs)	Well Casing Diameter (Inches)	Drilling Method	Date Well Installed	Lithology Screened
P-10		388,460.45	7,488,223.46	243.00	245.12	18.0	7.7-17.2	5.7-18.5	0-5.7	2	HSA	07/20/93	Weath. basalt, gravel, silt
P-19		389,840.33	7,492,921.45	383.15	385.65	106.5	96.3-106.1	94.2-106.5	0-94.2	2	Air Rotary	08/17/12	Fresh basalt
P-22		389,903.79	7,492,050.39	636.87	638.60	77.5	57.5-77.1	53.9-77.5	0-53.9	2	Air Rotary	09/10/15	Fresh basalt
P-23		389,618.74	7,491,365.81	690.96	693.11	183.5	163.5-183.2	160.0-183.5	0-160.0	2	Air Rotary	09/10/15	Fresh basalt
QP-3S		389,271.51	7,489,751.98	601.70	502.02	354.4	333.4-353.8	330.5-354.4	0-330.5	2	Air Rotary	09/09/98	Fresh basalt
QP-4S	Domestic supply	389,331.43	7,490,639.37	717.15	718.95	403.1	363.1-403.1	NA	0-28.4	5	Air Rotary	09/15/98	Fresh basalt
QP-5N		389,743.36	7,490,857.39	601.48	601.53	230.9	200.3-230.3	197.7-230.9	0-197.7	2	Air Rotary	09/16/98	Fresh basalt
QP-6N		390,259.59	7,490,886.35	445.39	445.82	150.0	119.4-149.4	117.3-150.0	0-117.3	2	Air Rotary	09/18/98	Fresh basalt
QP-7N		390,199.84	7,490,195.48	374.43	374.80	119.6	89.0-119.0	85.2-119.6	0-85.2	2	Air Rotary	09/09/98	Fresh basalt
WP-1		387,199.43	7,488,891.35	257.33	259.83	13.8	8.6-13.1	Prepack	0-1	2	Push probe	01/18/08	Clay
WP-3		386,661.80	7,489,643.80	271.01	273.39	9.8	4.6-9.2	Prepack	0-1	2	Push probe	01/18/08	Clay-sandy silt
WP-5		386,542.49	7,488,194.58	258.94	261.55	12.0	6.8-11.3	Prepack	0-2	2	Push probe	01/18/08	Sandy clay - clay
WP-6		385,925.20	7,487,996.18	262.17	264.85	13.0	7.8-12.3	Prepack	0-1	2	Push probe	01/19/08	Silty clay - clay
WP-8		387,861.89	7,487,856.57	253.15	255.80	10.3	5.1-9.7	Prepack	0-1	2	Push probe	01/19/08	Silty clay
WP-9		387,470.03	7,486,845.01	255.21	257.90	10.1	4.9-9.4	Prepack	0-1	2	Push probe	01/19/08	Clay

Notes: msl = mean sea level; bgs = below ground surface; OH= open hole; na = not available.
Drilling methods: HSA = hollow stem auger; SSA = solid stem auger

[a] Multiple well completion in single borehole.

[b] Measuring point is 0.02' higher than surveyed reference elevation shown due to installation of bladder pump enclosure. Groundwater elevations calculated from corrected elevation.

[c] Ground level and casing elevation were raised in June 1996 as part of regrading for truck scale. Wells and ground level elevation were resurveyed by Darryl Harms of Corvallis, OR.

[d] Estimated 20 feet higher than original elevation (added two 10-foot long pieces of 2-inch PVC pipe in 8/12/99 and 10/12/99). Well completion depths relative to original ground surface.

Table 3
Proposed Soil Boring and Test Pit Program
Hydrogeologic and Geotechnical Characterization Workplan
Coffin Butte Landfill

	Current Ground Level Elevation	Design Elevation	Below/ Above GL to Design Ele.[a]	Boring in Cut or Fill	Depth to Bottom of Boring (BGL)	Boring Bottom Depth-Elevation	Northing	Easting
Boring ID								
BH-1	291.7	314.3	-22.6	Fill	50.0	241.7	386,993.30	7,491,228.00
BH-2	244.0	244.6	-0.6	Fill	50.0	194.0	387,994.86	7,493,125.12
BH-3	510.0	502.3	7.7	Cut	110.0	400.0	386,177.39	7,491,884.63
BH-4	343.9	362.5	-18.6	Fill	50.0	293.9	386,458.65	7,492,451.61
BH-5	443.4	324.0	119.4	Cut	140.0	303.4	386,726.13	7,491,792.60
BH-6	291.2	307.4	-16.2	Fill	25.0	266.2	386,966.17	7,492,565.95
BH-7	338.9	321.6	17.3	Cut	25.0	313.9	367,015.13	7,493,175.46
BH-8	309.3	292.6	16.7	Cut	25.0	284.3	387,329.59	7,491,740.75
BH-9	359.1	301.9	57.1	Cut	100.0	259.1	387,151.79	7,491,742.28
BH-10	263.1	279.9	-16.8	Fill	25.0	238.1	387,441.49	7,492,703.58
BH-11	274.8	265.0	9.8	Cut	50.0	224.8	387,429.86	7,493,839.53
BH-12	270.7	278.5	-7.8	Fill	25.0	245.7	387,429.88	7,493,839.53
BH-13	390.2	376.9	13.2	Cut	50.0	340.2	388,760.08	7,493,861.25
BH-14	239.0	253.0	-14.0	Fill	25.0	214.0	387,972.34	7,493,517.97
Total Footage					**750.0**			
Test Pit ID								
TP-1	323.7	331.6	-7.9	Fill	12.0	311.7	386,961.84	7,491,410.53
TP-2	302.0	297.8	4.1	Cut	12.0	290.0	387,254.49	7,491,572.23
TP-3	306.3	311.0	-4.7	Fill	12.0	294.3	386,912.70	7,492,395.46
TP-4	334.2	345.5	-11.4	Fill	12.0	322.2	386,643.02	7,492,745.75
TP-5	297.8	298.6	-0.8	Fill	12.0	285.8	387,100.73	7,492,831.97
TP-6	274.2	289.5	-15.3	Fill	12.0	262.2	387,296.90	7,492,529.39
TP-7	260.0	266.4	-6.4	Fill	12.0	248.0	387,678.75	7,492,637.64
TP-8	247.7	248.6	-0.9	Fill	12.0	235.7	387,926.99	7,492,978.07
TP-9	253.2	265.4	-12.2	Fill	12.0	241.2	387,697.22	7,493,843.05
TP-10	256.3	265.0	-8.7	Fill	12.0	244.3	387,516.53	7,494,061.62
Total Footage					**120.0**			

Notes:

[a] negative number indicates liner above current ground level, boring in area of fill.

All measurements in feet

BGL: below ground level

GL: current ground level

Borings in fill, assume boring depth of 25 ft.

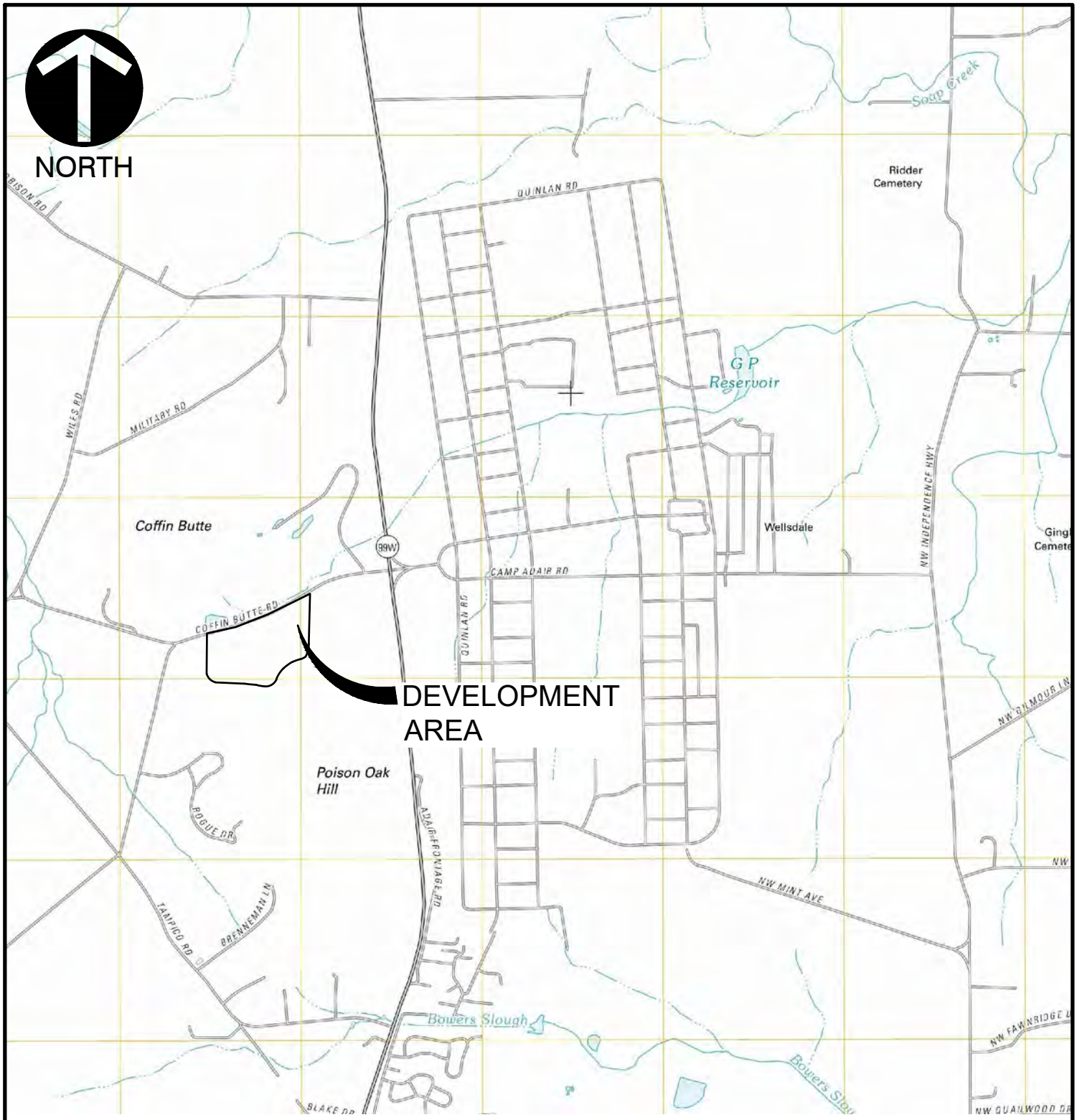
Borings in cut, depth is 20 feet below base of liner

Table 4
Geotechnical Testing Program
Hydrogeologic and Geotechnical Characterization Workplan
Coffin Butte Landfill

ASTM Test Number	Sample Type	Atterburg Limits D4318	Particle Size Distribution D422	Standard Classification D2487	Moisture Content D2216	Ring Shear Testing D6467	Triaxial Shear Testing (CU) D2664	Consolidation Testing D2435	Rock Core Compressive Strength D7012
Geotechnical Boreholes									
Landfill Footprint: BH-4, BH-5, BH-6, BH-7, BH-8, BH-9, BH-10	Core/bulk	X	X	X	X	X	X	X	X
Leachate Ponds: BH-11, BH-12, BH-13		X	X	X	X	X	X	X	X
Access Road: BH-1, BH-2, BH-3, BH-14		X	X	X	X	X	X	X	X
Test Pits									
Landfill Footprint: TP-2 to TP-8	Bulk/ composite	X	X	X	X	—	—	—	—
Leachate Pond: TP-9, TP-10		X	X	X	X	—	—	—	—
Access Road: TP-1, TP-9		X	X	X	X	—	—	—	—

Typical suite of tests; actual testing to be determined by engineer based on review of test pit log.
ED: engineer to determine based on review of log.

FIGURES



REFERENCE

1. U.S.G.S. 7.5' TOPOGRAPHIC MAP, LEWISBURG QUADRANGLE, OR DATED: 2011.

SCALE IN FEET

0 2500 5000

Civil & Environmental Consultants, Inc.

11811 N. Tatum Blvd., Suite 3057 - Phoenix, AZ 85028
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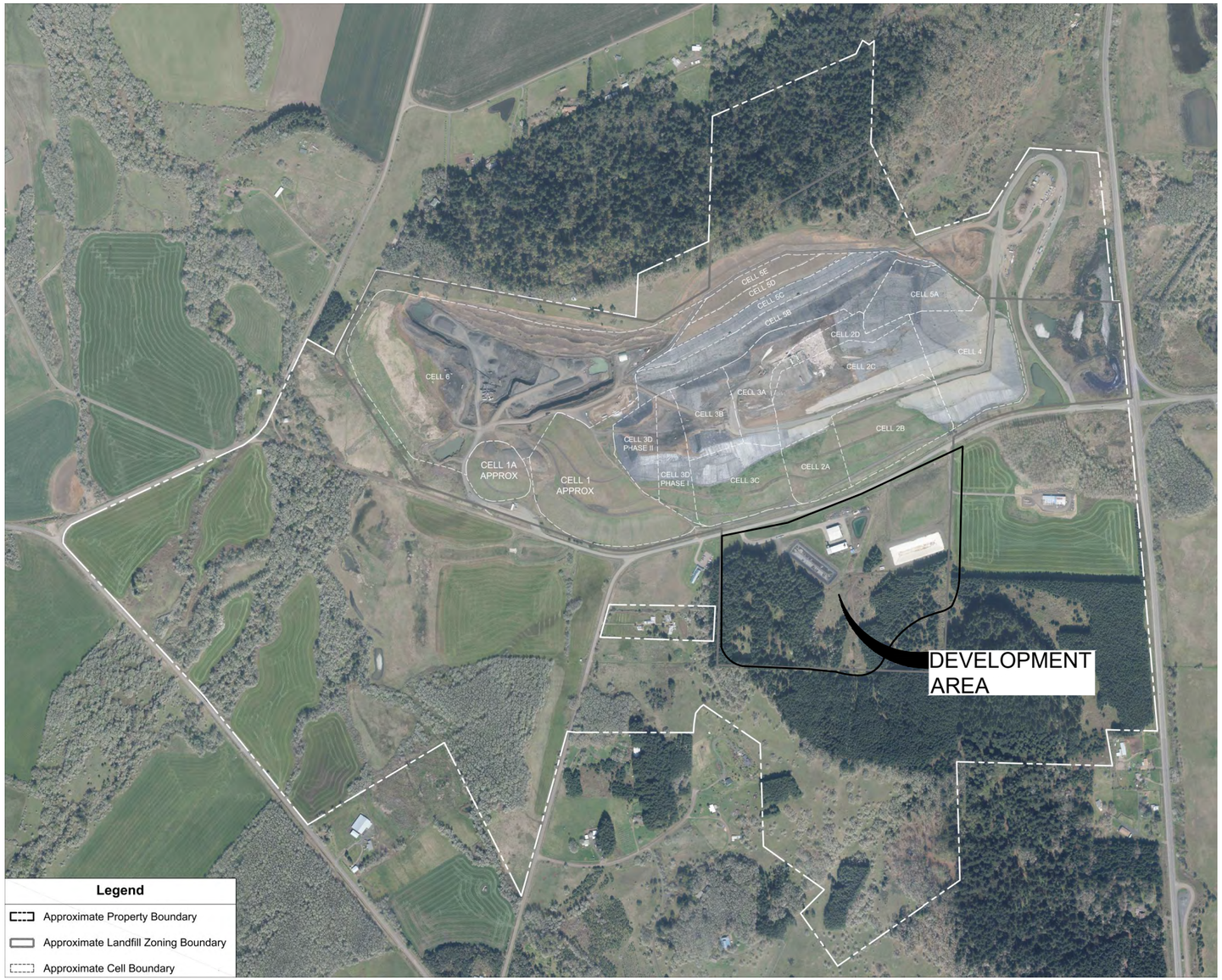
REPUBLIC SERVICES, INC.
COFFIN BUTTE LANDFILL
29175 COFFIN BUTTE ROAD
CORVALIS, OR 97330

SITE LOCATION MAP

DRAWN BY:	LAR	CHECKED BY:	PFB	APPROVED BY:	PFB	FIGURE NO.:	1
DATE:	JUN. 2021	DWG SCALE:	1"=2,500'	PROJECT NO:	310-145		

NORTH



SCALE IN FEET

0 1000 2000

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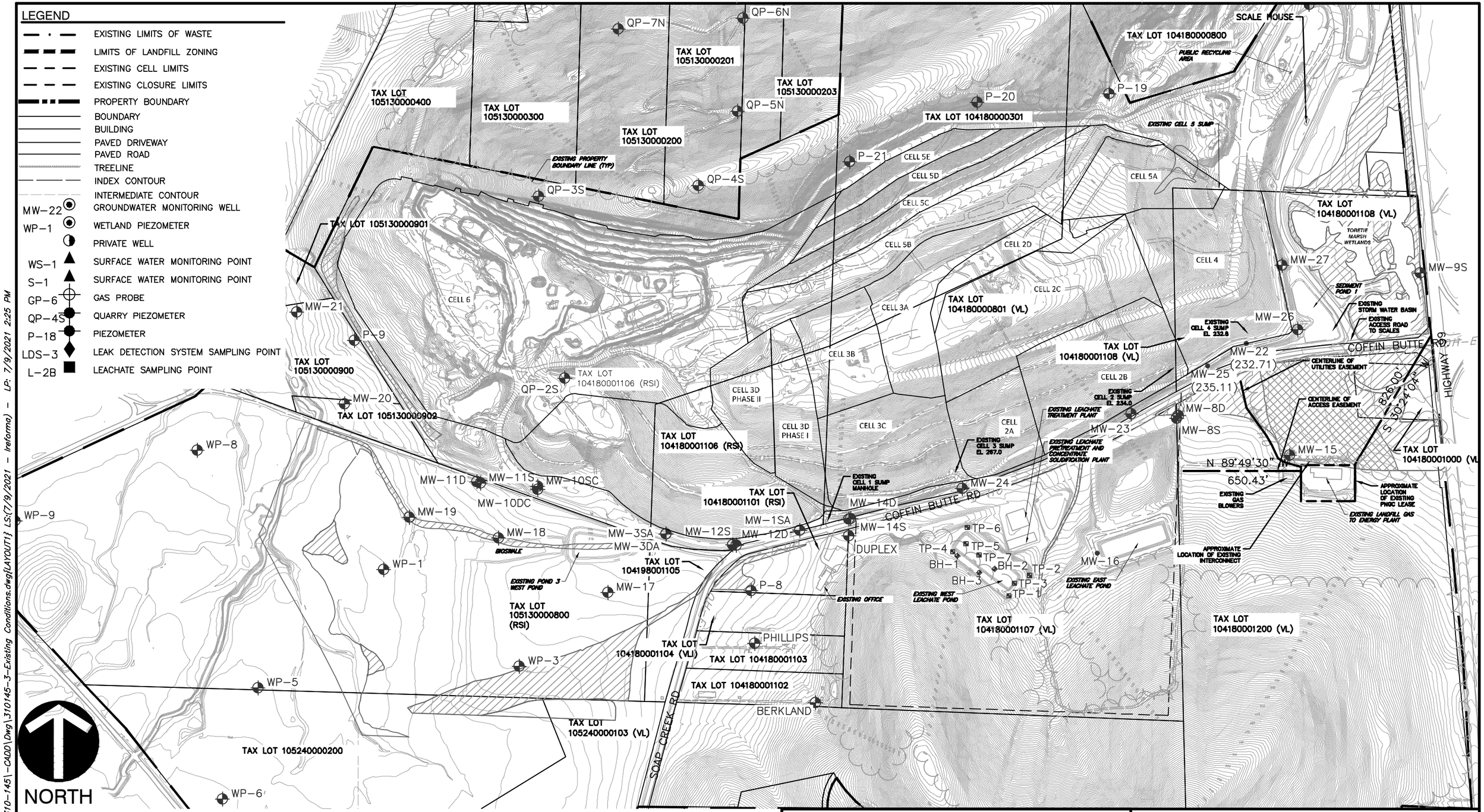
LANDFILL CELLS - AERIAL VIEW

DRAWN BY:	LAR	CHECKED BY:	PFB	APPROVED BY:	PFB	FIGURE NO.:	2
DATE:	JUL. 2021	DWG SCALE:	1"=1000'	PROJECT NO:	310-145		



REFERENCE

1. EXISTING TOPOGRAPHY FROM AERIAL SURVEY BY COOPER AERIAL SURVEYS CO. ON APRIL 3, 2013, UPDATED WITH GROUND SURVEY BY NORTHSTAR SURVEYING, INC. ON MAY 23, 2013.

