REPORT

Engineering Design Report

Landsburg Mine Site

Submitted to:

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ACRONYMS AND ABBREVIATIONS

AMSL	Above Mean Sea Level
ARARs	Applicable or Relevant and Appropriate Requirements
bgs	below ground surface
CAP	Cleanup Action Plan
CD	Consent Decree
CMP	Compliance Monitoring Plan
CQA	Construction Quality Assurance
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
ESC	Erosion and Sediment Control
EPA	U.S. Environmental Protection Agency
ERA	Expedited Response Action
FEMA	Federal Emergency Management Agency
MFS	Minimum Functional Standards
MTCA	Model Toxics Control Act
O&M	Operation and Maintenance
PCBs	Polychlorinated Biphenyls
PCC	Palmer Coking Coal Company
PLPs	Potentially Liable Parties
PPE	Personal Protective Equipment
RAO	Remedial action objective
RCW	Revised Code of Washington
RI/FS	Remedial Investigation and Feasibility Study
SEPA	State Environmental Policy Act
SHA	Site Hazard Assessment
SMCL	Secondary Maximum Contaminant Level
SPCC	Spill Prevention, Control, and Countermeasure
TCE	Trichloroethylene
TPH	Total Petroleum Hydrocarbons
USGS	Unites States Geologic Survey
VOCs	Volatile Organic Compounds
WAC	Washington Administrative Code
WDOH	Washington Department of Health

1.0 INTRODUCTION

This document is the Engineering Design Report (EDR) for the Landsburg Mine Site (Site). It contains the plans, designs, and procedures to ensure the remedial actions at the Site are conducted in a manner that is consistent with:

- The Cleanup Action Plan (CAP) (Washington State Department of Ecology [Ecology] 2017)
- Accepted engineering practices
- The requirements of Washington Administrative Code (WAC) 173-340-400(4)(a)

1.1 Background

The Site consists of a former underground coal mine located approximately 1.5 miles northwest of Ravensdale in a rural area of southeast King County, Washington. The Site is situated directly south and east of the S.E. Summit-Landsburg Road, and north of the S.E. Kent-Kangley Road. The Cedar River passes within approximately 700 feet of the Site to the north. The location of the Site is shown in Figure 1-1. The topography of the Site and general Site features are depicted in Figure 1-2.

The coal seam under study at the Site is named the Rogers Seam, which had active mining operations from 1959 to 1975. The mined section of the Rogers Seam has a near vertical dip and consists of coal and interbedded shale approximately 16 feet wide. The mined section is about a mile in length. Mining occurred at depths up to 750 feet below the ground surface. Figure 1-3 shows a cross-section along the strike of the Rogers coal seam. Mining was accomplished by causing the coal seam to cave into mine workings (locally called “booming”), from which the coal was hauled to the surface. As a result of this caving, subsidence trenches developed on the land surface above the mine workings. Based on available information, the northern portions of these trenches from the Summit-Landsburg Road (depicted in Figure 1-3) were used in the late 1960s to the late 1970s for disposal of various industrial waste materials, construction materials, and land-clearing debris.

Various investigations, including completion of a Model Toxics Control Act (MTCA) remedial investigation and feasibility study (RI/FS) were completed at the site from 1991 to 1996 (Golder 1996). Subsequent to completion of the RI/FS, additional groundwater monitoring wells and hydrogeologic studies were completed in support of the final selected remedial action, which is detailed within the CAP (Ecology 2017). The CAP, including completion of this EDR, is being implemented pursuant to the Consent Decree (CD) that became effective November 6, 2017.

1.2 Purpose and Scope

This EDR has been prepared to fulfill the requirements of WAC 173-340-400(4)(a). The purpose of this report is to provide or document the following:

- Goals of the remedial action
- General information on the facility, including a summary of information in the RI/FS
- Identification of who will own, operate, and maintain the remedial action during and following construction
- Facility-specific characteristics which affect design, construction, and/or operation of the remedial actions (existing operations, flooding, seismic activity, temperature extremes, planning and development issues, soil and groundwater characteristics)

- Facility maps/drawings showing existing site conditions and the proposed location(s) of the remedial action(s)
- Characteristics, quantity, and location of materials to be managed
- Conceptual plan of the remedial actions and conceptual design of treatment units, facilities and processes
- Design criteria or assumptions and operation parameters, including their engineering justification
- Implementation schedule
- Design features to assure long-term safety of workers and local residences
- Design features for control of spills and accidental discharge
- Discussion of methods for management of treatment residuals and other waste materials generated as a result of the remedial actions
- General description of construction testing for quality control
- Any other information needed to address applicable state, federal and local requirements
- General description of construction procedures to protect health and safety
- General description of compliance monitoring during and after construction

Several of these items were included and fully detailed as exhibits to the CD, and therefore will be provided as references in this EDR. A State Environmental Policy Act (SEPA) (RCW 43.21C) checklist was prepared and submitted to Ecology for public review and comment along with the CAP. Ecology issued a SEPA Determination of Nonsignificance (Appendix B of Exhibit B to the CD, Ecology 2017) in association with the proposed remediation activities. No additional information is required to meet the applicable requirements of SEPA. Design drawings, engineering specifications, construction quality assurance (CQA) plans, and a health and safety plan are included as appendices to this EDR and are referenced within the text.

1.3 Remediation Goals

Remedial Action Objectives (RAOs) are site-specific goals based on acceptable exposure levels that are protective of human health and the environment and consider applicable or relevant and appropriate requirements (ARARs). RAOs identify risk pathways that remedial actions should address, and identify acceptable exposure levels for residual constituents of concern. The RAOs identified in the CAP (Ecology 2017) for this Site are:

- Minimize the potential for future direct exposure of human or ecological receptors to any waste constituents that may remain at the Site.
- Reduce the potential for migration of any waste constituents from the trenches in groundwater, surface water, or airborne dust.

1.4 Overview of the Remedy

The remedy selected in the CAP for the Site was Alternative 5 (low permeability soil cap). This alternative provides a low-permeability soil cap over the backfill of the trenches. The permeability of this soil will be no higher than 1 x 10-6 centimeters per sec (cm/sec), and the cap will thus meet minimum functional standards (MFS) specified in WAC 173-304. The major steps in this alternative are:

1) Backfill the trenches to the same elevation as the adjacent ground surface, as required for capping.

2) Allow the backfill to consolidate between construction seasons, and add additional backfill as necessary to re-establish the previous fill surface.

3) Place a low-permeability soil cap over the backfill of the trenches, and grade the adjacent areas to collect and divert surface water away from the cap.

4) Cap maintenance will continue until residual hazardous substance concentrations no longer exceed cleanup or remediation levels as described in the CAP resulting from either (1) the application of new remediation technologies currently unavailable or (2) other circumstances or conditions that affect residual concentrations such that they no longer pose a risk to human health or the environment.

5) Implement and maintain institutional controls, groundwater monitoring and any instituted contingency plan until residual hazardous substance concentrations no longer exceed cleanup or remediation levels as described in the CAP resulting from either (1) the application of new remediation technologies currently unavailable, or (2) other circumstances or conditions that affect residual concentrations such that they no longer pose a risk to human health or the environment.

The areas that will be capped (areas 7, 8, and 9) are shown in Figure 1-4. This delineation is based on the areas of waste disposal identified in the RI/FS Report. The cap will extend slightly beyond the trenches on both sides to provide an “overhang” to prevent infiltration water from flowing laterally back into the trenches. Fill material will extend into area 6 as appropriate to provide a buttress to support the narrow pillar wall separating areas 6 and 7. This EDR presents the detailed design and procedures for implementing this remedy.

2.0 SITE INFORMATION

2.1 General Information

The Site occupies a single parcel of land owned by Palmer Coking Coal Company (PCC) and is located within sections 24 and 25, Township 22 N., Range 6 E. The Site is defined in Exhibit A of the Consent Decree (Ecology 2017). Along the mine footprint are a series of subsidence trenches extending from the north approximately 4,200 feet to the south. Figure 2-1 shows the Site boundaries. The final Site remediation boundaries will be determined from the as-built drawings to include the final capped area and stormwater diversion, collection and infiltration system.

The Site and most of the immediate surrounding land are currently used for forestry. Apart from the Site, the developments in the area include a junior high school and rural residential dwellings. The school is located about 0.65 miles northwest of the Site. The nearest residences are to the southwest approximately 800 feet from the Site. Drinking water for area residences is supplied by groundwater, either through private wells or small community water supply systems. Domestic sewage disposal throughout the area is provided by residential septic systems. Water and sewer service is provided to the junior high school from utility lines extending eastward from Four Corners in Maple Valley.

Several gravel roads provide access to the Site from public thoroughfares, and walking/horse trails run parallel to the east and west sides of the trenches. The primary access road to the Site begins from S.E. Summit Landsburg Road at about 1.7 road miles from the intersection at Kent-Kangley Rd. and allows access to the northern portion of the mine trenches. A second access road begins immediately past the intersection with S.E. 253rd Street at road mile 2.2 and provides access to the north portal area. A third gravel road begins across the street from the

Tahoma Junior High School at road mile 1.3 along S.E. Summit-Landsburg Road and provides access to monitoring well LMW-11. A fourth access road will begin at Kent-Kangley Road and provide access at the south end of the site and Portal #3 from the historic access road to the mine. Locked gates secure the Site at all of the access road entrances, and the portion of the trenches where disposal occurred is currently enclosed by a 6-foot tall chain link security fence. Dense vegetation and second growth timber covers most of the Site. Electrical transmission lines and a Bonneville Power Administration property easement cross the southern portion of the Site in an east-west direction.

The Landsburg Mine property is situated atop a gently sloping hill, which reaches a maximum elevation of approximately 800 feet above mean sea level (AMSL) near the central portion of the Site. This hill slopes steeply downwards towards the S.E. Summit Landsburg Road and Cedar River at the Site's northern end, and more gradually downwards towards the Kent-Kangley Road and Rock Creek drainage at the southern end. The Site is bounded to the east by a somewhat larger hill, which rises to a maximum elevation of approximately 940 feet AMSL.

2.2 Site Access, Property Owner and Operator Information

PCC owns the property, and the Landsburg Mine Site Potentially Liable Parties (PLPs) are responsible for the remedial action. The PLPs for the Landsburg Site are Palmer Coking Coal Company, LLP; Weyerhaeuser Company; the BNSF Railway Company; PACCAR Inc.; and Browning-Ferris Industries of Illinois, Inc. (collectively, the "PLP Group"). The PLP Group has contracted Golder to design, operate, and maintain the remedial action during and following construction.

The Site is accessed by authorized personnel through locked gates at all Site points of entry. Site roads provide access to groundwater monitoring wells and portions of the trench where remedial actions will occur. Some of the Site roads will be improved to ensure safe and appropriate access during completion of remedial actions and during the long-term maintenance and monitoring period.

Monitoring well LMW-5, located at the south end of the mine site is located on property currently owned by the City of Kent. Access is provided to LMW-5 through a Statutory Warranty Deed recorded with the King County's Auditors office, and notification to the City of Kent prior to each sampling event.

2.3 Facility-Specific Characteristics Affecting Design

- Existing Operations – The Site is currently forested with no operations, including routine forestry by the Site owner that will affect completion of the remedial action.
- Flooding – According to the Federal Emergency Management Agency (FEMA) flood insurance rate maps (Map Number 53033C1038F, Revised May 16, 1995), the Site is not within a 100-year flood zone and is not prone to flooding.
- Seismic Activity – The Unites States Geologic Survey (USGS) provides a probabilistic seismic hazard ground shaking risk level of 10% probability of exceedance in a 50-year period. The USGS indicates the Site is located in an area estimated to receive a peak horizontal acceleration of 0.25g (USGS 2014). No Quaternary-age faults (i.e. active in the last 11,000 years) are mapped by the USGS at the Site (USGS 2006). In consideration of the remedial measures proposed for the Site, this designation is not expected to have a significant impact on the remedial action. The CAP requires that in the event of an earthquake of Intensity IV or greater (Modified Mercalli Intensity Scale) in the area, the cap will be inspected for damage and repaired accordingly. The north and south portal areas will be inspected for ground ruptures, fractures,

earth displacements, or similar damage to original (pre- earthquake) landscape. If portal water surfaces due to the earthquake event, it will be inspected for signs of anomalous water quality (color, turbidity, odor, etc.). Ecology will be notified of site conditions within seven (7) days and a decision will be made between the property owner and Ecology on taking groundwater samples from on-site wells in accordance with the sampling network, protocols, and analytical methods of the Compliance Monitoring Plan (CMP). Contingency actions will be implemented as necessary in accordance with the procedures described in the CAP. These requirements are part of the CMP, which was included as Exhibit D to the CD (Ecology 2017).

- Climate Extremes – The climate of the Puget Sound region is typified as a marine climate with cool summers and mild, rainy winters. Summer temperatures generally remain below 80° Fahrenheit (F). Winter temperatures are usually above freezing. On average, January is the coldest month and August the warmest with average daily low temperatures ranging from 37 ^{o} F to 49 ^{o} F and average daily maximum temperatures ranging from 51 ^{o} F to 85 ^{o} F; respectively. Warm, moisture-laden winds move landward from the Pacific Ocean and are forced upward by the west slope of the Cascade Mountain Range. As the air rises, it is cooled and the resulting condensation of moisture produces precipitation in the form of rain and snow. In general, the months of July through September are driest, and October through January are the wettest. The wet season typically lasts from October to March. The average annual precipitation at the at the Landsburg weather station #454486 from 1903 to 2012 is 56 inches Western Regional Climate Center ([WRCC] 2012).
- Planning and Development – No specific planning and development issues are known that would affect the remedial action. The Environmental Covenants that were presented as Exhibit E of the CD (Ecology 2017) detail land use and groundwater restrictions at the Site. These Covenants will be filed when the remedial action is completed. The boundaries of the cap and restricted areas will be defined within the Covenants. Included in the Covenants are measures to restrict any Site development or activities that could interfere with the integrity of the remedial action, and the Covenants will also restrict the withdrawal of groundwater.

2.4 Site Investigations

Several preliminary environmental investigations were performed at the Site. These include a limited soil gas survey (Applied Geotechnology 1990), sampling of area private wells (WDOH 1992), sampling of surface water emanating from mine portals (Geraghty and Miller 1990), and limited sampling of ponded surface water, drum contents, and soils for a site hazard assessment (SHA) (Ecology and Environment 1991). These investigations detected hazardous substances in drum contents, adjacent soils, and ponded surface water within the trenches. Hazardous substances were not detected, however, in adjacent private or public water supply wells, mine portal groundwater discharge, or soil gases.

In 1991, Ecology designated the Site a high priority for remediation, and in late 1991 at Ecology's request, four of the PLPs implemented an Expedited Response Action (ERA) involving the removal of the most accessible drums from the trenches and construction of a fence to restrict access to the Site. The ERA involved the removal of over one hundred 55-gallon drums (Landsburg PLP Steering Committee 1991).

Following the removal of the drums, Ecology and the PLP Group negotiated and entered into an Agreed Order (Ecology 1993) which directed the PLP Group to conduct an RI/FS to evaluate the need for remedial action. The scope of work for the RI was outlined in the Landsburg Phase I Remedial Investigation/Feasibility Study (RI/FS) Work Plan (Golder 1992), which was incorporated by reference into the 1993 Agreed Order. The RI/FS, which

consisted of a comprehensive investigation of environmental conditions at the Site and evaluations of potential remedial action alternatives, was conducted by the PLP Group over the period of mid-1993 to early 1996.

Subsequent to completion of the RI/FS in 1996, several additional investigations and routine monitoring events were conducted at the Site.

In May of 2004, a hydrogeologic investigation was completed at the south end of the Site (Golder 2004). This investigation was conducted to understand groundwater movement at the south end of the Rogers Seam Coal Mine (Rogers Seam). Two monitoring wells and a piezometer (LMW-8, LMW-9, and P-2) were installed. Well LMW-10 was installed during this investigation at the north end of the Site.

In May of 2005, SubTerra, Inc. completed a coal mine hazard assessment for the Landsburg Mine (Subterra 2005) which was reviewed by the King County Department of Development and Environmental Services. A Notice of Availability of the Coal Mine Hazard Assessment Report was recorded at the King County recorder's office and noted on the title of the property.

In the late summer and fall of 2005, a deep groundwater monitoring well was installed to monitor the condition of groundwater at the bottom elevation of the mine (Golder 2006). LMW-11 is a 700-foot monitoring well that is near the south end of the Rogers Seam. Monitoring the groundwater conditions in LMW-11 was intended to determine whether contaminants were present at the bottom elevation of the mine.

Interim groundwater monitoring was conducted periodically from 1994 to 2003, quarterly in 2004, and semi-annually from 2005 to the present.

2.5 Site Geology and Hydrogeology

2.5.1 Geology

The surface soils at the upper elevations of the site are generally a glacial till consisting of dense sand and gravel with silt. The till is relatively thin near the top of the hill. Underlying the till is bedrock consisting of interbedded shales, siltstones, and sandstones with coal seams. The lithologic bedrock units dip to the west at approximately 65 to 70 degrees from horizontal on the south end of the Site and approximately 85 to 95 from horizontal (i.e., near vertical) on the northern end of the Site. The potential exists for large voids to be present within the mine workings. The mine workings have relatively high hydraulic conductivity, and the fine-grained Puget Group sediments located to either side of the seam are at least several orders of magnitude less permeable than the mined-out seam. The coal mine workings are filled with collapsed rubble (and potential voids), are permeable and could transmit large quantities of groundwater. Previous drilling at the site in the bedrock has produced little groundwater until the mine workings or coal seam are encountered.

2.5.2 Hydrogeology

The primary hydrogeologic system at the Site consists of a continuous to semi-continuous groundwater system comprised of the Puget Group bedrock materials and the surrounding glacial outwash aquifer. Within the bedrock, groundwater occurs at depths ranging from about 10 feet to greater than 200 feet below ground surface (bgs), depending on topographic position. Within the former mine workings, the depth to groundwater varies from about 160 feet below the ground surface in the central portion of the Site to near zero at either end. The variability in depth to water is primarily a function of changes in topography and hydraulic gradient. The groundwater within the Rogers Seam occurs under water table (i.e., unconfined) conditions, as any potential confining layers are now absent due to mining. Bedrock groundwater elsewhere in the Study Area may occur locally under confined to semi-confined conditions due to the presence of till which mantles much of the area or

from lower permeability strata lying over more permeable formations. Groundwater is present at the ground surface at both Portal #2, located at the north end of the mine, and Portal #3, located at the south end of the mine.

Groundwater flow in the north portion of the Rogers Seam is towards the north. The groundwater flow direction in the southern portion of the Rogers Coal Mine is toward the south. The flow of groundwater from the mine reveals that a groundwater divide exists within the mine. Groundwater potentiometric head measurements indicate that the groundwater divide exists near the south end of the mine.

There are currently ten groundwater monitoring wells at the Site (LMW-2 through LMW-11). Figure 1-2 shows the location of the existing Site monitoring wells, and Figure 1-3 is a cross-section that shows the monitored depth intervals of these wells. In addition to these ten monitoring wells, four additional sentinel wells were included in the CAP to augment the existing Site monitoring wells. The final monitoring well network will further refine groundwater gradients within the Rogers mine seam, and provide for early detection should mine waste contaminants be released from the mine. A work plan (Golder 2018), describing the details for drilling and installation of the sentinel wells, was submitted to and approved by Ecology.

2.6 Nature and Extent of Contamination

The air, soil, groundwater, and surface water analytical data collected as part of the RI, as well as during other Site investigations, were evaluated in the RI to assess the nature and extent of chemical constituents in environmental media at the Site. The primary purpose of this evaluation was to identify the chemical compounds potentially posing a human or environmental health risk and/or which exceed potential regulatory criteria, and which are the result of the prior waste disposal activities. Such compounds are termed “mine waste contaminants.” In order to accomplish this, the data were evaluated through a step-wise screening process which considered laboratory and field blank data, background concentrations (if available), and ARARs.

On the basis of the data screening performed, the following conclusions were drawn:

Air: There were no volatile organic compounds (VOCs) detected above background levels in areas outside of the trench. Throughout nearly the entire length of the bottom of the trenches, VOCs were not detected above background in air. Only one localized area within the trench area 9 had VOC air readings that were slightly above background. Air monitoring conducted during drilling did not detect levels of VOCs above background.

Groundwater: The Site, specifically the Rogers Seam, represents a unique hydrogeologic setting. The mine traverses a steep hillside that has prominent streams/rivers (Rock Creek to the south and the Cedar River to the north) on each side of the hill. The Rogers Seam is situated between these prominent surface water bodies and crosses their drainage divide. The data collected at the Site indicates that the groundwater divide between these surface water bodies also exists within the Rogers Seam. Therefore, groundwater in the southern portion of the mine flows and discharges to the south towards Rock Creek, while groundwater in the northern portion flows north toward the Cedar River.

Interim groundwater monitoring of Site compliance wells (LMW-2 through LMW-11) was conducted periodically from 1994 to 2003, quarterly in 2004, and semi-annually from 2005 through completion of the CD and CAP in 2017. There were no detections of contaminants that are attributable to contamination by waste materials during any of the interim groundwater monitoring events. Furthermore, the analytical results from the interim groundwater monitoring events over the years indicate no significant changes in groundwater conditions from those observed during the RI. The primary parameters detected in groundwater samples are metals that are naturally occurring. Subsequent to completion of the CD and CAP, low levels of 1,4-dioxane were detected in the

north end wells LMW-2, LMW-4 and one of the new north end sentinel wells LMW-12. Ecology and the PLP Group are investigating the potential source and extent of these 1,4-dioxane detections.

As indicated in the RI/FS Report, arsenic has been detected sporadically throughout the Study Area, while iron and manganese are very prevalent throughout the Study Area, including private wells and on-site monitoring wells that are hydraulically separated from the wells completed in the mine workings. These are naturally occurring metals in most groundwater. The U.S. Environmental Protection Agency (EPA) has established Secondary Maximum Contaminant Levels (SMCLs) for iron and manganese. However, these numeric secondary drinking water standards are based on aesthetics (taste, color, and odor) and are not enforceable standards. The EPA has established a primary drinking water standard for arsenic, which is considered a human carcinogen. Detected concentrations of arsenic in the on-site monitoring wells have been below federal and state drinking water standards.

Although a few organic compounds were detected in private wells sampled, all of the detected compounds were at very low concentrations, and the detections were inconsistent (not repeated in more than a single round). In addition, none of the organic compounds exceeded any established regulatory standards, except for one instance of bis(2-ethylhexyl)phthalate, a common laboratory contaminant, which was detected slightly above the MTCA Method B standard in a single privately-owned well, but was not detected during either of the other three monitoring periods from this well. Overall, there is no indication of organic or metal contamination in groundwater at the Study Area.

The observed distribution of chemical constituents (iron, manganese, and arsenic) in groundwater around the Study Area indicates that waste disposal at the Site is not the source of these compounds. The levels of compounds observed in the groundwater are consistent with reports in the literature, which indicate that coal is a natural and well-known source for these chemical constituents. The levels observed fall within the range of reported values considered typical for coal mine drainages in the State of Washington. Therefore, although concentrations of iron and manganese exceeded the SMCLs and arsenic concentrations exceeded the MTCA Method A cleanup level in monitoring well LMW-11 (but were typically below the federal and state drinking water standards), the occurrence of these compounds does not appear to be related to prior waste disposal activities at the Site, but rather to natural background levels that are typical of coal-bearing strata under reducing conditions. Therefore, based on groundwater sampling results, Ecology has determined that none of the contaminants in the groundwater are directly attributable to waste disposed of in the trenches at the Site.

Surface Water: Arsenic in surface water at the Site does not exceed the MTCA Method A standard for water discharging at Portals #2 and #3. No analytes were detected above MTCA cleanup levels. Arsenic concentrations in the surface water samples collected at the portals were consistent with concentrations detected in the groundwater sampled at the Site.

Soil: There are no contaminants of concern for soils outside of the trenches. Within the trenches, chromium, lead, PCBs, bis-(2-ethylhexyl)phthalate, methylene chloride, trichloroethylene (TCE) and total petroleum hydrocarbons (TPH) exceeded applicable MTCA cleanup level standards during the early 1990s in a localized area confined to the northern portion of the trenches where waste disposal is known to have occurred. Soil testing confirmed that contamination was not identified outside the northern portion of the trenches. These compounds are designated as mine waste contaminants for soil inside the trenches. However, on the basis of trench sampling conducted to date, and in conjunction with historical information and geophysics, potential contamination is believed to be restricted to the northern portion of the trenches.

Therefore, apart from soils located within the subsidence trenches in the area of known prior waste disposal activities, the soil, groundwater, and surface water media in the Study Area do not exhibit concentrations of chemical constituents above naturally occurring background levels. The contaminants identified in the RI are the seven compounds indicated below for soils inside one localized area of the trenches:

- Chromium and lead
- PCBs
- bis(2-ethylhexyl)phthalate
- Methylene chloride
- TCE
- TPH

2.7 Risks to Human Health and the Environment

As noted above, at the completion of the CD and CAP, the only locations where chemicals were observed at concentrations above applicable MTCA cleanup levels are within the trenches, in the vicinity of where waste disposal occurred in the past. The northern portion of the Site containing the wastes disposed of in the trenches has been fenced to prevent access by inadvertent intruders. For these reasons, no direct human exposures to these chemicals are occurring. Also, no chemicals (in concentrations exceeding federal or state standards) are known to have migrated off the Site in air, surface water, or groundwater; nor has soil outside of the trenches been impacted. In summary, there are no operative exposure pathways from the Site for chemicals that are directly attributable to disposal of waste in the trenches. Given the absence of exposure pathways, the Site does not pose a significant risk to human health or the environment under current known conditions. Subsequent to completion of the CD and CAP, low levels of 1,4-dioxane were detected in the north end wells LMW-2, LMW-4 and one of the new north end sentinel wells LMW-12. Ecology and the PLP Group are investigating the potential source and extent of these 1,4-dioxane detections.

2.8 Potential Contaminant Transport

Based on data available at the completion of the CD and CAP, contaminant migration was not detected at the Site monitoring points. However, as part of the RI, it was necessary to evaluate the potential future pathways for contaminant migration from the Site. The groundwater pathway represents the most significant potential pathway. Waste present in the trenches is believed to be confined to the northern half of the Site. Groundwater flow beneath this portion of the Site is to the north through the mined out and highly permeable Rogers Seam. Flow laterally away from the mine is negligible due to the tightness of faults and the vertical orientation and layering of low-permeability strata. Therefore, the primary pathway for contaminants potentially migrating from the Site through the Rogers Seam is through the groundwater flowing to the north. Contaminant migration from the southern end of the trenches is unlikely given the direction of groundwater flow and the absence of waste or contaminated water in this portion of the mine; however, both the northern and southern ends of the Site will continue to be monitored in the future to detect potential releases.

3.0 REMEDIATION APPROACH

The remedial alternative selected for the site is designed to achieve the RAOs:

- Minimize the potential for future direct exposure of human or ecological receptors to any waste constituents that may remain at the Site.
- Reduce the potential for migration of any waste constituents from the trenches in groundwater, surface water, or airborne dust.

As previously discussed, at the completion of the CD and CAP, the only Site areas where chemicals were observed at concentrations above applicable cleanup levels are within the trenches in the locations where waste disposal occurred in the past. Backfilling the northern trenches, which include those areas where waste was disposed of in the past, will eliminate the potential for direct human or ecological contact with any waste constituents and will prevent any off-site migration in stormwater or dust. Placing a low-permeability cap over the backfilled trenches and diverting stormwater away from the cap will minimize the volume of rainfall infiltrating through any waste remaining on-site, thus reducing the potential for contaminant migration in groundwater.

The following sections provide a general description of the remedial action, and the engineering analyses and construction documents are presented in the attached appendices, including:

Appendix A – Contains the Design Drawings for the remedial action.

Appendix B – Contains the Technical Specifications associated with various construction activities.

Appendix C – Contains the Construction Quality Assurance (CQA) Plan describing the CQA activities required during remedial construction activities.

Appendix D – Contains the engineering calculations that were performed to support the design.

Appendix E – Contains the Health and Safety Plan for the remedial action.

It should be noted that the construction documents (Appendices A, B, and C) have been completed to about the 90% level. Consequently, these documents may be expanded or modified to a limited degree as the design is finalized, but the basic concepts presented here for the purposes of this EDR are not expected to change.

3.1 Design Framework

The areas that will be capped (areas 7, 8, and 9; and area 6 for buttressing) are conceptually shown in Figure 1-4, and are presented in more detail in the design drawings provided in Appendix A. This delineation is based on the areas of waste disposal identified in the RI/FS Report.

3.1.1 Site Preparation

Prior to beginning earthwork activities, several site preparation activities will be performed:

- Installing erosion and sediment control measures in accordance with King County and Ecology requirements to prevent sediment from entering streams or migrating off site.
- In construction areas outside of the trenches, e.g., for new access roads or stockpiles, the ground surface will be cleared and grubbed to remove organic debris. The topsoil will be removed and stockpiled for use in the vegetative cover layer of the cap.
- Upgrading existing gravel access roads and constructing segments of new access road to allow trucks delivering soil and other materials to the trench areas to do so safely and efficiently.

- Constructing gates where access roads join public highways to control access and minimize risk to the public.

3.1.2 Trench Backfill

The remedial action includes first filling the trenches to provide a surface for cap construction. The backfill will also provide a thick physical barrier that will greatly enhance the effectiveness and reliability of the cap. Fill material will also be placed in area 6 as appropriate to provide a buttress to the narrow pillar wall separating areas 6 and 7.

Prior to placing backfill in the trenches, trees and large brush will be removed to prevent vertical transmissive zones through the backfill, when the trees eventually decay. This will also prevent excessive settlement of the backfill, which might occur if backfill is placed on top of a mat of small trees.

Suitable fill material would then be placed in the trenches, completely filling them to the elevations of the adjacent ground surfaces. Backfill can include any clean, inert material capable of supporting the overlying loads without excessive settlement. The most economical local source(s) of suitable fill will be used. Specifications, including acceptance criteria, for the backfill material are provided in Appendix B, and preliminary testing requirements for the backfill material are described in the CQA Plan included in Appendix C. When a source or sources for the backfill material are identified by the PLP Group, a work plan will be submitted to Ecology for review and approval. The work plan will establish the due diligence and sampling and analyses that will occur to ensure that the imported backfill material will not become a potential source of contaminants to the site, including the potential to leach contaminants to the groundwater.

Filling the trenches may induce settlement of the existing materials in the trenches, which are expected to be moderately compressible due to their loose nature and inclusion of construction debris and organic materials. Backfilling is expected to induce compression of these materials, which may result in eventual settlements on the order of 6 to 12 inches. Settlement of the new fill depends on the type of fill used and the method of placement. End-dumped fill of poor quality could settle on the order of 2 to 6 feet. A better quality fill with moderate compaction effort might settle on the order of 1 to 2 feet.

About 75 percent of the settlement is expected to occur soon after fill placement. The remediation schedule allocates at least 6 months between completion of trench backfilling and placement of the low-permeability soil cap. Most of the settlement is expected to occur during this 6-month period. At the end of this time, additional fill material will be placed as necessary in areas where settlement has occurred to re-establish the design grades prior to cap construction.

3.1.3 Capping

The cap will consist of a 2-foot-thick low-permeability soil layer placed over the trench backfill. The permeability of this layer will be 1 x 10-6 cm/sec or less to minimize infiltration. This layer will be covered with a 6-inch-thick layer of vegetative soil (e.g., topsoil) seeded with grasses suitable for the local climate to promote evapotranspiration and decrease the potential for erosion.

The cap will extend slightly beyond the trenches on both sides to provide an “overhang” to prevent infiltration water from flowing laterally back into the trenches. The cap will be sloped to promote stormwater runoff to minimize infiltration to the maximum extent possible. Surface water runoff from the cap will be collected in drainage ditches and directed away from the cap and into stormwater infiltration pond as shown in the design Drawings.

Because of its simplicity, only minor long-term maintenance will be required for this capping system. Any settling after cap construction can be repaired by filling, compacting, and regrading in the same manner as initial installation. Once vegetation is established, the thickness of the cap will provide long-term protection against erosion, and little maintenance is anticipated. The planted vegetative cover will be trimmed as needed.

3.1.4 Grading and Surface Water Management

The area around the cap (Figure 1-4) will be graded to divert stormwater away from the cap and to collect runoff from the cap, so that the potential for infiltration is minimized. Drainage ditches will be constructed, and this stormwater will be routed to an infiltration pond located at the north end of the Site. Ditch configurations, locations, and details are provided in the Appendix A Drawings and Appendix B Specifications. Calculations performed in accordance with the 2016 King County Surface Water Design Manual (King County 2016) are provided in Appendix D.

3.1.5 Contingent Groundwater Infrastructure

At the completion of the CD and CAP, groundwater met cleanup levels at the designated points of compliance. The CAP indicates that if during trench backfilling or if after completion of the remedial action, mine waste contaminants are detected in groundwater at or above trigger levels described in the CAP, a contingency groundwater treatment system will be activated to withdraw groundwater at a rate that will prevent the off-site migration of contaminants and to treat (as necessary) the groundwater prior to discharge to an existing municipal sewer. With this contingency for future groundwater treatment available, if needed, institutional controls on groundwater use, and long-term groundwater monitoring, the risks from groundwater to public health and the environment are reduced or avoided.

The contingency groundwater treatment system is presented in the Contingent Groundwater Extraction and Treatment Plan (Exhibit D, Part C of the CD [Ecology 2017]). Contingency groundwater extraction and treatment, if required, will continue until groundwater remains below one-half of the applicable MTCA cleanup level at the points of compliance and extraction well for an entire year.

The infrastructure to support the contingent groundwater treatment system at the north end of the site was constructed in 2008. This infrastructure consists of:

- A gravel pad for the treatment equipment
- Underground electrical service to a panel to provide power for the treatment equipment
- Light poles and fixtures at several locations around the pad to provide adequate illumination for night work
- A chain-link fence around the perimeter of the pad for security
- A gravel road from the Summit Landsburg road to provide vehicle access

As part of the activities described in this EDR, a similar system will be constructed near the South Portal to accommodate treatment system equipment if the need for treating groundwater should arise. Construction activities will include upgrading the historic access road from the Kent-Kangley Rd., constructing a gravel pad and perimeter security fence, and installing electrical service. Details of the south contingent groundwater treatment system are presented in Appendices A and B.

3.1.6 Post-Capping Monitoring

In response to a recommendation by the Washington Department of Health (WDOH) in its 2016 health consultation, soil samples will be taken just outside of the proposed cap edge at the trench rim and analyzed for VOCs. A work plan will be submitted to Ecology for approval detailing the location and scope of the soil sampling effort. The soil sampling work plan will be prepared following completion of the trench backfilling when the extent of the cap edge will be defined and soil sampling locations can be accurately established.

The Operation and Maintenance Plan (O&M Plan) detailing post-capping O&M requirements was included as Part B of the CMP. The O&M will consist primarily of routine inspection of the cap and associated drainage features, along with any necessary repairs. The selected remedy for the Landsburg Mine Site is construction of a low-permeability soil cap followed by long-term maintenance and monitoring. Because no treatment system is involved, many of the items often included in an O&M Plan (i.e., relating to treatment systems) are not relevant to the Landsburg O&M Plan. Groundwater monitoring conducted during construction and following construction is described in the CMP (Exhibit D to the CD [Ecology 2017]).

3.2 Implementation Schedule and Staging of Remedial Action

Remedial Action activities will be performed over three construction seasons, which typically extend from sometime in April to October. The first construction season may occur in 2018, subject to approval by Ecology. The construction activities for each of the three seasons are described in the following sections.

3.2.1 First Season (Phase 1) Work

- Install erosion and sediment control (ESC) measures
- Upgrade existing access roads as necessary
- Clear new access road alignment, areas to be excavated adjacent to the trenches, and stockpile locations
- Construct new access road to south end of trench area
- Install new monitoring well at south end of trench area
- Remove trees and large brush from trenches to be backfilled
- Maintain ESC measures between Phases 1 and 2

3.2.2 Second Season (Phase 2) Work

- Backfill trenches and buttress area 6 with on-site excavated soils and/or off-site imported soils
- Construct surface water diversion ditches around trench area and other conveyance system components
- Construct infiltration pond at north end of site
- Backfill North Portal
- Construct south portal contingent groundwater treatment system infrastructure
- Maintain ESC measures between Phases 2 and 3

3.2.3 Third Season (Phase 3) Work

- As necessary, add additional trench backfill soil to complete Phase 2 fill and/or regrade to accommodate any settlement that may have occurred since Phase 2
- Place low-permeability soil cap over trench backfill
- Place vegetative soil layer over low-permeability cap
- Seed cover and disturbed areas
- Install perimeter fencing around trench area

3.3 Other Design Features and Considerations

3.3.1 Potential Location of Remediation Equipment

Two areas have been identified as appropriate locations for groundwater treatment systems, as a contingency if the need should arise, at the north and south ends of the site, respectively. These areas will contain the infrastructure such as roads, equipment pads, electrical service, and security that would allow a treatment system to be efficiently installed and operated. The infrastructure for the north contingent treatment area was constructed in 2008, and the south contingent treatment area will be constructed as part of the remedial activities described in this EDR.

3.3.2 Access Controls

Access to the cap and groundwater treatment system areas will be controlled by vehicle gates at all entrances from public roads and by perimeter fences around these areas, as discussed in previous sections and presented in detail in Appendices A and B.

3.3.3 Design Features for Control of Spills

Contractor operations that involve potentially hazardous materials, such as equipment refueling, will be allowed only in areas where the potential for environment impacts from spills is low. In addition, the contractor will be required to submit a site-specific Spill Prevention, Control, and Countermeasure (SPCC) Plan for this project. Details of these environmental protection requirements are presented in Appendix B.

3.3.4 Management of Treatment Residuals

Because removal is not part of the selected remedy, management of treatment residuals is not included in this EDR. The handling and disposal of other waste materials generated as a result of the remedial actions (e.g., rubbish, personal protective equipment [PPE]) is detailed in the Specifications contained in Appendix B.

3.3.5 Construction CQA

A comprehensive CQA Plan has been developed for this project to ensure and demonstrate that the remedial action is performed in accordance with approved Construction Documents. The CQA Plan establishes the responsibilities and authorities of the various parties involved in construction, establishes procedures and frequencies for testing and inspection, establishes hold points for key construction activities, and defines minimum documentation requirements. The CQA Plan is included in Appendix C.

3.3.6 Other Information to Address Applicable, State, Federal, and Local Requirements

The MTCA exempts remedial actions from the procedural requirements of certain state and local laws (RCW 70.105D.090), if conducted under a CD. The Landsburg Mine Site remedial actions will be implemented under the CD (Ecology 2017) and would have these exemptions. The procedural exemption does not apply to state and local laws if such exemption would result in the loss of approval from a Federal agency necessary for the State to administer any Federal law under these chapters. Specific examples of this exception to the procedural exemption are addressed by Ecology in Publication No. 15-09-339. Even though the remedial actions are exempt from procedural requirements under RCW 70.105D.090(1), Ecology must ensure compliance with the substantive requirements associated with each exempted procedural requirement. Information necessary for Ecology to address meeting substantive requirements is provided in this EDR. Exhibit F of the CD provides an evaluation of permits that may be required for the remedial actions. Permits obtained for the remedial actions will be provided to Ecology.

3.3.7 Construction Procedures to Protect Health and Safety

Health and safety procedures for Site workers are addressed in the Health and Safety Environmental Plan, which is presented in Appendix E.

3.3.8 Compliance Monitoring

Under WAC 173-340-410, compliance monitoring consists of protection monitoring, performance monitoring, and confirmational monitoring. The CMP, which was included as Exhibit D to the CD, details the monitoring that will occur during construction and following completion of construction.

Protection monitoring is conducted to confirm “that human health and the environment are adequately protected during future construction and operation of an interim action or cleanup action as described in the safety and health plan” [WAC 173-340-410(a)]. Monitoring for protection of human health is addressed in the Site-specific Construction Health and Safety Environmental Plan, which is included as Appendix E of this EDR. Protection monitoring also includes short-term groundwater monitoring during remedial actions.

Backfilling the trenches will increase the load on any remaining buried drums and thus create the potential for collapse of any intact drums that may be in the trenches. Short-term protection monitoring will commence when the trench backfilling begins, and will continue throughout the trench backfilling and cap construction. Biweekly monitoring will continue for a period of one month after completion of backfilling in order to address the possibility of intact drum collapse leading to significant release of chemicals to groundwater. Details on the short-term (protection) groundwater monitoring program are presented in the approved CMP.

Performance monitoring confirms that the cleanup standard or other performance standards have been attained [see WAC 173-340-410(b)]. Because removal is not part of the selected remedy, and no media outside of the waste disposal areas of the mine are exposed above cleanup levels, performance monitoring will consist of CQA for the cap and associated drainage features as described in the CQA Plan (Appendix C).

Confirmational monitoring is performed to confirm the long-term effectiveness of the remedy, following completion of the constructed remedial action [see WAC 173-340-410(c)]. Long-term maintenance and monitoring inspections of the cap are described in the O&M Plan. Confirmational monitoring in the CMP specifically describes the long-term groundwater monitoring program.

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Golder Associates Inc.

Gary L. Zimmerman
Principal

Frank Shuri, LG, LEG, PE
Principal

GZ/FSS/sb

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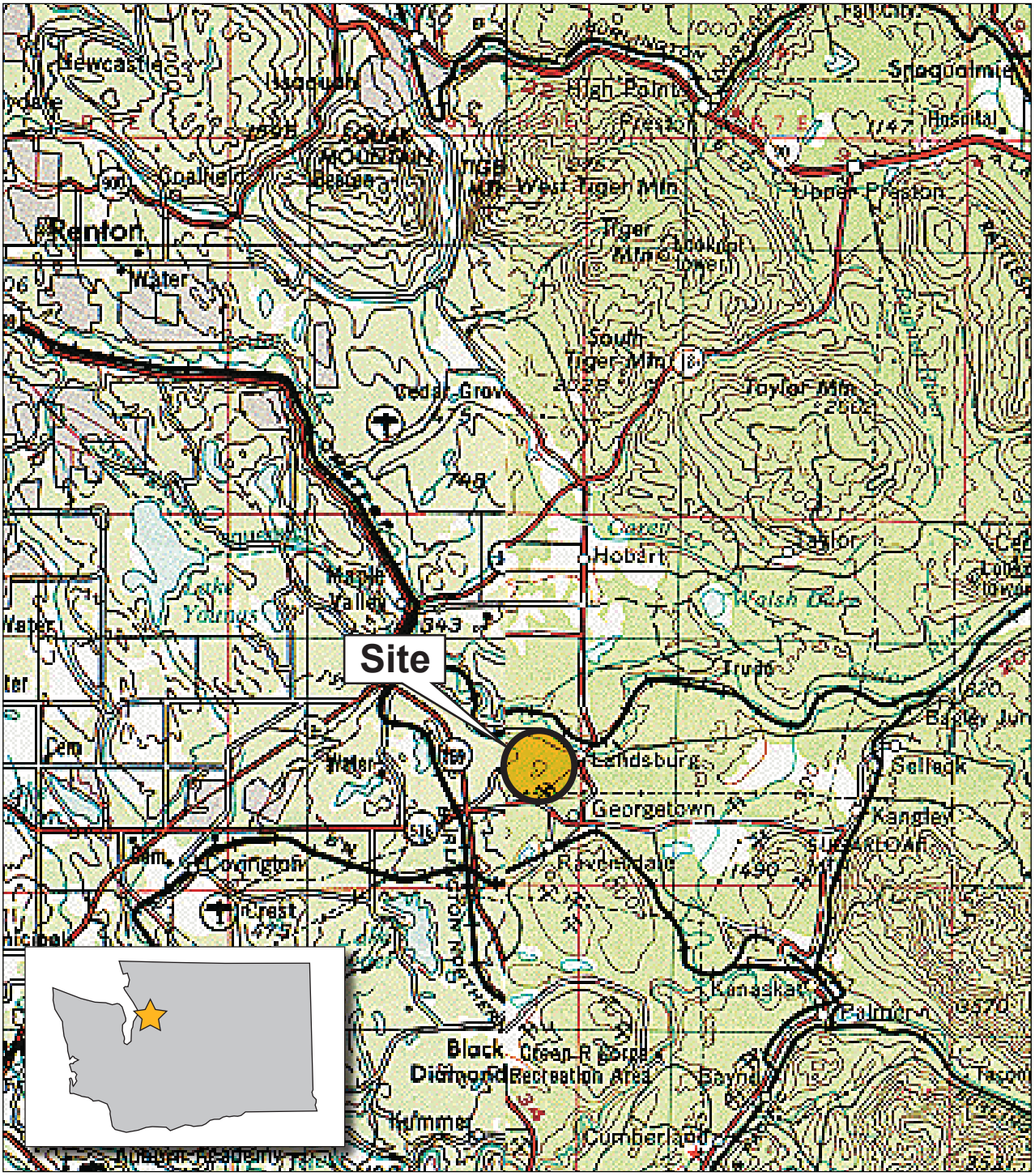
FIGURES



Source: USGS 1:250,000 Sheets,Seattle and Wenatchee

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SCALE IN FEET

CLIENT	PROJECT
LANDSBURG MINE SITE PLP GROUP	LANDSBURG MINE SITE

CONSULTANT

GOLDER

YYYY-MM-DD	2018-03-27
PREPARED	REDMOND
DESIGN	
REVIEW	
APPROVED	

TITLE

SITE LOCATION

PROJECT No.	PHASE	FIGURE
923-1000.005	1000	1-1

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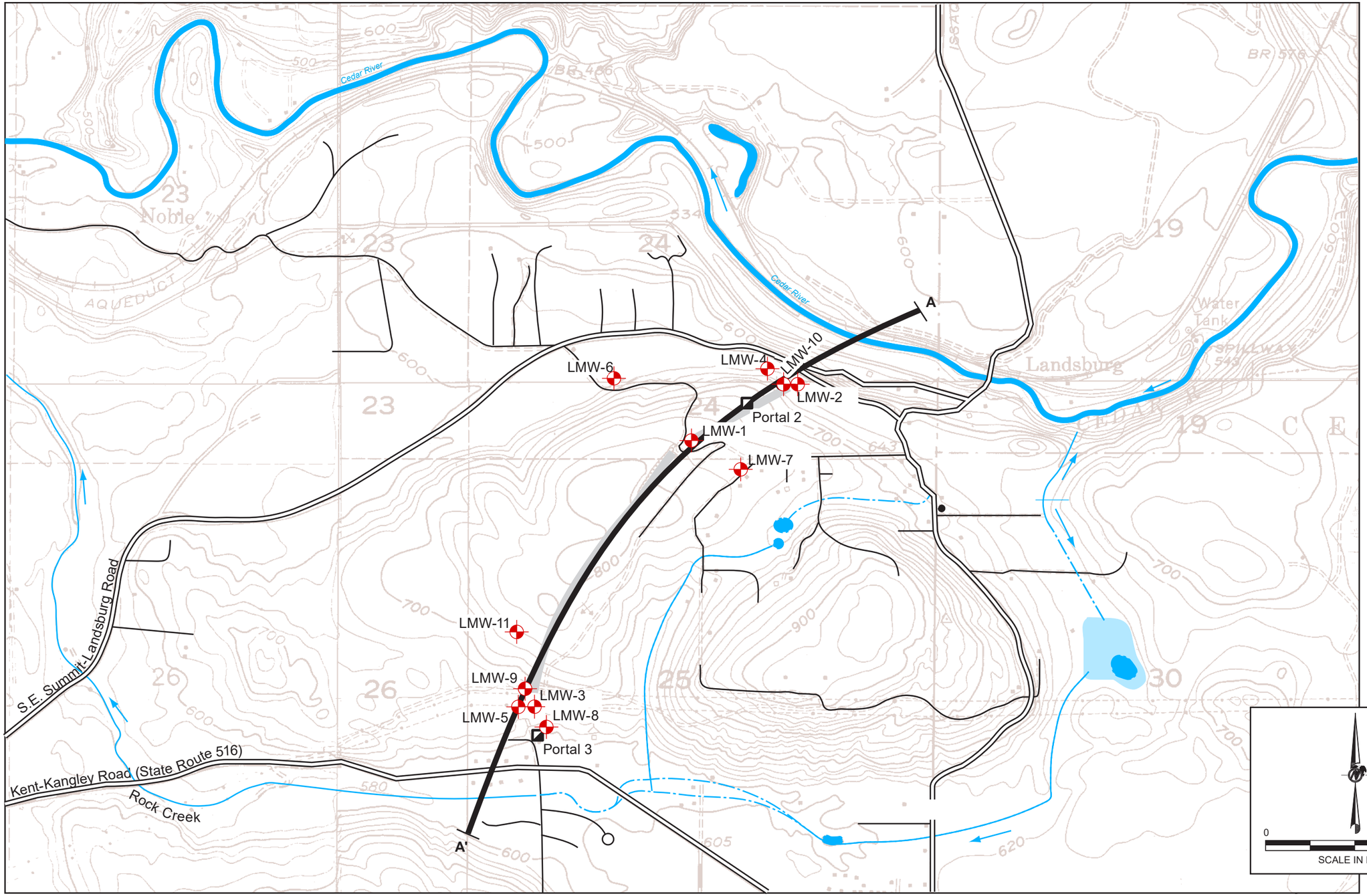

EXPLANATION

- Landsburg Monitoring Wells (LMW-_)
- Portal Seepage Locations
- **A-A'** Cross-Section Along Strike of Rogers Coal Seam (See Figure 1-3)

Base map from USGS 7.5' topographic quadrangles "Cumberland" and "Hobart".

