PREPARED FOR
INTALCO

Draft
2011 Early Works Implementation Plan Holden Mine

Chelan County, Washington

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MWH®

BUILDING A BETTER WORLD

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Attachment A 2011 Early Works Implementation Design Drawings

LIST OF ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
AOC	Administrative Order on Consent
ARAR	applicable or relevant and appropriate requirements
BMP	best management practice
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMP	corrugated metal pipe
CQCP	Contractor Quality Control Plan
CT	contact time
DBH	diameter at breast height
DI	ductile iron
EMCF	eastside mixed coniferous forest
FS	Forest Service
HDPE	high-density polyethylene
LWA	Lower West Area
MSHA	Mine Safety and Health Administration
MSL	mean sea level

NCP	National Contingency Plan
OBE	operating basis earthquake
OSHA	Occupational Safety and Health Administration
PVC	polyvinyl chloride
RCP	reinforced concrete pipe
ROD	Record of Decision
SDR	standard dimension ratio
SHEAP	Safety Health and Environmental Action Plan
SWRA	Surface Water Retention Area
TCRA	Time Critical Removal Action
UPS	uninterrupted power supply
USEPA	U.S. Environmental Protection Agency
USFS	United States Forest Service
USDA FS	United States Department of Agriculture Forest Service
WSDOT	Washington State Department of Transportation

1.0 INTRODUCTION

This 2011 Early Works Implementation Plan was developed by MWH on behalf of Intalco Aluminum Corporation (Intalco) to describe the 2011 construction activities that are scheduled to take place at the Holden Mine Site under a forthcoming Time Critical Removal Acton (TCRA) Memorandum. The Site is being managed by the U.S. Department of Agriculture Forest Service (USDA FS) in conjunction with the U.S. Environmental Protection Agency (USEPA) and Washington Department of Ecology (collectively referred to as the Agencies). Work to-date, which includes preparation of the Remedial Investigation, Feasibility Study, and Proposed Plan, has been conducted under an Administrative Order on Consent (AOC) dated April 11, 1998, and amended in October 2010, between Alumet Corporation (Intalco's predecessor). The Record of Decision (ROD) is anticipated to be finalized in 2011. The TCRA is necessary to allow for timely implementation of the anticipated remedial action for the Site. The remote site has numerous constraints that limit the time available to implement the remedy, and therefore it was essential to develop a schedule that was agreeable to all stakeholders and would achieve the remedial action objectives within a reasonable time period. This schedule, which was presented as Figure 15 of the Proposed Plan (Forest Service 2010), illustrates the intent by the Agencies and Intalco to complete, to the extent practical, the major remedial action construction activities in 2013 and 2014. In order to meet this schedule, it is critical to complete certain early construction activities at the Site in 2011 and 2012 to make it ready for 2013 remedial action construction work.

Specifically, the early actions to be conducted under this Removal Action are:

1. Timber removal
2. Uplake Port (Lucerne dock and barge ramp) modifications
3. Holden Village potable water line relocation
4. US Forest Service (USFS) Road 8301 (Holden-Lucerne Road) modifications
5. Construction of a bypass road and associated temporary bridge around Holden Village
6. Cleanup of debris from around the site
7. Installation of bulkheads in the 1500 Level Main and Ventilator portals
8. Construction of a new maintenance shop for Holden Village (the existing building will need to be demolished)
9. Construction of staging areas
10. Excavation or covering of soils in the Lagoon area and potentially in the Lower West Area-East to ready these areas to be used for contractor staging
11. Limited excavation or in-situ treatment of impacted soils in the Ballfield so the Holden Village wood yard can be relocated there
12. Excavation or in-situ remediation of impacted soils in the Surface Water Retention Area (SWRA)

The TCRA is being completed pursuant to Section 104(a)(1) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, 42 U.S.C. § 9601 et seq., and Section 300.415 of the National Contingency Plan (NCP), 40 C.F.R. § 300.415.

This Implementation Plan describes the scope of the work to be completed in 2011 and provides basic design information as well as details on the implementation of each work item. Included in this submittal are various design calculations and analyses as well as a set of Design Drawings.

Design for some of the work elements is still in progress and the following companion documents still need to be prepared and submitted to the Agencies:

- Solid Waste Management Plan
- Traffic Control Plan
- Permit Requirements Plan
- Emergency Contingency Plan
- Construction Quality Control Plan

1.1 SITE DESCRIPTION AND ENVIRONMENTAL SETTING

Holden Mine is an inactive underground copper mine located in the Cascade Mountain Range in the Wenatchee National Forest in north-central Washington State (see Figure 1-1). During its productive life, it was one of the largest copper mines in the United States employing approximately 450 workers until operations were discontinued in 1957. The mine was developed south of, and adjacent to, Railroad Creek approximately 11 miles upstream from the creek's outlet at Lake Chelan near the Lucerne dock. Access to the Holden Mine from Lucerne requires travel on a narrow gravel road. Access to Lucerne is provided by commercial ferry and barge from Chelan, at the south end of Lake Chelan, as well as a dock at Field's Point Landing on the southwest side of the lake, and by chartered float plane.

The underground mine is on the south side of the Railroad Creek drainage between 3,200 and 4,200 feet mean sea level (MSL). Remaining features include the remnants of the mill; three tailings piles; two primary waste-rock piles; tunnel and adit portals; and incidental remnants. Most of the above-ground features, including the tailings piles, waste rock piles, and main portal (the so-called 1500 Portal) are between 3,200 and 3,450 feet MSL. Tailings Piles TP-1, TP-2, and TP-3 cover a total of approximately 70 acres. The two primary waste rock piles are located next to the mill site, one just east and one just west, and five additional waste rock piles are situated within the area known as Honeymoon Heights. The main features of the Site are shown in Figure 1-2.

Several streams are tributary to Railroad Creek. These include Copper Creek, which flows from the south side of the valley into Railroad Creek between Tailings Pile 1 and Tailings Pile 2, and several tributaries east (downstream) of the Site. Copper Creek is the largest tributary stream. The next largest tributary is Tenmile Creek, which flows out of a steep gulley on the north side of the valley to the east of TP-3 southeastward and across the eastward side of a large alluvial fan before discharging to Railroad Creek. Other downstream tributaries to Railroad Creek include Ninemile Creek, Dole Creek, Sevenmile Creek, and Sixmile Creek.

Directly across the valley from the mine facilities, on the north side of Railroad Creek, are remnants of the old mining town and the existing community of Holden Village. Holden Village is a community of about 60 year-round residents as well as an interdenominational retreat center that receives thousands of visitors annually, primarily in the summer months. Holden Village relies on the income from the retreat program for their economic viability.

Railroad Creek lies in a glacial valley carved into the igneous and metamorphic bedrock. The mine workings were developed to extract ore from zones of metamorphic schists and gneisses on the south side of the valley. This zone is extensively faulted and fractured. East and west of the zone of metamorphism, the bedrock is primarily composed of igneous rocks, including diorite, tonalite, and granite. The igneous rock tends to be less faulted and fractured than the metamorphic zones.

The valley bottom and lower sidewalls have been covered with soil of glacial origin, reworked glacial sediments, and alluvium transported and deposited by Railroad Creek. The tailings and waste rock piles overlie the glacial soil and alluvium.

Groundwater is present in the glacial sediments and alluvium, and to a limited extent in the mine tailings. Minor amounts of groundwater are present in bedrock fractures, some of which drains into the mine workings. Water from the mine drains primarily from the 1500 Portal and discharges to Railroad Creek near the western end of the Lower West Area (LWA); a lesser flow of water also drains from various seeps throughout the Site.

The Glacier Peak Wilderness generally surrounds the Holden Mine, as shown in Figure 1-2. Railroad Creek, the Holden-Lucerne Road, the Holden Mine, Holden Village, and much of the north side of the valley are excluded from the wilderness area, but nearly all of the west side and most of the south side of the valley are within the wilderness area.

Both north- and south-facing slopes contribute to a rich diversity of plant community types and wildlife habitats. Based on habitat types defined by Johnson and O'Neil (2001), the area can be categorized into two dominant types: Eastside mixed coniferous forest (EMCF) and eastside riparian wetlands. EMCF supports a wide array of tree species with Douglas-fir (*Pseudotsuga menziesii*) being the most common. The undergrowth vegetation can vary from open to nearly closed shrub thickets. Eastside riparian wetland habitats contain shrublands, woodlands, and forest communities that are often multilayered and can have closed to open canopies.

1.2 REMEDY COMPONENTS

Although the remedy for the Site has not yet been selected by the Agencies, the major components relevant to this 2011 Early Works Implementation Plan are as follows:

Tailings Piles 1, 2, and 3: The tailings pile slopes will be regraded for greater stability under steady state and seismic conditions. A portion of Railroad Creek will be diverted northward. The Copper Creek channel will be improved to reduce the risk of erosion from Tailings Pile 1 and Tailings Pile 2. All three Tailings Piles will be capped with a soil cover. Soils with hazardous substances that may be consolidated from other portions of the Site, and possible excess waste rock from regrading the East and/or West Waste Rock Piles, will be consolidated onto the tailings piles before capping.

East and West Waste Rock Piles: The East and West Waste Rock Pile side slopes will be regraded to configurations that are stable under steady state and seismic conditions. The top and side slopes of the waste rock piles will then be capped with a cover.

Lower West Area and Lagoon: Contaminated soil in some locations, including the Lagoon, a portion of the Lower West Area-East, and contaminated soils in existing disturbed areas, may be removed and consolidated into the tailings piles prior to capping.

Maintenance Yard: The Maintenance Yard area will be capped with asphalt or concrete pavement to isolate contaminated soil. The extent of the cap will be determined based on additional characterization during Remedial Design

Former Mill Building: The former mill building will be demolished as needed to eliminate the safety risk associated with the dilapidated structure.

Surface Water Retention Area Soils: Soil above proposed cleanup levels will be excavated from the SWRA and consolidated into the tailings piles prior to capping; however, in-place capping of the area may be acceptable.

Groundwater: The Main Portal drainage, along with seeps SP-12 and SP-23, will be collected and treated. Additional seeps may be collected for treatment following source controls.

A groundwater containment barrier wall and collection system will be constructed around Tailings Pile 1 and the LWA. Collected water will be conveyed to a treatment facility located in the LWA or east of Tailings Pile 3. A portion of Railroad Creek will also be relocated and the old stream bed may be used to collect contaminated groundwater in the East area along Tailings Piles 2 and 3. An additional barrier wall and groundwater collection system, downgradient of Tailings Piles 2 and 3, are also under consideration as part of the remedy. If installed, water collected by this system also would be treated at the proposed treatment system. However, if it can be demonstrated over time that the installation of the barrier wall is not necessary to protect the aquatic environment or that other additional remedy components will be protective, the barrier wall around Tailings Piles 2 and 3 will not be required.

Surface Water: Surface water will be remediated by preventing the erosion of tailings into surface water and by controlling the discharge of contaminated seeps and groundwater (including discharge from the Main Portal) into Railroad Creek and Copper Creek. The actions associated with managing tailings and groundwater will be implemented in part to achieve the surface water cleanup objectives. In addition, construction of stormwater diversion swales upgradient from all three Tailings Piles and the East and West Waste Rock Piles will be performed to control surface water run-on.

Sediment: Relocation of Railroad Creek will divert stream flow away from areas impacted by existing ferricrete. However, in areas where Railroad Creek is not relocated, physical break up and/or removal of the iron armor may be required.

1.3 PROJECT ORGANIZATION

The following list provides the responsible personnel for implementation of the 2011 Early Works:

Organization	Representative	Role	Contact Tel. #
Intalco	Dave Cline	Intalco Project Manager	801 204-2526; 801 556-1376 (c)
MWH	Ron Schlicher	Project Manager	801 617-3227; 801 232-6206 (c)
MWH	Phil Crouse	Engineering Manager	303 291-2163; 303 589-2665 (c)
MWH	Paul Pellicer	Infrastructure Design Task Manager / Project Engineer	970 367-6943; 970 871-4373 (c)

All communications with Intalco's Project Manager and Agencies overseeing the work effort will be through the MWH Project Manager (Ron Schlicher) or the designated coordinator/task manager. All communications during which decisions are made and/or actions are taken will be documented.

A satellite telephone will be available at the site, as well as in Holden Village in the event of an emergency and/or key decisions need to be made by the Project Manager and/or Intalco's Project Manager. Two-way radio communications will be used by on-site personnel, and radio communications with road vehicle operators at Holden Village will be maintained on a predetermined frequency when operating vehicles on the Holden-Lucerne road. This requirement will apply to MWH, Intalco, and subcontractors. Another frequency will be established for MWH and its subcontractors for internal communications, and for on-site communications with the Agencies as appropriate.

1.4 SCOPE OF IMPLEMENTATION PLAN

This Plan is intended to cover all construction-related activities to be conducted at the Site in 2011 as part of or in preparation for the final remedy implementation. Some of these activities are still in the design stage or are subject to change based on permitting authority review. The discussion of such activities focuses on what is known at this time and the steps to complete the design and obtain Agency approval. For those items where the design has been more fully developed, we present the current configuration and/or condition, intended modification and use for each component, and briefly summarize the design basis for the modifications. In addition to the design basis and drawings, bid packages including specifications, insurance and safety requirements, etc. are being prepared for use in procuring contractors and materials but they are not included in this Plan.

2.0 COMPLIANCE WITH APPLICABLE REGULATIONS, RULES, AND PROCEDURES

Remedial action and associated studies at the Site are governed by the requirements of CERCLA and therefore, no federal, state, or local permits are required for this work, as allowed under 42 U.S.C. 9621(e)(1). However, the substantive requirements associated with the permits still need to be met. These permitting requirements and applicable codes or guidelines are briefly discussed in the relevant sections of this document. All activities will comply with potential applicable or relevant and appropriate requirements (ARARs) for on-site activities to the extent practicable and as described in this Plan.

Field work will be conducted in accordance with the Forest Service Fire Protection and Suppression requirements identified in R6-FS-6300-52 (5/97) as provided by the Forest Service, including any request for waiver as required to perform the work in the agreed-upon timeframe. In addition to the regulatory requirements, all equipment will be cleaned and inspected for noxious weeds prior to mobilizing to the Site and prior to leaving the Site.

All applicable requirements of the Occupational Safety and Health Administration (OSHA) will be followed as specified under 29 CFR 1910.120. All work will be completed under MWH's Health and Safety Plan and associated Safety Health and Environmental Action Plan (SHEAP).

3.0 DESIGN OBJECTIVES AND CRITERIA

3.1 DESIGN OBJECTIVES

The objectives of the infrastructure design component of the 2011 work are to provide improved, safe, site-wide access for the implementation of the proposed remedy; to protect or minimize construction impacts to non-affected areas; to permanently or temporarily relocate the Holden Village maintenance facilities which will be impacted by the remedy, while maintaining their functionality; and to establish adequate areas for contractor facilities and materials storage.

3.2 DESIGN CRITERIA

The 2011 Early works are designed based on guidance from several agencies. Various design guidelines were utilized from the USDA FS, Washington State Department of Transportation (WSDOT), Chelan County Building Division, the Mine Safety and Health Administration (MSHA), and the American Association of State Highway and Transportation Officials (AASHTO). Applicable guidelines are noted below and referenced in the design calculations where applicable.

The following table includes basic design criteria used for engineering the infrastructure improvements:

Item	Design Criteria	Reference
Forest Service Road 8301 Modifications		
	Design Vehicle Width = 12 feet	2
	Design Vehicle Length = 55 feet	2
	Minimum Travel Lane Width = 14 feet	2
	Minimum Width at Turn Outs = 2 times travel lane width + 4 feet clearance = 32 feet	1
	Turn Out Length = Design Vehicle Length = 55 feet	1
	Turn Out Transition Length = 50 ft	1
	Safety Berms at Turn Outs: mid axle height of the largest vehicle = 3.5 feet	3
	Design Speed: 20 mph	1, 2
Holden Bypass Road		
	Design Vehicle Width = 12 feet	2
	Design Vehicle Length = 55 feet	2
	Minimum Travel Lane Width : 2 times the design vehicle width = 24 feet	3
	Minimum Width at Turn Outs = 1.5 times travel lane width = 36 feet	3
	Turn Out Length = Design Vehicle Length = 55 feet	1

Item	Design Criteria	Reference
	Turn Out Transition Length = 50 ft	1
	Road Crown or Cross Grade: 2%	1
	Safety Berms for Elevated Roadways: mid axle height of the largest vehicle = 3.5 feet	3
	Design Speed: 20 mph	1, 2
Roadway Cut and Fill Slope Stability Criteria		
	Long – Term Static Stability: FOS >= 1.3	4
	Seismic Load: NA for non critical slope not supporting structures	4
Bridge Design		
	Design Vehicle: Caterpillar 740 Articulating Truck, Fully Loaded	2
	Minimum one-way Bridge Lane Width- 14 feet	8
	Wind Speed: 85 MPH exposure C	5
	Flat Roof Snow Load: 180 psf	5
	IBC Seismic Zone D	5
	Superstructure Design Per AASHTO Standard Specifications for Highway Bridges, 17th Edition	8
Bridge Abutment Design		
	Long – Term Static Stability: FOS >= 1.5	4
	Pseudo-Static FOS >= 1.1	4
	Operating Basis Earthquake (OBE): M = 6.0	7
	OBE Maximum Bedrock Acceleration = 0.118g	7
	Maximum Design Earthquake (MCE), M = 6.5	7
	MDE Maximum Ground Acceleration = 0.248g	7
	Flood Passage: 100 yr flow = 2500 cfs	7, 8
	Required Freeboard for Debris Passage = 5 feet from Max. water surface elevation to the lowest bridge member	8
Miscellaneous Structures		
	Wind Speed: 85 MPH exposure C	5
	Flat Roof Snow Load: 180 psf (Elevation 3230 feet ngvd or below)	5
	IBC Seismic Zone D	5
	Frost Penetration Depth: 24 inches	5

References:
1. USDA Forest Service, *FSH 7709.56 – Road Preconstruction Handbook*, 1987
2. MWH, *Based on Proposed Construction Equipment and Engineering Judgement,* 2010
3. MSHA, Haul Road Inspection Handbook, 1999
4. Washington State Department of Transportation, *Geotechnical Design Manual*, 2010
5. Chelan County Building Department, *Telephone Conversation*, Febuary 1, 2011
6. URS, *Draft Geotechnical Report*, 2009
7. URS, *AppendixE, Draft Hydrogeology Technical Memorandum*, 2009
8. USDA Forest Service – Pacific Northwest Region (R-6) Transportation Structures Group, *Guidelines for Bridge Design*, 2005

4.0 2011 PROJECT COMPONENTS

4.1 PROJECT OVERVIEW

The Holden Mine Site is in a remote location with limited access and very steep and heavily forested terrain. Access to the site requires boat travel up Lake Chelan from the greater Chelan area or Fields Point to Lucerne. Currently the facilities for boat transportation are primarily tailored for personnel transport and light cargo, with very limited access for vehicles and heavy cargo via barge transport. Improvements are needed to handle the heavier loads and large volumes of personnel, equipment, and materials needed for construction. From Lucerne, the Site is accessed by Forest Service (FS) Road 8301, a narrow, single lane gravel road with switch backs and no safety barriers. This road is the lifeline of the project and will need to be improved to handle the high volume of construction traffic as well as continue to serve Holden Village's needs.

The Holden Mine Site is generally compact, consisting of relatively steep valley walls, mining impacted soils, primitive gravel access roads, and little or no area which will not be impacted by the remedy. To accommodate construction activities associated with the remedy, numerous areas need to be developed to provide storage for construction material, construction offices and equipment. In addition, the main access road to the Site (FS Road 8301) runs directly through Holden Village which represents a significant safety issue. Therefore, it is essential to develop a bypass road to route traffic around the village. A temporary bridge will need to be installed across Railroad Creek as part of the bypass road.

Areas affected by the proposed remedy are utilized by Holden Village for their maintenance facilities, wood yard, potable water supply, and electricity generation. The continued functionality of these facilities is essential to Holden Village. The use of these facilities will be directly impacted by the remedy and must be temporarily or permanently relocated.

The Holden Site also receives significant precipitation as both rain and snow. As a result, the construction season is limited. However, the effort required to implement the remedy is significant and will require several construction seasons. The agreed upon schedule is to complete the major remedial action construction in 2013 and 2104 so that Holden Village can plan accordingly. To meet this schedule, the early work activities discussed below must be completed ahead of time.

4.2 TIMBERING

Construction areas will need to be cleared of trees and other woody material which would interfere with the completion of the remedy. Appendix A provides the Timbering Plan for the early actions and remedial construction. The Plan provides the requirements for storage, disposal and use of the timber and vegetation that will be generated during construction activities. The limits of timbering are shown on the drawings for ground disturbing activities. The Timbering Plan describes a process for delineating and approving areas for clear cutting and for cutting individual trees. The objective of the approval process is to allow the USDA FS to review the areas to be cleared while maintaining construction progress.

4.3 UPLAKE PORT (LUCERNE DOCK AND BARGE RAMP) MODIFICATIONS

Current barge and dock facilities available in Lucerne are undersized to adequately provide transportation support for the remediation efforts. Existing barge ramps are primitive, consisting of gravel placed on the natural shoreline, and are reported to be unusable during low water level periods. The barge and dock facilities must be modified to provide year round access and the ability to safely load/unload heavy equipment and construction supplies. In addition, staging areas will need to be established to stockpile material which is being loaded and unloaded.

Three potential locations were considered for the Lucerne dock and barge ramps: the Lady of the Lake dock, the Lucerne Yacht Club barge ramp area, and the USDA FS ramp and dock area. Each of these sites was evaluated, and the Lady of Lake dock area was selected as the most appropriate. Appendix B of this Plan contains a memorandum discussing the site selection and the preliminary design of the modifications for the site. The detailed design of the Lady of the Lake barge ramp is underway and will be submitted as an addendum to this plan for Agency review and approval. The uplake port is anticipated to be completed as part of the 2011 Early Works construction.

4.4 HOLDEN VILLAGE POTABLE WATER LINE RELOCATION

Holden Village owns and has operated the potable water system since 1961 under a Special Use Permit issued by the USDA FS. The system supplies water to approximately 25 buildings that cover an area of about 11 acres at an average elevation of 3,235 feet MSL. There is approximately 3,200 feet of buried potable water distribution pipe that extends from the water main located just north of the West foot bridge across Railroad Creek. The Holden Village raw water source is Copper Creek, diverted at a location several hundred feet in elevation above the treatment system location (see Drawing 10-5-1). Raw water to the potable water treatment system is supplied from a tap into the hydroelectric plant penstock which is housed in a small room located in the southwest corner of the existing Holden Village Maintenance Shop.

Water flows through the treatment system by gravity and discharges to the water storage reservoir without pumping. Potable water from the storage reservoir flows through a main line that connects to the Holden Village potable water distribution piping network for consumption and fire water supply.

As stated in the Proposed Plan (USDA, 2010), the preferred remedy for the Site includes demolition of the former Mill Building and regrading the East and West Waste Rock Piles (located directly above the maintenance yard) to be stable under steady state and seismic conditions. The treated

potable supply line is located beneath the former Mill Building and will need to be relocated to avoid damage during demolition activities. Additionally, demolition of the Maintenance Building and relocation of the potable treatment plant, which is housed in the building, will be necessary to make room for the reconfigured Waste Rock Piles.

A temporary location for the existing potable water treatment system will be needed during remedial construction. To complete the remedial construction over a relatively short period of two years, this and other early remedial actions as described in the Proposed Plan will need to be completed during the 2011 summer/fall season. The relocated potable water treatment system will continue to treat water to the same constituent concentrations as the current system consistent with the State of Washington Office of Drinking Water requirements for surface water via the continued use of the existing Strainrite filtration units.

Disassembling and reassembling the equipment will be minimized to reduce equipment damage and to reduce the need for additional piping, control wiring, and other ancillary components of the system. Water supply to Holden Village will continue during the equipment relocation by using the excess storage reservoir capacity without exceeding the minimum water storage requirement for fire suppression (storage reservoir water level of 12 feet). The existing system will be taken off-line during the low demand period between the months of September and October and is expected to take two to five days.

Relocating the system in the fall will take advantage of low water demand, good weather, and low raw water turbidity. The low raw water turbidity will also allow putting the Strainrite filters back in service while the Kinetico filters are disassembled, moved, and reassembled, thus minimizing downtime. Water quality will not be impacted since the Kinetico filters are only a pretreatment to reduce the bag change-out frequency of the Stainrite filters. The Strainrite filters alone can reduce the turbidity and bacteria concentrations at or below the State maximum allowable concentration levels.

Congruent with the initial move of the filter units, it will be necessary to also move the disinfection unit and associated monitoring instruments and equipment. The disinfection unit consists of a tank containing 3.2 percent calcium hypochlorite, a flow-paced metering pump, and a flow indicating transmitter to control the metering pump. Chlorine dose rates will be adjusted to ensure target concentration and contact time (CT) is maintained between the filter system and storage reservoir under the new arrangement. This will be necessary since the detention time in the reservoir fill line will be different than existing conditions.

Since the system control components are part of the Kinetico filter skid, the Strainrite filters will be operated manually until the Kinetico filters are reassembled and placed into service. The piping and valve design for the new, permanent location will allow for this type of operation during the relocation.

The design of the relocated system will be consistent with substantive requirements of the USEPA Surface Water Treatment Rule Criteria as applied by the State of Washington Office of Drinking Water for small supply systems. Site activities will be conducted in accordance with the USDA FS Fire Protection and Suppression requirements identified in R6-FS-6300-52 (5/97) as provided by the

Forest Service, including any request for waiver as required to perform the work in the agreed-upon timeframe.

4.4.1 Water Treatment Plant Structure

The temporary water treatment system enclosure will be located approximately 75 feet east of the existing raw water valve vault located on the patented mine claim boundary (see Drawing 10-5-6). This location is near the existing potable water system pipeline corridor and power grid, and will be accessible by an existing road in this area. The base elevation of the enclosure will be at an approximate elevation of 3,275 feet MSL, similar to the floor elevation of the present treatment system location. Presently, the water pressure in the raw water valve box is reduced from 240 psi down to 150 psi. A hydraulic analysis of the system indicates the plant must remain above elevation 3,254 feet MSL to remain a gravity driven system.

The structure will be a stand-alone moveable structure such as a shipping container(s) on skids. The structure will be large enough to house the filtration equipment, a disinfection system (with spill containment), electrical gear and uninterrupted power supply (UPS) (see Drawing 10-5-9). Maintenance/spare parts will be stored in a temporary location until the remedial construction is complete. The enclosure will be equipped with a heating system to maintain the proper temperature for freeze protection. End panels doors will easily accommodate the installation of the skid mounted filter arrays.

The enclosure will have minimum exterior dimensions of 25.0 feet (length), 10.5 feet (width), and 8.5 feet (height). Constructed of 14 gauge steel, the interior will be framed and insulated with 4-inch walls constructed of fire resistant material. The floor will consist of corrosion resistant grating laid over the existing steel floor with drain holes drilled at adequate intervals to allow water to freely drain into a gravel lift placed below the enclosure. A single 36-inch door will be the primary access point to the enclosure.

Fire suppression water will be supplied through the raw water line that enters the filtration equipment enclosure. Two heat activated sprinkler heads will be installed in the ceiling of the enclosure, isolated from the filtration circuit in accordance with applicable local and national fire codes. Special provisions for fire suppression and control will be provided in the event maintenance activities require isolation and depressurization of the raw water supply line.