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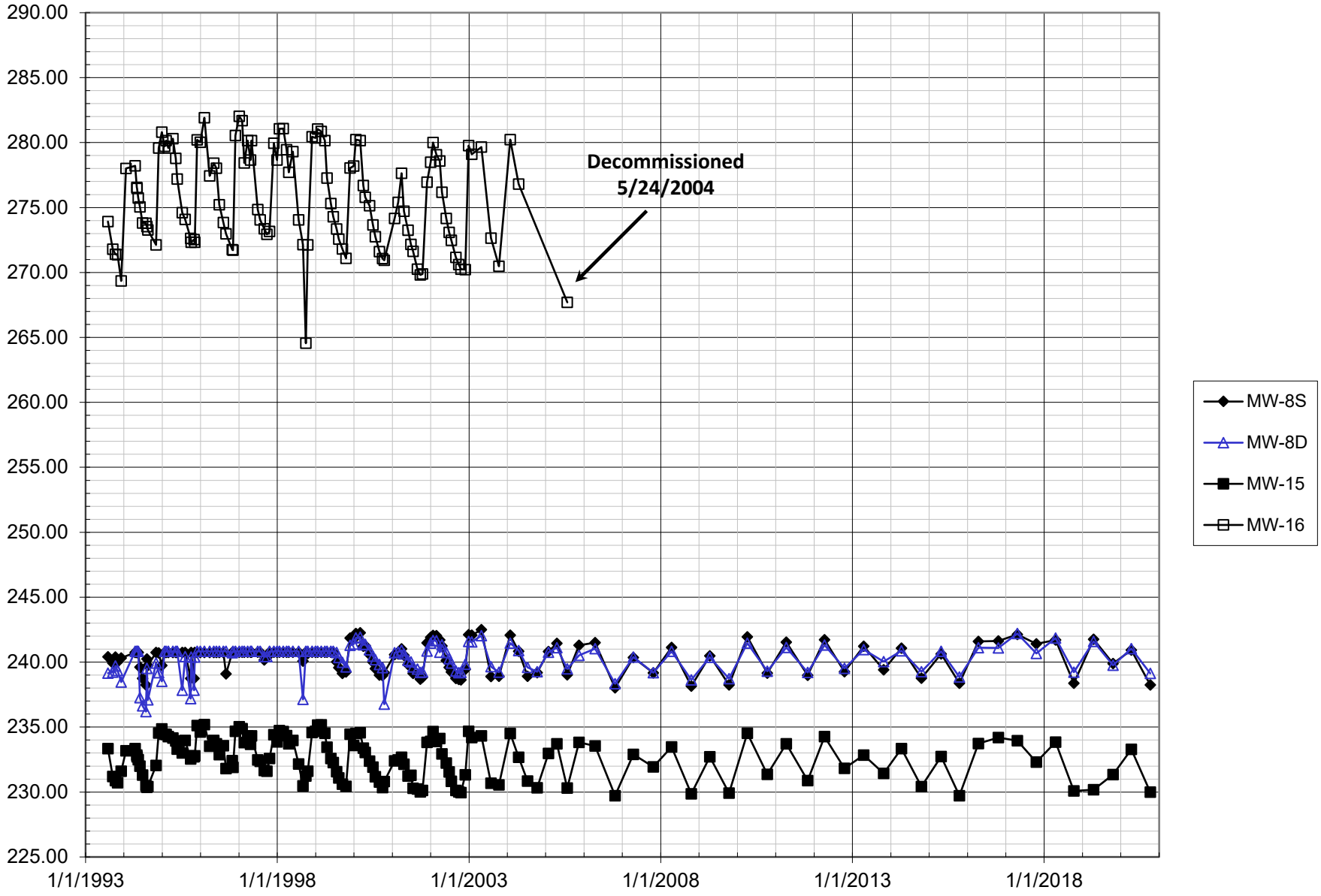
DEVELOPMENT AREA EXISTING CONDITIONS

DRAWN BY:	LAR	CHECKED BY:	PFB	APPROVED BY:	PFB	FIGURE NO.:	3
DATE:	JUL.2021	DWG SCALE:	1" = 500'	PROJECT NO:	310-145		

Figure 4
Hydrographs for Development Area Wells
Hydrogeologic and Geotechnical Characterization Workplan
Coffin Butte Landfill



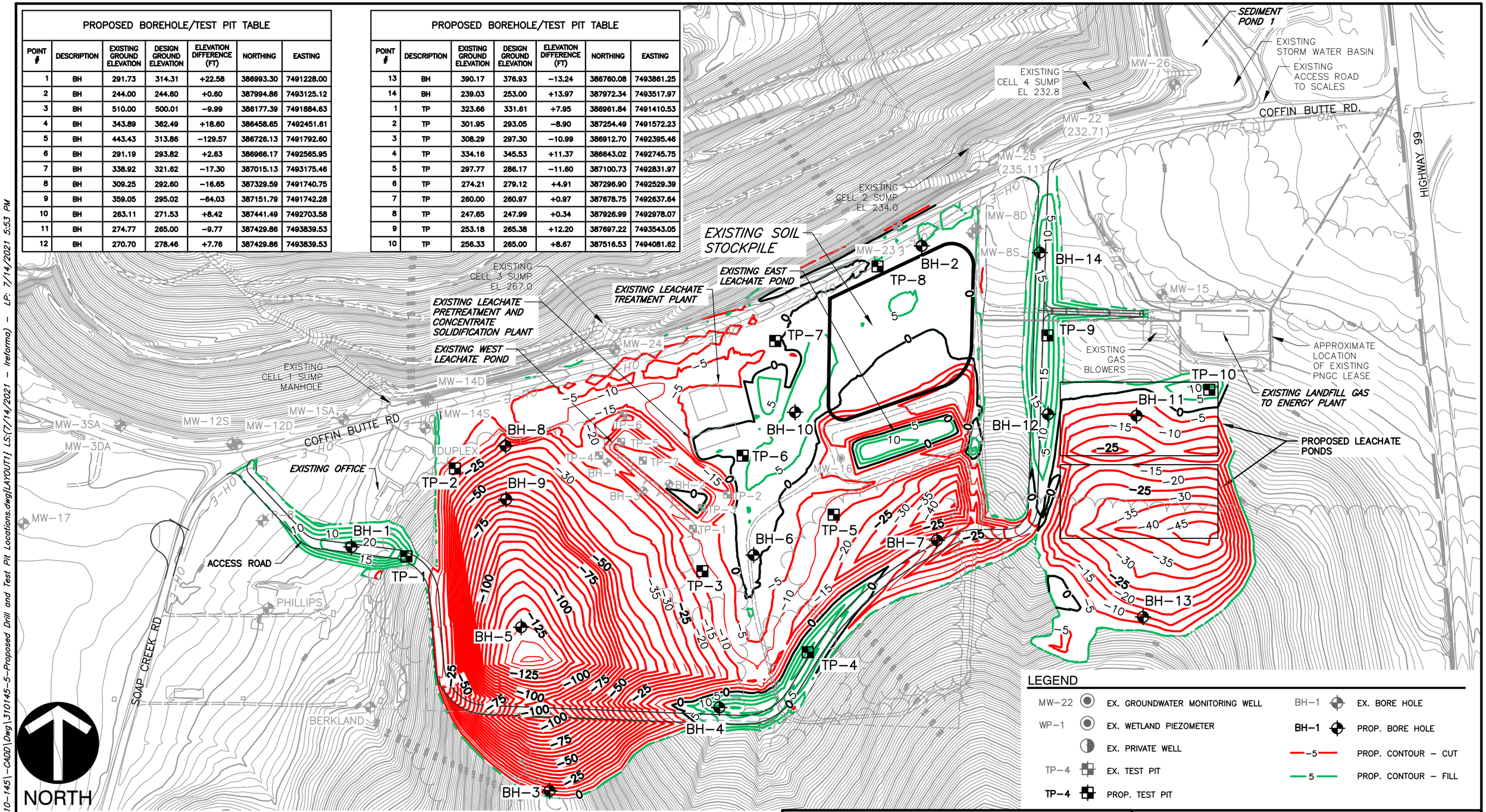
H20MASTER-Dev.xlsx\MW-8S-15-16

PROPOSED BOREHOLE/TEST PIT TABLE

POINT #	DESCRIPTION	EXISTING GROUND ELEVATION	DESIGN GROUND ELEVATION	ELEVATION DIFFERENCE (FT)	NORTHING	EASTING
1	BH	291.73	314.31	+22.58	386993.30	7491228.00
2	BH	244.00	244.60	+0.60	387994.86	7493125.12
3	BH	510.00	500.01	−9.99	386177.39	7491884.63
4	BH	343.89	362.49	+18.60	386458.65	7492451.61
5	BH	443.43	313.86	−129.57	386726.13	7491792.60
6	BH	291.19	293.82	+2.63	386966.17	7492565.95
7	BH	338.92	321.62	−17.30	387015.13	7493175.46
8	BH	309.25	292.60	−16.65	387329.59	7491740.75
9	BH	359.05	295.02	−64.03	387151.79	7491742.28
10	BH	263.11	271.53	+8.42	387441.49	7492703.58
11	BH	274.77	265.00	−9.77	387429.86	7493839.53
12	BH	270.70	278.46	+7.76	387429.86	7493839.53

PROPOSED BOREHOLE/TEST PIT TABLE

POINT #	DESCRIPTION	EXISTING GROUND ELEVATION	DESIGN GROUND ELEVATION	ELEVATION DIFFERENCE (FT)	NORTHING	EASTING
13	BH	390.17	376.93	−13.24	386760.08	7493861.25
14	BH	239.03	253.00	+13.97	387972.34	7493517.97
1	TP	323.66	331.61	+7.95	386961.84	7491410.53
2	TP	301.95	293.05	−8.90	387254.49	7491572.23
3	TP	308.29	297.30	−10.99	386912.70	7492395.46
4	TP	334.16	345.53	+11.37	386643.02	7492745.75
5	TP	297.77	286.17	−11.60	387100.73	7492831.97
6	TP	274.21	279.12	+4.91	387296.90	7492529.39
7	TP	260.00	260.97	+0.97	387678.75	7492637.64
8	TP	247.65	247.99	+0.34	387926.99	7492978.07
9	TP	253.18	265.38	+12.20	387697.22	7493543.05
10	TP	256.33	265.00	+8.67	387516.53	7494081.62



LEGEND

MW−22	EX. GROUNDWATER MONITORING WELL	BH−1	EX. BORE HOLE
WP−1	EX. WETLAND PIEZOMETER	**BH−1**	PROP. BORE HOLE
	EX. PRIVATE WELL	−5	PROP. CONTOUR – CUT
TP−4	EX. TEST PIT	5	PROP. CONTOUR – FILL
TP−4	PROP. TEST PIT		

SCALE IN FEET

0 300 600

REFERENCE

1. EXISTING TOPOGRAPHY FROM AERIAL SURVEY BY COOPER AERIAL SURVEYS CO. ON APRIL 3, 2013, UPDATED WITH GROUND SURVEY BY NORTHSTAR SURVEYING, INC. ON MAY 23, 2013.

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DEVELOPMENT AREA
PROPOSED DRILLING AND TEST PIT LOCATIONS

DRAWN BY:	LAR	CHECKED BY:	PFB	APPROVED BY:	PFB	FIGURE NO.:	5
DATE:	JUL.2021	DWG SCALE:	1"=300'	PROJECT NO:	310-145		

APPENDIX A

INFORMATION FROM OTHER REPORTS

A (NORTHWEST) — (EAST) **A'**

ELEVATION (MSL)

550 500 450 400 350 300 250 200 150 100

Note: Top of liner and subgrade for cell 2 are schematic and are not meant to accurately represent composite liner system at scale of drawing.

BEND IN SECTION

BEND IN SECTION

CELL 2D

CELL 2C

CELL 2B

P-18

HAUL ROAD

EXISTING GRADE

TOP OF LINER

SUBGRADE

CELL 2 SUMP

P-15 (Decom 5/95)

P-5 (38' Offset) (Decom 5/93)

P-3 (Decom 5/93)

Waste

Tsr

TD 74.5'

SEDIMENTATION BASIN

TOKETE MARSH

HWY 99W

MW-22 (13' Offset)

MW-9S (25' Offset)

TD 31.6'

TD 126.8'

Siletz River Volcanics (Tsr)

Quaternary Alluvium (Qal)

Explanation

MW-4 Monitoring Well

Screened Interval

Groundwater Elevation Measured 4/19/99

Sand Pack Interval

TD 17.5' Total Depth

0 300 600

SCALE IN FEET

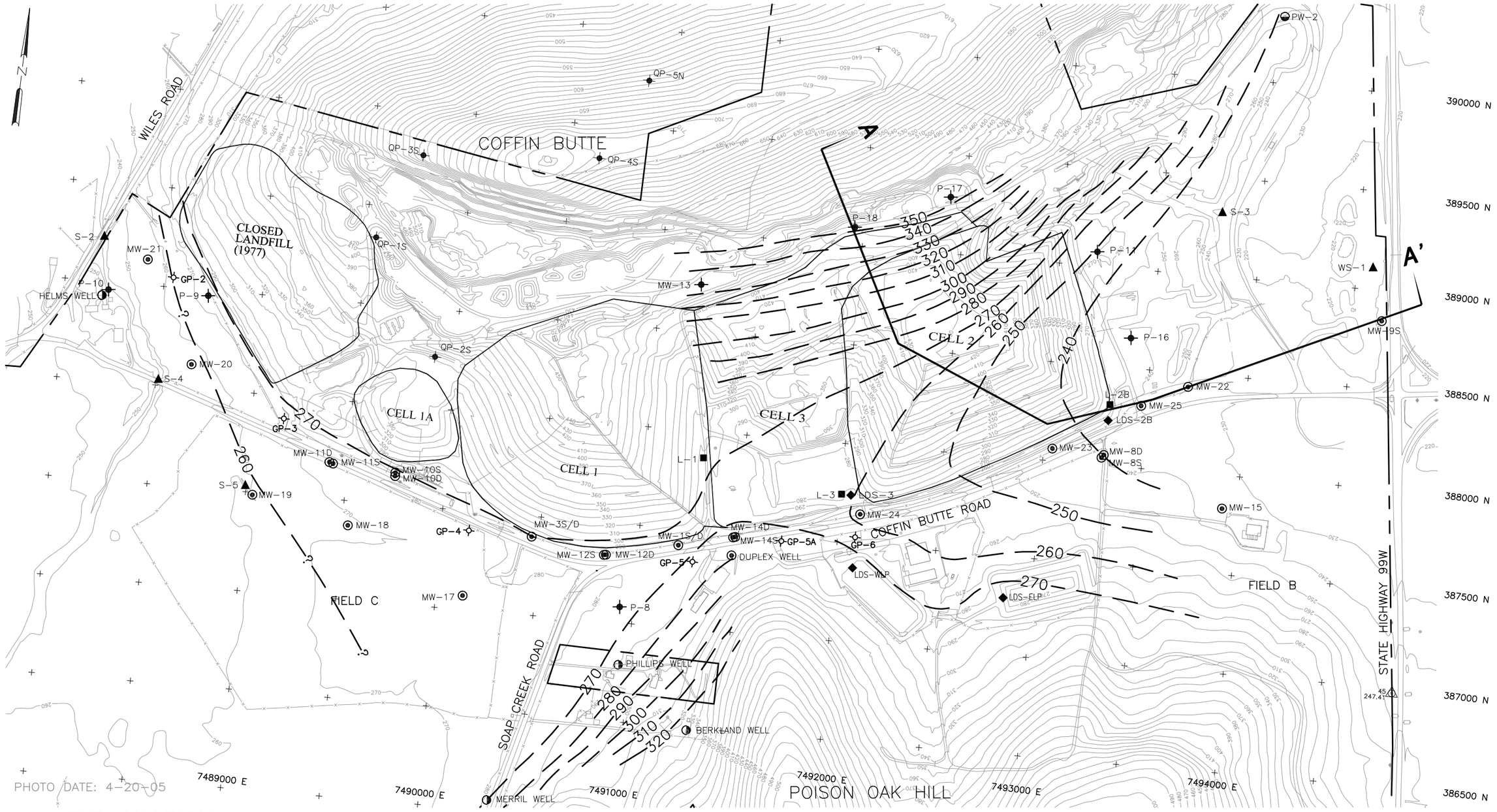
VERTICAL EXAGGERATION = 5X

Tuppan Consultants LLC
680 Iron Mountain Blvd.
Lake Oswego, Or 97034
Ph. 503.675.9103 Fax. 503.675.9107

DATE 11-12-03
DWN G. Haffner
APP
REV
PROJECT NO.
VLI-001-005

FIGURE 2-2
VALLEY LANDFILLS, INC.
COFFIN BUTTE LANDFILL
BENTON COUNTY, OREGON

GEOLOGIC CROSS SECTION A-A'



EXPLANATION

- MONITORING WELL
- PRIVATE WELL
- OBSERVATION WELL/PIEZOMETER
- LANDFILL WATER SUPPLY WELL
- SURFACE WATER MONITORING STATION
- GAS PROBE
- LEACHATE SUMP
- LEAK DETECTION SYSTEM
- PROPERTY LINE
- GROUNDWATER ELEVATION CONTOUR (FT-MSL) IN BEDROCK (4-19-99)

0 500 1000

SCALE IN FEET

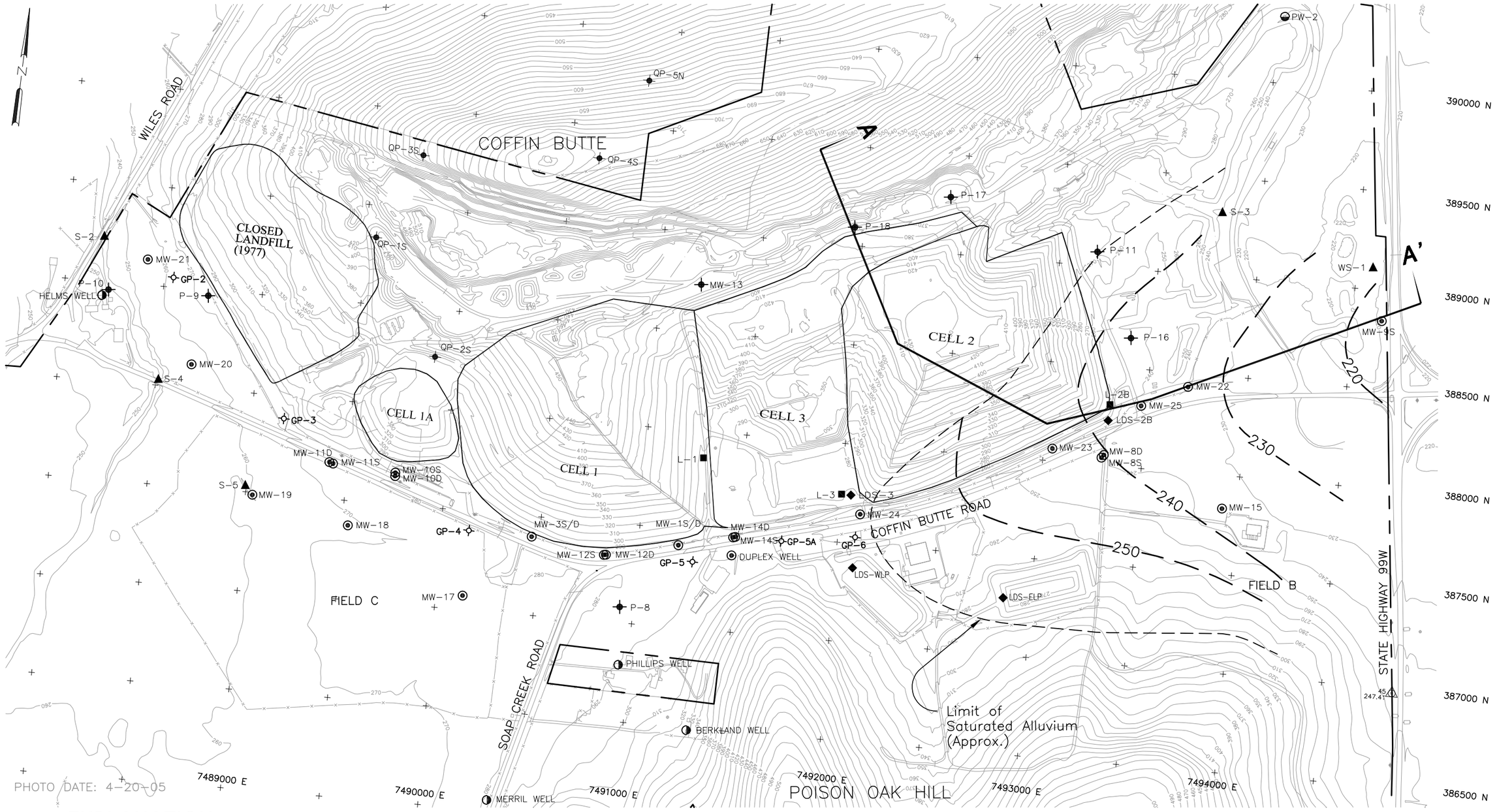
Tuppan Consultants, LLC
460 Second Street, Suite 103
Lake Oswego, Or 97034
Ph. 503.675.1335 Cell 503.866.2551