CLIENT
LANDSBURG MINE SITE PLP GROUP

PROJECT
LANDSBURG MINE SITE

CONSULTANT
GOLDER

YYYY-MM-DD	2018-03-27
PREPARED	REDMOND
DESIGN	
REVIEW	
APPROVED	

TITLE
SITE FEATURES AND MAP VIEW FOR LANDSBURG CROSS-SECTION

PROJECT No.	PHASE	FIGURE
923-1000.005	1000	1-2

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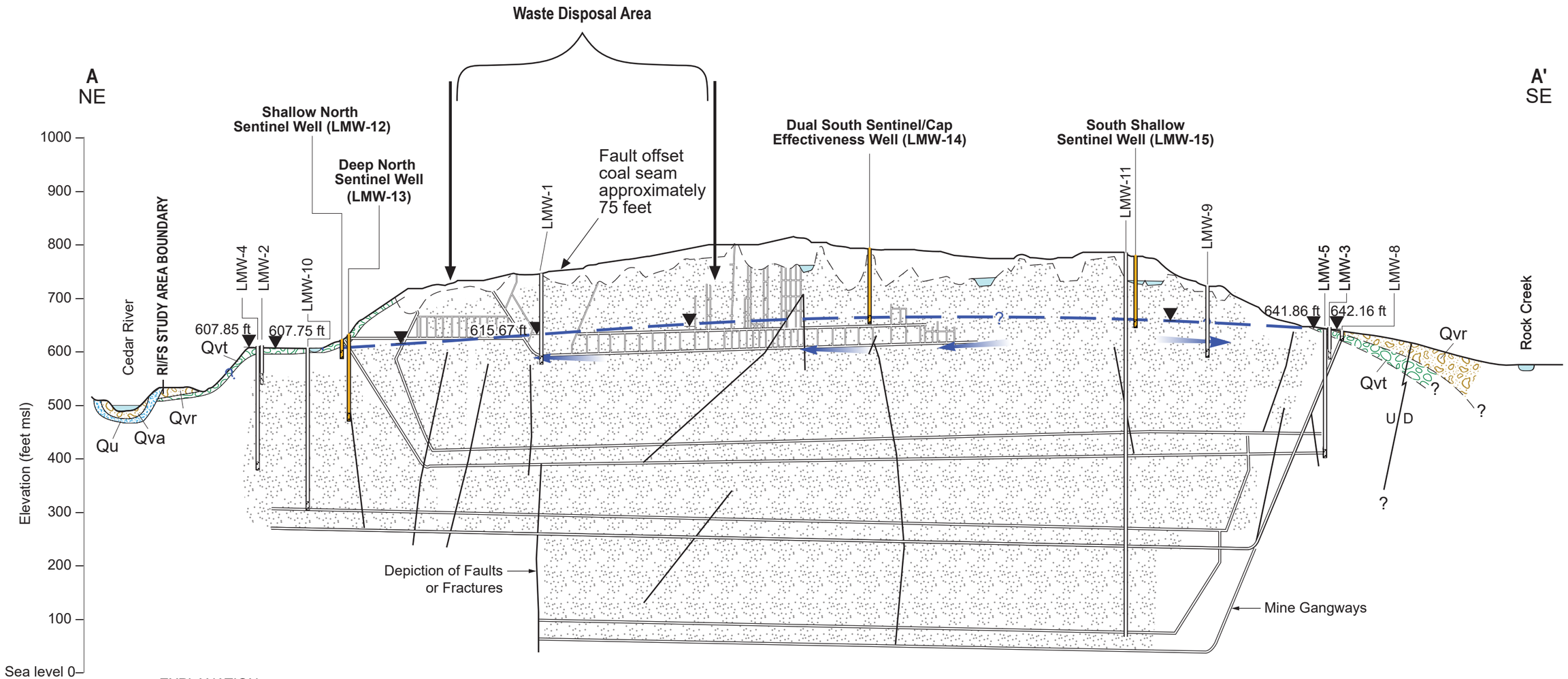

EXPLANATION

- Potentiometric surface
- Outline of trench bottom
- Water Level (ft. amsl) 2/23/94
- Qvt Till, compact mixture of gravel occasional boulders in clayey silty sand matrix
- Sandstone
- Surface water feature
- Anticipated collapsed zone within mine
- Qu Drift, till, fluvial sand and gravel, lacustrine sand, silt, clay and peat
- Qvr Recessional outwash, well sorted sand and pebble-cobble
- Qva Advanced outwash pebble-cobble gravel may include very fine sand
- Monitoring Interval
- Groundwater Flow Direction

0 500
FEET

Sources for the Geology and Mine Information:
J.E. Luzier 1969; surficial geology
State of Washington, Water Well reports
Mine Superintendant's Records
Landsburg Well Logs

NOTE: Vertical to horizontal scale ratio is 2.5:1
Wells are project normal into the strike of the Cross-Section A-A'

Assuming groundwater discharge at the north and south end of mine.

CLIENT	LANDSBURG MINE SITE PLP GROUP
CONSULTANT	GOLDER
YYYY-MM-DD	2018-03-27
PREPARED	REDMOND
DESIGN	
REVIEW	
APPROVED	
PROJECT	LANDSBURG MINE SITE
TITLE	CROSS-SECTION ALONG STRIKE AT COAL SEAM CROSS-SECTION A-A'
PROJECT No.	923-1000.005
PHASE	1000
FIGURE	1-3

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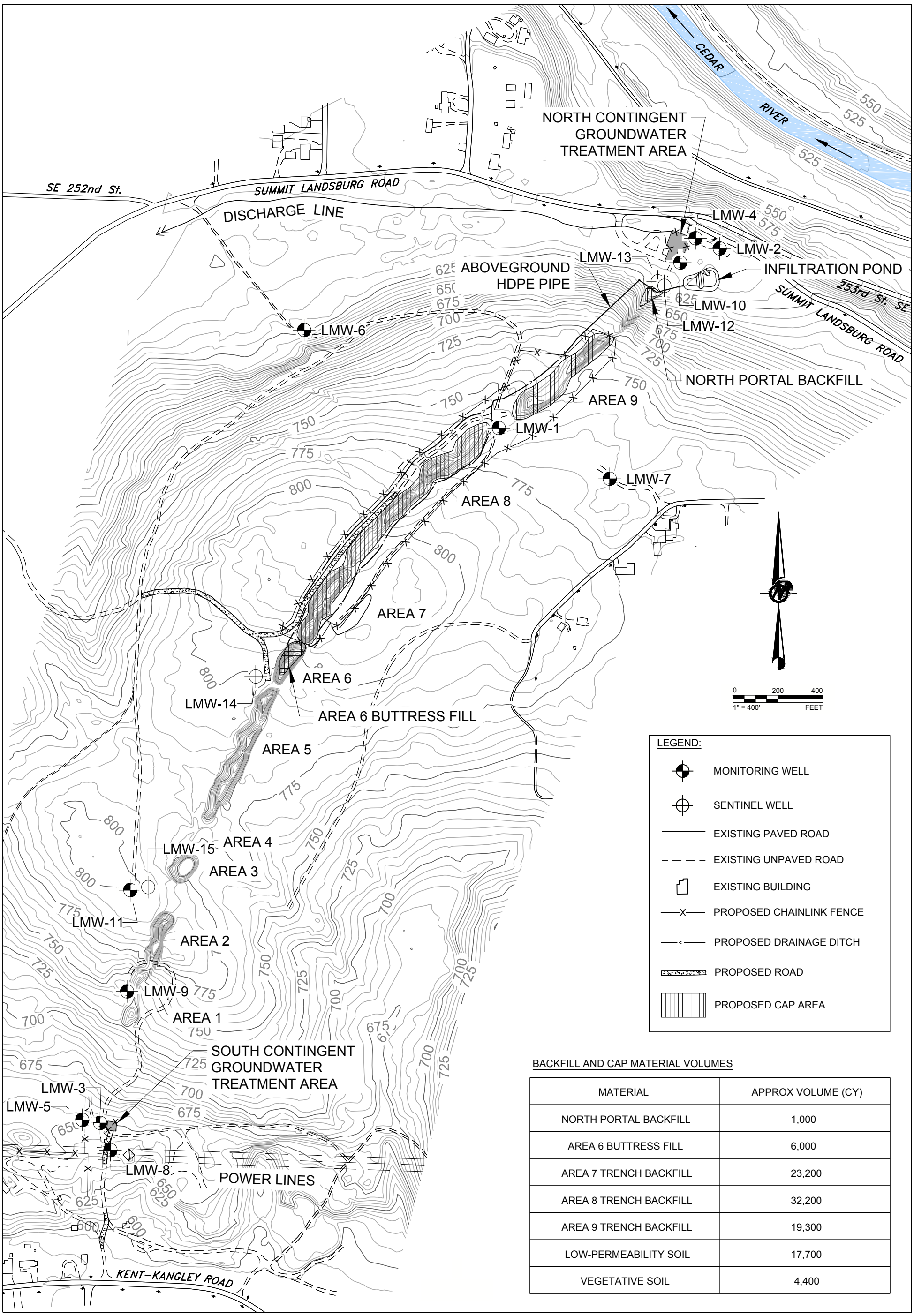

BACKFILL AND CAP MATERIAL VOLUMES

MATERIAL	APPROX VOLUME (CY)
NORTH PORTAL BACKFILL	1,000
AREA 6 BUTTRESS FILL	6,000
AREA 7 TRENCH BACKFILL	23,200
AREA 8 TRENCH BACKFILL	32,200
AREA 9 TRENCH BACKFILL	19,300
LOW-PERMEABILITY SOIL	17,700
VEGETATIVE SOIL	4,400

CLIENT
LANDSBURG MINE SITE PLP GROUP

PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-04-16
DESIGNED	VMN
PREPARED	VMN
REVIEWED	FSS
APPROVED	GZ

TITLE
DESIGNED CAPPED AREAS, DRAINAGE DITCHES, AND CONTINGENT TREATMENT SYSTEM AREAS

PROJECT NO.	PHASE	REV.	FIGURE
9231000005	1000	B	1-4

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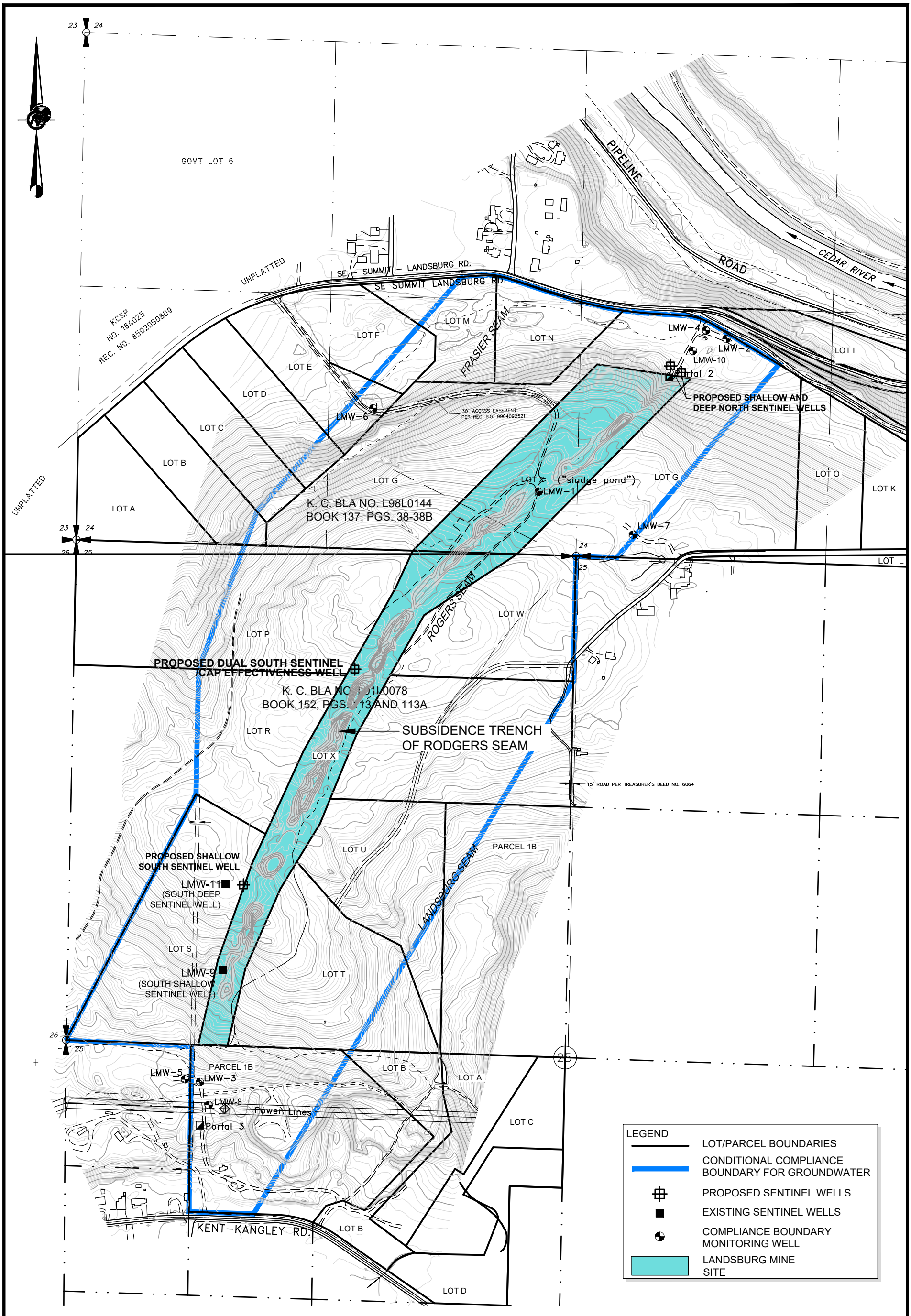

FIGURE **2-1**

NOTE:
1. LETTERS AT LOT X PROPERTY CORNERS CORRESPOND TO THE COORDINATES IN TABLE 1

LANDSBURG MINE SITE BOUNDARY

PALMER/LANDSBURG MINE/WA

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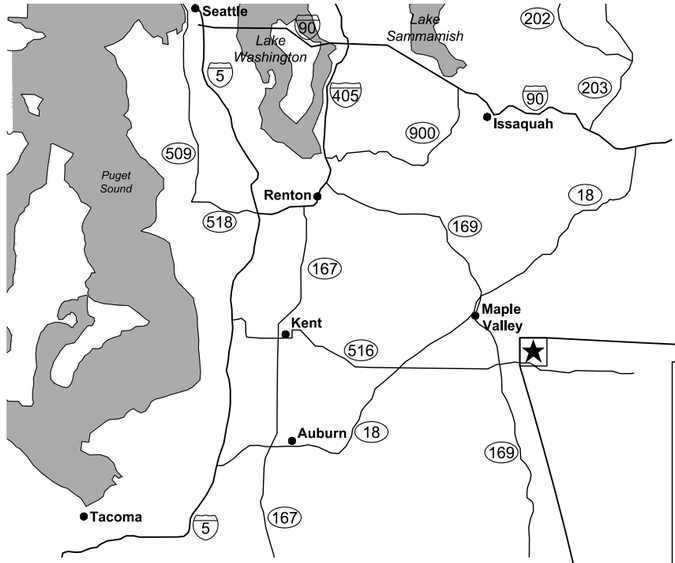
Golder Associates

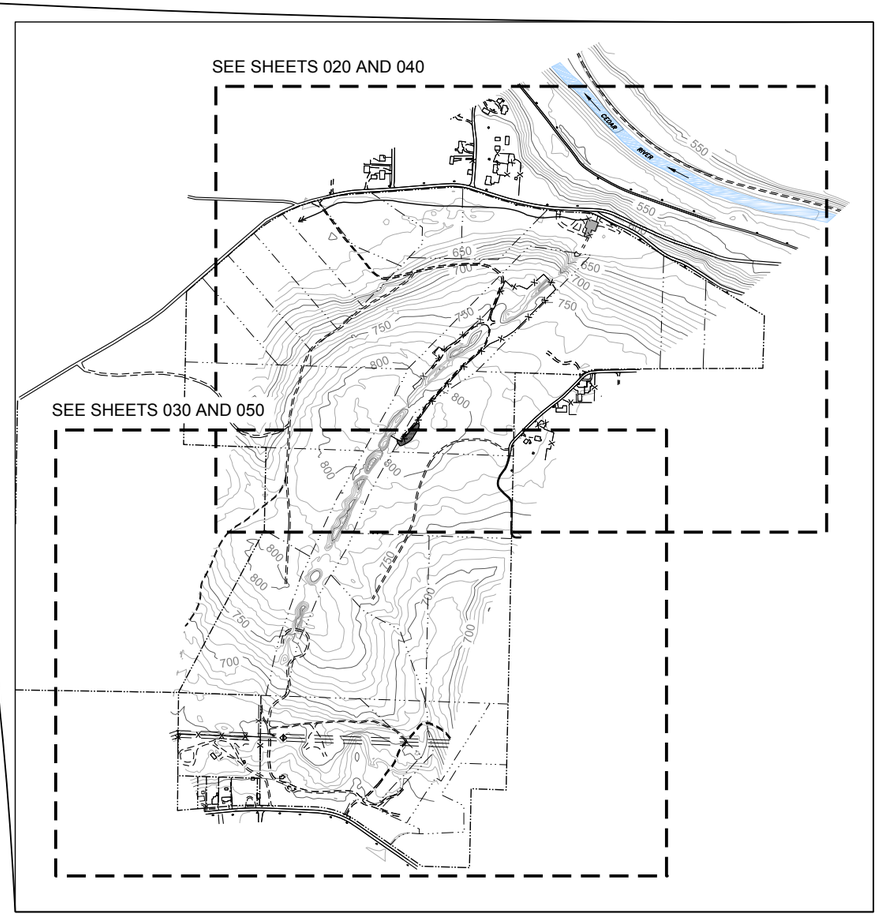
APPENDIX A

Design Drawings

LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

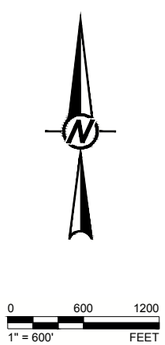


LOCATION MAP



VICINITY MAP

DRAWING LIST	
SHEET NUMBER	SHEET TITLE
010	COVER SHEET
020	EXISTING CONDITIONS AND SITE PLAN KEY (1 OF 2)
030	EXISTING CONDITIONS AND SITE PLAN KEY (2 OF 2)
040	EROSION AND SEDIMENT CONTROL PLAN (1 OF 2)
050	EROSION AND SEDIMENT CONTROL PLAN (2 OF 2)
060	EROSION AND SEDIMENT CONTROL DETAILS
100	SITE PLAN - AREA 9, NORTH PORTAL, AND INFILTRATION POND
110	SITE PLAN - AREA 8 AND 9
120	SITE PLAN - AREA 6 AND 7
130	SITE PLAN - SOUTH CONTINGENT GROUNDWATER TREATMENT SYSTEM AREA
200	NORTH PORTAL BACKFILL - PROFILE AND SECTIONS
210	TRENCH BACKFILL PROFILES
220	TRENCH BACKFILL SECTIONS (1 OF 4)
230	TRENCH BACKFILL SECTIONS (2 OF 4)
240	TRENCH BACKFILL SECTIONS (3 OF 4)
250	TRENCH BACKFILL SECTIONS (4 OF 4)
260	DRAINAGE PROFILE
300	DETAILS (1 OF 6)
310	DETAILS (2 OF 6)
320	DETAILS (3 OF 6)
330	DETAILS (4 OF 6)
340	DETAILS (5 OF 6)
350	DETAILS (6 OF 6)



REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2018-08-06	FINAL	VMN	VMN	FSS	GZ
B	2018-04-25	DRAFT FOR AGENCY REVIEW	VMN	VMN	FSS	GZ
A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

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USA
[+1] (425) 883 0777
www.golder.com

PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
COVER SHEET

PROJECT NO.	PHASE	REV.		SHEET
9231000005	1000	C	1 of 23	010

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NOTES

1. BASE TOPOGRAPHY FROM SURVEY BY TRIAD ASSOCIATES, DATED 01/21/03.
   - HORIZONTAL DATUM: NAD 83 (91) WASHINGTON STATE PLANE, NORTH ZONE, US FOOT (BASED ON KING COUNTY SURVEY CONTROL POINT NUMBERS 6201, 6161 AND 6234)
   - VERTICAL DATUM: NAVD 88 (BASED ON CONVERSION OF GPS FIELD MEASUREMENTS USING THE GEOID96 PROGRAM)
   - CONTOUR INTERVAL: 2 FT
2. AS-BUILT LOCATIONS OF NORTH CONTINGENT GROUNDWATER TREATMENT AREA FEATURES FROM SURVEY BY PACIFIC GEOMATIC SERVICES, INC., DATED 09/16/08.
3. PROPERTY BOUNDARIES FROM KING COUNTY GIS DATA PORTAL, ACCESSED 3/20/18.
4. LOCATIONS OF ROADS AND DISCHARGE LINE ARE APPROXIMATE.
5. SITE CONDITIONS PRESENTED IN THESE DRAWINGS MAY HAVE CHANGED SINCE THE DATE OF SURVEY. PROJECT FEATURE LOCATIONS, CONFIGURATIONS, AND LAYOUTS ARE TO BE DETERMINED IN THE FIELD AT THE TIME OF CONSTRUCTION BASED ON THE CONDITIONS ENCOUNTERED. THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY DISCREPANCIES ENCOUNTERED.

LEGEND

- LMW-2 EXISTING MONITORING WELL
- PROPERTY BOUNDARY
- PARCEL BOUNDARY
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING UTILITY POLE
- EXISTING CHAINLINK FENCE
- EXISTING BUILDING
- EXISTING WETLAND

0 200 400
1" = 200' FEET

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2018-08-06	FINAL	VMN	VMN	FSS	GZ
B	2018-04-25	DRAFT FOR AGENCY REVIEW	VMN	VMN	FSS	GZ
A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

CLIENT
LANDSBURG MINE SITE PLP GROUP

CONSULTANT
GOLDER
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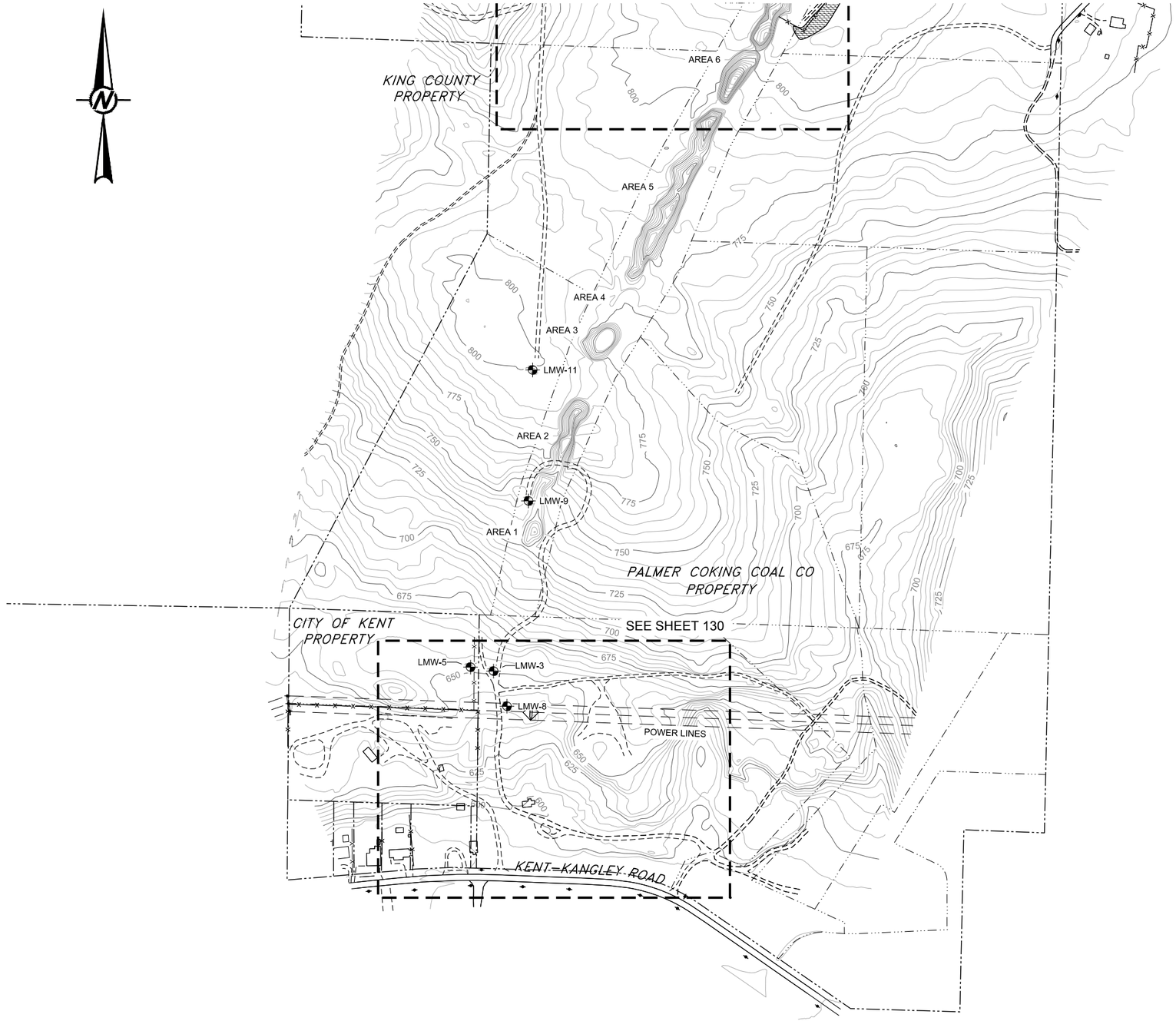
REDMOND, WA
USA
[+1] (425) 883 0777
www.golder.com

PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
EXISTING CONDITIONS AND SITE PLAN KEY (1 OF 2)

PROJECT NO.	PHASE	REV.	2 of 23	SHEET
9231000005	1000	C		020

Path: \\redmond.golder.gds\geomatics\PalmerCokingCoal\LandsburgMineWA\99_PROJECTS\9231000005_Remedial\Action\1000_Remedial\ActionDesign\02_PRODUCTION\DWG | File Name: 9231000005_1000_002.dwg | Last Edited By: vraynerr Date: 2018-08-06 Time:2:42:24 PM | Printed By: VRayner Date: 2018-08-06 Time:3:21:04 PM
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D
1 in
0



NOTES

1. SEE NOTES ON SHEET 020.

LEGEND

- LMW-2 EXISTING MONITORING WELL
- PROPERTY BOUNDARY
- PARCEL BOUNDARY
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING UTILITY POLE
- EXISTING CHAINLINK FENCE
- EXISTING BUILDING
- EXISTING WETLAND

0 200 400
1" = 200' FEET

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2018-08-06	FINAL	VMN	VMN	FSS	GZ
B	2018-04-25	DRAFT FOR AGENCY REVIEW	VMN	VMN	FSS	GZ
A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

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PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
EXISTING CONDITIONS AND SITE PLAN KEY (2 OF 2)

PROJECT NO. 9231000005 | PHASE 1000 | REV. C | 3 of 23 | SHEET 030

Path: \\redmond.golder.gds\geomat$\geomat\cs\Palmer\Coking\Coal\CoLandsburg\Mine\WA\99_PROJECTS\9231000005_RemedialAction\1000_RemedialActionDesign\02_PRODUCTION\DWG\ | File Name: 9231000005_1000_002.dwg | Last Edited By: vrayner Date: 2018-08-06 Time:2:42:24 PM | Printed By: VRayner Date: 2018-08-06 Time:3:21:07 PM

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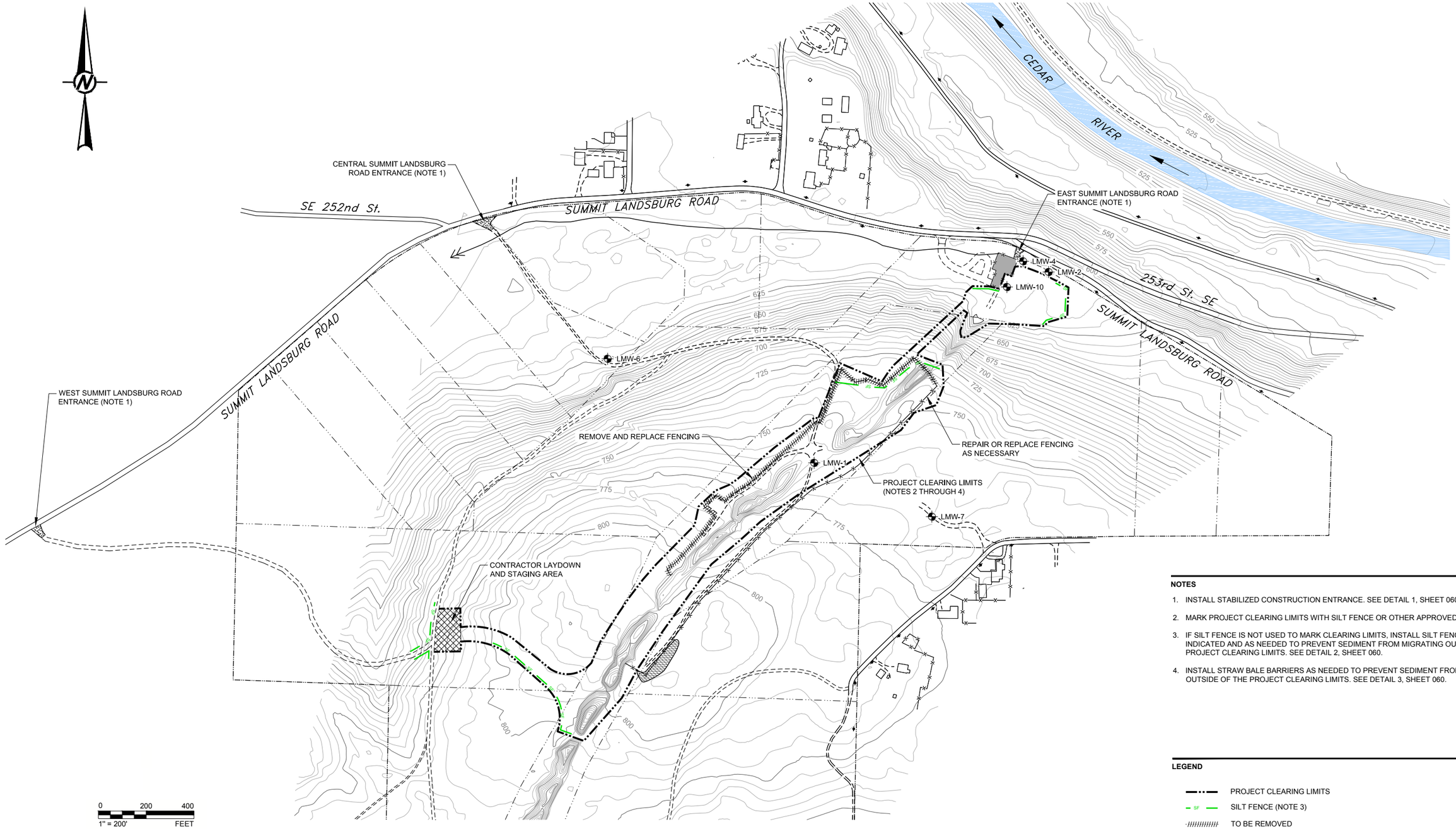
1 in
0



NOTES

1. INSTALL STABILIZED CONSTRUCTION ENTRANCE. SEE DETAIL 1, SHEET 060.
2. MARK PROJECT CLEARING LIMITS WITH SILT FENCE OR OTHER APPROVED MATERIAL.
3. IF SILT FENCE IS NOT USED TO MARK CLEARING LIMITS, INSTALL SILT FENCE AS INDICATED AND AS NEEDED TO PREVENT SEDIMENT FROM MIGRATING OUTSIDE OF THE PROJECT CLEARING LIMITS. SEE DETAIL 2, SHEET 060.
4. INSTALL STRAW BALE BARRIERS AS NEEDED TO PREVENT SEDIMENT FROM MIGRATING OUTSIDE OF THE PROJECT CLEARING LIMITS. SEE DETAIL 3, SHEET 060.

LEGEND

- PROJECT CLEARING LIMITS
- SF — SILT FENCE (NOTE 3)
- TO BE REMOVED

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2018-08-06	FINAL	VMN	VMN	FSS	GZ
B	2018-04-25	DRAFT FOR AGENCY REVIEW	VMN	VMN	FSS	GZ
A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

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PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
EROSION AND SEDIMENT CONTROL PLAN (1 OF 2)

PROJECT NO.	PHASE	REV.	4 of 23	SHEET
9231000005	1000	C		040

Path: \\redmond.golder.gds\geomat$\geomatics\PalmerCokingCoal\LandsburgMine\WA99_PROJECTS\9231000005_Remedial\Action\1000_Remedial\Action\Design\02_PRODUCTION\DWG | File Name: 9231000005_1000_006.dwg | Last Edited By: vrayner Date: 2018-08-06 Time:2:44:10 PM | Printed By: VRayner Date: 2018-08-06 Time:3:21:19 PM
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D
1 in
0

NOTES

1. SEE NOTES ON SHEET 040.

LEGEND

PROJECT CLEARING LIMITS

SF SILT FENCE

0 200 400
1" = 200' FEET

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2018-08-06	FINAL	VMN	VMN	FSS	GZ
B	2018-04-25	DRAFT FOR AGENCY REVIEW	VMN	VMN	FSS	GZ
A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

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PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
EROSION AND SEDIMENT CONTROL PLAN (2 OF 2)

PROJECT NO.	PHASE	REV.	5 of 23	SHEET
9231000005	1000	C		050

Path: \\redmond.golder.gds\geomat$\geomatics\PalmerCokingCoal\LandsburgMine\WA99_PROJECTS\9231000005_RemedialAction\1000_RemedialActionDesign\02_PRODUCTION\DWG | File Name: 9231000005_1000_006.dwg | Last Edited By: vrayner Date: 2018-08-06 Time:2:44:10 PM | Printed By: VRayner Date: 2018-08-06 Time:3:21:22 PM
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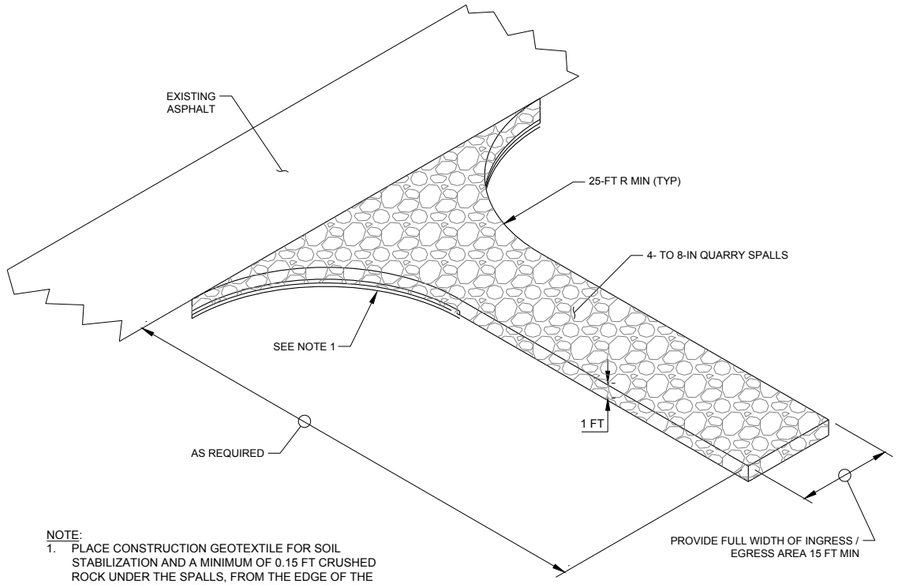
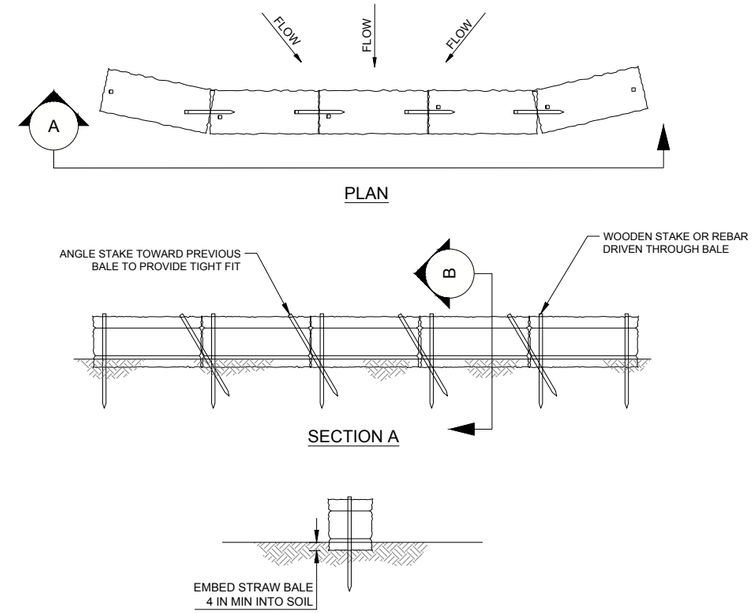


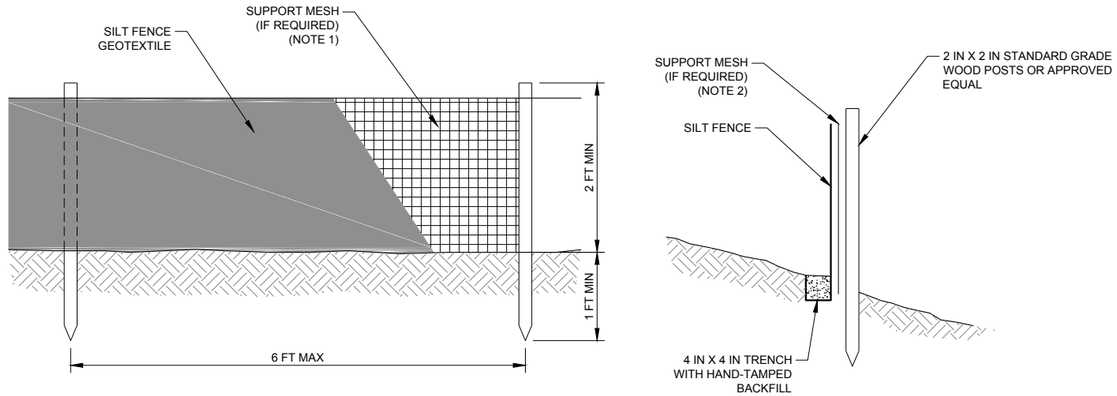
NOTE:
1. PLACE CONSTRUCTION GEOTEXTILE FOR SOIL STABILIZATION AND A MINIMUM OF 0.15 FT CRUSHED ROCK UNDER THE SPALLS, FROM THE EDGE OF THE EXISTING ROADWAY TO RADIUS RETURNS, OR AS DIRECTED BY THE CONSTRUCTION MANAGER.

NTS 1 -- CONSTRUCTION ENTRANCE



NOTES:
1. STRAW BALES SHALL BE PLACED IN A ROW WITH THE ENDS TIGHTLY ABUTTING.
2. KEY IN BALES TO PREVENT EROSION OR FLOW UNDER BALES.
3. NUMBER OF BALES IN EACH BARRIER TO BE DETERMINED BY THE CONSTRUCTION MANAGER.

NTS 3 -- STRAW BALE BARRIER



NOTES:
1. SUPPORT MESH SHALL BE REQUIRED IF SPACING BETWEEN POSTS IS INCREASED OR IF IN THE OPINION OF THE CONSTRUCTION MANAGER, THE SILT FENCE IS NOT ADEQUATELY SUPPORTED TO FUNCTION AS INTENDED.
2. EXTEND SUPPORT MESH AT LEAST 3 INCHES INTO TRENCH.

NTS 2 -- SILT FENCE

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2018-08-06	FINAL	VMN	VMN	FSS	GZ
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A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

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PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
EROSION AND SEDIMENT CONTROL DETAILS

PROJECT NO. 9231000005 | PHASE 1000 | REV. C | 6 of 23 | SHEET 060

Path: \\redmond.golder.gds\geomatics\PalmerCoking\CoalCo\Landsburg\MineWA\99_PROJECTS\9231000005_RemedialAction\1000_RemedialActionDesign\02_PRODUCTION\DWG\ | File Name: 9231000005_1000_005.dwg | Last Edited By: vrayner Date: 2018-08-06 Time:2:47:34 PM | Printed By: VRayner Date: 2018-08-06 Time:3:21:36 PM
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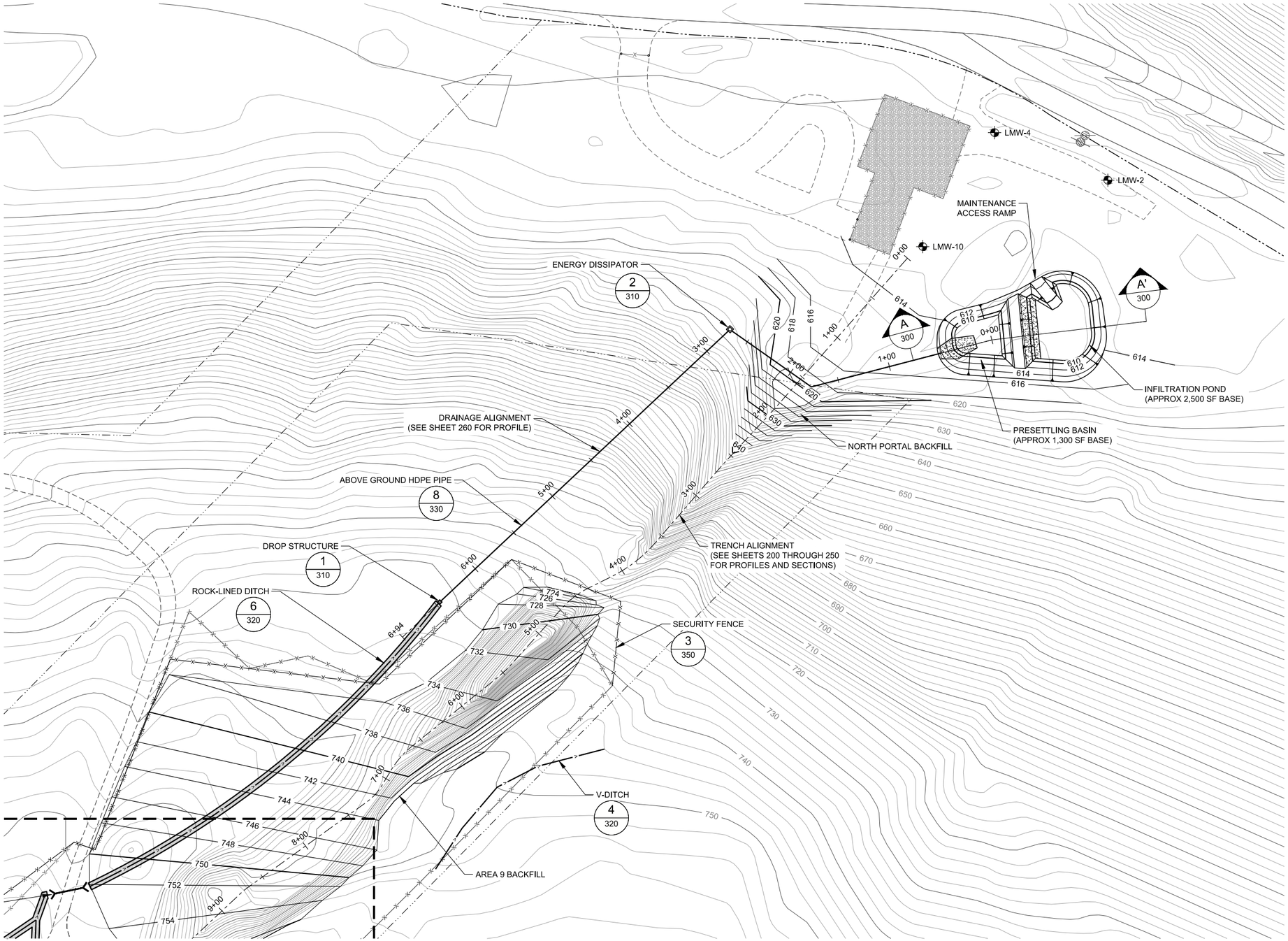

NOTES

1. FINAL LOCATIONS OF PIPE AND DITCHES TO BE DETERMINED IN THE FIELD. LOCATIONS SHOWN ARE APPROXIMATE.
2. DITCH SHALL BE ROCK-LINED WHERE THE FINAL GRADE IS 6% OR STEEPER. TRANSITION POINT FROM GRASS-LINED TO ROCK-LINED DITCH SHOWN AT TRENCH ALIGNMENT STA 18+50 IS APPROXIMATE.

LEGEND

- 740 — PROPOSED GROUND SURFACE AFTER TRENCH BACKFILL - INDEX CONTOUR
- 738 — PROPOSED GROUND SURFACE AFTER TRENCH BACKFILL - INTERMEDIATE CONTOUR
- PROPOSED FENCE
- PROPOSED DITCH
- PROPOSED ROCK-LINED DITCH
- PROPOSED HDPE PIPE
- ARMOR ROCK
- A / 300 — SECTION ID; SHEET WHERE SECTION IS CUT
- 1 / 310 — DETAIL NUMBER; SHEET WHERE DETAIL IS SHOWN

0 50 100
1" = 50' FEET

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2018-08-06	FINAL	VMN	VMN	FSS	GZ
B	2018-04-25	DRAFT FOR AGENCY REVIEW	VMN	VMN	FSS	GZ
A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

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PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
SITE PLAN - AREA 9, NORTH PORTAL, AND INFILTRATION POND

PROJECT NO.	PHASE	REV.		SHEET
9231000005	1000	C	7 of 23	100

Path: \\redmond.golder.gds\geomatics\PalmerCokingCoal\Landsburg\MineWA\99_PROJECTS\9231000005_Remedial\Action\1000_Remedial\ActionDesign\02_PRODUCTION\DWG\ | File Name: 9231000005_1000_003.dwg | Last Edited By: vrayner Date: 2018-08-06 Time:2:52:10 PM | Printed By: VRayner Date: 2018-08-06 Time:3:21:52 PM
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1 in
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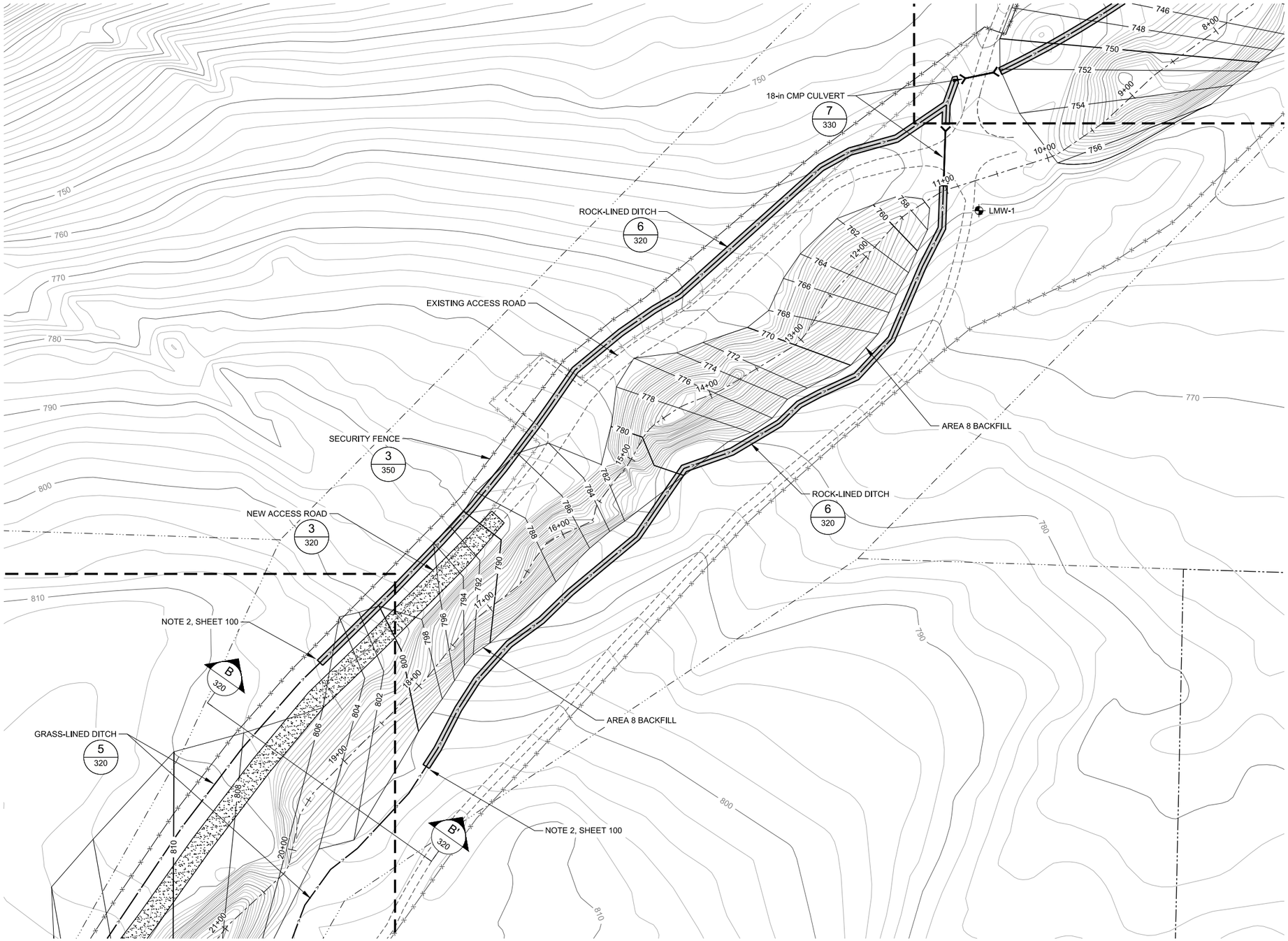

NOTES

1. SEE NOTES ON SHEET 100.

LEGEND

- 740 — PROPOSED GROUND SURFACE AFTER TRENCH BACKFILL - INDEX CONTOUR
- 738 — PROPOSED GROUND SURFACE AFTER TRENCH BACKFILL - INTERMEDIATE CONTOUR
- PROPOSED FENCE
- PROPOSED DITCH
- PROPOSED ROCK-LINED DITCH
- PROPOSED ACCESS ROAD

A / 300 — A' / 300 — SECTION ID; SHEET WHERE SECTION IS CUT

1 / 310 — DETAIL NUMBER; SHEET WHERE DETAIL IS SHOWN

0 50 100
1" = 50' FEET

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2018-08-06	FINAL	VMN	VMN	FSS	GZ
B	2018-04-25	DRAFT FOR AGENCY REVIEW	VMN	VMN	FSS	GZ
A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

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LANDSBURG MINE SITE PLP GROUP

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PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
SITE PLAN - AREA 8 AND 9

PROJECT NO.	PHASE	REV.		SHEET
9231000005	1000	C	8 of 23	110

Path: \\redmond.golder.gds\geomat$\geomatics\PalmerCokingCoal\LandsburgMineWA\99_PROJECTS\9231000005_RemedialAction\1000_RemedialAction\Design\02_PRODUCTION\DWG | File Name: 9231000005_1000_003.dwg | Last Edited By: vrayner Date: 2018-08-06 Time:2:52:10 PM | Printed By: VRayner Date: 2018-08-06 Time:3:21:58 PM
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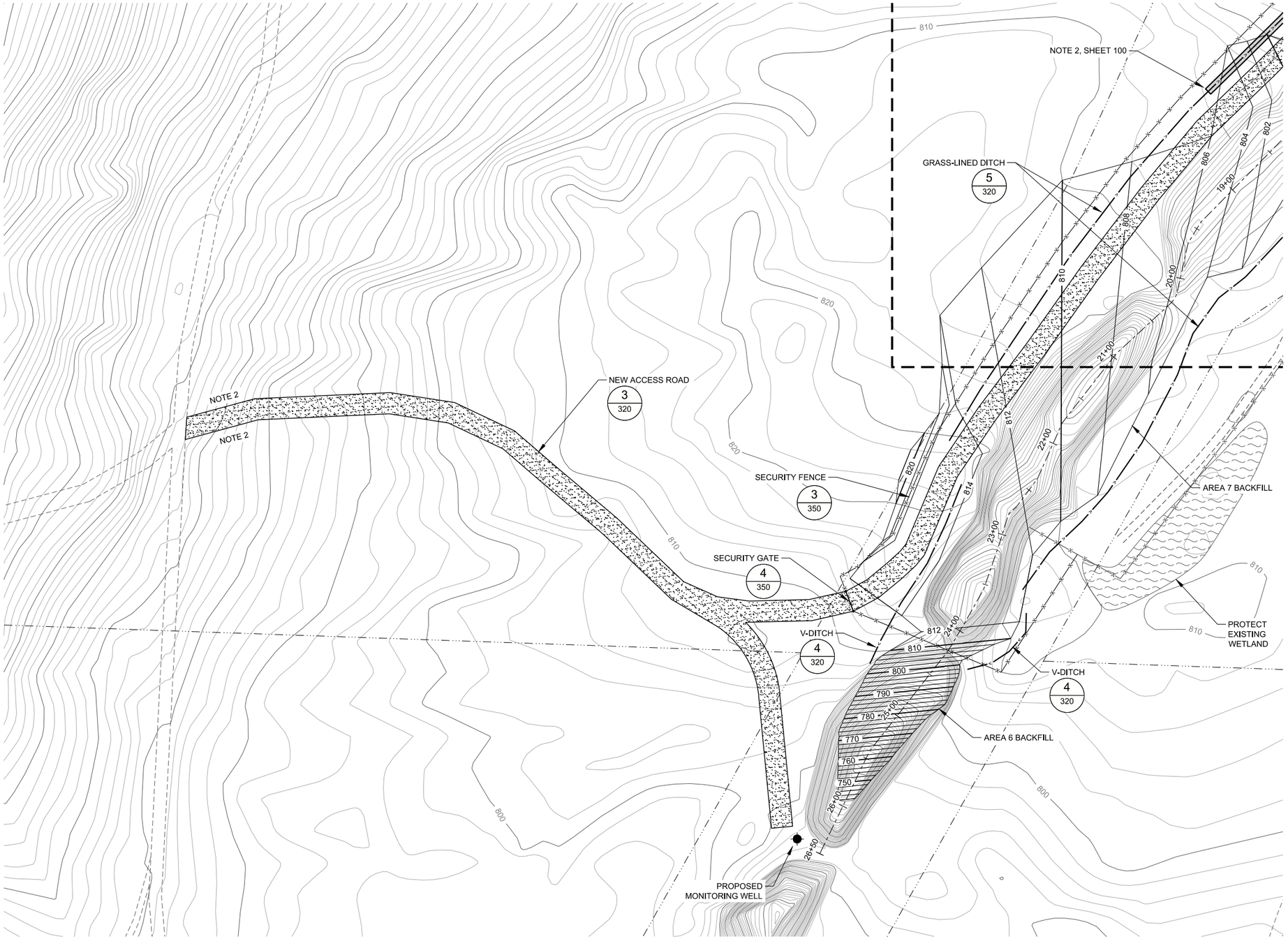
1 in



NOTES

1. SEE NOTES ON SHEET 100.
2. TOPOGRAPHY SHOWN IN THIS AREA DOES NOT REFLECT CURRENT TOPOGRAPHY. DESIGN ENGINEER TO PROVIDE STAKING OF ROAD CENTERLINE. ACCESS ROAD GRADE SHALL BE 10% OR LESS. WHERE CUTS ARE NECESSARY ADJACENT TO ROAD, CUT SLOPES AT 2H:1V.