4.4.2 Piping and Valving

The raw water valve box (near the existing maintenance building) will remain in place, but the piping will be modified on the outside of the vault, on the west side (see Drawings 10-5-5 and 10-5-10). Piping modifications to the 4-inch DI (ductile iron) pipe will be made to allow diverted Copper Creek flow to be routed to the relocated water treatment system.

A new 4-inch DI pipe and 90-degree slip on fittings will be installed below ground surface at a minimum invert depth of 30-inches below grade to transmit raw water to the new enclosure and through the steel floor, terminating with a 150-pound class flange adapter. The existing isolation gate valve and check valve will be dismantled from the present location and reinstalled at the new location, fastened to the ductile iron flange adapter. All new Schedule 80 polyvinyl chloride (PVC)

piping will be installed after the check valve to connect the new raw water line to both the Kinetico filter unit and a diversion pipe to the Strainrite filters (see Drawing 10-5-9).

Treated water is presently routed through the treated water valve box on Level 3 (near the storage reservoir). Piping modifications (see Drawing 10-5-10) will be made at this valve box to receive treated water from the new system location that will be piped below ground in a new 4-inch standard dimension ratio (SDR) 11 HDPE (high-density polyethylene) pipe installed along the existing corridor (see Drawing 10-5-6) for the Hydroplant penstock and potable supply line from the storage reservoir. The piping modifications will be made external to the valve vault, consisting of installation of a tee, isolation valves, and a bypass to flush the new HDPE treated water line at startup.

The elevation difference between the treated water valve vault (Level 3 valve vault) and the location of the temporary system will be approximately 160 feet. Given a maximum operating pressure of 150 psi for the Kinetico filters, and the differential operating pressure of the entire system (48 psi), additional modifications to the valve box piping beyond what is described above will not be required. New control wiring for the storage reservoir level sensor will be installed in the same trench as the new treated water pipeline, installed in protective conduit.

Depending on the final alignment and new location of the potable water system, it is anticipated that the length of the new treated water line will be shorter than the existing treated water line, approximately 530 feet in length. With an inside diameter of 3.633 inches, the detention volume of the pipe will be approximately 285 gallons. This detention volume will provide a minimum chlorine contact time of 4.8 minutes (at 60 gpm) prior to discharge into the storage reservoir, 1.1 minutes more than the present system.

Both raw water and treated water piping will be terminated through the floor of the temporary structure at locations such that the skid mounted filters can be 'cleanly' received for expedited installation. Flange assemblies will be installed on piping terminations to allow blind flange installation for sealing the new pipelines until they can be placed into service.

4.4.3 Pressure Testing

Prior to backfilling pipe trenches, the new pipelines will be pressure tested at operating pressures. A temporary crossover will be installed at the new system location to allow treated water from the storage reservoir to fill the finished water HDPE pipeline from the treated water valve box. The raw water DI pipeline will be filled utilizing the piping modifications made at the raw water valve box. New piping will be pressure tested for a minimum of 12 hours with no leaks detected. Any leaks that are detected will be repaired and the pressure test recommenced for a minimum of 12 hours. Air release valves will be temporarily located at the downstream ends to facilitate a complete fill of the new pipelines.

Prior to pressure testing, the new piping will be rinsed for a period of 60 minutes to ensure debris related to installation is removed from the pipeline. After rinsing, the pipes will be drained through a temporarily installed inline strainer to ensure all debris has been removed. Detection of any debris will constitute repeating the rinse and drain procedure until no material is detected in the inline strainer. All rinse water will be strained and discharged to the west end of TP-1 where it will pool

and infiltrate to the ground water system. Rinse water will be the same as that used to pressure test the new lines.

4.4.4 Instrumentation

In-line monitoring instruments will be re-installed at the temporary potable water system location, including turbidity sensors (Hach 1720C and 1720D), turbidity chart recorder, flow indicating/transmitter, and chemical metering pump (Wallace and Tiernan Premia 75). A new chemical metering pump will be installed at the temporary location with the existing pump at the potable water filtration saved as a backup unit. Pressure gauges, differential pressure indicators, automated control valves, and flow control valves are mostly integrated into the skid mounted filter systems and will not be replaced. Instruments located at the treated water valve box will not be replaced as part of the temporary relocation.

4.4.5 Backwash Water System

Backwash water from the Kinetico filters is presently managed by routing to a low area north of the Holden Village wood lot. The backwash water ponds in this area and infiltrates before surface flow can occur. Backwash water is combined with turbidity analyzer sampling streams into a single drainage line. The volume of water that is routed through the drainage line receiving backwash water is unknown, although the turbidity analyzers waste approximately 1 liter per minute (both units).

As part of the remedial construction activities, the availability of this area for infiltrating backwash water will end. Another suitable location will be identified and a sedimentation retention pond and delivery pipe constructed that allows for management of backwash waters from the new location. At present, the most suitable location appears to be the west end of TP-1 which presently receives surface runoff that is diverted around the larger pile area. Further information is required to verify the feasibility of this location, or if an alternate location will be required.

4.4.6 Equipment Relocation

Upon completing construction and testing of the new pipelines, the Strainrite filters will be moved to the temporary location. Electrical supply, heating system, and instrument cluster racks will be installed in the temporary enclosure prior to disconnecting any equipment at the current equipment location.

The Strainrite filter relocation will commence by taking the Kinetico filters out of service and isolating the raw water and treated water pipelines. Each of the three Strainrite filter assemblies is mounted on a common skid which will be disconnected at the distribution manifold and removed as a single unit from the existing location. The Strainrite filter assemblies can be disconnected at the influent and effluent end flange assemblies. If necessary, the doorway into the room housing the filtration equipment will be widened to minimize the degree of disassembly. This will be determined in advance and completed before the Kinetico filters are taken out of service.

A boom truck or similar will be used to lift and place the equipment on a flat bed truck for transport to the new location. A detailed plan for lifting and strapping equipment down will be developed and

approved by the appropriate representatives from Holden Village and Intalco. All equipment lifting and rigging will be compliant with the minimum safety requirements of Intalco.

After placement and securing the Strainrite filter assemblies at the new location, piping connections to the raw water and treated water lines will be completed. Next, the turbidity and flow sensing equipment will be dismantled and installed at the temporary enclosure. Once the turbidity and flow indicating equipment is reinstalled and tested, the Strainrite filters will be placed back into service. Note that the Strainrite filters will be operated in a manual mode until the Kinetico filters and storage level indicating equipment are brought back on-line. The uninterruptible power supply equipment will be reinstalled in the temporary enclosure during this first relocation phase to ensure process monitoring is continuously maintained.

It is expected that the Strainrite filter relocation will be completed in approximately three days and that the storage reservoir capacity will meet the demand while the system is out of service during this time frame. Once the Strainrite filters are placed back into service, it is expected that the loss in volume during the down time can be made up within a 24-hour period. The average daily demand in October 2010 was approximately 11,000 gallons, meaning the deficiency accumulated over three days can be made up in approximately 9 hours of continuous filtration.

The second step of the relocation is to move the Kinetico filters and control panel to the new location. The same procedures established for the Strainrite filter will be applied to disassembly, lifting, and rigging the Kinetico filters. One in place at the new location, wire terminations will be made at the system control panel, system checks performed to ensure all control loop wiring is operational and the microprocessor signals and relays are functional. It is expected that the level of wiring will be minimal since the filters and control panels are mounted to the same skid, consisting mainly of power supply terminations and instrument signal wiring to the primary control panel.

Raw water piping will be connected to the Kinetico filter system with the effluent piping connected to the Strainrite filter influent piping. Pressure checks will be performed and the Kinetico filters placed into automatic service with Strainrite filters. It is expected that Schedule 80 PVC material will be used for making the piping connections at the new location. Minimum cure times for the specific pipe size used will be adhered to prior to pressurizing any PVC piping.

4.4.7 System Power

Power to the existing potable water system is supplied from the Hydroplant, transmitted by utility power poles then through a 240 volt 3-phase transformer located near the raw water valve vault. New power supply wiring will be installed in the new raw water pipeline trench from this transformer to the temporary enclosure. If necessary, an additional stepdown transformer will be installed to ensure appropriate power phase and voltage to the equipment moved to the temporary enclosure.

4.4.8 System Monitoring

After each step of the relocation, turbidity monitoring and water sampling will be conducted at a frequency consistent with the present monitoring requirements. Initially, raw water and treated turbidity measurements will be recorded hourly and compared to historical performance data to ensure equipment was not damaged and the level of treatment is consistent. Any out-of-spec

measurements will constitute removing the potable water system from service until the problem can be identified and resolved. Once the system is proved-out and operating as intended, Holden Village will resume their normal sampling and maintenance activities.

4.4.9 Backup System

By utilizing the storage reservoir capacity and the low demand during the scheduled relocation, this plan is not expected to require treated water from a backup system. However, in the event that equipment is damaged or other unexpected problems arise during the temporary relocation, a backup system will be ready to ship to Holden. This system will be an approved mobile, potable water treatment system that meets or exceeds the treatment level provided by the present system. MWH will coordinate with the State to ensure adherence to their requirements by identifying an appropriate backup mobile treatment system. The State has preliminarily indicated that it will waive the extensive pilot testing requirements for a potable water system provided it is temporary and exceeds the treatment level provided by the current bag filter system.

4.5 USFS ROAD 8301 IMPROVEMENTS (HOLDEN-LUCERNE ROAD)

FS Road 8301 connects Lucerne and the Holden Mine Site. The road consists of a single traffic lane with periodic turn outs to allow passage of two-way traffic. The frequency and size of turnouts will be increased to accommodate higher traffic volumes and to safely allow passage of larger earthmoving equipment during remedy construction. FS Road 8301 is the only means of access to the Site. The road is utilized by residence and visitors of Holden Village and USDA FS personnel, and during implementation of the remedy, it will also have to accommodate heavy construction equipment and supply vehicles. The road is approximately 10.8 miles in length, starting from the existing dock facility in Lucerne and terminating at the Ballfield west of Holden Village. Road maintenance will be performed on an as-needed basis during the early work activities.

The road generally consists of a single lane of travel with turn outs spaced at random intervals as permitted by the prevailing topography. The road is classified as a Traffic Service Level C roadway, characterized by the following:

- Flow: Interrupted by limited passing facilities, or slowed by road condition.
- Volumes: Erratic, frequently controlled as the capacity is reached.
- Vehicle Types: Controlled mix; accommodates all vehicle types including the critical vehicle. Some use may be controlled to vehicle types.
- Critical Vehicle: Special provisions may be needed. Some vehicles will have difficulty negotiating some segments.
- Safety: Most protection is provided by management.
- Traffic Management: Traffic controls are frequently needed during periods of high use by the dominant resource activity.
- User Cost: Not important, efficiency of travel may be traded for lower construction costs.
- Alignment: Generally dictated by topographic features and environmental factors, design speeds are generally low.

- Road Surface: May not be stable under all traffic or weather conditions during the normal use season. Surface rutting, roughness, and dust may be present, but controlled for environmental or investment protection.

4.5.1 Switchbacks

Ten switchbacks occur within the first 1.5 miles of the roadway and limit the length of vehicles that can safely navigate the road. The switchbacks gain approximately 750 feet of elevation and have a grade of 10%, with isolated portions exceeding 10%.

Traffic simulation modeling indicates that a tractor-trailer combination with a maximum trailer length of 28 feet is the longest vehicle that can negotiate the switchbacks. Special loads such as the pre-manufactured bridge and building, which require a longer transport vehicle, may require cranes to aid in navigating the switchback. Widening the switchbacks was evaluated to allow longer vehicles, however, it was deemed impractical due to the steep topography.

4.5.2 Drain Structures

Existing drainage structures along the road alignment consist of a roadside ditch and 55 culverts. The roadside ditch runs along the north side of the road above the switchbacks and on alternating sides of the road through the switchbacks. The roadside ditch conveys run off to the culverts which discharge into natural drainages that eventually report to Railroad Creek.

Early actions will include cleaning the ditches. Care will be taken so as not to disturb vegetation which is providing erosion protection but not restricting drainage flow in the ditch. The ditch will not be resized or re-aligned aside from areas noted in the drawings.

The existing culverts consist of both reinforced concrete pipe (RCP) and corrugated metal pipe (CMP). Based on the survey data, the culvert diameters range from 12 inches to 36 inches. Some of the culvert ends are buried and may be clogged or have reduced flow capacity. An assessment of the condition of each culvert will be made and inlets and outlets cleared to ensure proper flow on an as-needed basis. Damaged culverts that cannot be repaired will be replaced.

The maximum design vehicle axle load which is anticipated to utilize FS Road 8301 is 37,809 lbs, for a fully loaded Caterpillar 740 articulating truck. The National Corrugated Steel Pipe Association recommends a minimum of 2 feet of cover over CMP for this magnitude of vehicle axle load.

Each culvert location with insufficient cover will be evaluated in the field to determine which of the following mitigating measures is most appropriate:

- Spot resurfacing. Addition of road surfacing material to provide adequate cover. The surfacing material will be "feathered" to blend smoothly with the existing road grade, while maintaining proper crowning of the road. Addition of material will not be so thick as to reduce the width of the traffic lane to less the 14 feet.
- Removal and re-installation. Some culverts may need to be dug out and re-installed to provide proper drainage. Any culverts handled in this manner will be inspected by the field engineer prior to reburial. If it is determined that a culvert is unsuitable for re-installation, it will be replaced with a culvert of equal size.

4.5.3 Turnouts

Although there are several existing turnouts between Lucerne and Holden Village, additional turnouts will be needed to provide increased vehicle capacity and to improve traffic safety on the road. Existing turnouts will also be enlarged to allow passing. The grading plans showing the proposed turnout modifications are provided in the FS Road 8301 section of the drawings.

Generally, the fill slopes for the turnouts will be less than 15 feet high. Slope stability analysis was performed to determine a slope that minimizes ground disturbance, supports the construction equipment, does not require a retaining structure and will meet the design criteria. Based on these considerations, the fills are designed as a 1.5H:1V slope. The stability analysis methodology consisted of the Morgenstern-Price limit equilibrium method with a half-sine function for interslice forces. This method uses both circular and non-circular shear surfaces and satisfies both moment and force equilibrium. Slope stability simulations were performed using the two-dimensional computer program Slope/W™ (Geoslope, 2009). Both infinite and circular failure surfaces were evaluated. Only the static loading case was analyzed since the turnouts are noncritical structures.

The materials to construct the turnouts will consist of alluvium sands and gravels that will achieve high shear strength after compaction and will be free draining. Unsuitable foundation material will be removed to provide firm competent foundation conditions. Additional stability evaluations will be necessary of conditions differ from the assumptions made for the stability analysis.

Construction of the turnouts will consist of:

- Timbering delineation
- Installation of Best Management Practices (BMPs)
- Timbering
- Clear and grubbing
- Topsoil stripping
- Unsuitable material excavation if needed
- Fill placement in 12-inch thick compacted lifts
- Topsoil placement, seeding, and mulching
- Installation of leave-behind BMPs

Topsoil that is stripped from the alignment will be temporarily stockpiled adjacent to the work area and utilized as part of the reclamation for the fill slopes to be constructed for turnouts.

Construction materials for the turnouts will be produced from on-site borrow sources. Fill will be moisture conditioned and placed in compacted 12-inch thick lifts with a maximum rock diameter of

six inches. A 12-inch thick layer of base course will be placed and compacted overlying the fill. The turnout and adjoining existing road will be surfaced with a 6-inch thick wearing course material. Due to the small volume of wearing course needed for 2011, this activity will be deferred to a subsequent construction season when a larger volume of material will justify mobilizing the screening and crushing equipment needed to manufacture the wearing course material. Appendix C provides a draft of the proposed Earthwork specifications.

4.5.4 Safety Barriers

Intalco will assess the need for road safety barriers on the portions of the road between turnouts and in particular in the "narrows" section of FS 8301. Jersey and cable type safety barriers only require a small amount of shoulder area, so these would be the most likely type of safety barrier used. Jersey barriers are less permanent than cable barrier systems that require driven piles. Details of the safety barriers are shown on the FS Road 8301 section of the drawings. The need for road safety barriers will include, but not be limited to, traffic management procedures, traffic volume, snow removal and space constraints and Intalco's risk assessment policy.

Road safety in addition to overall project safety is a top priority for Intalco. A robust traffic control plan will be implemented and include road signage, speed limits, designated drivers, site specific training, and a limit of non-essential construction traffic using the FS 8301 Road.

4.5.5 Road Repair and Maintenance

It is anticipated that the size and volume of truck traffic will degrade the road bed and the entire length of FS Road 8301 will require continual maintenance throughout the life of the project. Initial maintenance of the road will focus on re-establishing proper crowning of the road to promote road surface drainage. A 2 to 4 % crown grade will be established if possible. Road slough and built up shoulders will be removed to allow proper drainage of the road surface. Gravel slough from the road edges may be utilized to re-establish the proper road grade if it is of suitable quality and does not contain organic material. Spot surfacing will be performed in areas which appear unstable with excessive washboard rutting at the time of maintenance. A 6-inch layer of road surface material will be utilized for spot resurfacing.

4.5.6 Existing Bridges

Three existing bridges on the Holden-Lucerne Road will be utilized as part of the remedy construction. All three bridges are on USDA FS land and are regulated by them. The first bridge is located in Lucerne and consists of an 85 foot long timber bridge which spans Railroad Creek, south of FS Road 8301. The second bridge is a 31 foot long timber bridge which spans Tenmile Creek. The third bridge is an 85 foot long pre-engineered steel bridge, which spans Railroad Creek west of Holden Village. Appendix D provides the summary of the structural evaluation of the existing bridges. The gross weight of the early works construction vehicles such as haul trucks that cross the existing bridges will be in compliance with the maximum weight standard vehicle determined in the structural evaluation. No reinforcement or modifications to the existing bridges is anticipated for 2011. However, the following concepts would be evaluated to reinforce the bridge that crosses Tenmile Creek if it is necessary.

- Add a transverse steel crossbeam under the bridge at mid-span to support the timber stringers of the bridge. The crossbeam would be supported by steel piles that are driven into the riverbed on the outside edges of the bridge.
- Add a transverse steel crossbeam under the bridge at mid-span to support the timber stringers of the bridge. The crossbeam would be supported by longitudinal steel beams placed along the outside edges of the bridge. The longitudinal steel beams would be supported by footings constructed along the banks or by some other means.
- Add one long steel beam placed diagonally from bank to bank under the bridge. The beam would pass under the exterior girders near the 1/3 point of the span and would support the timber stringers of the bridge. The steel beam would be supported by footings constructed on each bank.
- Use a temporary portable bridge. The rails on the existing bridge would be removed and a temporary/portable steel bridge would be placed over top of the existing timber bridge. The approach would then be modified to match the grade of the new bridge.

4.6 CONSTRUCTION OF BYPASS ROAD AROUND HOLDEN VILLAGE

Currently, vehicle access to the Holden Mine Site requires travel through Holden Village. Routing of heavy construction equipment through the village poses severe safety hazards and degradation of the community's peaceful environment. Therefore, a new bypass road will be constructed to divert construction traffic off the main road just east of Holden Village, across Railroad Creek and along the southern edge of the tailings piless, terminating at the existing vehicle bridge west of Holden Village as shown on the drawings.

4.6.1 Bypass Road Design

The bypass road width is designed based on two times the design vehicle width of 12 feet for a total width of 24 feet. The road incorporates a 2% crown or cross grade for surface water drainage. The heights of the safety berms are based on a mid axle height of 3 feet.

Turnouts are provided (see Drawings 10-4-1 through 10-4-22) at intervals which will provide a traffic capacity equal to or greater than FS Road 8301. The design speed for the road is 20 mph. Due to the space constraint and steep topography, the design incorporates grades up to 12% for short portions of the road. The sections of the road adjacent to the tailings pile are temporary and may be modified during the remedial construction based on the final grading plan.

The majority of the fill for the bypass road will be needed in the areas just south of Tailings Pile 3 on the south side of Railroad Creek. Fill heights range from 1 to 20 feet. The highest fill is located south of Railroad Creek to provide the grade to climb from the valley floor to the top of Tailings Pile 3. Slope stability analysis was performed to determine a slope that minimizes ground disturbance, supports the construction equipment, does not require retaining structures and will meet the design criteria. Based on these considerations, the fill and cut slopes are designed as a 1.5H:1V slope. The stability analysis methodology consisted of the Morgenstern-Price limit equilibrium method with a half-sine function for interslice forces. This method uses both circular and non-circular shear surfaces and satisfies both moment and force equilibrium. Slope stability simulations were performed using the two-dimensional computer program Slope/W™ (Geoslope, 2009). Both infinite and circular failure surfaces were evaluated.

The materials to construct the bypass road will consist of alluvium sands and gravels that will achieve high shear strength after compaction. Unsuitable material will be removed to provide firm competent foundation conditions. Additional stability evaluations will be necessary if conditions differ from the assumptions made for the stability analysis.

Construction of the bypass road will consist of:

- Timbering delineation
- Installation of BMPs
- Timbering
- Clear and grubbing
- Topsoil stripping
- Unsuitable material excavation if needed
- Fill placement in 12-inch thick compacted lifts
- Topsoil placement, seeding, and mulching
- Installation of leave-behind BMPs

Topsoil which is stripped from the alignment will be temporarily stockpiled adjacent to the work area and utilized as part of the reclamation for the fill slopes to be constructed for turnouts.

Construction materials for the bypass road will be produced from on-site borrow sources. Fill will be moisture conditioned and placed in compacted 12-inch thick lifts with a maximum rock diameter of six inches. A 12-inch thick layer of base course will be placed and compacted overlying the fill. The turnout and adjoining existing road will be surfaced with a 6-inch thick wearing course material. Due to the small volume of wearing course needed for 2011, this activity will be deferred to a subsequent construction season when a larger volume of material will justify mobilizing the screening and crushing equipment needed to manufacture the wearing course material. Appendix C provides a draft of the proposed Earthwork specifications.

4.6.2 New Railroad Creek Bridge

The new Railroad Creek Bridge will consist of a pre-manufactured steel structure, with a single traffic lane width of 14 feet. Intalco will provide shop drawings and design calculations to the USDA FS for review prior to installation of the bridge. The bridge will have a capacity capable of supporting a fully loaded Caterpillar 740 articulating truck. Concrete footings will support and are designed based on an allowable soil bearing pressure of 5000 psf. The bridge length will be 100 feet, and will be installed with a 1% grade for drainage.

Based on preliminary discussions with bridge suppliers, the lead time for manufacturing and delivering a bridge could be several months. Therefore, Intalco may opt to install a temporary river crossing in order to have the bypass road functional earlier in the construction season. The temporary crossing would consist of culverts or equivalent means which would be defined in a memorandum to be submitted for Agency approval.

The bridge abutments for the new Railroad Creek Bridge consist of 1.5H:1V geotextile reinforced slopes. Stability analysis of the abutment slopes indicate that they have a static factor of safety of 1.5 and a pseudo-static factor of safety of 1.1 based on the operating basis earthquake (OBE). These factors of safety are consistent with Washington State Department of Transportation guidelines. The stability analysis method was performed using the same simulation model as for the bypass road.

The abutment toe locations are outside the estimated full channel flow width of Railroad Creek in compliance with USDA FS requirements. A HEC-RAS flood routing analysis was performed to determine the water surface profile of Railroad Creek based on a 100 yr flood flow of 2500 cfs. The heights of the abutments were designed to provide a minimum of 5 feet of free board for debris passage above the maximum water surface elevation. The design incorporates scour protection to 1 foot below this depth. Scour protection will be placed one foot above the maximum water elevation based on the 100 yr flood.

Due to the lack of a rip-rap source during the early phases of work, concrete filled geotextile pillows or Reno mattresses (a type of gabion) will be used for scour protection. Scour protection will be placed as shown in the drawings.

4.6.3 Copper Creek Crossing

The bypass road will utilize the existing Copper Creek road crossing alignment. However, the current road section constrains flow in Copper Creek, and therefore, the width of the bypass road will be reduced to 16 feet. A safety berm will be constructed on the outside edge of the road. Fill placement will be limited to the upstream side of the existing road to minimize work within Copper Creek and for ease of construction. The existing culverts will be extended by connecting additional pipe sections.

4.7 CLEANUP OF SITE DEBRIS

Pending discussions with the Agencies on debris management, Intalco will prepare a Solid Waste Management Plan for site cleanup activities and debris disposal for Agency approval. Site cleanup activities will include removing and consolidating debris that is present throughout the Site. Some of this material is waste or equipment from the original mining operations, others are wastes from Holden Village or appliances and equipment, etc. that are being stored by Holden Village for future use or salvage. This material includes scrap metal; appliances; transformers; the former bridge that crossed Railroad Creek; building materials such as concrete, wood, and metal; as well as other items. Discussions are still ongoing with the Agencies and Holden Village regarding the ultimate disposition of the debris that will be collected during site cleanup activities.

4.8 INSTALLATION OF BULKHEADS IN THE 1500 LEVEL MAIN AND VENTILATOR PORTALS

The Portal Bulkhead Implementation Plan (2011, Golder Associates) previously submitted to the Agencies describes the bulkhead construction that will take place during the 2011 Early Works. Intalco has retained Golder Associates and their mining contractor Atlas Fausett Contracting to perform the underground work activities. MWH will support above ground activities and provide overall management and coordination for the bulkhead construction. In addition to the below ground work, the above ground support activities will include constructing staging areas, rehabilitating the ventilator portal access road, installing portal water conveyance piping and modifying the settling basin on top of Tailings Pile 1 as described in the Portal Bulkhead Implementation Plan. Above ground facilities that will be built are shown on the Bulkhead Construction section of the drawings (see Drawings 10-9-1- to 10-9-6).

4.9 CONSTRUCTION OF TEMPORARY MAINTENANCE FACILITY FOR HOLDEN VILLAGE

A temporary maintenance facility will be located in the vacant area just west of the Narnia School House at Holden Village. Once constructed, Holden Village will move its maintenance operations to the temporary location so the existing facility can be demolished to make room for regrading the Waste Rock Piles. Current village operations at the maintenance facility include potable water treatment, vehicle and equipment maintenance, waste storage and incineration. The following is an inventory of the structures associated with the current maintenance facility:

Holden Village Maintenance Area Inventory

Structure	**Dimensions**	**Replacement Area (ft^2)**
Shop/Water Treatment Bldg 2 vehicle bays 20' x 50'x 16' high. Bays are insulated, heated and have a reinforced concrete floor. The minimum length of the shop needs to be 40' so vehicles can fit. Water Treatment will be housed in a separate structure.	63'x45'	2,620
A-Frame Storage Building Actual dimensions are 80'x30'; however HV requires 2000 ft^2 of storage to replace the A-Frame storage shop 2nd floor storage. Heat is not required for storage space or a concrete floor.	40'x50'	2,000
Change House (fire wood storage) Current space is 18'x95'; however, approximately half of the space is needed for wood storage during remedial construction. Wood could be stacked higher than the current 4 foot height and lumber racks can be used to increase space if needed.	20'x40'	800
Total Area Needed for Temporary Maintenance Building **Total Storage Area** **Fire wood storage**		4,620 2,000 800

The current incinerator will be left in place during the early actions and will be removed prior to the remedy construction. The water treatment equipment will be disassembled and reassembled in a new structure as described in Section 4.4.1. The temporary shop will be a pre-manufactured shop building with the approximate dimensions of 50 feet by 100 feet having an area of 5,000 sf. The building will be high enough to provide an upper level storage area. Fire wood storage would be adjacent to the building under a wooden roof structure or at the Ballfield. Construction of the temporary shop will include:

- Utility clearance
- BMP installation
- Timbering (limited timbering will be necessary and coordinated with the USDA FS)
- Clearing and grubbing
- Grading
- Foundation excavation
- Concrete placement for the foundation and floor slab
- Building erection
- Interior buildout
- Utility installation

Intalco will continue to work with Holden Village to amend their Special Use Permit with the USDA FS for the new facility in Holden Village. The Chelan County Building Division will review the pre-manufactured building shop drawings and grading plan to comply with substantive local regulatory requirements. Intalco has already met the Current Planning and Administration office that implements zoning and other land regulations to provide them with an overview of the project and gain an understanding of the local building requirements. Additional meetings are planned with Chelan County to provide them with more design and construction details pending approval of this 2011 Early Works Implementation Plan.