DATE 12-14-05
DWN GRH
APP
REV
PROJECT NO. VL1-001-005

FIGURE 2-3
COFFIN BUTTE LANDFILL
BENTON COUNTY, OREGON

BEDROCK GROUNDWATER CONTOURS

March 17, 2011
C:\000Projects\00Tuppan\Coffin Butte\Envir. mon. plan 2005\fig2-3.dwg



EXPLANATION

- MONITORING WELL
- PRIVATE WELL
- OBSERVATION WELL/PIEZOMETER
- LANDFILL WATER SUPPLY WELL
- SURFACE WATER MONITORING STATION
- GAS PROBE
- LEACHATE SUMP
- LEAK DETECTION SYSTEM
- PROPERTY LINE
- GROUNDWATER ELEVATION CONTOUR (FT-MSL) IN ALLUVIUM (4-19-99)

0 500 1000

SCALE IN FEET

Tuppan Consultants, LLC
460 Second Street, Suite 103
Lake Oswego, Or 97034
Ph. 503.675.1335 Cell 503.866.2551

DATE 12-14-05
DWN GRH
APP
REV
PROJECT NO. VL1-001-005

FIGURE 2-4
COFFIN BUTTE LANDFILL
BENTON COUNTY, OREGON

ALLUVIUM GROUNDWATER CONTOURS

March 17, 2011
C:\000Projects\00Tuppan\Coffin Butte\Envir. mon. plan 2005\fig2-4.dwg

N

Wiles Road

COFFIN BUTTE

CLOSED LANDFILL (1977)

Knife River Quarry

CELL 1A

CELL 1

CELL 2

CELL 3

CELL 4

CELL 5A

Poison Oak Hill

TOKETIE MARSH WETLANDS

Coffin Butte Road

PUBLIC DISPOSAL & RECYCLING

TRUCK SCALE

BIOSWALE

SEDIMENT POND 2

SEDIMENT POND 1

EAST LEACHATE POND

WEST LEACHATE POND

PNGC

State Hwy. 99W

Landfill Office

PHILLIPS WELL 263.53

BERKLAND WELL 323.7*

DUPLEX WELL 272.16

MERRIL WELL 268.17

QP-7N 364.92

QP-6N 392.11

QP-5N 503.36

QP-4S 608.31

QP-3S 336.14

QP-2S 275.81

P-22 592.53

P-23 583.81

P-20

P-21

P-19 369.69

PW-2 236.96

S-2 236.23

P-10 245.12

P-9 266.85

MW-21 253.04

MW-20 255.87

S-4 239.58

WP-8 250.55

MW-19 258.82

WP-1 255.88

MW-18 263.58

MW-11D

MW-11S 264.60

MW-10S 265.39

MW-10D

MW-3D 264.88

MW-12S

MW-12D 264.31

MW-1S 266.26

L-1

MW-14D

MW-14S 272.36

LDS-WLP

MW-17 264.99

P-8 265.57

WP-3 269.18

WP-5 255.04

S-1

WP-6 258.55

LDS-3

L-3

MW-24 257.20

S-U3

S-U5

MW-23 242.89

MW-8D

MW-8S 240.92

S-U4

LDS-2B

L-2B

LDS-4

L-4

S-U6

MW-26 230.58

MW-27 233.42

MW-15 233.29

LDS-ELP

WS-1

MW-9S 219.89

500 450 400 350 340 330 320 310 300 290 280 270 260 250 240 230 600 550

PHOTO DATE: 2017

MONITORING WELL/PIEZOMETER
OBSERVATION WELL/PIEZOMETER
LANDFILL WATER SUPPLY WELL
GAS PROBE
AVERAGE FOR APRIL

PRIVATE WELL
LEACHATE SUMP
LEAK DETECTION SYSTEM
SURFACE WATER MONITORING STATION
? GROUNDWATER ELEVATION CONTOUR (FT-MSL) QUERIED WHERE PROJECTED

0 500 1000
SCALE IN FEET

3-1-21:\Tuppan\Coffin Butte\GW APRIL 2020.dwg

Tuppan Consultants LLC
460 Second Street, Suite 103
Lake Oswego, Or 97034
Ph. 503.675.1335

DATE 2-23-21
DWN GRH
APP
REV
PROJECT NO.
VLI-001-002

FIGURE 3-5
COFFIN BUTTE LANDFILL
BENTON COUNTY, OREGON
APRIL 18, 2020
GROUNDWATER CONTOURS

N

Wiles Road

COFFIN BUTTE

CLOSED LANDFILL (1977)

Knife River Quarry

CELL 1A

CELL 1

CELL 2

CELL 3

CELL 4

CELL 5A

Landfill Office

Poison Oak Hill

TOKETIE MARSH WETLANDS

PUBLIC DISPOSAL & RECYCLING

TRUCK SCALE

BIOSWALE

SEDIMENT POND 2

SEDIMENT POND 1

Coffin Butte Road

EAST LEACHATE POND

WEST LEACHATE POND

PNGC

State Hwy. 99W

QP-7N 361.96
QP-6N 391.35
QP-5N 502.15
QP-4S 603.92
QP-3S 335.6*
QP-2S 267.9*
P-22 589.51
P-20
P-23 579.02
P-21
P-19 365.04
PW-2 233.94
S-2 236.31
MW-21 248.52
P-10 242.24
GP-2
P-9 265.01
S-4 239.21
MW-20 250.72
WP-8 245.73
GP-3
MW-11S 259.99
S-5
MW-19 256.91
MW-18 259.11
WP-1 247.18
GP-4
MW-3D 262.3*
MW-1D 262.4*
MW-12S
MW-12D 260.29
L-1
MW-14D 269.17
MW-14S
GP-5A
GP-5
DUPLEX WELL 268.31
MW-17 260.76
P-8 261.34
WP-5 250.92
WP-3 261.82
PHILLIPS WELL 261.49
S-1
WP-6 256.14
MERRIL WELL 257.71
BERKLAND WELL 317.8*
L-5
SU-7
LDS-5
MW-27 232.17
WS-1
MW-9S 217.67
MW-26 229.13
LDS-4
L-4
L-2B
LDS-2B
S-U6
MW-23 242.20
MW-8D
MW-8S 238.25*
S-U4
LDS-3
L-3
MW-24 254.06
S-U3
S-U5
GP-6
LDS-WLP
L-POND
LDS-ELP
MW-15 229.99

350 300 250 600 550 500 450 400 350 340 320 310 300 290 280 270 260 250 240 260 270 280 290 300 310 270 260 250 240 230

PHOTO DATE: 2017

MONITORING WELL/PIEZOMETER
OBSERVATION WELL/PIEZOMETER
LANDFILL WATER SUPPLY WELL
GAS PROBE
AVERAGE FOR OCTOBER

PRIVATE WELL
LEACHATE SUMP
LEAK DETECTION SYSTEM
SURFACE WATER MONITORING STATION
GROUNDWATER ELEVATION CONTOUR (FT-MSL) QUERIED WHERE PROJECTED

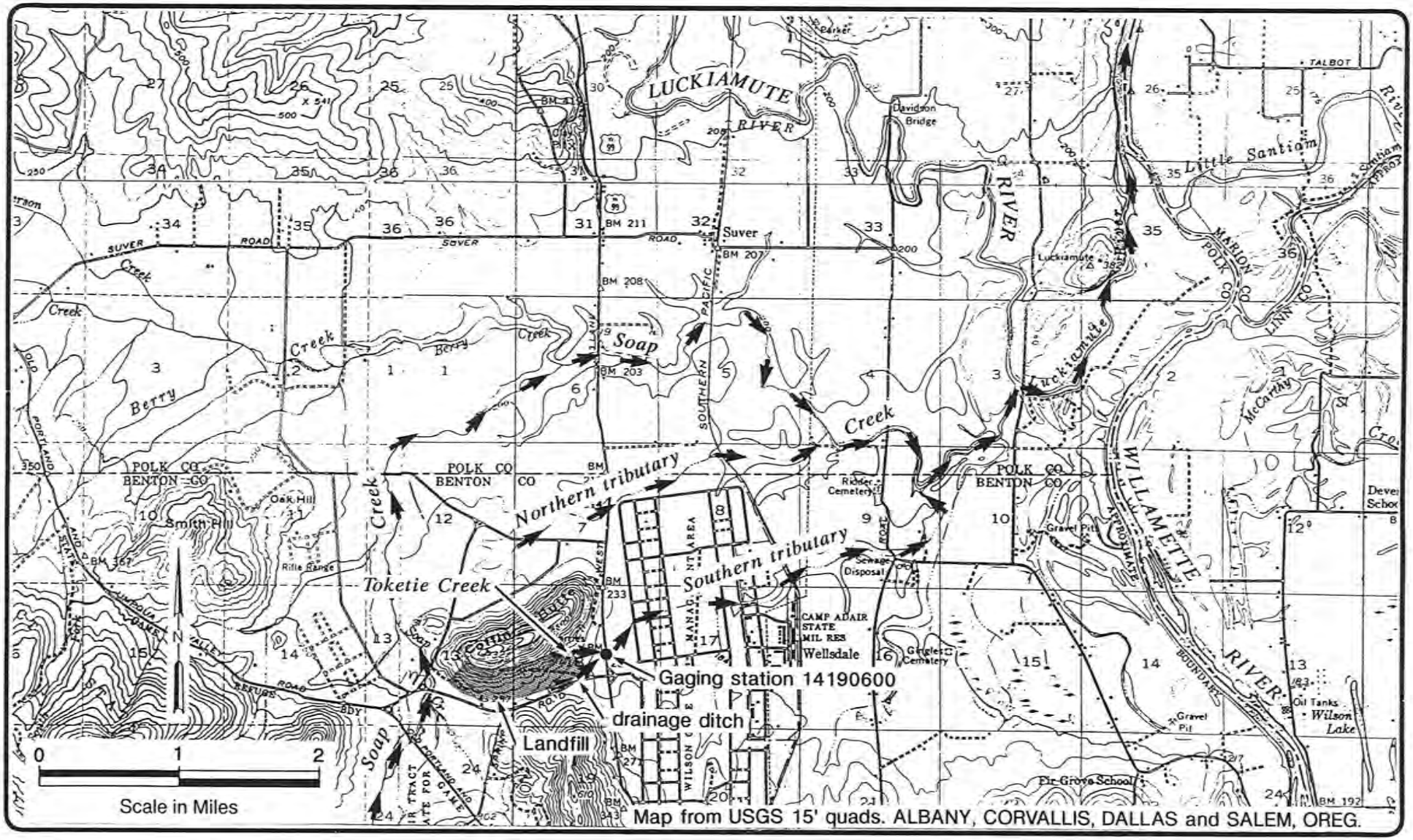
0 500 1000
SCALE IN FEET

3-1-21:\Tuppan\Coffin Butte\GW OCTOBER 2020.dwg

Tuppan Consultants LLC
460 Second Street, Suite 103
Lake Oswego, Or 97034
Ph. 503.675.1335

DATE 2-21-21
DWN GRH
APP
REV
PROJECT NO. VLI-001-002

FIGURE 3-6
COFFIN BUTTE LANDFILL
BENTON COUNTY, OREGON
OCTOBER 8, 2020
GROUNDWATER CONTOURS



EMCON Northwest, Inc.

DATE 5/93
DWN. mk
APPR.
REVIS.
PROJECT NO. 0139001.12

Figure 1
VALLEY LANDFILLS, INC.
COFFIN BUTTE LANDFILL
BENTON COUNTY, OREGON

SURFACE WATER FEATURES

APPENDIX B

BORNG LOGS – DEVELOPMENT AND ADJACENT AREAS

Appendix B
Boring Logs, Test Pit Logs, and Well Construction Diagrams
Coffin Butte Landfill
Development and Adjacent Areas

MW-8S, MW-8D
MW-9S, MW-9D
MW-14S, MW-14D
MW-15
MW-16
MW-22
MW-23
MW-24
MW-25
Berkland Domestic Well (2 wells)
Duplex Well
West Leachate Pond Borings and Test Pits
- **BH-1**
- **BH-2**
- **BH-3**
- **TP-1**
- **TP-2**
- **TP-3**
- **TP-4**
- **TP-5**
- **TP-6**

Sweet, Edwards & Associates, Inc.

BORING LOG

PROJECT COFFIN BUTTE LANDFILL

Location SE of Landfill

Boring No. MW-8S

Surface Elevation

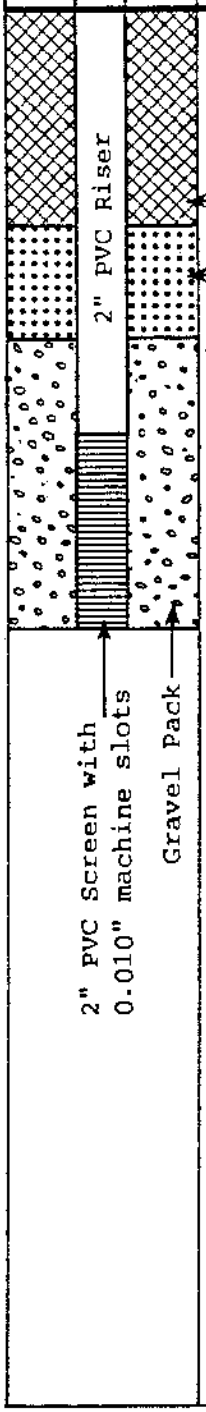
Drilling Method Air Rotary

Total Depth 32 feet

Drilled By Jones Drilling Co.

Date Completed 7/30/85

Logged By S.R. Henshaw

WELL DETAILS	PENE-TRATION TIME/ RATE	DEPTH (FEET)	SAMPLE NO.	SAMPLE TYPE	PERME-ABILITY TESTING	SYMBOL	LITHOLOGIC DESCRIPTION	WATER QUALITY
		0 10 20 30 40					See boring log MW-8D for lithologic details.	

Sweet, Edwards & Associates, Inc.

BORING LOG

PROJECT COFFIN BUTTE LANDFILL

Location SE of Landfill

Boring No. MW-8D

Surface Elevation

Drilling Method Air Rotary

Total Depth 75 feet

Drilled By Jones Drilling Co.

Date Completed 7/30/85

Logged By S.R. Henshaw

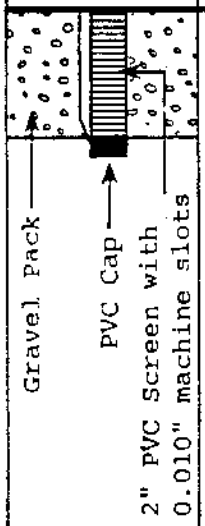
WELL DETAILS	PENETRATION TIME/ RATE	DEPTH (FEET)	SAMPLE NO.	SAMPLE TYPE	PERMEABILITY TESTING	SYMBOL	LITHOLOGIC DESCRIPTION	WATER QUALITY
		0					0-5.0' CLAYEY-GRAVEL, light brown.	
		10					5.0-22.0' CLAY to CLAYEY-SILT, light brown to gray to black, cohesive, highly plastic lens of gravel and color transition from brown to gray-black at 15'.	
2" PVC Riser; Bentonite		20						▽
		30					22.0-62.0' TUFFACEOUS BASALIC CONGLOMERATE, brown to black, transition from weathered and poorly consolidated at top to well indurated at bottom. Some larger gravel at 40'.	600 conductivity micromohs/cm
		40						475 conductivity micromohs/cm
Bentonite Chips		50						500 conductivity micromohs/cm
		60						480 conductivity micromohs/cm
2" PVC Screen with 0.010" machine slots; Gravel Pack		70					62.0-75.0' BASALT, black to blue gray, hard.	

Sweet, Edwards & Associates, Inc.

BORING LOG

PROJECT COFFIN BUTTE LANDFILL

Boring No. MW-8D

WELL DETAILS	PENE-TRATION TIME/ RATE	DEPTH (FEET)	SAMPLE NO.	SAMPLE TYPE	PERME-ABILITY TESTING	SYMBOL	LITHOLOGIC DESCRIPTION	WATER QUALITY
		70					62.0-75.0' See previous page for lithology description.	500 conduc-tivity micro-mohs/cm

Sweet, Edwards & Associates, Inc.

BORING LOG

PROJECT COFFIN BUTTE LANDFILL

Location East of Landfill

Boring No. MW-9S

Surface Elevation

Drilling Method Air Rotary

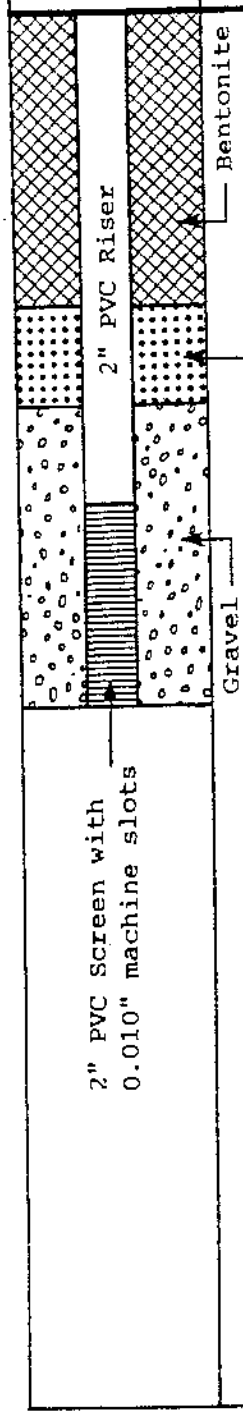
Total Depth 35 feet

Drilled By Jones Drilling Co.

Date Completed 8/2/85

Logged By S.R. Henshaw

WELL DETAILS	PENETRATION TIME/ RATE	DEPTH (FEET)	SAMPLE NO.	SAMPLE TYPE	PERMEABILITY TESTING	SYMBOL	LITHOLOGIC DESCRIPTION	WATER QUALITY
							See boring log MW-9D for lithologic details.	



Sweet, Edwards & Associates, Inc.

BORING LOG

PROJECT COFFIN BUTTE LANDFILL

Location East of Landfill **Boring No.** MW-9D

Surface Elevation _____ **Drilling Method** Air Rotary

Total Depth 125 Feet **Drilled By** Jones Drilling Co.

Date Completed 8/1/85 **Logged By** S.R. Henshaw

WELL DETAILS	PENETRATION TIME/ RATE	DEPTH (FEET)	SAMPLE NO.	SAMPLE TYPE	PERMEABILITY TESTING	SYMBOL	LITHOLOGIC DESCRIPTION	WATER QUALITY
ABANDONED RISER Cement slurry backfilled from 115' to 0'. Settled to ___ and backfilled with bentonite chips.		0 10 20 30 40 50 60 70					0-5.0' FILL, brown, soil and gravel. 5.0-19.0' CLAYEY SILT to CLAY, light brown, cohesive, hard, very plastic, sticky, some gravel. 19.0-36.0' CLAY, blue gray, hard, very plastic, sticky. 36.0-110.0' CLAYEY-SILT to SILTY-CLAY, light gray to light brown and red, firm, exhibits shale properties as observed from cuttings, moderately plastic, some small rock fragments 1-2 mm. Little sample recovered due to mixing.	1000 conductivity micromohs/cm 1000 conductivity micromohs/cm 1075 conductivity micromohs/cm 1050 conductivity micromohs/cm

Sweet, Edwards & Associates, Inc.