LEGEND

- 740 — PROPOSED GROUND SURFACE AFTER TRENCH BACKFILL - INDEX CONTOUR
- 738 — PROPOSED GROUND SURFACE AFTER TRENCH BACKFILL - INTERMEDIATE CONTOUR
- PROPOSED FENCE
- PROPOSED DITCH
- PROPOSED ROCK-LINED DITCH
- PROPOSED ACCESS ROAD
- 1 / 310 — DETAIL NUMBER / SHEET WHERE DETAIL IS SHOWN

0 50 100
1" = 50' FEET

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2018-08-06	FINAL	VMN	VMN	FSS	GZ
B	2018-04-25	DRAFT FOR AGENCY REVIEW	VMN	VMN	FSS	GZ
A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

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PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
SITE PLAN - AREA 6 AND 7

PROJECT NO.	PHASE	REV.		SHEET
9231000005	1000	C	9 of 23	120

Path: \\redmond.golder.gds\geomatics\Palmer\Coking\Coal\Landsburg\MineWA\9_PROJECTS\9231000005_RemedialAction\1000_RemedialAction\Design\02_PRODUCTION\DWG\ | File Name: 9231000005_1000_003.dwg | Last Edited By: vraynerr Date: 2018-08-06 Time:2:52:10 PM | Printed By: VRayner Date: 2018-08-06 Time:3:22:03 PM
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D
0 1 in

NOTES

1. SEE NOTES ON SHEET 100.
2. PORTIONS OF POWER LINE MAY BE OVERHEAD DEPENDING ON PUGET SOUND ENERGY REQUIREMENTS, TO BE DETERMINED FOR FINAL DESIGN.

LEGEND

- PROPOSED FENCE
- PROPOSED DITCH
- PROPOSED ACCESS ROAD
- U/G — PROPOSED UNDERGROUND POWER LINE
- A / 300 — SECTION ID; SHEET WHERE SECTION IS CUT (A' / 300)
- 1 / 310 — DETAIL NUMBER; SHEET WHERE DETAIL IS SHOWN

0 50 100
1" = 50' FEET

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2018-08-06	FINAL	VMN	VMN	FSS	GZ
B	2018-04-25	DRAFT FOR AGENCY REVIEW	VMN	VMN	FSS	GZ
A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

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PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
SITE PLAN - SOUTH CONTINGENT GROUNDWATER TREATMENT SYSTEM AREA

PROJECT NO. 9231000005 | PHASE 1000 | REV. C | 10 of 23 | SHEET 130

Path: \\redmond.golder.gds\geomat$\geomatics\PalmerCokingCoal\LandsburgMine\WA99_PROJECTS\9231000005_RemedialAction\1000_RemedialActionDesign\02_PRODUCTION\DWGs | File Name: 9231000005_1000_003.dwg | Last Edited By: vrayner Date: 2018-08-06 Time:2:52:10 PM | Printed By: VRayner Date: 2018-08-06 Time:3:22:08 PM
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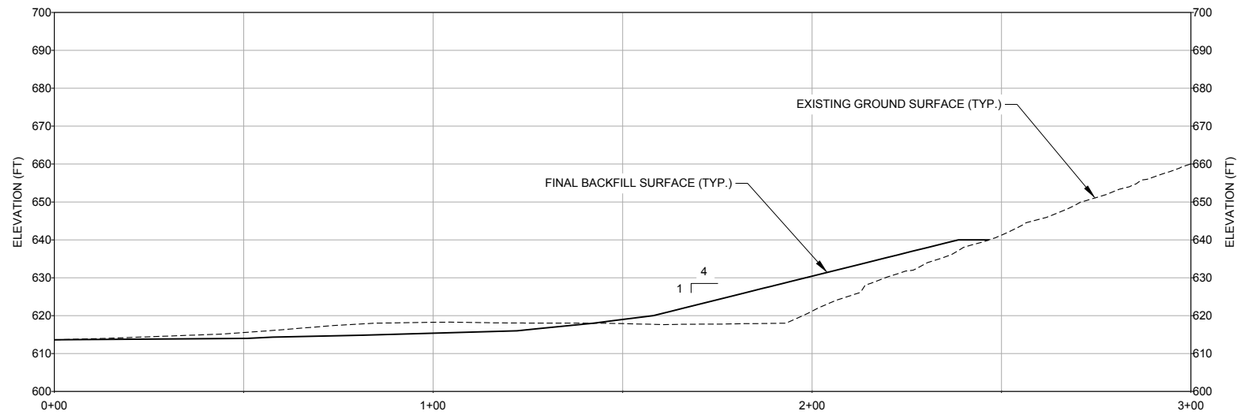
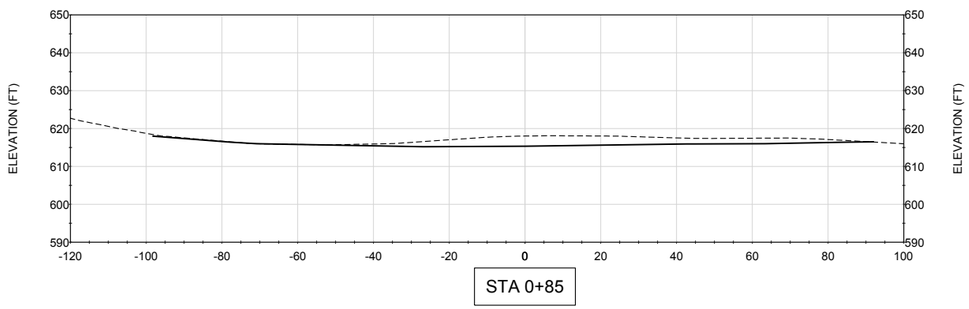
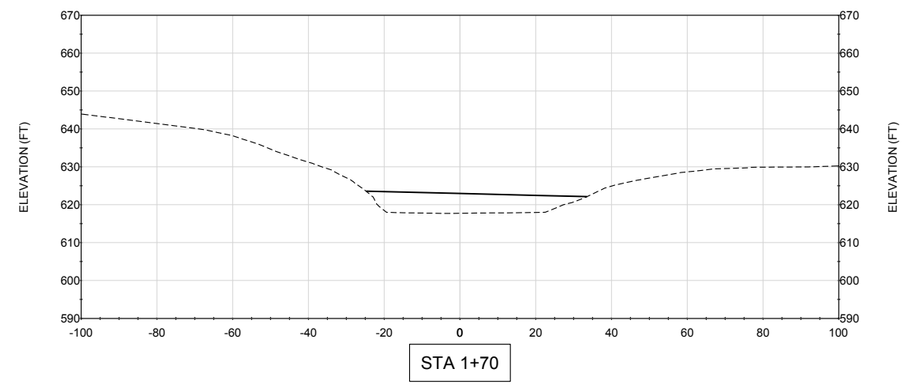
1 in



NORTH PORTAL BACKFILL PROFILE





NORTH PORTAL BACKFILL SECTIONS

NOTES

1. STATIONING REFERS TO TRENCH ALIGNMENT, SHEET 100.

0 20 40
1" = 20' FEET

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2018-08-06	FINAL	VMN	VMN	FSS	GZ
B	2018-04-25	DRAFT FOR AGENCY REVIEW	VMN	VMN	FSS	GZ
A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

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PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
NORTH PORTAL BACKFILL - PROFILE AND SECTIONS

PROJECT NO.	PHASE	REV.	11 of 23	SHEET
9231000005	1000	C		200

Path: \\redmond.golder.gds\geomat$\geomatics\PalmerCokingCoal\LandsburgMine\WA99_PROJECTS\9231000005_RemedialAction\1000_RemedialActionDesign\02_PRODUCTION\DWG\ | File Name: 9231000005_1000_004.dwg | Last Edited By: vrayner Date: 2018-08-06 Time:2:55:37 PM | Printed By: VRayner Date: 2018-08-06 Time:3:22:21 PM
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1 in
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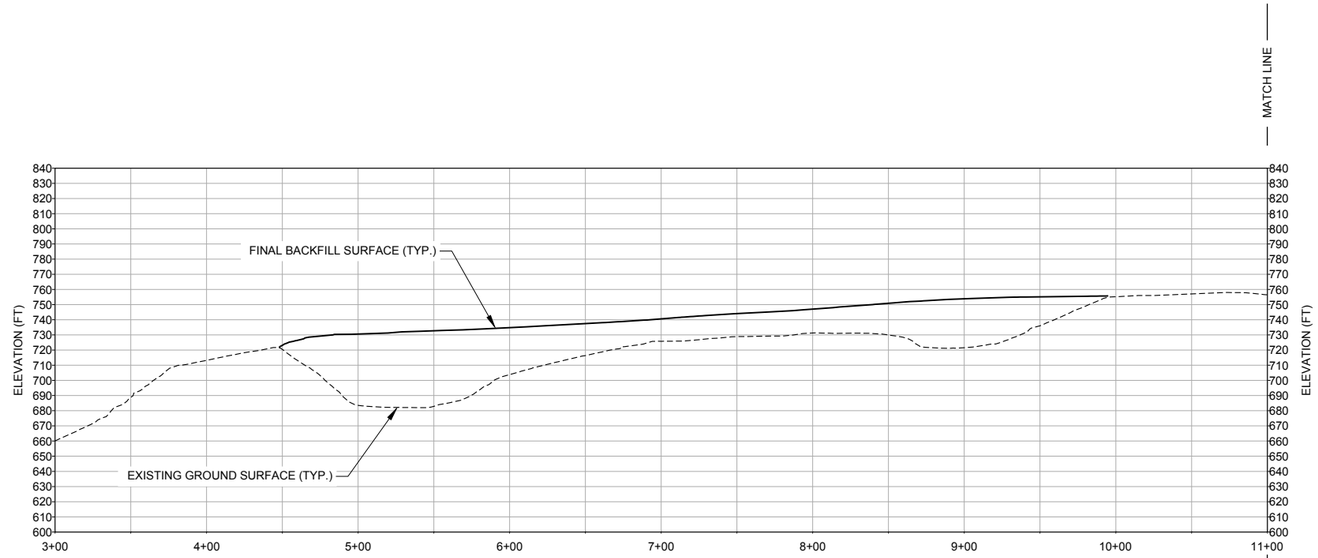
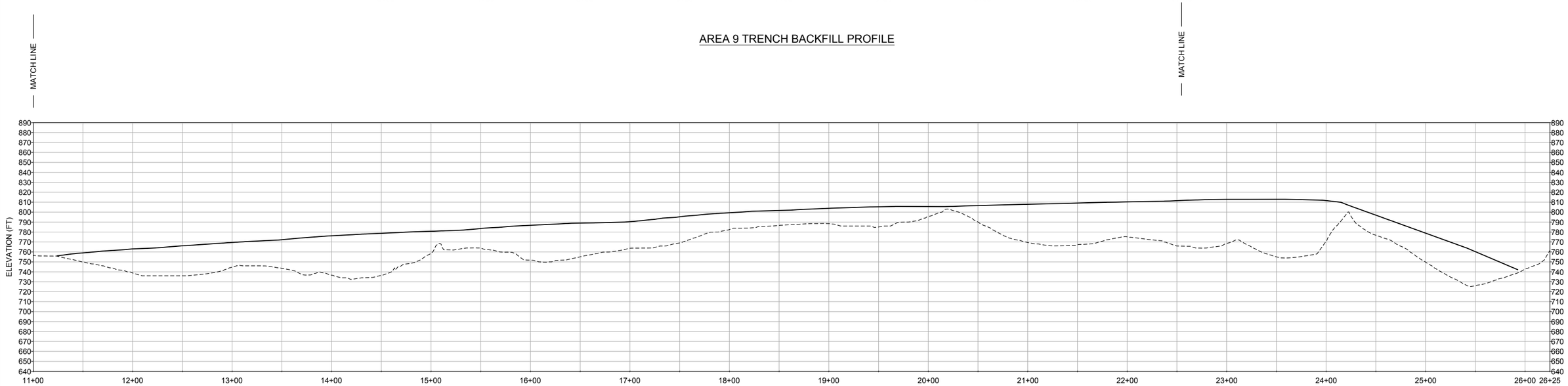


AREA 9 TRENCH BACKFILL PROFILE



AREA 6, 7 AND 8 TRENCH BACKFILL PROFILE

NOTES

1. STATIONING REFERS TO TRENCH ALIGNMENT, SHEETS 100 THROUGH 120.

0 50 100
1" = 50' FEET

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2018-08-06	FINAL	VMN	VMN	FSS	GZ
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A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

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PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
TRENCH BACKFILL PROFILES

PROJECT NO.	PHASE	REV.	12 of 23	SHEET
9231000005	1000	C		210

Path: \\redmond.golder.gds\geomat\$\geomatics\PalmerCokingCoal\LandsburgMine\WA99_PROJECTS\9231000005_RemedialAction\1000_RemedialActionDesign\02_PRODUCTION\DWG\ | File Name: 9231000005_1000_004.dwg | Last Edited By: vrayner Date: 2018-08-06 Time:2:55:37 PM | Printed By: VRayner Date: 2018-08-06 Time:3:22:28 PM
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1 in
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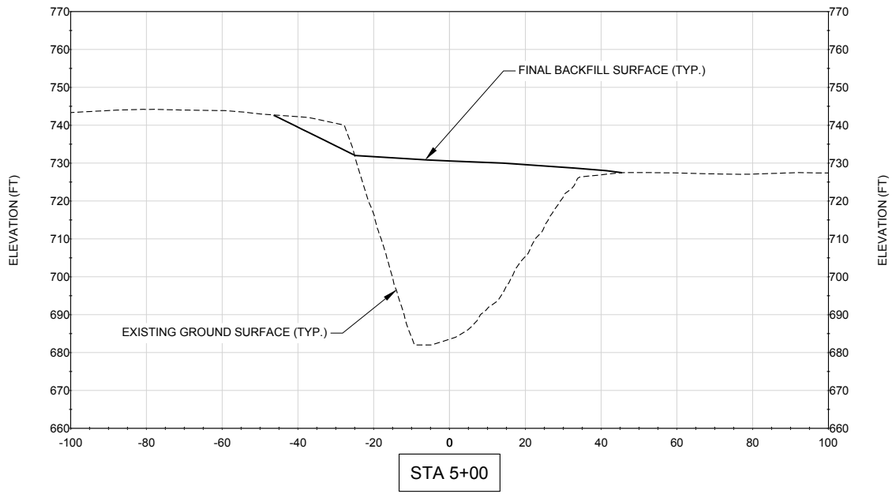
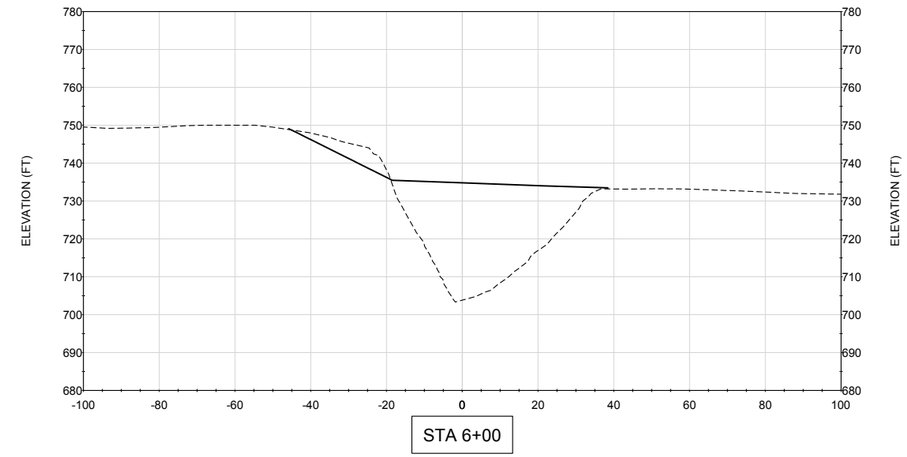
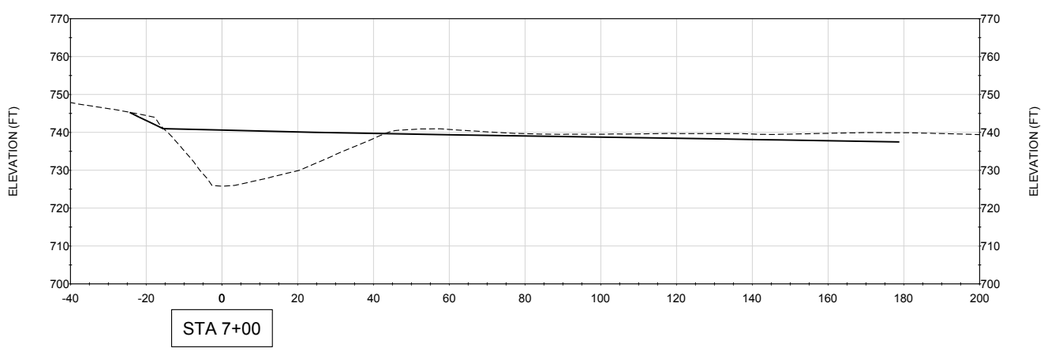


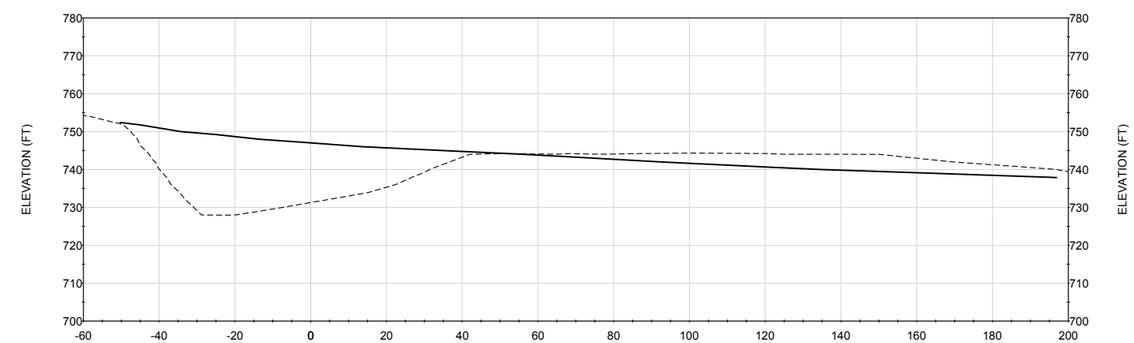
STA 5+00



STA 6+00



STA 7+00



STA 8+00

NOTES

1. STATIONING REFERS TO TRENCH ALIGNMENT, SHEET 100.

0 20 40
1" = 20' FEET

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2018-08-06	FINAL	VMN	VMN	FSS	GZ
B	2018-04-25	DRAFT FOR AGENCY REVIEW	VMN	VMN	FSS	GZ
A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

CLIENT
LANDSBURG MINE SITE PLP GROUP

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PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
TRENCH BACKFILL SECTIONS (1 OF 4)

PROJECT NO.	PHASE	REV.	SHEET
9231000005	1000	C	220

Path: \\redmond.golder.gds\geomatic$\Geomatics\PalmerCokingCoal\CoLandsburgMineWA\99_PROJECTS\9231000005_RemedialAction\1000_RemedialAction\Design\02_PRODUCTION\DWG\ | File Name: 9231000005_1000_004.dwg | Last Edited By: vrayner Date: 2018-08-06 Time:2:55:37 PM | Printed By: VRayner Date: 2018-08-06 Time:3:22:32 PM
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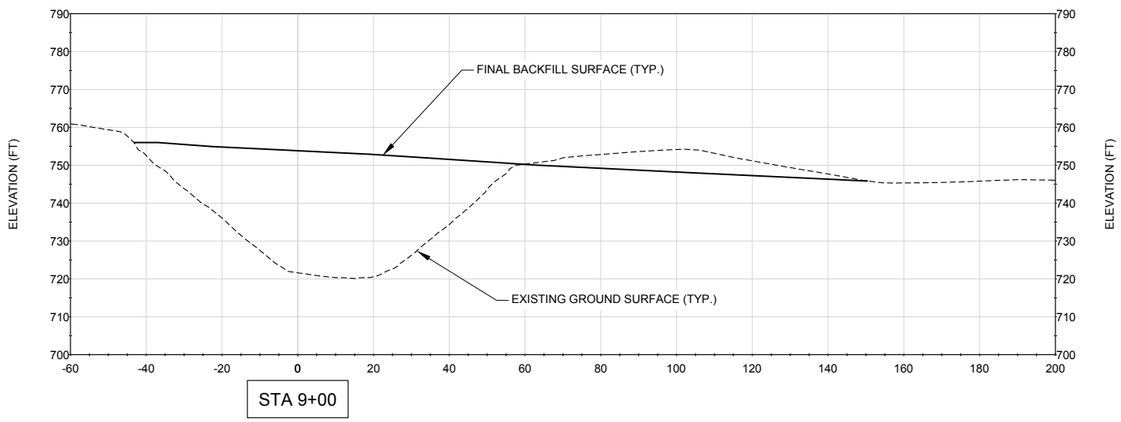
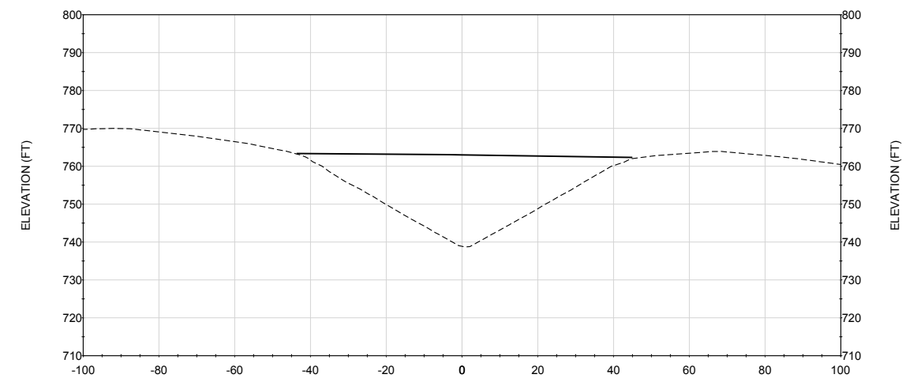
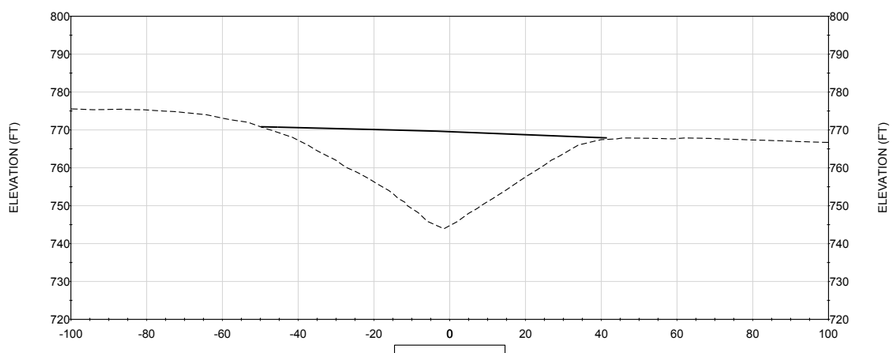


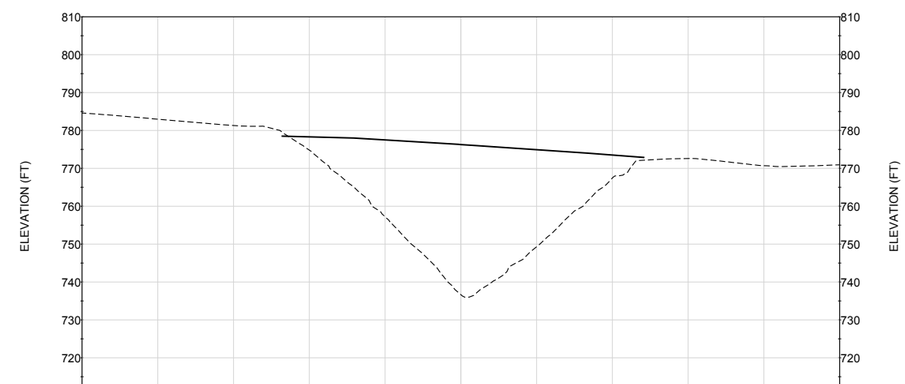
STA 9+00



STA 12+00



STA 13+00



STA 14+00

NOTES

1. STATIONING REFERS TO TRENCH ALIGNMENT, SHEET 110.

0 20 40
1" = 20' FEET

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2018-08-06	FINAL	VMN	VMN	FSS	GZ
B	2018-04-25	DRAFT FOR AGENCY REVIEW	VMN	VMN	FSS	GZ
A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

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PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
TRENCH BACKFILL SECTIONS (2 OF 4)

PROJECT NO.	PHASE	REV.	SHEET
9231000005	1000	C	14 of 23 230

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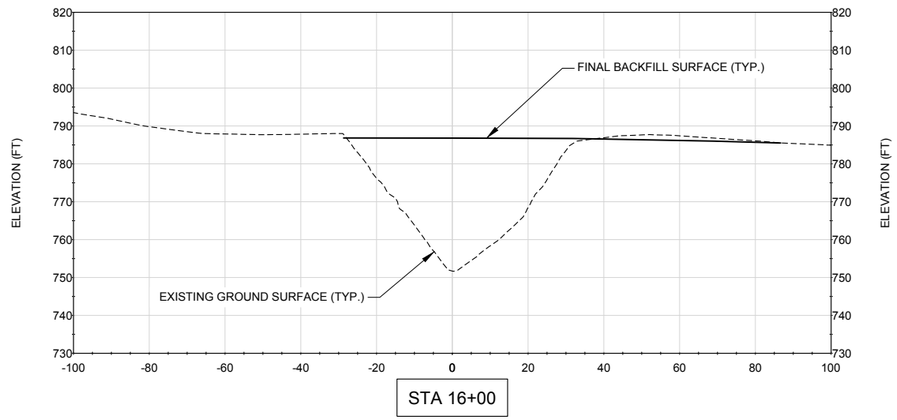
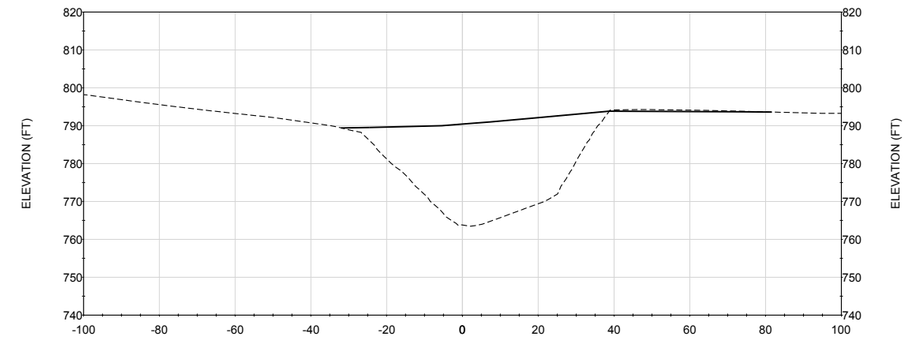
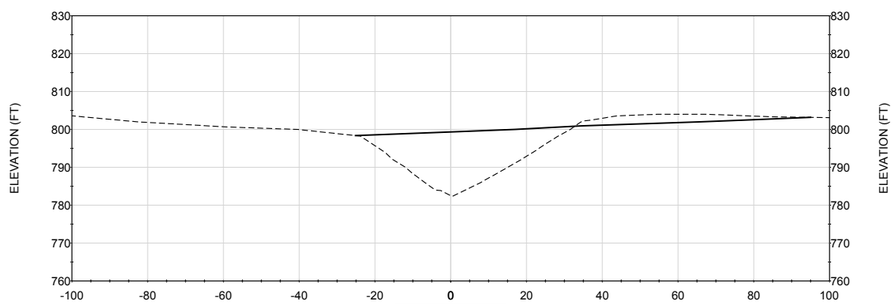
1 in
0



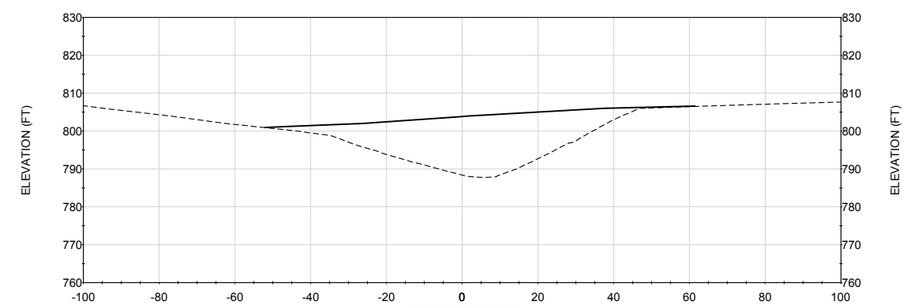
STA 16+00



STA 17+00



STA 18+00



STA 19+00

NOTES

1. STATIONING REFERS TO TRENCH ALIGNMENT, SHEET 110.

0 20 40
1" = 20' FEET

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2018-08-06	FINAL	VMN	VMN	FSS	GZ
B	2018-04-25	DRAFT FOR AGENCY REVIEW	VMN	VMN	FSS	GZ
A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

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PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
TRENCH BACKFILL SECTIONS (3 OF 23)

PROJECT NO.	PHASE	REV.	SHEET
9231000005	1000	C	240

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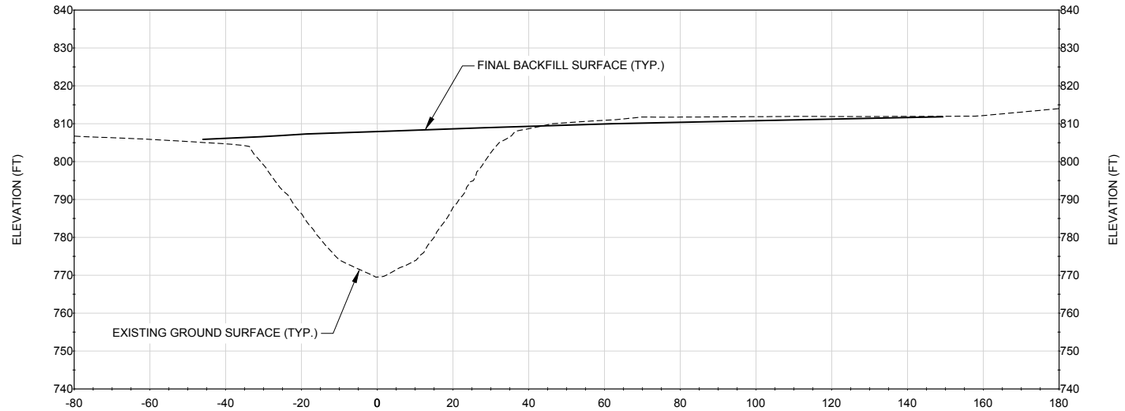
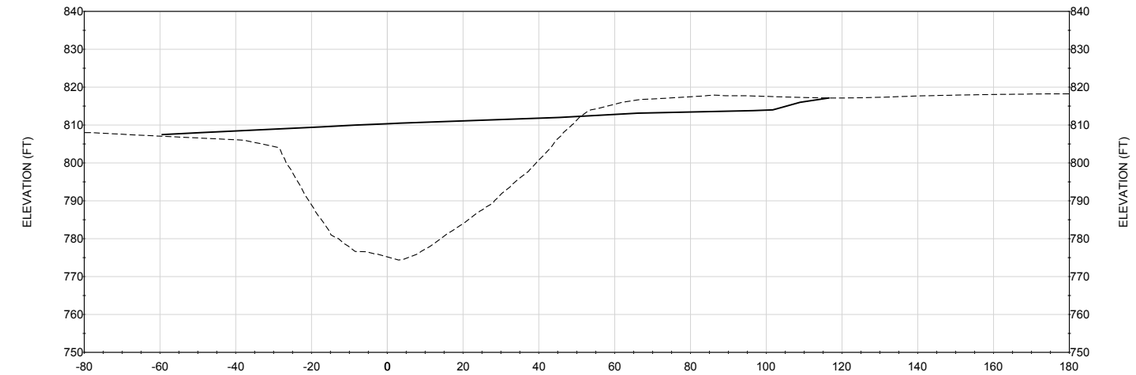
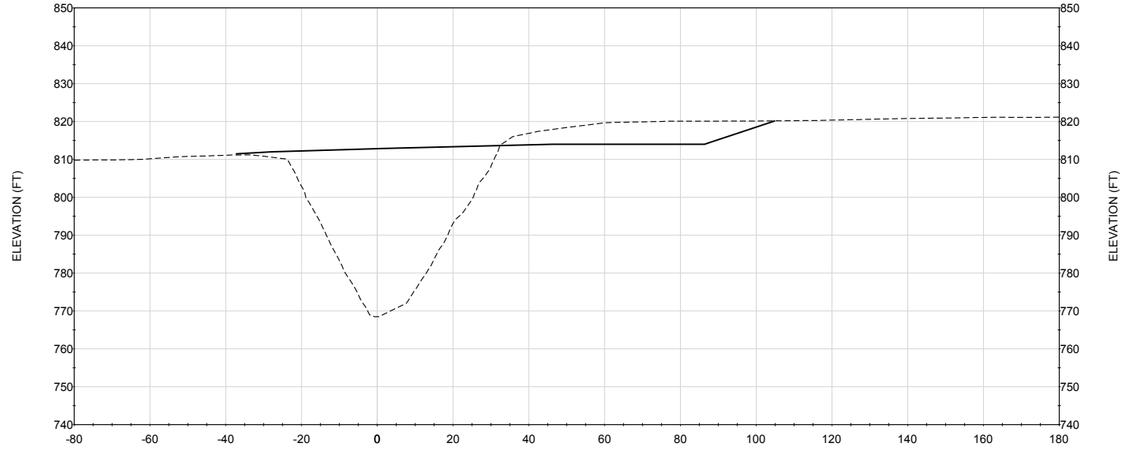


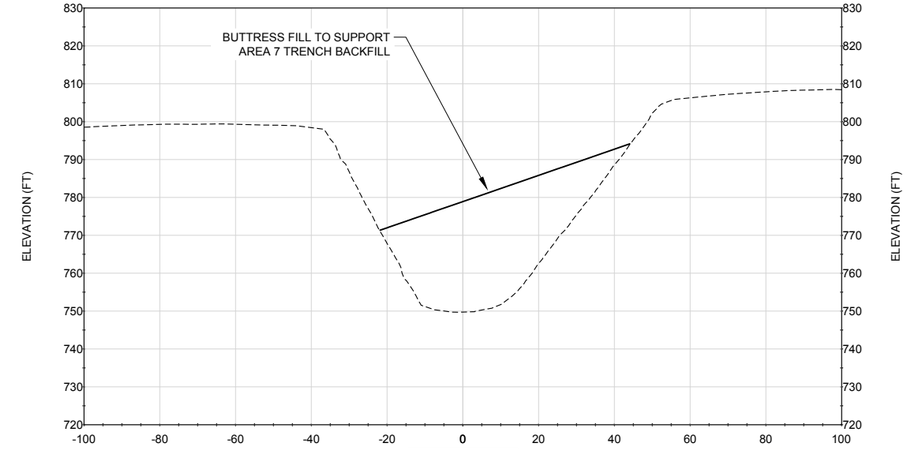
STA 21+00



STA 22+00



STA 23+00



STA 25+00

0 20 40
1" = 20' FEET

NOTES

1. STATIONING REFERS TO TRENCH ALIGNMENT, SHEET 120.

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2018-08-06	FINAL	VMN	VMN	FSS	GZ
B	2018-04-25	DRAFT FOR AGENCY REVIEW	VMN	VMN	FSS	GZ
A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

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PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
TRENCH BACKFILL SECTIONS (4 OF 4)

PROJECT NO. 9231000005 | PHASE 1000 | REV. C | 16 of 23 | SHEET 250

Path: \\redmond.golder.gds\geomat$\geomatics\PalmerCokingCoalCo\Landsburg\MineWA\99_PROJECTS\9231000005_RemedialAction\1000_RemedialActionDesign\02_PRODUCTION\DWGs | File Name: 9231000005_1000_004.dwg | Last Edited By: vrayner Date: 2018-08-06 Time:2:55:37 PM | Printed By: VRayner Date: 2018-08-06 Time:3:22:47 PM

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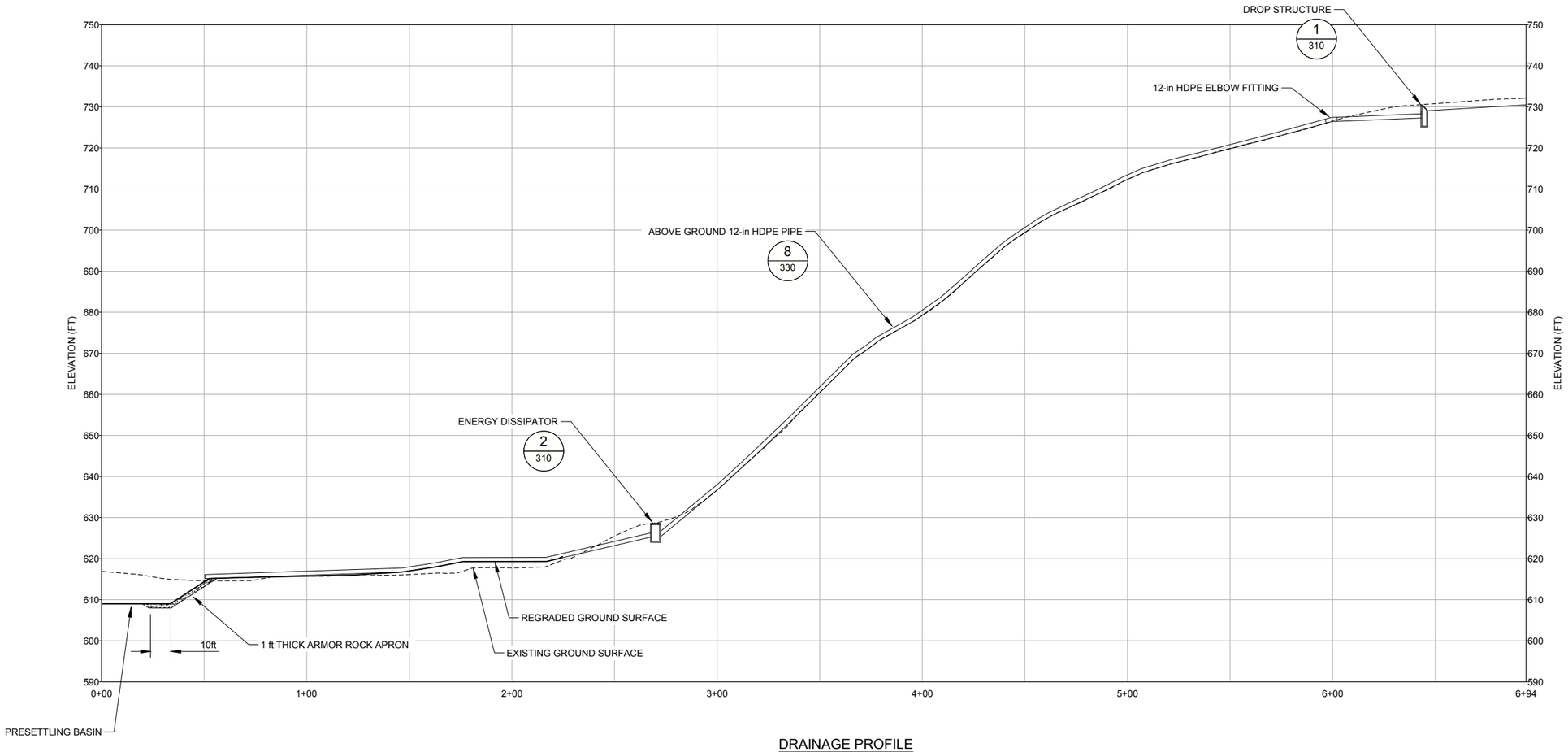

DRAINAGE PROFILE
1" = 30'
2X VERTICAL EXAGGERATION

NOTES

1. STATIONING REFERS TO DRAINAGE ALIGNMENT, SHEET 100.

0 30 60
1" = 30' FEET

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2018-08-06	FINAL	VMN	VMN	FSS	GZ
B	2018-04-25	DRAFT FOR AGENCY REVIEW	VMN	VMN	FSS	GZ
A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

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PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
DRAINAGE PROFILE

PROJECT NO. 9231000005 | PHASE 1000 | REV. C | 17 of 23 | SHEET 260

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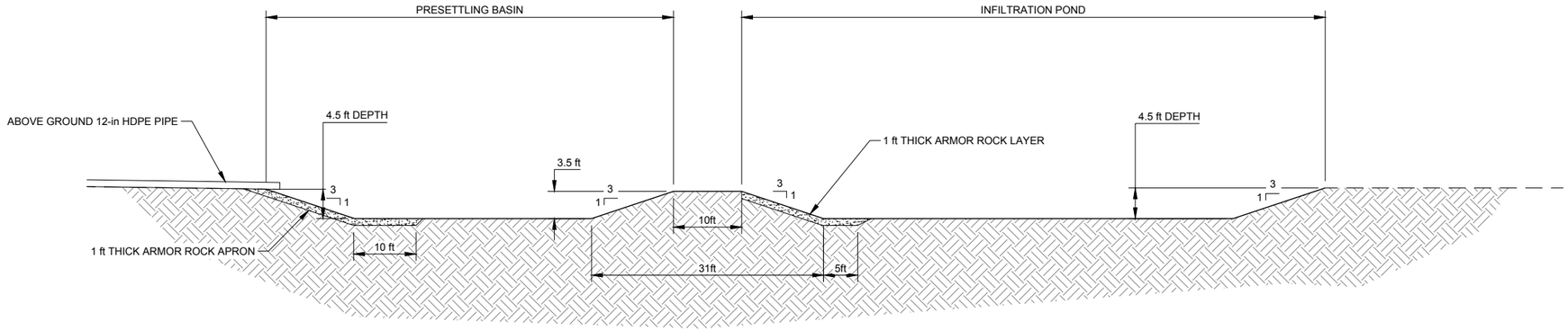

SCALE 1" = 10' A/100 INFILTRATION POND SECTION

0 10 20
1" = 10' FEET

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2018-08-06	FINAL	VMN	VMN	FSS	GZ
B	2018-04-25	DRAFT FOR AGENCY REVIEW	VMN	VMN	FSS	GZ
A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

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PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
DETAILS (1 OF 6)

PROJECT NO. 9231000005 | PHASE 1000 | REV. C | 18 of 23 | SHEET 300

Path: \\redmond.golder.gds\geomatics\PalmerCoking\CoalCo\LandsburgMineWA\99_PROJECTS\9231000005_RemedialAction\1000_RemedialActionDesign\02_PRODUCTION\DWG\ | File Name: 9231000005_1000_005.dwg | Last Edited By: vrayner Date: 2018-08-06 Time:2:47:34 PM | Printed By: VRayner Date: 2018-08-06 Time:3:23:03 PM
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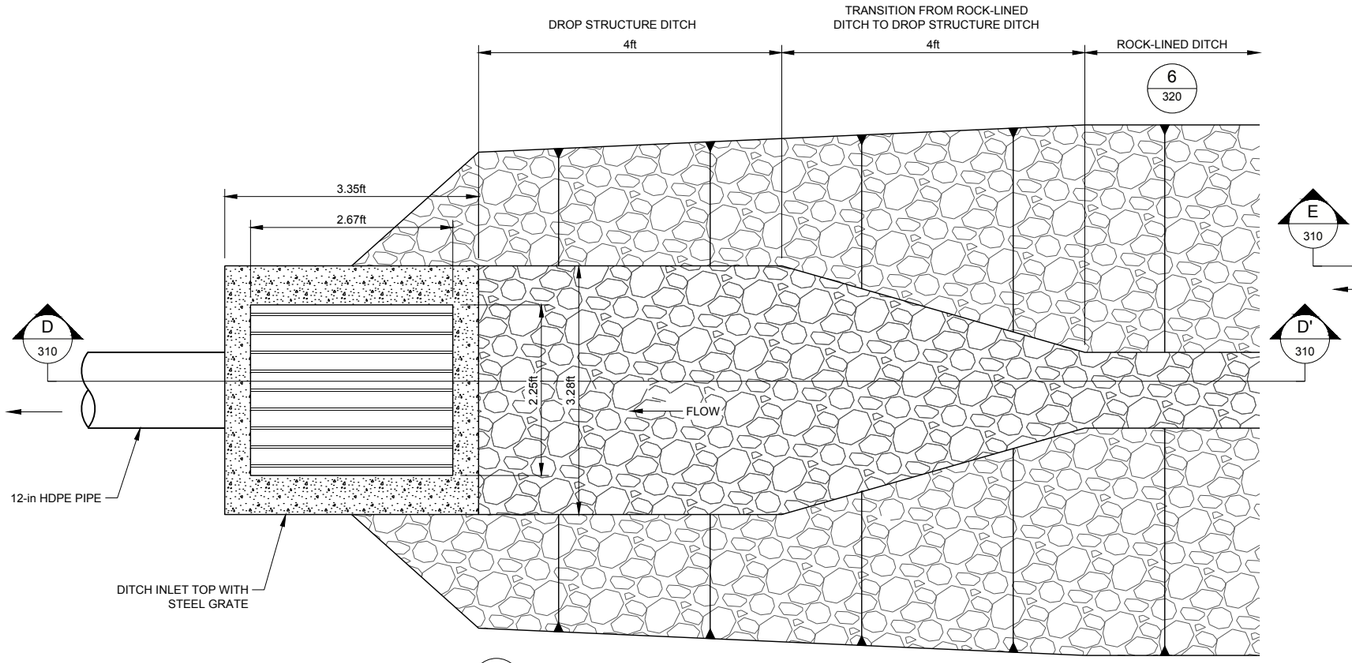
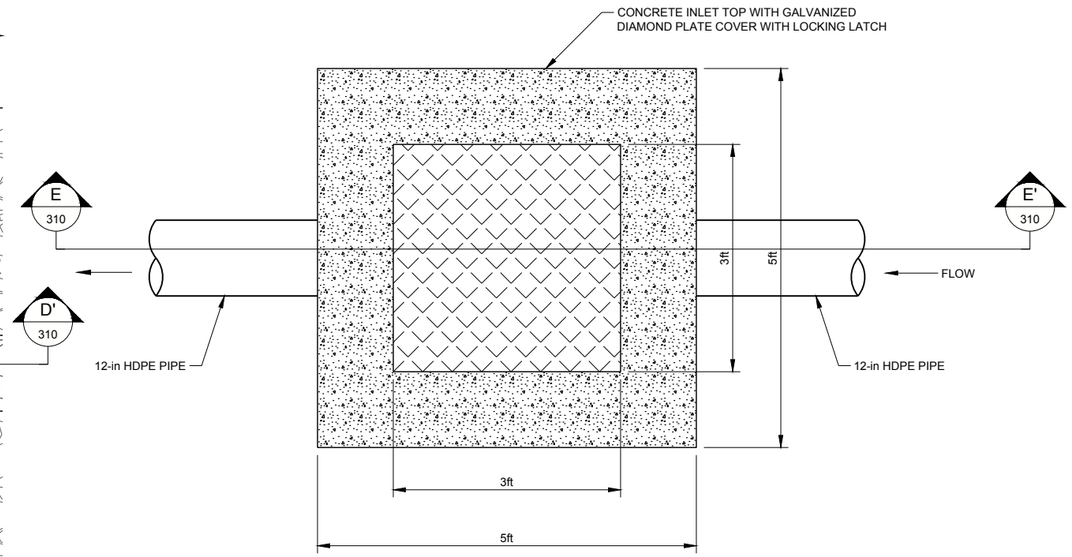
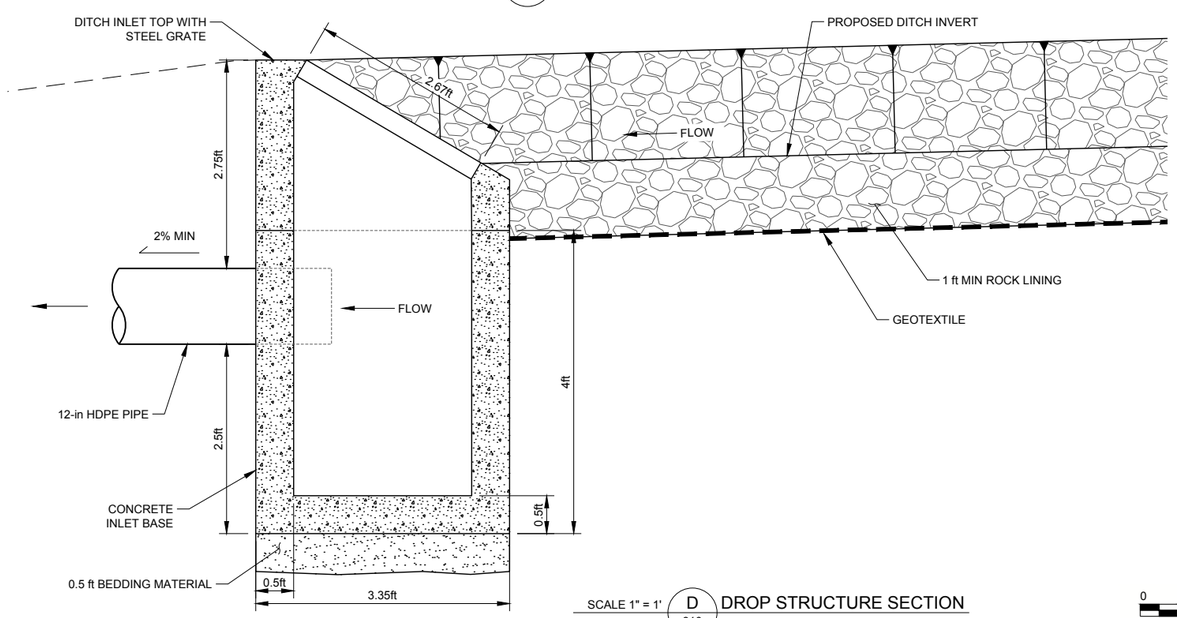