4.10 CONSTRUCTION OF STAGING AND STORAGE AREAS

In preparation for heavy construction activities associated with the remedy implementation, staging and storage areas will need to be built to provide stable pads for the establishment of construction office trailers, equipment maintenance, and construction related material storage. Three areas have been designed to provide equipment and construction material unloading, staging and storage. The areas are identified as areas "A", "B", and "C" as shown on the construction support facilities section of the Drawings (see Drawings 10-6-1 to 10-6-7).

- "Area A" is on top of Tailings Pile 2 adjacent to the Holden Village Bypass Road, and provides approximately 5.2 acres of area. The area can be constructed at one time or developed in phases as storage requirements increase. Construction of this area will consist of clearing and grubbing existing vegetation, regrading the tailings to the subgrade design elevation, and placing granular fill material to provide a clean trafficable surface, with a minimum 1% grade to promote drainage.

- Area "B" is in the eastern portion of the LWA. This area will provide approximately 1.4 acres of staging area at a surface elevation of approximately 3124 feet MSL. Construction of

this area will consist of timbering, clearing and grubbing existing vegetation, stripping topsoil, and placing clean fill material to provide a trafficable surface, with a 1 to 3% grade to promote drainage. Fill placement will be performed in accordance with the specifications. Potentially impacted soils exist in this area and further discussion regarding management of these soils is discussed in Section 4.15.2 of this document.

- Area "C" is in the western portion of the LWA, specifically the Lagoon area. The area will provide approximately 1 acres of staging at a surface elevation of approximately 3228 feet MSL. Construction of this area will consist of clearing and grubbing existing vegetation, stripping topsoil, removing potentially impacted and unsuitable soils as discussed in Section 4.15.1 of this document, and placing fill material to provide a trafficable surface, with a 1 to 2% grade to promote drainage.

Staging Areas B and C are located approximately 75 and 100 feet from the existing banks of Railroad Creek near the west vehicle and walking bridge, respectively. The 100yr return interval flood water elevation in this area is predicted at an approximate elevation of 3222 and 3210 feet MSL for the west vehicle and walking bridge, respectively. The low points of staging area Areas B and C are 10 and 5 feet higher than the 100yr return interval water surface, respectively, indicating that the staging areas are outside of the flood plain.

4.11 CONSTRUCTION EQUIPMENT MAINTENANCE AND FUELING FACILITIES

The site of the proposed construction equipment fueling area (see Drawing 10-6-5) was selected based on three criteria:

- Adjacent to the Holden Village Bypass Road
- Outside the riparian zone
- Outside areas proposed to be impacted by the remedial action construction

The size of fuel tank which will be utilized by the contractor is not known at this time. The proposed location of the construction fueling area is shown on the drawings. Spill containment will be constructed for all fuel storage tanks in accordance with local and federal regulations.

4.12 STOCKPILES AND STORAGE AREAS FOR TIMBERING PRODUCT

Sawcut timber, slash root wads and wood chips will be stockpiled in the Winston and Ballfield areas during early actions and remedial construction. Other staging areas may also be needed for stockpiling materials generated from timbering and clearing and grubbing activities. Sawcut timber will include trees that have a minimum diameter at breast height (DBH) of five inches. They will be stacked in the Sawn Timber Storage area located in the Winston site as shown in the construction support facilities section of the drawings. The Sawn Timber Storage area will be approximately 420 feet long by 60 feet wide covering an area of approximately 0.6 acres. Construction and preparation of the area will involve the following activities:

- Archeological resource survey
- Noxious weed control
- Installation of BMPs
- Timbering
- Clear and grubbing
- Grading and drainage improvements
- Base course surfacing

It is anticipated that a significant amount of saw cut timber will be produced during the early action and remedial construction. All saw cut timber generated from USDA FS land will be sold to Holden Village for fuel. Slash and root wads will be stockpiled in the Ballfield area for chipping and shredding to be used for erosion control, reclamation, or cover construction.

Noxious weeds are known to exist in the Ballfield and Winston areas and will be controlled to minimize contamination of stockpiles and spreading to other areas of the Site. Known noxious weeds include the Japanese knotweed, knapweed and common tansy. Noxious weed control will consist of species-specific and site-specific chemical treatment. Herbicide application will be by a licensed contractor in compliance with all federal and Washington State laws.

4.13 ANCILLARY ACCESS ROAD REHABILITATION

Existing unimproved roads leading to the historic Winston area and Ballfield will require improvement to provide access for remedial construction purposes. Additionally, the unimproved access road from the LWA to the 1500 Level Ventilator Portal will require improvement for bulkhead construction occurring in 2011. The location of the road to Winston and the Ballfield area is shown on the construction support facilities section of the drawings. The 1500 Level Ventilator Portal access road is shown in the Bulkhead Support section of the drawings. These are unimproved dirt roads with an overgrowth of vegetation from infrequently use.

Rehabilitation will consist of:

- Installation of BMPs
- Timbering
- Clear and grubbing
- Grading and drainage improvements
- Road surfacing

Historic monuments and structures in the Winston area will be clearly marked to avoid damage during construction. Intalco will coordinate closely with the USDA FS to finalize the alignment of the ancillary roads that pass through historic areas.

4.14 CONSTRUCTION WATER LOAD OUT STATIONS

Three construction water load out stations will be built in preparation for the remedial action implementation, but only one of the three stations will be used during the early works (see Drawing 2-1). The construction water load out stations will be established at the following three locations as shown on the drawings:

- South side of Railroad Creek adjacent to existing vehicle bridge
- North side of Railroad Creek adjacent to existing foot bridge
- South shore of Lake Chelan adjacent to the Lady of the Lake dock facility

Early works activities for the load out stations will consist of timbering, clearing and grubbing the load areas, and grading a level pad for pumping equipment and filling water trucks. The pad will be surfaced with a base and wearing course material. Equipment at the load outs will be supplied by the contractor and generally consists of a filtered intake, gasoline or diesel powered pump, and a self supported filling tower. The intake utilized in Railroad Creek will be configured to operate in 1.5 feet of water. Temporary weirs may need to be constructed to pool water within Railroad Creek during low flow periods.

The contractor will be responsible for coordinating with the Washington State Department of Ecology, Central Regional Office regarding meeting the substantive requirements of appropriate temporary construction water use permits.

4.15 EXCAVATION OF SOILS IN THE LAGOON AREA AND POTENTIALLY IN THE LOWER WEST AREA-EAST

4.15.1 Lagoon Area

The Lagoon area was originally constructed to receive mine runoff water from the 1500 Level Portal and was used as a settlement basin during the operation of the mine. Previous sampling events associated with the Lagoon Area have concluded that this area has been impacted. As stated in the Preferred Remedy in the Proposed Plan, soils and sediment from the Lagoon Area that exceed the site specific cleanup levels are to be excavated and disposed of within the tailings piles. This material also needs to be excavated because it is unsuitable for geotechnical purposes. Unsuitable soils are generally defined as fined grained, weak, saturated soils that will not support a compacted fill. Once the material is removed, the excavation will be backfilled with compacted clean fill. The staging area that is to be established in this portion of the Site extends beyond the Lagoon and essentially encompasses all of the disturbed area where there is little vegetation. The entire staging area will be over-excavated to a depth of 1 foot below ground surface and then replaced with a minimum of 1.5 feet (the minimum desired thickness of engineered fill) of compacted clean fill material to obtain the final design grade.

Because impacted soils remaining beneath the staging area would be covered in a manner essentially equivalent to the tailings piles, and because institutional controls (e.g., access and excavation restrictions) will also be implemented in the LWA to limit direct contact with soil, additional sampling of the soils in the staging area is not needed. Soils outside the staging area will be discussed in the forthcoming PreDesign Investigation Work Plan.

With respect to the excavation, the Lagoon may contain water and saturated materials. If necessary, the water will be pumped or transported via water truck to the setting basin on top of Tailings Pile 1. Saturated materials that are excavated will be blended with the drier soils that are scraped from the entire staging area to eliminate free water. Following mixing, the excavated soil will be transported and stockpiled on Tailings Pile 2. Stockpiled soils will be graded, and covered with clean fill to minimize wind and water erosion.

4.15.2 Lower West Area-East

The Proposed Plan states that the Lower West Area-East contains impacted soils that pose a risk to ecological receptors and need to be managed as part of the remedial action. According to the Preferred Remedy in the Proposed Plan, these soils need to be sampled to define the extent of those which contain concentrations above the cleanup levels and then these soils need to be excavated and placed on top of the tailings for later consolidation under the cover. However, the Proposed Plan and supporting documents were prepared with the understanding that soils in this area would need to be excavated as part of construction of the water treatment plant and did not contemplate that the area would be covered to establish clean, level staging areas. The current concept for the water treatment plant does not include locating it in the Lower West Area-East. With this new concept in mind, it does not appear necessary to excavate impacted soils for consolidation into the tailings when the remedial action objective can be met by covering the soils in-place.

Portions of the Lower West Area-East will be used as staging areas for office trailers, equipment, materials, and fuel storage to support the remediation activities. The areas that will be used as staging areas will be over-excavated to a depth of 1 foot below ground surface and then replaced with a minimum of 1.5 feet (the minimum desired thickness of engineered fill) and up to 5 feet of compacted clean fill material to obtain the final design grade. The excavated soil will be placed on top of the tailings piles for later consolidation under the cover. At the completion of the remediation activities, the staging areas will not be reclaimed but instead will be incorporated into the final grading plan and covered with the same cover as the tailings. Under this scenario, the potentially impacted soils beneath the staging area will have a cover at least as protective as the tailings piles. Therefore, Intalco proposes that characterization soil sampling does not need to be completed in the staging areas prior to excavation. It is important to note that not all soils in the Lower West Area-East will be covered to create staging areas. Soil sampling associated with the portions that are not part of the staging areas will be as discussed in the forth coming PreDesign Investigation Work Plan.

4.16 LIMITED EXCAVATION OF IMPACTED SOILS IN THE BALLFIELD

The Ballfield will provide an area for construction materials such as stockpiles of shredded slash and root wads generated during the early works as well as subsequent remedial actions. Holden Village may also use the Ballfield for temporary wood cutting and storage to make room for remedial

construction at the current wood cutting area. There is a limited area of impacted soils in the Ballfield and it would be prudent to address these soils prior to the remedial action when space will be needed for temporary storage of construction materials. The Preferred Remedy in the Proposed Plan recommends that soils from the Ballfield area which exceed proposed cleanup levels be excavated and consolidated into the tailing piles prior to capping, unless the soils to be excavated are in the late succession riparian habitat. If so, in-situ treatment may be used instead.

Previous sampling was conducted in the Ballfield and in the area to the west of the Ballfield. The two sample locations (DMSS 26 and DMSS 27) exhibiting the highest copper concentrations are located approximately 200 and 300 feet, respectively, to the west of the open area of the Ballfield. If these sampling locations are not in the late succession riparian habitat and are accessible by excavation equipment, it may be appropriate to collect additional samples to define the extent of soils with copper above the cleanup standard. However, sampling at depth will likely require a drill rig or excavator (for test pits). Therefore, the plan will be to simply excavate some soils from the area based on visual assessment and then collect confirmation samples (i.e., no pre-excavation sampling would be conducted). The details of this sampling effort will be presented in the 2011 PreDesign Investigation Work Plan to be submitted to the Agencies in the coming weeks. On the other hand, if the locations of concern are within the riparian habitat, no sampling is recommended at this time. Instead, the proposed approach for these soils will be defined in the In-Situ Lime Treatment Testing Plan to be submitted to the Agencies later this year. To establish concurrence as to whether excavation or in-situ treatment is most appropriate, Intalco recommends that these locations be visited jointly by representatives of MWH and the Agencies. The purpose of this visit will be to evaluate the type of habitat, verify equipment access, and visually determine if the previously detected areas of elevated copper concentrations are associated with fill materials or naturally occurring mineralization associated with the ore body.

If it is determined that excavation is necessary, the construction sequence will generally consist of:

- Establish agreed upon limits of excavation based on the site visit with MWH and the Agencies taking into consideration habit and equipment access
- Clear and grub the area
- Remove the impacted soil within the pre-defined limits of excavation and stockpile it on Tailings Pile 2
- Collect confirmation soil samples from the side walls (as defined in the forthcoming 2011 PreDesign Investigation Work Plan)
- Haul in clean soil from the borrow area and compact it in lifts up to the existing ground surface leaving behind a slight mound to promote surface runoff and accommodate consolidation
- Either haul in topsoil from another ground disturbing activity or strip a six inch layer of topsoil from the surrounding Ballfield area and spread over the removal area
- Seed and mulch the removal and other disturbed Ballfield area during the fall using a USDA FS approved seed mix

4.17 EXCAVATION OR IN-SITU REMEDIATION OF IMPACTED SOILS IN THE SURFACE WATER RETENTION AREA

The former SWRA is an historic man-made pond where water exiting the 1500 Level Ventilator Portal was captured to allow sediment to settle out prior to being discharged through a decant structure into Railroad Creek. To address ecological risks associated with impacted soils in the SWRA, the Preferred Remedy in the Proposed Plan includes removing materials that exceed the cleanup levels and consolidation within the tailings piles. In order to meet this requirement, the former SWRA would be excavated and the removed material would be placed on the tailings piles. The excavation would then be backfilled with clean fill material. Based on discussions with the Agencies and Intalco, it became apparent that covering the soils without excavation could potentially achieve the same objective without the need to destroy a significant amount of habitat to create a haul road to the area for removing excavated soils.

Closing the SWRA in-place would consist of the following activities:

1. Remove or cap the decant structure and the associated piping
2. Push in the earthen berm surrounding the SWRA
3. Fill the remainder of the SWRA with clean fill to promote positive drainage (see Drawing 10-9-5 or 10-9-6)
4. If needed, amend the surface of the cover with bentonite to reduce permeability and thus reduce infiltration to minimize future migration of contaminants
5. Add a protective layer of clean fill over the amended surface, seed and mulch

One potential source of clean fill is the rock and soil to be removed from the collapsed Ventilator tunnel which is just up slope from the SWRA. At this time, it is uncertain how much material will be removed, but estimates are in the 100 to 1100 cubic yard range. Additional clean fill will be hauled in from the borrow area if needed to supplement the fill from the Ventilator tunnel. As requested by the Agencies, the material removed from the Ventilator tunnel will be sampled and tested for constituents of concern prior to being used as clean fill and cover in the SWRA. Details of the sampling are included in the previously submitted Portal Bulkhead Implementation Plan.

Spoils from the Ventilator tunnel will be stockpiled just down slope from the Ventilator portal. The area for the stockpile will be prepared by timbering (if necessary), clearing and grubbing and stripping topsoil prior to stockpiling spoils from the Ventilator tunnel. Once the quantity and chemical characteristics of the Ventilator portal material are known, a technical memorandum will that describes the detailed closure design of the SWRA will be prepared and submitted to the Agencies for approval.

4.18 BORROW SOURCE DEVELOPMENT

It is anticipated that developing the Lower West Tenmile Creek as the primary source of construction materials will be needed for the 2011 Early Works facilities. Borrow from Dan's Camp may also be used for the nearby FS 8301 turnouts to reduce haul distance or if smaller grained (i.e. base course) material are needed during construction. Additional test pit investigations will occur during 2011 to investigate and confirm the material characteristics in the borrow areas including the Lower West and East Tenmile Creek, Ninemile Creek, and the area south TP-3. These investigations

will be described in a separate report and will occur in conjunction with the construction activities. The use of additional borrows other than the Lower West Tenmile Creek and Dan's Camp may be needed based on the utilization of material and results from the 2011 construction investigation program.

The Lower West Tenmile Creek borrow is part of an alluvial fan with a high percent of gravel, cobble, and boulder size material (MWH 2011). Screening and crushing may be necessary to produce the materials needed for the 2011 Early Work construction season including general fill, base and wearing course materials. Development of this borrow will include timbering, site preparation, and erosion control as described for ground disturbing activities. Removal of a thin layer of windblown tailings may also be required in this area. If so, this material would be stockpiled on top of the tailings piles for later consolidation into the overall regrading.

The approximate limits of the Lower West Tenmile Creek borrow are provided on Drawing 9-1. The area of ground disturbing activities will be between 5 and 10 acres. The floor of the borrow area will be located above the water table and sloped to drain towards Railroad Creek where it will day light with the existing ground surface. A buffer zone will be established to provide a screen of existing trees between the FS 8301 road and the limits of the borrow. The maximum excavation depth is anticipated to be 15 feet which would occur at the northern end of the borrow area.

An area of no more than 2 acres will be developed in advance of what is predicted for immediate construction material needs. Borrow area development will begin at the low end of the borrow pit and advance up slope. The top 6 inches of material will be stripped in the area of visible windblown tailings. The material will be temporally stockpiled in the vicinity until the Bypass Road bridge is in place for transportation to the tailings pile.

2011 early work construction activities in the borrow area will include excavation, stockpiling, material processing, loading trucks, and transporting material to 2011 Early Work facilities. Material processing may include screening and crushing operations necessary to manufacture construction products such as base and wearing course materials. Erosion control BMPs will be left in place over the winter season so that the borrow area can be utilized during future construction seasons. The end use of the borrow area may be for the mine water treatment plant to be determined during the remedial design. The borrow area will be restored in accordance with the USDA FS requirements if this area will not be used for the water treatment plant or other remedial components.

5.0 EROSION CONTROL

Measures will be taken to control erosion and manage storm water during all ground disturbing activity using BMPs. Erosion control BMPs will protect exposed soil surfaces from rain generated splash erosion and help reduce the velocity of flows across a site of ground disturbance. Erosion control measure will be in general compliance with the USDA EM-7700-100 – Forest Service Specifications for Construction of Roads and Bridges and the Washington State Department of Natural Resources Forest Practices.

Conceptual designs of a variety of erosion control BMPs are provided on Drawings 4-9 through 4-16 as described below:

Filter Barriers: Structures that filter sediment from runoff and reduce the velocity of sheet flow. Filter Barriers will include slash filter windrow, brush sediment barrier, gravel filter berm, vegetated buffer zone, silt fence, and straw bales.

Temporary Sediment Traps: Structures that temporarily trap sediment to detain runoff from disturbed areas and settle out sediment. Temporary sediment retention structures include log check dam, rock check dam, sediment trap or catch basin, earthern water bar, earthern and log water bar.

Sediment Basins: Structures that store runoff and settle out sediment for large drainage areas. The size of sediment basins will be determined on a case-by-case basis.

Outlet Protection: Structures that are constructed at the outlet of culverts, chutes and other erosion control BMPs to reduce water flow velocity and minimize scour.

Water Crossings: A temporary culvert pipe or rolling dip at a temporary crossing where construction vehicles cross a waterway.

Diversions: Structures that consist of diversion ditches, diversion dikes, culverts, or sandbags to divert runoff storm water around disturbed areas and slopes. Diversion will be stabilized with riprap or gabions

Waterway and Slope Protection: Features that minimize erosion from overland flow on side slopes. These include erosion control blankets, gabions, geocells, straw logs, and silt fence.

The layout and selection of BMPs will be developed for each area of ground disturbing activity. Erosion control measures will be in place prior to the work and be constructed in incremental stages during the progress of the construction.

Topsoiling will be performed on disturbed areas as soon as practical at the completion of construction. Seeding will occur in late fall prior to snow accumulation, but late enough that seed germination and the breaking of seed dormancy will not occur. All seed used will be in conformance with the Washington State Seed Law of the Department of Agriculture.

Mulch will be a wood fiber mulch that will consist of specially prepared wood fibers and will not be produced from recycled material such as sawdust, paper, cardboard, or residue from pulp and paper plants. The fibers will be dyed with an appropriate color, non-toxic, water-soluble dye to facilitate visual metering during application. Tackifier will be added to the mulch and will be a biodegradable organic formulation processed specifically for the adhesive binding of mulch slurry.

Seed will be applied to the areas designated for revegetation with a centrifugal broadcast seeder (either hand held or mounted on the back of a four-wheeler) or by hydro seeding. Wood fiber will be applied within one day of seeding by means of hydraulic equipment that utilized water as the carrying agent.

6.0 DECONTAMINATION

Vehicles and heavy equipment that are mobilized to the Site will be washed to control the spread of noxious weeds. The washing will be conducted using a pressure washer prior to mobilization to the

Site (either at the contractor's home office or at the barge loading area) and before demobilizing from the Site.

To prevent the inadvertent transport of mine wastes associated with soils, tailings, etc., vehicles and heavy equipment will be dry cleaned and washed. The dry decontamination will be conducted using shovels, brooms or brushes to remove encrusted soil as the equipment leaves work zones that are in mine waste areas. The wet washing will occur before the equipment moves into "clean areas" or demobilizes from the Site. The pressure washing station will be established on TP-1 and will consist of a plastic lined 20ft x 20ft bermed pad that will retain all generated fluids for later transfer to the settling basin on TP-1 (once it is no longer in use for the bulkhead installation). Water for the pressure washing will be non-potable construction water obtained from Railroad Creek.

7.0 MANAGEMENT OF WASTES

The construction crew will utilize Holden Village for room and board and will comply with the Village's policies for segregating and managing their wastes. Other wastes generated during the construction activities will be collected, contained and transported off site to an approved disposal or recycling facility.

8.0 CONSTRUCTION QUALITY ASSURANCE / QUALITY CONTROL

A Contractor Quality Control Plan (CQCP) will be developed to define the personnel and procedures necessary to verify compliance with the contractual and regulatory requirements of the proposed 2011 Early Works. The CQCP will establish the responsibility and authority of all organizations and key personnel involved in the construction activities, as well as the general administrative and documentation procedures and the specific testing and inspection requirements for construction quality assurance and control.

9.0 SITE MANAGEMENT

As the early works activities commence, it will be necessary to control access to the work areas to maintain a safe work environment. For this reason, signs and barricade fencing will be placed at the three main crossings across Railroad Creek (i.e., the west vehicle bridge, the foot bridge near the sauna, and the foot bridge just east of TP-3) to notify individuals of the limited access to certain areas and to prohibit their entry. Individuals who need to access work areas will first participate in a safety orientation and then be escorted by appropriate project personnel. Because visitors to Holden still need access to hiking trails and certain points of interest, corridors will be maintained to allow individuals to safely walk to these areas as long as construction work is not in progress. However, it is important to minimize the possibility of unauthorized entry into work areas. Holden Village has agreed to include such discussions in their orientation program for new arrivals.

Additional security measures, other than the security fence, will be employed around the excavation and stockpile areas. These measures include:

- Placing barricades or construction fence around excavations and stockpiles
- Using caution tape around potentially dangerous areas

- Installing safety signs throughout the construction area.

These steps will protect personnel from inadvertently entering the excavations, stockpiles, or other hazardous zones.

Construction will mainly occur during the day; however, some of the early bulkhead work will require a day and night shift operation. Noise from construction activities should be expected during the work. All machinery will be equipped with back-up alarms which tend to echo in the valley. Stationary equipment such as generators and air compressors will be equipped with noise reduction exhaust systems. Noise blankets may also be used for stationary equipment that operates at night.

10.0 SUMMARY

These early actions are essential to ensure the continued progress of the Holden Mine remediation in accordance with the aggressive schedule agreed upon by all parties. Delaying these early actions will have significant impacts to the local community which relies on its summer retreat program for its economic viability. Holden Village requires adequate advance planning to accommodate the temporary closure which will occur during the two years of heavy construction beginning in 2013. Some of these activities are still in the design stage or are subject to change based on permitting authority review. Additional details regarding certain remedial elements will be provided in the additional forthcoming documents as referenced throughout this document.