BORING LOG

PROJECT COFFIN BUTTE LANDFILL

Boring No. MW-9D

WELL DETAILS	PENETRATION TIME/ RATE	DEPTH (FEET)	SAMPLE NO.	SAMPLE TYPE	PERMEABILITY TESTING	SYMBOL	LITHOLOGIC DESCRIPTION	WATER QUALITY
ABANDONED RISER; Cement Slurry backfilled from 115' to 0'. Settled to ___ and backfilled with bentonite chips.		70					36.0-110.0' CLAYEY-SILT to SILTY CLAY. See previous page for lithology detail.	
		80						
		90						
		100						
		110					110.0-125.0' WEATHERED COLLUVIAL MATERIAL, characterized by angular rock fragments (1-4mm) and clay matrix. Some sand and clay stringers, good water yield, Artesian flow. Conductivity on 8/6/85 = 11,000 micro-mohs/cm.	2500 conductivity micro-mohs/cm
		120						5000
2" PVC Screen with 0.010" machine slots								6000 conductivity micro-mohs/cm.

LOG OF EXPLORATORY BORING

PROJECT NAME	COFFIN BUTTE LANDFILL	BORING NO.	MW- 14S
LOCATION	Benton County, Oregon	PAGE	1 OF 3
DRILLED BY	Staco Well Services	REFERENCE ELEV.	287.50'
DRILL METHOD	Air Rotary	TOTAL DEPTH	35.50'
LOGGED BY	Creig Fanshier	DATE COMPLETED	7/27/92

SAMPLE NUMBER SAMPLE TYPE	RECOVERY PERCENT	BLOW COUNTS (N COMP)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	WELL DETAILS	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION
				5				0-10 feet: SILTY CLAY (CL), yellowish brown, soft, damp, trace (<5%) 3/8-inch angular gravel. (COLLUVIUM)
S-1 GRAB				10				10-27 feet: BASALT, brown to orange brown, slightly fractured, strongly weathered on fractures, carbona.. veinlets. (Siletz River Volcanics)
S-2 GRAB				15				
S-3 GRAB			22.2' 7/27/92 ▽ 23.79' 8/5/92	20				
				25				

REMARKS

Exploratory boring B-14 drilled by 8-inch dia. hollow stem auger from 0-9.7 feet; continuously diamond cored from 9.7-70 feet. Boring backfilled with cement-bentonite grout. Monitoring well boring MW-14S drilled approx. 20 feet east of B-14 by air rotary with 8-inch downhole hammer from surface to 35.5 feet.

LOG OF EXPLORATORY BORING

PROJECT NAME	COFFIN BUTTE LANDFILL	BORING NO.	MW- 14S
LOCATION	Benton County, Oregon	PAGE	2 OF 3
DRILLED BY	Staco Well Services	REFERENCE ELEV.	287.50'
DRILL METHOD	Air Rotary	TOTAL DEPTH	35.50'
LOGGED BY	Craig Fanshier	DATE COMPLETED	7/27/92

SAMPLE NUMBER SAMPLE TYPE	RECOVERY PERCENT	BLOW COUNTS (N COMP)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	WELL DETAILS	LITHOLOGIC COLUMN	LITHOLOGIC DESCRIPTION
S-4 GRAB								**10-27 feet:** BASALT, brown to orange brown, slightly fractured, strongly weathered on fractures, carbonate veinlets. (Siletz River Volcanics)
								27-35.5 feet: BASALT, greenish gray to dark green, highly fracture, propylitic alteration, fine carbonates, (quartz) veinlets, trace pyrite.
S-5 GRAB				30				
S-6 GRAB				35				Bottom of boring at 35.5 feet below ground surface.
				40				**WELL COMPLETION DETAILS:**
								+2.08-19.5 feet: 4-inch dia. schedule 40 PVC flush threaded blank casing with "O" rings.
								19.5-29.5 feet: 4-inch dia. schedule 40 PVC screen with 0.020-inch machine slots.
								29.5-30.1 feet: 4-inch dia. schedule 40 PVC end cap.
								0-1.5 feet: Concrete.
								1.5-16.5 feet: 4.5 - 50 pound bags of 3/4-inch bentonite chips.
								16.5-30.5 feet: 4.5 - 100 bags of 8x12 graded silica sand. (FILTER PACK)
								30.5-35.5 feet: 2.25 - 50 pound bags of 3/4-inch bentonite chips.
				45				**SURFACE COMPLETION DETAILS:**
								6-inch steel locking protective casing, surrounded by 3 - 5-foot long, 3-inch dia. protective posts.
								Ground surface elevation: 287.5 feet MSL.
								Top of casing elevation: 289.58 feet MSL.
								Coffin Butte base map coordinates:
								Eastings: 674.78 feet.
								Northings: 251.74 feet.
				50				

REMARKS

Exploratory boring B-14 drilled by 8-inch dia. hollow stem auger from 0-9.7 feet; continuously diamond cored from 9.7-70 feet. Boring backfilled with cement-bentonite grout. Monitoring well boring MW-14S drilled approx. 20 feet east of B-14 by air rotary with 8-inch downhole hammer from surface to 35.5 feet.

LOG OF EXPLORATORY BORING

PROJECT NAME COFFIN BUTTE LANDFILL
LOCATION Benton County, Oregon
DRILLED BY Staco Well Services
DRILL METHOD Air Rotary
LOGGED BY Craig Fanshier

BORING NO. MW-14S
PAGE 3 OF 3
REFERENCE ELEV. 287.50'
TOTAL DEPTH 35.50'
DATE COMPLETED 7/27/92

SAMPLE NUMBER SAMPLE TYPE	RECOVERY PERCENT	BLOW COUNTS (N COMP)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	WELL DETAILS	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION
				55				Sample depth indicates where a discrete interval sample was collected and archived. Air rotary cuttings were semi-continuously monitored at the discharge during the drilling process.
				60				
				65				
				70				
				75				

REMARKS

Exploratory boring B-14 drilled by 8-inch dia. hollow stem auger from 0-9.7 feet; continuously diamond cored from 9.7-70 fee Boring backfilled with cement-bentonite grout. Monitoring well boring MW-14S drilled approx. 20 feet east of B-14 by air rotary with 6-inch downhole hammer from surface to 35.5 feet.

LOG OF EXPLORATORY BORING

PROJECT NAME	COFFIN BUTTE LANDFILL	BORING NO.	MW- 14D
LOCATION	Benton County, Oregon	PAGE	1 OF 4
DRILLED BY	Staco Well Services	REFERENCE ELEV.	287.80'
DRILL METHOD	Air Rotary	TOTAL DEPTH	75.00'
LOGGED BY	Craig Fenshier	DATE COMPLETED	7/24/92

SAMPLE NUMBER SAMPLE TYPE	RECOVERY PERCENT	BLOW COUNTS (N COMP)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	WELL DETAILS	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION
S-1 GRAB				5				**0-10 feet:** SILTY CLAY (CL), brown, soft, damp, trace (5%) 3/8-inch angular gravel. (COLLUVIUM)
S-2 GRAB				10				**10-27 feet:** BASALT, brown to orange brown, slightly fractured, strongly weathered on fractures, carbonate veinlets. (Siletz River Volcanics)
S-3 GRAB				15				
S-4 GRAB				20				
			23.27' 7/29/92	25				

REMARKS

Exploratory boring B-14 drilled by 8-inch dia. hollow stem auger from 0-8.7 feet; continuously diamond cored from 9.7-70 feet. Boring backfilled with cement-bentonite grout. Monitoring well boring MW-14D drilled approx. 10 feet east of B-14 by air rotary with 6-inch downhole hammer from surface to 75 feet.

LOG OF EXPLORATORY BORING

PROJECT NAME COFFIN BUTTE LANDFILL
LOCATION Benton County, Oregon
DRILLED BY Staco Well Services
DRILL METHOD Air Rotary
LOGGED BY Craig Fanshier

BORING NO. MW- 14D
PAGE 2 OF 4
REFERENCE ELEV. 287.80'
TOTAL DEPTH 75.00'
DATE COMPLETED 7/24/92

SAMPLE NUMBER SAMPLE TYPE	RECOVERY PERCENT	BLOW COUNTS (N COMP)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	WELL DETAILS	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION
S-5 GRAB								**10-27 feet:** BASALT, brown to orange brown, slightly fractured, strongly weathered on fractures, carbonate veinlets. (Siletz River Volcanics)
S-6 GRAB								**27-71 feet:** BASALT, greenish gray to dark green, intensely fractured, propylitic alteration, fine-grained carbonates, (quartz) veinlets, trace pyrite.
S-7 GRAB	–	–		30				
S-8 GRAB				35				@ 36 feet: 5% gray ash, tuff. @ 37 feet: 5% gray ash, tuff.
S-9 GRAB								
S-10 GRAB				40				
S-11 GRAB				45				
				50				

REMARKS

Exploratory boring B-14 drilled by 8-inch dia. hollow stem auger from 0-9.7 feet; continuously diamond cored from 9.7-70 feet. Boring backfilled with cement-bentonite grout. Monitoring well boring MW-14D drilled approx. 10 feet east of B-14 by air rotary with 6-inch downhole hammer from surface to 75 feet.

LOG OF EXPLORATORY BORING

PROJECT NAME COFFIN BUTTE LANDFILL
LOCATION Benton County, Oregon
DRILLED BY Staco Well Services
DRILL METHOD Air Rotary
LOGGED BY Craig Fanshier

BORING NO. MW-14D
PAGE 3 OF 4
REFERENCE ELEV. 287.80'
TOTAL DEPTH 75.00'
DATE COMPLETED 7/24/92

SAMPLE NUMBER SAMPLE TYPE	RECOVERY PERCENT	BLOW COUNTS (N COMP)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	WELL DETAILS	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION
S-12 GRAB								27-71 feet: BASALT, greenish gray to dark green, intensely fractured, propylitic alteration, fine-grained carbonates, (quartz) veinlets, trace pyrite.
								@ 51-60 feet: Harder drilling.
				55				
S-13 GRAB								@ 56-71 feet: Trace (5%) white calcite filling small fractures.
				60				
S-14 GRAB								@ 60-64 feet: Easier drilling.
			▽ 64.0' 7/24/92	65				@ 64 feet: Minor water produced at surface cuttings discharge pipe.
S-15 GRAB								
				70				@ 69-71 feet: Easier drilling, produces approx. 0.2 gpm.
S-16 GRAB								71-75 feet: TUFFACEOUS BASALT, fine grain, greenish gray, 20% light gray ash-tuff, discharge water turns gray.
				75				

REMARKS

Exploratory boring B-14 drilled by 8-inch dia. hollow stem auger from 0-9.7 feet; continuously diamond cored from 9.7-70 feet. Boring backfilled with cement-bentonite grout. Monitoring well boring MW-14D drilled approx. 10 feet east of B-14 by air rotary with 6-inch downhole hammer from surface to 75 feet.

LOG OF EXPLORATORY BORING

PROJECT NAME	COFFIN BUTTE LANDFILL	BORING NO.	MW-14D
LOCATION	Benton County, Oregon	PAGE	4 OF 4
DRILLED BY	Staco Well Services	REFERENCE ELEV.	287.80'
DRILL METHOD	Air Rotary	TOTAL DEPTH	75.00'
LOGGED BY	Craig Fanshier	DATE COMPLETED	7/24/92

SAMPLE NUMBER SAMPLE TYPE	RECOVERY PERCENT	BLOW COUNTS (N COMP)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	WELL DETAILS	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION
S-17 GRAB				80 85 90 95 100				Bottom of boring at 75.0 feet below ground surface. WELL COMPLETION DETAILS: +2.47-60 feet: 2-inch dia. schedule 40 PVC flush threaded blank casing with "O" rings. 60-70 feet: 2-inch dia. schedule 40 PVC screen with 0.020-inch machine slots. 70-70.6 feet: 2-inch dia. schedule 40 PVC end cap. 0-3 feet: Concrete. 3-57.5 feet: 13.5 - 50 pound bags of 3/4-inch bentonite chips. 57.5-71 feet: 2.6 - 100 bags of 8x12 graded silica sand. (FILTER PACK) 71-75 feet: 0.8 50 pound bag of 3/4-inch bentonite chips. SURFACE COMPLETION DETAILS: 6-inch steel locking protective casing, surrounded by 3 - 5-foot long, 3-inch dia. protective posts. Ground surface elevation: 287.8 feet MSL. Top of casing elevation: 290.27 feet MSL. Coffin Butte base map coordinates: Eastings: 664.50 feet. Northings: 248.23 feet. Notes: Sample depth indicates where a discrete interval sample was collected and archived. Air rotary cuttings were semi-continuously monitored at the discharge during the drilling process.

REMARKS

Exploratory boring B-14 drilled by 8-inch dia. hollow stem auger from 0-9.7 feet; continuously diamond cored from 9.7-70 feet. Boring backfilled with cement-bentonite grout. Monitoring well boring MW-14D drilled approx. 10 feet east of B-14 by air rotary with 6-inch downhole hammer from surface to 75 feet.

LOG OF EXPLORATORY BORING

PROJECT NAME Coffin Butte Landfill
LOCATION Coffin Butte, Benton County, Oregon
DRILLED BY GeoTech Explorations
DRILL METHOD H.S.A. with C.C.B.
LOGGED BY Mike Free

BORING NO. MW-15
PAGE 1 OF 2
GROUND ELEV.
TOTAL DEPTH 29.00'
DATE COMPLETED 07/14/93

SAMPLE TYPE	RECOVERY PERCENT	POCKET PENE-TROMETER (T/ft)
CCB	100	1
		0.8
		2
CCB	102	1.3
		1.5
		2
		1.3
		1.2
CCB	102	0.8
		1.6
		1.8
		1.5
		1.8
CCB	98	
		2
		2.5
		3.8
CCB	102	3

GROUND WATER LEVELS | DEPTH IN FEET | SAMPLES | LITHOLOGIC COLUMN | WELL DETAILS

LITHOLOGIC DESCRIPTION

0 to 13.0 feet: CLAYEY SILT (MH), very dark gray to black (0 to 1.5 feet), dark grayish brown (1.5 to 2.6 feet), mottled brown and orange (2.6 to 13.0 feet), 75 percent silt, 25 percent clay, trace fine sand, soft to firm, moist, roots to 3.0 feet, micaceous, pore wetness at 13.0 feet. (ALLUVIUM)

13.0 to 20.4 feet: CLAYEY SILT (MH), dark grayish brown (13.0 to 15.9 feet), gray to dark reddish brown (15.9 to 18.0 feet), strong brown (18,0 to 20.4 feet), 75 percent silt, 20 percent clay, 5 percent fine to coarse gravel, soft to firm (overall somewhat crumbly), moist to wet. (ALLUVIUM)

REMARKS

LOG OF EXPLORATORY BORING

PROJECT NAME Coffin Butte Landfill
LOCATION Coffin Butte, Benton County, Oregon
DRILLED BY GeoTech Explorations
DRILL METHOD H.S.A. with C.C.B.
LOGGED BY Mike Free

BORING NO. MW-15
PAGE 2 OF 2
GROUND ELEV.
TOTAL DEPTH 29.00'
DATE COMPLETED 07/14/93

SAMPLE TYPE	RECOVERY PERCENT	POCKET PENE-TROMETER (T/ft)	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	LITHOLOGIC COLUMN	WELL DETAILS	LITHOLOGIC DESCRIPTION
								13.0 to 20.4 feet: CLAYEY SILT (MH), continued.
								20.4 to 21.8 feet: SANDY GRAVEL (GP), strong brown, 60 percent fine to coarse decomposed well-rounded gravel, occasional cobbles, 30 percent fine to coarse sand, 10 percent clay and silt. (ALLUVIUM)
CCB	94	2 1 2		25				21.8 to 29.0 feet: SANDY GRAVELLY SILT (ML), reddish brown to brown, 50 percent silt, 30 percent decomposed fine to medium gravel, 20 percent fine to coarse sand, mostly crumbly, soft to firm, moist. (ALLUVIUM)
				30				Total depth drilled = 29.0 feet. Total depth sampled = 29.0 feet.
				35				WELL COMPLETION DETAILS: 0 to 19.0 feet: 2-inch-diameter, flush-threaded, schedule 40 PVC blank riser pipe. 19.0 to 28.0 feet: 2-inch-diameter, flush-threaded, schedule 40 PVC well screen with 0.010-inch machined slots. 28.0 to 29.0 feet: 2-inch-diameter, flush-threaded, schedule 40 PVC blank sump pipe. 0 to 3.0 feet: Concrete. 3.0 to 16.5 feet: Bentonite chips hydrated with potable water. 16.5 to 29.0 feet: 20 - 40 Colorado Silica Sand.
				40				

REMARKS

LOG OF EXPLORATORY BORING

PROJECT NAME Coffin Butte Landfill
LOCATION Coffin Butte, Benton County, Oregon
DRILLED BY GeoTech Explorations
DRILL METHOD H.S.A. with C.C.B.
LOGGED BY Mike Free

BORING NO. MW-16
PAGE 1 OF 2
GROUND ELEV.
TOTAL DEPTH 27.30'
DATE COMPLETED 07/19/93

SAMPLE TYPE	RECOVERY PERCENT	POCKET PENE-TROMETER (T/ft)	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	LITHOLOGIC COLUMN	WELL DETAILS	LITHOLOGIC DESCRIPTION
CCB	98							**0 to 3.0 feet:** CLAYEY SILT (MH), very dark grayish brown, 70 percent silt, 30 percent clay, trace fine sand, stiff to very stiff, dry to damp, crumbly dry from 0 to 1.0 foot. (ALLUVIUM)
CCB	104			5				**3.0 to 9.0 feet:** CLAYEY SILT (ML), dark yellowish brown, 60 percent silt, 25 percent clay, 10 percent fine to medium gravel, 5 percent fine to coarse sand, stiff (crumbly from 7.0 to 9.0 feet), moist. (COLLUVIUM)
CCB	50			10				**9.0 to 15.2 feet:** CLAYEY GRAVELLY SILT (ML), dark yellowish brown, 50 percent silt, 30 percent fine to coarse, fresh to slightly weathered, subangular basalt gravel, 20 percent clay, stiff, moist. (COLLUVIUM)
CCB	100			15				**15.2 to 16.2 feet:** SANDY SILTY GRAVEL (GP), orangy brown, 60 percent fine to coarse angular weathered basalt gravel, 20 percent basalt sand, 20 percent silt and clay. (COLLUVIUM)
CCB	68		▽					**16.2 to 27.3 feet:** BASALT, black to very dark bluish gray, aphanitic, equigranular, crushed to intensely fractured, hard, fresh. (BEDROCK)
CCB	100			20				

REMARKS

Augered with center bit from 20.8 to 27.3 feet; hard drilling.

LOG OF EXPLORATORY BORING

PROJECT NAME Coffin Butte Landfill
LOCATION Coffin Butte, Benton County, Oregon
DRILLED BY GeoTech Explorations
DRILL METHOD H.S.A. with C.C.B.
LOGGED BY Mike Free

BORING NO. MW-16
PAGE 2 OF 2
GROUND ELEV.
TOTAL DEPTH 27.30'
DATE COMPLETED 07/19/93

SAMPLE TYPE	RECOVERY PERCENT	POCKET PENE-TROMETER (T/ft)	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	LITHOLOGIC COLUMN	WELL DETAILS	LITHOLOGIC DESCRIPTION
CCB	100			25				16.2 to 27.3 feet: BASALT, continued.
				30				Total depth drilled = 27.3 feet. Total depth sampled = 27.3 feet. WELL COMPLETION DETAILS: 0 to 17.2 feet: 2-inch-diameter, flush-threaded, schedule 40 PVC blank riser pipe. 17.2 to 26.6 feet: 2-inch-diameter, flush-threaded, schedule 40 PVC well screen with 0.020-inch machined slots. 26.6 to 27.3 feet: 2-inch-diameter, flush-threaded, schedule 40 PVC blank sump pipe. 0 to 3.0 feet: Concrete. 3.0 to 15.6 feet: Bentonite chips hydrated with potable water. 15.6 to 27.3 feet: 10 - 20 Colorado Silica Sand.
				35				
				40				

REMARKS

Augered with center bit from 20.8 to 27.3 feet; hard drilling.