SCALE 1" = 1' 1 -- DROP STRUCTURE

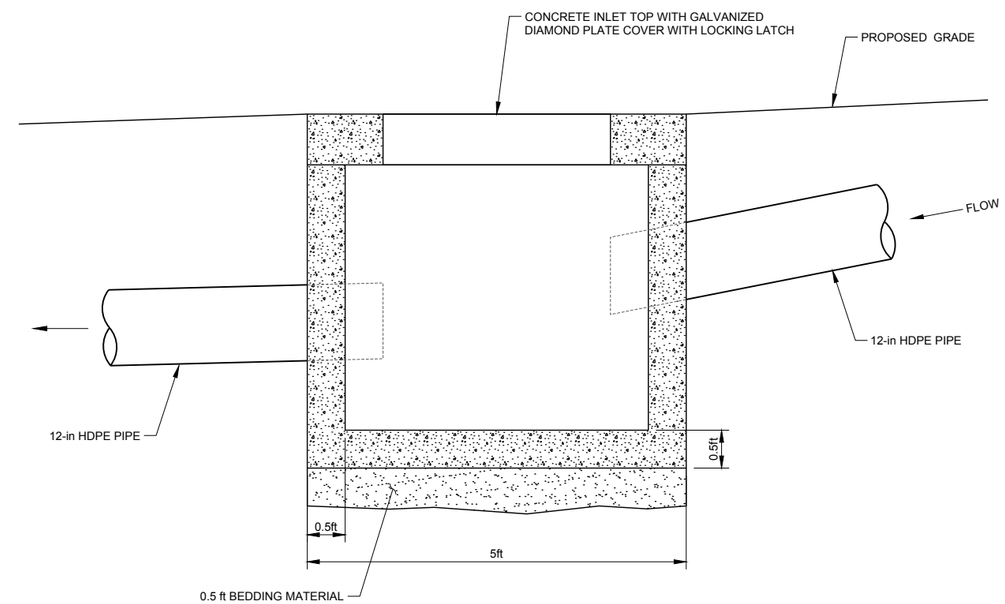


SCALE 1" = 1' 2 -- ENERGY DISSIPATOR



SCALE 1" = 1' D 310 DROP STRUCTURE SECTION

0 1 2
1" = 1' FEET



SCALE 1" = 1' E 310 ENERGY DISSIPATOR SECTION

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2018-08-06	FINAL	VMN	VMN	FSS	GZ
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A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

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PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
DETAILS (2 OF 6)

PROJECT NO.	PHASE	REV.	19 of 23	SHEET
9231000005	1000	C		310

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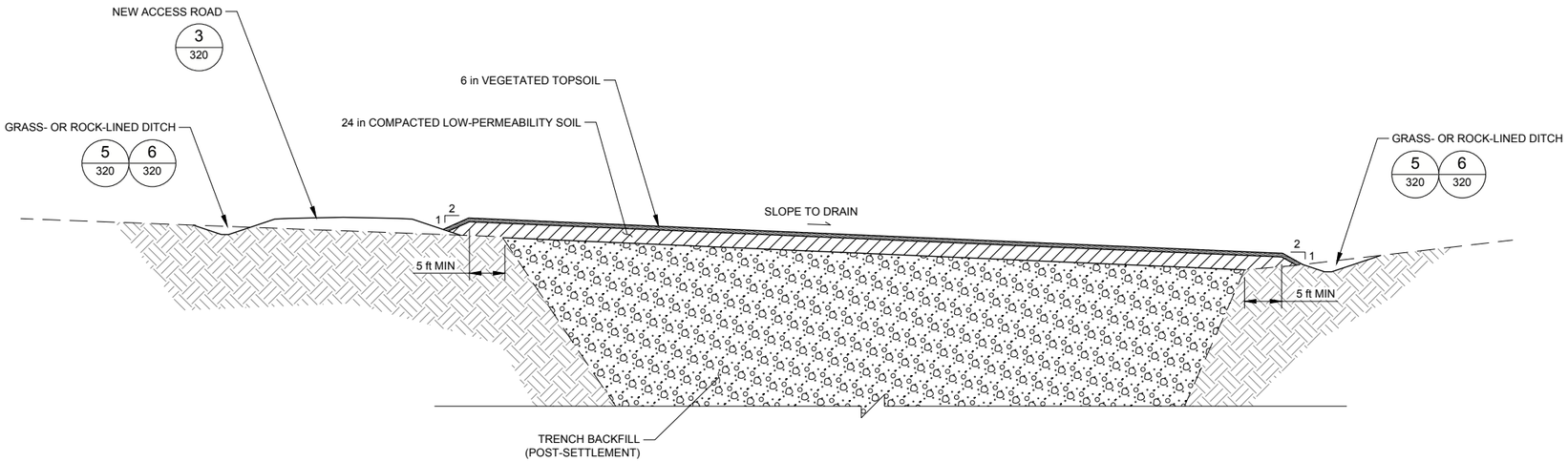
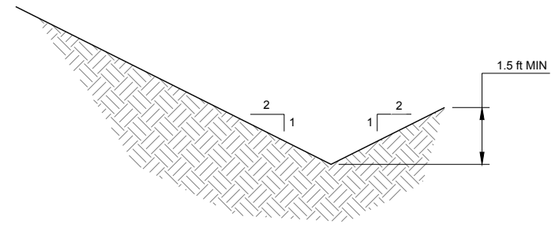
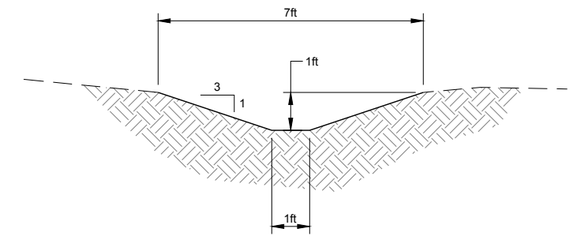


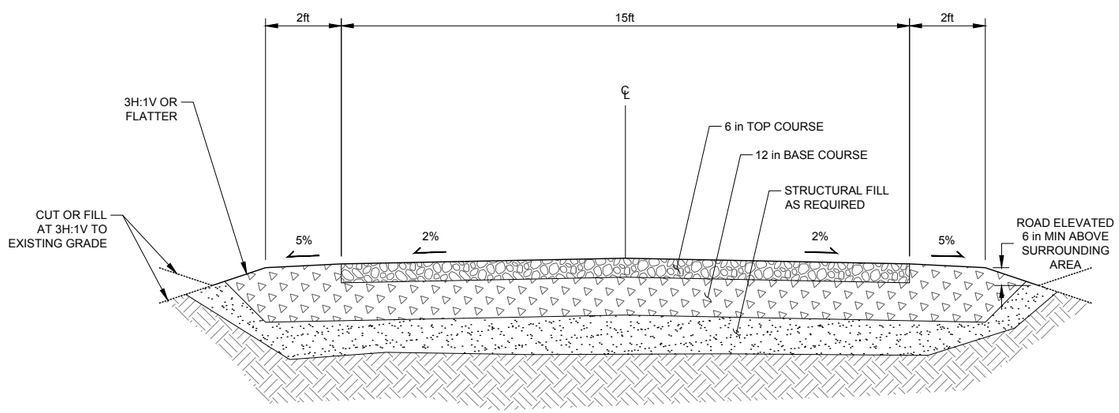
SCALE 1" = 10' B 110 SOIL CAP TYPICAL SECTION



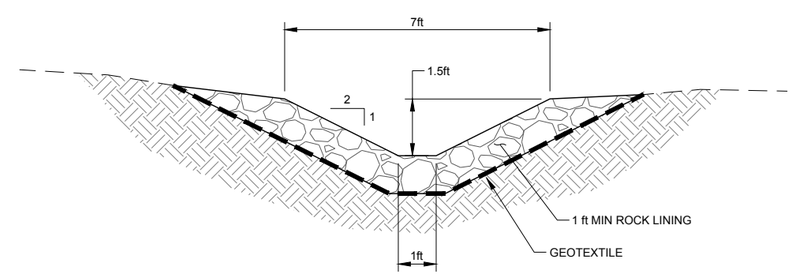
SCALE 1" = 2' 4 -- V-DITCH



SCALE 1" = 2' 5 -- GRASS-LINED DITCH



SCALE 1" = 2' 3 -- NEW ACCESS ROAD TYPICAL SECTION



SCALE 1" = 2' 6 -- ROCK-LINED DITCH

0 2 4
1" = 2' FEET

0 10 20
1" = 10' FEET

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
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B	2018-04-25	DRAFT FOR AGENCY REVIEW	VMN	VMN	FSS	GZ
A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

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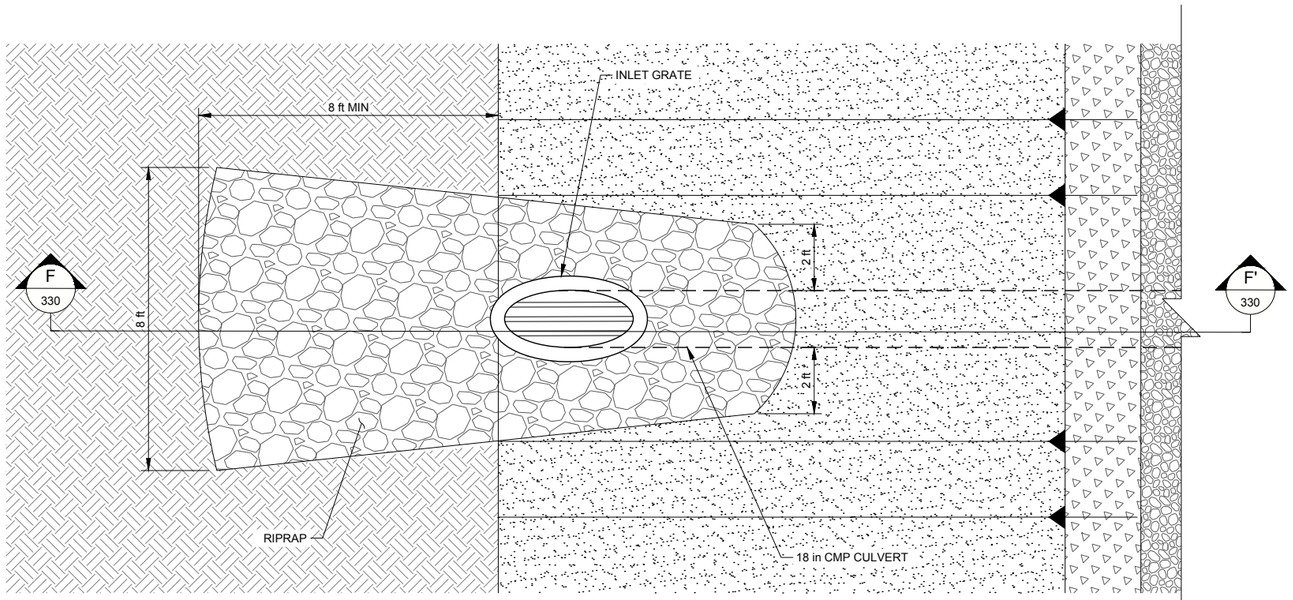
PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
DETAILS (3 OF 6)

PROJECT NO. 9231000005 | PHASE 1000 | REV. C | 20 of 23 | SHEET 320

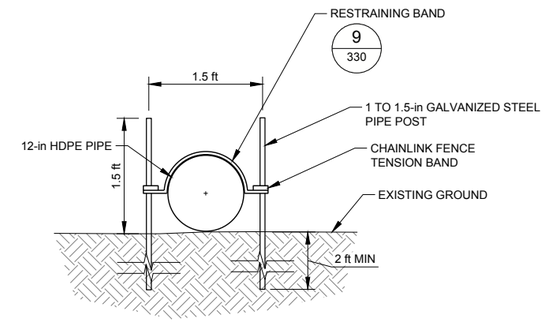
Path: \\redmond.golder.gds\geomatics\PalmerCokingCoal\CoalLandsburgMineWA\99_PROJECTS\9231000005_RemedialAction\1000_RemedialActionDesign\02_PRODUCTION\DWG\ | File Name: 9231000005_1000_005.dwg | Last Edited By: vrayner Date: 2018-08-06 Time:2:47:34 PM | Printed By: VRayner Date: 2018-08-06 Time:3:23:21 PM
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D



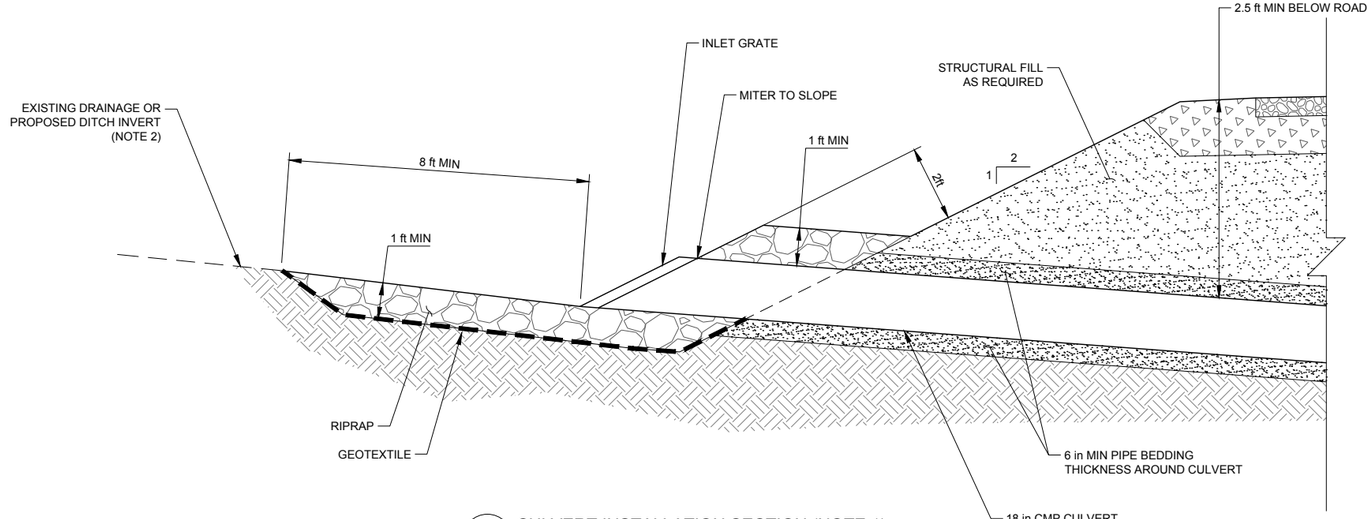
SCALE 1" = 2' 7 -- CULVERT INSTALLATION (NOTE 1)

NOTES

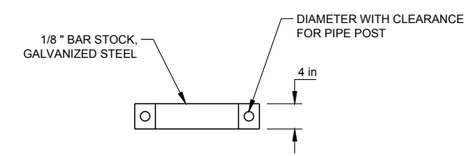
1. CULVERT INSTALLATION DETAIL SHOWN AT INLET. DETAIL ALSO APPLIES TO OUTLET, EXCEPT THAT AN INLET GRATE IS NOT REQUIRED.
2. TIE-IN TO EXISTING DRAINAGE OR PROPOSED DITCH INVERT.
3. INSTALL PIPE ANCHORS AT 100 FT MAXIMUM INTERVALS AND AS REQUIRED.



SCALE 1" = 1' 8 -- ABOVE GROUND HDPE PIPE ANCHOR INSTALLATION (NOTE 3)



SCALE 1" = 2' F 330 CULVERT INSTALLATION SECTION (NOTE 1)



SCALE 1" = 1' 9 -- RESTRAINING BAND

0 1 2
1" = 1' FEET

0 2 4
1" = 2' FEET

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2018-08-06	FINAL	VMN	VMN	FSS	GZ
B	2018-04-25	DRAFT FOR AGENCY REVIEW	VMN	VMN	FSS	GZ
A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

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18300 NE UNION HILL RD
REDMOND, WA
USA
[+1] (425) 883 0777
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PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
DETAILS (4 OF 6)

PROJECT NO.	PHASE	REV.	21 of 23	SHEET
9231000005	1000	C		330

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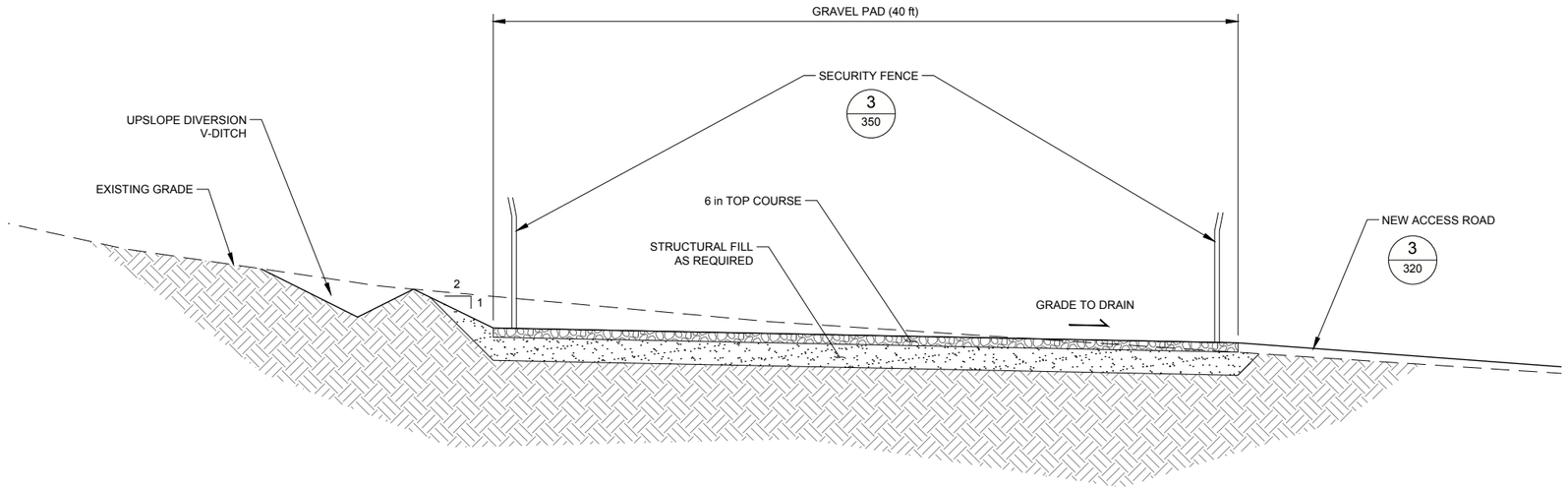

SCALE 1" = 4' C/130 GRAVEL PAD SECTION

0 4 8
1" = 4' FEET

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2018-08-06	FINAL	VMN	VMN	FSS	GZ
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A	2018-03-27	DRAFT	VMN	VMN	FSS	GZ

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PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
DETAILS (5 OF 6)

PROJECT NO. 9231000005 | PHASE 1000 | REV. C | 22 of 23 | SHEET 340

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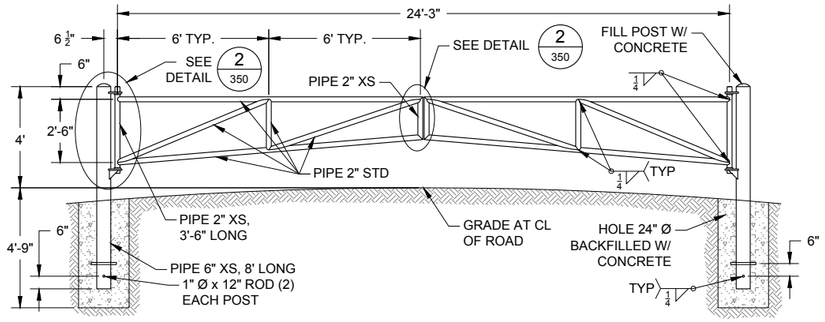
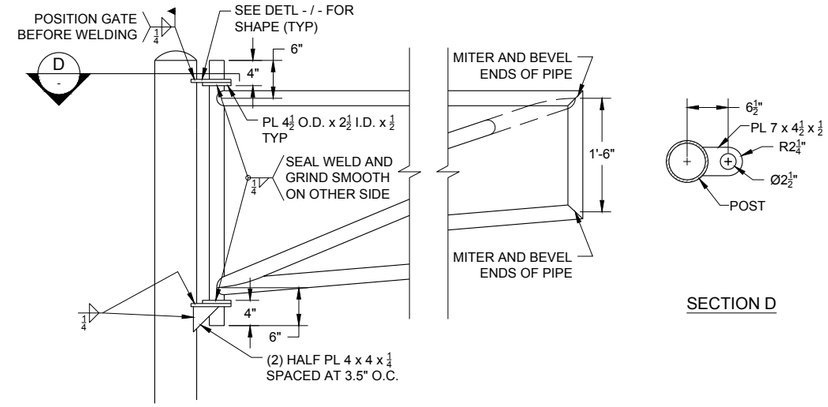
1 in

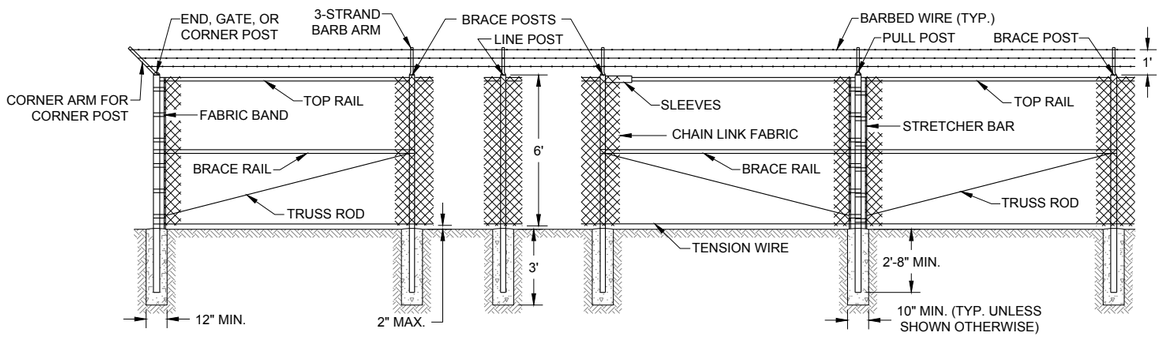


SCALE 1" = 3' 1/-- VEHICLE ACCESS GATE



SCALE 1" = 1' 2/-- VEHICLE ACCESS GATE DETAILS

SECTION D



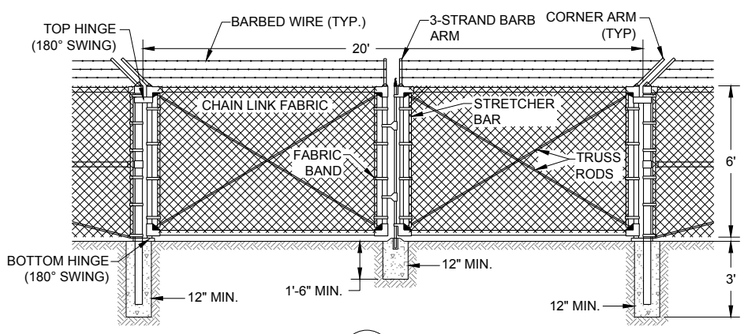
SCALE 1" = 3' 3/-- SECURITY FENCE TYPICAL DETAIL

NOTES:

1. ALL POSTS SHALL BE SPACED AT 10' MAXIMUM INTERVALS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
2. TENSION WIRES SHALL BE PLACED WITHIN THE LIMITS OF THE FIRST FULL FABRIC WEAVE.
3. DETAILS ARE ILLUSTRATIVE AND SHALL NOT LIMIT HARDWARE DESIGN OR POST SELECTION OF ANY PARTICULAR FENCE TYPE.
4. BARB ARMS SHALL BE INCLINED AT APPROXIMATELY 45° FROM VERTICAL TOWARD THE OUTSIDE OF THE ENCLOSED AREA.

SECURITY FENCE POST AND RAIL SCHEDULE

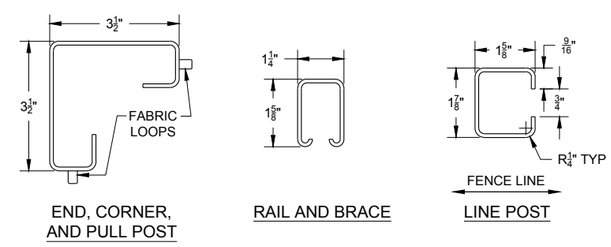
		BRACE RAIL & TOP RAIL	LINE POST & BRACE POST	END, CORNER, & PULL POST	GATE POST
ROUND	I.D. PIPE (IN)	1 1/4	2	2 1/2	3 1/2
	WEIGHT (LB/FT)	2.27	3.65	5.79	9.1
H-COLUMN	SIZE (IN)	1 1/4 x 1 5/8	2 1/4	N/A	N/A
	WEIGHT (LB/FT)	1.35	4.0	N/A	N/A
ROLL FORMED	SIZE (IN)	1 5/8 x 1 1/4	1 5/8 x 1 7/8	3 1/2 x 3 1/2	N/A
SEE DETL 5/050	WEIGHT (LB/FT)	1.35	2.34	5.14	N/A



SCALE 1" = 3' 4/-- SECURITY GATE

NOTES:

1. BARBED WIRE SHALL BE DISCONTINUED BETWEEN GATE FRAME AND GATE POST.
2. BARB ARMS SHALL BE INCLINED AT APPROXIMATELY 45° FROM VERTICAL TOWARD THE OUTSIDE OF THE ENCLOSED AREA.



NTS 5/-- ROLL-FORMED SECTIONS FOR SECURITY FENCE

0 1 2
1" = 1' FEET

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
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PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

TITLE
DETAILS (6 OF 6)

PROJECT NO. 9231000005 | PHASE 1000 | REV. C | 23 of 23 | SHEET 350

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APPENDIX B

Technical Specifications

SECTION 01 10 00
SUMMARY OF WORK

PART 1: GENERAL

1.1 SUMMARY

The objective of this project is to minimize infiltration into portions of the mine subsidence trenches where waste disposal activities historically occurred at the site by backfilling the trenches, placing a low-permeability soil cap over the trenches, and diverting surface water away from the trenches. This project is being performed in accordance with the *Cleanup Action Plan, Landsburg Mine Site* under the Model Toxics Control Act (MTCA) administered by the Washington State Department of Ecology.

1.2 PROJECT LOCATION AND SITE ACCESS

A. The site is located in South King County, between Kent-Kangley Road on the south and Summit Landsburg Road on the north.

B. Site Access

1. Site access locations are shown on the Drawings.

2. Access to the North Portal area shall be from the eastern entrance along Summit Landsburg Road.

3. Access to the trench area shall be from the western entrance along Summit Landsburg Road.

4. Access to the South Portal area shall be from the entrance along Kent-Kangley Road.

1.3 WORK ACTIVITIES

A. Remediation construction activities for this project have been divided into three phases, corresponding to three construction seasons, respectively. Listing of activities within each phase, however, is not intended to establish a detailed construction sequence. The Contractor shall provide his proposed detailed sequence of activities in the construction schedule submitted with his bid.

B. Phase 1 work shall be performed during the first construction season and includes the following activities:

1. Install erosion and sediment control (ESC) measures.

2. Upgrade existing access roads as necessary.

3. Clear new access road alignment, areas to be excavated adjacent to the trenches, and stockpile locations in the trench area, including removal of merchantable timber.

4. Construct new access road to south end of trench area.

5. Remove trees and large brush from trenches to be backfilled.

6. Maintain ESC measures between Phases 1 and 2.

C. Phase 2 work shall be performed during the second construction season and includes the following activities:

1. Backfill trenches with on-site excavated soils and off-site imported soils.

2. Excavate surface water diversion ditches around trench area.

3. Install drop inlet, downslope pipe, and energy dissipator at north end of site.

4. Construct infiltration pond at north end of site.

5. Backfill North Portal.

6. Maintain ESC measures between Phases 2 and 3.

D. Phase 3 work shall be performed during the third construction season and includes the following activities:

1. As necessary, add trench backfill soil and regrade to accommodate any settlement that may have occurred since Phase 2.

2. Place low-permeability soil cap over trench backfill.

3. Place vegetative soil layer over low-permeability cap.

4. Clean, regrade (as required), and line diversion ditches.

5. Seed cover and disturbed areas.

6. Install perimeter fencing around trench area.

7. Construct south portal contingent groundwater treatment system infrastructure.

1.4 COORDINATION

A. The Landsburg Mine Site is owned by Palmer Coking Coal Co., LLP (PCC).

B. Coordinate all construction activities with the PCC Site Manager to avoid disrupting operations or other adverse effects.

C. Failure to coordinate in an adequate or timely manner shall not be allowed as a basis for increased budget or schedule.

D. The Contractor shall be solely responsible for any damages resulting from interference with PCC operations, damage to equipment, or other adverse consequences of Contractor's activities.

1.5 PROTECTION

A. The Contractor shall protect at all times underground or above-ground utilities that are present, either temporarily or permanently, within the Work limits. The Contractor shall be responsible for any damage or service interruptions to utilities caused by work performed by the Contractor, routine or otherwise.

B. Prior to beginning ground disturbing activities for the south contingent groundwater treatment system, the Contractor shall arrange for a utility survey to locate any buried utilities that may be present.

C. Groundwater monitoring wells shall be protected against damage. In the event of damage to a well, the Contractor shall reimburse the project for the full cost of replacing the well. The Contractor shall at all times maintain access to groundwater monitoring wells on the Site.

1.6 PERMITS

A. The Contractor may assume that all necessary permits including grading and stormwater permits have been obtained by others, but the Contractor shall notify the Construction Manager immediately if they believe a permit is required and has not been obtained.

B. The Contractor shall comply with all permit conditions, in particular the requirements for working within the Bonneville Power Administration power transmission line easement.

C. The Contractor shall be responsible for identifying and complying with any environmental regulations applicable to his activities and are not included in the permits for the project.

1.7 WORKING HOURS

Coordinate with the PCC Site Manager to establish allowable working hours.

1.8 GOVERNING DOCUMENTS

All Work involved with this project shall be constructed and completed in accordance with the contract provisions and clauses, these Specifications, and the Drawings.

PART 2: PRODUCTS

NOT USED.

PART 3: EXECUTION

3.1 MEASUREMENT AND PAYMENT

A. Descriptions of measurement and payment for materials and work activities are included in the associated sections of these specifications.

B. Mobilization will include transport of equipment and materials to the site, constructing and maintaining temporary facilities, pre-construction submittals, personnel training and baseline medical monitoring, bonding, insurance, and other commercial elements, and any other activities required to begin on-site work and not included in other pay items.

C. Demobilization will include site cleanup, removal of all equipment and materials, completion of contract closeout activities, and any other work necessary to complete the project and not included in other pay items.

END OF SECTION

SECTION 01 33 00
SUBMITTALS

PART 1: GENERAL

1.1 GENERAL REQUIREMENTS

Required submittals are identified in this Section and in other sections of these Specifications. The Construction Manager may at his discretion direct the Contractor to provide other submittals if necessary to document material quality, construction, measurement for payment, or other purposes.

A. Submittal Numbering

1. Submittals shall be numbered sequentially.

2. Resubmittals, if required, shall maintain the original number, but shall also include the suffix “A”, for first and re-submittals, “B” for second re-submittal, and so on.

B. Procedures

1. Deliver all submittals to the Construction Manager.

2. Unless indicated or directed otherwise, submit three (3) copies of all documents.

3. Unless indicated or directed otherwise, submit required information, samples, and other items a minimum of 14 calendar days prior to purchase or intended use. Regardless of the minimum requirements in the Contract Documents, Contractor shall determine submittal dates to avoid adverse impacts to project schedule. Failure to submit in a timely manner shall not constitute a basis for additional payment or extension of the project schedule.

C. Review and Disposition

1. The Construction Manager will review the submittals to determine completeness, adequacy, and conformance with the project requirement and will then distribute each submittal to the appropriate party for review.

2. One copy of the submittal will be returned to the Contractor with one of the following dispositions:

   a. Accepted as is.

   b. Work may proceed, resubmit with additional information.

   c. Work may not proceed, resubmit with additional information.

   d. Rejected.

3. Resubmittals shall be subject to the requirements of all paragraphs of this article.

4. The Construction Manager’s or Engineer’s determination of acceptability of plans, schedules, specified or alternative products, and any other items where review and approval is required shall be final.

D. Equivalent Products

1. Where “or equal” is included in the product description, and the Contractor elects to submit an alternative product, sufficient information shall be provided to fully document that the proposed alternative will function in the same manner, has the required longevity and reliability, is appropriate for the environment, and in all other ways satisfies the characteristics and performance of the specified product. The burden of proof for equivalency shall be upon the Contractor.

2. If engineering review effort for the proposed alternative beyond that for the specified product is required, the Contractor shall pay for such review.

3. Acceptance of a substitute item shall not relieve the Contractor of the responsibility for full compliance with the Contract Documents and for adequacy of the substitute item.

4. The Contractor shall be responsible for resultant changes and all additional costs which the accepted substitution requires in the Contractor's work, the work of its subcontractors and of other contractors, and shall effect such changes without additional cost to the Contract.

5. No substitute item shall be ordered, installed, or utilized without prior written acceptance by the Construction Manager of the Contractor's written request.

1.2 CONSTRUCTION SCHEDULE

A. Provide a bar chart schedule that details specific dates on which each item of work included in Section 01 10 00 will begin and be completed.

B. Initial Schedule Submittal

1. Submit preliminary Construction Schedule with bid. Preliminary Construction Schedule will be reviewed as part of bid evaluation. Contractor may be interviewed to determine Contractor’s understanding of work and ability to complete work in a timely and efficient manner.

2. Submit final Construction Schedule within 7 days after Notice to Proceed is issued.

C. Updates

1. Every 7 calendar days after the Notice to Proceed is issued, revise construction schedule to reflect progress of work and items completed.

2. Indicate progress of each activity to date.

3. Show changes occurring since previous submittal, including but not limited to:

a. Major changes in scope.

b. Activities modified since previous submittal.

c. Revised projections of progress and completion.

d. Other identifiable changes.

4. Failure to submit schedule and revisions on a timely basis shall be considered cause for withholding progress payments otherwise due under this Contract.

1.3 INFORMATION AND SAMPLE SUBMITTALS

Submittal requirements for other information, samples, documentation, measurements, and similar items are described in the pertinent technical sections of these Specifications. Submit in accordance with the requirements of these other sections and the general submittal requirements contained in this Section.

1.4 RECORD AND AS-BUILT DRAWINGS

A. The Contractor shall keep and maintain, at the job site, one record set of Drawings.

B. On the Record Drawings, mark all project conditions, locations, configurations, and any other changes or deviations which vary from the details represented on the original Contract Drawings and addenda, change orders, and the like. The Record Drawings shall include buried or concealed construction and utility features which were not previously identified and are revealed during the course of construction.

C. The Record Drawings shall be supplemented by any detailed sketches as necessary or directed to fully indicate the Work as actually constructed.

D. The Record Drawings shall be maintained up-to-date during the progress of the Work.

E. The Contractor shall prepare and submit As-Built Drawings in both hard copy and electronic format for all aspects of the Work within 6 weeks of project completion and as a condition of final payment. Electronic files shall be AutoCAD 2017 or compatible approved equal.

PART 2: PRODUCTS

NOT USED.

PART 3: EXECUTION

3-1 MEASUREMENT AND PAYMENT

Submittals shall be considered incidental to the performance of other aspects of the Work and shall be included in the prices for those activities.

END OF SECTION

SECTION 01 35 29
HEALTH AND SAFETY

PART 1: GENERAL

1.1 SUMMARY

A. This section establishes the health and safety requirements for the project.

B. All health and safety requirements from the project Health and Safety Plan, the Site Owner's health and safety requirements, applicable Occupational Health and Safety Administration (OSHA) requirements, and pertinent industry standards are incorporated into this section by reference.

1.2 SUBMITTALS

The Contractor shall submit a site-specific Health and Safety Plan (HASP) in conformance with 29 CFR 1910 prior to mobilizing to the site. The Health and Safety Plan shall address the following topics at a minimum:

A. Hazard Assessment and Mitigation

B. Personnel Protective Equipment

C. Emergency Response, including but not limited to equipment and personnel for first aid, CPR, and other potentially required actions

D. Training

E. Procedures for Working Near Power Lines

1.3 GENERAL REQUIREMENTS

A. For purposes of this section, the "Project Area" refers to the Work area and any staging, stockpile, laydown, facilities, parking, and other areas under the Contractor's control.

B. The Contractor shall comply with all safety requirements and protocols of the Site, including but not limited to traffic flow and speed limits, safety equipment, emergency procedures, and others. Coordinate with the Palmer Coking Coal Site Manager to identify these requirements.

C. The Contractor shall coordinate traffic flow patterns within the work area and with any other operations to ensure safe conditions.

D. The Contractor shall be responsible for Project Area health and safety and shall comply with all applicable Federal, State, and local health and safety requirements, whether listed in the Contract Documents or not.

E. The Contractor shall be responsible for all Project Area security and shall provide the means to prevent unauthorized access, theft, injury, vandalism, and other harmful actions to personnel, equipment, supplies, and property, whether his own or others.

F. The Contractor shall be responsible for the health and safety of all personnel in the Project Area during execution of the Work, whether in his employ or not. Such personnel may include, but are

not limited to, the Contractor's employees, subcontractor personnel, third party personnel involved with the work, visitors, other contractors, and the general public.

G. The Contractor shall appoint a Health and Safety Officer (HSO) who shall be on-site full time during construction activities. The Contractor's HSO may have other duties and roles on the project, but shall be responsible for ensuring that the requirements of the HASP are implemented, for conducting safety training and briefings, safety inspections, and other safety-related activities.

H. Health and Safety shall be a permanent agenda item for daily tailgate meetings and shall include discussion of any incidents, inspection results, issues of concern, and other health and safety topics.

I. The Contractor shall be responsible for being cognizant of and ensuring compliance with the pertinent requirements of 29 CFR 1910. Such responsibility shall apply to both the Contractor's operations and those of the Contractor's subcontractors.

J. If violations of the requirements in the approved HASP are called to the Contractor's attention, the Contractor shall immediately correct the subject condition. In the event that the Contractor fails or refuses to promptly comply with the Construction Manager's or Owner's directive, the Construction Manager or Owner may issue an order to stop all or any part of the Work. When satisfactory corrective action has been taken, an order to resume work will be issued. The Contractor shall not be entitled to any extension of time, any claim for damage, nor to additional compensation by reason of either the directive or the stop work order. Failure of the Construction Manager or Owner to identify an unsafe condition or to issue a directive or stop-work order shall not relieve the Contractor of his responsibility for the safety of personnel and property.

K. There shall be no retribution of any kind by the Contractor (or subcontractors) towards subcontractors or employees for reporting perceived unsafe conditions.

L. The Owner and the Construction Manager shall have the right to eject any worker from the Site for health and safety violations.

M. The Contractor shall maintain an accurate record of all death, occupational diseases, and injury to employees or the public and shall report any such incidents to the Construction Manager immediately. The Contractor shall record any damage to property and shall report such damage to the Construction Manager within 24 hours of occurrence.

1.4 SPECIFIC SAFETY REQUIREMENTS

A. For work with potential fall exposure, the Contractor shall provide and require use of full body harnesses, ropes, lanyards, and other equipment as required by Federal and State regulations and the approved Health and Safety Plans.

B. No equipment shall operate in subsidence trenches until they have been backfilled to the design (ground surface) elevations.

C. Emergency Procedures

1. Emergency planning shall be described in detail in an Emergency Response Plan to be submitted as part of Contractor's Health and Safety Plan.

2. The Contractor shall conspicuously post a list of emergency phone numbers (including fire, police, ambulance, Owner representative, Construction Manager, Contractor representatives, etc.) and location of emergency phone outside all entrances to work areas. It is the

Contractor's responsibility to notify all on-site workers of the existence and locations of these lists and the telephone(s) to be used in emergency situations.

3. The Contractor shall provide first aid kits that will be readily accessible to each work crew during all work activities. The first aid kits shall comply with OSHA, State, and other local requirements.

4. All vehicles shall have first aid kits and fire extinguishers in the cab or other readily accessible location.

5. A sufficient number of spill cleanup kits shall be provided by the Contractor and distributed throughout the work area.

1.5 SAFETY OF THE PUBLIC

A. All personnel visiting the Project Area shall attend a health and safety briefing conducted by the Contractor's HSO prior to entering the Work area.

B. The Contractor shall provide personnel protective equipment (PPE) to all personnel visiting the Project Area, including but not limited to hard hats, safety glasses, high-visibility vests, and boots or over-shoes. Additional PPE shall be provided on a case-by-case basis if determined necessary by the HSO.

C. Roads subject to interference by the Work shall be kept open, or suitable temporary passages through the Work shall be provided and maintained by the Contractor. The Contractor shall provide, erect, and maintain all necessary barricades, suitable and sufficient flasher lights, flaggers, danger signals, and signs, and shall take all necessary precautions for the protection of the Work and the safety of the public and other on-site personnel.

D. The Contractor shall maintain public roadways and shoulders clear of any obstructions and provide safe public environments at all times.

1.6 WORKER HEALTH AND SAFETY

A. All Contractor and subcontractor personnel engaged in construction activities, including foremen and supervisors, shall be appropriately trained and qualified for their assigned duties, and shall complete site-specific training as required by the PCC Site Manager.

B. Equipment operators shall be trained on and certified to operate the specific equipment to which they are assigned.

C. All personnel who could potentially come into contact with the MTCA-designated contaminants at this site shall be 40-hour trained in accordance with 29 CFR 1910.120 Hazardous Waste Operations (HAZWOPER). Examples include but are not limited to personnel working in subsidence trenches and drillers. The Construction Manager will make the final determination of which personnel will need 40-hour HAZWOPER training.

D. Provide documentation that required training has been provided, such as training certificates, prior to employees beginning work on the project. The Construction Manager will make the final determination of adequate training.

E. The Contractor shall not require any employee to work under conditions which are unsanitary, hazardous, or dangerous to the worker's health and safety.

F. The Contractor shall provide the following to employees, both his own and those of subcontractors, all at no cost to the employee and in compliance with applicable laws, regulations, and the Contractor's HASP:

1. all required PPE, except steel-toed boots
2. copies of the approved HASP
3. potable water
4. sanitary and wash facilities
5. first aid kits
6. safety equipment for vehicles and machinery
7. safety monitoring equipment
8. any other required safety equipment, supplies, and facilities

1.7 HAZARDOUS MATERIALS

A. The Contractor shall submit safety data sheets (SDS) for any hazardous materials brought on site.

B. The Contractor shall maintain a file of all SDS; the file shall be available to all personnel on site.

C. The information in each SDS shall be followed to ensure safe use, handling, storage, and environmentally acceptable disposal.

PART 2: PRODUCTS

2.1 SAFETY FENCE

A. Temporary safety fence shall be Tenax Sentry Secura™ fence or approved equivalent. The fence shall be bright orange.

B. Posts, hardware, and accessories shall be as recommended by the manufacturer.

PART 3: EXECUTION

3.1 SAFETY FENCE

Install safety fence as shown on the Drawings, as necessary, and as directed by the Construction Manager in accordance with the manufacturer's recommendations.

3.2 MEASUREMENT AND PAYMENT

Health and safety activities shall be considered incidental to the performance of other aspects of the Work and shall be included in the prices for those activities.

END OF SECTION

SECTION 01 35 43
ENVIRONMENTAL PROTECTION

PART 1: GENERAL

1.1 GENERAL REQUIREMENTS

A. The Contractor shall prevent, abate, and control all environmental pollution arising from construction activities by identifying and complying with all applicable Federal, State, and local laws and regulations concerning environmental pollution control and abatement, as well as any other requirements of the Contract Documents.

B. Compliance by subcontractors shall be the responsibility of the Contractor.

1.2 PREVENTION OF WATER POLLUTION

A. Erosion and sediment control facilities shall be installed prior to any clearing, excavation, stockpiling of soil materials on site, or other ground-disturbing activity that could introduce sediment into surface water runoff.

B. The Contractor's construction activities shall be performed by methods that will prevent entrance or accidental spillage of solid matter, contaminants, silts, debris, and other objectionable pollutants and wastes into rivers, streams, storm drains, flowing or dry watercourses, irrigation ditches, lakes, ponds, and underground water sources.

C. All storage areas, stockpiles, equipment yards, fueling areas and other construction-related activity areas shall be located away from both natural and manmade water courses. Runoff from such areas shall be controlled to prevent discharge of any and all potential contaminants and/or pollutants whether accidental or not.

D. Spills, if any, shall immediately be reported to the site Construction Manager and shall be immediately and properly cleaned up.

E. Sanitary facilities, such as chemical toilets, shall be located far enough from bodies of water to prevent pollution of the water.

F. Dewatering work for excavations adjacent to, or encroaching on, streams or watercourses shall be conducted in a manner to prevent muddy water and eroded materials from entering the streams or watercourses by construction of intercepting ditches, bypass channels, barriers, settling ponds, or by other approved means. Excavated material shall not be deposited or stored in, or alongside of, water courses where it can be washed away by high water or storm runoff.

G. Waste waters from aggregate processing or other construction operations shall not enter streams, watercourses, irrigation ditches, or other surface waters.

H. The Contractor shall comply with applicable requirements of any existing Stormwater Pollution Prevention Plan for the site.

1.3 PREVENTION OF AIR POLLUTION

A. Perform construction activities in such a manner that air pollution and dust generation is minimized.

B. Burning of materials is prohibited.

C. All access roads, parking areas, stockpiles, storage areas, excavations, and other work areas used during construction shall be managed by application of water to suppress dust. Dust suppression shall be sufficient to prevent visible dust. No substances other than clean water shall be used.

D. Water use for dust control shall minimize ponding and/or runoff.

E. Coordinate with the PCC Site Manager to identify a source of water for dust control.

1.4 NOISE ABATEMENT

A. Construction activities shall be performed in such a manner that the noise level is minimized.

B. All equipment and operation of equipment shall comply with all State and local regulations.

C. All equipment shall be equipped with mufflers or other noise abatement devices with effectiveness equal or better than that supplied by the original manufacturer.

1.5 HAZARDOUS MATERIALS AND SOLID WASTE

A. Transport, use, store, and dispose of hazardous materials in accordance with applicable Federal and State laws.

B. The Contractor shall legally dispose of all potential pollutants and contaminants such as petroleum products, rubbish, etc., by hauling the material away in tanks, containers, or other acceptable method for disposal in a regulated landfill or other permitted disposal facility.

C. The Contractor shall at all times keep the construction area, including storage areas used by the Contractor, free from accumulations of waste materials or rubbish.

D. Upon completion of the Work, the Contractor shall remove from the vicinity of the Work all rubbish, unused materials, debris, and similar material belonging to the Contractor or used under the Contractor's direction during construction.

1.6 ENVIRONMENTAL LITIGATION

A. No time lost due to work stoppage because of failure of Contractor to comply with environmental regulations or the requirements of this section shall be allowed as the basis of any claim for extension of time or for costs or damages.

B. The Contractor shall pay all fines, damages, penalties, and other costs associated with his failure comply with environmental regulations or the requirements of this section.

C. If construction under these specifications is suspended, delayed, or interrupted through no fault of the Contractor by an order of a court of competent jurisdiction pursuant to environmental litigation, such suspension, delay, or interruption will be considered to be outside of the Contractor's control. In this case, equitable adjustment of the construction contract cost or schedule shall be made in accordance with the provisions of the Contract Documents.

PART 2: PRODUCTS

NOT USED.

PART 3: EXECUTION

3.1 MEASUREMENT AND PAYMENT

A. Except for erosion and sediment control activities described in Section 31 25 00 of these specifications, environmental protection activities shall be considered incidental to the performance of other aspects of the Work and shall be included in the prices for those activities.

B. Erosion and sediment control activities will be measured and paid for as described in Section 31 25 00 of these specifications.

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES

PART 1: GENERAL

1.1 SUMMARY

The Contractor shall provide all temporary facilities and utilities described in this section and as required to fully support construction activities and comply with the health and safety and environmental protection requirements described in these specifications.

1.2 REFERENCES

Washington State Department of Transportation (WSDOT) *2016 Standard Specifications for Road, Bridge, and Municipal Construction*.

1.3 SUBMITTALS

Submit a Spill Prevention, Control, and Countermeasure (SPCC) Plan describing equipment and procedures for fuel storage, fueling operations, spill prevention and cleanup, maintenance operations, and similar activities. The SPCC plan shall comply with applicable Federal, State, and local regulations.

PART 2: PRODUCTS

NOT USED.

PART 3: EXECUTION

3.1 TRAFFIC CONTROL AND PARKING

A. The Contractor shall take all necessary measures to control the flow of vehicular and pedestrian traffic to prevent accidents and to protect the Work throughout the construction stages.