11.0 REFERENCES

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MWH, 2011. Draft Construction Material Investigation Data Summary for Holden Mine. April 2011

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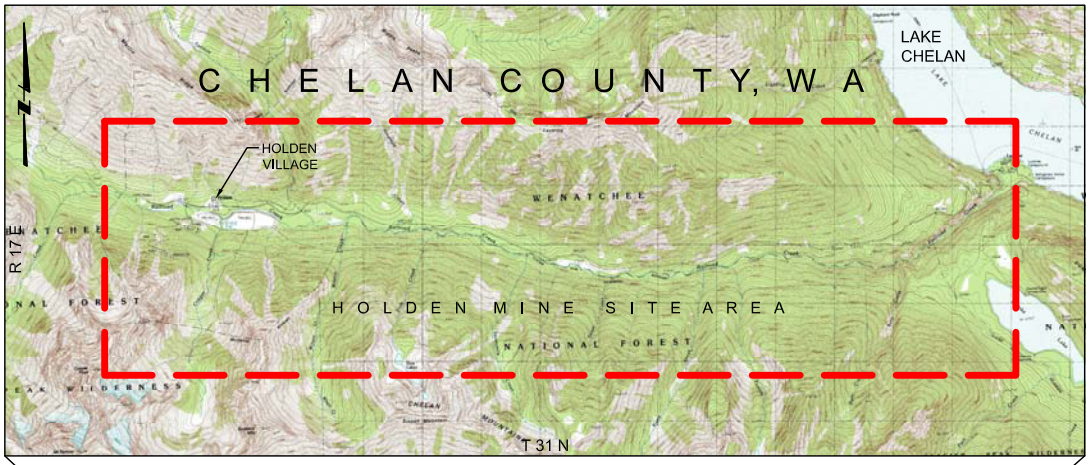
FIGURES



USGS MAP OF SITE AREA
NOT TO SCALE

LOCATION MAP
NOT TO SCALE

DESIGNED BY	D. RODRIGUEZ	06/11/10
DRAWN BY	F. ANDRADE	06/11/10
CHECKED BY	D. RODRIGUEZ	06/11/10
APPROVED BY	R. LEESON	06/11/10
PROJECT MANAGER	R. SCHLICHER	06/11/10
CLIENT APPROVAL		
CLIENT REFERENCE NO		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: HOLDEN MINE
TITLE: SITE LOCATION MAP

MWH

FIGURE: 1-1
REVISION: A
FILE NAME: 1008679D006

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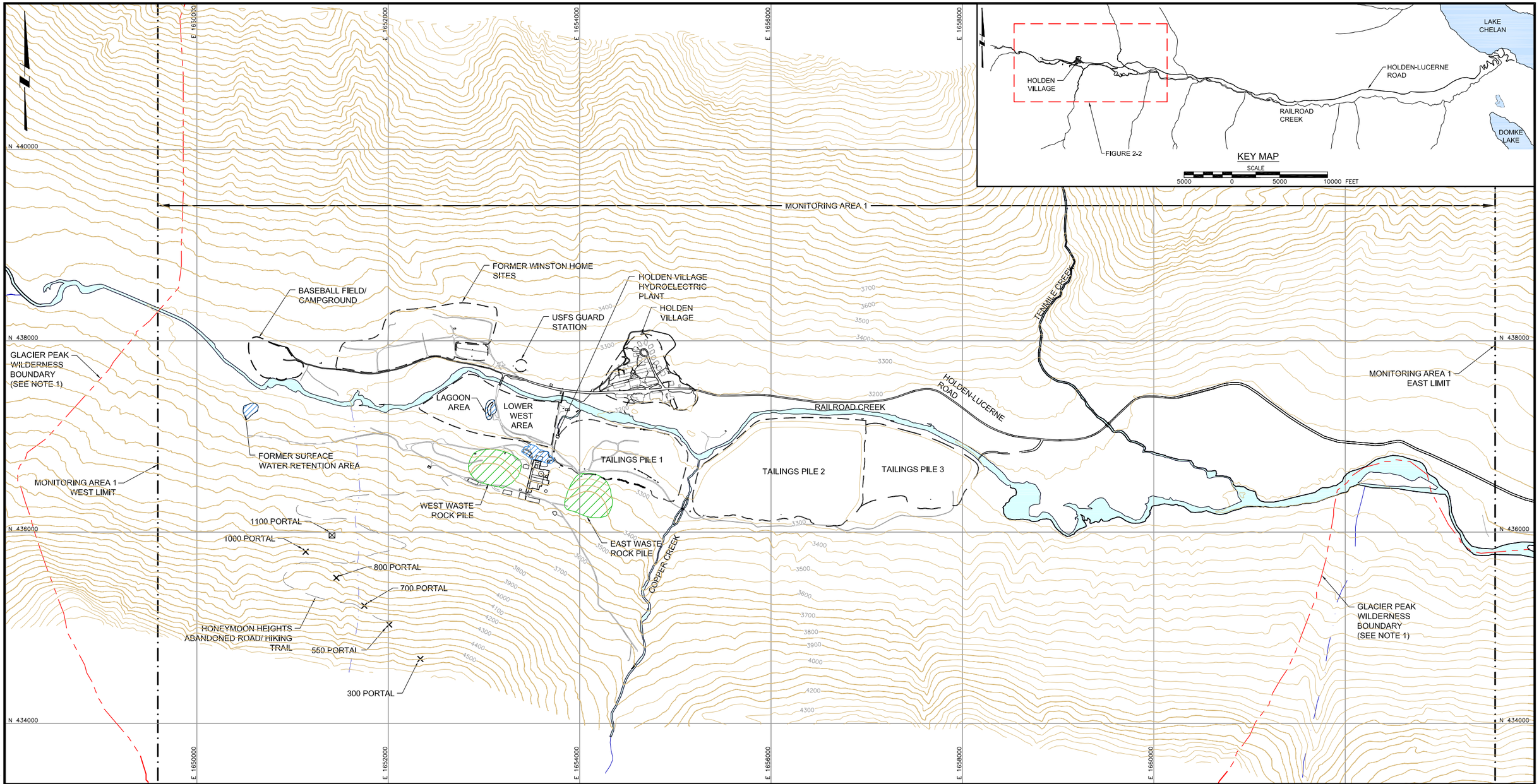

PLAN
SCALE
500 0 500 1000 FEET
CONTOUR INTERVAL = 50 FEET

LEGEND:

5200	APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET
	TRIBUTARIES / CREEKS
	INTERMITTENT DRAINAGE
	AREA LIMIT
	GLACIER PEAK WILDERNESS BOUNDARY
USFS	UNITED STATES FOREST SERVICE

NOTE:

1. GLACIER PEAK WILDERNESS BOUNDARY LOCATION CONSIDERED APPROXIMATE AT THIS TIME (SOURCE: WILDERNESS.NET).

DESIGNED BY	DJR / RTL	06/11/10
DRAWN BY	F. ANDRADE	06/11/10
CHECKED BY	D. RODRIGUEZ	06/11/10
APPROVED BY	R. LEESON	06/11/10
PROJECT MANAGER	R. SCHLICHER	06/11/10
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: HOLDEN MINE
TITLE: EXISTING SITE FEATURES

MWH

FIGURE 1-2 REVISION A
FILE NAME 1008679D007

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APPENDIX A

DRAFT TIMBERING PLAN

PREPARED FOR
INTALCO

Draft Timbering Plan for Holden Mine

Chelan County, Washington

April 2011

MWH®

BUILDING A BETTER WORLD

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List of Acronyms

AOC	Administrative Order on Consent
BMP	best management practice
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DBH	diameter breast height
DFR	Daily Field Reports
HVI	Holden Village Incorporated
MWH	MWH Americas, Inc.
OSHA	Occupational Safety and Health Administration
SHEAP	Safety Health and Environmental Action Plan
TP	tailings pile
USDA	United States Department of Agriculture
USDA FS	US Department of Agriculture Forest Service

1.0 INTRODUCTION

This Timbering Plan (Plan) was prepared by MWH Americas, Inc. (MWH) on behalf of Intalco to establish the requirements for storage, disposal and use of the timber and vegetation that will need to be removed as part of the remedy implementation for the Holden Mine Site in Chelan County, Washington. This Plan is one of many work elements being conducted pursuant to the Administrative Order on Consent (AOC) dated April 11, 1998, and amended on October 29, 2010 and again in 2011 (forthcoming), between Alumet Corporation (Intalco's predecessor) and the US Department of Agriculture Forest Service (USDA FS), US Environmental Protection Agency (US EPA), and Washington Department of Ecology (the Agencies). On June 1, 2010, the Agencies issued the Proposed Plan for the Site describing their preferred remedy (Alternative 14). As stated in the Proposed Plan (USDA, 2010), the selected remedy will include early actions and remedial construction. Vegetation and timber will need to be cleared to implement the early actions and remedial construction. This Plan provides the requirements for clearing vegetation and trees and the overall plan for managing cleared vegetation and timber. This Plan is not intended to define where timbering will be carried out but to establish protocols for approval and disposition.

A description of the Site, the Environmental Setting, and the Remedy Components for the Holden Mine Site are detailed in the 2011 Early Works Implementation Plan.

1.1 PROJECT ORGANIZATION

Organization	Representative	Role	Contact Tel. #
USDA Forest Service	Norman Day	Project Manager	509 664-9304
USDA Forest Service	Mallory Lentz	Biologist	509 682-4940
USDA Forest Service	TBD	Agency Representative	
Intalco	Dave Cline	Intalco Project Manager	801 204-2526 801 556-1376 (cell)
MWH	Ron Schlicher	Project Manager	801 617-3227 801 232-6206 (cell)
MWH	Phil Crouse	Engineering Manager	303 291-2163 303 589-2665 (cell)
MWH	TBD	Health and Safety Director	
TBD	TBD	Construction Manager	
TBD	TBD	Construction Superintendent	
MWH	James (Jed) Thompson	Project Engineer	970 367-6943 970 871-4373 (cell)

All communications with Intalco's Project Manager and Agencies overseeing the work effort will be through the MWH Project Manager (Ron Schlicher) or the designated coordinator/task manager. All Health and Safety issues are to be addressed by the MWH Site Health and Safety Director.

All communications during which decisions are made and/or actions are taken will be documented.

A satellite telephone will be available at the site, as well as in Holden Village in the event of an emergency and/or key decisions need to be made by the Project Manager and/or Intalco's Project Manager. Two-way radio communications will be used by on-site personnel, and radio communications with road vehicle operators at Holden Village will be maintained on a predetermined frequency when operating vehicles on the Holden-Lucerne road. This requirement will apply to MWH, Intalco, and subcontractors. Another frequency will be established for MWH and its subcontractors for internal communications, and for on-site communications with the Agencies as appropriate.

1.2 DOCUMENT ORGANIZATION

This document is divided into six sections as follows:

Section 1.0 – Introduction; includes site description and remedy components.

Section 2.0 – Compliance with Applicable Regulations, Rules, and Procedures; includes a discussion of the regulations that will be adhered to during the course of the investigative efforts.

Section 3.0 – Field Program; includes the field program rationale, methods and handling.

Section 4.0 – Burning Requirements; includes the discussion of timber waste burning procedures, including permit requirements prior to burning.

Section 5.0 – Delineating Clear and Grub Areas; includes the delineation process for clear cut areas and for individual trees along with timber ownership and accounting.

Section 6.0 – Temporary Runoff Control; includes the discussion of temporary sediment control mechanisms required.

2.0 COMPLIANCE WITH APPLICABLE REGULATIONS, RULES, AND PROCEDURES

Remedial action and associated studies at the Site are governed by the requirements of a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) AOC. No federal, state, or local permits are required for this work, as allowed by CERCLA under 42 U.S.C. 9621(e)(1). All activities will comply with the substantive requirements of permits and potential ARARs for on-site activities to the extent practicable and as described in this Plan.

Field work, timbering and vegetation clearing, will be conducted in accordance with:

- Forest Service Fire Protection and Suppression requirements identified in R6-FS-6300-52 (5/97) as provided by the Forest Service, including any request for waiver as required to perform the work in the agreed-upon timeframe.

- FSH 2409.14 "Timber Management Information System handbook" (United States Department of Agriculture Forest Service 1992)

- 47 FR 43037, Sept 30, 1982 – "National Forest System Land and Resource Management Planning" (United States Department of Agriculture Forest Service 1982)

- Washington Department of Ecology Burn Permits: http://www.ecy.wa.gov/pubs/ecy07052.pdf

- Forest Sciences Laboratory, "Slash Management Recommendations to Reduce the Likelihood of Bark Beetle Attacks" (Wenatchee Forest Insect & Disease Service Center, 2010).

All applicable requirements of the Occupational Safety and Health Administration (OSHA) will be followed as specified under 29 CFR 1910.120.

All work will be completed under the MWH Health and Safety Plan (MWH 2010a), Remedial Design, Holden Mine, Washington. MWH (MWH 2010b) and the Safety Health and Environmental Action Plan (SHEAP) prepared for Intalco for the Holden Mine, Washington. September 2010.

In addition to the regulatory requirements identified in Section 2.0, all equipment will be cleaned and inspected for noxious weeds prior to mobilizing to the Site and prior to leaving the Site.

3.0 FIELD PROGRAM

Construction areas will be cleared of trees and other woody material and any other objectionable material which would interfere with the completion of the construction activity, create a hazard to safety, or impair the subsequent purpose of the activity or obstruct its operation. The limits of timbering and grubbing will be defined and approved prior to the work in accordance with the procedures defined in this Plan and subsequent construction documentation. Timbering is the cutting and processing of trees that are a source of wood for remedial construction or fuel. Grubbing is the removal of tree stumps, shrubs, or other natural vegetation that can be chipped or otherwise processed for remedial construction material or burned.

3.1 WOODY AREAS

Woody areas are predominant on the project site. The timing and specific limits of timbering and grubbing at each area will be included in the construction documentation (e.g., Specifications and Drawings) that are currently being developed for each construction package. Woody areas are located at:

- Lucerne
- Forest Service Road 8301 turnouts
- Quarries and borrow areas
- Tailings piles
- Areas adjacent to waste rock piles
- Areas adjacent to the historic mill
- Areas adjacent to Railroad and Copper Creeks
- Baseball field area
- Former Winston home site area
- Area between the Winston home site and Holden Village
- Lagoon area
- Lower West Area

- Maintenance yard
- Area east of Tailings Pile 3
- Ventilator Portal and Surface Water Retention Area
- Holden Village and surrounding area

Timbering and grubbing will be required in other areas needed to implement the early actions and remedial construction. All timber and woody materials will remain on site unless otherwise approved for off-site use by the Agencies. Use of cut timber for building materials will be prohibited unless otherwise approved by the Agencies.

3.2 WOODY MATERIAL TYPES

Woody materials generated during construction activities will consist of:

- Sawcut timber
- Slash
- Root Wads

Timber and vegetation that is comingled with mine waste materials or from impacted areas will be managed separately from woody materials generated from un-impacted areas such as quarry and borrow areas, Forest Service Road 8301, Winston home site, and at Lucerne.

Sawcut timber will include trees that have a minimum diameter breast height (DBH) of five inches, (diameter of the tree trunk measured 4.5 feet above the ground). Slash is the coarse and fine woody debris that will be generated during site clearing and grubbing. The root wad is the trunk of a tree with the roots attached and the soil removed so that the roots are exposed.

3.3 LOGGING METHODS

Logging will consist of felling the tree, skidding, on-site processing, and loading of trees or logs onto trucks. Logging methods will include tree-length, full-tree, and cut-to-length. Springboards will not be allowed unless otherwise approved by Intalco due to fall hazards. Tree-length logging will consist of felling a tree, delimbed and topped at the stump. The log is then transported to the specified processing area based on the end-use for the log. The slash and root are removed and stockpiled in a designated area. Full-tree logging consists of felling the tree and transporting it to the processing area with the top and limbs intact. The trees are then delimbed, topped for future processing. Cut-to-length logging consists of felling, delimbing, bucking and sorting at the stump area. The bunks of logs are then retrieved at a later date. If necessary gross decontamination of the logs will be performed on site by using shovels, brushes, water jets, air wands or other approved methods to remove any encrusted soil from the logs before the bunks are moved or transported.

Logs will be transported from the cut area to designated storage and processing areas using the cable logging method. Equipment such as a yarder will drag several logs along the ground to a platform where it can be loaded onto a transport vehicle. Helicopter logging will not be used for removing logs from cut areas. Logs that are cut in mine waste or impacted areas will be loaded directly onto the transport vehicle to avoid soil from sticking to the log and being transported to un-impacted areas. If logs cannot be directly loaded they will be stacked on site and if necessary gross

decontamination of the logs will be performed to remove any encrusted soil from the logs before eventually being loaded.

3.4 SLASH HANDLING

Slash will be handled either at the cut area or timber processing area. Slash will either be shredded to produce wood mulch for remedial construction and early action purposes or placed in stockpiles for subsequent burns during the winter season. Slash material located in mine waste areas will be burned and not used for remedial construction or early action activities. Burn stockpiles will be located in areas with mine waste material to avoid affecting un-impacted areas. Construction materials manufactured from slash (i.e., mulch) will remain on site. Tailings Pile1 (TP1) will be used as the burn stockpile location for 2011 activities. Future stockpile locations will be coordinated prior to field activity initiation.

3.5 ROOT WAD HANDLING

Tree roots and root wads will be removed by earthmoving equipment and stockpiled in the cut area. Root removal using chemicals will not be allowed at any time during the project. Root wads will either be shredded to produce wood mulch, used for stream restoration, or burned. Root material located in mine waste areas will be burned and not used for remedial construction or early action activities. Burn stockpiles will be located in areas with mine waste material to avoid affecting un-impacted areas. Construction Materials manufactured from slash (i.e., mulch) will remain on site.

3.6 TIMBER STOCKPILE LOCATIONS

Future stockpile or deck locations will be coordinated with HVI in approved areas by the USDA FS. The Wenatchee Forest Insect & Disease Service Center provided guidelines to reduce the likelihood of bark beetle attacks on timber decks. These guidelines have been incorporated into this section. Timber decks of large quantities of cut live trees for long periods of time are considered a poor sanitation practice. Certain tree species will attract bark beetles and the beetles can reproduce in the timber decks. The Wenatchee Forest Insect & Disease Service Center provided guidelines to reduce the likelihood of bark beetle attacks on timber decks. The second generation of beetles may emerge from the timber decks and attack surrounding live trees. The species of most concern are the Douglas-fir beetle in the Douglas-fir and the spruce beetle in Engelmann spruce. Below is information provided by the USDA FS about the risks involved and approaches to risk reduction for bark beetle attacks.

<u>Douglas-fir beetles</u>

Douglas-fir beetles *(Dendroctonus pseudotsugae)* are attracted to Douglas-firs that are weakened by agents such as root disease, defoliation, fire, or drought. They are particularly attracted to blowdown or freshly-cut Douglas-fir logs 18 inches in diameter or larger. Freshly killed trees do not have the chemical defenses of live trees, and provide excellent host material. If large quantities of this material are available, the beetles can build up a large population which may then attack live Douglas-firs in the area. Douglas-firs in the Holden area are already weakened by defoliation by western spruce budworm, and are vulnerable to Douglas-fir beetle attack.

Douglas-fir beetles have a one-year life cycle. In early spring adult beetles emerge from their overwintering sites under the bark of trees attacked the previous year, searching for new Douglas-firs to colonize. When beetles locate a suitable host they burrow through the bark and begin feeding on the phloem, where the females lay eggs. Beetle eggs hatch within a week or two, and grub-like larvae also begin feeding on the phloem, girdling the tree. Larvae feed through the summer, eventually forming pupae and transforming into adults. They overwinter under the bark as adult beetles, and emerge in spring to begin the cycle again.

Large Douglas-firs that are cut in winter or spring are likely to attract large numbers of beetles. The phloem of trees cut in summer or fall may dry out or decompose before large numbers of spring-emerging beetles are available to colonize them. The risk of Douglas-fir beetle damage can be reduced by limiting the season of cutting to begin no earlier than July 1 and end by October 30. Cutting Douglas-fir logs into 18-inch long bolts will also reduce the likelihood of damage, since short bolts will dry more quickly than logs. This makes it more difficult for beetle larvae to complete their development. Debarking logs makes them unsuitable for beetle development, and may be practical in some situations. If logs are removed from the site prior to beetle emergence during the spring following logging, the risk to nearby Douglas-firs can be eliminated.

If timing, log removal, or mechanical treatments are not feasible, log decks that contain large Douglas-firs can be treated with the anti-aggregation pheromone MCH, which causes beetles to fly past without attacking. If beetles can be prevented from building up, the risk of outbreak can be mitigated. MCH is available in the form of bubble caps applied manually or flakes applied aerially. Bubble caps should be applied at a rate of 30 per acre, or a minimum of 16 for areas less than ½ acre. Flakes should be applied at a rate of one pound per acre. Application needs to be done in late April or early May, shortly before beetles emerge in the spring.

Spruce Beetles

Spruce beetles *(Dendroctonus rufipennis)* are attracted to weakened Engelmann spruce trees, much as Douglas-fir beetles are attracted to weakened Douglas-firs. Spruce beetles have a two-year life cycle. Adult beetles emerge after the snow disappears in June or July and seek out new spruce trees or fresh logs to attack. They prefer trees 18 inches in diameter or larger. When beetles locate a suitable host they burrow through the bark and begin feeding on the phloem, where the females lay eggs. Beetle eggs hatch within a week or two, and grub-like larvae also begin feeding on the phloem. Larvae overwinter and complete development the following year. When adults emerge they migrate to the base of the host tree where they bore into the bark and overwinter, emerging the following summer to begin the cycle again.

Spruce beetles may be seeking out new host material any time the weather is warm enough to allow flight. Cutting spruce logs into 18-inch long bolts will reduce the likelihood of damage, since short bolts will dry more quickly than logs. This makes it more difficult for beetle larvae to complete their development. Debarking logs makes them unsuitable for beetle development, and may be practical in some situations. If logs are removed from the site prior to beetle emergence, the risk to nearby spruce trees can be eliminated. Since spruce beetles require two years to complete their development, infested spruce logs can be left longer than infested Douglas-fir logs without substantial risk of spillover into live trees.

If log removal or mechanical treatments are not feasible, decks that contain large spruce logs can be treated with the anti-aggregation pheromone MCH. Spruce beetles are known to respond to MCH

in somewhat the same way as Douglas-fir beetles. The results of treatment are often not as satisfactory, but it is the only pheromone available to reduce the likelihood of infestation.

Recommendations

Promptly removing green logs or promptly bucking logs into firewood is the most effective way of reducing the risk of unwanted bark beetle response. If removal is not possible, I recommend treating log decks with MCH to prevent a buildup of Douglas-fir beetles and reduce the buildup of spruce beetles.

3.7 FIELD DOCUMENTATION

Observations and documentation of field activities made during timbering activities will be entered directly into field logbooks and on project-specific field forms. Field forms applicable to this project include: Tailgate Safety Meeting Forms and Daily Field Reports (DFR). Sample field forms are provided in **Appendix A** in this plan. The field logbook will be maintained throughout all field activities and will be a weatherproof, bound survey-type book, with non-removable, numbered pages. All data generated during timbering activities and any deviations from the design documents will be recorded in detail in the field logbook. All field documentation shall be accurate, legible and written in indelible black or blue ink. Incorrect entries in the field books, logs, or on forms that need to be deleted will be crossed out with one line, initialed, and dated. At a minimum, the date, weather conditions, personnel on site, type of activities being performed, and any unusual conditions encountered will be recorded in the logbook.

In addition to written records, the timbering efforts will be documented with photographs. Photographs will be taken as necessary to supplement written descriptions of field activities entered in the field logbook and on field forms.

A DFR will be prepared by the MWH field coordinator each day that field work is performed. DFRs will summarize daily activities and will include work performed, the individuals performing the work, problems encountered and corrective actions taken. The report form is included in **Appendix A**. A weekly summary will be submitted to Intalco with a projection of personnel and activities for the following week, as applicable.

3.8 MOBILIZATION / DEMOBILIZATION

Mobilization and demobilization will be necessary for personnel and equipment, including vehicles for on-site transportation, heavy equipment necessary for timbering and grubbing. All personnel, vehicles and equipment will be mobilized to Holden from Chelan by ferry or, for vehicles and larger equipment, a commercial barge. From the Lucerne dock, vehicles will be transported to the Site. The equipment, vehicles, supplies, and personnel will be demobilized along the same access route used for entry.

4.0 BURNING REQUIREMENTS

Disposal of timbering waste (slash) by burning shall follow the following procedures. Prior to burning of slash and root wads, all other methods of material disposal must be ruled out. Burning shall only be utilized if there is an excess of chipped material for remediation purposes or if the slash and root wads are determined to be from impacted areas or unsuitable for use during remediation.

Slash and root wads which are designated to be burned shall be stockpiled in areas previously approved by USDA FS. These areas must not lie within the 100 yr flood plain, Riparian Management Zone, or Wetland Management Zone. Slash piles shall not be constructed within 100 ft of a roadway or within 500 ft of a structure. Piles shall be constructed in open areas away from live trees to minimize the potential for spreading of the fire.

Slash may be piled by hand or by machinery. Slash shall be stacked to minimize the size of the pile, generally using overlapping layers of material to form a dense pile. The butt ends of slash and larger debris shall be placed toward the center of the pile. In general the dimension of the slash pile should be as tall as it is wide. The inclusion of soil and other foreign material shall be minimized. Random construction debris cannot be placed within the pile.

Slash piles shall be ignited utilizing a propane blow touch or other Forest Service approved ignition source. The use of gasoline to aid in ignition is not allowed.

Slash burns shall be performed during the fall and winter after at least 6" of snow has accumulated and is expected to remain on the ground. Temporary covers on the slash pile may be utilized to minimize the infiltration of snow into the pile.

Typically all slash burns would require a burn permit through the Washington State Department of Ecology, however the Holden Mine Site is a CERCLA site therefore a formal permit is not required however the substantive requirements of the permit will be met.

5.0 DELINEATING CLEAR AND GRUB AREAS

Delineating clear and grub areas will require close coordination with the USDA FS representative and biologist. There will be a delineation process for clear cut areas and one for individual trees.

5.1 DELINEATING AND APPROVING AREAS

Areas which require clear cut timbering will be indicated on a drawing, which will be submitted to the Forest service for review and approval. The Forest Service will provide comments or approval of the area submitted within two weeks of receiving the drawing.

The clear cut area will be delineated by adhering colored ribbon to the trees that define the outer limits of the area to be clear cut. The flagged trees will be those that will remain after the clear cut is complete. Wooden survey laths will be used to define clear cut limits if there is not a sufficient density of trees for adhering ribbon to. Physical features such as the edge of stream or toe of the tailings pile may also be used to delineate the limits of clear cut areas. Flagging will consist of wrapping the tree at its breast height with florescent survey tape. The clear cut area will include all areas for staging, processing and loading timber and woody materials necessary for implementing the remedial construction. The outer limits will be defined so that any tree that is intercepted by a line between two flagged trees is subject to authorized cutting.

The Timbering Contractor will be responsible for attaching the colored ribbon to the outer limit trees or survey laths based on construction submittal documents. The clear cut area, lead time, and other information described in this Plan will be included in the construction submittal as defined in the Construction Specifications. A field approval process will be developed to define cut areas that

had not previously been defined due to changes in the construction plan. A streamlined decision process will be important to minimize construction delays.

Subsequent to the Timber Contractor flagging the area in the field the Forest Service will be notified and will have the option to perform a field review of the flagged area. The field review shall be performed within one week of notification that the area has been flagged.

The remedial construction and early work actions may require individual trees to be marked for selected cutting. The Timbering Contractor will clearly mark the trees to be removed by painting a ring just below the breast height in a specific color of paint to indicate proposed cutting and removal. The approval of individual trees that require cutting will be made in the field between the Intalco and US Forest Service representative and documented in the field logbook and field construction reports. The USDA FS will be responsible for authorizing and marking the individual trees for cutting and removal.

5.2 TIMBER OWNERSHIP AND ACCOUNTING

Timber at the Holden project is either on land managed by the USDA FS or patented mining claims owned by Holden Village Incorporated (HVI). Un-impacted logs from HVI property will be used as fuel to heat structures at Holden Village. Un-impacted logs from the land managed by the USDA FS will be sold to HVI or otherwise chipped or burned as described in this plan. The property ownership will be provided on the design drawings.

The USDA FS Representative will be responsible for tracking the number and type of trees cut on land managed by the USDA FS and computing the timber volume and associated value for the logs sold to HVI. The measurement of the wood volume contained in a log will be as cords of wood. The board feet volume of a log will be based on the log rule determined prior to timbering. Some adjustments may be made to reduce the value of the wood if it contains defects that reduce the merchantable wood volume. A cord is a stack of wood measuring 8 feet long, 4 feet high, and 4 feet wide. A solid cord generally contains from 80 to 90 cubic feet of wood.

6.0 TEMPORARY RUNOFF CONTROL

Temporary sediment control mechanisms may be required to prevent runoff of sediments from areas disturbed by timbering and root wad removal. The temporary sediment control mechanisms will be install around the perimeter of the disturbed area and shall stay in-place until permanent sediment control measures can be implemented.

Methods for temporary runoff control may vary from location to location. A runoff control plan will be provided prior to timbering activities. The need for special best management practices (BMPs) to protect against erosion and site deterioration after logging will be developed as part of the Early Work and Remedial Design Packages.

7.0 REFERENCES

MWH Americas, Inc. (MWH 2010a). MWH Health and Safety Plan, Remedial Design, Holden Mine, Washington. August 20, 2010.

MWH, Americas, Inc. (MWH 2010b). Safety Health and Environmental Action Plan (SHEAP). Prepared for Rio Tinto for the Holden Mine, Washington. September 2010.

United States Department of Agriculture (USDA 2010). Proposed Plan for the Site. June 1, 2010

United States Department of Agriculture Forest Service (1992). "Timber management Information System handbook", Forest Service Handbook 2409.14 (Region 6 Issuance), November 3, 1992

United States Department of Agriculture Forest Service (1982). "National Forest System Land and Resource Management Planning", 47 FR 43037, Sept 30, 1982

Outdoor Burn Special Permit Application. Available from: Washington Department of Ecology, http://www.ecy.wa.gov/pubs/ecy07052.pdf

APPENDIX A

FIELD FORMS

TAILGATE SAFETY MEETING FORM

Date:_____ Time:_____ Job Number:_____

Client: Rio Tinto

Site Specific Location: Holden Mine Site, WA

Safety Topics Presented

Protective
Clothing/Equipment:_____

Chemical azards:_____

Physical Hazards:_____

Special Equipment:_____

Other (IIPP):_____

Emergency Procedures: Contact Holden Village by 2-way radio for Medical Assistance. On site Paramedic will respond to medical emergency and coordinate medical transport by helicopter to Lake Chelan Community Hospital.