LOG OF EXPLORATORY BORING

PROJECT NAME	Coffin Butte Landfill	BORING NO.	MW-22
LOCATION	Benton County, Oregon	PAGE	1 OF 2
DRILLED BY	Geo-Tech Explorations, Inc.	GROUND ELEV.	232.73'
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	29.00'
LOGGED BY	Eric Tuppan	DATE COMPLETED	07/22/94

SAMPLE TYPE	RECOVERY PERCENT	POCKET PENETRO-METER	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHOLOGIC COLUMN	LITHOLOGIC DESCRIPTION
CCB	75%							0 to 1.0 foot: GRAVEL FILL, grass at surface.
		3.3						1.0 to 9.3 feet: SILTY CLAY (CL), very dark grayish brown (10YR 3/2), some mottling with dark gray brown (10YR 2/6); medium plasticity fines; silty, minor fine to medium sand; root hairs; very stiff to stiff; damp. (ALLUVIUM)
CCB	100%	1.75	▼ 7/22/94	5				@ 5.5 feet: dark brown (10YR 3/3) with oxidized medium sand grains.
								@ 6.0 feet: root holes; moist to wet.
CCB	100%	2.5		10				@ 9 to 9.3 feet: basal layer of sandy clay.
								9.3 to 14.0 feet: CLAYEY SILT (ML), dark olive gray (5Y 3/2); very clayey; medium plasticity; trace fine to medium sand; very stiff; root hairs and root holes are wet to moist; crumbly texture. (ALLUVIUM)
CCB	100%	0.75		15				14.0 to 24.7 feet: SILT (MH), dark olive gray (5Y 3/2); minor clay; high plasticity; roots and organic matter common; root holes are wet. (ALLUVIUM)
			▽ 7/22/94					@ 17.0 feet: zones of very dark grayish brown (2.5Y 3/2); twigs horizontal to core axis; roots and root holes abundant; firm to very stiff; wet in root holes.
		3.25						
CCB	100%			20				

REMARKS

Boring drilled with 3.75-inch I.D. hollow-stem augers to 29 feet and sampled with continuous core barrel. Backfilled hole from 24 to 29 feet with bentonite chips and pulled augers. Reamed out hole with 6.25-inch hollow-stem auger to 24.2 feet and installed well.

LOG OF EXPLORATORY BORING

PROJECT NAME	**Coffin Butte Landfill**	BORING NO.	**MW-22**
LOCATION	**Benton County, Oregon**	PAGE	**2 OF 2**
DRILLED BY	**Geo-Tech Explorations, Inc.**	GROUND ELEV.	**232.73'**
DRILL METHOD	**Hollow Stem Auger**	TOTAL DEPTH	**29.00'**
LOGGED BY	**Eric Tuppan**	DATE COMPLETED	**07/22/94**

SAMPLE TYPE	RECOVERY PERCENT	POCKET PENETRO-METER	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHOLOGIC COLUMN	LITHOLOGIC DESCRIPTION
								14.0 to 24.7 feet: SILT (MH), continued.
		3.0						@ 20.0 feet: dark gray (5Y 4/1); uniform silt with abundant roots; very stiff; damp to moist.
CCB	100%							
				25				**24.7 to 29.0 feet: CLAY (CL)**, dark olive gray (5Y 3/2); low plasticity clay with minor silt; trace fine to medium sand; relict intergranular basalt texture; few roots; crumbly and breaks apart along what appear to be relict fractures(?); very stiff; moist. (WEATHERED BEDROCK)
		2.0						
				30				Boring terminated at 29.0 feet; sufficient data.
				35				
				40				

REMARKS

Boring drilled with 3.75-inch I.D. hollow-stem augers to 29 feet and sampled with continuous core barrel. Backfilled hole from 24 to 29 feet with bentonite chips and pulled augers. Reamed out hole with 6.25-inch hollow-stem auger to 24.2 feet and installed well.

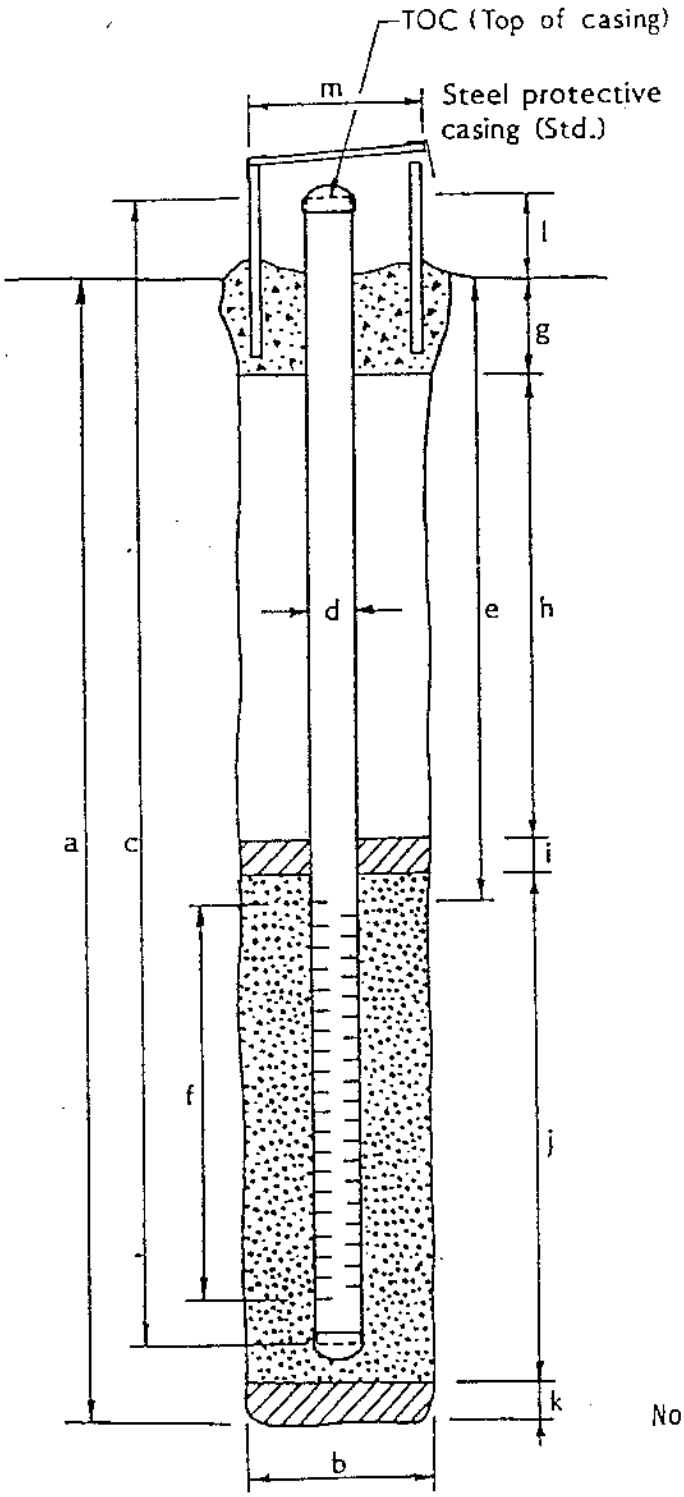
EMCON

WELL DETAILS

EMCON ASSOCIATES

PROJECT NUMBER 0139-001.47
PROJECT NAME Coffin Butte Landfill
LOCATION Benton County , Or
WELL PERMIT NO. 67395

BORING / WELL NO. MW-22
TOP OF CASING ELEV. 235.30
GROUND SURFACE ELEV. 232.73
DATUM Mean Sea level
INSTALLATION DATE 7-22-94



EXPLORATORY BORING

a. Total depth 29.0 ft.
b. Diameter 10 1/4 in.
Drilling method Hollow-stem auger

WELL CONSTRUCTION

c. Total casing length 26.7 ft.
Material Sch. 40 PVC
d. Diameter 2 in.
e. Depth to top perforations 14.0 ft.
f. Perforated length 9.6 ft.
Perforated interval from 14.0 to 23.6 ft.
Perforation type Machine Slotted
Perforation size 0.010 inch
g. Surface seal (0-2.0) 2.0 ft.
Seal material Concrete
h. Backfill ft.
Backfill material NA
i. Seal (2.0 - 11.0) 9.0 ft.
Seal material Bentonite Chips
j. Gravel pack (11.0-24.2) 13.2 ft.
Pack material 20X40 Silica Sand
k. Bottom seal (24.2 - 29.0) 4.8 ft.
Seal material Bentonite Chips
l. Casing stickup 2.46 ft.
m. Protective casing diameter 6.5 in.

Note: SS Centralizers at 8.7' and 24.0'

Prepared by: Eric Tuppan

Reviewed by: [signature] Date: 8/12/94

LOG OF EXPLORATORY BORING

PROJECT NAME	**Coffin Butte Landfill**	BORING NO.	**MW-23**
LOCATION	**Coffin Butte, Benton County, Oregon**	PAGE	**1 OF 2**
DRILLED BY	**Geo-Tech Explorations, Inc.**	GROUND ELEV.	**242.81'**
DRILL METHOD	**Hollow Stem Auger**	TOTAL DEPTH	**24.30'**
LOGGED BY	**Mike Free**	DATE COMPLETED	**08/02/94**

SAMPLE TYPE	RECOVERY PERCENT	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHOLOGIC COLUMN	LITHOLOGIC DESCRIPTION
CCB	45	▽ 8/2/94					**0 to 3.0 feet: CLAYEY SILT (ML)**, very dark grayish brown, some black; medium plasticity fines; 10 percent fine to coarse sand; 10 percent medium gravel; firm, moist, few roots. (FILL) @ 1.0 foot: soft. @ 2.0 feet: wet.
CCB	100		5				**3.0 to 10.5 feet: SANDY CLAYEY SILT (ML)**, very dark grayish brown; medium plasticity fines; 15 percent fine to coarse sand, mostly medium; few roots; firm, wet (root holes wet). (ALLUVIUM) @ 4.8 feet: grayish brown and orange mottling.
CCB	90						@ 7.0 to 8.0 feet: crumbly, low plasticity.
CCB	100		10				**10.5 to 16.2 feet: CLAYEY SILT (ML)**, dark gray to dark greenish gray; breaks with massive, fine grained texture; trace fine rootlets; micaceous; stiff to firm; wet. (ALLUVIUM) @ 12.0 feet: core barrel wet on outside.
CCB	100		15				@ 15.5 to 16.5 feet: few fine rootlets.
CCB	100		20				**16.2 to 20.4 feet: SANDY SILTY CLAY (CL)**, very dark greenish gray; medium plasticity fines; 20 percent fine to coarse sand; trace fine gravel; breaks with massive, textured surface; trace fine rootlets; stiff; wet. (ALLUVIUM) @ 17.0 feet: low plasticity.

REMARKS

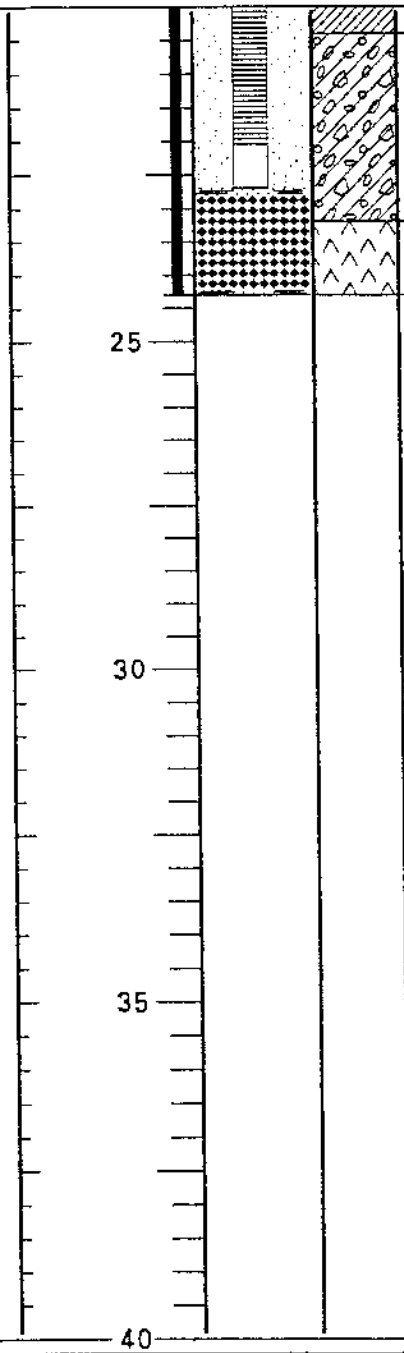
Drilled to 24.3 feet with 3 3/4-inch I.D. augers and sampled with continuous core barrel. Backfilled with bentonite chips from 21.0 to 24.3 feet. Reamed with 6 1/4-inch I.D. auger with PVC plug to 22.8 feet and installed well. Added 30 gallons of potable water during well installation.

EMCON

LOG OF EXPLORATORY BORING

PROJECT NAME	**Coffin Butte Landfill**	BORING NO.	**MW-23**
LOCATION	**Coffin Butte, Benton County, Oregon**	PAGE	**2 OF 2**
DRILLED BY	**Geo-Tech Explorations, Inc.**	GROUND ELEV.	**242.81'**
DRILL METHOD	**Hollow Stem Auger**	TOTAL DEPTH	**24.30'**
LOGGED BY	**Mike Free**	DATE COMPLETED	**08/02/94**

SAMPLE TYPE	RECOVERY PERCENT		GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHOLOGIC COLUMN	LITHOLOGIC DESCRIPTION



16.2 to 20.4 feet: SANDY SILTY CLAY (CL), continued.

20.4 to 23.2 feet: CLAYEY SANDY GRAVEL (GC), dark greenish gray; 30 percent fines; 10 percent fine to coarse sand; 60 percent well graded fine to coarse gravel; sand and gravel subangular to well rounded; loose; wet. (ALLUVIUM)

23.2 to 24.3 feet: BASALT, light to very dark brown, some yellow; crushed; 50 percent friable, 50 percent low to moderate hardness; weakly to deeply weathered; wet. (BEDROCK)

Boring terminated at 24.3 feet; sufficient data.

WELL COMPLETION DETAILS:

0 to 12.4 feet: 2-inch-diameter, flush-threaded, Schedule 40 PVC blank riser pipe.
12.4 to 22.1 feet: 2-inch-diameter, flush-threaded, Schedule 40 PVC well screen with 0.010-inch machined slots.
22.1 to 22.7 feet: 2-inch-diameter flush-threaded end cap.

0 to 2.0 feet: Concrete.
2.0 to 9.6 feet: Bentonite chips hydrated with potable water.
9.6 to 22.7 feet: 20 - 40 Colorado Silica Sand.
22.7 to 22.8 feet: Slough
22.8 to 24.2 feet: Bentonite chips.
24.2 to 24.3 feet: Slough.

REMARKS

Drilled to 24.3 feet with 3 3/4-inch I.D. augers and sampled with continuous core barrel. Backfilled with bentonite chips from 21.0 to 24.3 feet. Reamed with 6 1/4-inch I.D. auger with PVC plug to 22.8 feet and installed well. Added 30 gallons of potable water during well installation.

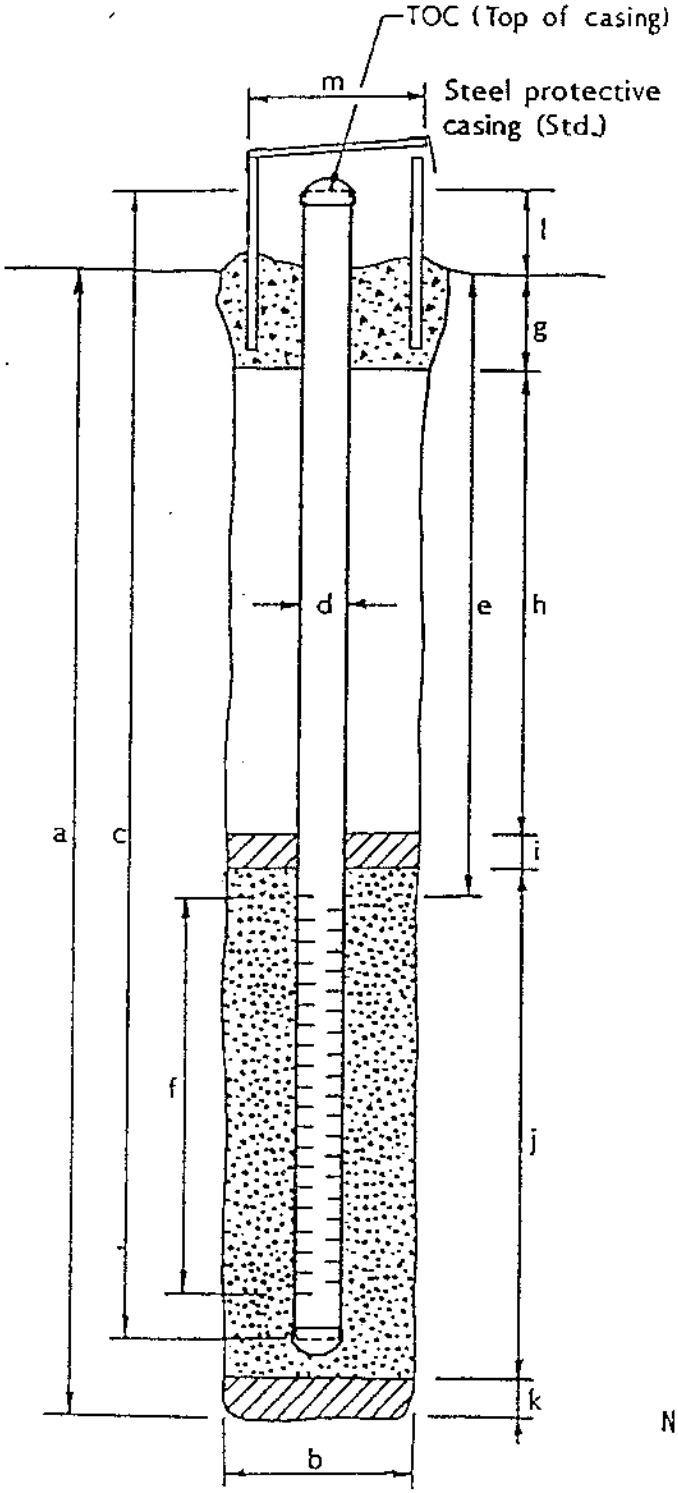
EMCON

WELL DETAILS

EMCON ASSOCIATES

PROJECT NUMBER 0139-001.47
PROJECT NAME Coffin Butte Landfill
LOCATION Benton County, Or
WELL PERMIT NO. 67396

BORING / WELL NO. MW 23
TOP OF CASING ELEV. 244.71
GROUND SURFACE ELEV. 242.81
DATUM Mean Sea Level
INSTALLATION DATE 8-2-94



EXPLORATORY BORING

a. Total depth 24.3 ft.
b. Diameter 10 1/4 in.
Drilling method Hollow Stem Auger

WELL CONSTRUCTION

c. Total casing length 24.7 ft.
Material Sch 40 PVC
d. Diameter 2 in.
e. Depth to top perforations 12.4 ft.
f. Perforated length 9.7 ft.
Perforated interval from 12.4 to 22.1 ft.
Perforation type Machine Slotted
Perforation size 0.010 inch
g. Surface seal (0-2.0) 2.0 ft.
Seal material Concrete
h. Backfill ft.
Backfill material NA
i. Seal (2.0- 9.6) 7.6 ft.
Seal material Bentonite Chips
j. Gravel pack (9.6-22.7) 13.1 ft.
Pack material 20-40 Silica Sand
k. Bottom seal 1.5 ft.
Seal material Bentonite Chips
l. Casing stickup 2.0 ft.
m. Protective casing diameter 6.5 in.
Note: SS Centralizers at 7.2' and 21.2'.