B. On public highways, the Contractor shall make all necessary arrangements to reroute traffic, if necessary, and shall provide and maintain barriers, cones, flaggers, barricades, lighting, construction warning and regular signs, and other controls as necessary. Controls shall conform to the applicable requirements of Section 1-10 of the WSDOT *Standard Specifications*. A traffic control plan that specially addresses the truck traffic and safety measures during import of trench backfill and capping material shall be prepared and submitted to King County Department of Permitting and Environmental Review.

C. All Contractor and subcontractor personnel shall park their vehicles only in the area adjacent to the work site as shown on the Drawings or as directed by the Palmer Coking Coal (PCC) Site Manager.

3.2 CONTRACTOR'S UTILITIES

A. The Contractor shall contact all utility providers and arrange for services directly.

B. If generators are used to supply electrical power, they shall be equipped with suitable noise and exhaust limiting devices and located so as to prevent noise or exhaust disturbance to any personnel working in the facilities area and comply with applicable noise limits at the property boundary.

C. The Contractor shall provide his own communication facilities as necessary.

3.3 FUELING AND MAINTENANCE AREAS

A. Fueling and maintenance facilities shall be designed, equipped, and operated in accordance with the provisions of Contractor's approved SPCC Plan.

B. Provide appropriate fire extinguishers at the fueling and maintenance areas and any locations where fueling, welding, torch cutting, or other similar activities will be performed.

3.4 WATER

A. The Contractor shall provide potable bottled water from a commercial source normally engaged in providing such water. Water stations shall be provided at convenient locations in or adjacent to the Work areas.

B. For non-potable water for dust control, moisture conditioning, and other uses, coordinate with the PCC Site Manager.

3.5 SANITARY FACILITIES

A. The Contractor shall provide a sufficient number of portable toilet facilities for all personnel on site to allow efficient operations and satisfy the minimum regulatory requirements.

B. The Contractor shall clean, empty, supply, and maintain all portable toilet facilities as required to keep them in a functional and sanitary condition, but in no case at intervals greater than once per week, unless approved otherwise by the Construction Manager.

3.6 SECURITY

A. The Contractor shall be responsible for the security of his equipment and material on site. The Contractor shall provide secured storage space as necessary and shall provide any security fencing he deems necessary to control unauthorized access, vandalism, and theft.

B. Provide secure, lockable storage facilities as necessary for tools, materials, equipment, supplies, and the like. Storage facilities shall comply with all applicable regulatory and safety requirements.

3.7 MEASUREMENT AND PAYMENT

A. Measurement will be by the month.

B. Payment will include all labor, materials, tools, supplies, rental, utility costs, equipment, services, and other items required to provide, operate, and maintain the temporary facilities described in this section, or as the Contractor may elect to use, complete and functional.

END OF SECTION

SECTION 01 71 23
SURVEYING

PART 1: GENERAL

1.1 GENERAL REQUIREMENTS

A. The Contractor shall provide all surveying, including but not limited to monumentation, staking, layout, and all other necessary activities as required during construction to control his activities, to achieve lines and grades, and otherwise complete the Work as shown on the Drawings.

B. All surveying activities shall be performed under the direct supervision of a professional land surveyor licensed in the State of Washington.

C. "Survey point" as defined in this section means determination of northing, easting, and elevation at the subject point.

1.2 REFERENCE DATUM

Survey points shall be referenced to the same horizontal datum and vertical datum as shown on the Drawings for this project.

1.3 SUBMITTALS

A. Survey for Measurement

1. Provide hard copy and electronic files in AutoCAD 2017 or higher version to the Construction Manager.

2. Data shall include as a minimum the date of the survey, personnel performing the survey, equipment used, a unique identifier for each survey point, and the X, Y, and Z coordinates of that point in the project coordinate system.

3. Final determination of the acceptability of the Contractor's survey data shall be made by the Construction Manager.

B. As-Built Drawings

Perform surveying activities as required to prepare As-Built Drawings as described in Section 01 33 00.

C. Other

The Contractor shall provide copies of all survey data in both electronic and hard-copy format to the Construction Manager as requested during the course of construction.

PART 2: PRODUCTS

2.1 EQUIPMENT

The Contractor shall supply all equipment, supplies, and supporting material required for survey activities. Such equipment shall be standard commercially available equipment suitable for the intended purpose of this Section.

2.2 ACCURACY

A. All surveying activities shall be performed using methods and equipment with sufficient accuracy to measure to the tolerances listed in these Specifications.

B. Unless otherwise specified or indicated, the minimum required accuracy for both vertical and horizontal measurements shall be ± 0.1 foot.

C. Surveying of groundwater monitoring well elevations shall have a vertical accuracy of ± 0.01 foot.

PART 3: EXECUTION

3.1 CONTROL

A. Prior to beginning the Work, the Contractor shall verify the locations, condition, and accuracy of existing monuments and establish any other reference points or monuments that may be required.

B. Coordinate with the Construction Manager for locations of existing survey monuments.

3.2 SURVEY FOR MEASUREMENT

A. Survey points to measure area shall be at intervals of 50-feet or less around the perimeter of the subject area.

B. Survey for linear foot measurements shall be at intervals of 50-feet or less along the centerline of the subject feature.

C. When “before” and “after” surveys are performed for thickness measurement, points at the same horizontal coordinates shall be used for measurement, unless approved otherwise in advance by the Construction Manager. The grid spacing for such measurement shall be 25 feet, unless approved or directed otherwise by the Construction Manager.

D. Where the measurement method is by taping, the Contractor shall perform the measurement with a high-quality surveyor’s tape.

E. The Contractor shall survey the locations of any “potholes” or other features used for measurement, as directed by the Construction Manager.

3.3 MEASUREMENT AND PAYMENT

Surveying shall be considered incidental to the performance of other aspects of the Work and shall be included in the prices for those activities.

END OF SECTION

SECTION 31 10 00
SITE PREPARATION

PART 1: GENERAL

1.1 SUMMARY

A. This Section describes requirements for clearing and grubbing, and removing and stockpiling vegetative soil.

B. Work related to erosion and sediment control is described in section 31 25 00 of these Specifications.

PART 2: PRODUCTS

NOT USED.

PART 3: EXECUTION

3.1 GENERAL

A. Clear and \ or grub only within the limits of clearing indicated on the Drawings.

B. In borrow areas, clear only as much ground as is reasonably expected to be used for borrow.

C. No pioneering of roads shall be allowed outside of the limits of clearing unless approved in advance by the Construction Manager.

D. All trees, brush, and other materials removed during clearing, except for merchantable timber, shall be chipped, and the chips shall be stockpiled in an approved location for later use as soil amendment or mulch.

3.2 MERCHANTABLE TIMBER REMOVAL

A. Merchantable timber is defined as any commercially-useable hardwood or softwood species with a trunk diameter of 8 inches or greater, measured 6 feet above the adjacent ground surface.

B. Remove limbs and top less than 6-inches in diameter from merchantable timber, cut into 40-foot lengths with a maximum of one length shorter than 40 feet, and stack adjacent to the nearest access road as shown on the Drawings or as directed by the Construction Manager.

C. Chip and stockpile removed limbs and other slash produced by preparing merchantable timber.

3.3 CLEARING FOR ACCESS ROADS AND LINED DRAINAGE DITCHES

A. Remove merchantable timber as described in this section.

B. Remove all vegetation and any other surficial debris. Clearing shall completely remove all trees, brush, fallen trees, and other surficial vegetative material that is not decomposed to the extent that it would readily disintegrate to fragments smaller than 1-inch in dimension when the underlying topsoil is excavated.

C. Grub areas to receive fill.

D. Grub unlined portions of ditches.

3.4 CLEARING IN TRENCHES

A. Prior to the start of clearing activities in trenches, use audible wildlife deterrent devices (e.g., air horn, propane cannon) to cause wildlife to exit the trench.

B. In trenches to be backfilled, remove all trees and large brush above the existing ground surface (i.e., bottom and walls of trench).

C. Small brush, grasses, and the like that would form a layer less than 6 inches thick when compressed under the weight of backfill soil may be left in place.

D. The Construction Manager will make the final determination of which materials shall be removed from the trenches.

E. Grubbing is not required in trenches.

3.5 GRUBBING

A. Grubbing shall remove all stumps from trees and large brush, roots greater than ½-inch in diameter, and rocks greater than 6 inches in maximum dimension.

B. Grubbed organic debris shall be stockpiled or disposed of at a location as directed by the Construction Manager. Rocks shall be stockpiled or disposed of at a separate location as directed by the Construction Manager.

3.6 VEGETATIVE SOIL REMOVAL

A. Clear and grub the existing ground surface within the limits of clearing prior to removing and stockpiling existing topsoil for use as vegetative soil.

B. Remove and stockpile vegetative soil in areas where access roads or drainage ditches will be constructed, from borrow areas prior to development, and from other areas to be excavated.

C. The depth of vegetative soil removal will vary and will be defined by visually estimating the percentage of organic material. Soil will be considered vegetative soil if it meets the minimum organic content threshold defined in section 31 20 00 of these Specifications. The Construction Manager will make the final determination of vegetative soil removal depth.

D. Stockpile vegetative soil for later reuse in accordance with the requirements of section 31 20 00 of these Specifications.

3.7 SUBGRADE PREPARATION

A. In areas to receive fill, except trench backfill, complete clearing, grubbing, and topsoil removal.

B. Proof roll subgrade surface to a firm and unyielding condition with a minimum of 4 passes of a smooth drum vibrating roller, or approved equal In confined areas where a roller is not practical, use a plate compactor, jumping jack, hoe-pack, or similar piece of equipment. Moisture condition as necessary.

C. If any subgrade area cannot be compacted to a firm, unyielding condition because of soft, wet, or otherwise unsuitable soils or conditions, overexcavate and replace with suitable fill and recompact in accordance with the requirements of this section.

D. The Construction Manager will make the final determination of acceptable subgrade.

3.8 MEASUREMENT AND PAYMENT

A. Measurement

1. Clearing and \ or grubbing: Acres cleared and \ or grubbed, area as measured by survey.

2. Merchantable timber removal: Length felled and moved, as measured by taping.

3. Vegetative soil removal and stockpiling: Cubic yards removed and stockpiled, volume as measured by truckloads. The volume of each truck type shall be mutually agreed upon by the Construction Manager and Contractor prior to beginning removal activities. The Construction Manager will observe truck loading to verify that trucks are fully loaded to the nominal capacity. The Construction Manager will adjust the submitted quantities if necessary to correct for under-loaded trucks.

4. Subgrade preparation: Square feet prepared, as measured by taping or survey.

B. Payment

1. Payment for all items will include labor, materials, tools, and equipment for supplying, transporting, placing, and all other activities required to perform the Work as specified and as shown on the Drawings.

2. Payment will include all required incidental activities not specifically identified for separate payment in other sections of these specifications or in the bid schedule. Such incidental activities include but are not limited to chipping of vegetation, stockpiling of grubbed materials, and the like.

3. No separate payment will be made for double handling of material or rework/replacement of placed or stockpiled material that becomes unacceptable due to weather, construction activities, or other cause.

END OF SECTION

SECTION 31 20 00
EARTHWORKS

PART 1: GENERAL

1.1 SUMMARY

This section describes the procedures and requirements for excavation, stockpiling, and placement of soils used for backfill, capping, and other purposes. Also described are the requirements for soil and rock materials for drainage ditch linings and the access road. Topsoil removal and stockpiling is addressed in Section 31 10 00 of these specifications, and replacement of topsoil is addressed in Section 32 90 00.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM), version current at time of bid:

D 698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

D2974 Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

B. Washington State Department of Transportation (WSDOT) 2016 *Standard Specifications for Road, Bridge, and Municipal Construction*.

1.3 SUBMITTALS

A. Existing particle size data for all soil materials purchased from commercial entities, if available.

B. Minimum 50-lb samples in 5 gallon buckets of all soil materials proposed for use, one per material type, except submit 100 lbs of soil proposed for low-permeability soil cap.

C. For soils from other construction projects or non-commercial borrow areas, analytic data for each proposed soil material demonstrating that they are free of contamination above the levels stated in this specification section.

D. Weigh tickets for soil materials purchased from off-site sources.

E. Survey data and other data required for measurement.

F. Other submittals that may be discussed elsewhere in this section.

1.4 QUALITY ASSURANCE

A. Additional details of construction quality assurance (CQA) testing, including test types and frequencies, are presented in the CQA Plan for this project.

B. Physical Properties Testing

1. The Quality Assurance (QA) Manager will perform physical properties testing to verify compliance with the requirements of this section.

2. Prior to placement, soil materials will be tested for particle size and, for some materials, moisture-density (Proctor) relationships and permeability.

3. Other physical property tests may be required by the QA Manager or Engineer.

4. Test data from commercial suppliers may be accepted to fulfill this requirement provided that the test methods and quality control (QC) procedures are equivalent to those specified for this project. The QA Manager will make the final determination of acceptability.

C. Contamination Testing

1. The Quality Assurance (QA) Manager will perform contamination testing on soils from commercial suppliers or on-site soils to verify compliance with the requirements of this section.

2. The term “clean” as used in the construction documents for this project shall mean that contamination levels in the material do not exceed the allowable levels listed in this section.

3. Contamination in all soils and earth materials used for this project shall not exceed the following levels (MTCA soil cleanup levels for unrestricted use or lower):

Element or Compound	**Maximum Allowable Level (mg/kg)**
Arsenic	20
Cadmium	2
Chromium III	2000
Chromium VI	19
Lead	50
Mercury	2
Gasoline Range Organics	30
Diesel Range Organics	200
Heavy Fuels and Oils	200
Mineral Oils	200

4. The QA Manager will submit a work plan to Ecology for review and approval describing the due diligence and sampling and analyses proposed for each identified source of backfill and capping material..

5. If soils from other construction projects or non-commercial borrow areas are proposed for use on this project, the generator of such soils shall be responsible for contamination testing in accordance with the work plan described in paragraph 4 above and for preparation of a material manifest. At a minimum, the manifest shall include the following information:

   - Generator’s name and address
   - Location and address where soil originated
   - Shipper’s name and address

- Description of soil
- Analytical test data and results to demonstrate that soil contamination does not exceed the levels in the table above.

6. All materials used for trench backfill shall also meet the requirements of WAC 173-350-990(3) and King County Ordinance 18166.

D. Hold Points

Hold points have been established for several of the activities described in this section. These hold points and release criteria are listed in the CQA Plan for this project. At each hold point, the Contractor shall not proceed with work in the affected area until the release criteria have been satisfied and approved by the Construction Manager or other responsible party.

PART 2: PRODUCTS

2.1 GENERAL

A. Material quality, handling, and placement procedures shall at all times be the responsibility of the Contractor, subject to approval of the Construction Manager.

B. All earth materials shall conform to the requirements of this section. The Engineer may modify the specifications for these materials at any time during construction to respond to changes in project requirements, material availability, and other factors. The Contractor shall not modify the properties or sources of earth materials without prior written approval of the Construction Manager.

C. Identification of borrow source areas does not imply that all material from the borrow source will be suitable for the intended use. Processing such as segregation, screening, washing, crushing or other methods may be required. The Contractor shall process borrow materials as required to conform to these specifications.

2.2 TRENCH BACKFILL MATERIAL

Trench backfill material shall consist of clean, inorganic soil, rock, or inert material free of roots, rubbish, debris, frozen soil, ice, and other deleterious material.

2.3 STRUCTURAL FILL

A. Structural fill shall consist of clean, inorganic, granular soil free of roots, rubbish, debris, frozen soil, ice, and other deleterious material.

B. Structural fill shall have a maximum particle size of 3 inches in maximum dimension and shall contain no more than 15% by dry weight passing the U.S. No. 200 sieve.

2.4 LOW-PERMEABILITY SOIL

A. Low-permeability soil shall consist of clean, inorganic soil free of roots, rubbish, debris, frozen soil, ice, and other deleterious material.

B. The maximum particle size for low-permeability soil shall not exceed 3 inches in maximum dimension, unless such particles will break down during compaction.

C. Low-permeability soil shall have a minimum of 25% by dry weight passing the U.S. No. 200 sieve.

D. Low-permeability soil shall achieve a hydraulic conductivity no greater than 1 x 10^{-6} cm/sec when properly moisture conditioned and compacted to 95% of maximum dry density in accordance with ASTM D698.

2.5 VEGETATIVE SOIL

A. Vegetative soil shall consist of clean soil free of rubbish, debris, frozen soil, ice, and other deleterious material.

B. The maximum particle size for vegetative soil shall not exceed 3 inches in maximum dimension, unless such particles will break down during compaction.

C. Vegetative soil shall have a minimum of 15% by dry weight passing the U.S. No. 200 sieve.

D. Vegetative soil shall have a minimum organic content of 5% as measured by ASTM D2974 Method C. The required organic content may be achieved by mixing with wood chips or other approved organic material(s).

2.6 ARMOR ROCK AND DITCH LINING

Armor rock and ditch lining shall meet the requirements for quarry spalls as described in WSDOT 2016 Sections 9-13.1(1) and 9-13.1(5).

2.7 ACCESS ROAD GRAVEL

A. Subbase shall conform to the requirements of WSDOT Section 9-03.9(1) “Ballast”.

B. Surfacing shall conform to the requirements of WSDOT Section 9-03.9(3) “Top Course”.

PART 3: EXECUTION

3.1 GENERAL

A. Tolerances

1. Fill shall be placed to at least the minimum lines indicated on the Drawings.

2. The tolerance for the slope of access road or drainage ditch invert subgrade (i.e., before placing subbase or linings) shall be plus or minus 0.1 foot over a 10-foot length, unless otherwise specified or approved.

3. Tolerances for ditch lining layers shall be –0% to +25% of the design thickness shown on the Drawings.

4. Tolerances for access road subbase and surfacing layers shall be ±0.1 ft.

5. Tolerances for the thickness of the low-permeability soil and vegetative soil layers shall be -0.0 to +0.2 ft.

B. Preparatory Activities

1. Install erosion and sediment control measures in accordance with Section 31 25 00 of these specifications prior to beginning earthworks activities.

2. Perform clearing and grubbing in accordance with Section 02110 of these specifications prior to beginning earthworks activities,

C. Water Control

Excavation and fill areas shall be properly graded and maintained to provide adequate drainage at all times. Work shall be suspended when the site is overly wet, muddy, or in any other condition where the area cannot be properly maintained or is unsafe for the required work activity.

D. Dust Control

1. Prevent damaging and nuisance dust during all earthwork operations as required or as directed by the Construction Manager.

2. Control dust by spraying with water. No other materials or methods shall be used unless approved by the Construction Manager.

3. For off-site hauling, all loads shall be covered or otherwise treated in accordance with State and local regulations to prevent blowing of soil material.

E. Modifications

The Construction Manager, in consultation with the Engineer, may modify the placement, compaction, or other requirements of this section at any time as the Work progresses based on ongoing project experience as necessary to achieve the specified properties or to allow greater efficiency in the execution of the Work.

3.2 EXCAVATION

A. Excavate to the limits shown on the Drawings or as directed by the Construction Manager.

B. Comply with all applicable local, State, and Federal regulations with respect to slopes, safety, environmental protection, and other design and construction requirements. Safe temporary construction slopes, both excavation and fill, shall be the responsibility of the Contractor.

C. The Contractor shall be responsible for protecting the excavation grade and lines until completion and acceptance of the Work.

3.3 ON-SITE TEMPORARY STOCKPILES

A. Stockpile location and sequencing shall be entirely at the Contractor's discretion to facilitate his construction activities, subject to the constraints of these specifications.

B. Soil materials shall be temporarily stockpiled on-site only within the limits of disturbance as indicated on the Drawings, or otherwise approved in advance by the Construction Manager.

C. Do not stockpile in surface water ditches, across access roads, or at other locations that would interfere with site operations or cause adverse impacts to the environment. Coordinate with the Owner of the project property as necessary when locating stockpiles.

D. The Contractor shall be solely responsible for stability of all stockpiles. The requirements of this section are general in nature and shall not relieve the Contractor of responsibility of maintain stable stockpiles. These requirements may be modified by the Contractor at his discretion to increase stability as necessary. Such modifications shall in all cases be consistent with other project requirements.

E. On-site temporary stockpiles shall have a maximum slope of 2H:1V and a maximum height of 40 feet.

F. Stockpiles shall be graded to provide positive drainage at all locations.

G. On-site stockpiles shall not be disturbed by construction activities, and shall be protected from wind and water erosion, unnecessary compaction, and contamination.

H. Install silt fence completely around the base of stockpiles to contain sediment. Silt fence materials, installation, and maintenance shall conform to the requirements of Section 31 25 00 of these specifications and the Drawings.

3.4 TRENCH BACKFILL

A. No construction machinery shall be allowed in the trenches during backfilling or compaction. Backfill shall be placed by dumping or pushing over the side of the trench, reaching with an excavator, or other method complying with the Health and Safety Plan for this project.

B. The maximum thickness of each backfill lift shall not exceed 5 feet.

C. To prevent formation of significant voids, large-size backfill material such as rock or broken concrete shall be placed in a single layer and covered with backfill soil prior to placing the next lift of material.

D. Compact the surface of each backfill lift using a Ho Pac® Model 1600 or larger compactor or similar compaction equipment mounted on an excavator arm, crane, or other suitable piece of equipment.

E. Compact each lift of trench backfill until no settlement greater than 3 inches is observed between repeated passes in the same area.

3.5 STRUCTURAL FILL

A. Place structural fill in maximum 6-inch-thick loose lifts.

B. Compact each lift with a minimum of 4 passes of a smooth drum vibratory roller with a minimum static weight of 15,000 lb such as a CAT CS44, IR SD-70, similar approved equivalent to achieve a firm and unyielding surface.

C. Structural fill soils that are too wet or dry to be adequately compacted, as determined by the Construction Manager, shall be moisture conditioned appropriately to achieve adequate compaction.

3.6 LOW-PERMEABILITY SOIL

A. Place low-permeability soil in maximum 8-inch-thick loose lifts.

B. Compact each lift to at least 95% of maximum dry density in accordance with ASTM D698 using a smooth drum vibratory roller with a minimum static weight of 15,000 lb such as a CAT CS44, IR SD-70, similar approved equivalent. In all cases, however, each lift shall be compacted with a minimum of 4 passes unless approved or directed otherwise by the Construction Manager.

C. Soils that are too wet to be effectively compacted, as evidenced by high moisture content results, pumping during placement, free water during handling, inability to compact to a firm surface, or other behaviors, shall be spread and dried as required to achieve adequate compaction. Determination of excessive moisture will be made by the Construction Manager.

D. Soils that are too dry to be effectively compacted, as evidenced by inability to break down clods, inability to achieve a firm surface, or other behaviors, shall be spread, moisture conditioned by spraying with water, and mixed or allowed to hydrate as necessary to achieve adequate compaction. Determination of inadequate moisture will be made by the Construction Manager.

E. Prior to placing the next layer of overlying material, protect the surface of each lift from erosion, precipitation, desiccation, freezing, or other conditions that could affect the permeability of the lift.

3.7 VEGETATIVE SOIL

A. Place vegetative soil in a single lift to the thickness shown on the Drawings.

B. Place vegetative soil from the bottom to the top of slopes so that dozer cleat tracks are across the slope.

C. Do not compact the vegetative soil layer. After placement, minimize traffic on vegetative soil to prevent excessive compaction.

3.8 ARMOR ROCK AND DITCH LINING

A. On slopes steeper than 10%, place armor rock from the bottom of the slope upwards.

B. Place armor rock or ditch lining in a controlled manner that does not damage or disturb the underlying material. Use methods which do not drag the armor rock or ditch lining across the underlying material.

C. The finished armor rock or ditch lining surface shall be uniform and free of undulations.

3.9 ACCESS ROAD SURFACING

A. Place access road surfacing layers in a single lift for each material so that the road surface will be at the design grades and elevations after compaction.

B. Compact road surfacing to form a firm, unyielding surface.

C. Final driving surface shall be smooth and uniform.

3.10 MEASUREMENT AND PAYMENT

A. General

1. Where the measurement method is survey, the Contractor shall perform the survey and submit the results to the Construction Manager for review and approval.

2. Surveying and reporting shall be performed in accordance with the requirements of Section 01 71 23 of these specifications.

3. When soil material is placed to a minimum thickness as shown on the Drawings, the thickness shall be the measured from the surface of the underlying layer, after approval for placement of the fill.

4. Materials placed beyond the tolerances listed in this section, or, where no tolerances are listed, the design thickness, shall not be paid for; the Construction Manager will adjust the measured quantities accordingly.

5. All activities related to providing and placing earth materials shall be included in the unit costs for the respective materials and shall be considered incidental unless explicitly noted otherwise.

B. Trench Backfill

1. From off-site commercial sources: tons. Provide weigh tickets from supplier.

2. From off-site non-commercial borrow areas: tons. Provide portable truck axle scales or other approved method and weigh data for each truckload.

3. From off-site sources if soil disposal fee is collected: Cubic yards as measured by nominal truck capacity or other method acceptable to the site Owner.

4. From on-site borrow areas: Bank cubic yards as measured by before and after survey of borrow area.

5. At the discretion of the Construction Manager, trench backfill volume may alternatively be measured using aerial drones to periodically monitor backfill elevation in the trenches. The Construction Manager will provide such equipment and perform such measurements.

C. Low-Permeability Soil

Cubic yards placed, as measured by before and after survey.

D. Vegetative Soil

Cubic yards placed, as measured by potholing at a minimum frequency of 1 per 1,000 sf.

E. Armor Rock, Ditch Lining, Structural Fill, and Access Road Surfacing

Tons. Provide weigh tickets from supplier.

END OF SECTION

SECTION 31 25 00
EROSION AND SEDIMENT CONTROL

PART 1: GENERAL

1.1 SUMMARY

A. This section describes requirements for temporary soil erosion and sediment control measures necessary during construction. The temporary measures shall include but are not limited to furnishing, installing and/or constructing silt fences, straw bales, plastic sheeting, and other items.

B. Erosion and sediment control activities shall prevent the spread of soil material outside of the Work area.

1.2 REFERENCES

A. King County, Washington, 2016, *Surface Water Design Manual, Appendix D, Construction Stormwater Pollution Prevention Standards*.

B. Washington State Department of Transportation (WSDOT) *2016 Standard Specifications for Road, Bridge, and Municipal Construction*.

PART 2: PRODUCTS

2.1 SILT FENCE

Conform to the requirements of WSDOT 2016 sections 8-01.3(9)A2, 9-33.1, and 9-33.2 Table 6.

2.2 STRAW BALES OR WATTLES

Straw bales shall be weed-free in accordance with WSDOT 2016 section 9-14.4(1). Straw wattles shall conform to the requirements of WSDOT 2016 section 9-14.5(5).

2.3 PLASTIC SHEETING

Black polyethylene plastic sheeting conforming to the requirements of WSDOT 2016 sections 8-01.3(5) Erosion Control and 9-14.5(3).

2.4 TEMPORARY SEEDING

A. Erosion control mix conforming to the requirements of WSDOT 2016 section 9-14.2.

B. Acceptable products:

1. Emerald Erosion Control Mix, Emerald Seed & Supply, Redmond, OR
2. Washington State DOT Erosion Control Mixture, Country Green Turf Farms, Olympia, WA
3. Region 1 Standard Erosion Control Mix, Direct Seed Sales, Issaquah, WA
4. Approved equal

PART 3: EXECUTION

3.1 GENERAL

A. Installation and maintenance of erosion and sediment control measures shall conform to the requirements of King County 2016.

B. The Contractor shall take all necessary precautions to minimize erosion and prevent sediment from leaving the site under any and all atmospheric conditions including, but not limited to, storm runoff, melting snow, and wind.

C. Construct temporary erosion and sediment control measures prior to beginning any activities in the affected area which will disturb the existing ground surface in a manner that makes it more susceptible to erosion.

D. If construction occurs during the wet season, the Contractor shall comply with the applicable requirements of King County Code 16.82.095 and the King County 2016 Surface Water Design Manual, Appendix D governing wet season work.

E. The Contractor shall have available on site at all times during construction sufficient quantities of silt fence, plastic sheeting, straw bales, and other materials as required to protect disturbed areas from erosion during heavy precipitation events.

F. The Contractor shall provide and install temporary erosion control measures, in addition to those shown on the Drawings and required by permits, at any time if directed by the Construction Manager as necessary in his judgment to prevent unacceptable impact to areas outside of the Work area.

G. The requirements of this section shall in no way be construed as relieving the Contractor of his responsibility for planning, furnishing, installing, and maintaining those measures necessary to provide temporary erosion control. The Contractor shall be responsible at his own expense for any damages, penalties, and remedial actions resulting from sedimentation of streams or other non-impacted areas. Rework of erosion and sediment control measures or remedial actions resulting from the failure of the existing measures shall not constitute a basis for change in the project schedule or price.

3.2 SEDIMENT CONTROL DURING CONSTRUCTION

A. Install silt fence downslope of all construction activities, whether indicated on the Drawings or not, unless approved otherwise by the Construction Manager. Use of an on-site vegetated buffer zone in lieu of silt fence may be acceptable if approved in advance in writing by the Construction Manager.

B. Remove sediment from behind silt fences, straw bales, and other sediment control facilities prior to the sediment reaching one-third (1/3) of its maximum potential depth. Dispose of sediment in the Work area or as directed by the Construction Manager.

C. Anchor plastic sheeting as recommended by supplier to prevent wind uplift.

D. Inspect all erosion and sedimentation control measures at least once each week and immediately after each major rainfall event, and maintain as necessary to ensure their continued functioning.

E. Perform temporary seeding of disturbed soil areas at the end of each construction season or earlier as required in accordance with the recommendations of King County 2016 and the seed supplier, including suitable planting times.

F. Install straw wattles in accordance with WSDOT 2016 section 8-01.3(10) and the supplier's recommendations.

G. Do not remove silt fence and other erosion control measures until directed by the Construction Manager.

3.3 STABILIZED CONSTRUCTION ENTRANCE

A. Construct stabilized construction entrance at each entrance to \ from public highways.

B. Construct stabilized construction entrance to the dimensions shown on the Drawings.

C. Requirements for rock materials for the stabilized construction entrance are included in section 31 20 00 Earthworks of these specifications.

3.4 MEASUREMENT AND PAYMENT

A. Measurement for payment will be made by the following methods:

1. Silt Fence

   Lineal feet installed, length as measured by survey or taping.

2. Straw Bales and Wattles

   Each, installed.

3. Plastic Sheeting

   Square yard satisfactorily placed, area as measured by survey or taping.

4. Temporary Seeding

   Acres, area as measured by survey or mapping.

B. Payment

1. Payment for all items will include labor, materials, tools, and equipment for supplying, placing, maintaining, and all other activities required to perform the Work as specified and as shown on the Drawings.

2. Payment will include any required incidental activities not specifically identified for separate payment in other sections of these specifications or in the bid schedule.

3. Payment for plastic sheeting will include the associated anchoring system.

4. No separate payment will be made for double handling of material; rework/replacement of placed material that becomes unacceptable due to weather, construction activities, or other cause.

5. Costs incurred as a result of Contractor's failure to adequately control erosion will be deducted from any money due or to become due to the Contractor. Such costs may include, but are not limited to, engineering costs, construction of erosion control measures, cleanup of impacted areas, and repair of damage caused by erosion.

END OF SECTION

SECTION 32 31 00
FENCES AND GATES

PART 1: GENERAL

1.1 SUMMARY

This Section describes the requirements for the materials and installation of fences and gates.

1.2 REFERENCES

A. References are the versions current at the time of bid for this project.

B. American Society for Testing and Materials (ASTM)

1. ASTM A36 Carbon Structural Steel

2. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

3. ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

4. ASTM A153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

5. ASTM F567 Standard Practice for Installation of Chain-Link Fence

C. American Welding Society, AWS D1.1, *Structural Welding Code - Steel*.

D. Washington State Department of Transportation (WSDOT), 2016, *Standard Specifications for Road, Bridge, and Municipal Construction*.

F. Chain Link Fence Manufacturers Institute (CLFMI), *Product Manual*.

1.3 SUBMITTALS

A. Product Data: Manufacturer's published information sufficient to demonstrate that the material conforms to the requirements of this section, including any specifications or installation instructions.

B. Shop Drawings as needed to supplement details shown on the Drawings and to describe modifications required for field conditions.

1.4 QUALITY CONTROL

The Contractor shall provide at least one person who is skilled and experienced in erecting chain link fences and gates and is familiar with current industry practice.

1.5 DELIVERY, STORAGE AND HANDLING

A. Check all materials upon delivery to assure that the proper type, grade, color, and certification have been received.

B. Protect all materials from damage due to jobsite conditions and in accordance with manufacturer's recommendations. Damaged materials shall not be incorporated into the Work.

PART 2: PRODUCTS

2.1 SECURITY FENCE

A. Fence and gates shall conform to the requirements of WSDOT 9-16.1 except as noted in this section.

B. Posts shall be Grade 1.

C. Steel pipe shall conform to the requirements of ASTM A53 and shall be hot-dipped galvanized inside and out.

D. Use seamless pipe only.

E. Chain link fence fabric shall be 9 gauge steel, 2-inch mesh, galvanized class 1 (1.2 oz/sf) and shall satisfy all other requirements of the CLFMI *Product Manual*.

F. Barbed wire shall consist of two strands of twisted wire with 4-point barbs at 5-inch spacing. Barbs shall be 14 gauge and shall be galvanized at a minimum of 0.65 oz/sf and of sufficient strength to withstand without failure, 250 pounds downward pull. Line wire shall be 12-1/2 gauge and shall be galvanized at a minimum of 0.8 oz/sf. Barbed wire support arms shall conform to the requirements of the CLFMI *Product Manual* and shall be inclined outward at approximately 45 degrees from the enclosed area. Barbed wire shall be discontinued between the gate frame and gate post.

G. Steel plates, shapes, and bars shall conform to the requirements of ASTM A36.

H. Hot dip galvanize all steel components and fabrications and in accordance with ASTM A123, 2.3 oz per square foot minimum.

I. Electrodes for welding shall meet AWS specifications for the metal alloy welded. Use E70xx unless noted otherwise.

J. Galvanizing solder shall be GAL-VIZ manufactured by Harris Welco or approved equal.

K. All other chain link fence materials and hardware shall conform to the requirements of WSDOT 9-16.1 or, if not specified, the requirements of the CLFMI *Product Manual* unless indicated otherwise in these specifications or on the Drawings.

L. Concrete shall at a minimum conform to the requirements of WSDOT Class 3000 concrete.

2.2 VEHICLE ACCESS GATES

A. Fabricate and install vehicle access gate as shown on the Drawings.

B. Paint vehicle access gates with OSHA safety yellow paint suitable for outdoor exposure.

C. The Contractor may propose an alternative gate design if it uses standard commercial design and will provide equivalent performance and durability.

2.3 LOCKS

A. Provide high-strength hardened steel padlocks and chains for all security gates and vehicle access gates.

B. The locks for each type of gate (vehicle access and security gates) shall be keyed the same, but the locks for vehicle access gates shall be keyed differently from those for security gates.

C. Provide 3 sets of keys of each type to the Construction Manager.

PART 3: EXECUTION

3.1 SECURITY FENCE

A. Construct security fence in accordance with the applicable portions of WSDOT 8 12.3(1) and the CLFMI *Product Manual*, unless indicated otherwise on the Drawings.

B. Install chain link fence in accordance with ASTM F567.

C. Install vehicle access gates prior to the start of other Work.

D. Do not install fence or security gates until final site grading has been performed and approved by the Construction Manager.

E. Place concrete around posts in a single placement and tamp for consolidation. Check each post for vertical alignment and depth of set. Crown top of post footings to shed water off concrete, away from post.

F. Set keepers, stops, sleeves, and other accessories into concrete.

G. Install braces so that posts are plumb when diagonal rods are under proper tension.

H. Install tension wires before stretching fabric. Tie wires to each post with ties or clips.

I. After the erection and installation are complete, repair all damaged galvanized surfaces according to ASTM A153, using “hot stick” galvanizing solder, in accordance with the Manufacturer’s recommendations.

3.2 VEHICLE ACCESS GATES

Install vehicle access gates as shown on the Drawings.

3.3 MEASUREMENT AND PAYMENT

A. Measurement

1. Fencing: Linear feet of fence installed, not including gates, as measured by taping.

2. Security Gate: Each gate, installed.

3. Vehicle Access Gate: Each gate, installed.

B. Payment

Payment includes all materials and appurtenances to install the fencing and gates, including but not limited to sleeves, posts, fasteners, braces, wires, fabric, bands, concrete, welds, treatments, chains, locks, and all other items required to install the fencing and gates as shown on the Drawings and described in these Specifications to provide complete and functional systems.

END OF SECTION

SECTION 32 90 00
SEEDING

PART 1: GENERAL

1.1 SUMMARY

A. This Section describes requirements for permanent seeding of the trench area cover and other disturbed areas at the end of the project.

B. Temporary seeding for erosion and sediment control is described in section 31 25 00 of these Specifications.

1.2 REFERENCES

Washington State Department of Transportation (WSDOT) 2016 *Standard Specifications for Road, Bridge, and Municipal Construction*.

1.3 SUBMITTALS

A. Proposed seed mix and amendments, including application rates.

B. Certification that seed mix, compost, and mulch are free of noxious weeds.

C. Original delivery tags of seed mix, compost, mulch, and fertilizer bags showing supplier, quantity, type of material, and delivery location.

PART 2: PRODUCTS

2.1 VEGETATIVE SOIL

Requirements for vegetative soil are described in section 31 20 00 of these Specifications.

2.2 SEED

A. Grass seed mix shall conform to the requirements of WSDOT 2016 section 9-14.2.

B. Seed mix shall be suitable for the climatic conditions at the project site, so that vegetation can become established in a single season without the need for irrigation or additional fertilizer.

C. Seed mix shall be an erosion control mix with the following composition, or approved equal:

- 50% Perennial Ryegrass
- 35% Annual Ryegrass
- 15% Creeping Red Fescue

2.3 FERTILIZER

Low-phosphorous fertilizer conforming the requirements of WSDOT 2016 section 9-14.3.

2.4 MULCH

Mulch shall conform to the requirements of WSDOT 2016 section 9-14.4.

2.5 TRACER

If hydroseeding is used, tracer used in hydroseeding shall conform to the requirements of WSDOT 2016 section 8-01.3(2)B.

2.6 TACKIFIER

If hydroseeding is used, tackifier shall conform to the requirements of WSDOT 2016 section 9-14.4(7).

2.7 SEEDING EQUIPMENT

A. Hydroseeding equipment shall satisfy the requirements of WSDOT 2016 section 8-01.3(2)B and the following:

   1. Hydroseeder shall utilize water as the carrying agent and shall maintain continuous agitation of seed mix.

   2. Hydroseeder shall have sufficient operating capacity to agitate, suspend, and mix specified products into a homogenous slurry.

   3. Distribution and discharge lines shall be large enough to prevent clogging.

   4. Spray nozzles shall provide a uniform distribution of slurry.

B. Broadcast seeding equipment shall be hand- or machine-operated mechanical spreaders that uniformly apply dry seed at the specified rate.

PART 3: EXECUTION

3.1 VEGETATIVE SOIL PLACEMENT

Place vegetative soil in accordance with section 31 20 00 of these Specifications.

3.2 SEEDING

A. Extent

   1. Seed all areas where vegetative soil has been placed or that remain in a disturbed condition at the end of the project, except for access roads, drainage ditches, and cuts in rock steeper than 10%.

   2. Seed on-site borrow areas.

   3. The requirement for permanent seeding may be waived in areas that have been temporarily seeded and where such seeding has become well-established, as determined by the Construction Manager.

B. Allowable Seeding Times

1. In accordance with the requirements of WSDOT 2016 section 8-01.3(2)F unless approved otherwise by the Construction Manager.

2. Seeding shall not occur during windy weather, when the ground is frozen, or when the ground is excessively wet or dry.

C. Seed may be placed using either hydroseeding or broadcast seeding methods, as approved by the Construction Manager.

D. Hydroseeding Methods

1. No more than 30 minutes shall elapse between placing the mix components in the hydroseeder tank and beginning the hydroseed application.

2. Apply mixture with uniform, continuous, and complete coverage.

3. Prevent drift and displacement of hydroseed mixture. Use protective covering on structures and objects where coverage and stains would be objectionable. Protect vehicles and personnel from drifting spray.

E. Application Rates

Apply seed, fertilizer, mulch, and (for hydroseeding) tackifier in accordance with supplier's recommended rates.

F. Protection

Contractor shall not drive equipment on or allow other damage to reseeded areas.

G. Coverage Standards

1. The establishment period shall be 45 days after completion of seeding.

2. At least 80% of the ground surface shall have a uniform, healthy, and weed-free stand of grass at the appropriate stage of germination for the season and weather conditions at the end of the establishment period.

3. Coverage shall be determined by visual inspection by the Construction Manager.

3.3 MEASUREMENT AND PAYMENT

A. Measurement

1. Seeding: Acres satisfactorily reseeded, area as measured by survey.

2. Satisfactory reseeding shall conform to the requirements of this section, including coverage standards. Areas that do not meet coverage standards shall be reseeded by the Contractor at his expense until satisfactory coverage is achieved during the associated establishment period or acceptance by the Construction Manager.

B. Payment

1. Payment for all items will include labor, materials, tools, and equipment for supplying, placing, and all other activities required to perform the Work complete as specified and as shown on the Drawings.

2. Payment for seeding will include associated mulching, fertilizer, tackifier, and all other components for complete reseeding.

3. Materials placed beyond the limits shown on the Drawings or beyond the areas that have been directed in the field by the Construction Manager shall not be paid for; the Construction Manager will adjust the measured quantities accordingly.

END OF SECTION

SECTION 33 40 00
STORMWATER MANAGEMENT

PART 1: GENERAL

1.1 SUMMARY

A. This section describes requirements for drainage ditches, culverts, drop structures, piping, and other components of the permanent stormwater management system for the project.

B. Erosion and sediment control measures are described in section 31 25 00 of these Specifications.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM), version current at time of bid:

C858 Standard Specification for Underground Precast Concrete Utility Structures.

B. Washington State Department of Transportation (WSDOT) *2016 Standard Specifications for Road, Bridge, and Municipal Construction*.

1.3 SUBMITTALS

A. For each type of pipe, submit pipe manufacturer's data sheets and specifications for approval prior to use. Provide sufficient information to demonstrate compliance with the requirements of this section, including information for pipe ends, fittings, and other associated components.

B. For precast structures, submit manufacturer's information and shop drawings for approval prior to ordering materials or fabricating the structure.

PART 2: PRODUCTS

2.1 GENERAL

All culvert, piping, and precast materials shall be new and unused.

2.2 CULVERT PIPE

Minimum 16 gage galvanized steel corrugated metal pipe conforming to the requirements of WSDOT 2016 section 9-05.4, including the requirements for coupling bands.

2.3 PRECAST CONCRETE STRUCTURES

A. Precast concrete shall use Type II Portland cement and conform to the pertinent requirements WSDOT 2016 section 9-05.50.

B. Precast concrete shall have a minimum 28-day compressive strength of 4,000 psi.

C. Reinforcement for precast concrete shall conform to all pertinent ACI guidelines and shall be designed to prevent damage to the precast structure during transportation, handling, installation, and use.

D. Precast underground structures shall conform to the requirements of ASTM C858 and this Section.

E. Precast concrete structures shall be manufacturer's standard products unless approved in writing prior to ordering by the Construction Manager.

F. Penetrations through the vault wall or inlet shall be sealed with pre-mixed mortar, or similar non-shrink, cement-based material compatible with associated concrete structure, designed for use as a sealer around pipe penetrations. Product shall be Commercial Grade FastSet Repair Mortar by QUIKRETE or approved equal.

2.4 DRAINAGE PIPE

A. High density polyethylene (HDPE) pipe shall meet the requirements of WSDOT 2016 section 9-05.23.

B. HDPE pipe shall have a standard dimension ratio of 21 unless otherwise indicated on the Drawings.

2.5 CULVERT, PIPE, AND STRUCTURE BEDDING

A. Pipe bedding shall consist of clean, inorganic, primarily granular soil free of roots, rubbish, debris, ice, and other deleterious material.

B. Pipe bedding shall meet the following particle size limits, or as approved by the Construction Manager:

Sieve Size	Percent Passing (by dry weight)
U.S. No. 4	90 - 100
U.S. No. 200	less than 10

2.6 DITCH LINING

Per the requirements of Section 31 20 00 of these Specifications.

PART 3: EXECUTION

3.1 GENERAL

A. Excavation and trenching for pipes, culverts, and underground precast structures shall be performed in accordance with applicable OSHA and other requirements. Safe excavations and temporary construction slopes are the responsibility of the Contractor.

B. Piping dimensions shown on the Drawings are approximate. It shall be the Contractor's responsibility to furnish and install piping of the proper dimensions, and ensure that piping properly fits with the connecting elements, pipes, fittings, vaults, etc. to provide a complete and functional system.

C. Excavations for pipe, culverts, and below-grade precast concrete structures shall comply with the requirements of Section 31 20 00.

3.2 CULVERTS

A. Install culverts to the lines and grades shown on the Drawings.

B. Install and joint culverts (if required) in accordance with manufacturer's recommendations.

C. Use procedures that will not damage the galvanizing on the culvert. If the galvanizing is damaged, apply zinc paint prior to backfilling.

D. Maintain culvert entrances and exits in a clear and unobstructed condition throughout the project.

3.3 PRECAST CONCRETE STRUCTURES

A. Install precast as shown on the Drawings and in accordance with manufacturer's recommendations.

B. Prepare subgrade beneath structures by compacting to a firm, unyielding condition.

C. Provide all temporary support, bracing, and shoring as needed to safely resist all earth loads during installation.

D. Handle and place structures using designated lifting points only to prevent damage.

E. Tops of installed structures shall be level and even with adjacent final grades as shown on the Drawings.

F. Seal pipe penetrations in accordance with the following:

1. Remove all loose concrete, soil, and other deleterious materials from pipe and concrete surfaces to be mortared.

2. Prepare surfaces in accordance with mortar manufacturer's recommendations.

3. Completely fill annulus between pipe and concrete structure wall with mortar.

4. Allow mortar to fully cure in accordance with manufacturer's requirements before further construction or use.

3.4 DRAINAGE PIPE

A. Pipe shall be delivered, handled, and stored in such a manner as to ensure a sound, undamaged condition. Pipe shall be delivered to the job site and handled by means that provide adequate support to the pipe and do not subject it to undue stresses or damage. When handling and placing plastic pipe, care shall be taken to prevent impact blows, abrasion damage, and gouging or cutting by metal edges and/or surface or rocks.

B. Follow manufacturer's special handling and storage requirements. Avoid impacts when handling plastic pipe at temperatures less than 40 degrees Fahrenheit. Pipe shall be stored on a relatively flat surface so that the barrels are evenly supported. Unless the pipe is specifically manufactured to withstand exposure to ultraviolet radiation as certified by the manufacturer, all pipe shall be covered with an opaque material when stored outdoors for more than 15 days.

C. Pipe shall be cut in a neat, workmanlike manner using an approved mechanical cutter that will not damage the pipe in accordance with the manufacturer's instructions.

D. Join HDPE pipe in accordance with manufacturer's recommendations.

E. For the joining process, pipe ends shall be cut square, deburred to provide a uniform, smooth surface, and cleaned to remove any dirt or grease.

F. During placement in final position, the pipe shall not be pulled across sharp projections that could cause gouges, kinks, or other types of damage. Exercise care when moving pipe to prevent twisting or damage to pipe.

G. Provide a minimum of three inches of overhang at the interior of precast concrete structures where pipe drains from or discharges into the structure.

3.5 TRENCH AND EXCAVATION BACKFILLING

A. Backfilling operations shall not deform or damage the pipe or precast structure.

B. Backfilling operations shall ensure that no voids are present under or at the sides of the pipe. Unless otherwise approved by the Construction Manager, pipe bedding material shall initially be placed to the top of the pipe in loose lifts not exceeding 6 inches in thickness and compacted by hand to a firm condition.

C. The remainder of the trench or excavation shall then be backfilled with previously excavated soil or other approved material in maximum 6-inch lifts and compacted with a power tamper or plate compactor only to a firm condition.

D. The Contractor shall protect the installation at all times during and after construction. Movement of construction equipment, vehicles, and loads over and adjacent to any pipe or precast structure shall be performed at the Contractor's risk.

3.6 DITCH LINING

A. Line only those ditches so indicated on the Drawings or that were previously lined in this way.

B. On slopes steeper than 10%, place ditch lining from the bottom of the slope upwards.

C. Place ditch stone/gravel lining in a controlled manner that does not damage or disturb the underlying geotextile material. Use methods which do not drag the ditch lining across the underlying material.

D. The finished ditch lining surface shall be uniform and free of undulations.

3.7 MEASUREMENT AND PAYMENT

A. Measurement

1. Culvert: Linear feet of culvert installed, as measured by taping.

2. Precast Concrete Structures: each.

3. Stormwater Drainage Pipe: Linear feet of pipe installed, as measured by taping.

4. Ditch Lining: Linear feet of ditch lined, as measured by taping or survey.

B. Payment

1. Payment for all items will include labor, materials, tools, and equipment for supplying, placing, maintaining, and all other activities required to perform the Work as specified and as shown on the Drawings.

2. Payment will include joining, fittings, ancillary hardware, and any associated equipment, materials, and activities required to provide a complete and functional system as shown on the Drawings.

3. Payment will include any required incidental activities not specifically identified for separate payment in other sections of these specifications or in the bid schedule.

4. No separate payment will be made for with work associated with connection of pipes to precast vaults and inlets.

5. Tolerances for ditch lining are listed in section 31 20 00 of these specifications. No payment will be made for material that is placed outside of these tolerances.

6. No separate payment will be made for double handling of material; rework/replacement of placed material that becomes unacceptable due to weather, construction activities, or other cause.

END OF SECTION

APPENDIX C

Construction Quality Assurance Plan

REPORT

CONSTRUCTION QUALITY ASSURANCE PLAN

Landsburg Mine Site

Submitted to:

Washington Department of Ecology
3190 - 160th Ave SE
Bellevue, WA 98008

Submitted by:

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923-1000-05-1000

August 14, 2018

Distribution List

Washington State Department of Ecology

Palmer Coking Coal Company, LLP

Weyerhaeuser Company

BNSF Railway Company

PACCAR Inc.

Browning-Ferris Industries of Illinois, Inc.

CONSTRUCTION QUALITY ASSURANCE PLAN

Landsburg Mine Site

August 2018

This report was prepared under the supervision and direction of the undersigned.

Frank S. Shuri

Frank S. Shuri, LG, LEG, PE
Golder Associates Inc., Principal Engineer

August 14, 2018
Date:

Gary Zimmerman
Golder Associates Inc., Principal and Practice Lead

August 14, 2018
Date:

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FIGURES

Figure 2-1: Landsburg Mine Site Remediation – Project Organization Chart 5

ATTACHMENTS

Attachment A
CONSTRUCTION QUALITY ASSURANCE FORMS Daily Field Report Form Request for Information Form Engineering Change Notice Form Nonconformance Report

1.0 INTRODUCTION

This Construction Quality Assurance (CQA) Plan describes the CQA activities required during construction activities associated with the Landsburg Mine Site Model Toxics Control Act (MTCA) Remediation Project.