Hospital: Lake Chelan Community Hospital Phone: 509-682-3300

Hospital Address and Route: 503 East Highland, Chelan, Washington.

ATTENDEES

NAME PRINTED SIGNATURE

_____

_____

_____

_____

Meeting Conducted By:_____ _____
Name Printed Signature

On-Site Safety Officer:_____ Project Manager:_____

MWH
MONTGOMERY WATSON HARZA

DAILY QUALITY CONTROL REPORT

DATE _____

DAY	S	M	T	W	TH	F	S

WEATHER	Bright	Clear	Overcast	Rain	Snow
TEMP Low/High	To 32	32-50	50-70	70-85	85-up
WIND	Still	Moder.	High	**Report No.**	
HUMIDITY	Dry	Moder.	Humid		

MWH PROJECT MANAGER _____

PROJECT _____

JOB NO. _____

LOCATION _____

CONTRACT NO. _____

PERSONNEL AND SUBCONTRACTORS ON SITE:

VISITORS ON SITE:

EQUIPMENT ON SITE:

WORK PERFORMED (INCLUDING SAMPLING):

.

PROJECT _____ **REPORT NO.** _____

JOB NO. **DATE**

HEALTH AND SAFETY AND/OR SITE SPECIFIC TOPICS:

SPECIAL NOTES:

FUTURE EXPECTATIONS:

SUBMITTED BY _____ **TITLE** _____ **DATE** _____

DAILY QUALITY CONTROL REPORT FORM

APPENDIX B

PRELIMINARY SITE SELECTION AND DESIGN FOR UPLAKE PORT DOCK AND BARGE RAMPS AT LUCERNE

APPENDIX B

PRELIMINARY SITE SELECTION AND DESIGN FOR UPLAKE PORT DOCK AND BARGE RAMPS AT LUCERNE

INTRODUCTION

Heavy construction associated with the Holden Mine remediation is scheduled to begin in the spring of 2013. Infrastructure improvements and material stockpiling will commence in the spring of 2011 and continue through 2012. Dock and barge facilities must provide year round access for the mobilization of heavy equipment and stockpiling of construction supplies. It is anticipated that 150 to 200 construction personnel will require transport during the start and end of each construction season. Once the construction crews are mobilized to the site for the season, it is anticipated that 20 to 40 will be transported up and down the lake per day.

The Lucerne Port has three existing dock and barge ramp facilities, but none of them are adequate to support the volume and types of loads associated with the construction traffic for the mine remediation. Therefore, one of the existing port facilities needs to be modified to improve its capacity and functionality.

SITE SELECTION

Three existing dock and barge ramps sites at Lucerne were considered for upgrades to support the remediation effort: the Lady of the Lake dock, the Lucerne Yacht Club barge ramp area, and the USFS ramp and dock area. All three sites are on USFS land.

Lady of the Lake Dock—This site refers to the general area that encompasses the existing USFS dock that the Lady of the Lake boating service uses to load and offload goods and pedestrians at Lucerne. Although the existing dock would be used for offloading personnel, the barge ramp will not be connected to the dock and would be located so it would not impede the use of the USFS dock. The Lady of the Lake docks at the site twice a day in the summer time and twice a week in the winter, for short durations in both cases. Logistical scheduling will greatly reduce the amount of impact on the Lady of the Lake operations.

Lucerne Yacht Club—This site is located adjacent to the residences within the town of Lucerne and poses the highest security problem uplake. It was considered as a possibility because it is currently used at high water by the local barge operator (Tom Courtney). It is likely to require moderate road improvements from the barge and dock site to the Holden Village road. In particular, vehicles and equipment offloaded at this location will need to cross the Railroad Creek bridge which has a weight limit that is not adequate to support the construction equipment. Therefore, the bridge would need to be upgraded to increase its capacity. This site could be used in conjunction with the Lady of the Lake site as a backup, for light goods only or as the primary site with upgrade to the bridge. There is no ability to use this site for personnel transfer without exceptional cost, so the Lady of the Lake dock site would be required for personnel traffic.

USFS Dock and Ramp—This site is located near the USFS office at Lucerne. Adjacent to the office is an existing fixed dock that could be used for offloading personnel during periods of high water but the Lady of the Lake dock site would most likely be used for personnel at low water. Improving this site is likely to require moderate road improvements from the barge and dock site to the Holden

Village road. As with the Lucerne Yacht Club site, vehicles and equipment offloaded at this location will need to cross the Railroad Creek bridge which has a weight limit that is not adequate to support the construction equipment. This site could be used in conjunction with the Lady of the Lake site as a backup, for light goods only or as the primary site with upgrade to the bridge. A small boat camping area is located around this site that would require closing during the operation of for safety concerns and to minimize wave action.

Each of these sites was evaluated with respect to safety, ability to handle barge and passenger traffic, usability for construction, vehicle traffic, public visibility, operational impact to neighbors, wind and wave protection, available space, site layout characteristics, potential construction cost, and ability to be usable over the expected range of water levels. Based on this evaluation, the Lady of Lake dock area was selected as the most appropriate.

The remainder of this memorandum discusses the preliminary design of the modifications to the Lady of the Lake dock which are necessary to service the mine remediation.

DESIGN BASIS

The following assumptions and criteria were established in order to select the most appropriate site and then complete the preliminary design for the dock and barge ramp.

General

Barge ramps will accommodate the loading and unloading of heavy construction equipment including Caterpillar 740 articulating trucks, Caterpillar D9 dozers, and fully loaded semi trucks. The barge ramps and staging areas will be designed to accommodate a minimum of 2 barges a day. Personnel transport and light freight transport will be provided by vessels assumed to be 65' in length or less. Other specific assumptions are:

- Water level will be at 1088 for construction.
- The site must be usable for year round use.
- The construction season will begin in late fall.
- Suitable fill material and rock for riprap, crushed surfacing, and ballast will be provided near the uplake sites and will not require transport uplake.
- All primitive road construction is 6" crushed surfacing with a 12 foot lane width.
- Fuel and oil transfer will not require any special BMP's for transport or storage.

Barge Characteristics

It was assumed for the preliminary design that the barges to be used for construction will be similar to the one currently operating on Lake Chelan, which is a 40 by 80 foot barge with a 5 foot depth that can carry up to 200 tons of cargo. It has a non-tapered hull design at the bow. The barges for

construction will have 15 inches of draft unloaded and 42 inches of draft loaded allowing for a minimum of 18 inches of freeboard.

A "bridge" or "drop ramp" can be used to allow vehicles to drive on and off the barge. These vary in length and width. The barge currently in use on Lake Chelan uses a 26 foot by 10 foot wide bridge, and the same was assumed for the preliminary design.

Barge Access Ramp

15% Ramp Slope

There are numerous variables that affect the maximum and minimum feasible slopes for the barge access ramp. The design characteristics of the barges themselves greatly affect the ramp design. If the ramp slope is too shallow, then when the barge is fully loaded and at maximum draft, a much longer bridge is needed to access the barge from the ramp. Conversely, if the ramp becomes too steep, then the drivability of the ramp becomes an issue, particularly in the winter time. The ramp used by Tom Courtney at Chelan has a 16-17% slope and is textured concrete. From our research, ramps are viable up to 18%, but 13-15% is more common for boat ramps.

There is also a significant reduction in cost and environmental impact when the ramp slope is increased. The ramp will be much shorter over a given range of lake level drop compared to a ramp with a shallower slope. Therefore, the steepest ramp usable should be chosen. A 15% ramp slope provides a good compromise between functional usability, cost-effectiveness, and environmental impact, and is at the high end of the usable range for a boat ramp if the ramp is to be left as a "leave-behind".

Concrete Ramp Surfacing

It was assumed for the preliminary design that all barge access ramps will utilize concrete surfacing. Based on the slope criteria, railroad ballast and other materials would not provide an adequate traction surface at 15% slope. In addition, water level fluctuations and wave action could potentially cause significant maintenance issues. For ramps consisting of shallow slope sections, railroad ballast may be used for the ramp surface, but only when the slopes are less than 5%. The ramps in this study do not meet this criterion.

Laydown and Handling Area

- The minimum handling and laydown area for uplake sites was assumed to be 6,400 square feet (0.15 acres) which will accommodate the cargo of 2 barges at one time. Materials will be constantly moved from the landing to the construction site so a smaller area is needed.

- The laydown and handling area will be an all weather surface consisting of 6 inches of crushed rock.

- No accommodations will be provided for spill containment.

Logistics Office Buildings

- 10x20 portable building.
- Generator supplied power.
- No other utilities provided.
- Portable toilet provided where no existing facility exists.
- One worker parking stall.

Transportation

2011 & 2012

- 20 personnel round trips per day for 200 days each year.
- 70 barge trips per year.
- 420 truck trips per year (6 trucks per barge).

2013 & 2014

- 40 personnel round trips per day for 200 days each year.
- 270 barge trips per year.
- 1,620 truck trips per year (6 trucks per barge).

Water Level Usability

For the Holden Mine remediation project, it will be critical that the barge ramps are operable throughout the minimum and maximum water levels of Lake Chelan. The Lake Chelan PUD indicates that the maximum operating water level of Lake Chelan is 1100 ft ngvd and the minimum operating water level is 1079 ft ngvd. The lake water level has been monitored daily since 1926, and the data are available for public use on the U.S.G.S. website. The Lake Chelan Hydroelectric Project, including the dam at the lower end of Lake Chelan, was constructed from 1927-1928 to maintain the lake level and provide electricity to Chelan County. Water level data prior to 1930 was omitted from this analysis for the reason that the existing dam had not been installed prior to 1927. A graph of the data ranging from 1930-2010 has been created to show Lake Chelan water level averages, minimums, and maximums (see Figure 1). From the graph, it can be seen that there are large variations in lake levels within any given year, and no apparent correlation between year-to-year water elevations.

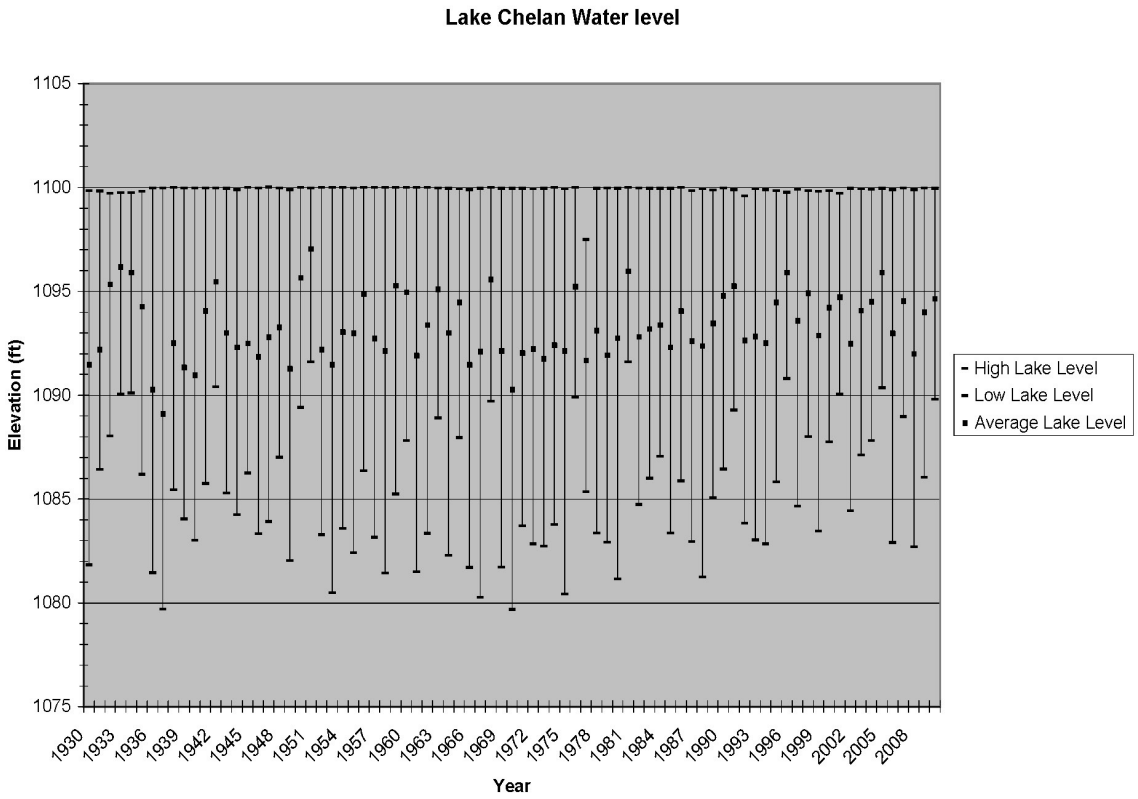


Figure 1 – Lake Chelan Water Level

From the water level data obtained in this analysis, the probability in a given year of the water level falling below predetermined elevations was computed (see Table 1). The probability of the water level falling below these predetermined elevations for the 5-year construction window for this project is 5 times greater than the probability in any given year.

Table 1 Water Elevations (1930-2010)

Water Elevation (ft)	Probability of Lower Lake Level in 1 Year	Probability of Lower Lake Level in 5 Years
1082	18.3%	91.5%
1081	7.0%	35.2%
1080	2.8%	14.1%

It should be noted that the maximum water level experienced on Lake Chelan since 1930 was 1100.02ft, and the minimum was 1079.68ft. The lake level has never reached the minimum authorized elevation of 1179.00ft since the construction of the Lake Chelan Hydroelectric Project.

Furthermore, Figure 1 illustrates a pattern of higher lake elevations since 1985. Therefore, the "probable" water levels were computed using only the past 25 years of data as shown in Table 2. This data represents the most recent and most probable lake level data.

Table 2 – Probable Water Elevations (1985-2010)

Water Elevation (ft)	Probability of Lower Lake Level in 1 Year	Probability of Lower Lake Level in 5 Years
1083	16.67%	83.33%
1082	3.33%	16.67%
1081	0%	Minimal
1080	0%	Minimal

As shown in the table above, recent data suggests that the lake level has been kept at a higher minimum elevation compared to prior data. The water level has not fallen below 1081ft in the past 25 years; however, Chelan County PUD is authorized to draw the lake down to 1179ft. There is a chance that the water level will fall below 1081ft, but based on the most recent and probable data, this chance is minimal. Chelan County PUD recently renewed the license for the Lake Chelan Hydroelectric Project through the Federal Energy Regulatory commission (FERC), and as part of this renewal, Chelan County PUD proposed modifications to their current lake level management practices (information available on Chelan County PUD website). The authorized lake level elevations remains in the range of 1079-1100ft, but the new lake level operating plan will attempt to increase the lake level earlier in the spring and summer, and decrease the lake level earlier in the fall (See Figure 2). The increase in water elevation earlier in the year has been proposed to increase recreational opportunities earlier in the summer months. The decrease in water elevation earlier in the year has been proposed to enhance spawning opportunities for native fish by allowing tributary streams to scour out any sediment barriers at the mouth of the stream. While it does not directly affect the minimum and maximum lake level elevations as those elevations remain unchanged, the design team should be aware of these changes in operations.

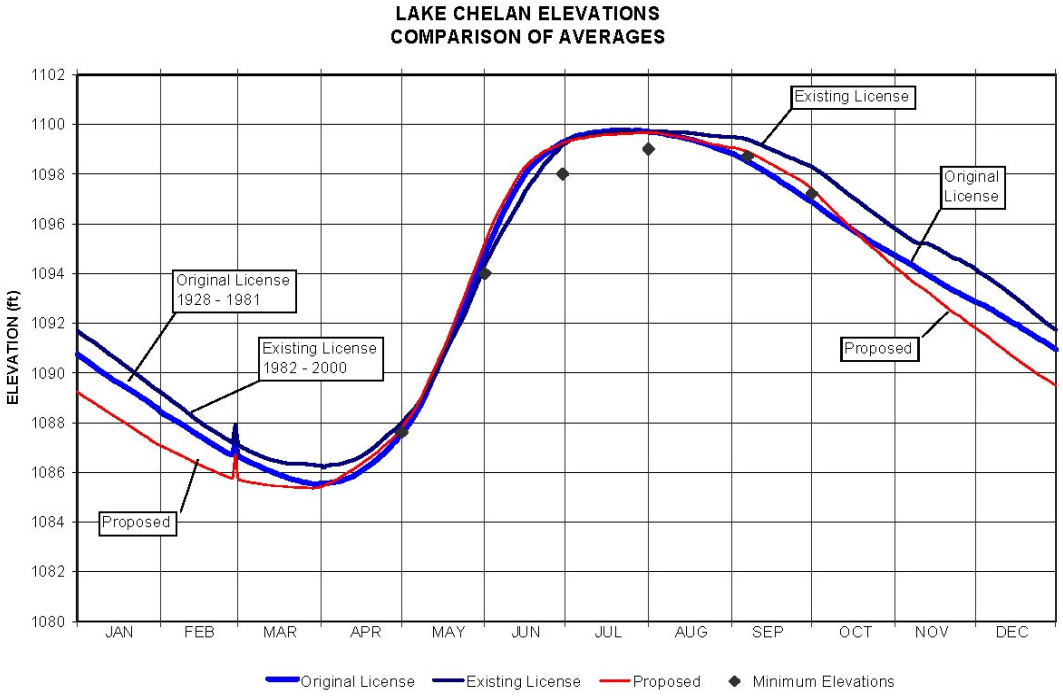


Figure 2 – Lake Chelan Elevations Comparison by Month (Chelan County PUD)

The preliminary design provides facilities suitable for year round use at all water depths, which assumes that the water level will drop to the minimum 1079 level during the operation of the facility. However, as indicated in Table 2, the water level has not been lowered to a depth below 1081 in the last 25 years. In addition, only a 16% chance exists of the water level being lowered below 1082 during a 5 period. Designing the barge facility to a depth of 1082 rather than 1079 has rather large construction cost ramifications, particularly at sites where dredging and temporary barges are used. In designing to 1082, Intalco would accept a certain amount of risk; saving in cost of construction weighed against the possibility of dropping below 1082 and having to find an alternate low water site. However, lake level drawdown is planned in advance by the PUD and they may give sufficient notice to enable stockpiling of resources uplake to permit operations at Holden to continue until lake levels rise again. In addition, a drawdown below 1082 would occur during winter, the off-season for construction, so it is possible the drawdown below 1082 would not affect operations at all. As previously noted, the agreement with Chelan County PUD has changed and future operation may not fit the 25-year model. This alternative should be considered by Intalco and explored further in the 60% design set.

PRELIMINARY SITE LAYOUT

The preliminary layout for the Lady of the Lake dock area is shown in the attached Drawing C2.0. The layout locates the barge ramp to the west of the USFS dock. It requires filling the area between the existing retaining wall at the dock approach and the cliff. This site was chosen because it utilizes the existing dock facility and provides access to the Holden Village road without the need for improvements to the Railroad Creek Bridge.

The layout provides for:

- 40'x173' concrete barge ramp at 15%
- 275 cubic yards of total cut and 3000 cubic yards of total fill
- 0.27 acres of additional laydown area
- Ample room for logistics office and office staff parking

The layout also offers the following benefits:

- Public visibility- this site is the least publically visible site at Lucerne from casual boat traffic using the lake and from local residents. However, it does impact ferry traffic users and they will get a close up view of the operations.
- Operation impact (neighbors) - operation of the site would impact the ferry traffic once on shore due to the reconstruction of the access road but would not affect residents day to day lives.
- Barge safety from recreational boat traffic- use of this site is well away from any recreational boat traffic.
- Passenger facility proximity- personnel will offload adjacent to the barge launch on the existing lady of the lake dock.
- Vehicle traffic- moving goods and personnel from the barge facility to the project site will impact the minimal amount of local traffic that is expected because they will share the main road to the turnaround.
- Wind/wave protection- this site is very well protected from uplake and downlake wind and wave action from boaters.

- Method of OffLoading—loading and unloading of light freight transported in passenger craft will be accomplished by different means depending on water depth. At high water, a passenger vessel may be loaded or unloaded by a jib crane mounted on the existing fixed dock structure. Cargo could be handled on shore by forklift. Upgrade of the dock structure may be required to support crane and forklift operations.

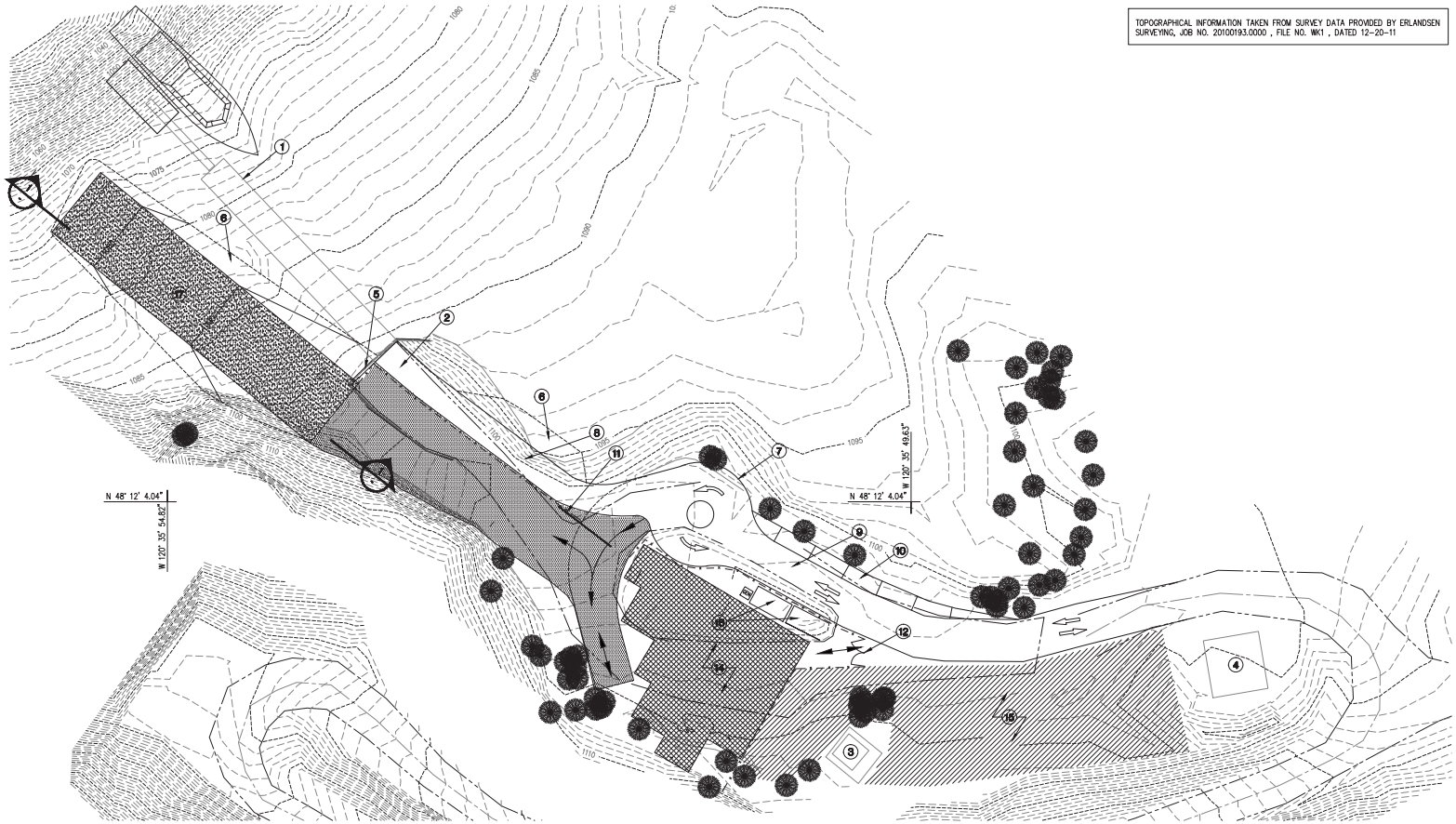
CONSTRUCTION SEQUENCE

The following is a description of the construction sequence and operations necessary to build the dock and barge facilities as detailed in the preliminary design drawing.

1. Fill for ramp below water
2. Fill for ramp above water
3. Geotextile, base course, concrete and rip rap for ramp
4. Clear, cut and fill to reconstruct access for non-project traffic
5. Clear, cut and fill for laydown and access areas
6. Surfacing for laydown and access areas
7. Install logistics office
8. Complete fences, gates and signage
9. Remove improvements
10. Restoration

ADDITIONAL DATA REQUIRED TO ADVANCE DESIGN

In order to advance the preliminary design of the Lucerne port upgrades, it will be necessary to conduct a topographic survey and a geotechnical investigation as well as initiate discussions with the USFS regarding the proposed layout.



TOPOGRAPHICAL INFORMATION TAKEN FROM SURVEY DATA PROVIDED BY ERLANDSEN SURVEYING, JOB NO. 20100193.0000 , FILE NO. WK1 , DATED 12-20-11

KEYED NOTES

1. EXISTING "LADY OF THE LAKE" BOAT DOCK.
2. EXISTING "LADY OF THE LAKE" ACCESS.
3. EXISTING RESTROOM TO BE RETAINED IN USE.
4. EXISTING EMERGENCY SHELTER.
5. EXISTING WALL TO REMAIN.
6. APPROXIMATE 2 TO 1 FILL SLOPE.
7. 27' RADIUS TURNAROUND FOR NON-PROJECT TRAFFIC.
8. REALIGN ACCESS TO "LADY OF THE LAKE" BOAT DOCK MAINTAINING EXISTING WIDTH.
9. 22' WIDE ROADWAY FOR NON-PROJECT TRAFFIC AND BARGE-BOUND TRUCK AND TRAILER.
10. PARKING STALLS AND DROP OFF FOR "LADY OF THE LAKE" PASSENGERS.
11. SLIDING GATE FOR BARGE-BOUND TRUCKS AND TRAILERS.
12. 14' GATE FOR ALL OTHER PROJECT TRAFFIC.
13. NOT USED.
14. TARGET LAYDOWN & STORAGE AREA 6400 S.F.
15. ADDITIONAL LAYDOWN AREA & STORAGE AREA 0.27 ACRES.
16. 10'x20' LOGISTICS OFFICE, GENERATOR AND ONE WORKER PARKING STALL.
17. 40'x173' LONG BARGE RAMP @ 15% (NO DREDGE. ALL SLOPE CREATED BY FILL).