Prepared by: Mike Free

Reviewed by: EQ Date: 8/12/94

LOG OF EXPLORATORY BORING

PROJECT NAME	Coffin Butte/Valley Landfills		
LOCATION	Benton County, Oregon	PAGE	1 OF 2
DRILLED BY	GeoTech Explorations, Inc.	BORING NO.	MW-24
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	35'
LOGGED BY	John Renda	DATE COMPLETED	8/31/98

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOWS/6"	GROUND WATER LEVEL	DEPTH IN FT.	SAMPLES	WELL DETAILS	LITHOLOGIC COLUMN	LITHOLOGIC DESCRIPTION
1 SS	67	6-11-16						**0.0 to 13.5 feet: SILTY CLAY (CL);** yellowish-brown (10 YR, 6/6); 95% medium to high plasticity fines, trace coarse sand; 5% organics (roots); very stiff; dry. (ALLUVIUM)
2 SS	33	10-7-5						
3 SS	100	3-6-8		5				
4 SS	20	3-3-6						
5 SS	100	3-5-8						
6 SS	100	3-3-7		10				
7 SS	100	3-8-11						
8 SS	100	3-9-24						@ 12.0 feet: sand content increases to 5%.
9 SS	100	24-23-17						**13.5 to 35.0 feet: BASALT WEATHERED TO SILTY CLAY (CL) WITH SAND (SW) AND GRAVEL (GC);** brown (7.5 YR, 4/6); 50% medium to high plasticity fines, 40% deeply weathered basaltic gravel; friable; 10% fine to medium sand; dense. (WEATHERED BASALT)
10 SS	33	16-24-50/0.4'		15				
11 SS	100	8-25-36						
12 SS	100	19-22-44	8/31/98 ▼					@ 18.0 feet: moist.
				20				

REMARKS

EMCON®

LOG OF EXPLORATORY BORING

PROJECT NAME	Coffin Butte/Valley Landfills		
LOCATION	Benton County, Oregon	PAGE	2 OF 2
DRILLED BY	GeoTech Explorations, Inc.	BORING NO.	MW-24
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	35'
LOGGED BY	John Renda	DATE COMPLETED	8/31/98

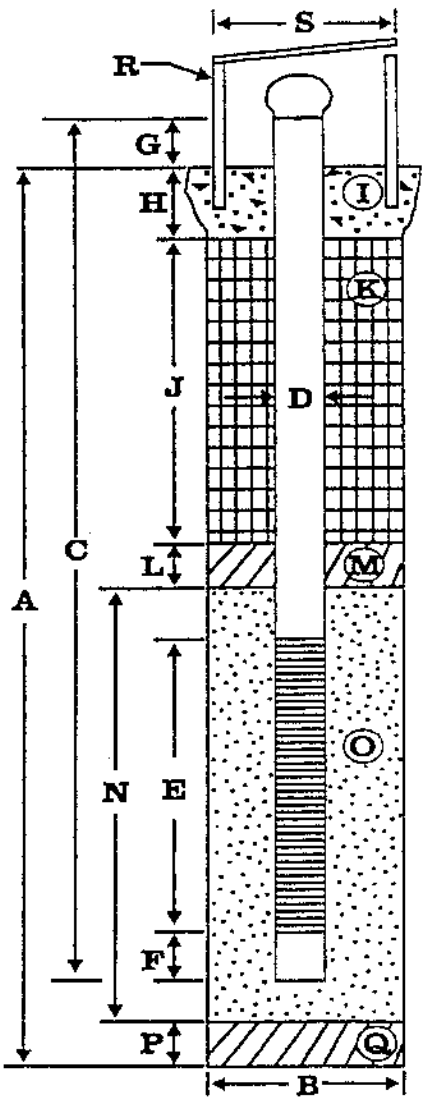
SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOWS/6"	GROUND WATER LEVEL	DEPTH IN FT.	SAMPLES	WELL DETAILS	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION
13 SS	100	12-50/0.4'						
14 SS	67	21-24-50/0.4'						
15 SS	100	19-50/0.4'	▽					
16 SS	40	50/0.4'						@ 24.0 feet: wet.
17 SS	40	50/0.4'		25				@ 25.0 feet: split spoon refusal.
				30				
18 SS	100	50/0.4'		35				@ 35.0 feet: fractured basalt; auger refusal. @ 35.0 feet: boring terminated.
				40				

REMARKS

EMCON®

WELL DETAILS

Project Number:	40139-001.065	Boring/Well No.:	MW-24
Client Name:	Valley Landfills, Inc	Top of Casing Elev.:	276.76
Project Name:	Coffin Butte Landfill	Ground Surface Elev.:	273.94
Location:	Benton County, Oregon	Installation Date:	8/31/98
Driller:	Geo-Tech Explorations, Inc.	Permit/Start Card No.:	112462



	Depth (feet)	Elev. (ft, msl)
	3.0	276.94
	2.8	276.76
	0.0	273.94
	1.0	272.94
	1.0	272.94
	18.0	255.94
	19.5	254.44
	34.5	239.44
	35.0	238.94
	35.0	238.94

EXPLORATORY BORING

A. Total depth:	35.0 ft.
B. Diameter	10 in.
Drilling method:	Hollow Stem Auger

WELL CONSTRUCTION

C. Well casing length:	37.7 ft.
Well casing material:	Sched 40 PVC
D. Well casing diameter:	2.0 in.
E. Well screen length:	15.0 ft.
Well screen type:	Machine Slotted
Well screen slot size:	0.020 in.
F. Well sump/end cap length:	0.5 ft.
G. Well casing height (stickup):	2.7 ft.
H. Surface seal thickness:	1.0 ft.
I. Surface seal material:	Concrete
J. Annular seal thickness:	NA ft.
K. Annular seal material:	NA
L. Filter pack seal thickness:	18.0 ft.
M. Filter pack seal material:	Bentonite Chips
N. Sand pack thickness:	17.0 ft.
O. Sand pack material:	8X12 Silica Sand
P. Bottom material thickness:	NA ft.
Q. Bottom material:	NA
R. Protective casing material:	Steel
Well centralizer depths:	20 and 34 ft.
S. Protective casing diameter:	6.5 in.

NOTES:

Installed by: John J. Renda

Reviewed by: [signature]

Date: 2/8/98

LOG OF EXPLORATORY BORING

PROJECT NAME	**Coffin Butte Landfill**	BORING NO.	**MW-25**
LOCATION	**Benton County, Oregon**	PAGE	**1 OF 2**
DRILLED BY	**Geo-Tech Explorations, Inc.**	REFERENCE ELEV.	**242.79**
DRILL METHOD	**Hollow Stem Auger**	TOTAL DEPTH	**32.5 feet**
LOGGED BY	**John Renda**	DATE COMPLETED	**6/4/99**

SAMPLE NUMBER	BLOWS PER FOOT	GROUND WATER LEVEL	DEPTH IN FEET	SOIL SAMPLES	WELL DETAILS	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION
							0.0 to 7.0 feet: GRAVEL FILL.
SS-1	3-4-6 (10)						**7.0 to 11.0 feet:** SILTY CLAY (CL); very dark grayish brown (2.5YR 3/2); medium plasticity fines; silty; trace fine to medium sand; root hairs; firm to stiff; damp. (ALLUVIUM)
SS-2	2-3-4 (7)	▼					
SS-3	1-2-3 (5)						
SS-4	4-6-10 (16)						**11.0 to 14.5 feet:** CLAYEY SILT (ML); dark gray (2.5YR 4/1); medium plasticity fines; trace fine to medium sand; root hairs; stiff, crumbly texture. (ALLUVIUM)
SS-5	4-6-8 (14)	▼					@ 13.0 feet: wet.
SS-6	4-7-10 (17)						**14.5 to 24.0 feet:** SILT (MH); dark greenish gray (10GY 4/1); medium to high plasticity fines; root hairs; moist. (ALLUVIUM)
SS-7	3-5-5 (10)						
SS-8	5-11-11 (22)						
SS-9	3-4-6						

5 10 15 20

REMARKS

SS = samples collected with a split-spoon stainless steel sampler.

EMCON®

LOG OF EXPLORATORY BORING

PROJECT NAME	Coffin Butte Landfill	BORING NO.	MW-25
LOCATION	Benton County, Oregon	PAGE	2 OF 2
DRILLED BY	Geo-Tech Explorations, Inc.	REFERENCE ELEV.	242.79
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	32.5 feet
LOGGED BY	John Renda	DATE COMPLETED	6/4/99

SAMPLE NUMBER	BLOWS PER FOOT	GROUND WATER LEVEL	DEPTH IN FEET	SOIL SAMPLES	WELL DETAILS	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION
	(10)						**14.5 to 24.0 feet: SILT (MH)**; continued.
SS-10	3-6-8 (14)						
SS-11	4-8-7 (15)						
SS-12	2-3-5 (8)						**24.0 to 32.5 feet: CLAY (CL)**; dark greenish gray (10Y 3/1); medium to high plasticity clay; trace fine to coarse, subrounded to well-rounded sand; relict basalt texture visible; root hairs; stiff; moist. (WEATHERED BASALT)
SS-13	3-4-6 (10)		25				
SS-14	4-8-12 (20)						
SS-15	5-10-13 (23)						
SS-16	8-13-15 (28)		30				
SS-17	4-6-7 (13)						
							Boring terminated at 29.5 feet. Split-spoon sampler advanced to 32.5 feet.
			35				
			40				

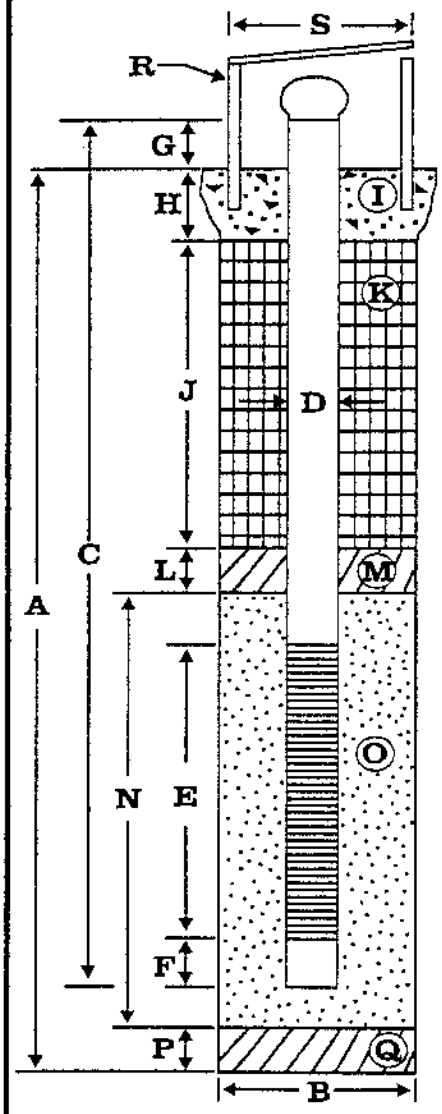
REMARKS

SS = samples collected with a split-spoon stainless steel sampler.

EMCON®

WELL DETAILS

Project Number:	40139-001.071	Boring/Well No.:	MW-25
Client Name:	Valley Landfills, Inc.	Top of Casing Elev.:	242.79
Project Name:	Coffin Butte Landfill	Ground Surface Elev.:	240.39
Location:	Benton County, Oregon	Installation Date:	6/4/99
Driller:	Geo-Tech Explorations	Permit/Start Card No.:	122965



	Depth (feet)	Elev. (ft, msl)
	2.6	243.0
	2.4	242.8
	0.0	240.4
	2.0	238.4
	11.0	229.4
	13.5	226.9
	23.5	216.9
	24.0	216.4
	24.0	216.4
	32.5	207.9

Installed by: J. Renda

Reviewed by: ET

Date: 7/20/99

EXPLORATORY BORING

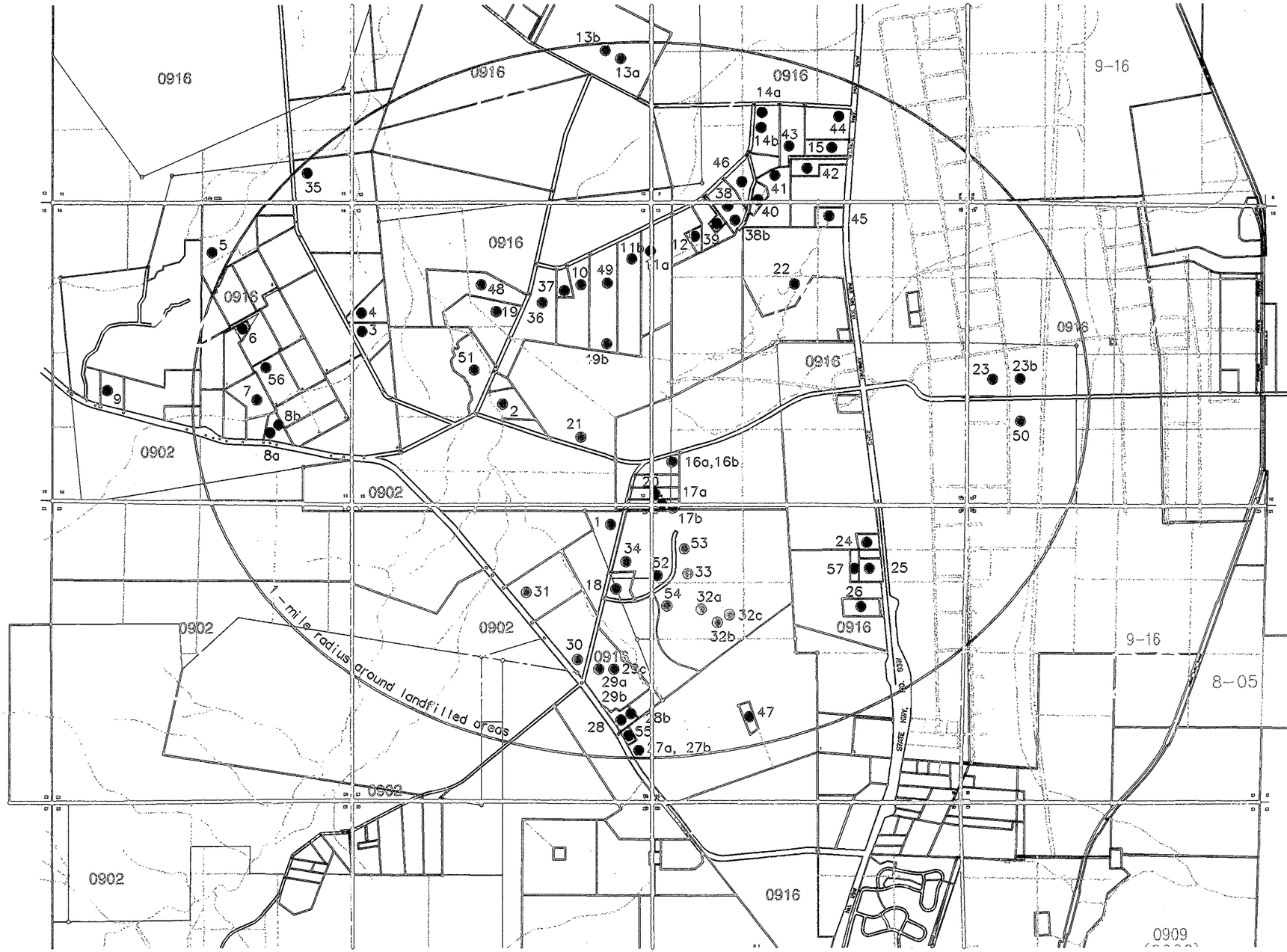
A. Total depth: 32.5 ft.
B. Diameter 10 in.
Drilling method: Hollow Stem Auger

WELL CONSTRUCTION

C. Well casing length: 26.7 ft.
Well casing material: Schedule 40 PVC
D. Well casing diameter: 2 in.
E. Well screen length: 10 ft.
Well screen type: Machine Slotted
Well screen slot size: 0.020 in.
F. Well sump/end cap length: 0.5 ft.
G. Well casing height (stickup): 1.5 ft.
H. Surface seal thickness: 2.0 ft.
I. Surface seal material: Cement
J. Annular seal thickness: 9 ft.
K. Annular seal material: Bentonite Chips
L. Filter pack seal thickness: NA ft.
M. Filter pack seal material: NA
N. Sand pack thickness: 13 ft.
O. Sand pack material: 10 x 20 Silica Sand
P. Bottom material thickness: 8.5 ft.
Q. Bottom material: Bentonite Chips
R. Protective casing material: Steel
Well centralizer depths: 13.0 ft.
23.5 ft.
S. Protective casing diameter: 6.5 in.

NOTES:

Well coordinates: Northing: 1181.5 Easting: 2626.8



NUMBER OF WELLS NOT REFERENCED TO FIELD LOCATIONS

TOWNSHIP 10S

RANGE 4W

SECTION 7 = 6 WELLS
SECTION 8 = 0 WELLS
SECTION 17 = 3 WELLS
SECTION 18 = 13 WELLS
SECTION 19 = 16 WELLS
SECTION 20 = 2 WELLS

RANGE 5W

SECTION 11 = 0 WELLS
SECTION 12 = 3 WELLS
SECTION 13 = 16 WELLS
SECTION 14 = 19 WELLS
SECTION 23 = 0 WELLS
SECTION 24 = 11 WELLS

0 2000 4000
SCALE IN FEET

DATE 5/15/00
DWN JAC
APP KT 5/15/00
REV
PROJECT NO.
793036

Figure 2-3b
VALLEY LANDFILLS, INC.
COFFIN BUTTE LANDFILL
BENTON COUNTY, OREGON

BENEFICIAL USE MAP

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

RECEIVED
OCT 4 1972
STATE ENGINEER
SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

Bent EMCON 16a 1760

State Well No. 10S/4W-1
State Permit No.

(1) OWNER:
Name Robert Westfall
Address Rt 1 Box 303E
Corvallis, Oregon

(2) TYPE OF WORK (check):
New Well ☑ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☑ Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☑ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) CASING INSTALLED:
Threaded ☐ Welded ☑
6 " Diam. from 0 ft. to 26 ft. Gage .250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(6) PERFORATIONS:
Perforated? ☐ Yes ☑ No.
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:
Well screen installed? ☐ Yes ☑ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☑ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " "
AIR " " "
Bailer test 20 gal./min. with 47 ft. drawdown after 2 hrs.
Artesian flow g.p.m.
Temperature of water Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used Cement
Well sealed from land surface to 20 ft.
Diameter of well bore to bottom of seal 9 in.
Diameter of well bore below seal 6 in.
Number of sacks of cement used in well seal 1 sacks
Number of sacks of bentonite used in well seal — sacks
Brand name of bentonite —
Number of pounds of bentonite per 100 gallons of water lbs./100 gals.
Was a drive shoe used? ☐ Yes ☑ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☑ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☑ No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
County Benton Driller's well number
SW ¼SW¼ Section 18 T. 10S R. 4W W
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found 48
Static level 17 ft. below land surface. Date 9/15
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing 6
Depth drilled 74 ft. Depth of completed well 74

Formation: Describe color, texture, grain size and structure of materi and show thickness and nature of each stratum and aquifer penetra with at least one entry for each change of formation. *Report each chang position of Static Water Level and indicate principal water-bearing str*

MATERIAL	From	To	SW
Soil	0	2	
Clay, yellow	2	16	
Broken Sandrock in clay yellow	16	20	
Sandrock, hard, blue	20	48	
Sandrock, blue, broken water stratum	48	56	
Sandrock, blue.	56	74	

Work started Sept 14 19 72 Completed Sept 14 19
Date well drilling machine moved off of well Sept 15 19

Drilling Machine Operator's Certification:
This well was constructed under my direct supervisi Materials used and information reported above are true to best knowledge and belief.
[Signed] Leroy W. Mutschler Date 9/15, 19
(Drilling Machine Operator)
Drilling Machine Operator's License No. 80

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report true to the best of my knowledge and belief.
Name L.W. Mutschler well Drilling
(Person, firm or corporation) (Type or print)
Address 7555 N.W. Oak Creek Dr. Corvallis Ore 97330
[Signed] Leroy W. Mutschler
(Water Well Contractor)
Contractor's License No. 237 Date Sept 15, 19

NOTICE TO WATER WELL CONTRACTOR: The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

RECEIVED AUG 28 1972 STATE ENGINEER SALEM, OR.