1.1 Purpose

During construction, Quality Assurance activities will be performed to ensure that:

1) All components are constructed in accordance with the approved Plans and Specifications, and

2) Requirements of regulatory agencies related to documentation are satisfied.

This CQA Plan has been prepared to describe the activities that will be performed during construction to satisfy these objectives. If problems related to achieving the technical requirements of the design documents are encountered during construction, the procedures described in this CQA Plan are intended to identify such problems in a timely manner and to document that these problems are corrected before construction is complete.

1.2 Scope

This plan establishes general administrative and documentation procedures and specific inspection and testing activities that will be applicable for all aspects of construction. Major work items include:

- Backfilling the North Portal
- Constructing and upgrading access roads to the trench area
- Clearing trees and brush within the trenches to be remediated and adjacent areas
- Placing backfill in the trenches to be remediated
- Constructing a low-permeability soil cap over the backfilled trenches
- Constructing surface water drainage ditches, an infiltration pond, and other features to divert surface water and provide positive drainage away from the capped area
- Constructing infrastructure near the South Portal for a contingent groundwater treatment system
- Hydroseeding the cap and other disturbed areas
- Constructing fences around the perimeter of the capped area

Construction activities are fully described in the approved Plans and Specifications and may include activities not listed in the summary above.

This CQA Plan is intended to function independently of the construction contractor's Quality Control (QC) program. The construction contractor's QC activities during construction, including test methods, location, frequency, and similar requirements, may be established at the contractor’s own discretion and are independent of this CQA Plan. The contactor’s QC program does not waive his responsibility to comply with all provisions of this CQA Plan and the approved construction documents.

1.3 Change Control Procedures

This CQA Plan and any implementing procedures are subject to the following change control procedures. Requests for modifications to the CQA Plan shall be made by memorandum from the CQA Manager to the Golder

Associates Inc. (Golder) Project Manager, with copies to the Construction Manager. If the modification is acceptable, the modified CQA Plan will be distributed as a unique revision to all parties who received the original CQA Plan. The CQA Manager will collect and destroy all copies of previous versions, except that one copy of each revision shall be maintained in the project file.

2.0 PROJECT ORGANIZATION

This section describes the project organization for the Landsburg Remediation Project. The following sub-sections list the organizations involved in the remedial construction and describe their respective roles in construction activities and the protocol for interactions between organizations. The organization chart for this project is shown on Figure 2-1.

Designation of a party by title implies either the specific individual or his \ her authorized representative.

2.1 PLP Group

The Landsburg Potentially Liable Parties (PLP) Group will be responsible for implementing remedial action (RA) activities at the Site in accordance with the approved Cleanup Action Plan (CAP) and design documents. They will designate a PLP Project Manager (PLPPM), who will have final authority to supervise and direct RA activities as appropriate. The PLPPM or his designee will interface with the regulatory agencies as necessary.

2.2 Owner

The Owner of the physical property where the work will be performed is Palmer Coking Coal Company, LLP. However, all coordination and other interactions with the Owner shall be through the PLPPM or approved designee.

2.3 Site Health and Safety Officer

The Site Health and Safety Officer (HSO) will observe construction activities and verify that all pertinent health and safety requirements as described in the site-specific Health and Safety Plans (HASPs) are being implemented. The HSO shall not be an employee or subcontractor of the Construction Contractor. Actions by the HSO shall not relieve the Contractor or any other party of their responsibilities under the HASPs. The role of HSO may be combined with another role such as Construction Manager, with a single individual performing both activities.

The Site HSO will be responsible for:

- Ensuring that all site personnel have been trained in accordance with the requirements of the HASP
- Verifying that documentation for specific specialized training (e.g., OSHA 40-hour HAZWOPER, equipment-specific training, etc.) has been received for all personnel involved in the associated activities
- Reviewing job hazard analyses to verify that risks and mitigating measure have been identified
- Conducting daily “tailgate” meetings prior to beginning work to discuss the planned activities for the day and any safety considerations
- Periodically inspecting equipment and operations to verify compliance with the HASP

A complete description of the duties and responsibilities of the HSO is contained in the HASP for this project.

2.4 Golder Associates Project Manager

The Golder Project Manager (PM) will oversee all work performed by other Golder personnel, including engineering support during construction, safety, and CQA activities. The Golder PM will also coordinate as directed with the regulatory agencies on behalf of the PLP Group to ensure that permitting requirements are satisfied. The Golder PM will report directly to and work closely with the PLPPM.

2.5 Construction Manager

The Construction Manager (CM) will serve as the single point of contact for all other parties listed in this section and will in general coordinate activities on site during construction. Duties will include:

- Schedule necessary meetings between parties and distribute meeting minutes as appropriate
- Receive submittals from the Contractor, review or distribute to the appropriate party as appropriate, and provide results to the Contractor
- Serve as the Contractor's point of contact for design clarification and change requests, pay requests, and other communications from the Construction Contractor
- Notify the CQA Engineer of activities that require on-site CQA observation or testing

The CM will report directly to the Golder Project Manager.

2.6 CQA Manager

The CQA Manager will directly supervise the quality assurance functions on site, ensure that required inspections are performed at the appropriate locations and times, direct the location and frequency of CQA tests, monitor the results of tests, verify that deficiencies have been corrected, and prepare documentation of construction activities. The CQA Manager will also be responsible for training of all CQA inspection personnel on requirements, procedures, scheduling, and inspection activities.

The CQA Manager will report directly to the Golder Project Manager, but will also notify the CM, who will be responsible for implementing corrective actions, of any deficiencies or changes to CQA activities.

The CQA Manager shall possess, as a minimum, a Bachelor's degree in civil or construction engineering, engineering geology, or a closely related discipline, and shall have sufficient practical, technical, and managerial experience to successfully direct the CQA activities discussed in this plan.

2.7 CQA Personnel

CQA Personnel include any personnel performing CQA inspection and testing activities under the direct supervision of the CQA Manager. As a minimum, CQA personnel shall have a high school diploma and at least two years of construction-related experience for earthworks. Equivalent qualifications may be approved by the CQA Manager on a case-by-case basis.

Prior to beginning project activities, CQA personnel shall receive any training required by the project Health and Safety Plan, specialty training for testing and inspection activities, and any other training that may be required to perform assigned activities. Training shall be performed under the supervision of the CQA Manager or Design Engineer and shall be documented by previous applicable experience listed on the individual's resume or in a memo listing date of training and topics covered, together with the signatures of the trainee and the person administering the training.

2.8 Design Engineer

Golder prepared the design of this project and will act as Design Engineer during construction. The Design Engineer will work under the direction of the Golder PM and will interface with the CM and CQA Manager as required. Duties will include clarifying and interpreting the plans and specifications, incorporating new or changed requirements, reviewing submittals as requested by the CM, and reviewing CQA documentation.

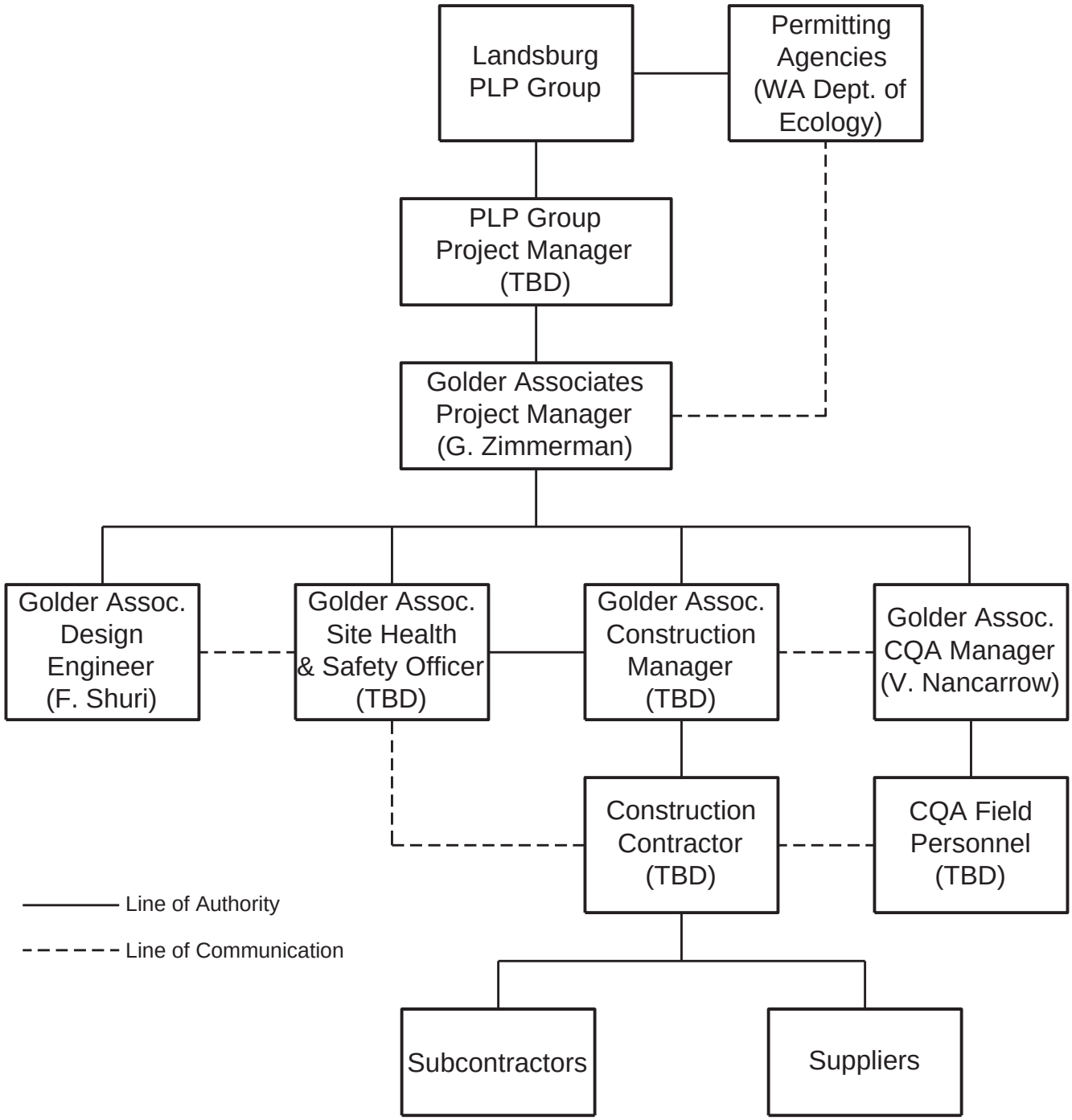
2.9 Construction Contractor

The Construction Contractor will perform all work activities associated with actual remedial construction. The Contractor will be responsible for directing and supervising any subcontractors.

The Construction Contractor will communicate directly with the CM for all pay, contractual, design, and similar matters. The Construction Contractor shall have a Site Supervisor on site at all times to serve as point-of-contact. The Contractor's Site Supervisor shall have authority to direct all of the Contractor's and subcontractor's operations.

The Contractor may implement his own internal Quality Control (QC) activities as he feels necessary to ensure the progress and quality of the work. However, should differences between QA and QC test results arise, the CQA test results shall take precedence over QC results. CQA test results will be made available to the Contractor on a timely basis; however, the use of such results shall not relieve him of the responsibility for performing any additional testing necessary to ensure the quality and progress of the work.

The Contractor shall provide all required access and other logistical support for CQA activities, both before and during construction.



Line of Authority

Line of Communication

FIGURE **2-1**

Project Organization Chart

Landsburg Mine Site Remediation - CQA Plan

3.0 PROJECT MEETINGS

This section discusses various progress and status meetings to be held throughout remedial construction activities. The intent of the meetings is to ensure satisfactory communication between all organizations involved in the remedial construction.

3.1 Pre-Construction CQA Meeting

A meeting will be held following the award of the construction contract, but prior to the start of construction, to clarify all CQA procedures and requirements for Landsburg Mine Site MTCA Remediation Construction. At a minimum, the meeting shall be attended by a representative of the PLPPM, the CM, the CQA Manager, the Design Engineer, and the Construction Contractor. The topics of this meeting shall include but not be limited to:

- Reviewing the responsibilities of each organization
- Reviewing lines of authority and communication for each organization
- Providing each organization with all relevant CQA documents and supporting information
- Familiarizing each organization with the CQA Plan and its role relative to the design criteria, plans, and specifications
- Determining any changes to the CQA Plan that may be needed
- Discussing the established procedures or protocol for observations and tests, including sampling strategies
- Discussing the established procedures or protocol for handling construction deficiencies, repairs, and retesting, including "stop work" conditions
- Reviewing methods for documenting and reporting inspection data
- Reviewing methods for distributing and storing documents and reports
- Reviewing Contractor support requirements for CQA activities
- Reviewing the proposed project schedule

The meeting will be documented and minutes will be transmitted to the required distribution and meeting attendees.

3.2 Pre-Construction Health and Safety Meeting

Prior to the start of construction, a health and safety meeting will be held to orient all on-site personnel with the project health and safety requirements. This meeting will be led by the HSO and will cover potential hazards on the project, mitigating measures, training requirements, safety procedures, and other topics. A complete discussion of the health and safety meeting is included in the Health and Safety Plan for this project.

3.3 Weekly Progress Meetings

Weekly progress meetings will be held at the site. At a minimum, weekly progress meetings will be attended by the CM, the CQA Manager, the HSO, the Construction Contractor, and other major subcontractors performing significant activities on site. The purpose of the meeting is to:

- Review the previous week's activities and accomplishments

- Review pay requests, claims, change orders, delays, and similar items
- Review any safety issues, training, and other related topics
- Review planned activities for the upcoming week
- Finalize resolution of problems from the previous week
- Discuss any potential problems with the work planned for the upcoming week

This meeting will be documented and minutes will be transmitted to the required distribution and meeting attendees.

3.4 Problem or Work Deficiency Meetings

Meetings will be convened as necessary to address inspection deficiencies and non-conformances. To the extent possible, deficiencies observed during construction will be brought to the attention of the Construction Contractor on a real-time, informal basis. If the requested corrective action is not completed to the CQA Manager's satisfaction, the deficiency shall be considered a nonconformance, documented on a nonconformance report (NCR) form, and submitted to the Design Engineer for resolution.

4.0 HOLD POINTS

Mandatory hold points will be established for certain key activities as described in the design documents and listed in Table 4-1. At these points, the Construction Contractor shall cease work on the affected activity until it has been reviewed and accepted by the CQA Manager. The schedule for hold points will be determined when the Construction Contractor develops his construction schedule for the project. The hold points listed in Table 4-1 are in addition to any submittal requirements prior to or during construction as described in the technical specifications.

Table 4-1: Landsburg Mine Site Remediation - Hold Points

Hold Point No.	Description	Release Criteria
General	Prior to use or placement of any material	Require submittals have been received and demonstrate that material conforms to the requirements of the specifications
1	Prior to any ground disturbing activities on site	Erosion and Sediment Control (ESC) measures installed and functional in accordance with ESC Plan
2	Prior to placing gravel subbase for new access road	Survey data demonstrates that road profile is correct
3	After tree removal and brush\debris removal in trenches, prior to placing trench backfill	All trees, brush, and debris that could cause excessive cap settlement have been removed
4	Prior to placing trench backfill	Backfill physical test results verify that proposed materials comply with specifications

Hold Point No.	Description	Release Criteria
5	Prior to placing trench backfill	Analytical test results verify that proposed backfill materials are uncontaminated
6	After completing regrading of trench backfill in second year, prior to placing low-permeability soil cap	Survey data demonstrates that design grades have been achieved
7	Prior to placing low-permeability soil over trench backfill	Soil physical test results confirm that specified permeabilities can be achieved using proposed materials
8	Prior to placing low-permeability soil over trench backfill	Analytical test results verify that proposed low-permeability soil materials are uncontaminated
9	During low-permeability cap soil placement, prior to placing the next lift	Nuclear gage test results confirm that compaction and moisture content of placed lift are within specified ranges
10	Prior to placing vegetative soil over low-permeability soil cap	Survey data demonstrates that minimum low-permeability soil cap thickness and design grades have been achieved
11	Prior to placing vegetative soil over low-permeability soil cap	Analytical test results verify that proposed vegetative soil materials are uncontaminated
12	Prior to seeding cover surface	Potholing verifies that minimum vegetative soil layer thickness is present
13	Prior to placing ditch lining or backfilling infiltration trenches	Survey data demonstrates that ditch and trench profiles are correct

5.0 INSPECTION ACTIVITIES

This section describes the inspection activities (observations and tests) that will be conducted by the CQA Personnel during construction of the Landsburg Mine Site MTCA Remediation activities. The CQA Manager may increase or decrease the frequency of inspection and testing on the basis of experience as the project progresses.

5.1 General

5.1.1 Specifications

CQA Personnel shall familiarize themselves with the requirements of the Technical Specifications for this project prior to beginning CQA activities.

If discrepancies between this CQA Plan and the Technical Specifications are identified, the Design Engineer shall be notified and shall determine which requirements shall apply. If the Design Engineer is not available, the requirements of the Specifications shall prevail.

5.1.2 Submittals

Review submittals for all materials as identified in the Specifications to verify that the specified requirements are satisfied.

5.1.3 Earth Material Changes

Determining whether an earth material has changed significantly for purposes of additional testing as listed below shall be made in consultation with the Design Engineer, based on laboratory test results when available, and in general accordance with the procedures contained in ASTM D2488.

5.1.4 Earth Materials Contamination

Earth materials used for backfill, soil cap, surface water management features, and other applications shall be free of contamination above acceptable limits, as listed in the Specifications. Source areas for backfill and soil cap material have not yet been identified. As each source area is identified, a work plan describing the proposed due diligence activities and Sampling and Analyses Plan (SAP) to ensure that the imported fill material will not introduce contaminants, including the potential to leach contaminants to the groundwater, will be submitted to Ecology for review and approval. Due to the extensive characterization that will be required to accept material for use at the Site, the minimal number of sources necessary to provide the required quantities of fill and capping material will be used. The level of CQA inspection will differ depending on the source of the earth material, as described in the following subsections.

5.1.4.1 Materials from Off-Site Commercial Sources

Earth materials may be obtained from off-site commercial sources, such as gravel pits or quarries, whose regular business is to supply these types of products. For materials from such sources, CQA Personnel shall perform the following inspection activities:

- Obtain and review any analytical testing data from the facility operator on the products proposed for use on this project.
- Visually inspect the source and off-site stockpile area(s) of the proposed backfill material.
- If there is no analytical testing data for a particular product or specified parameter, and visual inspection of the material source area (e.g., gravel pit or quarry) indicates a potential for contamination, collect samples and test the material for the parameters listed in the Specifications. Details of sampling and testing procedures shall conform to the requirements of the SAP prepared specifically for the identified commercial source. Review the test results to confirm that contaminants do not exceed the specified limits.

5.1.4.2 Materials from Other Sources

For purposes of this subsection, other sources of earth materials include but are not limited to the following:

- Off-site borrow areas on private property
- Off-site construction projects generating excess soil for disposal
- On-site mine waste areas
- On-site locations greater than 100 feet from the nearest edge of a trench being backfilled

The CQA Manager will make the final determination of whether a material source is subject to the requirements of this subsection.

Materials from other sources will likely require a higher level of evaluation (including a more extensive sampling and analysis program) than that required for a commercial souce. The CQA characterization details will be provided in the work plan and SAP submitted for each identified source area. CQA Personnel shall at a minimum perform the following inspection activities:

- Obtain historical records for the source location to the extent practical and review to identify any industrial processes that could have resulted in contamination.
- Visit the source location to determine whether industrial processes occurred in the past, to screen potential soil material locations with a portable photoionization detector (PID) to determine if volatile organic compounds are present, and to collect samples for analytical testing.
- Collect samples and test the material for the parameters listed in the SAP. Details of sampling and testing procedures, including sampling frequencies, shall conform to the requirements of the Sampling and Analysis Plan for the particular material source.
- Screen samples collected for analytical testing with the PID to develop correlations between VOC concentrations in the earth materials and PID readings.
- Review the test results to confirm that contaminants do not exceed the specified limits.
- During construction, visually observe earth materials at the placement location to confirm that they are similar to the materials previously tested. Randomly screen incoming truckloads of material with the PID at an overall rate of not less than every 1 in 5 truckloads to verify that any readings are below the established correlations for acceptable levels of VOC concentrations.

5.2 Trench Backfill

CQA Personnel shall perform the following observations on trench backfill materials:

Table 5-1: CQA Observations - Trench Backfill

Property	Test Designation	Frequency
During Placement		
Material is consistent with tested sample	Visual observation	Continuous
No unsuitable materials are placed	Visual observation	Continuous
Compaction is applied	Visual observation	Continuous

5.3 Low-Permeability Soil

CQA Personnel shall perform the following physical property tests and observations on low-permeability soil materials:

Table 5-2: CQA Tests and Observations – Low-Permeability Soil

Property	Test Designation	Frequency
Prior to Placement		
Particle Size	ASTM D6913	1 per 1,000 cy or 1 per material type (a)
Moisture-Density Relationship	ASTM D1557	1 per 2,000 cy or 1 per material type (a)
Permeability	ASTM D5084	1 per 5,000 cy or 1 per material type (a)
During Placement		
Material is consistent with tested sample	Visual observation	Continuous
No unsuitable materials are placed	Visual observation	Continuous
Lift thickness does not exceed specified maximum	Visual observation	Continuous
In-place soil density and moisture content (nuclear gage)	ASTM D6938	1 per 1,000 sf per lift
Soil moisture content	ASTM D2216 or ASTM D4643	1 per 10 nuclear gage tests

Notes:

(a) whichever results in the greater number of tests

5.4 Other Earth Materials

Other earth materials include but are not limited to the following:

- Road base and surface courses
- Ditch lining
- Backfill around pipes and culverts
- Armor rock

For other earth materials that are specified as Washington State Department of Transportation (WSDOT) standard materials and are obtained from commercial off-site sources, such as gravel pits or quarries, whose regular business is to supply these types of products, compliance with the project physical property specifications may be demonstrated by the supplier's standard QC test results. For on-site sources or commercial sources that do not have the required test data, CQA personnel shall obtain and test samples of the material as listed in Table 5-3. Note that the requirements of subsection 5.1.3 apply in addition to the requirements of this subsection.

Table 5-3: CQA Tests and Observations – Other Earth Materials

Property	Test Designation	Frequency
Prior to Placement		
Particle Size	ASTM D6913	1 per 100 cy or 3 per material type (a) (b)
During Placement		
Material is consistent with tested sample	Visual observation	Continuous
No unsuitable materials are placed	Visual observation	Continuous
Compaction is applied	Visual observation	Continuous

Notes:

(a) whichever results in the greater number of tests

(b) materials from commercial sources which can provide acceptable particle size data are exempt from this testing requirement.

5.5 Vegetative Soil and Seeding

Prior to placement, CQA Personnel shall visually inspect vegetative soil sources to verify that the maximum particle size is not exceeded. Collect samples at a frequency of 1 per 250 cy or 3 per vegetative soil source, whichever results in the greater number of samples, and test in accordance with ASTM D2974 Method C to verify that the minimum organic material content is present.

During placement, CQA Personnel shall observe the operations to verify that the soil material does not change significantly and that compaction of the vegetative soil layer is minimal.

After placement, CQA Personnel shall verify that the minimum vegetative soil thickness is present by potholing at the frequency listed in the Specifications.

During seeding, CQA Personnel shall observe seeding operations to confirm that all materials have been placed and that all designated areas have received a uniform application of materials in accordance with the application rates listed in the Specifications.

6.0 DOCUMENTATION

6.1 Daily Field Reports

Daily field reports will be completed by each of the CQA Personnel when they are on site. CQA Personnel will be assigned field books, which will be labeled with a unique number issued by the CQA Manager. CQA Personnel will record all field observations and the results of field tests either in their assigned field book or on standard field data sheets. After each book is filled (or at the end of the project), the field book will be returned to the CQA Manager and routed to the project files.

Each page of the field book shall be numbered, dated, and initialed by CQA Personnel. At the start of a new work shift, CQA Personnel shall list the following information at the top of the page:

- Job Name
- Job Number
- Date
- Name
- Weather conditions
- Page number (if pages are not pre-numbered)

The remaining individual entries shall be prefaced by an indication of the time at which they occurred. If the results of test data are being recorded on separate sheets, it shall be noted in the field book.

Entries in the field book shall include but not be limited to the following information:

- Reports on any meetings held and their results
- Equipment and personnel being used in each location, including subcontractors
- Descriptions of areas and operations being observed and documented
- Description of materials delivered to the site, including any quality verification (vendor certification) documentation
- Descriptions of materials incorporated into construction
- Calibrations, or recalibrations, of test equipment, including actions taken as a result of recalibration
- Decisions made regarding use of material and/or corrective actions to be taken in instances of substandard quality
- Unique identifying sheet numbers of inspection data sheets and/or problem reporting and corrective measures reports used to substantiate the decisions described in the preceding item

At the end of each day, CQA Personnel shall summarize the day's activities on a Daily Field Report form (see Attachment A). The field report shall include a brief summary of the day's activities and photographs of key activities and shall highlight any unresolved issues that must be addressed by the CM or CQA Manager the following day. In addition, the summary report shall reference the field book number and page numbers that cover that day's activities. The summary field reports shall be turned into the CQA Manager at the end of each day.

The CQA Manager shall review and initial each daily field report before distribution. Distribution of the daily reports shall be as follows:

- Original shall be filed in Golder’s Redmond, Washington office
- One copy transmitted to the PLPPM
- One copy transmitted to the Golder PM
- One copy transmitted to the Design Engineer
- A summary of the daily reports will be provided to Ecology in the monthly progress reports

6.2 Requests for Information

If during the course of construction questions arise from the Construction Contractor regarding interpretation of the drawings and/or specifications, a Request for Information (RFI) form (see Attachment A) will be completed. The Contractor shall inform the CM of the requested information, and the CM shall prepare and route the RFI to the Design Engineer. The Design Engineer will obtain input from the CQA Manager on any questions that involve project quality. The clarification shall be documented on the RFI form, and routed to the Contractor, the PLPPM, the Golder PM, the CQA Manager, and the project files for record.

6.3 Design Changes

Changes to the specifications or drawings may be necessary to accommodate unforeseen field conditions, alternative materials or methods that could improve the project schedule or lower costs, or for other reasons. Requests for such changes shall be submitted in writing to the CM, who shall refer them to the PLPPM, the Golder PM, and the Design Engineer for disposition. Technically significant design changes, i.e., those that may affect the potential effectiveness of a particular design feature, may also require review and approval by the Washington State Department of Ecology; the PLPPM and Golder PM will determine whether Ecology review is required.

The CQA Manager shall be involved in the design change process to ensure that appropriate quality requirements are included. Design changes shall be documented on Engineering Change Notice (ECN) Forms (see Attachment A), and routed to the PLPPM, Golder PM, Design Engineer, Contractor, CQA Manager, and other affected parties. A copy of the ECN shall also be placed in the project files for record.

6.4 Nonconformance Reporting

A nonconformance is considered to be a deficiency in characteristics, documentation, or procedures that renders the quality of an item or activity unacceptable or indeterminate. All potentially nonconforming situations shall be brought to the attention of the Design Engineer for concurrence prior to initiation of the NCR. If a deficiency cannot be repaired or replaced to the satisfaction of the CQA Manager within the guidelines established by this CQA Plan, then such a deficiency shall be considered a nonconformance and shall be documented on an NCR form (see Attachment A) and referred to the Golder PM, the PLPPM, and the Design Engineer for disposition and initiation of corrective action processes. The CQA Manager will determine whether a given condition constitutes a deficiency and whether a nonconformance report should be initiated.

All documentation relating to NCR situations shall be retained in the project quality records.

6.5 Final Documentation

At the completion of remedial construction, a final construction summary and report shall be prepared by the CQA Manager. The summary report shall include documentation of each construction component monitored by CQA Personnel and the results of all testing. At a minimum, it shall include the following components:

- A signed and stamped statement by the Design Engineer that the project has been constructed in substantial conformance with the approved construction documents.
- A narrative text listing the contractors and subcontractors performing the construction, a description of the major work activities, and a chronology of the work.
- A summary of CQA activities and results, including numbers and types of tests, and a discussion of any data anomalies.

- Attachments providing all supporting information, including but not limited to:
  - As-built drawings
  - Submittal data and acceptance forms
  - Laboratory test data
  - Field test data
  - Daily field reports
  - All RFIs, ECNs, and NCRs
  - Pertinent photographic or video records in addition to those contained in the daily field reports
  - All other pertinent documentation

6.6 Records Management

At a minimum, all construction, design, permitting, correspondence, and other documents associated with the project shall be stored in Golder's Redmond office. Electronic files shall be stored in an organized manner on Golder's secure server system and periodically backed up in accordance with standard data management procedures.

7.0 REFERENCES

American Society for Testing and Materials (ASTM)

D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))

D2216 Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedures)

D4643 Standard Test Method for Determination of Water Content of Soil and Rock by Microwave Oven Heating

D5084 Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

D6913 Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

D6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

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ATTACHMENT A

CONSTRUCTION QUALITY ASSURANCE FORMS

Daily Field Report Form

Request for Information Form

Engineering Change Notice Form

Nonconformance Report

Daily Field Report # xx

Date:	**On-Site:** xxxx PST	**Off-Site:** xxxx PST
Project: Landsburg Mine Site MTCA Remediation Project		
Location: Ravensdale, WA	**Job No.:**	
Client: Landsburg Mine Site PLP Group	**Contractor:** [TBD]	

High Temperature:	**Wind:**
Cloud Cover:	**Precipitation:**

Personnel On Site/Company	**Responsibility**
[TBD]	Construction Manager
[TBD]	Contractor Superintendent
[TBD]	CQA

1.0 EQUIPMENT ON SITE:

- [List major equipment]

2.0 ACTIVITIES:

- Safety
  - [List safety meetings, topics discussed, potential hazards related to planned work activities for the shift]
- Work Activities [List work activities performed on site during shift]

3.0 PROBLEMS AND RESOLUTIONS:

- [Discuss any technical or administrative problems encountered during the shift and the resolutions, including action items and responsibilities]

4.0 SUMMARY OF H&S ISSUES

- [Discuss any health and safety issues that occurred on site including corrective actions]

5.0 PHOTO LOG

- [Attach photos showing key activities and any problems]

[Photos with captions]

GOLDER

REQUEST FOR INFORMATION (RFI)	RFI No. RFI-00x	Page No. Page 1 of x

Contract No.	Contract Title	Prime Contractor
Golder Project No. 923-1000-xx Contractor Project No. xxx	Landsburg Mine Site MTCA Remediation Project	xxx

Contractor Request for Information

Requested By:	Date Requested:	Potential Cost Impact: Yes ☐ Potential Schedule Impact: Yes ☐
xxx	xxx	

RFI Subject:	
Feature of Work:	
Specification Sections:	
Drawings:	

Information Requested:

Golder Construction Manager Response

Answered By: xxx Title: xxx	Date RFI Received: xxx	Date RFI Answered: xxx

Response to Contractor:

Distribution:

☑ xxx	PLPPM	☑ xxx	Contractor
☑ G. Zimmerman	Golder PM	☐ xxx	xxx
☑ V. Nancarrow	Golder QA Manager	☐ xxx	xxx
☑ F. Shuri	Design Engineer	☑ Golder Project Files	

ENGINEERING CHANGE NOTICE

Date: xxx	**ECN No.:** **00x**
Project: Landsburg Mine Site MTCA Remediation Project	**Project No.:** 923-1000-xx.xxx
Engineering Change Notice Name: xxx	**Contract No.:** xxx
Project Feature:	
Affected Documents:	
Description of Change:	
Justification for Change:	
☐ Significant Design Change – Regulatory approval of this ECN is required prior to construction ☑ Insignificant Design Change – No regulatory approval is required	
Prepared by:	
Approvals:	

Golder Associates Design Engineer: ..... Date: .....

Golder Associates Project Manager: ..... Date: .....

Golder Associates Construction Manager: ..... Date: .....

PLP Project Manager: ..... Date: .....

Regulatory Project Manager: .....NA..... Date: .....

Distribution:

☑ xxx	PLPPM	☑ xxx	Contractor
☑ G. Zimmerman	Golder PM	☑ xxx	Golder CM
☑ V. Nancarrow	Golder QA Manager	☐ xxx	xxx
☑ Frank Shuri	Design Engineer	☐ xxx	xxx
☐ xxx	Ecology Project Manager	☑ Golder Project Files	

NONCONFORMANCE REPORT

Landsburg Mine Site MTCA Remediation Project	**NCR No. 00x**
Golder Project No.: 923-1000-xx.xxx	☐ **Stop Work**
Initiated by: xxx	Date Initiated: xxx
Nonconforming Condition:	
Golder Quality Assurance Manager:	Date: .....
Proposed Corrective Action:	
Final Implementation:	
Approved by:	
Golder Associates Quality Assurance Manager:	Date: .....
PLP Project Manager:	Date: .....
Golder Associates Project Manager:	Date: .....
Golder Associates Design Engineer:	Date: .....
Golder Associates Construction Manager:	Date: .....
Construction Manager:	Date: .....

Distribution:

☑ **xxx**	PLPPM	☑ xxx	Contractor
☑ **G. Zimmerman**	Golder PM	☐ xxx	xxx
☑ **V. Nancarrow**	Golder QA Manager	☐ xxx	xxx
☑ Frank Shuri	Design Engineer	☐ xxx	xxx
☑ **xxx**	Golder CM	☑ Golder Project Files	

APPENDIX D

Design Calculations

TECHNICAL MEMORANDUM

DATE August 14, 2018 **Project No.** 9231000005

TO Landsburg Mine Site PLP Group

CC Gary Zimmerman

FROM Scott Stoneman, PE
Frank Shuri, PE

EMAIL sstoneman@golder.com

LANDSBURG MINE SITE MTCA REMEDIAL ACTION – STORMWATER ANALYSIS AND DESIGN

This technical memorandum presents the stormwater analysis and design for the Landsburg Mine Site (Site) Model Toxics Control Act (MTCA) remedial action. The stormwater analysis and design follows the substantive requirements in the King County 2016 *Surface Water Design Manual* (SWDM)[1] and is presented in the general format of a technical information report (TIR) as described in the SWDM. It should be noted that MTCA exempts remedial actions from the procedural requirements of certain state and local laws if conducted under a Consent Decree. Here, the remedial actions will be implemented under a Consent Decree and is exempt from a King County Clearing and Grading Permit which includes requirements under the SWDM. However, the Landsburg Mine Site PLP Group have agreed to ensure compliance with the substantive regulatory requirements.

1.0 PROJECT OVERVIEW

The Site consists of a former underground coal mine located approximately 1.5 miles northwest of Ravensdale in a rural area of southeast King County, Washington. The Site is situated directly south and east of the SE Summit-Landsburg Road, and north of the SE Kent-Kangley Road. The Cedar River passes within approximately 700 feet of the Site to the north. The location of the Site is shown in Figure 1.

[1] 2016. King County. Surface Water Design Manual.

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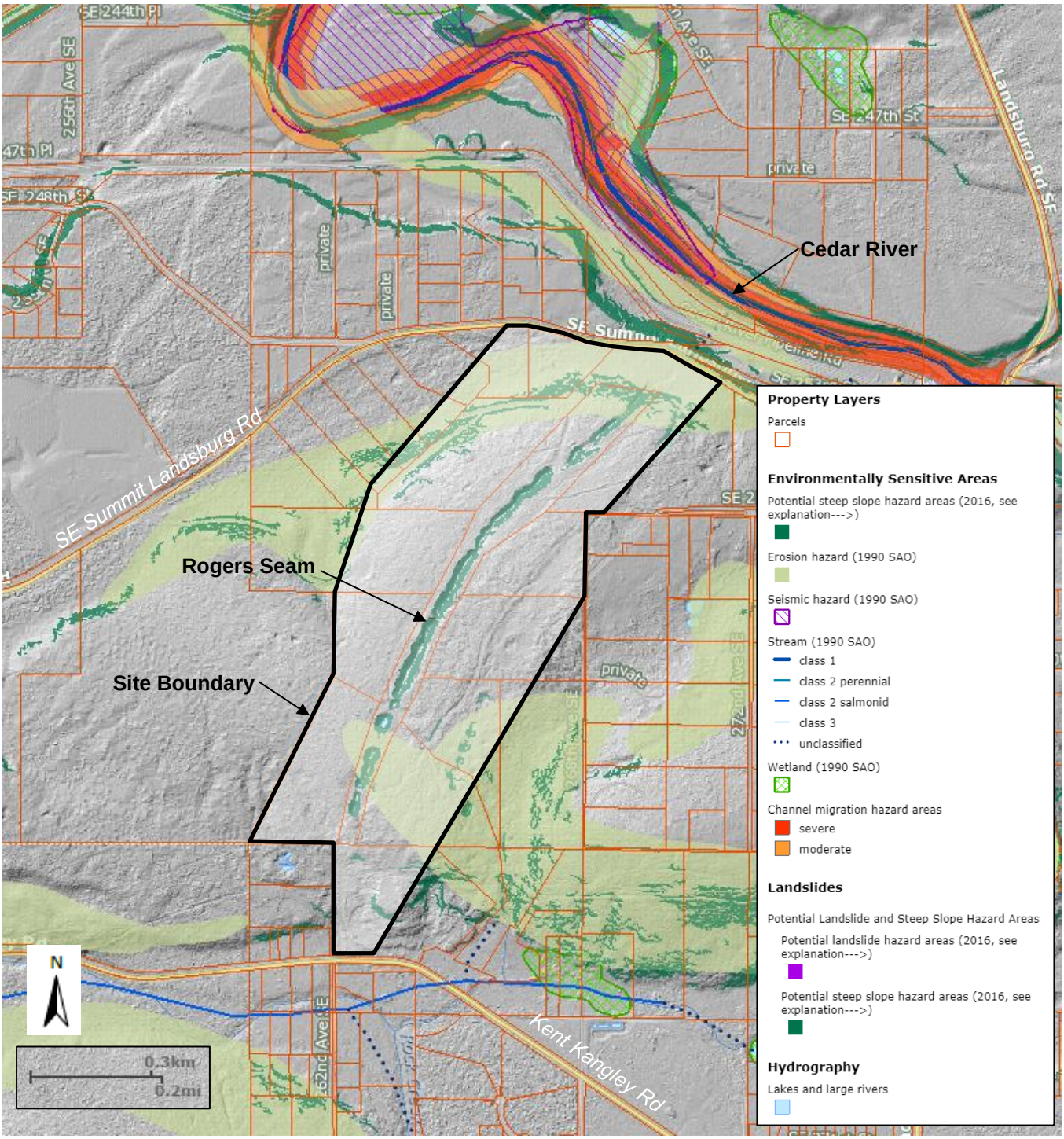

Figure 1: Site Location Map

The coal seam under study at the Site is named the Rogers Seam, which had active mining operations from 1959 to 1975. The mined section of the Rogers Seam has a near vertical dip and consists of coal and interbedded shale approximately 16 feet wide. The mined section is about a mile in length running in a northeast - southwest

direction and is mapped as steep slopes in Figure 1. Figure 1 is from the King County iMap[2] web service and also shows environmentally sensitive areas and landslide areas.

The proposed MTCA remedial action includes backfilling the northern portion of the Rogers Seam up to the natural ground surface and placing a soil cap on top of the backfill to reduce potential infiltration. Figure A1 (attached) presents the proposed project features, proposed and existing contours, and subbasin delineation. The cap will be vegetated and graded (between 2% and 10% slope) to shed runoff. Most of the stormwater from the cap will be collected in a pair of parallel ditches that will drain to the northeast (Subbasin 001). Stormwater from the ditches will then be conveyed through a surface pipe down a steep slope (greater than 40%) to the northeast. At the toe of the slope, it is proposed to infiltrate stormwater, up to the 100 year recurrence interval, into an infiltration pond where recessional outwash soils naturally exist.

Figure 2 presents the Natural Resources Conservation Service (NRCS) Soil Survey as downloaded through the NRCS Web Soil Survey[3]. The Site is mapped primarily as Alderwood (Ag) type soils, which is hydrologic soil group (HSG) rating of C. These are glacial till soils described as gravelly sandy loam. At the lower elevations along the north and southern edges of the Site the soils are mapped as Everett (Ev) soils, which are recessional glacial outwash soils and described as very gravelly sandy loam. The Everett soils have a HSG rating of A.

[2] 2018. King County. iMap, https://gismaps.kingcounty.gov/iMap/. Accessed 3/6/2018.

[3] NRCS. 2018. Web Soil Survey, https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. Accessed 3/6/2018.

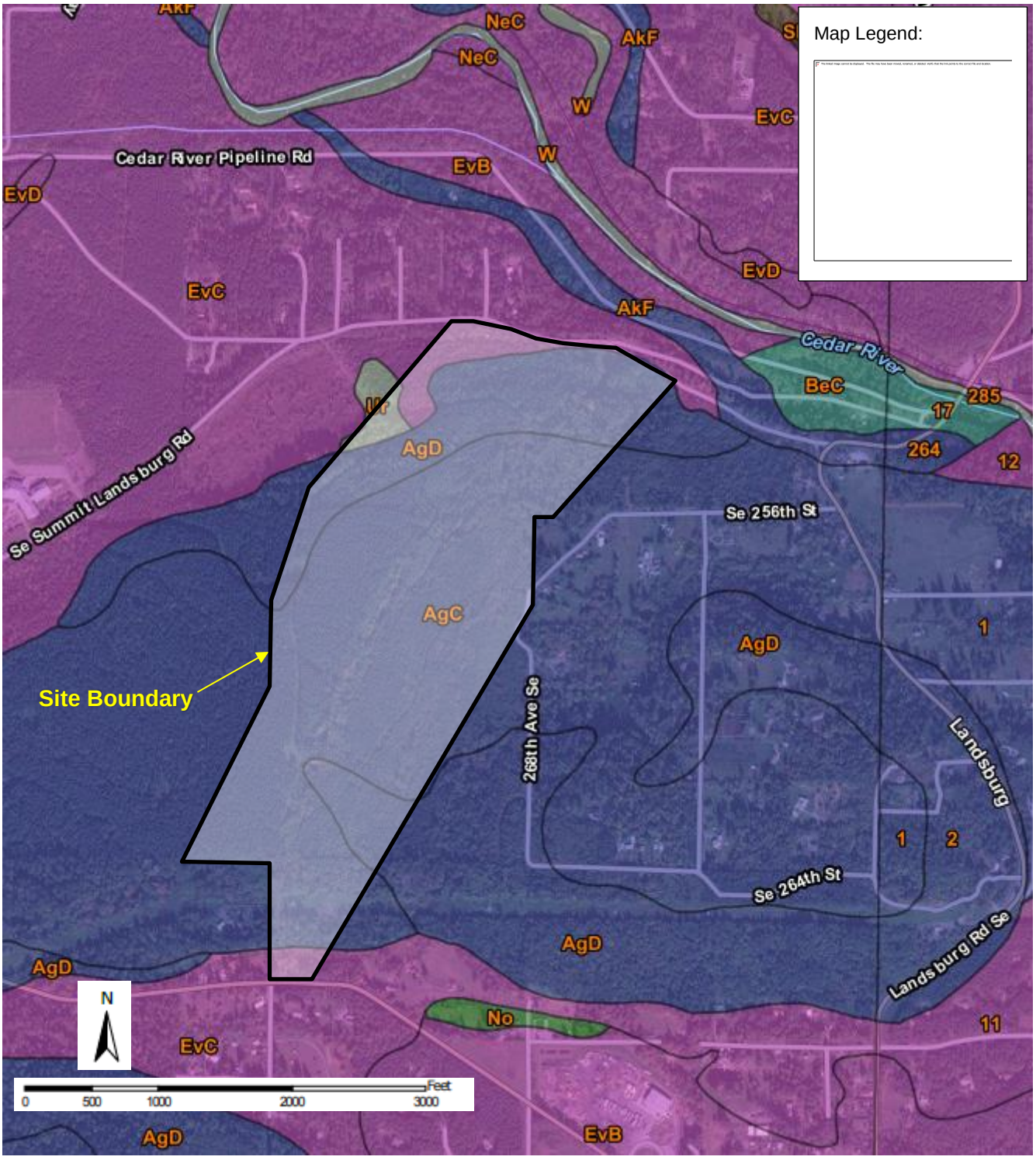

Figure 2: Soils Map

2.0 CONDITIONS AND REQUIREMENTS SUMMARY

As mentioned in the introduction, MTCA exempts remedial actions from the procedural requirements of certain state and local laws if conducted under a Consent Decree. Here, the remedial actions will be implemented under a Consent Decree and is exempt from a King County Clearing and Grading Permit which includes requirements under the SWDM. However, the Landsburg Mine Site PLP Group have agreed to ensure compliance with the substantive regulatory requirements.

This project is proposed to have more than 7,000 square feet of land disturbing activity and would typically require a Full Drainage Review. A Full Drainage Review requires the applicant to demonstrate that the proposed project complies with the all nine core requirements and all five special requirements of the SWDM.

3.0 OFFSITE ANALYSIS

It is proposed that this project is exempt from *Core Requirement #2 – Offsite Analysis* because there is sufficient information to conclude that the project will not have a significant adverse impact on the downstream and/or upstream drainage system. In the existing conditions, nearly all runoff from the project area is infiltrated down into Rogers Seam. There is currently no evidence of surface runoff from the Site. In proposed conditions, all runoff up to the 100-year event from Subbasin 001 will be infiltrated in an infiltration pond. Runoff from Subbasins 002, 003 and 004 are estimated to increase less than 0.15 cfs from pre-developed conditions during the 100-year peak discharge. Finally, capping within Subbasins 005A and 005B and the construction of the south access road will all meet the SWDM's full dispersion requirements.

4.0 FLOW CONTROL, LOW IMPACT DEVELOPMENT (LID) AND WATER QUALITY FACILITY ANALYSIS AND DESIGN

4.1 Existing Site Hydrology

The Site project area extends over the crest of a gently rounded hill. The top of the hill is approximately 810 feet and the base is approximately 600 feet along the north and south edges. Most of the Site is forested with the exception of a few gravel access roads and parking area at the northeast part of the site. There are no streams, ditches or pipe system connected to the Site project area (Figure A1).

The Site has been divided into two main threshold discharge areas (TDAs). In historic conditions (pre-mining), most of the delineated subbasins (001, 002, 004, and 005A&B) generally drained to the north as potentially overland sheet flow only during intense rainfall events (North TDA). Subbasin 003 drained to the south (South TDA). However, after mining (existing conditions), much of the precipitation falling in the proposed area that will be capped currently drains into Rogers Seam, but it is still applicable to consider the two TDAs based on the surrounding topography (Figure A1).

The Western Washington Hydrologic Model (WWHM) was run at a 15-minute time step. For predeveloped conditions, forest land cover was assigned to all subbasins as historic conditions (prior to any development in the Puget Sound Region). Moderate slope (5-15%) was assumed for each of the subbasins. WWHM input and results are presented in Attachment B. Table 4-1 summarizes the pre-developed site hydrology (under historic site conditions).

Table 4-1: Pre-developed Site Hydrology

Subbasin ID	HSG Rating	Forested Area (ac)	100-year Discharge (cfs)
001	C	12.40	2.30
002	C	4.38	0.81
003	C	1.43	0.26
004	C	0.47	N.A.[1]
005A	C	0.24	N.A.[1]
005B	C	0.61	N.A.[1]

Notes: [1]Discharge not computed because meets full dispersion criteria.

4.2 Developed Site Hydrology

Figure A1 also presents the developed conditions hydrology. Land covers types for each of the subbasins are delineated as vegetative cover (pasture), forest, or gravel road (impervious). The vegetative cover mostly represents the cap material. All subbasins are modelled as till soil whether it is native soil or cap material.

WWHM was run at a 15-minute time step. Moderate slope (5-15%) was assumed for each of the subbasins. WWHM input and results are presented in Attachment B. Table 4-2 summarizes the developed site hydrology.

Table 4-2: Developed Site Hydrology

Subbasin ID	HSG Rating	Subbasin Area (ac)				100-year Peak Discharge (cfs)
		Forest	Pasture	Impervious	Total	
001	C	6.73	5.02	0.65	12.40	3.34
002	C	4.38	0.00	0.00	4.38	0.81
003	C	0.80	0.52	0.11	1.43	0.41
004	C	0.47	0.00	0.00	0.47	N.A.[1]
005A	C	0.00	0.24	0.00	0.24	N.A.[1]
005B	C	0.00	0.61	0.00	0.61	N.A.[1]

Notes: [1]Discharge not computed because meets full dispersion criteria.

4.3 Performance Standards

The Site is located within the Conservation Flow Control Area, and there are no identified problems downstream of the Site. Therefore, the Flow Control Performance Standard is the Historic Site Conditions Level 2 Flow Control Standard, which matches historic durations for 50% of the 2-year through 50-year peaks and matches historic 2- and 10-year peaks.

The Low Impact Development (LID) Performance Standard applicable for this project is: “Stormwater discharges shall match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 8% of the 2-year peak flow to 50% of the 2-year peak flow. Assume historic site conditions as the predeveloped conditions.”

New pipe and ditch/channel systems are to be designed with sufficient capacity to convey the 25-year peak flow. Additionally, the 100-year runoff event shall not create or aggravate a severe flooding or severe erosion problem.

This project is located in the Basic Water Quality Treatment area, however, is exempt from Water Quality Treatment based on the Surface Area Exemption.

4.4 Flow Control System

Several methods are proposed to meet the Flow Control Standard. For Subbasin 001, an infiltration pond is proposed to infiltrate all runoff up to the 100-year event. This meets both the Flow Control Performance Standard and the LID Performance Standard. Additionally, since the 100-year event is proposed to be infiltrated, this satisfies the discharge requirement of Core Requirement 1, where no conveyance system exists at the abutting downstream property.

The pond is to be located at the toe of the slope at the north end of the site within the Everett glacial recessional outwash soils. Test pits nor pilot infiltration tests (PIT) have been completed at the proposed location of the infiltration pond yet. However, based on the NRCS mapped soils and previous monitoring well construction east of the pond site, it is believed that the outwash material will consist of sand and gravel. Detailed testing and analysis is proposed to be completed prior to final design. For preliminary sizing, a long term infiltration rate of 10 in/hr has been assumed. Additionally, it is assumed that the seasonal high ground water will be greater than 3 feet below the bottom of the proposed infiltration pond.

Based on WWHM, the resulting pond dimensions are presented in Table 4-3.

Table 4-3: Proposed Infiltration Pond Summary

Item	Value
Assumed infiltration rate	10 in/hr
Infiltration pond bottom area	2,500 sf
Infiltration pond side slopes	3H:1V
Infiltration 100-year water depth[1]	3.42 ft
Infiltration pond volume at 3.42-ft	12,600 cf
Drawdown time	6 hr
Pre-settling pond volume (25% WQ Volume)	7,500 cf

Notes: [1]Maximum water depth based on Extreme Value Type-1 fit for resulting WWHM stage data.

Calculations for pre-settling pond volume, 100-year water depth and drawdown time are presented in Attachment C.