SITE CONSIDERATIONS

CONSTRUCTION COST	$336,753
4 YEAR OPERATION COST FREIGHT PLUS PERSONNEL	$66,883
TOTAL 4 YEAR COST	$403,636

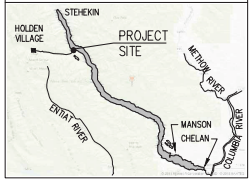
SITE PROS:
- EXCELLENT WIND PROTECTION
- PASSENGER FACILITY ON-SITE
- WELL LOCATED PUBLIC LEAVE-BEHIND

SITE CONS:
- POTENTIAL CONFLICT WITH FERRY TRAFFIC ON SHORE

LEGEND

- TARGET LAYDOWN AREA
- ADDITIOAN LAYDOWN AREA
- APPROXIMATE TRUCK MANEUVERING AREA
- BARGE RAMP
- EXISTING GROUND MINOR CONTOUR
- EXISTING GROUND MAJOR CONTOUR
- APPROXIMATE CUT OR FILL CATCH LINE
- PROPOSED FENCE
- EXISTING EDGE OF ROAD
- DIRECTION OF TRAVEL (NON-PROJECT TRAFFIC)
- DIRECTION OF TRAVEL (PROJECT TRAFFIC)

KEY PLAN



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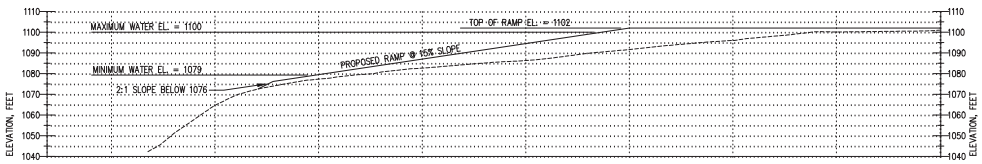
PLAN
LADY OF THE LAKE SITE AT LUCERNE - LAYOUT A

0 50' 100'



SECTION
1 LADY OF THE LAKE SITE AT LUCERNE - LAYOUT A

0 50' 100'

PACIFIC ENGINEERING & DESIGN PLLC
CONSULTING ENGINEERS
206 S. COLUMBIA STREET, SUITE 200
WENATCHEE, WASHINGTON 98801
PHONE: (509) 662-1101
FAX: (509) 663-6227
officepacificengineering.net

SUBMITTAL

REVISION

DATE	DESCRIPTION
2-8-2011	30% REVIEW
3-11-2011	30% PROGRESS
3-18-2011	30% SUBMITTAL

LAKE CHELAN DOCK & BARGE FACILITIES FOR HOLDEN MINE

Prepared for MWH Americas, Inc.

MWH

PROJ. NO. : 10312AS
FILE NAME : 10312C2-0
DRAWN BY : SCF
CHECKED BY : ADA
DATE : 3-18-2011

LADY OF THE LAKE SITE AT LUCERNE LAYOUT A

SCALE VERIFICATION
0 1/2" 1" 2"
VERIFY SCALE. IF BAR IS OUT OF SCALE ADJUST ALL SCALES ON THIS SHEET ACCORDINGLY.

C2.0
OF 19 SHEETS

APPENDIX C

EARTHWORK SPECIFICATIONS

SECTION 02200 – EARTHWORK

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall perform earthwork as indicated and required for construction of the WORK, complete and in place, in accordance with the Contract Documents.

1.2 CONTRACTOR SUBMITTALS

A. Samples:

1. The CONTRACTOR shall submit samples of materials proposed for the WORK in conformance with the requirements of Section 01300 – Contractor Submittals.

2. Sample sizes shall be as determined by the testing laboratory.

PART 2 -- PRODUCTS

2.1 FILL AND BACKFILL MATERIAL REQUIREMENTS

A. General:

1. Fill, backfill, and embankment materials shall be selected or shall be processed and clean fine earth, rock, gravel, or sand, free from grass, roots, brush, other vegetation and organic matter.

2. Fill and backfill materials that are to be placed within 6 inches of any structure or pipe shall be free of rocks or unbroken masses of earth materials having a maximum dimension larger than 3 inches.

B. Suitable Materials:

1. Materials not defined below as unsuitable will be considered as suitable materials and may be used in fills, backfilling, and embankment construction, subject to the indicated requirements.

2. If acceptable to the ENGINEER, some of the material listed as unsuitable may be used when thoroughly mixed with suitable material to form a stable composite.

3. Mixing or blending of materials to obtain a suitable composite is the CONTRACTOR's option but is subject to the approval of the ENGINEER.

4. The CONTRACTOR shall submit certification to the ENGINEER that the chloride concentration in imported materials within the pipe zone does not exceed 100 ppm, when tested in accordance with the requirements of AASHTO T291-94 – Standard Method of Test for determining Water-Soluble Chloride Ion Content in Soil.

5. Suitable materials may be obtained from on-Site excavations, may be processed on-Site materials, or may be imported.

6. If imported materials are required by this Section or are required in order to meet the quantity requirements of the WORK, the CONTRACTOR shall provide the imported materials as part of the WORK,unless a unit price item is included for imported materials in the Bidding Schedule.

C. The following types of materials are defined:

Soil Class	Soil Type[1]	Description of Material Classification	Acceptable Areas
Class I[3,4]	GW	Well-graded gravels and gravel-sand mixtures with little or no fines. 50 percent or more retained in the No. 4 sieve.	As per Drawings
	GP	Poorly graded gravels and gravel-sand mixtures with little or no fines. 50 percent or more retained on the No. 4 sieve. More than 95 percent retained in the No. 200 sieve.	As per Drawings
	SW	Well graded sands and gravelly sands with little or no fines. More than 50 percent passing the No. 4 sieve and more than 95 percent retained on the No. 200 sieve.	As per Drawings
	SP	Poorly graded sands and gravelly sands with little or no fines. More than 50 percent passing the No. 4 sieve and more than 95 percent retained on the No. 200 sieve.	As per Drawings
Class II	GM	Silty gravels, gravelly-sand-silt mixtures. 50 percent or more retained on the No. 4 sieve. Less than 88 percent retained on the No. 200 sieve.	As per Drawings
	GC	Clayey gravels, gravelly-sand-silt mixtures. 50 percent or more retained on the No. 4 sieve. Less than 88 percent retained on the No. 200 sieve.	As per Drawings
	SM	Silty sands, sand-silt mixtures. More than 50 percent passing the No. 4 sieve. Less than 88 percent retained on the No. 200 sieve.	As per Drawings
	SC	Clayey sands, sand-clay mixtures. More than 50 percent passing the No. 4 sieve. Less than 88 percent retained on the No. 200 sieve.	As per Drawings
Class III	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands. Liquid limit 50 percent or less. 50 percent or more passing the No. 200 sieve.	As per Drawings

<table>
<tr><td></td><td>CL</td><td>Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays. Liquid limit 50 percent or less. 50 percent or more passing the No. 200 sieve.</td><td>As per Drawings</td></tr>
<tr><td></td><td>MH</td><td>Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts. Liquid limit greater than 50 percent. 50 percent or more passing the No. 200 sieve.</td><td>None – Material is unsuitable</td></tr>
<tr><td></td><td>CH</td><td>Inorganic clays of high plasticity, fat clays. Liquid limit greater than 50 percent. 50 percent or more passing the No. 200 sieve.</td><td>None – Material is unsuitable</td></tr>
<tr><td>Class IV</td><td>OL</td><td>Organic silts and organic silty clays of low plasticity. Liquid limit of 50 percent or less. 50 percent or more passing the No. 200 sieve.</td><td>None – Material is unsuitable</td></tr>
<tr><td></td><td>OH</td><td>Organic clays of medium to high plasticity. Liquid limit greater than 50 percent. 50 percent or more passing the No. 200 sieve.</td><td>None – Material is unsuitable</td></tr>
<tr><td></td><td>PT</td><td>Peat, muck, and other highly organic soils.</td><td>None – Material is unsuitable</td></tr>
<tr><td>Class V</td><td>Base Course</td><td>Aggregates that consist of hard, durable particles or fragments of crushed stone. Free of lumps or balls of clay. Meeting the following gradation, and Attterberg limits.
Liquid Limit ASTM D4318-10 – 25 (max)
Plastic Limit ASTM D4318-10 – Nonplastic
<table>
<tr><td>Sieve Size</td><td colspan="3">% by Mass Passing Designated Sieve (ASTM D422)</td></tr>
<tr><td></td><td>Grade A</td><td>Grade B</td><td>Grade C</td></tr>
<tr><td>2</td><td>100</td><td></td><td></td></tr>
<tr><td>1.5</td><td>97-100</td><td>100</td><td></td></tr>
<tr><td>1</td><td></td><td>97-100</td><td>100</td></tr>
<tr><td>3/4</td><td></td><td></td><td>97-100</td></tr>
<tr><td>½</td><td></td><td></td><td></td></tr>
<tr><td>3/8</td><td></td><td>56-70(7)</td><td>67-79(6)</td></tr>
</table></td><td>As per Drawings</td></tr>
</table>

<table>
<tr><td></td><td></td><td>
<table>
<tr><td>#4</td><td>40-60(8)*</td><td>39-53(6)</td><td>47-59(7)</td></tr>
<tr><td>#40</td><td></td><td>12-21(4)</td><td>12-21(4)</td></tr>
<tr><td>#200</td><td>0-12(4)</td><td>4-8(3)</td><td>4-8(3)</td></tr>
</table>
*- Allowable deviation
</td><td></td></tr>
<tr><td>Class VI</td><td>Wearing Course</td><td>
Aggregates that consist of hard, durable particles or fragments of crushed stone. Free of lumps or balls of clay. Meeting the following gradation, and Attterberg limits.
Liquid Limit ASTM D4318: 35 (max)
Plastic Limit ASTM D4318: Nonplastic
<table>
<tr><td>Sieve Size</td><td colspan="2">% by Mass Passing Designated Sieve (ASTM D422)</td></tr>
<tr><td></td><td>Grade A</td><td>Grade B</td></tr>
<tr><td>1.5</td><td>100</td><td></td></tr>
<tr><td>1</td><td>97-100</td><td>100</td></tr>
<tr><td>3/4</td><td>76-89(6)*</td><td>97-100</td></tr>
<tr><td>3/8</td><td>56-68(6)</td><td>70-80(6)</td></tr>
<tr><td>#4</td><td>43-53(7)*</td><td>51-63(7)</td></tr>
<tr><td>#16</td><td>23-32(6)</td><td>28-39(6)</td></tr>
<tr><td>#40</td><td>15-23(5)</td><td>19-27(5)</td></tr>
<tr><td>#200</td><td>10-16(4)</td><td>10-16(4)</td></tr>
</table>
*- Allowable deviation
</td><td>As per Drawings</td></tr>
<tr><td>Class VII</td><td>Topsoil</td><td>Stockpiled topsoil material from the Site obtained by removing soil. Removal of topsoil shall be done after the area has been stripped and grubbed of vegetation.</td><td>As per drawings</td></tr>
<tr><td colspan="4">NOTES:
1. Refers to ASTM D 2487 classifications for Classes I, II, III, IV, and V.
2. In accordance with ASTM D 2487, less than 5 percent passes the No. 200 sieve.</td></tr>
</table>

3. In accordance with ASTM D 2487, more than 12 percent passing the No. 200 sieve. Soils with 5 to 12 percent passing the No. 200 sieve fall in borderline classification such as GP-GC. If borderline classifications are proposed, approval shall be subject to the CONTRACTOR demonstrating its ability to control moisture content and achieve the required compaction. If the borderline classification is predominately an unsuitable material, the composite material shall be considered unsuitable.

2.2 MATERIALS TESTING

A. Samples:

1. Soils testing of samples submitted by the CONTRACTOR will be performed by a testing laboratory of the OWNER's choice and at the CONTRACTOR's expense.

2. The ENGINEER may direct the CONTRACTOR to supply samples for testing of any material used in the WORK.

B. Particle size analysis of soils and aggregates will be performed using ASTM D 422 - Standard Test Method for Particle-Size Analysis of Soils.

C. Determination of sand equivalent value will be performed using ASTM D 2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

D. Unified Soil Classification System:

1. References in this Section to soil classification types and standards shall have the meanings and definitions indicated in ASTM D 2487.

2. The CONTRACTOR shall be bound by applicable provisions of ASTM D 2487 in the interpretation of soil classifications.

2.3 IDENTIFICATION TAPE

A. Unless otherwise indicated, identification tape shall be placed above buried pipelines that are not comprised of magnetic components at least in part. Curlverts are exempt from this requirement.

B. Identification tape shall be 6-inches wide, yellow in color, composed of polyethylene, and provided with an integral metallic wire.

C. Tape shall be labeled with CAUTION – BURIED UTILITIES.

PART 3 -- EXECUTION

3.1 EXCAVATION AND BACKFILLING - GENERAL

A. General:

1. Except when specifically provided to the contrary, excavation shall include the removal of materials, including obstructions, that would interfere with the proper execution and completion of the WORK.

2. The removal of such materials shall conform to the lines and grades indicated or ordered.

3. Unless otherwise indicated, the entire Site shall be stripped of vegetation and debris and shall be grubbed, and such material shall be removed from the Site prior to performing any excavation or placing any fill.

4. The CONTRACTOR shall furnish, place, and maintain supports and shoring that may be required for the sides of excavations.

5. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable state safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926).

6. The CONTRACTOR shall provide quantity surveys where so required to verify quantities for Unit Price Contracts.

7. Surveys shall be performed prior to beginning WORK and upon completion by a surveyor licensed in the state where the Site is located.

B. Removal and Exclusion of Water:

1. The CONTRACTOR shall remove and exclude water, including stormwater, groundwater, irrigation water, and wastewater, from excavations.

2. Dewatering wells, wellpoints, sump pumps, or other means shall be used to remove water and continuously maintain groundwater at a level at least 2 feet below the bottom of excavations before the excavation WORK begins at each location.

3. Water shall be removed and excluded until backfilling is complete and field soils testing has been completed.

3.2 OVER-EXCAVATION

A. Indicated:

1. Where areas are indicated to be over-excavated, excavation shall be to the depth indicated, and backfill shall be installed to the grade indicated.

B. Not Indicated:

1. When ordered to over-excavate areas deeper and/or wider than required by the Contract Documents, the CONTRACTOR shall over-excavate to the dimensions ordered and backfill to the indicated grade.

C. Neither Indicated nor Ordered:

1. Any over-excavation carried below the grade that is neither ordered or indicated shall be backfilled and compacted to the required grade with the indicated material as part of the WORK

3.3 EXCAVATION IN LAWN AREAS

A. Where excavation occurs in lawn areas, the sod shall be carefully removed, dampened, and stockpiled in order to preserve it for replacement.

B. Excavated material may be placed on the lawn, provided that a drop cloth or other suitable method is employed to protect the lawn from damage, but the lawn shall not remain covered for more than 72 hours.

C. Immediately after completion of backfilling and testing, the sod shall be replaced and lightly rolled in a manner as to restore the lawn as near as possible to its original condition.

D. The CONTRACTOR shall provide new sod if the stockpiled sod has not been replaced within 72 hours.

3.4 EXCAVATION IN VICINITY OF TREES

A. Except where trees are indicated to be removed, trees shall be protected from injury during construction operations.

B. Trees shall be supported during excavation by any means previously reviewed and accepted by the ENGINEER.

3.5 ROCK EXCAVATION

A. Rock excavation shall include removal and disposal of the following items:

1. rock material in ledges, bedding deposits, and un-stratified masses that cannot be removed using conventional equipment as defined herein and which require systematic drilling and blasting for removal;

2. concrete or masonry structures that have been abandoned; and,

3. conglomerate deposits that are so firmly cemented that they possess the characteristics of solid rock and cannot be removed using conventional equipment as herein defined and require systematic drilling and blasting for removal.

B. Scope and Payment:

1. Rock excavation shall be performed by the CONTRACTOR, provided that if the quantity of rock excavation is affected by any change in the scope of the WORK an appropriate adjustment of the Contract Price will be made under a separate Bid Item if such Bid Item has been established.

2. Otherwise, payment will be made in accordance with a negotiated price.

C. Explosives and Blasting: Blasting will not be permitted.

3.6 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. The CONTRACTOR shall be responsible for the removal and stockpiling of any excess excavated material according to Section 01552 – Staging and Stockpile Areas.

B. Material shall be disposed of at an approved on-Site disposal area or off-Site at a location arranged by the CONTRACTOR in accordance with laws and regulations regarding the disposal of such material.

3.7 STRUCTURE, ROADWAY, AND EMBANKMENT EXCAVATION AND BACKFILL

A. Excavation Beneath Structures and Embankments:

1. Except where indicated otherwise for a particular structure or where ordered by the ENGINEER, excavation shall be carried to an elevation 6 inches below the bottom of the footing or slab and brought back to grade with compacted materials acceptable for placement beneath structures.

2. The area where a fill or embankment is to be constructed shall be cleared of vegetation, roots, and foreign material.

3. Where indicated or ordered, areas beneath structures or fills shall be over-excavated.

4. The subgrade areas beneath embankments shall be excavated to remove all deleterious native material and where such subgrade is sloped, the native material shall be benched.

5. When such over-excavation is indicated, both the over-excavation and the subsequent backfill to the required grade shall be performed by the CONTRACTOR.

6. After the required excavation or over-excavation for fills and embankments has been completed, the exposed surface shall be scarified to a depth of 6 inches, brought to optimum moisture content, and rolled with heavy compaction equipment to obtain 95 percent of maximum density as determined by ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3).

B. Excavation Beneath Paved Areas:

1. Excavation under areas to be paved shall extend to the bottom of the aggregate base or subbase, if such base is called for; otherwise it shall extend to the paving thickness.

2. After the required excavation has been completed, the top 12 inches of exposed surface shall be scarified, brought to optimum moisture content, and rolled with heavy compaction equipment to obtain 95 percent of maximum density.

3. The finished subgrade shall be even, self-draining, and in conformance with the slope of the finished pavement.

4. Areas that could accumulate standing water shall be regraded to provide a self-draining subgrade.

C. Notification of ENGINEER:

1. The CONTRACTOR shall notify the ENGINEER at least 3 Days in advance of completion of any structure or roadway excavation and shall allow the ENGINEER a review period of at least one day before the exposed foundation is scarified and compacted or is covered with backfill or with any construction materials.

D. Compaction of Fill, Backfill, and Embankment Materials:

1. Each layer of backfill materials as defined herein, where the material is graded such that 10 percent or more passes a No. 4 sieve, shall be mechanically compacted to the indicated percentage of density.

2. Equipment that is consistently capable of achieving the required degree of compaction shall be used, and each layer shall be compacted over its entire area while the material is at the required moisture content.

3. Each layer of coarse granular backfill materials with less than 10 percent passing the No. 4 sieve shall be compacted by means of at least 2 passes from a vibratory compactor that is capable of obtaining the required density in 2 passes.

E. Flooding, ponding, and jetting shall not be used for backfill around structures, backfill around reservoir walls, for final backfill materials, or aggregate base materials.

F. Heavy Equipment:

1. Equipment weighing more than 10,000 pounds shall not be used closer to walls than a horizontal distance equal to the vertical depth of the fill above undisturbed soil at that time.

2. Hand-operated power compaction equipment shall be used where the use of heavier equipment is impractical or restricted due to weight limitations.

G. Layering:

1. Embankment and fill material shall be placed and spread evenly in approximately horizontal layers.

2. Each layer shall be moistened and aerated as necessary.

3. Unless otherwise approved by the ENGINEER, no layer shall exceed 6 inches of compacted thickness.

4. The embankment and fill shall be compacted in conformance with Paragraph K, below.

H. Embankments and Fills:

1. When an embankment or fill is to be constructed and compacted against hillsides or fill slopes steeper than 4:1, the slopes of the hillsides or fills shall be horizontally benched in order to key the embankment or fill to the underlying ground.

2. A minimum of 12 inches perpendicular to the slope of the hillside or fill shall be removed and re-compacted as the embankment or fill is brought up in layers.

3. Material thus cut shall be re-compacted along with the new material.

4. Hillside or fill slopes 4:1 or flatter shall be prepared in accordance with Paragraph A, above.

I. Compaction Requirements:

1. The following compaction requirements shall be in accordance with ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3) where the material is graded such that 10 percent or more passes a No. 4 sieve and in accordance with ASTM D 4253 - Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table, and D 4254 - Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density, where the material is coarse granular backfill materials with less than 10 percent passing the No. 4 sieve:

Location or Use of Fill or Backfill	Percentage of Maximum Dry Density	Percentage of Relative Density
Embankments and fills not identified otherwise	90	55
Embankments and fills beneath road areas or structures	95	70
Backfill beneath structures and hydraulic structures	95	70
Topsoil	80	NA
Base and wearing course	95	NA

2. All compaction shall be at plus or minus 2% of optimum moisture content as determined by ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3).

3.8 PIPELINE AND UTILITY TRENCH EXCAVATION AND BACKFILL

A. Exploratory Excavations:

1. The CONTRACTOR shall excavate and expose buried points of connection to existing utilities as indicated on the Drawings.

2. Excavation shall be performed prior to the preparation of Shop Drawings for connections and before the fabrication and installation of the pipe

3. The data obtained from exploratory excavations shall be used in preparing the Shop Drawings.

4. Data, including dates, locations excavated, and dimensioned sketches, shall be submitted to the ENGINEER within one week of excavation.

5. Damage to utilities from excavation activities shall be repaired by the CONTRACTOR at their expense.

B. General:

1. Unless otherwise indicated or ordered, excavation for pipelines and utilities shall be open-cut trenches with minimum widths as indicated.

2. Backfill shall not be dropped directly upon any structure or pipe.

3. Backfill shall not be placed around or upon any structure until the concrete has attained sufficient strength to withstand the loads imposed.

4. Backfill around water-retaining structures shall not be placed until the structures have been tested, and the structures shall be full of water while backfill is being placed.

C. Trench Bottom:

1. Except where pipe bedding is required, the bottom of the trench shall be excavated uniformly to the grade of the bottom of the pipe.

2. Excavations for pipe bells and welding shall be made as required.

3. Where pipe bedding is required, the bottom of the trench shall be excavated uniformly to the grade of the bottom of the pipe bedding.

D. Open Trenches:

1. The maximum amount of open trench permitted in any one location shall be 500 feet or the length necessary to accommodate the amount of pipe installed in a single Day, whichever is greater.

2. Trenches shall be fully backfilled at the end of each Day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each Day.

3. These requirements for backfilling or use of steel plate will be waived in cases where the trench is located further than 100 feet from any traveled roadway or occupied structure; in such cases, however, barricades and warning signs meeting appropriate safety requirements shall be provided and maintained.

E. Embankments, Fills and Structural Backfills:

1. Where pipelines are to be installed in embankments, fills, or structure backfills, the fill shall be constructed to a level at least one foot above the top of the pipe before the trench is excavated.

2. Upon completion of the embankment or structural backfill, a trench conforming to the appropriate detail may be excavated and the pipe may be installed.

F. Trench Shield

1. If a moveable trench shield is used during excavation operations, the trench width shall be wider than the shield such that the shield is free to be lifted and then moved horizontally without binding against the trench sidewalls and causing sloughing or caving of the trench walls.

2. If the trench walls cave or slough, the trench shall be excavated as an open excavation with sloped sidewalls or with trench shoring, as indicated and as required by the pipe structural design.

3. If a moveable trench shield is used during excavation, pipe installation, and backfill operations, the shield shall be moved by lifting the shield free of the trench bottom or backfill and then moving the shield horizontally.

4. The CONTRACTOR shall not drag trench shields along the trench causing damage or displacement to the trench sidewalls, the pipe, or the bedding and backfill.

G. Placing and Spreading of Backfill Materials:

1. Each layer of coarse granular backfill materials with less than 10 percent passing the No. 4 sieve shall be compacted by means of at least 2 passes from a vibratory compactor that is capable of achieving the required density in 2 passes and that is acceptable to the ENGINEER.

2. Where such materials are used for pipe zone backfill, vibratory compaction shall be used at vertical intervals of the lesser of:

   a. one-half the diameter of the pipe; or

   b. 24 inches, measured in the uncompacted state.

3. In addition, these materials shall be subjected to vibratory compaction at the springline of the pipe and the top of the pipe zone backfill, regardless of whether that dimension is less than 24 inches or not.

4. Each layer of backfill material with greater than 10 percent passing the No. 4 sieve shall be compacted using mechanical compactors suitable for the WORK.

5. The material shall be placed and compacted under the haunch of the pipe and up each side evenly so as not to move the pipe during the placement of the backfill.

6. The material shall be placed in lifts that will not exceed 6 inches when compacted to the required density.

7. During spreading, each layer shall be thoroughly mixed as necessary in order to promote uniformity of material in each layer.

H. Mechanical Compaction:

1. Backfill around and over pipelines that is mechanically compacted shall be compacted using light, hand-operated vibratory compactors and rollers that do not damage the pipe.

2. After completion of at least 2 feet of compacted backfill over the top of pipeline, compaction equipment weighing no more than 8,000 pounds may be used to complete the trench backfill.

I. Pre-Placement Conditions:

1. Immediately prior to placement of backfill materials, the bottoms and sidewalls of trenches and structure excavations shall have any loose, sloughing, or caving soil and rock materials removed.

2. Trench sidewalls shall consist of excavated surfaces that are in a relatively undisturbed condition before placement of backfill materials.

J. Pipe And Utility Trench Backfill:

1. Pipe Zone Backfill

a. Definitions

1) The pipe zone is defined as that portion of the vertical trench cross-section lying between a plane below the bottom surface of the pipe and a plane at a point above the top surface of the pipe as indicated.

2) The bedding is defined as that portion of pipe zone backfill material between the trench subgrade and the bottom of the pipe.

3) The embedment is defined as that portion of the pipe zone backfill material between the bedding and a level line as indicated.

b. Final Trim

1) After compacting the bedding, the CONTRACTOR shall perform a final trim using a stringline for establishing grade, such that each pipe section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe.

2) Excavation for pipe bells and welding shall be made as required.

c. The pipe zone shall be backfilled with the indicated backfill material.

d. Pipe zone backfill materials shall be manually spread evenly around the pipe, maintaining the same height on both sides of the pipe such that when compacted the pipe zone backfill will provide uniform bearing and side support.

e. The CONTRACTOR shall exercise care in order to prevent damage to the pipeline coating, cathodic bonds, and the pipe itself during the installation and backfill operations.

2. Trench Zone Backfill

a. After the pipe zone backfill has been placed, backfilling of the trench zone may proceed.

b. The trench zone is defined as that portion of the vertical trench cross-section lying as indicated between a plane above the top surface of the pipe and a plane at a point 18 inches below the finished surface grade, or if the trench is under pavement, 18 inches below the roadway subgrade.

3. Final Backfill

a. Final backfill is defined as backfill in the trench cross-sectional area within 18 inches of finished grade, or if the trench is under pavement, backfill within 18 inches of the roadway subgrade.

K. Except for drainrock materials being placed in over-excavated areas or trenches, backfill shall be placed after water is removed from the excavation and the trench sidewalls and bottom have been dried to a moisture content suitable for compaction.

L. Layering:

1. Backfill materials shall be placed and spread evenly in layers.

2. When compaction is achieved using mechanical equipment, the layers shall be evenly spread such that when compacted each layer shall not exceed 6 inches in thickness.

M. Identification Tape

1. Install identification tape as indicated.

2. Terminate the tape in a precast concrete box either adjacent to or part of the valve box, manhole, vault, or other structure into which the non-metallic pipe enters or at the end of the non-metallic pipeline.

3. The termination box shall be covered with a cast iron lid.

4. The box shall be located at grade in paved areas or 6 inches above grade in unpaved areas.

N. Trench Shield:

1. If a moveable trench shield is used during backfill operations, the shield shall be lifted to a location above each layer of backfill material prior to compaction of the layer.

2. The CONTRACTOR shall not displace the pipe or backfill while the shield is being moved.

O. Compaction Requirements:

1. The following compaction requirements shall be in accordance with ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3) where the material is graded such that 10 percent or more passes a No. 4 sieve, and in accordance with ASTM D 4253 - Standard Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table, and D 4254 - Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density where the material is coarse granular backfill materials with less than 10 percent passing the No. 4 sieve.

Location or Use of Fill or Backfill	Percentage of Maximum Dry Density	Percentage of Relative Density
Pipe embedment backfill for flexible pipe.	95	70
Pipe bedding and over-excavated zones under bedding for flexible pipe,.	95	70
Pipe embedment backfill for steel yard piping	---	70
Pipe zone backfill portion above embedment for flexible pipe	95	70

2. All compaction shall be at plus or minus 2% of optimum moisture content as determined by ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3)

3.9 FIELD TESTING

A. General:

1. Field soils testing will be performed by a testing laboratory of the OWNER's choice at the OWNER's expense, except as indicated below.