WATER WELL REPORT
STATE OF OREGON
(Please type or print) (Do not write above this line)

Bent EMCON 166 1773

State Well No. 10S/4W-18

State Permit No. .....

(1) OWNER:
Name Robert Westfall
Address Rt 1 Box 303E Corvallis, Oregon

(2) TYPE OF WORK (check):
New Well ☑ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☑ Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☑ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) CASING INSTALLED:
Threaded ☐ Welded ☑
6 " Diam. from 0 ft. to 36 ft. Gage .250
..... " Diam. from ..... ft. to ..... ft. Gage .....
..... " Diam. from ..... ft. to ..... ft. Gage .....

(6) PERFORATIONS:
Perforated? ☐ Yes ☑ No.
Type of perforator used
Size of perforations ..... in. by ..... in.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.

(7) SCREENS:
Well screen installed? ☐ Yes ☑ No
Manufacturer's Name .....
Type ..... Model No. .....
Diam. ..... Slot size ..... Set from ..... ft. to ..... ft.
Diam. ..... Slot size ..... Set from ..... ft. to ..... ft.

(8) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☐ No If yes, by whom?
Yield: ..... gal./min. with ..... ft. drawdown after ..... hrs.
" " "
" " "
Bailer test 22 gal./min. with Full ft. drawdown after 1 hrs.
Artesian flow ..... g.p.m.
Temperature of water ..... Depth artesian flow encountered ..... ft.

(9) CONSTRUCTION:
Well seal—Material used Cement
Well sealed from land surface to 20 ft.
Diameter of well bore to bottom of seal 9 in.
Diameter of well bore below seal 6 in.
Number of sacks of cement used in well seal 1 sacks
Number of sacks of bentonite used in well seal ..... sacks
Brand name of bentonite .....
Number of pounds of bentonite per 100 gallons of water ..... lbs./100 gals.
Was a drive shoe used? ☐ Yes ☐ No Plugs ..... Size: location ..... ft.
Did any strata contain unusable water? ☐ Yes ☑ No
Type of water? ..... depth of strata .....
Method of sealing strata off
Was well gravel packed? ☐ Yes ☑ No Size of gravel: .....
Gravel placed from ..... ft. to ..... ft.

(10) LOCATION OF WELL:
County Benton Driller's well number
¼ ¼ Section 18 T. 10S R. 4W W.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found 43
Static level 15 ft. below land surface. Date 8/17/
Artesian pressure ..... lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing 6
Depth drilled 74 ft. Depth of completed well 74

Formation: Describe color, texture, grain size and structure of materia and show thickness and nature of each stratum and aquifer penetrat with at least one entry for each change of formation. *Report each change position of Static Water Level and indicate principal water-bearing stra*

MATERIAL	From	To	SWI
Soil	0	2	
Clay, yellow	2	30	
Sandrock, blue	30	43	
Sandrock, blue, broken WATER STRATUM	43	74	

Work started Aug 17 1972 Completed Aug 17 19
Date well drilling machine moved off of well Aug 17 19

Drilling Machine Operator's Certification:
This well was constructed under my direct supervisi Materials used and information reported above are true to best knowledge and belief.
[Signed] Leroy A. Mutschler (Drilling Machine Operator) Date 8/18, 19
Drilling Machine Operator's License No. 80

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report true to the best of my knowledge and belief.
Name LA Mutschler well Drilling (Person, firm or corporation) (Type or print)
Address 7555 N.W. Oak Creek Dr. Corvallis Oregon
[Signed] Leroy A. Mutschler (Water Well Contractor)
Contractor's License No. 237 Date Aug 18, 19

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

RECEIVED
OCT - 7 1971
STATE ENGINEER
SALEM OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

Ben + Encon 17a
2146

State Well No. 10/5W-24
State Permit No. _____

(1) OWNER:
Name Don Helm
Address 966 N. W. Sequoia St Corvallis, Oregon

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☒ Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) CASING INSTALLED:
Threaded ☐ Welded ☒
6" Diam. from 0 ft. to 41 ft. Gage .250
_____" Diam. from _____ ft. to _____ ft. Gage _____
_____" Diam. from _____ ft. to _____ ft. Gage _____

(6) PERFORATIONS:
Perforated? ☐ Yes ☒ No.
Type of perforator used
Size of perforations in. by in.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.

(7) SCREENS:
Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " "
" " "
Tested with air estimated 300 GPH "could fluctuate
Bailer test gal./min. with 347 ft. drawdown after 1 hrs.
Artesian flow g.p.m.
Temperature of water Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used Cement Grout
Well sealed from land surface to 39 ft.
Diameter of well bore to bottom of seal 10 in.
Diameter of well bore below seal 6 in.
Number of sacks of cement used in well seal 6 sacks
Number of sacks of bentonite used in well seal sacks
Brand name of bentonite
Number of pounds of bentonite per 100 gallons of water lbs./100 gals.
Was a drive shoe used? ☐ Yes ☒ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
County Benton Driller's well number
¼ ¼ Section 24 T. 10S R. 5W. W.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found 76
Static level 43 ft. below land surface. Date 9-18-71
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing 6
Depth drilled 400 ft. Depth of completed well 400

Formation: Describe color, texture, grain size and structure of materials and show thickness and nature of each stratum and aquifer penetrated with at least one entry for each change of formation. *Report each change in position of Static Water Level and indicate principal water-bearing strata*

MATERIAL	From	To	SWL
Top Soil	0	3	
Yellow Clay	3	11	
Clay & Boulders	11	24	
Brown Sandstone soft	24	33	
Blue Sandstone	33	37	
Black Basalt	37	109	
Blue Black Cong.	109	163	
Black Basalt (Broken)	163	171	
Black Basalt	171	296	
Bleu Black Sandstone Cong	296	400	

Work started 9-16-71 19 Completed 9-18-71 19
Date well drilling machine moved off of well 9-18-71 19

Drilling Machine Operator's Certification:
This well was constructed under my direct supervisic Materials used and information reported above are true to r best knowledge and belief.
[Signed] Lawrence A. Kinsey (Drilling Machine Operator) Date 9-30-71, 19
Drilling Machine Operator's License No. 160

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report true to the best of my knowledge and belief.
Name Casey Jones Well Drilling Co Inc (Person, firm or corporation) (Type or print)
Address R 8 Box 695 Pleasant Hill, Oregon
[Signed] Delbert L Jones (Water Well Contractor)
Contractor's License No. 103 Date 9-30-71, 19

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the
WATER RESOURCES DEPARTMENT, SALEM, OREGON 97310 within 30 days from the date of well completion.

Bert 244

WATER WELL REPORT

STATE OF OREGON
(Please type or print)
(Do not write above this line)

EMCON 176

RECEIVED
MAY 24 1978
WATER RESOURCES DEPT.
SALEM, OREGON

State Well No. 10S/5W-2
State Permit No.

(1) OWNER:
Name John Wilkenson
Address 27469 Fern Ridge Rd.
Sweet Home Ore.

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☒ Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

CASING INSTALLED:
Threaded ☐ Welded ☒
6" Diam. from 0 ft. to 20 ft. Gage .250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

PERFORATIONS:
Perforated? ☐ Yes ☒ No
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:
Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " "
"Tested w/Air 15 gpm " "
Bailer test gal./min. with 189 ft. drawdown after 1 hrs.
Artesian flow g.p.m.
Temperature of water Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used Cement
Well sealed from land surface to 18 ft.
Diameter of well bore to bottom of seal 10 in.
Diameter of well bore below seal 6 in.
Number of sacks of cement used in well seal 12 sacks
How was cement grout placed? poured

Was a drive shoe used? ☒ Yes ☐ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
County Benton Driller's well number
¼ ¼ Section 24 T. 10S R. 5W W
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found 196
Static level 31 ft. below land surface. Date 5/1
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing 6"
Depth drilled ft. Depth of completed well

Formation: Describe color, texture, grain size and structure of materi and show thickness and nature of each stratum and aquifer penetra with at least one entry for each change of formation. Report each chang position of Static Water Level and indicate principal water-bearing str

MATERIAL	From	To	SW
Topsoil	0	5	
Brown Broken Basalt	5	18	
Blue basalt	18	114	
Blue sandstone	114	138	
Blue basalt	138	158	
Blue sandstone	158	220	

Work started 4/27/78 19 Completed 5/1/78 19
Date well drilling machine moved off of well 5/1/78 19

Drilling Machine Operator's Certification:
This well was constructed under my direct supervisi Materials used and information reported above are true to best knowledge and belief.
[Signed] Claude Irby (Drilling Machine Operator) Date 5/8, 19
Drilling Machine Operator's License No. 1133

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report true to the best of my knowledge and belief.
Name Bert Jones (Person, firm or corporation) (Type or print)
Address 29400 Santiam Hwy Lebanon
[Signed] Bert Jones (Water Well Contractor)
Contractor's License No. 544 Date 5/8/78, 19

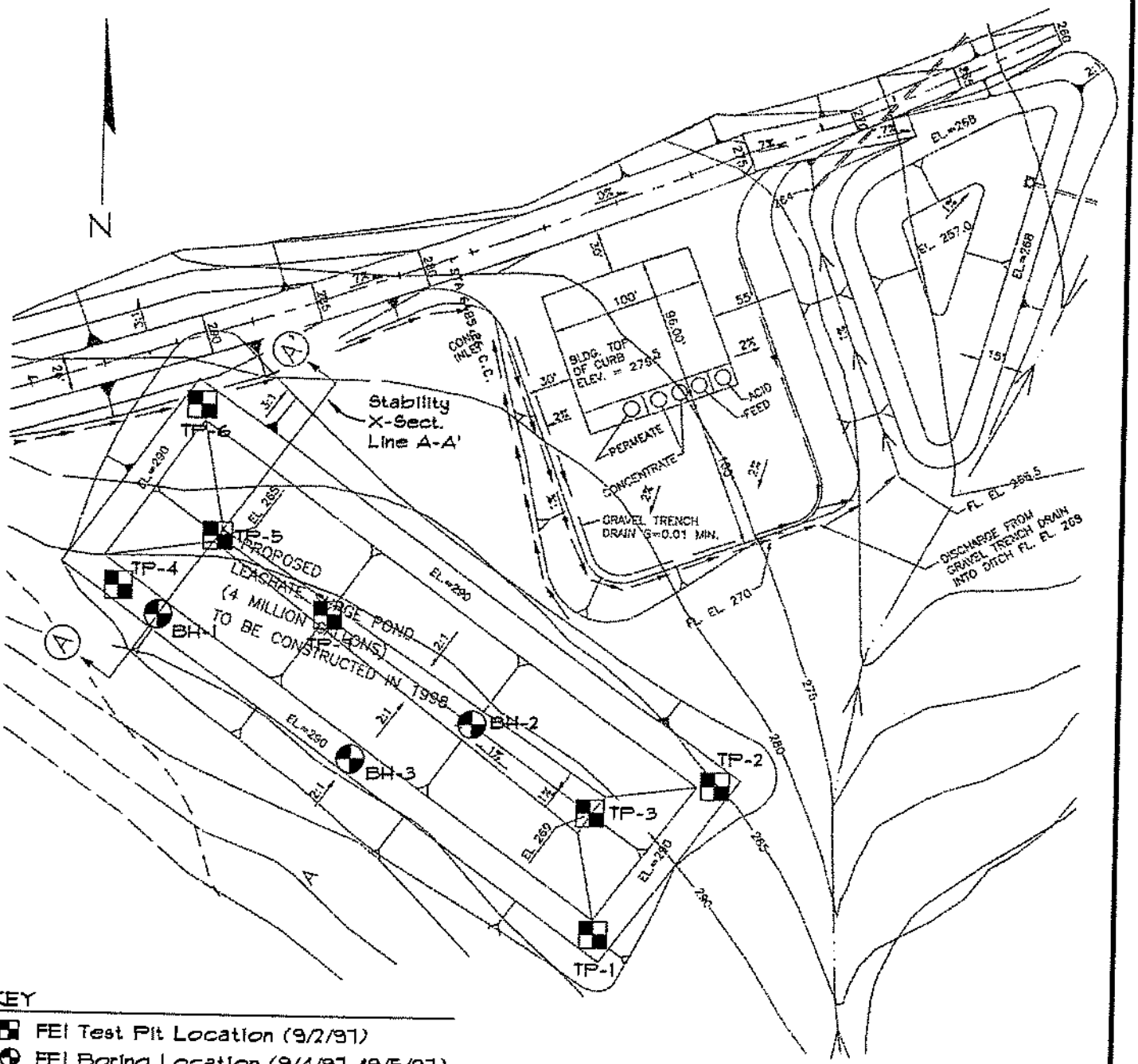
(USE ADDITIONAL SHEETS IF NECESSARY)

Appendix A

Figures

Professional Geotechnical Services

Foundation Engineering, Inc.



KEY

- FEI Test Pit Location (9/2/97)
- FEI Boring Location (9/4/97 &9/5/97)

Notes:
1. Site Plan Provided by Thiel Engineering
2. Test Pit and Boring Locations are Approximate

Scale: 1" = 100'

DATE 10/2/97
DWN. WLN
APPR. _____
REVIS. _____
PROJECT NO.
97100184

FOUNDATION ENGINEERING INC.
PROFESSIONAL GEOTECHNICAL SERVICES
5030 SW PHILOMATH BLVD.
CORVALLIS, OR 97333-1044
BUS. (641) 757-7646 FAX (641) 757-7650

SITE PLAN
COFFIN BUTTE LEACHATE POND

BENTON COUNTY, OREGON

FIGURE NO.
1

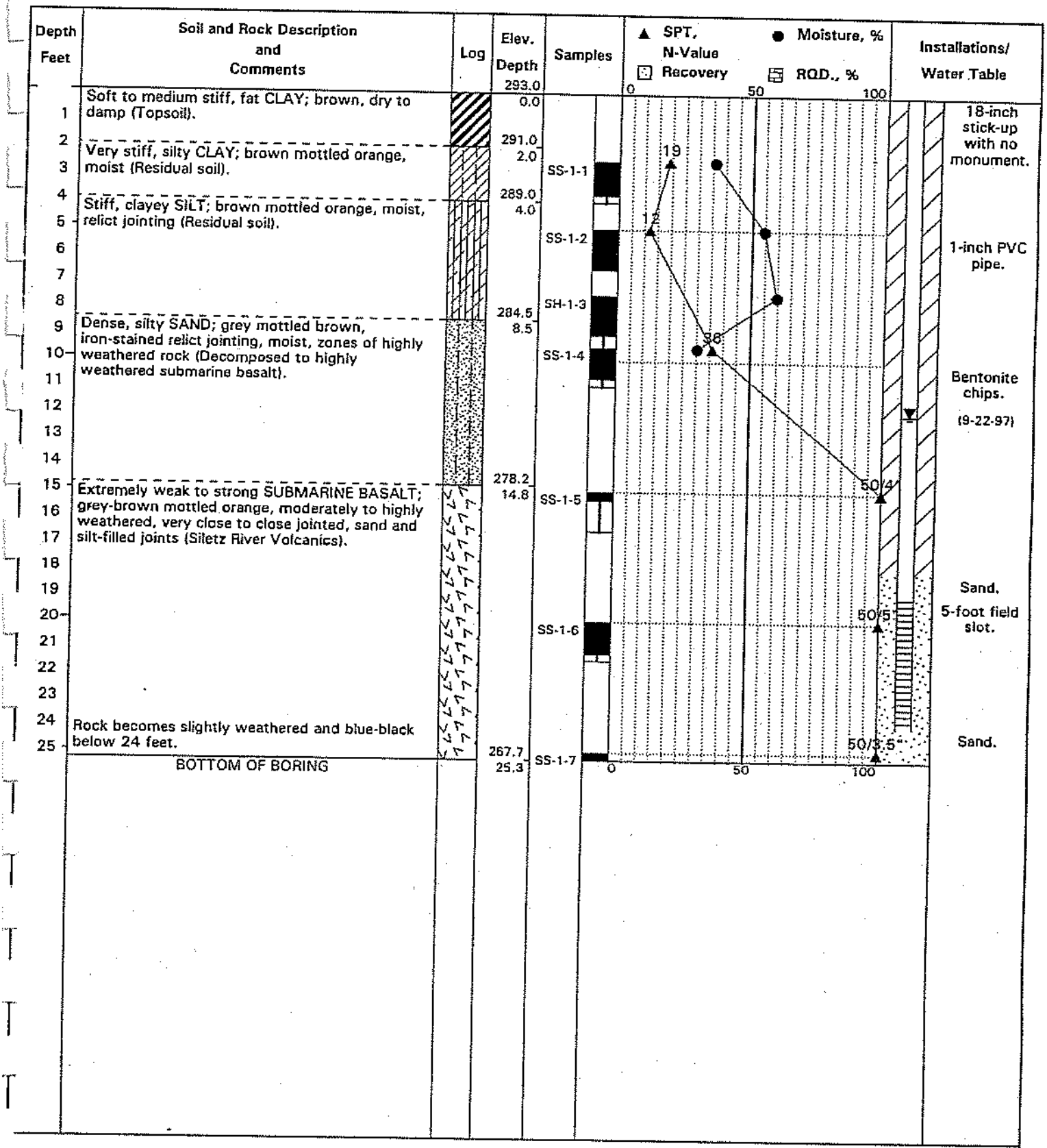
NAME: COFFIN

Appendix B

Boring & Test Pit Logs

Professional Geotechnical Services

Foundation Engineering, Inc.



Project No.: 97100184

Surface Elevation: 293 feet (Approx.)

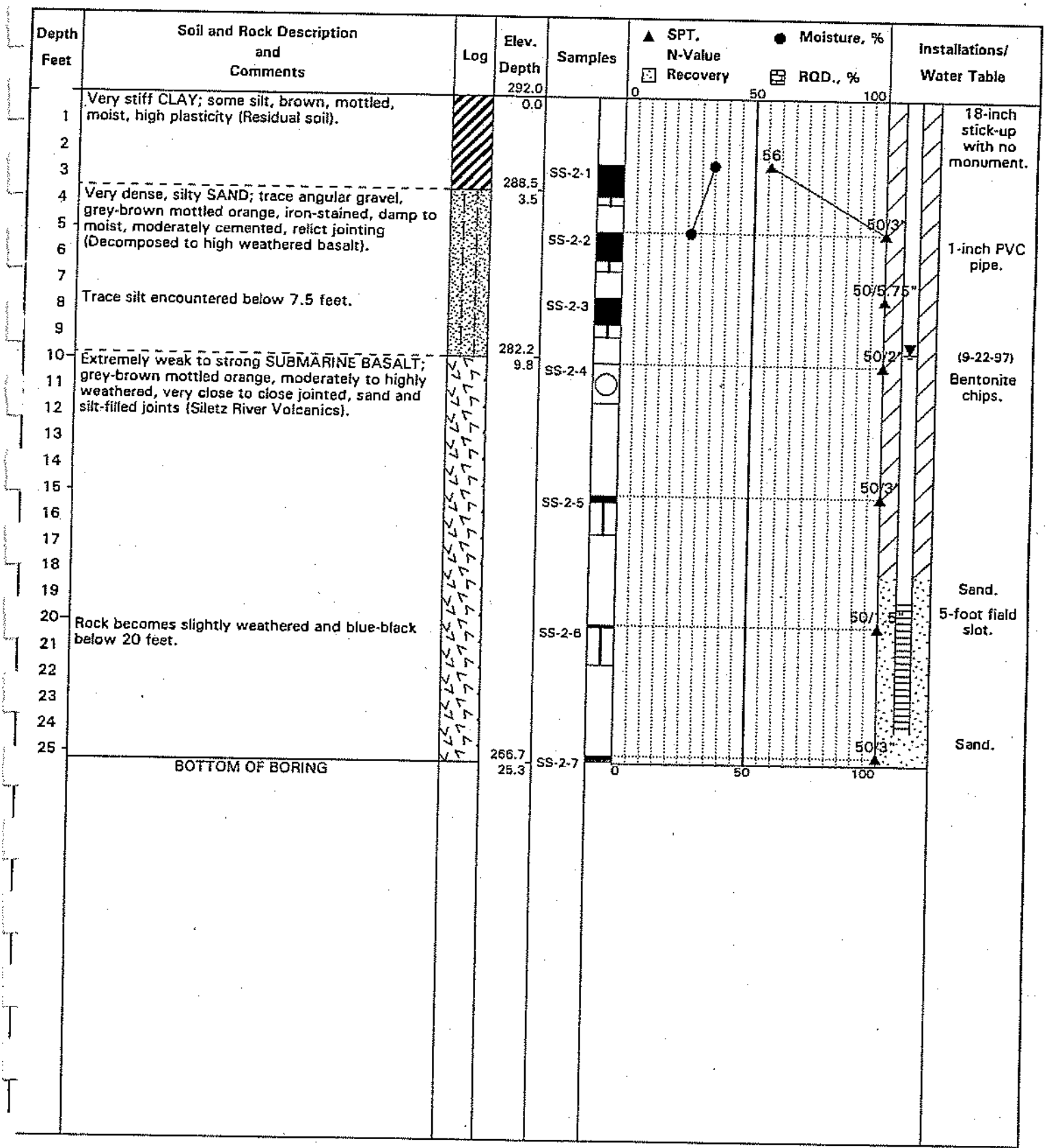
Date of Boring: September 4, 1997

Boring Log: BH-1

Coffin Butte Leachate Pond

Corvallis, Oregon

Foundation Engineering, Inc.