Subbasin 002 is upstream of the cap. It naturally discharges near the north end of the cap. A short ditch is proposed to divert the runoff away from the cap. There is no new impervious or new pervious surface introduces in Subbasin 002, therefore, it is not considered a target surface for flow control and does not need to meet the Flow Control Performance Standard or the LID Performance Standard.

Subbasins 004, 005A and 005B will all meet full dispersion requirements and are not considered targeted surfaces for flow control. Each of these areas are will discharge as sheet flow from non-native pervious with less than 250 feet of width in direction of flow to more than 100 feet of native vegetated flow-path length. The 100-foot flow path for Subbasin 005A is approximately 40% (steeper than the maximum required 15%). However, it is not considered a risk for erosion because the subbasin is only 0.24 acres and the slope is highly vegetated.

Subbasin 003 is located in the South TDA. This area is waived from flow control requirements because it will generate no more than a 0.15-cfs increase (modelled using 15 minute time steps) from the existing site conditions.

The south access road within the South TDA will implement full dispersion into the forested buffer. The driving surface is proposed to be 12 feet wide. In areas where the road is crowned and one side is collected by a roadside ditch, a rock splash outlet will be required every 230 feet (1,400 sf maximum impervious surface divided by 6 feet) or 10-foot gravel trench every 460 feet (2,800 sf / 6 feet). Other portions of the road surface will discharge runoff as sheet flow into forested buffer.

4.5 Water Quality System

This project is exempt from Water Quality Treatment based on the Surface Area Exemption. The proposed project will have zero pollution generating impervious surface (PGIS) and zero pollution generating pervious surface (PGPS). It is expected that the site will not be subject to vehicular use which is defined in the SWMD as an access road not regularly used (less than once per week) by motor vehicles.

5.0 CONVEYANCE SYSTEM ANALYSIS AND DESIGN

The ditches and piping have been sized to convey the 100-year discharge from the entire Subbasin 001 to prevent concentrated runoff from discharging over the slope to the north. Manning's Equation was used for the ditches and the Federal Highway Administration HDS-5 methodology for the steep slope surface pipe. Calculations for ditch and pipe sizing are presented in Attachment C.

Ditches less than 6% slope are proposed to be grass-lined ditches with a 1-foot bottom width, 3H:1V side slopes and 1.0 foot deep. Ditches over 6% slope are required to be rock lined, however, calculations show that velocity will be approximately 5 feet/second (fps) which is the minimum velocity that riprap is required per the SWDM. Based on additional calculation, a rock lining with a D50 of 4 inches will be adequate to protect against erosion up to the 25-year discharge. Quarry spalls per Washington State Department of Transportation (WSDOT) Standard Specification, Section 9-13.6 is recommended. Table 5-1summarizes the ditch design.

Table 5-1: Ditch Design

Item	Slopes < 6%	Slopes > 6%
Ditch type	Vegetation-lined (grass)	Rock-lined (quarry spalls)
Base width	1 foot	1 foot
Side slope	3H:1V	2H:1V
100-year water depth	~0.5 feet	~0.4 feet
Ditch depth	1 foot	1.5 foot

The pipe on the steep slope is proposed to be 12-inch diameter HDPE and placed on the surface. A headwater of 0.4 feet over the crown of the pipe inlet is estimated during the 100-year event. Average velocity within the pipe is estimated to be 15 fps. A manhole at the downstream end of the pipe is recommended for energy dissipation.

Golder Associates Inc.

Scott Stoneman, PE
Senior Consultant

Frank Shuri, PE
Principal

SS/FS/sb

Attachments:

Attachment A: Figure A1 – Drainage Subbasins
Attachment B: WWHM Model Input and Results
Attachment C: Calculations

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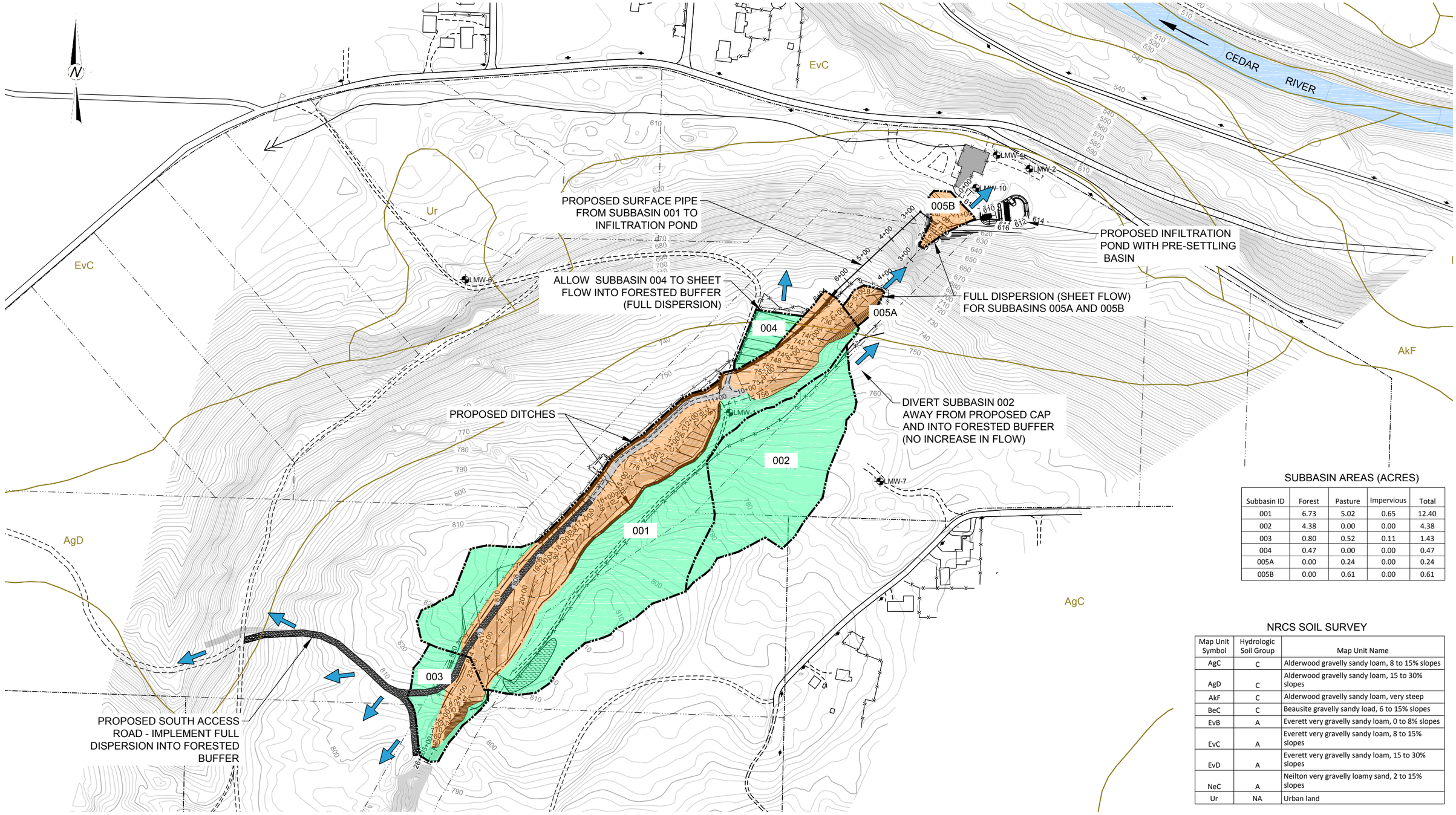
ATTACHMENT A

Figure A1 – Drainage Subbasins



SUBBASIN AREAS (ACRES)

Subbasin ID	Forest	Pasture	Impervious	Total
001	6.73	5.02	0.65	12.40
002	4.38	0.00	0.00	4.38
003	0.80	0.52	0.11	1.43
004	0.47	0.00	0.00	0.47
005A	0.00	0.24	0.00	0.24
005B	0.00	0.61	0.00	0.61

NRCS SOIL SURVEY

Map Unit Symbol	Hydrologic Soil Group	Map Unit Name
AgC	C	Alderwood gravelly sandy loam, 8 to 15% slopes
AgD	C	Alderwood gravelly sandy loam, 15 to 30% slopes
AkF	C	Alderwood gravelly sandy loam, very steep
BeC	C	Beausite gravelly sandy load, 6 to 15% slopes
EvB	A	Everett very gravelly sandy loam, 0 to 8% slopes
EvC	A	Everett very gravelly sandy loam, 8 to 15% slopes
EvD	A	Everett very gravelly sandy loam, 15 to 30% slopes
NeC	A	Neilton very gravelly loamy sand, 2 to 15% slopes
Ur	NA	Urban land

LEGEND

- DRAINAGE BASIN BOUNDARY (PROPOSED CONDITIONS)
- NRCS SOIL TYPE (WEB SOIL SURVEY)

LAND COVER TYPES (DEVELOPED CONDITIONS)

- VEGETATIVE COVER (PASTURE)
- FOREST COVER
- GRAVEL ROAD

0 150 300
1" = 150' FEET

CLIENT
LANDSBURG MINE SITE PLP GROUP

PROJECT
LANDSBURG MINE SITE
MTCA REMEDIAL ACTION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-03-27
DESIGNED	V.NANCARROW
PREPARED	REDMOND
REVIEWED	S.STONEMAN
APPROVED	G.ZIMMERMAN

TITLE
DRAINAGE BASINS

PROJECT NO.	PHASE	REV.	FIGURE
9231000005	1000	A	A1

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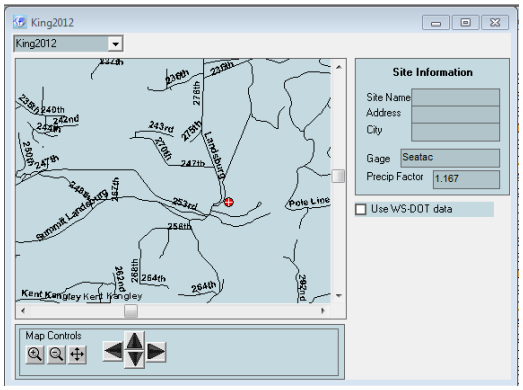
ATTACHMENT B

WWHM Model Input and Results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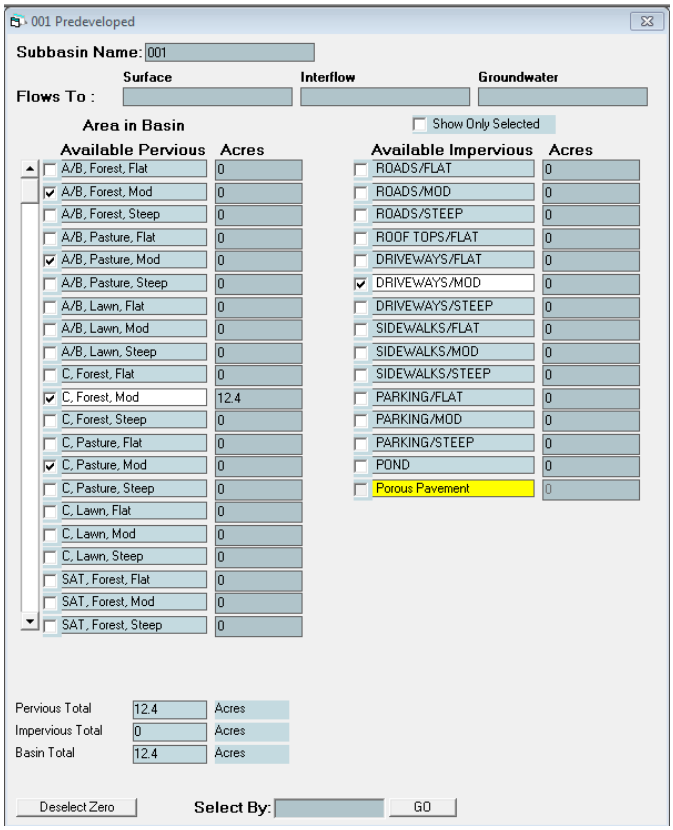
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Interflow
Groundwater
Area in Basin
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SAT, Forest, Steep 0
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ROADS/MOD 0
ROADS/STEEP 0
ROOF TOPS/FLAT 0
DRIVEWAYS/FLAT 0
DRIVEWAYS/MOD 0
DRIVEWAYS/STEEP 0
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SIDEWALKS/STEEP 0
PARKING/FLAT 0
PARKING/MOD 0
PARKING/STEEP 0
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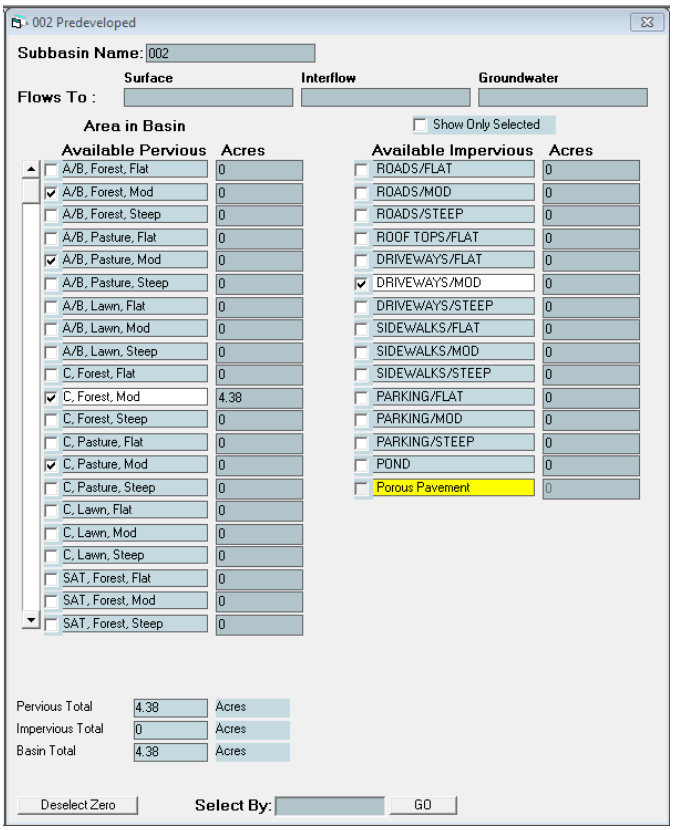
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Interflow
Groundwater
Area in Basin
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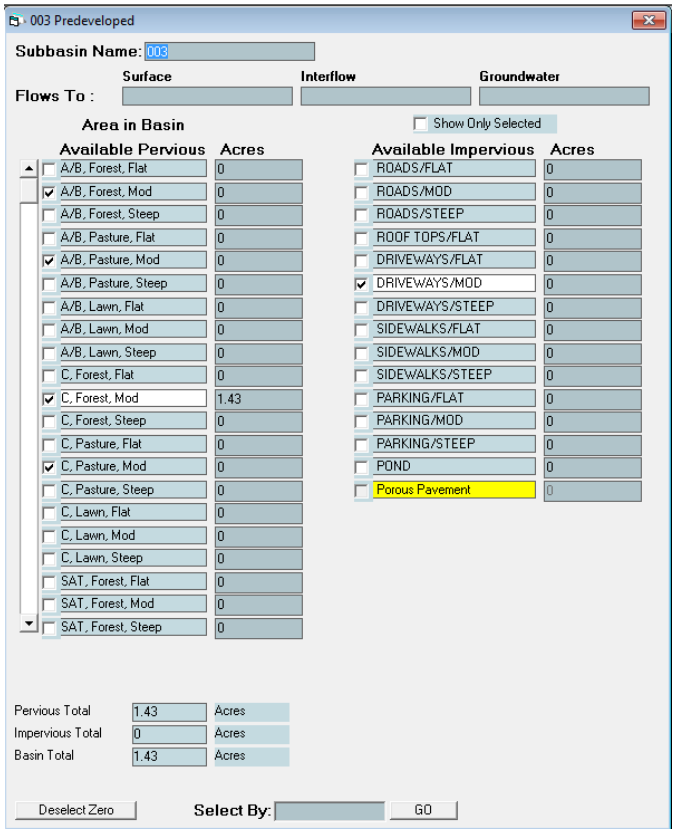
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ROADS/STEEP 0
ROOF TOPS/FLAT 0
DRIVEWAYS/FLAT 0
DRIVEWAYS/MOD 0
DRIVEWAYS/STEEP 0
SIDEWALKS/FLAT 0
SIDEWALKS/MOD 0
SIDEWALKS/STEEP 0
PARKING/FLAT 0
PARKING/MOD 0
PARKING/STEEP 0
POND 0
Porous Pavement 0
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Impervious Total 0 Acres
Basin Total 1.43 Acres
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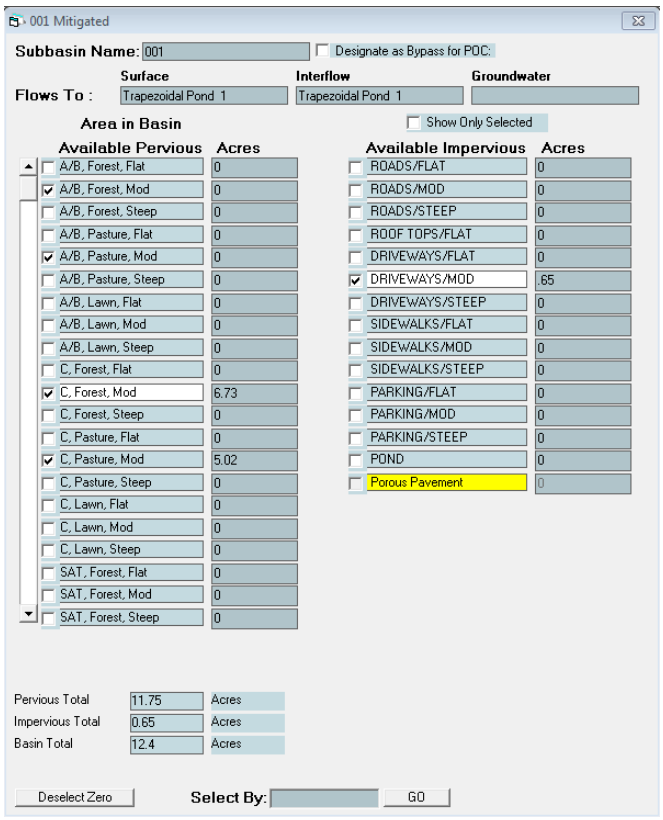
Select By:
GO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Interflow
Groundwater
Flows To :
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Trapezoidal Pond 1
Area in Basin
Show Only Selected
Available Pervious
Acres
Available Impervious
Acres
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A/B, Forest, Steep 0
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SIDEWALKS/STEEP 0
PARKING/FLAT 0
PARKING/MOD 0
PARKING/STEEP 0
POND 0
Porous Pavement 0
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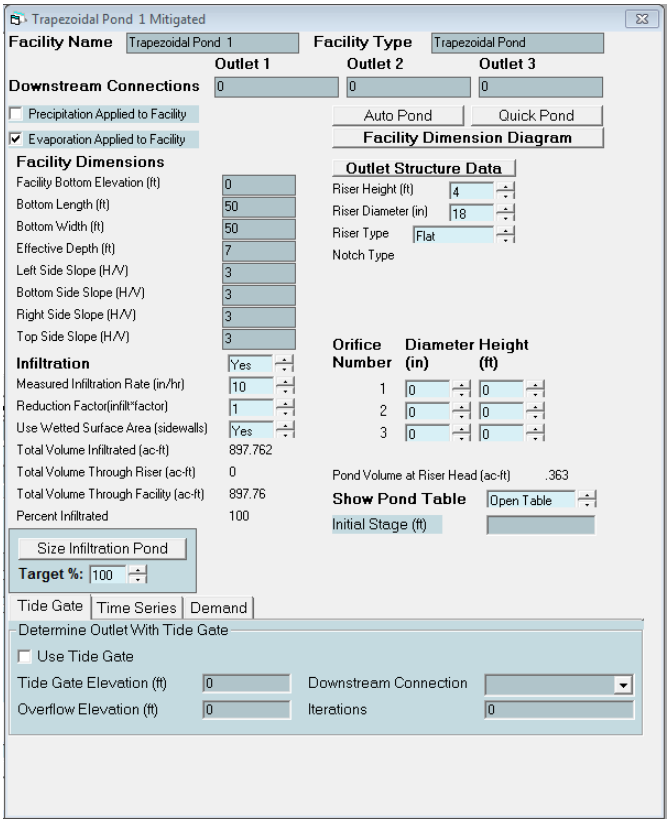
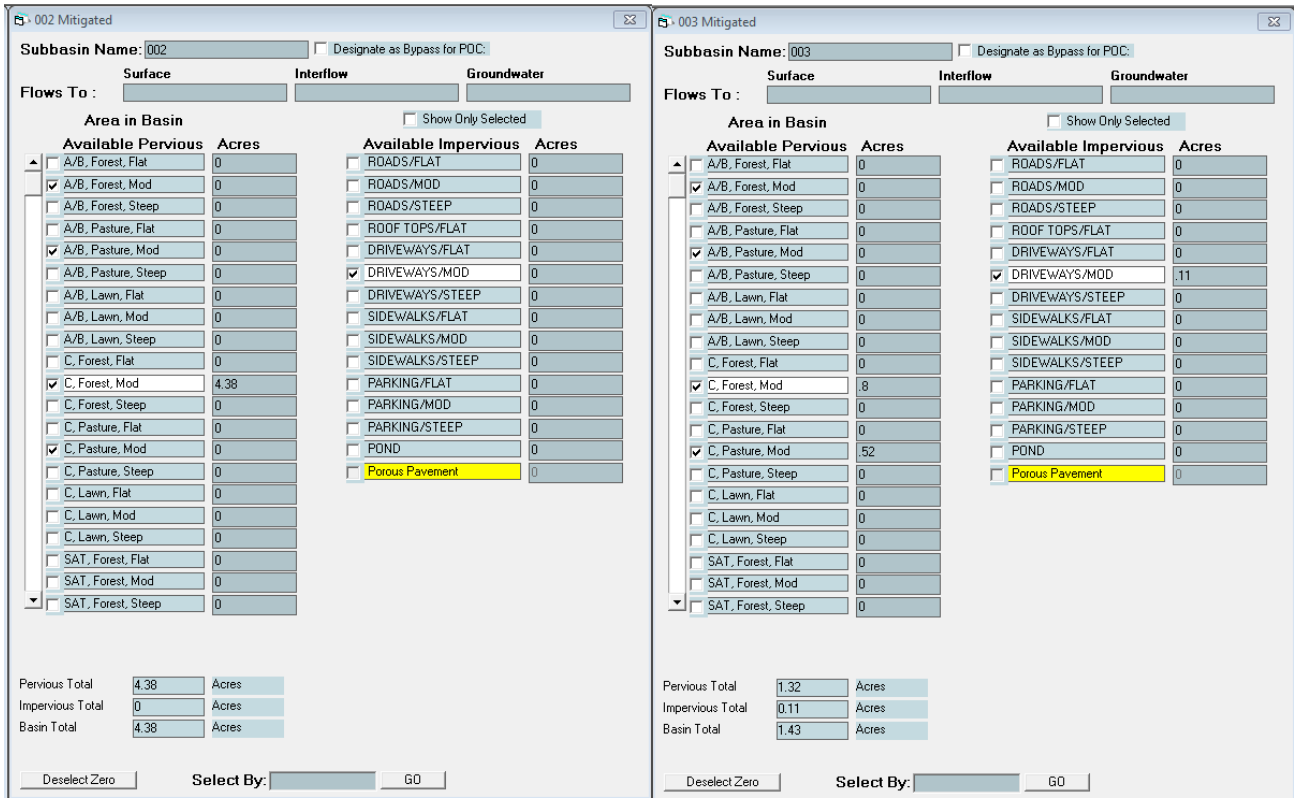
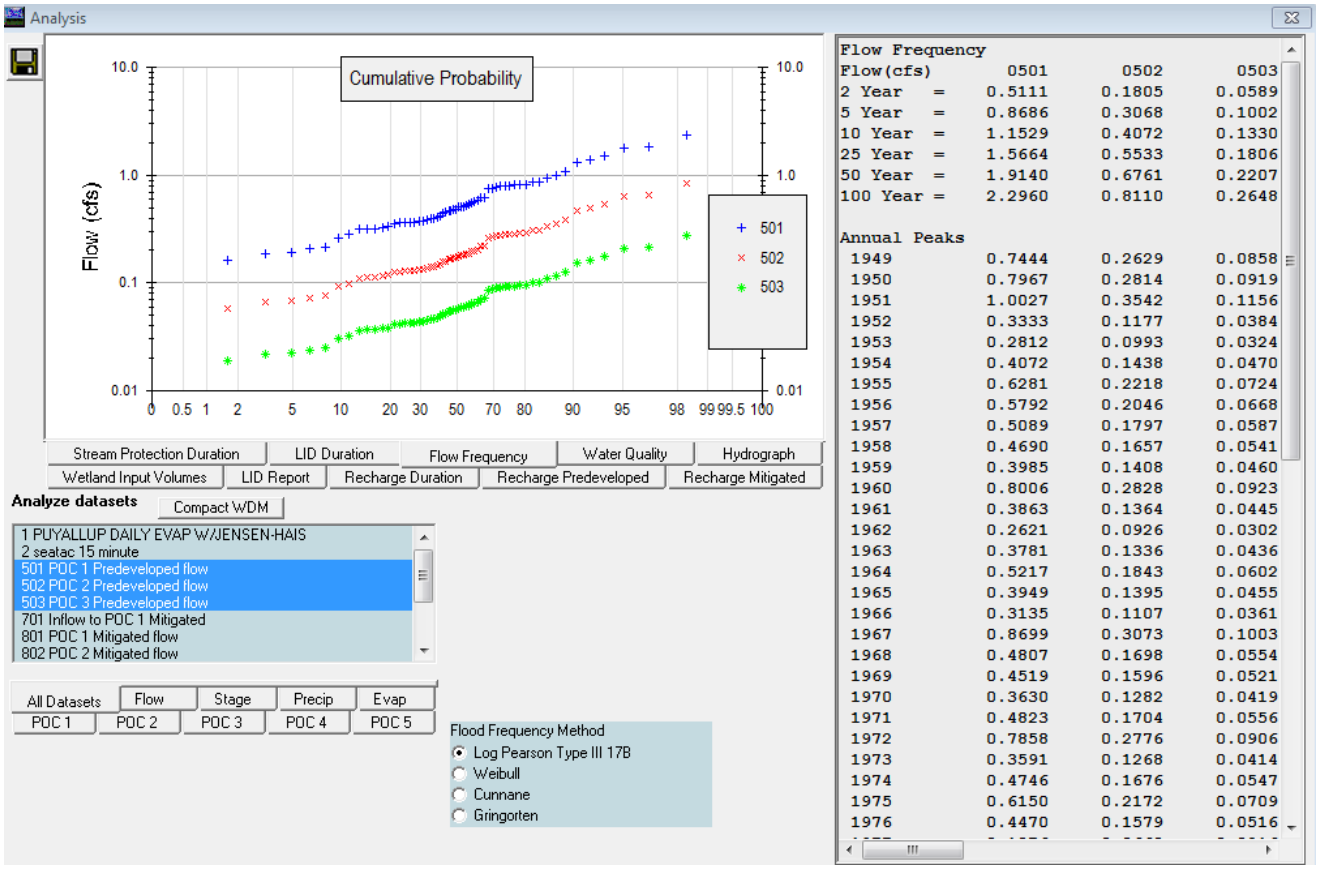
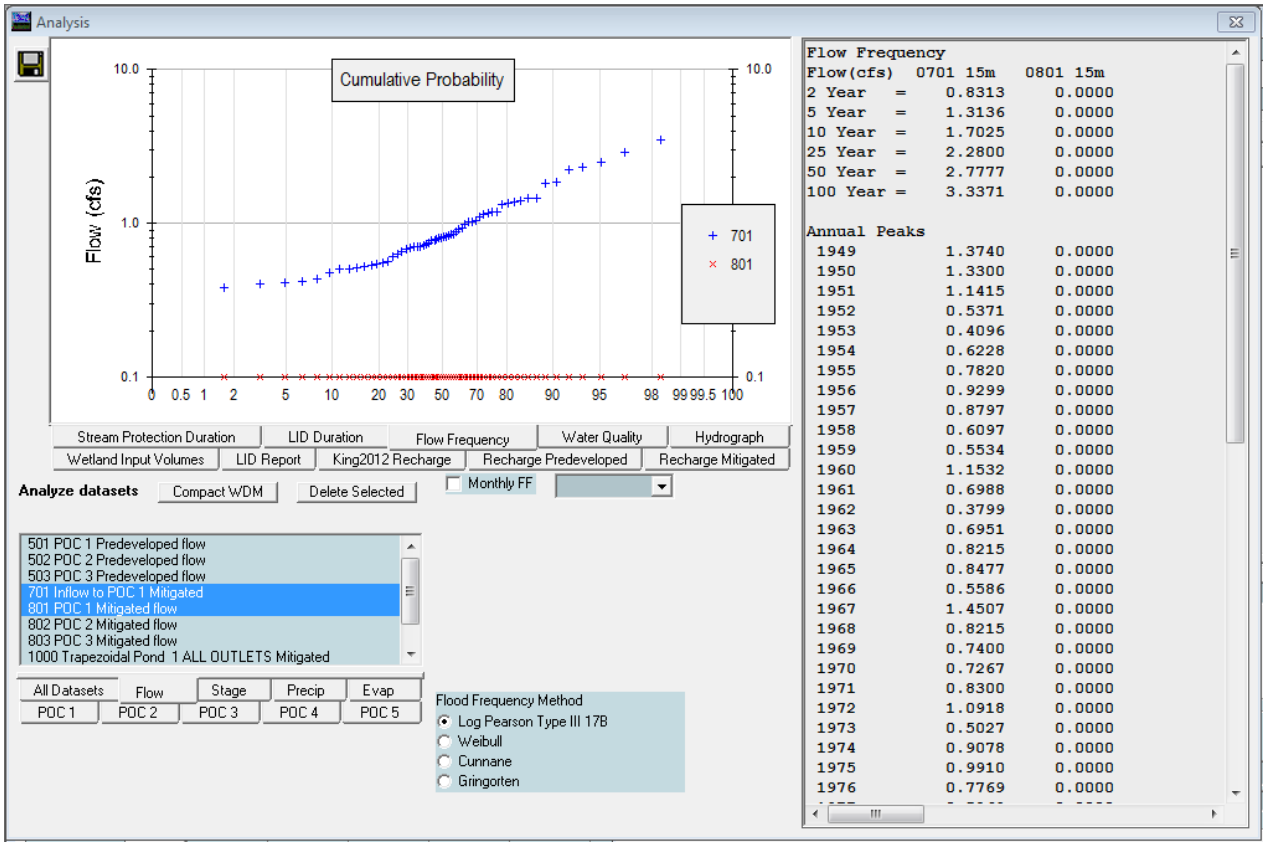
Impervious Total 0.65 Acres
Basin Total 12.4 Acres
Deselect Zero
Select By:
GO


Trapezoidal Pond 1 Mitigated
Facility Name
Trapezoidal Pond 1
Facility Type
Trapezoidal Pond
Outlet 1
Outlet 2
Outlet 3
Downstream Connections
0
0
0
Precipitation Applied to Facility
Evaporation Applied to Facility
Auto Pond
Quick Pond
Facility Dimension Diagram
Facility Dimensions
Facility Bottom Elevation (ft) 0
Bottom Length (ft) 50
Bottom Width (ft) 50
Effective Depth (ft) 7
Left Side Slope (H/V) 3
Bottom Side Slope (H/V) 3
Right Side Slope (H/V) 3
Top Side Slope (H/V) 3
Outlet Structure Data
Riser Height (ft) 4
Riser Diameter (in) 18
Riser Type Flat
Notch Type
Infiltration Yes
Measured Infiltration Rate (in/hr) 10
Reduction Factor(infilt*factor) 1
Use Wetted Surface Area (sidewalls) Yes
Total Volume Infiltrated (ac-ft) 897.762
Total Volume Through Riser (ac-ft) 0
Total Volume Through Facility (ac-ft) 897.76
Percent Infiltrated 100
Orifice Number
Diameter (in)
Height (ft)
1 0 0
2 0 0
3 0 0
Pond Volume at Riser Head (ac-ft) .363
Show Pond Table
Open Table
Initial Stage (ft)
Size Infiltration Pond
Target %: 100
Tide Gate
Time Series
Demand
Determine Outlet With Tide Gate
Use Tide Gate
Tide Gate Elevation (ft) 0
Overflow Elevation (ft) 0
Downstream Connection
Iterations 0

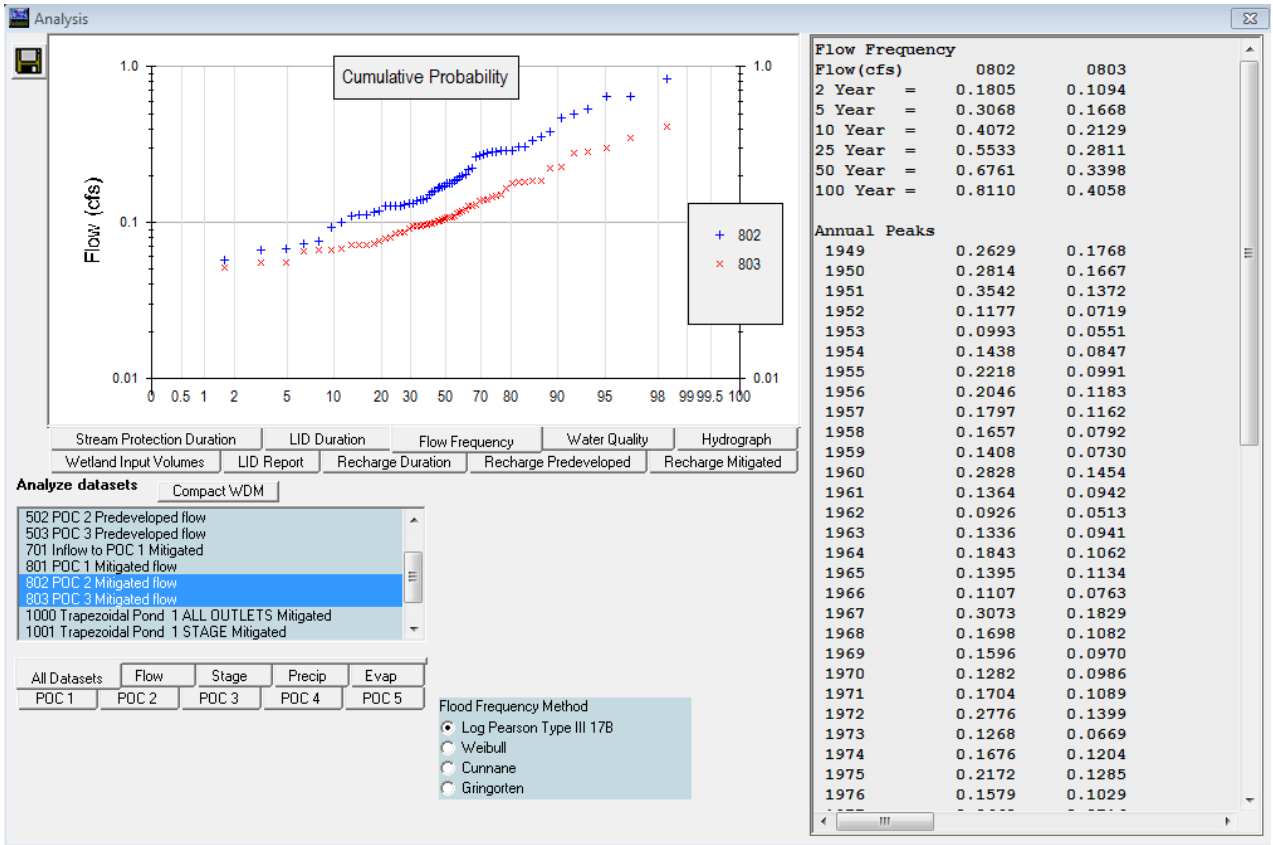

002 Mitigated
Subbasin Name: 002
Designate as Bypass for POC:
Flows To :
Surface
Interflow
Groundwater
Area in Basin
Show Only Selected
Available Pervious Acres
A/B, Forest, Flat 0
A/B, Forest, Mod 0
A/B, Forest, Steep 0
A/B, Pasture, Flat 0
A/B, Pasture, Mod 0
A/B, Pasture, Steep 0
A/B, Lawn, Flat 0
A/B, Lawn, Mod 0
A/B, Lawn, Steep 0
C, Forest, Flat 0
C, Forest, Mod 4.38
C, Forest, Steep 0
C, Pasture, Flat 0
C, Pasture, Mod 0
C, Pasture, Steep 0
C, Lawn, Flat 0
C, Lawn, Mod 0
C, Lawn, Steep 0
SAT, Forest, Flat 0
SAT, Forest, Mod 0
SAT, Forest, Steep 0
Available Impervious Acres
ROADS/FLAT 0
ROADS/MOD 0
ROADS/STEEP 0
ROOF TOPS/FLAT 0
DRIVEWAYS/FLAT 0
DRIVEWAYS/MOD 0
DRIVEWAYS/STEEP 0
SIDEWALKS/FLAT 0
SIDEWALKS/MOD 0
SIDEWALKS/STEEP 0
PARKING/FLAT 0
PARKING/MOD 0
PARKING/STEEP 0
POND 0
Porous Pavement 0
Pervious Total 4.38 Acres
Impervious Total 0 Acres
Basin Total 4.38 Acres
Deselect Zero
Select By:
GO
003 Mitigated
Subbasin Name: 003
Designate as Bypass for POC:
Flows To :
Surface
Interflow
Groundwater
Area in Basin
Show Only Selected
Available Pervious Acres
A/B, Forest, Flat 0
A/B, Forest, Mod 0
A/B, Forest, Steep 0
A/B, Pasture, Flat 0
A/B, Pasture, Mod 0
A/B, Pasture, Steep 0
A/B, Lawn, Flat 0
A/B, Lawn, Mod 0
A/B, Lawn, Steep 0
C, Forest, Flat 0
C, Forest, Mod .8
C, Forest, Steep 0
C, Pasture, Flat 0
C, Pasture, Mod .52
C, Pasture, Steep 0
C, Lawn, Flat 0
C, Lawn, Mod 0
C, Lawn, Steep 0
SAT, Forest, Flat 0
SAT, Forest, Mod 0
SAT, Forest, Steep 0
Available Impervious Acres
ROADS/FLAT 0
ROADS/MOD 0
ROADS/STEEP 0
ROOF TOPS/FLAT 0
DRIVEWAYS/FLAT 0
DRIVEWAYS/MOD .11
DRIVEWAYS/STEEP 0
SIDEWALKS/FLAT 0
SIDEWALKS/MOD 0
SIDEWALKS/STEEP 0
PARKING/FLAT 0
PARKING/MOD 0
PARKING/STEEP 0
POND 0
Porous Pavement 0
Pervious Total 1.32 Acres
Impervious Total 0.11 Acres
Basin Total 1.43 Acres
Deselect Zero
Select By:
GO


Analysis
Cumulative Probability
Flow (cfs)
10.0
1.0
0.1
0.01
0 0.5 1 2 5 10 20 30 50 70 80 90 95 98 99 99.5 100
501
502
503
Stream Protection Duration
LID Duration
Flow Frequency
Water Quality
Hydrograph
Wetland Input Volumes
LID Report
Recharge Duration
Recharge Predeveloped
Recharge Mitigated
Analyze datasets
Compact WDM
1 PUYALLUP DAILY EVAP W/JENSEN-HAIS
2 seatac 15 minute
501 POC 1 Predeveloped flow
502 POC 2 Predeveloped flow
503 POC 3 Predeveloped flow
701 Inflow to POC 1 Mitigated
801 POC 1 Mitigated flow
802 POC 2 Mitigated flow
All Datasets
Flow
Stage
Precip
Evap
POC 1
POC 2
POC 3
POC 4
POC 5
Flood Frequency Method
Log Pearson Type III 17B
Weibull
Cunnane
Gringorten
Flow Frequency
Flow(cfs) 0501 0502 0503
2 Year = 0.5111 0.1805 0.0589
5 Year = 0.8686 0.3068 0.1002
10 Year = 1.1529 0.4072 0.1330
25 Year = 1.5664 0.5533 0.1806
50 Year = 1.9140 0.6761 0.2207
100 Year = 2.2960 0.8110 0.2648
Annual Peaks
1949 0.7444 0.2629 0.0858
1950 0.7967 0.2814 0.0919
1951 1.0027 0.3542 0.1156
1952 0.3333 0.1177 0.0384
1953 0.2812 0.0993 0.0324
1954 0.4072 0.1438 0.0470
1955 0.6281 0.2218 0.0724
1956 0.5792 0.2046 0.0668
1957 0.5089 0.1797 0.0587
1958 0.4690 0.1657 0.0541
1959 0.3985 0.1408 0.0460
1960 0.8006 0.2828 0.0923
1961 0.3863 0.1364 0.0445
1962 0.2621 0.0926 0.0302
1963 0.3781 0.1336 0.0436
1964 0.5217 0.1843 0.0602
1965 0.3949 0.1395 0.0455
1966 0.3135 0.1107 0.0361
1967 0.8699 0.3073 0.1003
1968 0.4807 0.1698 0.0554
1969 0.4519 0.1596 0.0521
1970 0.3630 0.1282 0.0419
1971 0.4823 0.1704 0.0556
1972 0.7858 0.2776 0.0906
1973 0.3591 0.1268 0.0414
1974 0.4746 0.1676 0.0547
1975 0.6150 0.2172 0.0709
1976 0.4470 0.1579 0.0516



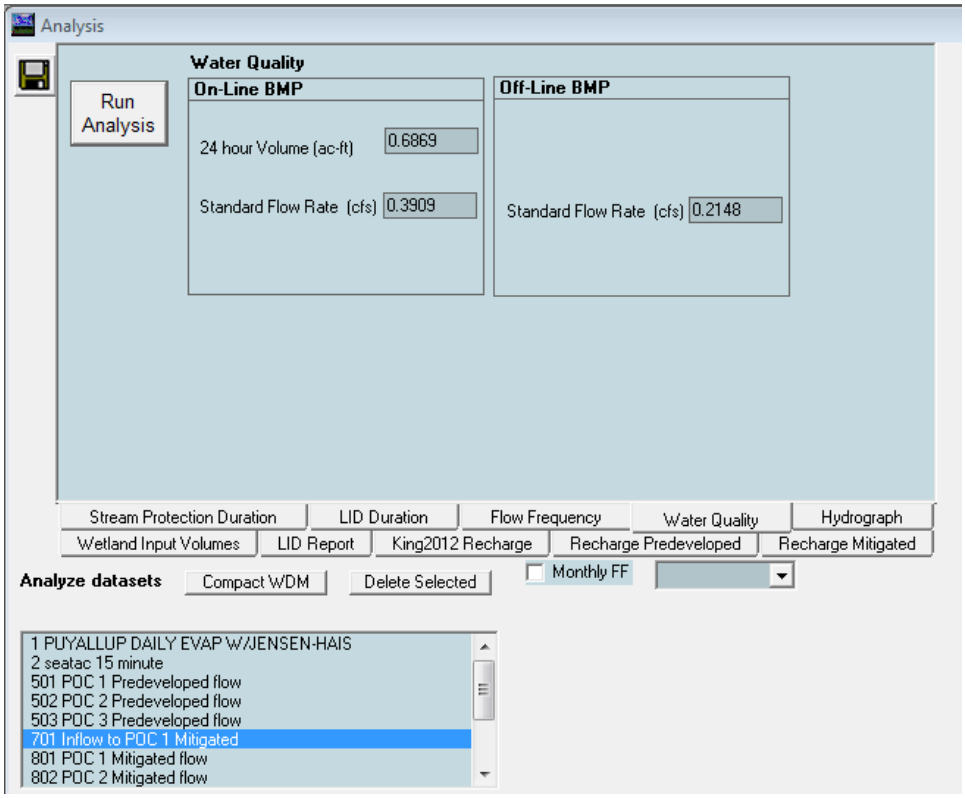

```
Flow Frequency
Flow(cfs)   0701 15m    0801 15m
2 Year    =     0.8313      0.0000
5 Year    =     1.3136      0.0000
10 Year   =     1.7025      0.0000
25 Year   =     2.2800      0.0000
50 Year   =     2.7777      0.0000
100 Year  =     3.3371      0.0000

Annual Peaks
 1949           1.3740      0.0000
 1950           1.3300      0.0000
 1951           1.1415      0.0000
 1952           0.5371      0.0000
 1953           0.4096      0.0000
 1954           0.6228      0.0000
 1955           0.7820      0.0000
 1956           0.9299      0.0000
 1957           0.8797      0.0000
 1958           0.6097      0.0000
 1959           0.5534      0.0000
 1960           1.1532      0.0000
 1961           0.6988      0.0000
 1962           0.3799      0.0000
 1963           0.6951      0.0000
 1964           0.8215      0.0000
 1965           0.8477      0.0000
 1966           0.5586      0.0000
 1967           1.4507      0.0000
 1968           0.8215      0.0000
 1969           0.7400      0.0000
 1970           0.7267      0.0000
 1971           0.8300      0.0000
 1972           1.0918      0.0000
 1973           0.5027      0.0000
 1974           0.9078      0.0000
 1975           0.9910      0.0000
 1976           0.7769      0.0000
```




```
Flow Frequency
Flow(cfs)        0802        0803
2 Year    =     0.1805      0.1094
5 Year    =     0.3068      0.1668
10 Year   =     0.4072      0.2129
25 Year   =     0.5533      0.2811
50 Year   =     0.6761      0.3398
100 Year  =     0.8110      0.4058

Annual Peaks
 1949           0.2629      0.1768
 1950           0.2814      0.1667
 1951           0.3542      0.1372
 1952           0.1177      0.0719
 1953           0.0993      0.0551
 1954           0.1438      0.0847
 1955           0.2218      0.0991
 1956           0.2046      0.1183
 1957           0.1797      0.1162
 1958           0.1657      0.0792
 1959           0.1408      0.0730
 1960           0.2828      0.1454
 1961           0.1364      0.0942
 1962           0.0926      0.0513
 1963           0.1336      0.0941
 1964           0.1843      0.1062
 1965           0.1395      0.1134
 1966           0.1107      0.0763
 1967           0.3073      0.1829
 1968           0.1698      0.1082
 1969           0.1596      0.0970
 1970           0.1282      0.0986
 1971           0.1704      0.1089
 1972           0.2776      0.1399
 1973           0.1268      0.0669
 1974           0.1676      0.1204
 1975           0.2172      0.1285
 1976           0.1579      0.1029
```


Analysis
Water Quality
Run Analysis
On-Line BMP
24 hour Volume (ac-ft) 0.6869
Standard Flow Rate (cfs) 0.3909
Off-Line BMP
Standard Flow Rate (cfs) 0.2148
Stream Protection Duration
LID Duration
Flow Frequency
Water Quality
Hydrograph
Wetland Input Volumes
LID Report
King2012 Recharge
Recharge Predeveloped
Recharge Mitigated
Analyze datasets
Compact WDM
Delete Selected
Monthly FF
1 PUYALLUP DAILY EVAP WJENSEN-HAIS
2 seatac 15 minute
501 POC 1 Predeveloped flow
502 POC 2 Predeveloped flow
503 POC 3 Predeveloped flow
701 Inflow to POC 1 Mitigated
801 POC 1 Mitigated flow
802 POC 2 Mitigated flow

ATTACHMENT C

Calculations

Presettling Basin Sizing and Infiltration Drawdown

Landsburg Mine Site PLP Group / Landsburg Mine Site MTCA Remedial Action
created by: sjs 3/6/2018
checked by: vmn 3/13/2018

WWHM WQ Volume (ac-ft)	0.6874
Presettling volume (WQ Vol x 0.25) (ac-ft)	0.17185
Presettling volume (cf)	**7485.786**

Approx. base length (ft)	40
Approx. base width (ft)	32
Base area (sf)	**1280**
Depth (ft)	3.5
Side slopes (xH:1V)	3
Top length (ft)	61
Top width (ft)	53
Top area (ft)	3233
Volume using conic eq. (cf)	**7638.478**

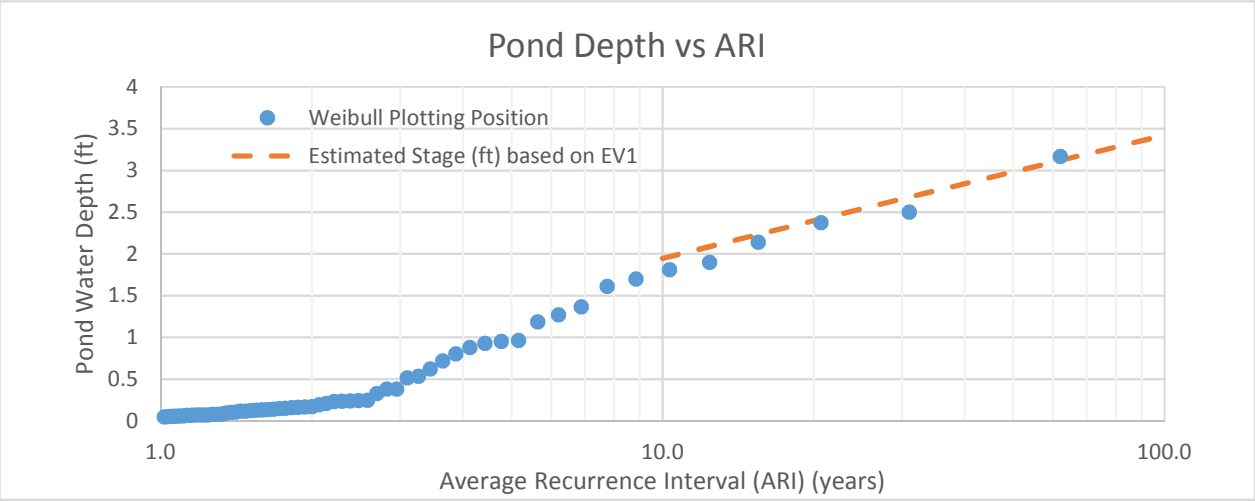
Infiltration Rate at 0.1 foot stage (cfs)	0.59
Volume at max stage (4 ft) (ac-ft)	0.29
Volume at max stage (4 ft) (cf)	12632.4
Drawdown time (hrs)	**5.9**

Estimation of 100-year Water Surface in Infiltration Pond

Landsburg Mine Site PLP Group / Landsburg Mine Site MTCA Remedial Action

created by: sjs 3/6/2018

checked by: vmn 3/13/2018



			Stage Threshold ->	0.15
Year	Stage (ft)	Rank	Weibull Plotting Position	Values for EV1 Analysis
1949	0.5344	19	3.3	0.5344
1950	0.7195	17	3.6	0.7195
1951	2.3731	3	20.7	2.3731
1952	0.0722	50	1.2	
1953	0.0545	59	1.1	
1954	0.0923	46	1.3	
1955	0.5136	20	3.1	0.5136
1956	0.209	29	2.1	0.209
1957	0.2345	27	2.3	0.2345
1958	0.1053	44	1.4	
1959	0.0777	48	1.3	
1960	1.2682	10	6.2	1.2682
1961	0.1363	38	1.6	
1962	0.0512	60	1.0	
1963	0.1151	43	1.4	
1964	0.1642	33	1.9	0.1642
1965	0.2431	25	2.5	0.2431
1966	0.0775	49	1.3	
1967	0.6224	18	3.4	0.6224
1968	0.168	32	1.9	0.168
1969	0.1571	34	1.8	0.1571
1970	0.1259	41	1.5	
1971	0.2306	28	2.2	0.2306
1972	0.8787	15	4.1	0.8787
1973	0.068	54	1.1	

ARI (yr)	Estimated Stage (ft) based on EV1
2	0.77
5	1.48
10	1.95
25	2.54
50	2.98
100	**3.42**

1974	0.1921	30	2.1	0.1921
1975	0.3262	23	2.7	0.3262
1976	0.1461	36	1.7	
1977	0.0822	47	1.3	
1978	0.1326	39	1.6	
1979	0.0698	53	1.2	
1980	0.8039	16	3.9	0.8039
1981	0.101	45	1.4	
1982	0.9535	13	4.8	0.9535
1983	0.169	31	2.0	0.169
1984	0.0714	51	1.2	
1985	0.0592	56	1.1	
1986	1.3661	9	6.9	1.3661
1987	1.1871	11	5.6	1.1871
1988	0.0575	57	1.1	
1989	0.0676	55	1.1	
1990	2.4994	2	31.0	2.4994
1991	1.8112	6	10.3	1.8112
1992	0.1297	40	1.6	
1993	0.0699	52	1.2	
1994	0.0488	61	1.0	
1995	0.1395	37	1.7	
1996	2.1415	4	15.5	2.1415
1997	1.8979	5	12.4	1.8979
1998	0.1506	35	1.8	0.1506
1999	0.965	12	5.2	0.965
2000	0.1178	42	1.5	
2001	0.0558	58	1.1	
2002	0.3819	21	3.0	0.3819
2003	0.3794	22	2.8	0.3794
2004	1.6994	7	8.9	1.6994
2005	0.2375	26	2.4	0.2375
2006	0.2488	24	2.6	0.2488
2007	1.6117	8	7.8	1.6117
2008	3.1685	1	62.0	3.1685
2009	0.929	14	4.4	0.929

Pipe Hydraulics based on FHWA HDS-5

Landsburg Mine Site PLP Group / Landsburg Mine Site MTCA Remedial Action

created by: sjs 3/6/2018

checked by: vmn 3/13/2018

	25-yr	100-yr
Discharge (cfs)	2.28	3.34
Pipe dia (ft)	1	1
n-value	0.013	0.013
Inlet Type	11	11
IE (in)	730	730
IE (out)	615	615
Length (ft)	500	500
Slope (ft/ft)	**0.23**	**0.23**
HW El (ft)	**731.1**	**731.4**
HW Depth (ft)	**1.1**	**1.4**
Normal Depth (ft)	**0.25**	**0.30**
Cross-sectional area (sf)	**0.15**	**0.20**
Normal velocity (fps)	**15.12**	**16.87**

Ditch Hydraulics using Mannings Equation

Landsburg Mine Site PLP Group / Landsburg Mine Site MTCA Remedial Action
created by: sjs 3/6/2018
checked by: vmn 3/13/2018

Discharge, 100-yr (cfs)	3.34	3.34	3.34
Bottom Width (ft)	1	1	1
Side Slope (XH:1V)	3	3	2
Slope (ft)	0.02	0.06	0.15
n-value	0.04	0.04	0.045

Depth (ft)	**0.53**	**0.41**	**0.38**
Velocity (fps)	**2.43**	**3.65**	**5.03**

Rock Lining Calculations

Landsburg Mine Site PLP Group / Landsburg Mine Site MTCA Remedial Action
created by: sjs 3/6/2018
checked by: vmn 3/13/2018

Reference: Robinson, Rice, Kadavy. 1998. *Design of Rock Chutes* . ASAE.