B. Density:

1. Where soil material is required to be compacted to a percentage of maximum density, the maximum density at optimum moisture content will be determined in

accordance with ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3).

2. Where cohesionless, free draining soil material is required to be compacted to a percentage of relative density, the calculation of relative density will be determined in accordance with ASTM D 4253 and D 4254.

3. Field density in-place tests will be performed in accordance with ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method, ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place By Nuclear Methods (Shallow Depth), or by such other means acceptable to the ENGINEER.

C. Remediation:

1. In case the test of the fill or backfill shows non-compliance with the required density, the CONTRACTOR shall accomplish such remedy as may be required to ensure compliance.

2. Subsequent testing to show compliance shall be by a testing laboratory selected by the OWNER and paid by the CONTRACTOR.

D. CONTRACTOR's Responsibilities:

1. The CONTRACTOR shall provide test trenches and excavations, including excavation, trench support and groundwater removal for the OWNER's field soils testing operations.

2. The trenches and excavations shall be provided at the locations and to the depths as required by the OWNER.

- END OF SECTION -

APPENDIX D

DRAFT LOAD RATING REPORT FOR TEN MILE CREEK BRIDGE, RAILROAD CREEK BRIDGE, HOLDEN VEHICLE BRIDGE

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PROJECT Holden Mine Load Rating JOB NO. 10177.01 BY GJN

Holden Mine

DRAFT
Load Rating Report

For

Ten Mile Creek Bridge
Railroad Creek Bridge
Holden Village Vehicle Bridge

PE STAMP BOX

DATE

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HOLDEN MINE PROJECT
BRIDGE LOAD RATING

EXECUTIVE SUMMARY (Draft)

Ten Mile Creek (Timber) Bridge

The Ten Mile Creek Bridge has adequate strength to carry normal highway trucks (HS20, Type 3, Type 3S2 and Type 3-3), but not the specified special vehicle, Caterpillar 740 (80 ton truck). The rated capacity is 0.40 for a fully loaded CAT 740 and 0.81 for an unloaded CAT 740, meaning the capacity is approximately 40% and 81% of what it should be in order to safely carry a fully loaded or unloaded CAT 740, respectively. The point of maximum stress is at mid-span of each of the five longitudinal timber stringers.

The following are a few preliminary retrofit ideas to improve the load rating of the Ten Mile Creek Bridge. Note that member sizes and cost information have not yet been determined for any of these alternative concepts. These concepts will need to be analyzed further in order to verify that they do indeed work.

1. Add a transverse steel crossbeam under the bridge at mid-span to support the timber stringers of the bridge. The crossbeam would be supported by steel piles that are driven into the riverbed on the outside edges of the bridge. (See Figure 1 of the Report)

2. Add a transverse steel crossbeam under the bridge at mid-span to support the timber stringers of the bridge. The crossbeam would be supported by longitudinal steel beams placed along the outside edges of the bridge. The longitudinal steel beams would be supported by footings constructed along the banks or by some other means. (See Figure 2 of the Report)

3. Add one long steel beam placed diagonally from bank to bank under the bridge. The beam would pass under the exterior girders near the 1/3 point of the span and would support the timber stringers of the bridge. The steel beam would be supported by footings constructed on each bank.

4. The rails on the existing bridge would be removed and a temporary/portable steel bridge would be placed over top of the existing timber bridge. The approach would then be modified to match the grade of the new bridge.

Railroad Creek (Glu Lam) Bridge at Lucerne

The Railroad Creek Bridge at Lucerne does not have sufficient rating to carry the normal highway trucks or CAT 740 (loaded or unloaded). Its rating for HS 20 is at 0.40 (or about 40% of the capacity required). The bridge is rated adequate for HS 15 or lighter trucks.

No retrofit concepts have been investigated for the Railroad Creek Bridge since it will not be retrofitted to use for the Holden Mine project. Retrofit concepts can be provided upon request.

Railroad Creek (Steel) Bridge at Holden Village

The Holden Village Bridge has sufficient rating to carry the normal highway trucks (HS20, Type 3, Type 3S2 and Type 3-3), but not for loaded CAT 740. Its rating for fully loaded CAT 740 is 0.75 (or about 75% of the capacity required). The rating for unloaded CAT 740 is 0.95 (about 5% overstressed) which may be considered acceptable.

No retrofit concepts have been investigated for the Holden Village Bridge since it is not anticipated to carry CAT 740. Retrofit concepts can be provided upon request.

1. Load Rating Criteria

Reference Codes

The following reference codes were used in calculating the load rating of the three bridges. They are listed below in order of priority.

1. *WSDOT Bridge Design Manual (LRFD), August 2010*
2. *AASHTO Manual for Bridge Evaluation, 2008 with 2010 Interims*
3. *AASHTO Standard Specifications for Highway Bridges, 17th Edition, 2002*
4. *AASHTO LRFD Bridge Design Specifications, 2010*
5. *USDA Timber Bridges: Design, Construction, Inspection, and Maintenance*

According to Chapter 13 of the WSDOT Bridge Design Manual, the load rating of existing structures can be based on either the load factor (LFR) or load and resistance factor (LRFR) methods. The WSDOT Bridge Design Manual specifies the use of the allowable stress (ASD) method when load rating timber bridges. The load rating of the bridges need also be in accordance with the AASHTO Manual for Bridge Evaluation. Chapter 6 Part B of the AASHTO Manual for Bridge Evaluation covers the load rating criteria using the allowable stress and load factor rating methods. The AASHTO Standard Specification for Highway Bridges manual was used for all matters not covered by the AASHTO Manual for Bridge Evaluation. The USDA Timber Bridges manual provided design examples of various timber bridges and was used as a reference for analyzing the timber bridges.

Engineering Software

The following engineering software programs were utilized:

1. *STAAD.Pro 2006*

STAAD.Pro is a finite element analysis program that was used to compute moments and shears along the bridge members based on input applied loads. It was especially used to determine loadings based on moving vehicle live load configurations.

Load Rating Method

The load ratings of the timber bridges were determined using the *Allowable Stress Method (ASD)*.

The load rating of the steel bridge was performed using the *Load Factor Method (LFR)*.

Vehicles

The following vehicles have been rated for each bridge unless otherwise noted.

1. H-15 Truck – Railroad Creek Bridge only
2. HS-20 Truck
3. AASHTO Type 3 Truck
4. AASHTO Type 3S2 Truck
5. AASHTO Type 3-3 Truck
6. Caterpillar 740 Articulated Truck (Loaded)
7. Caterpillar 740 Articulated Truck (Empty)

2. Ten Mile Creek Bridge

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Bridge Description

The Ten Mile Creek Bridge is a single, simple span timber bridge with a span length of 31'-0". The roadway deck is 14'-0" wide and is composed of 2 x 6 continuous nail laminated timber deck lams oriented in the transverse direction. The deck lams are supported by five 10" x 24" sawn lumber stringers spaced at 3'-1". Three 4 x 12 timber running planks are positioned on top of the deck along each side of the bridge to provide for a partial wearing surface. Solid timber diaphragms are provided at the 1/3 points of the span. Timber wheel guards and rail posts are provided along both sides of the bridge.

The most critical elements of the superstructure are the 10" x 24" sawn lumber stringers. These stringers are responsible for transferring all of the loads that are applied to the deck to the substructure. Thus, these stringers were the main components being checked in the load rating. The nail laminated deck was also checked to verify that it is capable of transmitting each vehicle wheel load to the longitudinal stringers. The components were checked for positive moment near midspan and horizontal shear near the supports. Vertical shear was not checked because horizontal shear always governs in timber design. Deflection was not checked either as this is an optional check and has little to do with the strength of the structure. The substructure is not typically analyzed for load rating and can be assumed adequate for this bridge.

The following are some recent photos of the Ten Mile Creek Bridge…

2.b Load Rating Calculations

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PROJECT Holden Mine Load Rating JOB NO. 10177.01 BY GJN

Bridge Rating Summary

PE Stamp

Bridge Name:	Ten Mile Creek Bridge
Span Types:	Sawn Lumber Stringers
Bridge Length:	31'-0"
Rated By:	GJN
Checked By:	
Date:	February 9, 2011

Inspection Report Date		Substructure Condition	Good
Rating Method	ASD	Deck Condition	Good
Overlay Thickness	N/A	Superstructure Condition	Good

Truck	Inventory Rating	Operating Rating	Controlling Point
HS-20	0.95	1.37	Midspan – Positive Moment in Ext. Stringer
AASHTO Type 3	1.18	1.70	Midspan – Positive Moment in Ext. Stringer
AASHTO Type 3S2	1.22	1.74	Midspan – Positive Moment in Ext. Stringer
AASHTO Type 3-3	1.47	2.11	Midspan – Positive Moment in Ext. Stringer
Cat 740 Truck (Loaded)	0.40	0.57	Midspan – Positive Moment in Ext. Stringer
Cat 740 Truck (Empty)	0.81	1.16	Midspan – Positive Moment in Ext. Stringer

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PROJECT:	Holden Mine	JOB NO.:	10177.01	DESIGNED BY:	GJN	DATE:	02/02/11
SUBJECT:	Ten Mile Creek Bridge			CHECKED BY:		DATE:	

1.0 Stringer Bending Capacity

CODE REFERENCE

1.1 Allowable Stress

The allowable unit stress in bending, Fb', shall be the tabulated stress adjusted by the applicable adjustment factors given in the following equation: — 13.6.4.1

Fb' = FbCMCDCFCL = *1437* *psi* — 13-2

where:

Fb	=	tabulated unit stress in bending.....	*1350* *psi*	T-13.5.1A
CM	=	wet service factor for bending.....	*1*	
CD	=	load duration factor.....	*1.15*	
CF	=	bending size factor.....	*0.93*	
CL	=	beam stability factor.....	*0.99*	

The Inventory unit stresses should be equal to the allowable stresses for stress-grade lumber given in the AASHTO Standard Specifications as calculated above. — 6B.6.2.7(1)

F_b^{inv} = Fb' = *1437* *psi*

The maximum allowable Operating unit stresses should not exceed 1.33 times the allowable stresses for stress-grade lumber given in the current AASHTO Standard Specifications as calculated above. — 6B.6.2.7(2)

F_b^{op} = 1.33Fb' = *1912* *psi*

1.2 Wet Service Factor

When the moisture content at installation or in service is expected to exceed 19% for sawn lumber, tabulated values shall be reduced by the wet service factor, CM. — 13.5.5.1.1

CM = wet service factor for bending..... *1* — T-13.5.1A

The moisture content of wood used in exposed bridge applications will typically exceed the 19% limit. — 13.5.5.1.3

1.3 Load Duration Factor

When the full maximum load is applied either cumulatively or continuously for periods other than 10 years, tabulated stresses shall be multiplied by the load duration factor, CD. — 13.5.5.2.2

CD = load duration factor..... *1.15* — T-13.5.5A

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PROJECT:	Holden Mine	JOB NO.:	10177.01	DESIGNED BY:	GJN	DATE:	02/02/11
SUBJECT:	Ten Mile Creek Bridge			CHECKED BY:		DATE:	

1.0 Stringer Bending Capacity

CODE REFERENCE

1.4 Size Factor

For rectangular sawn lumber bending members 5 inches or thicker and greater than 12 inches in depth, the tabulated bending stress shall be multiplied by the size factor, CF, determined from the following relationship: 13.6.4.2.2

$$C_F = \left(\frac{12}{d}\right)^{1/9} = 0.93$$ 13-5

where:

d = depth of bending member..... 24 *in.*

1.5 Beam Stability Factor

Tabulated bending values are applicable to members which are adequately braced. When members are not adequately braced, the tabulated bending stress shall be modified by the beam stability factor, C_L. 13.6.4.4.1

The bending member effective length, l_e, shall be determined from the following relationships for any loading condition: 13.6.4.4.3

l_e	=	$2.06 l_u$	when $l_u/d < 7$	**X**
l_e	=	$1.63 l_u + 3d$	when $7 \le l_u/d \le 14.3$	
l_e	=	$1.84 l_u$	when $l_u/d > 14.3$	

where:

l_e = effective length..... 255.4 *in.*

l_u = unsupported length..... 124 *in.*

If lateral support is provided to prevent rotation and lateral displacement at intermediate points as well as at the bearings, the unsupported length is the distance between such points of intermediate lateral support. 13.6.4.4.3

d = depth of bending member..... 24 *in.*

The slenderness ratio for bending members, R_B, is determined from the following equation:

$$R_B = \sqrt{\frac{l_e d}{b^2}} \le 50 = 7.8$$ 13-6

where:

b = width of bending member..... 10 *in.*

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PROJECT:	Holden Mine	JOB NO.:	10177.01	DESIGNED BY:	GJN	DATE:	02/02/11
SUBJECT:	Ten Mile Creek Bridge			CHECKED BY:		DATE:	

1.0 Stringer Bending Capacity

CODE REFERENCE

The beam stability factor, CL, shall be computed as follows: 13.6.4.4.5

$$C_L = \frac{1+\left(F_{bE}/F_b^*\right)}{1.90} - \sqrt{\frac{\left(1+F_{bE}/F_b^*\right)^2}{3.61} - \frac{F_{bE}/F_b^*}{0.95}} \quad = \quad 0.99 \qquad \text{13-7}$$

$$F_{bE} = \frac{K_{bE}E'}{R_B^2} \quad = \quad 11431 \ psi \qquad \text{13-8}$$

where:

KbE = material factor for beam stability…… *0.438* — 13.6.4.4.5

Fb* = tabulated bending stress adjusted by all applicable adjustment factors except the beam stability factor, CL…….. *1437* *psi*

where, Fb* = FbCMCDCF

E' = allowable modulus of elasticity…… *1600000* *psi*

where, E' = ECM — 13-1

E = tabulated modulus of elasticity…….. *1600000* *psi* — T-13.5.3A

CM = wet service factor for modulus of elasticity…… *1* — T-13.5.3A

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SUBJECT:	Ten Mile Creek Bridge			CHECKED BY:		DATE:	

2.0 Stringer Shear Capacity

CODE REFERENCE

The critical shear in wood bending members is shear parallel to grain (horizontal shear). It is unnecessary to verify the strength of bending members in shear perpendicular to grain (vertical shear). — 13.6.5.1.2

2.1 Allowable Stress

The allowable unit stress in shear parallel to grain, Fv', shall be the tabulated stress adjusted by the applicable adjustment factors given in the following equation: — 13.6.5.3

Fv' = FvCMCD = *196* *psi* — 13-11

where:

Fv	=	tabulated unit stress in shear parallel to grain……	*170*	*psi*	T-13.5.1A
CM	=	wet service factor for shear……	*1*		
CD	=	load duration factor……	*1.15*		

The Inventory unit stresses should be equal to the allowable stresses for stress-grade lumber given in the AASHTO Standard Specifications as calculated above. — 6B.6.2.7(1)

F_v^{inv} = Fv' = *196* *psi*

The maximum allowable Operating unit stresses should not exceed 1.33 times the allowable stresses for stress-grade lumber given in the current AASHTO Standard Specifications as calculated above. — 6B.6.2.7(2)

F_v^{op} = 1.33Fv' = *260* *psi*

2.2 Wet Service Factor

When the moisture content at installation or in service is expected to exceed 19% for sawn lumber, tabulated values shall be reduced by the wet service factor, CM. — 13.5.5.1.1

CM = wet service factor for shear…… *1* — T-13.5.1A

The moisture content of wood used in exposed bridge applications will typically exceed the 19% limit. — 13.5.5.1.3

2.3 Load Duration Factor

When the full maximum load is applied either cumulatively or continuously for periods other than 10 years, tabulated stresses shall be multiplied by the load duration factor, CD. — 13.5.5.2.2

CD = load duration factor…… *1.15* — T-13.5.5A

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3.0 Live Load Distribution Factors

CODE REFERENCE

Two sets of distribution factors need to be determined. One set for the typical trucks with wheel spacing of 6 ft and one set for the specialized Cat 740 truck with wheel spacing of 8.8 ft.

Live load distribution factors shall be per AASHTO based on the method used. — BDM 13.2.2

3.1 Bending Distribution for Interior Stringers

The live load bending moment for each interior stringer shall be determined by applying to the stringer the fraction of a wheel load (both front and rear) determined in Table 3.23.1 of the AASHTO Standard Specification for Highway Bridges. — 3.23.2.2

For a nail laminated timber deck that is 6" thick or more, the wheel line distribution factor for a bridge designed for one traffic lane shall be taken as follows:

DF = S/5.0 = *0.62* — T-3.23.1

where:

S = average stringer spacing…… *3.08* *ft.*

The distribution factor for interior stringers shall be checked using the lever rule method as well. The lever rule typically yields a more conservative distribution factor than the above equation; however, due to the narrow roadway along with the wider wheel spacing of the Cat 740 truck, a lower distribution factor may be applicable instead.

DF = *0.77* (for Cat 740 truck) — STAAD

3.2 Bending Distribution for Exterior Stringers

The live load bending moment for outside roadway stringers shall be determined by applying to the stringer the reaction of the wheel load obtained by assuming the flooring to act as a simple span between stringers (lever rule). — 3.23.2.3.1.2

A STAAD model was set up with two wheel loads spaced at 6 ft to represent a typical truck axle and two wheel loads spaced at 8.8 ft to represent the Cat 740 truck axle. The wheel loads are allowed to move transversly across the bridge section, but remain within 2' of the curb lines as indicated in Figure 3.7.7A in the AASHTO Standard Specification for Highway Bridges. The maximum reaction loads at the exterior stringers were then analyzed to determine their respective distribution factors.

DF = *0.62* (for typical truck) — STAAD
DF = *0.62* (for Cat 740 truck) — STAAD

In no case shall an exterior stringer have less carrying capacity than an interior stringer. Thus, the interior stringer distribution factor should be used if larger than the exterior stringer's. — 3.23.2.3.1.4

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CODE REFERENCE

3.0 Live Load Distribution Factors

3.3 Shear Distribution for All Stringers

The distribution for horizontal shear in rectangular timber beams shall be in accordance with Article 13.6.5 of the AASHTO Standard Specification for Highway Bridges.

3.23.1.2

3.4 Summary

		Typical Truck		Cat 740 Truck	
		Int. Gir.	Ext. Gir.	Int. Gir.	Ext. Gir.
bending:	DFm	0.62	0.62	0.62	0.62
shear:	DFv	see 13.6.5		see 13.6.5	

Note that the calculated distribution factors are per wheel line and not per lane.

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4.0 Applied Loads

CODE REFERENCE

4.1 Dead Loads per Stringer

The dead load of each component on the bridge was calculated by hand and then input into a STAAD model to determine the maximum moments and shears along the bridge.

	Int. Gir.	Ext. Gir.	
M+ (kip-ft)	25.6	27.6	STAAD
V (kip)	2.9	3.1	STAAD

The maximum positive moment was taken at midspan.

The magnitude of vertical shear shall be the maximum shear occurring at a distance from the support equal to the bending member depth, d. — 13.6.5.2

where, d = *24* *in.*

4.2 Undistributed Live Loads per Wheel Line

The vehicular wheel line live loads for each type of truck were modeled in STAAD as moving wheel loads. The maximum undistributed wheel line moments and shears without impact are as follows:

	HS-20 Truck	Type 3 Truck	Type 3S2 Truck	Type 3-3 Truck	Cat 740 Loaded	Cat 740 Unloaded	
M+ (kip-ft)	148	119	116	96	352	175	STAAD
V (kip)	18.6	14.1	13	11.6	41	21.2	STAAD

The maximum positive moment was taken near midspan.

For vehicle live loads, the maximum vertical shear shall be taken at a distance from the support equal to three times the bending member depth, 3d, or at the span quarter point, L/4, whichever is the lesser from the support. — 13.6.5.2

where, 3d = *6.0* *ft.* governs
L = *31* *ft.*
L/4 = *7.75* *ft.*

Impact is not applied to timber structures. — BDM 13.1.3

4.0 Applied Loads

CODE REFERENCE

4.3 Distributed Live Loads per Stringer

4.3.1 Moment

The distributed vehicular live load moment per stringer shall be calculated by multiplying the distribution factors by the respective undistributed wheel line live loads tabulated above. The bending moment per stringer is summarized as follows:

Gir.		HS-20 Truck	Type 3 Truck	Type 3S2 Truck	Type 3-3 Truck	Cat 740 Loaded	Cat 740 Unloaded
Int.	M+ (kip-ft)	91	73	72	59	217	108
Ext.	M+ (kip-ft)	92	74	72	60	218	109

4.3.2 Shear

The distributed vehicular live load shear per stringer shall be determined by the following expression: 13.6.5.2

VLL = 0.50[0.6VLU + VLD] 13-10

where, VLU = vertical shear due to undistributed wheel loads (kip)
VLD = vertical shear due to wheel load distributed as specified for moment (kip)

Gir.		HS-20 Truck	Type 3 Truck	Type 3S2 Truck	Type 3-3 Truck	Cat 740 Loaded	Cat 740 Unloaded
	VLU (kip)	18.6	14.1	13.0	11.6	41.0	21.2
Int.	VLD (kip)	11.5	8.7	8.0	7.2	25.3	13.1
Ext.	VLD (kip)	11.5	8.7	8.1	7.2	25.4	13.1
Int.	VLL (kip)	11.3	8.6	7.9	7.1	24.9	12.9
Ext.	VLL (kip)	11.3	8.6	7.9	7.1	25.0	12.9

4.4 Distributed Live Load Stresses per Stringer

The unit stress per stringer due to the applied moment on rectangular members shall be determined by the following equation:

fb = M/S see tabulated values below

where, M = distributed moment per stringer (lb-in)
S = section modulus of rectangular section (in3)

S = bd2/6 = *960* *in.3*

where, b = bending member width (in) = *10* *in.*
d = bending member depth (in) = *24* *in.*

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4.0 Applied Loads

CODE REFERENCE

The unit stress in shear parallel to grain due to applied loading shall be determined by the following equation: 13.6.5.2

fv = 3V/2bd see tabulated values below 13-9

where, V = vertical shear per stringer (lb)

4.4.1 Dead Load

Stress	Int. Gir.	Ext. Gir.
fb+ (psi)	320	345
fv (psi)	18.1	19.4

4.4.2 Live Load

Gir.	Stress	HS-20 Truck	Type 3 Truck	Type 3S2 Truck	Type 3-3 Truck	Cat 740 Loaded	Cat 740 Unloaded
Int.	fb+ (psi)	1141	917	894	740	2713	1349
Int.	fv (psi)	70.7	53.6	49.4	44.1	155.9	80.6
Ext.	fb+ (psi)	1147	922	899	744	2728	1356
Ext.	fv (psi)	70.9	53.8	49.6	44.2	156.3	80.8

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5.0 Load Rating

CODE REFERENCE

5.1 Stringer Capacities

Fb'in	=	allowable inventory bending stress……	*1437*	*psi*
Fb'op	=	allowable operating bending stress……	*1912*	*psi*
Fv'in	=	allowable inventory shear stress……	*196*	*psi*
Fv'op	=	allowable operating shear stress……	*260*	*psi*

5.2 Stringer Applied Loads

	Dead Load	
Stress	Int. Gir.	Ext. Gir.
fb+ (psi)	320	345
fv (psi)	18.1	19.4

		Live Load					
Gir.	Stress	HS-20 Truck	Type 3 Truck	Type 3S2 Truck	Type 3-3 Truck	Cat 740 Loaded	Cat 740 Unloaded
Int.	fb+ (psi)	1141	917	894	740	2713	1349
Int.	fv (psi)	70.7	53.6	49.4	44.1	155.9	80.6
Ext.	fb+ (psi)	1147	922	899	744	2728	1356
Ext.	fv (psi)	70.9	53.8	49.6	44.2	156.3	80.8

5.3 Rating Factors

The allowable stress method is applicable to timber structures. The rating equation shall be taken as follows: BDM 13.1.3

RF = (Fa - Fd)/Fl BDM 13.1.3-1

where, Fa = allowable stress (psi)
Fd = dead load stress (psi)
Fl = live load stress (psi)

5.3.1 Inventory Rating

		Inventory Rating Factor					
Gir.		HS-20 Truck	Type 3 Truck	Type 3S2 Truck	Type 3-3 Truck	Cat 740 Loaded	Cat 740 Unloaded
Int.	RFb+	0.98	1.22	1.25	1.51	0.41	0.83
Int.	RFv	2.51	3.31	3.59	4.02	1.14	2.20
Ext.	RFb+	0.95	1.18	1.22	1.47	0.40	0.81
Ext.	RFv	2.48	3.28	3.55	3.98	1.13	2.18
	MIN.	0.95	1.18	1.22	1.47	0.40	0.81

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5.0 Load Rating

CODE REFERENCE

5.3.2 Operating Rating

For the operating rating, the allowable stress is increased by 33%. BDM 13.1.3

		Operating Rating Factor					
Gir.		HS-20 Truck	Type 3 Truck	Type 3S2 Truck	Type 3-3 Truck	Cat 740 Loaded	Cat 740 Unloaded
Int.	RFb+	1.40	1.74	1.78	2.15	0.59	1.18
Int.	RFv	3.42	4.51	4.89	5.48	1.55	3.00
Ext.	RFb+	1.37	1.70	1.74	2.11	0.57	1.16
Ext.	RFv	3.39	4.48	4.86	5.44	1.54	2.98
	MIN.	1.37	1.70	1.74	2.11	0.57	1.16

5.4 Conclusion

The load rating of the bridge is governed by positive moment stresses in the exterior stringers near midpan.

3.c Preliminary Retrofit Concepts

The following are a few preliminary retrofit ideas to improve the load rating of the Ten Mile Creek Bridge. Note that member sizes and cost information have not yet been determined for any of these retrofit concepts. These concepts will need to be analyzed further in order to verify that they do indeed work.