Project No.: 97100184

Surface Elevation: 292 feet (Approx.)

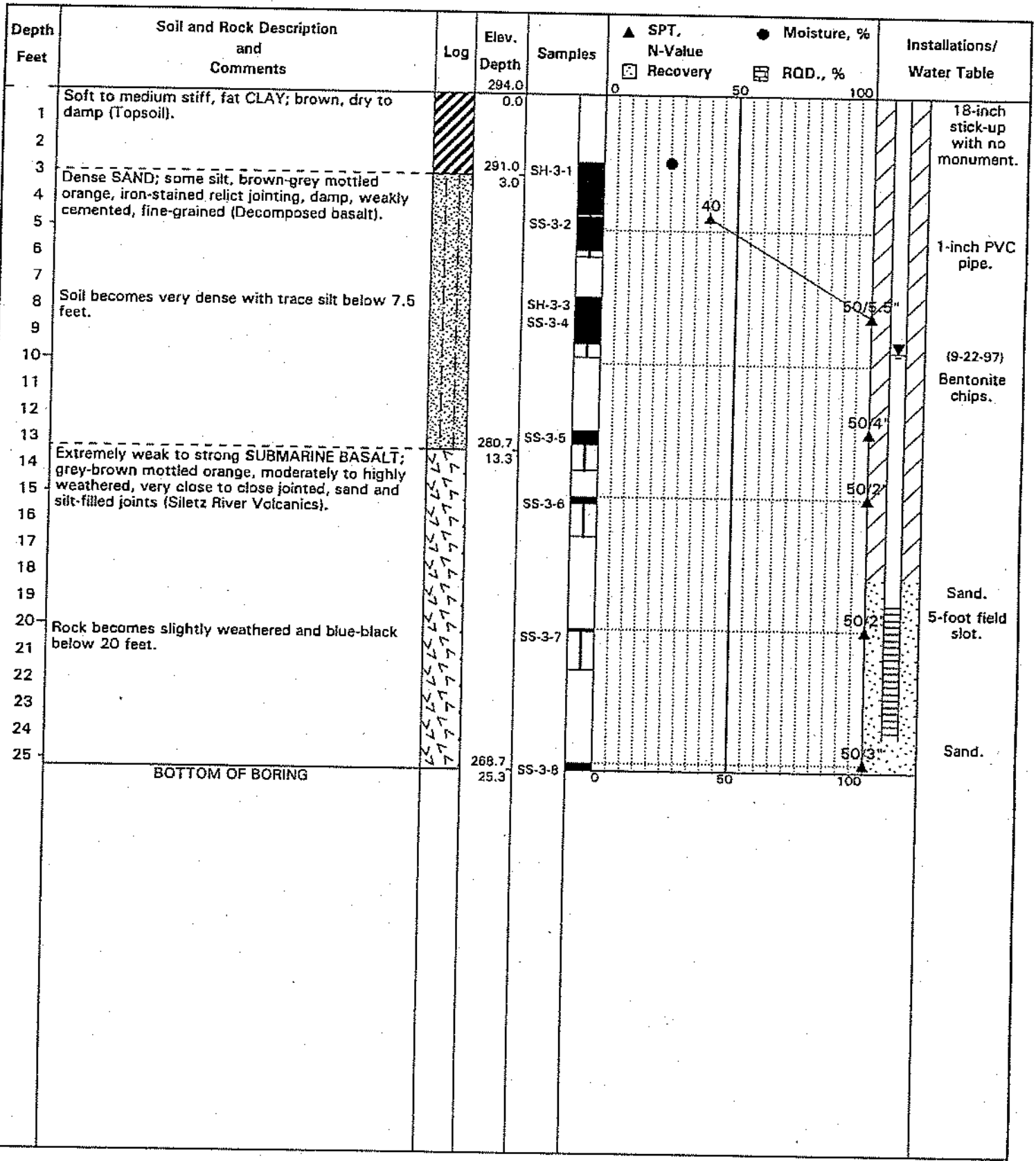
Date of Boring: September 4, 1997

Boring Log: BH-2

Coffin Butte Leachate Pond

Corvallis, Oregon

Foundation Engineering, Inc.



Project No.: 97100184

Surface Elevation: 294 feet (Approx.)

Date of Boring: September 5, 1997

Boring Log: BH-3

Coffin Butte Leachate Pond

Corvallis, Oregon

Foundation Engineering, Inc.

Comments	Depth, Inches	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
6 inches of ground water infiltration after 4 hours. Small to medium-sized roots extend to 3 feet. Hard digging encountered below 6 feet. 2-foot diameter boulder encountered at 6.5 feet. Test pit sidewalls remained vertical. Encountered digging refusal at 15 feet.	1- 2- 3- 4- 5- 6- 7- 8- 9- 10- 11- 12- 13- 14- 15- 16- 17- 18- 19-	S-1-1 WC = 19.4 S-1-2						Very stiff CLAY; some silt, dark brown, dry to damp, high plasticity, numerous roots, fissured (Residual soil). Dense SAND; some cobbles, trace silt and boulders, light orange-brown, iron-stained, dry to damp, weakly cemented, seams of high plasticity clay. Soil is composed of spheroidally weathered corestones in matrix of decomposed basalt. Very dense COBBLES and BOULDERS; some sand and gravel, orange-brown, dry to damp, relict volcanic texture, rock is rounded to angular (Slight to highly weathered basalt in a decomposed matrix). Weak to strong SUBMARINE BASALT; dark grey mottled orange, slightly to highly weathered, very close to close jointed, stained and sand filled joints (Siletz River Volcanics). BOTTOM OF TEST PIT

Project No.: 97100184

Surface Elevation: 293 feet (Approx.)

Date of Test Pit: September 2, 1997

Test Pit Log: TP-1

Coffin Butte Leachate Pond

Corvallis, Oregon

Comments	Depth, Inches	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
12 inches of ground water infiltration after 4 hours. Fine roots encountered to 2 feet. Hard digging encountered at 10.5 feet. Test pit sidewalls remained vertical. Encountered digging refusal at 14 feet.	1- 2- 3- 4- 5- 6- 7- 8- 9- 10- 11- 12- 13- 14- 15- 16- 17- 18- 19-	S-2-1 WC = 26.9 S-2-2						Very stiff CLAY; some silt, dark brown, damp, fissured, slickensides, high plasticity (Residual soil). Dense SAND; some cobbles, trace silt, orange brown, iron-stained, damp, weakly cemented, seams of high plasticity clay to 4.5 feet. Soil is composed of spheroidally weathered corestones in a matrix of decomposed basalt. Weak to strong SUBMARINE BASALT; dark grey mottled orange, slightly to highly weathered, very close to close jointed, stained and sand-filled joints (Siletz River Volcanics). BOTTOM OF TEST PIT

Project No.: 97100184

Surface Elevation: 285 feet (Approx.)

Date of Test Pit: September 2, 1997

Test Pit Log: TP-2

Coffin Butte Leachate Pond

Corvallis, Oregon

Comments	Depth, Inches	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
No ground water infiltration encountered.	1- 2- 3- 4- 5- 6- 7- 8- 9- 10– 11- 12- 13- 14- 15- 16- 17- 18- 19-	S-3-1 WC = 25.1 S-3-2				+/-1.6		Very stiff CLAY; some silt, dark brown, damp, fissured, slickensides, high plasticity (Residual soil). Dense SAND; some cobbles, trace silt, orange-brown, iron-stained, damp, weakly cemented, seams of high plasticity clay. Soil is composed of spheroidally weathered corestones in a matrix of decomposed basalt. Weak to strong SUBMARINE BASALT; dark grey mottled orange, slightly to highly weathered, close to very close jointed, stained and sand-filled joints (Siletz River Volcanics). BOTTOM OF TEST PIT
Test pit sidewalls remained vertical. Encountered digging refusal at 15 feet.								

Project No.: 97100184

Surface Elevation: 291 feet (Approx.)

Date of Test Pit: September 2, 1997

Test Pit Log: TP-3

Coffin Butte Leachate Pond

Corvallis, Oregon

Comments	Depth, Inches	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
No ground water infiltration encountered.	1- 2- 3- 4- 5- 6- 7- 8- 9- 10– 11- 12- 13- 14- 15- 16- 17- 18- 19-	S-4-1 WC = 18.3 S-4-2 WC = 33.5 S-4-3 S-4-4				+/-1.3		Soft to medium stiff SILT; brown, dry to damp (Topsoil). Very stiff CLAY; some silt, brown, damp, high plasticity, fissured, slickensides (Residual soil). Medium stiff SILT; orange-brown, moist, relict jointing, blocky (Residual soil). Extremely weak to very weak SUBMARINE BASALT; brown, highly weathered, close to very close jointed, joints are wet and stained (Siletz River Volcanics). BOTTOM OF TEST PIT
Fine roots encountered to 2 feet. Test pit sidewalls remained vertical. Digging terminated at 17 feet due to excavator limitations.								

Project No.: 97100184

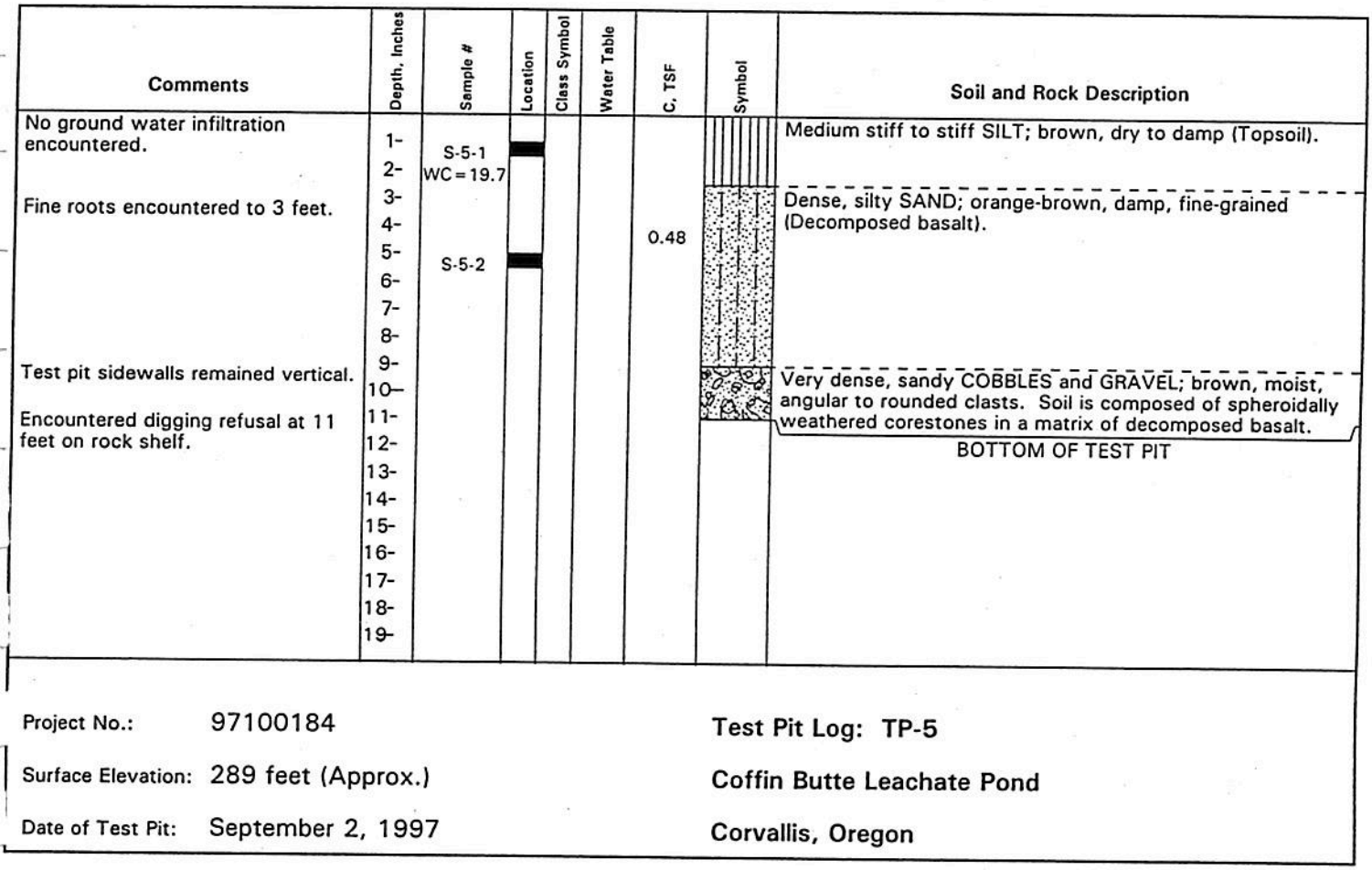
Surface Elevation: 292 feet (Approx.)

Date of Test Pit: September 2, 1997

Test Pit Log: TP-4

Coffin Butte Leachate Pond

Corvallis, Oregon



Project No.: 97100184

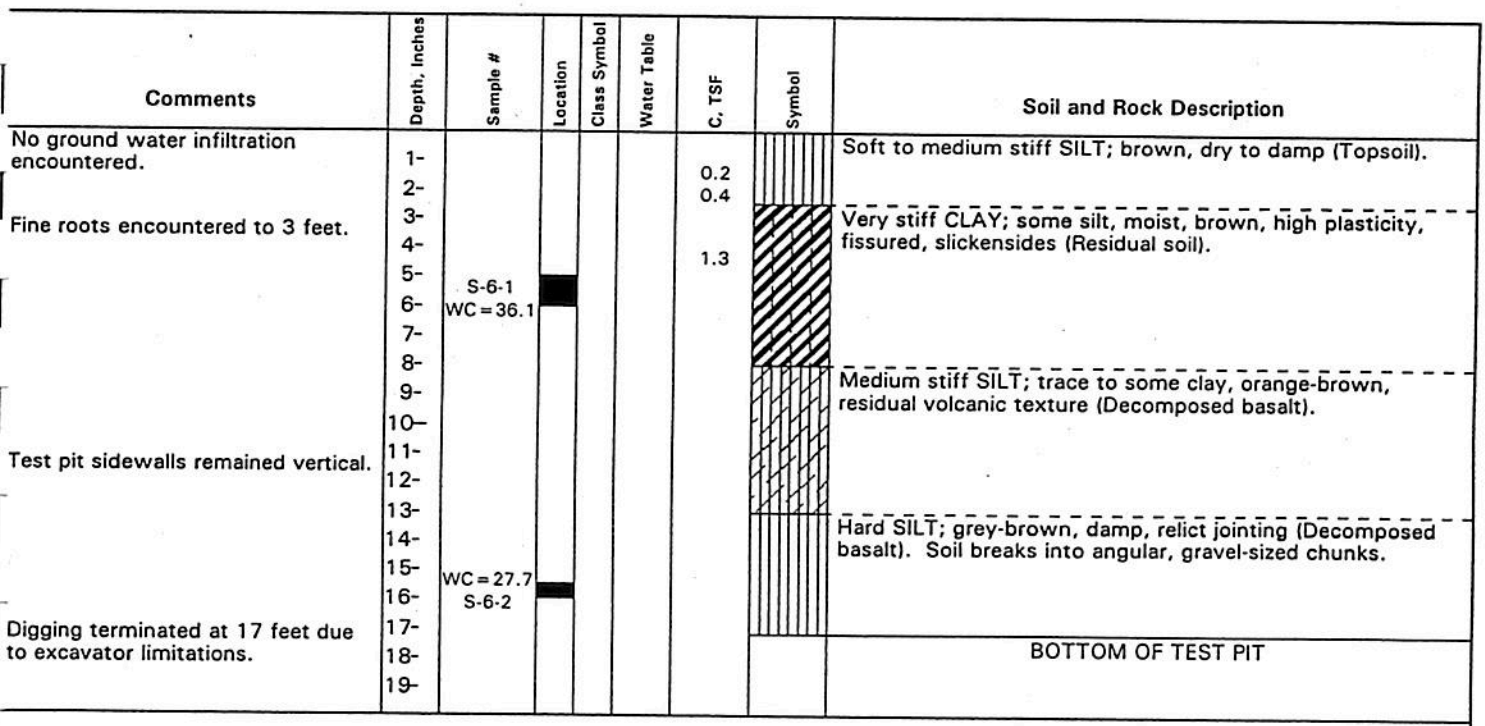
Surface Elevation: 289 feet (Approx.)

Date of Test Pit: September 2, 1997

Test Pit Log: TP-5

Coffin Butte Leachate Pond

Corvallis, Oregon



Project No.: 97100184

Surface Elevation: 282 feet (Approx.)

Date of Test Pit: September 2, 1997

Test Pit Log: TP-6

Coffin Butte Leachate Pond

Corvallis, Oregon

Comments	Depth, Inches	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
No ground water infiltration encountered.	1- 2- 3- 4-							Soft to medium stiff SILT; brown, dry to damp (Topsoil and residual soil).
	5- 6- 7-							Medium dense to dense SAND; some cobbles, orange-brown, damp. Soil is composed of spheroidally weathered corestones in a matrix of decomposed basalt.
Hard digging encountered below 8 feet. Test pit sidewalls remained vertical.	8- 9- 10– 11- 12-							Dense to very dense, sandy COBBLES and GRAVEL; orange-brown, moist (Moderately to highly weathered basalt in a decomposed matrix). Medium strong to strong SUBMARINE BASALT; dark brown mottled orange, moderately to highly weathered, close to very close jointed (Siletz River Volcanics).
	13- 14- 15- 16- 17- 18- 19-							BOTTOM OF TEST PIT

Project No.: 97100184

Surface Elevation: 291 feet (Approx.)

Date of Test Pit: September 2, 1997

Test Pit Log: TP-7

Coffin Butte Leachate Pond

Corvallis, Oregon

APPENDIX C

FIELD FORMS

The Wallace Group
62915 NE 18th Street, Suite 1
Bend, OR 97701
(541) 382-4707

BORING NUMBER B-01

CLIENT CEC, Inc.
PROJECT NAME Coffin Butte Landfill
PROJECT NUMBER 21129-1
PROJECT LOCATION Corvallis, OR
DATE STARTED _____ **COMPLETED** _____
GROUND ELEVATION _____
DRILLING CONTRACTOR _____
GROUND WATER LEVELS:
DRILLING METHOD _____
AT TIME OF DRILLING ---
LOGGED BY _____ **CHECKED BY** _____
24HRS AFTER DRILLING ---
NOTES _____

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0			
5			
10			
15			
20			

Figure: A - 1

The Wallace Group
62915 NE 18th Street, Suite 1
Bend, OR 97701
(541) 382-4707

TEST PIT NUMBER TP-01

CLIENT CEC, Inc.
PROJECT NAME Coffin Butte Landfill
PROJECT NUMBER 21129-1
PROJECT LOCATION Corvallis, OR
DATE STARTED _____ **COMPLETED** _____
GROUND ELEVATION _____
EXCAVATION CONTRACTOR _____
GROUND WATER LEVELS:
EXCAVATION METHOD _____
AT TIME OF EXCAVATION ---
LOGGED BY _____ **CHECKED BY** _____
24HRS AFTER EXCAVATION ---
NOTES _____

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0			
5			
10			
15			
20			

Figure: A - 1