Input Data

discharge, cfs	2.28
base width, ft	1
slope, ft/ft	0.15
side slope, xH:1V	2
n (initial estimate, iterate to match calc'd below)	**0.045**
np, porosity	0.4
g, gravity, ft/s²	32.2
K'	4
SF, rock size safety factor	1.0

Calculate Surface Flow Regime (conservatively assume no subsurface flow)

normal depth (based on Manning's Eq.), ft	**0.31**
area (based on normal depth), sf	**0.5**
top width (based on normal depth), ft	**2.24**
average width, ft	**1.62**
velocity (Q=V/A), fps	**4.5**
critical depth (watertools.xla), ft	**0.41**
froude no. (watertools.xla)	**1.7**
flow regime	**supercritical**
unit discharge (discharge/average width), cfs/ft	**1.41**

Estimate rock size

$$q = 9.76E-7\, D_{50}^{1.89}\, S_o^{-1.50} \qquad S_o < 0.10$$

$$q = 8.07E-6\, D_{50}^{1.89}\, S_o^{-0.58} \qquad 0.10 \le S_o \le 0.40$$

D_{50} (s<0.1), mm	**114**
D_{50} (s>0.1), mm	**94**
D_{50} x SF, mm	**94**
D_{50} x SF, in	**3.7**

Caculate Manning's roughness coefficient

$$n = 0.0292\, (D_{50}\, S_o)^{0.147}$$

n, based on equation	**0.043**

Calculate percent subsurface flow

Check initial condition. For long-term condition assume sediment will fill void space of rock.

$$V_m = n_p \left(\frac{S_o g D}{K'}\right)^{1/2}$$

Vm, velocity within rock, fps	**0.24**
Riprap thickness, 2*D50, in	**7.4**
qm, unit flow in mantle, m3/s/m	**0.15**
Percent subsurface flow	**11%**

Rock Gradation

D_{100}, (D_{100} = 1.5* D_{50}), in	**6**
D_{85}, (D_{85} = 1.2* D_{50}), in	**4**
D_{50}, see above, in	**4**

D_{15}, (D_{15} = 0.6 * D_{50}), in	2
Liner thickness (2*D_{50}), in	7

Minimum Channel Depth

d, max. depth of flow (max of critical and normal depth), ft	0.41
Freeboard, ft	0.50
Lined channel depth, ft	0.91

Apron length at toe of spillway

min. length of apron, 15*D50, ft	4.6

APPENDIX E

Health and Safety Environmental Plan

Health Safety And Environment Plan

LANDSBURG 2018 CONSTRUCTION

Site Address Landsburg
27000 Southeast Summit Landsburg Road,
Ravensdale, WA

Version: 0

Date: August 14, 2018

Project No.923-1000-05.1000

A world of capabilities delivered locally

1.0 CONTACTS LIST SUMMARY

1.1 Emergency Contacts

Contact	Number
Ambulance	911 (Direct emergency responders to entry points provided on Figure 1).
Fire	911 (Direct emergency responders to entry points provided on Figure 1).
Police	911 (Direct emergency responders to entry points provided on Figure 1).
Crisis Response Hotline (Outside Canada)	(403) 775-1041
Golder National Health, Safety, Security, and Environment Advisor - Renee Weaver	(336) 707-3869
Human Resources-Local	
International SOS, Member ID: 11BYCA084630	+1-215-942-8226 (Philadelphia)
Local Electrical Authority	
Local Gas Authority	
Local Telecom Authority	
Local Water Authority	
Media Relations (Golder) - Tina Marano	1-647-402-3596
Roadside Assistance	
Spills Reporting	NRC - 800-424-8802 WA Emergency Management - 800-258-5990
WorkCare	(888) 449-7787

Hospital name	Address	Phone	Level of Care Available
Multicare Auburn Medical Center	202 N Division St., Auburn, WA	253-833-7711	Emergency

1.2 Golder Contacts

	Name	Office Name	Office	Cell
Project Manager	Gary Zimmerman	Redmond	+1 425 883-0777 x52621	+1 425-753-4903
Project Director	Frank Shuri	Redmond	+1 425 883-0777 x52604	+1 206 799-8582
Field Supervisor	Joseph Miller	Redmond	+1 (425) 883-0777 x52638	513-602-1619
Field Staff	Jing Song Xi	Redmond	+1 (425) 883-0777	+1 (832) 416 3888
Field Staff	Alyssa Witt	Redmond	+1 (425) 883-0777 x52530	507-317-0942
H&S Representative	Todd Morris	Redmond	+1 425 883-0777 x52509	+1 206 619-9909
Client				

1.3 Missed Check-in Contacts

	Name	Phone	Cell
Project Manager	Gary Zimmerman	+1 425 883-0777 x52621	+1 425-753-4903
Project Director	Frank Shuri	+1 425 883-0777 x52604	+1 206 799-8582

1.4 Client and Site Contacts

	Number
Site field cell phone	513-602-1619 Joe Miller

Nearest Golder office	USA - Redmond
Phone	+1 (425) 883-0777
Fax	+1 (425) 882-5498
Email	

Role	Name	Number
Contact person on site	Joseph Miller	Office: +1 (425) 883-0777 x52638 Cell: 513-602-1619
Client safety contact	Bill Kombol	425-432-4700, 360-886-2841
Company Golder reports to	Landsburg PLP Group	
Company reporting to Golder	TBD	
Golder overall site supervisor and alternate:	Gary Zimmerman	Office: +1 425 883-0777 x52621 Cell: +1 425-753-4903
	Frank Shuri	Office: +1 425 883-0777 x52604 Cell: +1 206 799-8582

1.5 Subcontractor Contacts

Name	Subcontractor key staff	Phone
TBD		

You have the right to refuse any work you feel is unsafe, or that you are not trained to do. Choose to work safely and in compliance with all HSE requirements.

It is company policy to complete a HaSEP form including a task-based Health, Safety and Environment (HSE) risk assessment for every project that includes site work, working alone or international travel.
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2.0 PROJECT PROPOSAL DETAILS

Project/Proposal Number	923-1000-05.1000	**Start Date**	May 14, 2018	**End Date**	Oct 31, 2019
Project Title	Landsburg Capping & Construction				
Client Name	Landsburg PLP				

Brief description of project and scope of works (include any hazardous activities, if known)

The site is a former underground coal mine. As a result of caving, subsidence trenches developed at the land surface. The portion of these trenches were used for disposal of various industrial waste material, construction materials, and land-clearing debris. The industrial waste material were contained in drums and also included about 200,000 gallons of oil wastewater and sludges. The site is vegetated and undeveloped, with numerous trees populating the trench and work area that will need to be removed. The site is somewhat remote, being in the middle of an undeveloped parcel, and is approximately 30 minutes away from the closest emergency medical facility.

The work will involve backfilling the portions of the subsidence trench where waste were previously disposed, and constructing a soil cap over the trench. In some areas, the trench approaches 100 feet wide and 60 feet deep. The depth and size of the trench poses a fall hazard. Hazardous activities may include soil moving/placement with heavy equipment, road construction, clearing/grubbing, and tree removal. Extra care will be required during backfill in areas of the trench where drums where disposed to minimize disturbance of these drums.

Potential constituents of concern (COCs) are trichloroethene (TCE)/ tetracholoroethene (PCE), chromium, lead, polychlorinated biphenyls (PCBs), bis(2-ethylhexyl)phthalate, methylene chloride, and Total Petroleum Hydrocarbons (TPH).

As fully described in the subcontractor bid specifications and the Engineering Design Report, the Subcontractor(s) will complete clearing, grubbing, and grading, including tree removal from within the trench. They will also complete road construction of haul roads, and perform backfilling and capping of the historical trench.

The Subcontractor is required to provide a HaSEP for Golder's review prior to mobilization. The Subcontractor is required to adequately address safety measures to be taken during site activities, with special consideration to the potentially hazardous atmosphere that may be encountered. Safety measures will include, but are not limited to, fall hazards working around the top of trench, tree cutting/falling, providing safe access/egress, overhead hazards while workers are in the trench, and providing quick extraction of potentially unresponsive workers. Subcontractor workers performing activities near the waste disposal areas of the trench, will be required to have, at minimum, 10-hour OSHA and 40-hour HAZWOPER training, including current annual refresher training certificates.

Utility locate clearance will be obtained prior to any ground penetrating work.

A Job Safety and Environment Analysis (JSEA) will be completed as part of a tailgate meeting every day before any work begins.

3.0 GOLDER TEAM

Name	Office	Contact number (cell phone)	Office Phone	Role
Joseph Miller	Redmond	513-602-1619	+1 (425) 883-0777 x52638	Field Supervisor
Jing Song Xi	Redmond	+1 (832) 416 3888	+1 (425) 883-0777	Field Staff
Alyssa Witt	Redmond	507-317-0942	+1 (425) 883-0777 x52530	Field Staff
Gary Zimmerman	Redmond	+1 425-753-4903	+1 425 883-0777 x52621	PM
Frank Shuri	Redmond	+1 206 799-8582	+1 425 883-0777 x52604	PD
Todd Morris	Redmond	+1 206 619-9909	+1 425 883-0777 x52509	H&S Representative

Project Manager (PM)

- Appoint a competent site supervisor and alternate. For sites with multiple Golder projects/disciplines at work, coordinate with the overall site supervisor
- Oversee/develop hazard controls including work instructions and
- Assign only adequately trained and competent employees to the project

Site Supervisor

- The site supervisor is responsible for the safety of all Golder employees, subcontractors, visitors and public on the parts of the site under Golder control.
- Communicate all site hazards to affected parties, in real time, as hazards, conditions and employees change.
- Ensure that work is undertaken in accordance with the hazard controls included in this HaSEP.

Contractor

- All plant and equipment is maintained in a safe working condition
- All plant and equipment are to be registered/licensed and electrical equipment tagged and tested
- Potential hazards are to be controlled (e.g., cage over rotating parts)
- You will report any identified hazards to the Golder Associates field staff member

Field Staff

- Inspect your worksite and equipment before starting work
- Apply the controls outlined in this HaSEP
- Look out for the safety of yourself and others
- Report unsafe acts, conditions and incidents to the site supervisor

4.0 CLIENT/SITE LOCATION DETAILS

4.1 Client/Site Location Details

Project location map (paste URL here)	https://goo.gl/maps/XRVoLPXNY8Q2

4.1.1 *Site Description*

If the project is near another Golder Office, has the local Office been notified of the work? ☐Yes ☒No

Site Name	Landsburg			
Address	27000 Southeast Summit Landsburg Road, Ravensdale, WA. See Figure 1 for complete list of addresses at entry points.			
Coordinates	47.374719, -121.982328			
Description	Open Area near former mine portal			
Access info	Locked Gate (Yellow) Protecting Area			
Previous land uses	Former coal mine portal			
Site Receptors that maybe impacted by the proposed work	Cedar River, City of Kent Watershed Protection Area			
Additional Info				
HSE Induction / orientation provider	☒Golder	☐Client	☐Contractor	
Site Contact Numbers	**Field cell phone**	513-602-1619	**Satellite phone**	
	Other			
Nearest Golder office	USA - Redmond	**Address**	18300 NE Union Hill Road, Suite 200, Redmond, Washington, USA 98052	
Opening days and hours		**Email**		
Phone	+1 (425) 883-0777	**Fax**	+1 (425) 882-5498	
Google Maps				

5.0 SUBCONTRACTOR DETAILS

Has Golder been assigned the role of Principal Contractor? * ☒Yes ☐No

Name	Subcontractor key staff	Phone	Subcontractor activities	Risk Assessment Supplied	Method Statement Supplied	Approved Golder subcontractor?
TBD			The Subcontractor will complete clearing and grading, including tree removal from within the trench. They will also complete road construction of haul roads, and perform backfilling and capping of the historical trench. The trench was previously used as a disposal pit for drums of unknown hazardous wastes. The Subcontractor is required to provide a HaSEP for Golder's review prior to mobilization. The Subcontractor is required to adequately address safety measures to be taken during site activities, with special consideration to the potentially hazardous atmosphere that may be encountered. Safety measures will include, but are not limited to, fall hazards working around the top of trench, tree cutting/falling, providing safe access/egress, overhead hazards while workers are in the trench, and providing quick extraction of potentially unresponsive workers. Subcontractor workers will be required to have, at minimum, 10-hour OSHA and 40-hour HAZWOPER training. Based on how safety concerns are addressed in the Subcontractor HaSEP, workers will also be required to have additional certifications as needed.	☐	☐	☐

5.1 Welfare / Hygiene Facilities

The following issues should be considered when planning welfare provision including: the work to be carried out; the associated health risks; duration and number of different locations; number of people working at different locations and distances from welfare facilities.
Describe the project's welfare facilities below:

Facility	Yes	No	Describe alternate arrangements:
Toilets available?	☒	☐	Portable toilets provided.
Rest areas available?	☐	☒	Use truck or designated area for rest/breaks.
Washing facilities available?	☐	☒	Temporary Eye-Wash available. No full showers. Bottled water available for hand washing.
Drinking water available?	☐	☒	Bottled water provided by Golder/Subcontractor.
Area for changing and storing clothes available?	☐	☒	Use truck for storage or for changing clothes.
Mode of transportation to site available?	☒	☐	Company vehicles
Smoking permitted on site?	☐	☒	Designated smoking areas to be provided as needed.

6.0 CHECK-IN SYSTEM

6.1 Check-in contacts

	Primary	Secondary
Name	Gary Zimmerman	Frank Shuri
Phone/Email	Office: +1 425 883-0777 x52621 Cell: +1 425-753-4903 Email: Gary_Zimmerman@golder.com	Office: +1 425 883-0777 x52604 Cell: +1 206 799-8582 Email: Frank_Shuri@golder.com
Check-in frequency*	On/Off-site, as needed.	On/Off-site, as needed.
By phone	☐	☐
By email	☒	☒
By SMS	☒	☒
On site	☐	☐

6.2 Missed Check-in Procedure

Within 2 hours of missed check-in time:

1. Attempt to contact employee
2. Contact accommodation or other project personnel to determine last contact with employee
3. Notify Project Manager.
4. Project manager to determine timing of further action, based on project details.

Within 4 hours of scheduled call-in time:

1. Contact client and request assistance to locate employee.
2. Notify Project Director, Office Manager, and local authorities (as appropriate)
3. Initiate Crisis Response Plan (as appropriate)

☐Does missed check-in procedure for this project deviate from the standard procedure?

7.0 CHEMICALS AND CONTAMINANTS

7.1 Possible Contaminants or Chemical Exposures

☒Additional contaminants likely to be encountered during this project (consider previous land uses)

Contaminant Name	TCE/PCE			
Exposure routes	Inhalation, skin contact, eye contact, ingestion.			
Flash point	Practically non-flammable		**Odor threshold**	
Explosive limits	**LEL**	8 %	**UEL**	10.5 %
Occupational Exposure Limits	**TWA**	10 ppm	**STEL**	25 ppm
			Ceiling	
☒**Air Monitoring Required**				
Monitoring equipment	PID			
Monitoring location	breathing zone, especially if working in or around trench			
Monitoring frequency	continuous			
Action levels and appropriate response	If prolonged concentrations (holding elevated readings for 30 seconds or more) >10 ppm of >10 ppm in breathing zone or interim PID readings >30 ppm in breathing zone other than a momentary spike. Stop work, move upwind, call PM to assess conditions and determine additional actions needed. PID measurements are set to 10 ppm and 30 ppm because they represent the most conservative screening levels for TCE.			
Exposure Controls	Provide venting using non-sparking fans if necessary.			
Medical Surveillance, if required	NA			
Additional Info	PID will be calibrated with 100 ppm isobutylene gas. Readings will provide a concentration of total volatile organic compounds detectable rather than a specific compound. The detected compounds depend on the lamp installed in the PID. For this application an 11.7 eV lamp will be used. Correction Factor (CF) for an 11.7 eV lamp is 0.43.			

Contaminant Name	Chromium			
Exposure routes	Inhalation (dust), skin contact, eye contact, ingestion			
Flash point			**Odor threshold**	
Explosive limits	**LEL**		**UEL**	
Occupational Exposure Limits	**TWA**		**STEL**	
			Ceiling	
☐**Air Monitoring Required**				
Medical Surveillance, if required	NA			
Additional Info	Minimize dust generation. Do not ingest potentially contaminated soil. Do not smoke, eat, or drink after handling potentially contaminated materials without first washing your hands.			

Contaminant Name	Lead
Exposure routes	Inhalation (dust), skin contact, eye contact, ingestion

Flash point			**Odor threshold**	
Explosive limits	**LEL**		**UEL**	
Occupational Exposure Limits	**TWA**		**STEL**	
			Ceiling	
☐**Air Monitoring Required**				
Medical Surveillance, if required	NA			
Additional Info	Minimize dust generation. Do not ingest potentially contaminated soil. Do not smoke, eat, or drink after handling potentially contaminated materials without first washing your hands.			

Contaminant Name	bis(2-ethylhexyl)phthalate			
Exposure routes	Inhalation, skin contact, eye contact, ingestion			
Flash point	421° F		**Odor threshold**	
Explosive limits	**LEL**	0.3 %vol	**UEL**	2.4 %vol
Occupational Exposure Limits	**TWA**	0.3 ppm	**STEL**	
			Ceiling	
☐**Air Monitoring Required**				
Exposure Controls	Provide venting using non-sparking fans if necessary.			
Medical Surveillance, if required	NA			
Additional Info	Extremely low vapor pressure. Do not ingest potentially contaminated soil. Do not smoke, eat, or drink after handling potentially contaminated materials without first washing your hands.			

Contaminant Name	PCBs			
Exposure routes	skin contact, eye contact, ingestion			
Flash point	201° F		**Odor threshold**	
Explosive limits	**LEL**		**UEL**	
Occupational Exposure Limits	**TWA**	50 ppm (as Hexane)	**STEL**	1100 ppm (as Hexane)
			Ceiling	
☒**Air Monitoring Required**				
Monitoring equipment	PID			
Monitoring location	breathing zone, especially if working in or around trench			
Monitoring frequency	continuous			
Action levels and appropriate response	If prolonged concentrations (holding elevated readings for 30 seconds or more) >10 ppm of >10 ppm in breathing zone or interim PID readings >30 ppm in breathing zone other than a momentary spike. Stop work, move upwind, call PM to assess conditions and determine additional actions needed. PID measurements are set to 10 ppm and 30 ppm because they represent the most conservative screening levels for TCE.			
Exposure Controls	Provide venting using non-sparking fans if necessary.			

Medical Surveillance, if required	NA
Additional Info	PID will be calibrated with 100 ppm isobutylene gas. Readings will provide a concentration of total volatile organic compounds detectable rather than a specific compound. The detected compounds depend on the lamp installed in the PID. For this application an 11.7 eV lamp will be used. CF for an 11.7 eV lamp is 0.54 (for hexane).

Contaminant Name	Methylene Chloride			
Exposure routes	Inhalation, skin contact, eye contact, ingestion			
Flash point	None, but can form flammable vapor-air mixtures above ~212 °C		**Odor threshold**	
Explosive limits	**LEL**	13% (10% 13,000 ppm)	**UEL**	
Occupational Exposure Limits	**TWA**	25 ppm	**STEL**	125 ppm
			Ceiling	
☒**Air Monitoring Required**				
Monitoring equipment	PID			
Monitoring location	breathing zone, especially if working in or around trench			
Monitoring frequency	continuous			
Action levels and appropriate response	If prolonged concentrations (holding elevated readings for 30 seconds or more) >10 ppm of >10 ppm in breathing zone or interim PID readings >30 ppm in breathing zone other than a momentary spike. Stop work, move upwind, call PM to assess conditions and determine additional actions needed. PID measurements are set to 10 ppm and 30 ppm because they represent the most conservative screening levels for TCE.			
Exposure Controls	Provide venting using non-sparking fans if necessary.			
Medical Surveillance, if required	NA			
Additional Info	PID will be calibrated with 100 ppm isobutylene gas. Readings will provide a concentration of total volatile organic compounds detectable rather than a specific compound. The detected compounds depend on the lamp installed in the PID. For this application an 11.7 eV lamp will be used. CF for an 11.7 eV lamp is 0.89.			

Contaminant Name	Total Petroleum Hydrocarbons (assume hexane)			
Exposure routes	Inhalation, skin contact, eye contact, ingestion			
Flash point	201° F		**Odor threshold**	
Explosive limits	**LEL**	1.2% vol	**UEL**	7.4% vol
Occupational Exposure Limits	**TWA**	50 ppm (as Hexane)	**STEL**	1100 ppm (as Hexane)
			Ceiling	
☒**Air Monitoring Required**				
Monitoring equipment	PID			
Monitoring location	breathing zone, especially if working in or around trench			
Monitoring frequency	continuous			

Action levels and appropriate response	If prolonged concentrations (holding elevated readings for 30 seconds or more) >10 ppm of >10 ppm in breathing zone or interim PID readings >30 ppm in breathing zone other than a momentary spike. Stop work, move upwind, call PM to assess conditions and determine additional actions needed. PID measurements are set to 10 ppm and 30 ppm because they represent the most conservative screening levels for TCE.
Exposure Controls	Provide venting using non-sparking fans if necessary.
Medical Surveillance, if required	NA
Additional Info	PID will be calibrated with 100 ppm isobutylene gas. Readings will provide a concentration of total volatile organic compounds detectable rather than a specific compound. The detected compounds depend on the lamp installed in the PID. For this application an 11.7 eV lamp will be used. CF for a 11.7 eV lamp is 0.6 (for hexane).

8.0 RISK REGISTER

8.1 Risk Register

Header key:

- PA: Persons Affected
- IC: Initial Consequence
- IL: Initial Likelihood
- IR: Initial Risk
- RC: Residual Consequence
- RL: Residual Likelihood
- RR: Residual Risk
- AC: Additional controls

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Overhead Hazards	Overhead Hazards – Review Conditions	Subcontractor	4	3	12	The Subcontractor is required to provide a HaSEP for Golder's review prior to mobilization. The Subcontractor is required to adequately address safety measures taken to prevent overhead hazards while workers are in the trench.	3	1	3	

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Subsurface Utilities	Subsurface Utilities	Golder Employee	5	3	15	Comply with the Underground Utilities SWP17. Before starting any ground-penetrating work, determine if there are underground utilities. Employees must contact the federally-mandated 811 notification center, 72 hours or 48 hours in advance (pending state reporting requirements), generally excluding weekends and holidays. A private utility locate may be conducted. Review all markings made by the locators and move work locations as needed to avoid striking identified services. Use visual clues to identify possible underground services such as service boxes, pits, manholes or patched pavement. Make note of services coming into or out of the ground like power lines and down spouts. When possible shut off utilities that are in the area while drilling. Consider using other soft-dig techniques such as hand augering or vacuum excavation to verify utility locations.	4	2	8	

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Driving Vehicle (Personal)	Driving Vehicle (Personal)	Golder Employee	4	2	8	Follow Motor Vehicles and Driving on Company Business SWP24. Drivers will have a current driving license and appropriate insurance. Maintain vehicle in a roadworthy condition. Ensure any signs, stickers, or labels are affixed in such a manner that they do not obstruct the driver's vision or impede the driver's use of any controls. The driver should be fit to drive. Adhere to highway regulations and follow speed limits. Do not use any electronic devices while driving. Do not drive in adverse weather or when fatigued. Check weather and routes before departure. Conduct a pre-use inspection of the vehicle including fluid levels. Carry extra windshield washer fluid if expecting to enter a dirty road area. Equip vehicle used for on-site work with fire extinguisher and first aid kit.	2	2	4	

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Driving Vehicle (Rental/Fleet)	Driving Vehicle	Golder Employee	4	2	8	Follow Motor Vehicles and Driving on Company Business SWP24). If unfamiliar with the vehicle, allow sufficient time to familiarize oneself with the controls of vehicle. Verify the vehicle is in roadworthy condition, suited for the intended purpose, and equipped with the appropriate tires (including a spare). Ensure any signs, stickers, or labels are affixed in such a manner that they do not obstruct the driver's vision or impede the driver's use of any controls. Drivers will have a current driving license and be fit to drive. Adhere to all roadway regulations and follow speed limits. Do not drive in adverse weather or when fatigued. Equip vehicle used for on-site work with fire extinguisher and first aid kit. If any safety concerns are identified, the vehicle must not be used. For Golder fleet vehicles, report vehicle deficiencies to the Operations Manager as soon as they are noticed. The Operations Manager, or his/her delegate, will arrange for maintenance of the vehicle.	2	2	4	

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Operating a Vehicle Around Heavy Equipment	Traffic and Road Conditions (e.g., Heavy Equipment Traffic)	Golder Employee	5	3	15	Seat belts shall be worn by all drivers and passengers in vehicles on company business. The vehicle should have a clean windshield unobstructed by rain, debris, fog, or cracks to the shield. Headlights, tail lights, brake lights, and the car's horn should be fully functional to help alert equipment operators to their presence. When reversing onsite, must have a clear rear view, reverse signal alarm, or an observer who can signal instructions to the driver while reversing. Verify the rules of the road (speed limit, type of vehicles, rules on passing, signage, method of communication with other vehicles) and follow any site-specific traffic control.	4	1	4	
General	Pick-Up Truck - Haul Road	Haul Road	Golder Employee	5	3	15	Determine the best way for traffic movement on the planned haul road before project start, and ensure all drivers (truckers, subcontractors, and Golder employees) understand the rule of the road. Drive with headlights on.	2	2	4	

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Vehicle-Animal Collisions	Vehicle-Animal Collisions	Golder Employee	4	2	8	Be alert for wildlife or domestic animals near the road, particularly at dusk, dawn, and night. The number of animal collisions has been documented to peak in October and November during deer mating season. Use high beams whenever possible and watch roadside ditches for animals or for reflections from animal eyes. Slow down if animals are present to reduce stopping distance and watch the animal to see if it moves onto the road. Be aware, some animals move in groups and more may be near the road than can be readily seen. If the animal enters the path of the vehicle, do not swerve into the ditch or into on-coming traffic in an attempt to avoid a collision. In the event of a collision, contact local Fish & Wildlife office or DOT if animal is still alive or if the carcass is a danger to traffic.	3	1	3	
General	Air Emissions (also see SWP 08 for hazardous atmospheres)	Air Pollution	Golder Employee/Community	2	3	6	When using equipment with the potential for air emissions, minimize impacts by using well-maintained and efficient equipment. Do not position any exhaust vents near air intakes of buildings or direct toward a work area. For larger equipment, determine if the equipment is subject to any local/state air permitting or registration requirements. Client should be informed of the relevant equipment we are bringing on site and if it could potentially require permitting/registration or be subject to site-specific procedures.	1	2	2	

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Land Clearing	Animal/Plant Disturbance	Golder Employee/Local Habitat	2	4	8	Clearing may include trees with up to xx-feet tall. Do not undertake any plant clearing without first obtaining permission from the applicable stakeholders and reviewing environmentally sensitive areas. Minimize clearing and choose appropriate clearing methods for the task. Relocate affected plants and animals, if required. Check the applicable regulations for any clearing restrictions or approvals that may apply. Do not destroy or disturb vegetation in areas such as wetlands, creeks, rivers, or declared conservation areas without first consulting regulatory authorities, as a permit may be required for clearing in these areas.	2	1	2	
General	Stormwater Runoff/Erosion Control	Contamination of Local Land and Water	Golder Employee/Local Habitat	3	3	9	Identify potentially sensitive drainage areas and, where possible, move activities away from these areas. Store chemicals, oil/fuel filled equipment, and exposed materials (e.g., excavated materials) away from storm drains, water conveyances, or surface water. If potential for impact to storm/surface water, install silt traps/trenches, fences, or other stormwater controls. Cover cleared/bare areas with geotextiles, vegetation, gravel, or other materials, as necessary, to prevent erosion. Determine if the activities are subject to any local/state stormwater permits, land disturbance permits, erosion control plan, or the like for any land disturbance.	2	1	2	

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	General Lifting	General Lifting	Golder Employee	3	3	9	Understand the appropriate technique for lifting materials and equipment safely. Maintain good working posture, avoid bending your back, twisting, and placing undue strain on your lower back. Hold the load close to your body to reduce the force required to lift. Lift with your legs.	3	2	6	
General	Repetitive Movements	Repetitive Strain (e.g., Field Activities, Offsite Workstation)	Golder Employee	3	4	12	Whenever possible, repetitive tasks should be combined with non-repetitive tasks. Rotate jobs so that you get up and move around frequently. When using field equipment, pay close attention to the potential for awkward body position and the development of muscle fatigue, back strain, or injury. Minimize bending as much as possible. If you experience stiffness or soreness, take a break and stretch.	2	2	4	
General	Operating a Vehicle	Operating a Vehicle	Golder Employee	4	3	12	Comply with the Fitness for Duty and Fatigue SWP27. Employees will not operate a vehicle or mobile equipment if fatigued. Employees shall not drive if the work period has exceeded 14 hours. Travel to and from the work site may be considered part of the working hours. Arrange for accommodation close to the work location to limit travel time.	3	2	6	
General	Undertaking Work Without Adequate Rest	Undertaking Work Without Adequate Rest	Golder Employee	4	3	12	Identify hours of work and comply with the Fitness for Duty and Fatigue SWP27. There should be a minimum of one 30 minute break in each 8 hour work period or part thereof. If a period of 12 hours has been worked, an employee is required to ensure that a break away from work of at least 8 hours is taken prior to returning to work. Non-work activities must allow for sufficient rest.	3	2	6	

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Working Abnormal Shifts	Working Without Adequate Rest	Golder Employee	4	3	12	Comply with the Fitness for Duty and Fatigue SWP27. Include fatigue as a topic of discussion during daily tailgates. Schedule work during daylight hours, if possible.	3	2	6	
General	Working Long Hours	Working Without Adequate Rest	Golder Employee	5	3	15	Identify hours of work to comply with the Fitness for Duty and Fatigue Management SWP27. All activities should be designed to fit into the standard work day/work shift of 12 hours (including travel time). If work exceeds the maximum, a fatigue risk assessment must be conducted and permission sought by PM or OM. Employees shall not drive if the work period has exceeded 14 hours - find alternative methods of transportation.	3	2	6	

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	General	Using the Correct Tool for the Task	Golder Employee	3	2	6	Follow the Hand and Portable Power Tools SWP20. Misuse and improper maintenance of tools pose serious hazards. Use the correct tool for the job it was designed for. Verify manufacturer's safe operating pressures for hydraulic hoses, valves, pipes, and filters. Understand the potential hazards and safety precautions specific to the tool. If unsure how to use a piece of equipment, seek advice from your Project Manager, Site Supervisor, or Site Safety Officer. Never carry a tool by a cord or hose. Avoid creating a trip hazard from cords and hoses. Disconnect tools and de-energize when not in use, before servicing, and when changing accessories, such as blades or bits. If there is machine guarding on the tool, do not remove it when using the tool. Inspect the integrity of any guards and the condition of any cords and hoses before each use. Use only intrinsically safe tools in locations where sources of ignition may cause fire or explosion.	2	2	4	
General	Hand Tool Inspection	Using Properly Maintained Tools	Golder Employee	4	3	12	Inspect all tools before each use. Check handles and heads on hammers, sledges, shovels, picks, mattocks, and other such tools for splinters, soundness, and adequate sharpness. Clearly label damaged tools "Out of Service". It may be necessary to cut cords or render unusable to prevent inadvertent use of a damaged tool.	2	2	4	

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Knives, Saws, or Sharp Tools	Cuts	Golder Employee	4	3	12	Use the right cutting tool for the job. When using utility knives, use those with a spring loaded self-retracting blade. The use of cutting tools with blades longer than 4 inches in length must be approved by your OM. Always cut away from your body. Cut samples on clean, dry surfaces. Never cut anything placed in your hand. Dull tools can be more hazardous that sharp ones. Properly maintain and store all knives and blades.	2	2	4	
General	Power Tools - Electrical	Laceration/Electrocution/Flyings/Rotating Equipment	Golder Employee	5	4	20	Inspect all tools before each use. Clearly label damaged tools "Out of Service". It may be necessary to cut cords or render unusable to prevent inadvertent use of a damaged tool. Use a tool only for its designed purpose.	3	2	6	
General	Distraction (SWP 23)	Distraction	Golder Employee	5	3	15	Always pay attention to the task at hand and the hazards posed by the work site, including mobile and stationary equipment and other people working. Never use a cell phone or other electronic device while operating a motorized vehicle or while walking on a construction or client site. Do not wear headphones while on the project site.	3	1	3	
General	Stress	Stress	Golder Employee	3	4	12	Supervisor to communicate expectations and receive feedback from staff regarding workload. Identify options to provide rest and food breaks to staff. Stay focused and eliminate any distractions and interruptions. Do not overcommit.	2	2	4	

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Young or New Worker	Not Familiar with Work	Golder Employee	4	4	16	Provide orientation training before the worker goes to site. New worker should work with a mentor until their level of knowledge and understanding of site and work hazards is assessed and verified to be adequate.	4	1	4	
General	Slips, Trips, and Falls	Slips, Trips, and Falls	Golder Employee	4	3	12	Follow Slips, Trips, and Falls SWP14. Use care and attention when walking. Before starting work, conduct a survey of the area looking for uneven ground, mud, water, loose material, or other conditions that could cause slips, trips, or falls. In cold weather environments, walkways shall be sanded, salted, or cleared of snow and ice as soon as practicable. Establish level pedestrian footpaths, avoiding slippery surfaces wherever possible. Relay identified hazards to others working at the site. Wear footwear appropriate to the tasks and identified hazards. Footwear should be in good condition and provide effective traction and ankle support.	2	2	4	
General	Changing Weather Conditions	Changing Weather Conditions	Golder Employee	4	3	12	Assess forecasted weather conditions before beginning work. Postpone activities if weather conditions are not favorable. Remain vigilant at all times and continually re-assess weather conditions. Consider carrying a weather radio with spare batteries. Know how to contact the local weather resources. If weather conditions deteriorate, stop work and seek shelter as necessary. Understand who is responsible for suspending work due to extreme weather conditions.	3	2	6	

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Heat (SWP 04)	Heat stroke, heat stress, sunburn	Golder employee	4	3	12	Check daily weather reports. Wherever possible, reduce temperature and humidity through air cooling and increased air movement. Assess physical demands of the work and provide equipment that will reduce the physical demands. Work in shaded areas, or provide barrier to give shelter from the sun. Schedule work to allow workers to acclimatize. Schedule work to cooler times of the day. Increase the frequency and lengths of break periods. Provide a cool, shady place to take breaks. Assign extra workers or slow down the pace. Drink plenty of fluids. Make water and sports drinks available. Use a buddy system; check each other frequently for signs of heat stress (e.g. disorientation, lack of sweat, fatigue). Assess each worker for factors that may contribute to early onset of heat stress. Wear hats and light colored loose clothing. Cooling vests may be required. Consider the additional stress load caused by PPE such as Tyvek coveralls. If someone is suffering from heat-related illness:- Move the person to a cool area, maybe the air-conditioned vehicle. - Give the person small amounts of cool (not cold) water.- DO NOT leave the person unattended.- Immediately seek qualified medical assistance if the person does not recover or their condition worsens.	3	2	6	

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Lightning	Lightning	Golder employee	5	3	15	Check daily forecast. Carry a weather radio and extra battery as well as a personal lightning detector. Postpone outdoor activities if thunderstorms are imminent. Stay away from tall objects such as towers, fences, telephone poles and power lines. Avoid touching metal if you take shelter in your car. If you must take shelter outdoors, find a low spot away from trees, fences and poles. If you feel your skin tingle and hair stand on end, squat low to the ground, on the balls of your feet. Place hands over ears and your head between your knees. Make yourself the smallest target possible, with minimum contact with the ground. DO NOT lie down.	3	1	3	
General	Sun (SWP 04)	Sunburn	Golder employee	4	3	12	Sunburn can occur even when the weather is not hot. It is possible to get sunburn in the winter time or on water. Check UV rating, wear sunscreen, look for shade, protect eyes with shaded glasses.	2	3	6	
Tasks	Monitoring Excavation Conditions	Monitoring Excavation Conditions	Golder Employee	4	2	8	Golder personnel should observe conditions in excavations or trenches from the 'short' edge (opposite end to the excavator) as the potential for instability is generally lower here. Monitor the excavation for signs of instability such as slumping of side walls, tension cracks, and water ingress. Observations are particularly important for sandy soils, poorly compacted soils, uncontrolled fills or wet fissured clays. If slumping occurs or any changes are observed indicating possible unstable conditions, move out of the work area and contact the project manager.	3	2	6	

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
Tasks	Stability of excavator	Stability of excavator	Golder Employee	3	2	6	Choose a site that allows for safe access for the excavator. Determine the experience level of the excavator operator, years of experience, type of equipment and the type of sites worked on. Request that the excavator operator verifies the equipment is stable. Slope stability should also be considered particularly when working in close proximity to crests or at the base of steep slopes where rock falls are possible. Keep traffic, equipment, and the edge of temporary spoil piles at least 2 feet from the edge of the excavation. Permanent spoil piles should be placed further from the excavation.	2	2	4	
Tasks	Working Around Heavy Equipment (SWP 18)	Working around heavy equipment	Golder employee	4	3	12	Heavy equipment activity may change daily or hourly, with differing potential hazards that need to be identified and addressed. Never approach an operational piece of heavy equipment until the operator is aware of your presence, your desire to approach, and signals the OK – where possible use radio contact. Stand in a safe location. Never work or pass directly under a lifted or suspended load. Whenever a Golder employee works on a project site where heavy equipment is operated, the Working Around Heavy Equipment SWP 18 must be followed.	4	2	8	

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
Tasks	Tree Falling	Unique task that requires falling trees from the sides of the trench and removing them from the work area.	Subcontractor or Employee	3	3	9	Trees within the trench will need to be cut down and removed prior to backfilling. The Subcontractor is required to provide a HaSEP for Golder's review prior to mobilization. The Subcontractor is required to adequately address tree cutting/falling from the sides of the trench.	3	3	9	
Work Environment	Electrical (GAI electrical safety program HSE 204)	Electrical (extension cords, electrical panels)	Golder employee	5	3	15	Be aware of electrical cords lying on the ground. Report any damage or taped cords as these should be taken out of service and replaced. Keep extension cords away from traffic areas to prevent damage. Keep extension cords away from wet areas. Use ground fault circuit interrupter (GFCI) protection in wet or outdoor locations. Stay away from live electrical panels. Do not store material within 3 feet of electrical panels.	3	3	9	
Work Environment	Falls - Housekeeping (SWP 14 and 22)	Slips, trips, and falls	Golder employee	4	4	16	Conduct a survey of the work area to determine areas where slips, trips and falls could occur. Look for uneven ground, mud, water, loose material, snow, ice, or other housekeeping issues. Smooth out uneven ground, place material to counteract mud or water, clear snow and ice away, salt or sand icy areas.	3	3	9	
Work Environment	Working near unstable slopes	Falling, cave-ins Falls of ground	Golder employee	4	4	16	Watch for signs of unstable slopes (tension cracks). Watch your footing, stay off rocky, steep or unstable slopes. Do not enter any unsupported excavation areas.	3	3	9	

Work Environment	Hazardous/Flammable Atmosphere (SWP 08)	Flammable / combustible gases and liquids	Golder employee	4	3	12	All hazardous areas, defined as areas where flammable atmospheres are likely to be present must be designated and identified on a site plan. Review this plan on entry to the site. Electrical and battery-powered equipment and equipment capable of producing a local source of ignition (e.g. flame, static electricity, friction, heat, spark, exhaust) are not permitted unless approved by the permit and certified as intrinsically safe (documented evidence required). Some examples of such equipment are power tools, portable radios, mobile phones, pagers, calculators and water quality meters. As some gases are heavier than air, entry into all excavations deeper than 4 feet is strictly prohibited because it may be classified as a potential confined space. Monitoring of flammable gases in ambient air (the breathing zone) will be undertaken where ground penetrating work is being performed or where any work is undertaken in enclosed areas. If <10% LEL: continue with investigation. 10% and 25% LEL: Continue onsite monitoring with extreme caution as higher levels may be encountered. >25% LEL: Explosion hazard. Withdraw from area immediately. All personnel to evacuate upwind, to a safe distance. Contact Project Manager. Flame retardant clothing shall be worn in potentially flammable environments. Subcontractor is required to provide a HaSEP for Golder's review prior to mobilization. The Subcontractor is required to adequately address safe access/egress and a quick means of extraction for workers	4	2	8	

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
							who may become unresponsive in a potentially hazardous atmosphere.				
Unique Issues	Bees, wasps	Bees, wasps	Golder employee	3	3	9	Follow Biological Exposure Risk SWP 3. Check the area for nests. Do not disturb nests. Wear light-colored clothing and cover as much of the body as possible. Avoid perfumed soaps, shampoos, and deodorants. Don't wear cologne or perfume. Avoid flowering plants when possible. Keep work areas clean. Social wasps thrive in places where humans discard food. Remain calm and still if a single stinging insect is flying around. (Swatting at an insect may cause it to sting.) If you are attacked by several stinging insects at once, run to get away from them. (Bees release a chemical when they sting, which may attract other bees.) Employees with a history of severe allergic reactions to insect bites or stings should consider carrying an epinephrine auto injector (EpiPen).	3	1	3	

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
Unique Issues	Mosquitoes	Mosquitoes	Golder employee	3	2	6	Follow Biological Exposure Risk SWP 3. Wear full length clothing. Light colored clothing makes it easier to see mosquitoes. Avoid working at dawn and dust when mosquitoes are most active. An insect repellent containing diethyl-meta-polyamide (DEET, > 20% for longer protection) or something similar (e.g., picaridin, or oil of lemon eucalyptus) should be applied to clothing and skin before going into the field.. Permethrin may be used, but on clothing only. The repellent should be applied and re-applied according to the manufacturer's instructions. Determine if area is impacted by West Nile virus, Encephalitis viruses, Dengue fever or Malaria. If so, know the symptoms of infection and seek medical treatment, as needed.	3	2	6	
Unique Issues	Spiders	Spiders	Golder employee	2	3	6	Follow Biological Exposure Risk SWP 3. Do not place bare hands in hollow logs or under piles of wood or trash. Be cautious inside manholes and other confined spaces. Wear leather gloves or similar when handling these items. If boots or clothing removed, check them prior to putting them back on for the presence of spiders. Keep your tetanus boosters up-to-date (every 10 years). Spider bites can become infected with tetanus spores. Bites by most spiders result in local swelling only. If bitten: 1. Remain calm. 2. Clean the area with soap and water. 3. Apply ice to relieve swelling and pain. 4. Elevate bite area, if possible. 5. Seek medical assistance. If possible, collect the spider or remains of spider to facilitate identification.	2	2	4	

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
Unique Issues	Ticks	Ticks	Golder employee	3	2	6	Follow Biological Exposure Risk SWP 3. Wear full length clothing (tucking pants into socks prevents access for ticks). Light colored clothing makes it easier to see ticks and remove them before they can attach to the skin. Walk in the center of trails. An insect repellent containing diethyl-meta-toluamide (DEET) (20 – 30%) or other effective repellent should be applied to clothing and skin before going into infested areas. The repellent should be applied and re-applied according to the manufacturer's instructions. All clothing should be removed after visiting tick infested areas and the entire body checked for ticks. Paying particular attention to the scalp, areas behind the ears and the back of the head or neck. Review and understand the signs and symptoms of a tick bite.	3	1	3	

9.0 PERSONAL PROTECTIVE EQUIPMENT

Item	Required	Provided by Golder	Provided by Client	Specific Requirement
Wet Weather Gear	☒	☒	☐	If necessary to Golder employees, subcontractors to provide for there employees
Gloves				
Cut resistant	☒	☒	☐	If necessary
Chemical resistant	☒	☒	☐	Use when environmental sampling.
Head Protection				
Hard Hat	☒	☒	☐	
Hearing Protection				
Disposable foam ear plugs	☒	☒	☐	When working in high noise locations
High Visibility Clothing				
Yellow	☒	☒	☐	Orange also allowed
Safety Footwear				
Safety boots	☒	☒	☐	Steel toe
Eye Protection				
Impact resistant safety goggles or glasses	☒	☒	☐	
General Protection				
Sun cream or block	☒	☒	☐	If necessary
Insect repellent	☒	☒	☐	If necessary
Other				
PID	☒	☒	☐	for monitoring breathing zone

10.0 TRAINING

It is up to the Project Manager to arrange for the following training e.g. Confined Spaces.

Course Name	Employee Name or Role
10 HR OSHA, 40 HR HAZWOPER, First Aid/CPR	All Golder Employees
10 HR OSHA, 40 HR HAZWOPER	Subcontractors

11.0 INCIDENT AND EMERGENCY MANAGEMENT

11.1 First Aid Arrangements

Method of communication	**Phone**	Field phone (to be provided by field lead at start of work)
	Radio channel	
Location of first aid kit	Field Vehicles	
First Aider(s)	Golder employees	

11.2 Fire Safety

Location of fire extinguishers	Field Vehicles
Location of assembly point	Will be established at the beginning of the project, and may change depending on field conditions.

11.3 Environmental

☒Spill kit – to be provided by subcontractor
☒Sediment control – to be supplied and installed by subcontractor

12.0 HSE PLAN CONTROL

It is the responsibility of the Project Manager to ensure that this HaSEP is prepared and the contents communicated at the pre-start / toolbox meeting to all project staff, Golder or subcontractor, with a copy held on site. The HaSEP has been reviewed or prepared by the Project Manager.
If the project site is remote from the home office, this HaSEP is to be reviewed and approved by the local Golder office whether in another country, province or city.

Role	Name (printed)	Date	Signature
Prepared by	Jing Song Xi	3/15/18	
Reviewed by	Aaron Rydecki	3/16/18	
Approved by	Gary Zimmerman		
Other			

12.1 Golder Sign-off

Signing below indicates you have read and agree to comply with the information contained in this document.

Date	Name	Company	Signature

13.0 ONSITE CHANGES AND REVIEW

Date	Change or modification	How was it communicated?

14.0 REVISION HISTORY

Version	Author	Date	Amendments, hazards associated with amendments & controls	Reviewed and communicated to all parties	Approved by
V1					

APPENDIX A

Written Work Procedures
(Documents to be provided for Field Work)

- HSE_200.004_SWP_Heat_Stress.pdf
- HSE_200.008_SWP_Gas_Hazards_and_Exposure.pdf
- HSE_200.014_SWP_Slips_Trips_and_Falls.pdf
- HSE_200.017_SWP_Underground Utilities.pdf
- HSE_200.018_SWP_Working_Around_Heavy_Equipment.pdf
- HSE_200.020_SWP_Hand_and_Portable_Power_Tools.pdf
- HSE_200.021_SWP_Hearing_Protection.pdf
- HSE_200.022_SWP_Housekeeping.pdf
- HSE_200.023_SWP_Cellular_Telephone.pdf
- HSE_200.024_SWP_Motor_Vehicles_and_Driving.pdf
- HSE_200.027_SWP_Fitness_For_Duty.pdf
- HSE_200.034_SWP_Lockout_Tagout.pdf
- HSE_200.036_SWP_FA_CPR_AED_BBP.pdf
- HSE_200.052_SWP_Behavior_Based_Safety.pdf

APPENDIX B

GAI HSE 204 – Electrical Safety Program
(Documents to be provided for Field Work)

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