1. Add a transverse steel crossbeam under the bridge at midspan to support the sawn stringers of the bridge. The crossbeam will be supported by steel piles that are driven into the riverbed on the outside edges of the bridge. (See Figure 1)

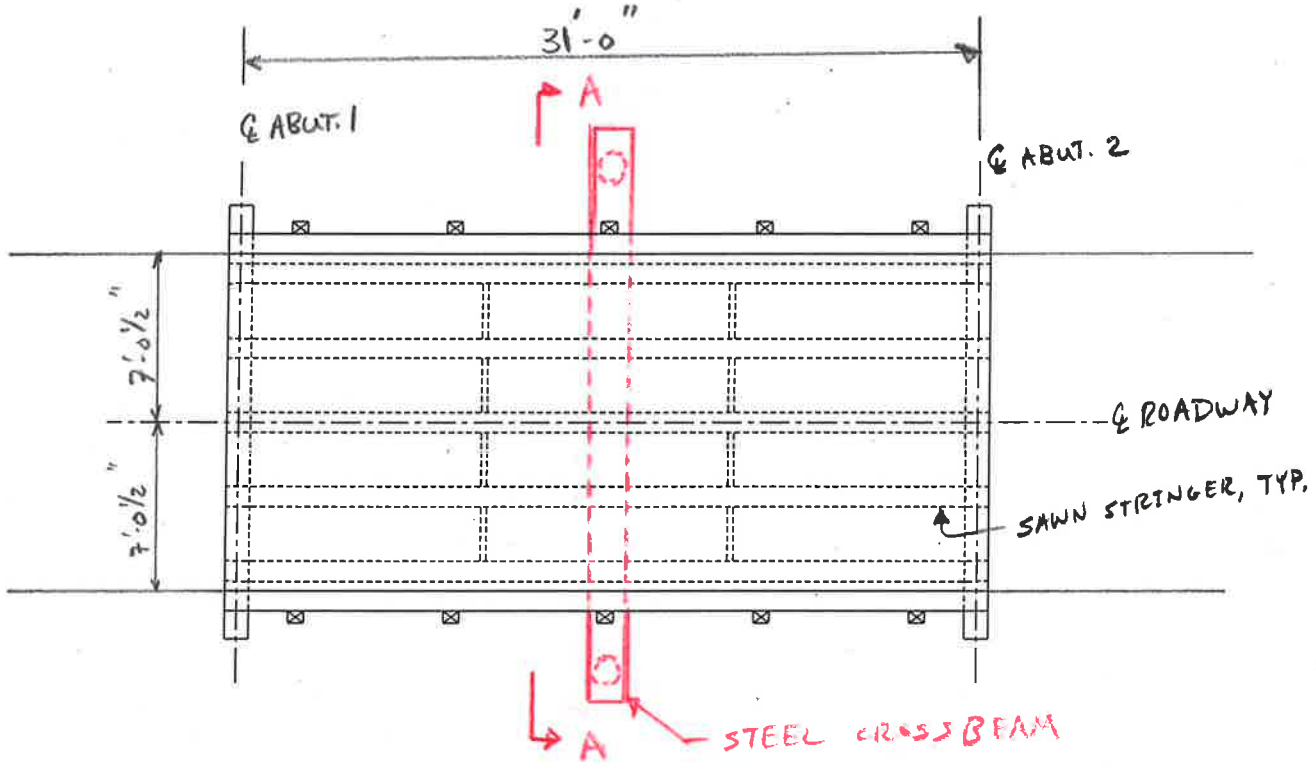
2. Add a transverse steel crossbeam under the bridge at midspan to support the sawn stringers of the bridge. The crossbeam will be supported by longitudinal steel beams placed along the outside edges of the bridge. The longitudinal steel beams would be supported by footings constructed along the banks or by some other means. (See Figure 2)

3. Add one long steel beam placed diagonally from bank to bank under the bridge. The beam would pass under the exterior girders near the 1/3 point of the span and would support the sawn stringers of the bridge. The steel beam would be supported by footings constructed on each bank.

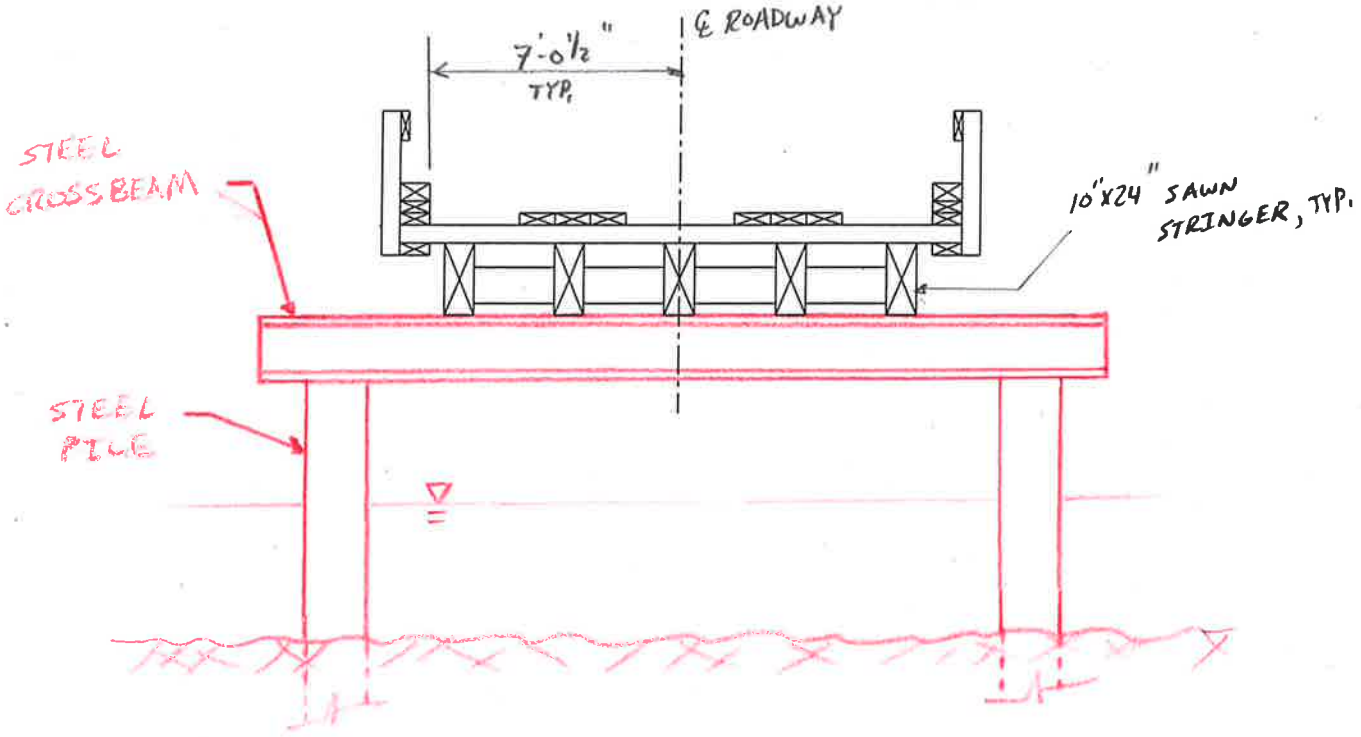
4. The rails on the existing bridge would be removed and a temporary/portable steel bridge would be placed over top of the existing timber bridge. The approach would then be modified to match the grade of the new bridge.

FIGURE 1

CROSSBEAM SUPPORT @ MIDSPAN SUPPORTED BY DRIVEN PILES



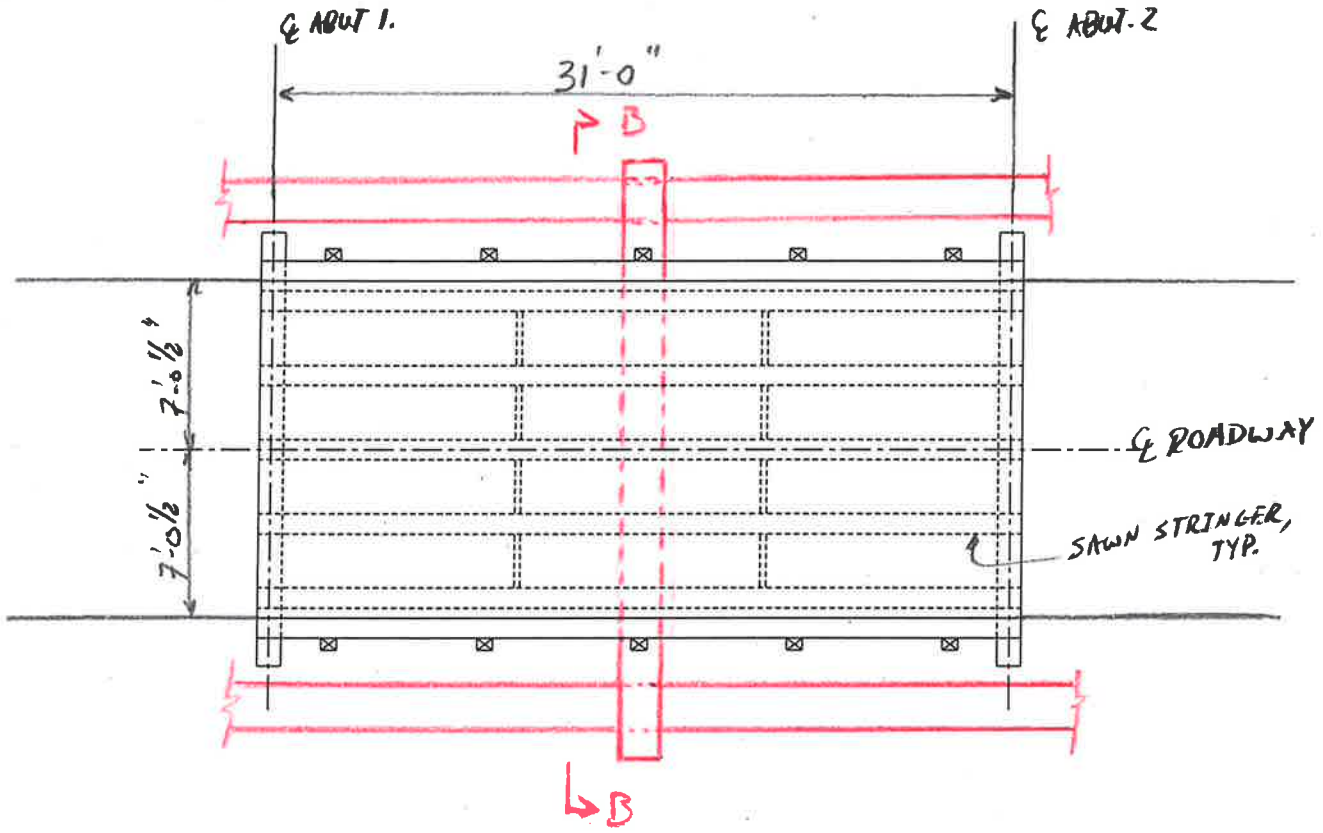
PLAN



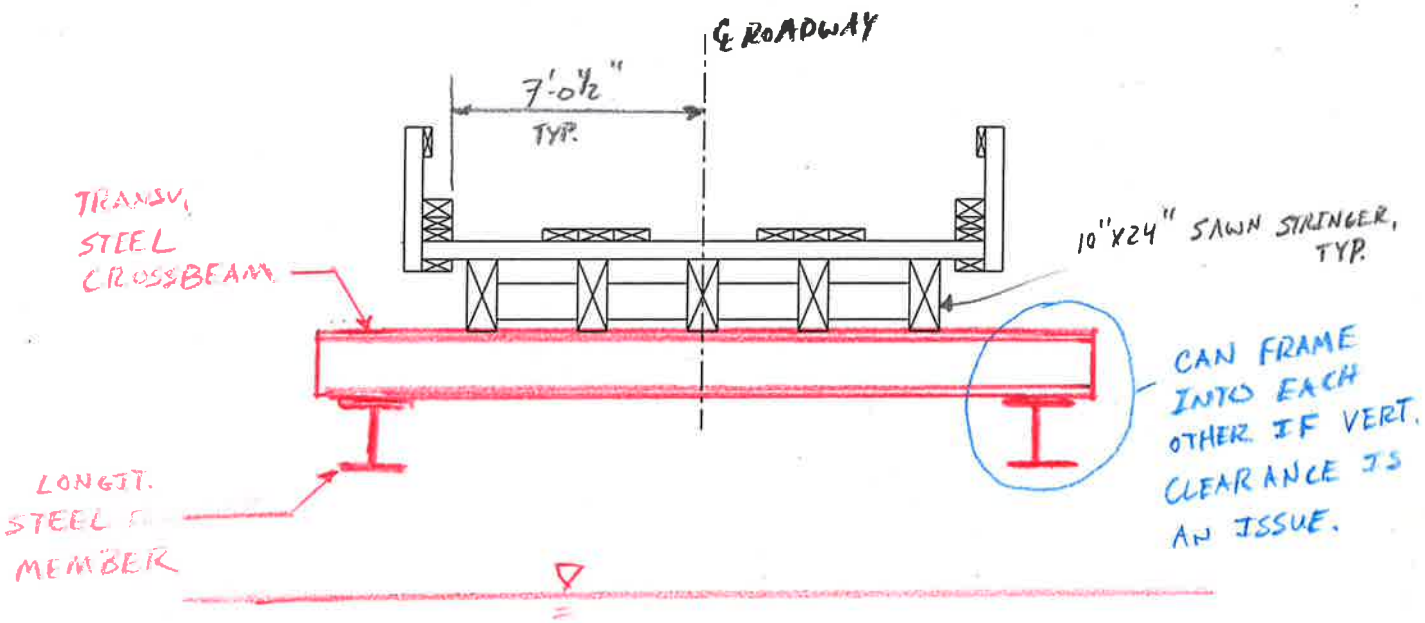
SECTION A-A

FIGURE 2

STEEL CROSSBEAM SUPPORT @ MIDSPAN SUPPORTED BY STEEL FRAMING MEMBERS



PLAN



SECTION B-B

3. Railroad Creek Bridge

Bridge Description

The Railroad Creek Bridge at Lucerne is a three span timber bridge with span lengths of 12'-6", 60'-0", and 12'-6" respectively, totaling 85'-0". Spans 1 and 3 are cantilevered over the span 2 supports near the ends of the bridge. The roadway deck is 14'-0" wide and is composed of 2 x 6 continuous nail laminated timber deck lams oriented in the transverse direction. The deck lams are supported by four 7" x 39" glued laminated timber girders spaced at 4'-0". Three 4 x 12 timber running planks are positioned on top of the deck along each side of the bridge to provide for a partial wearing surface. Steel cross frames are provided at the 1/4 points of span 2. Timber wheel guards and rail posts are provided along both sides of the bridge.

The most critical elements of the superstructure are the 7" x 39" glued laminated timber girders. These girders are responsible for transferring all of the loads that are applied to the deck to the substructure. Thus, these girders were the main components being checked in the load rating. The nail laminated deck was also checked to verify that it is capable of transmitting each vehicle wheel load to the longitudinal girders. The girders were checked for positive moment near midspan and negative moment and horizontal shear near the supports. Vertical shear was not checked because horizontal shear always governs in timber design. Deflection was not checked either as this is an optional check and has little to do with the strength of the structure. The substructure is not typically analyzed for load rating and can be assumed adequate for this bridge.

No retrofit concepts have been included in this report for the Railroad Creek Bridge since it is not anticipated to be used much for the Holden Mine project. Retrofit concepts can be provided upon request.

The following are some recent photos of the Railroad Creek Bridge at Lucerne…

3.b Load Rating Calculations

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PROJECT Holden Mine Load Rating JOB NO. 10177.01 BY GJN

Bridge Rating Summary

PE Stamp

Bridge Name:	Railroad Creek Bridge
Span Types:	Glued Laminated Timber Girders
Bridge Length:	85'-0"
Rated By:	GJN
Checked By:	
Date:	February 9, 2011

Inspection Report Date		Substructure Condition	Good
Rating Method	ASD	Deck Condition	Good
Overlay Thickness	N/A	Superstructure Condition	Good

Truck	Inventory Rating	Operating Rating	Controlling Point
H-15	1.01	1.54	Midspan – Positive Moment in Ext. Girder
HS-20	0.51	0.78	Midspan – Positive Moment in Ext. Girder
AASHTO Type 3	0.69	1.05	Midspan – Positive Moment in Ext. Girder
AASHTO Type 3S2	0.67	1.02	Midspan – Positive Moment in Ext. Girder
AASHTO Type 3-3	0.76	1.16	Midspan – Positive Moment in Ext. Girder
Cat 740 Truck (Loaded)	0.24	0.36	Midspan – Positive Moment in Ext. Girder
Cat 740 Truck (Empty)	0.51	0.79	Midspan – Positive Moment in Ext. Girder

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SUBJECT:	Railroad Creek Bridge			CHECKED BY:		DATE:	

1.0 Girder Bending Capacity

CODE REFERENCE

1.1 Allowable Stress

The allowable unit stress in bending shall be the tabulated stress adjusted by the applicable adjustment factors given in the following equation: — 13.6.4.1

Fb' = FbCMCD(Cv or CL) = *1784* *psi* — 13-2

where:

Fb = unit stress in bending..... *2000* *psi* — Plans
The as-built Plans call out glued-laminated timber stresses as being 2000 *f* for wet condition of use.

CM = wet service factor..... *1*
CD = load duration factor..... *1.15*
Cv = volume factor..... *0.78*
CL = beam stability factor..... *0.91*

The volume factor shall not be applied simultaneously with the beam stability factor. Use the lesser of the two factors. — 13.6.4.1

The Inventory unit stresses should be equal to the allowable stresses for stress-grade lumber given in the AASHTO Standard Specifications as calculated above. — 6B.6.2.7(1)

F_b^{inv} = Fb' = *1784* *psi*

The maximum allowable Operating unit stresses should not exceed 1.33 times the allowable stresses for stress-grade lumber given in the current AASHTO Standard Specifications as calculated above. — 6B.6.2.7(2)

F_b^{op} = 1.33Fb' = *2373* *psi*

1.2 Wet Service Factor

When the moisture content in service is expected to exceed 16% for glued laminated timber, tabulated values shall be reduced by the wet service factor, CM. — 13.5.5.1.2

CM = wet service factor for bending..... *1* — T-13.5.3A

The moisture content of wood used in exposed bridge applications will typically exceed the 16% limit. — 13.5.5.1.3

The as-built Plans provide the unit stress of the glulam girders for wet condition of use. Thus, the wet service factor is already incorporated in the unit stress provided.

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SUBJECT:	Railroad Creek Bridge			CHECKED BY:		DATE:	

1.0 Girder Bending Capacity

CODE REFERENCE

1.3 Load Duration Factor

When the full maximum load is applied either cumulatively or continuously for periods other than 10 years, tabulated stresses shall be multiplied by the load duration factor, CD. — 13.5.5.2.2

CD	=	load duration factor.....	*1.15*	T-13.5.5A

1.4 Volume Factor

The tabulated bending stress for glued laminated timber bending members with loads applied perpendicular to the wide face of the laminations shall be adjusted by the volume factor, Cv, as determined by the following relationship: — 13.6.4.3.1

$$C_v = (21/L)^{1/x}(12/d)^{1/x}(5.125/b)^{1/x} \le 1.0 \quad = \quad 0.78$$ — 13-5

where:

L	=	length of bending member between points of zero moment.....	*60*	*ft.*
d	=	depth of bending member.....	*39*	*in.*
b	=	width of bending member.....	*7*	*in.*
x	=	20 for Southern pine or 10 for all other species.....	*10*	

1.5 Beam Stability Factor

Tabulated bending values are applicable to members which are adequately braced. When members are not adequately braced, the tabulated bending stress shall be modified by the beam stability factor, C_L. — 13.6.4.4.1

The bending member effective length, l_e, shall be determined from the following relationships for any loading condition: — 13.6.4.4.3

l_e	=	$2.06 l_u$	when $l_u/d < 7$	**X**
l_e	=	$1.63 l_u + 3d$	when $7 \le l_u/d \le 14.3$	
l_e	=	$1.84 l_u$	when $l_u/d > 14.3$	

where:

l_e	=	effective length.....	*370.8*	*in.*
l_u	=	unsupported length.....	*180*	*in.*
		If lateral support is provided to prevent rotation and lateral displacement at intermediate points as well as at the bearings, the unsupported length is the distance between such points of intermediate lateral support.		
d	=	depth of bending member.....	*39*	*in.*

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1.0 Girder Bending Capacity

CODE REFERENCE

The slenderness ratio for bending members, R_B, is determined from the following equation:

$$R_B = \sqrt{\frac{l_e d}{b^2}} \le 50 \quad = \quad 17.2$$ 13-6

where:

b = width of bending member…… 7 *in.*

The beam stability factor, CL, shall be computed as follows: 13.6.4.4.5

$$C_L = \frac{1+\left(F_{bE}/F_b^*\right)}{1.90} - \sqrt{\frac{\left(1+F_{bE}/F_b^*\right)^2}{3.61} - \frac{F_{bE}/F_b^*}{0.95}} \quad = \quad 0.91$$ 13-7

$$F_{bE} = \frac{K_{bE}E'}{R_B^2} \quad = \quad 3094 \ psi$$ 13-8

where:

KbE = material factor for beam stability…… *0.609* 13.6.4.4.5

Fb* = tabulated bending stress adjusted by all applicable adjustment factors except the volume factor, Cv and the beam stability factor, CL…….. *2300* *psi*

where, Fb* = FbCMCD

E' = allowable modulus of elasticity…… *1499400* *psi*

where, E' = ECM 13-1

E = tabulated modulus of elasticity…… *1800000* *psi* T-13.5.3A

CM = wet service factor for modulus of elasticity…… *0.833* T-13.5.3A

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PROJECT:	Holden Mine	JOB NO.:	10177.01	DESIGNED BY:	GJN	DATE:	02/02/11
SUBJECT:	Railroad Creek Bridge			CHECKED BY:		DATE:	

2.0 Girder Shear Capacity

CODE REFERENCE

The critical shear in wood bending members is shear parallel to grain (horizontal shear). It is unnecessary to verify the strength of bending members in shear perpendicular to grain (vertical shear). — 13.6.5.1.2

2.1 Allowable Stress

The allowable unit stress in shear parallel to grain, Fv', shall be the tabulated stress adjusted by the applicable adjustment factors given in the following equation: — 13.6.5.3

Fv' = FvCMCD = *267* *psi* — 13-11

where:

Fv	=	tabulated unit stress in shear parallel to grain……	*265*	*psi*
CM	=	wet service factor for shear……	*0.875*	
CD	=	load duration factor……	*1.15*	

T-13.5.3A

The Inventory unit stresses should be equal to the allowable stresses for stress-grade lumber given in the AASHTO Standard Specifications as calculated above. — 6B.6.2.7(1)

F_v^{inv} = Fv' = *267* *psi*

The maximum allowable Operating unit stresses should not exceed 1.33 times the allowable stresses for stress-grade lumber given in the current AASHTO Standard Specifications as calculated above. — 6B.6.2.7(2)

F_v^{op} = 1.33Fv' = *355* *psi*

2.2 Wet Service Factor

When the moisture content at installation or in service is expected to exceed 16% for glued laminated timber, tabulated values shall be reduced by the wet service factor, CM. — 13.5.5.1.2

CM = wet service factor for shear…… *0.875* — T-13.5.3A

The moisture content of wood used in exposed bridge applications will typically exceed the 16% limit. — 13.5.5.1.3

2.3 Load Duration Factor

When the full maximum load is applied either cumulatively or continuously for periods other than 10 years, tabulated stresses shall be multiplied by the load duration factor, CD. — 13.5.5.2.2

CD = load duration factor…… *1.15* — T-13.5.5A

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3.0 Live Load Distribution Factors

CODE REFERENCE

Two sets of distribution factors need to be determined. One set for the typical trucks with wheel spacing of 6 ft and one set for the specialized Cat 740 truck with wheel spacing of 8.8 ft.

Live load distribution factors shall be per AASHTO based on the method used. — BDM 13.2.2

3.1 Bending Distribution for Interior Girders

The live load bending moment for each interior girder shall be determined by applying to the girder the fraction of a wheel load (both front and rear) determined in Table 3.23.1 of the AASHTO Standard Specification for Highway Bridges. — 3.23.2.2

For a nail laminated timber deck that is 6" thick or more, the wheel line distribution factor for a bridge designed for one traffic lane shall be taken as follows:

DF = S/5.0 = *0.80* — T-3.23.1

where:

S = average girder spacing..... *4.00* *ft.*

The distribution factor for interior girders shall be checked using the lever rule method as well. The lever rule typically yields a more conservative distribution factor than the above equation; however, due to the narrow roadway along with the wider wheel spacing of the Cat 740 truck, a lower distribution factor may be applicable instead.

DF = *0.55* (for Cat 740 truck) — STAAD

3.2 Bending Distribution for Exterior Girders

The live load bending moment for outside roadway girders shall be determined by applying to the girder the reaction of the wheel load obtained by assuming the flooring to act as a simple span between girders (lever rule). — 3.23.2.3.1.2

A STAAD model was set up with two wheel loads spaced at 6 ft to represent a typical truck axle and two wheel loads spaced at 8.8 ft to represent the Cat 740 truck axle. The wheel loads are allowed to move transversly across the bridge section, but remain within 2' of the curb lines as indicated in Figure 3.7.7A in the AASHTO Standard Specification for Highway Bridges. The maximum reaction loads at the exterior girders were then analyzed to determine their respective distribution factors.

DF = *0.75* (for typical truck) — STAAD

DF = *0.75* (for Cat 740 truck) — STAAD

In no case shall an exterior girder have less carrying capacity than an interior girder. Thus, the interior girder distribution factor should be used if larger than the exterior girder's. — 3.23.2.3.1.4

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CODE REFERENCE

3.0 Live Load Distribution Factors

3.3 Shear Distribution for All Girders

The distribution for horizontal shear in rectangular timber beams shall be in accordance with Article 13.6.5 of the AASHTO Standard Specification for Highway Bridges.

3.23.1.2

3.4 Summary

		Typical Truck		Cat 740 Truck	
		Int. Gir.	Ext. Gir.	Int. Gir.	Ext. Gir.
bending:	DFm	0.80	0.80	0.55	0.75
shear:	DFv	see 13.6.5		see 13.6.5	

Note that the calculated distribution factors are per wheel line and not per lane.

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4.0 Applied Loads (Span 2)

CODE REFERENCE

4.1 Dead Loads per Girder

The dead load of each component on the bridge was calculated by hand and then input into a STAAD model to determine the maximum moments and shears along the bridge.

	Int. Gir.	Ext. Gir.	
M+ (kip-ft)	85.2	99	STAAD
V (kip)	6.4	7.4	STAAD

The maximum positive moment was taken at midspan.

The magnitude of vertical shear shall be the maximum shear occurring at a distance from the support equal to the bending member depth, d. — 13.6.5.2

where, d = *39* *in.*

4.2 Undistributed Live Loads per Wheel Line

The vehicular wheel line live loads for each type of truck were modeled in STAAD as moving wheel loads. The maximum undistributed wheel line moments and shears without impact are as follows:

	H-15 Truck	HS-20 Truck	Type 3 Truck	Type 3S2 Truck	Type 3-3 Truck	Cat 740 Loaded	Cat 740 Unloaded	
M+ (kip-ft)	204	403	299	309	272	930	427	STAAD
V (kip)	11.8	24.5	17.8	19	17.5	54.9	26.3	STAAD

The maximum positive moment was taken near midspan.

For vehicle live loads, the maximum vertical shear shall be taken at a distance from the support equal to three times the bending member depth, 3d, or at the span quarter point, L/4, whichever is the lesser from the support. — 13.6.5.2

where, 3d = *9.8* *ft.* governs
L = *60* *ft.*
L/4 = *15* *ft.*

Impact is not applied to timber structures. — BDM 13.1.3

CODE REFERENCE

4.0 Applied Loads (Span 2)

4.3 Distributed Live Loads per Girder

4.3.1 Moment

The distributed vehicular live load moment per girder shall be calculated by multiplying the distribution factors by the respective undistributed wheel line live loads tabulated above. The bending moment per girder is summarized as follows:

Gir.		H-15 Truck	HS-20 Truck	Type 3 Truck	Type 3S2 Truck	Type 3-3 Truck	Cat 740 Loaded	Cat 740 Unloaded
Int.	M+ (kip-ft)	163	322	239	247	218	512	235
Ext.	M+ (kip-ft)	163	322	239	247	218	698	320

4.3.2 Shear

The distributed vehicular live load shear per girder shall be determined by the following expression: 13.6.5.2

VLL = 0.50[0.6VLU + VLD] 13-10

where, VLU = vertical shear due to undistributed wheel loads (kip)
VLD = vertical shear due to wheel load distributed as specified for moment (kip)

Gir.		H-15 Truck	HS-20 Truck	Type 3 Truck	Type 3S2 Truck	Type 3-3 Truck	Cat 740 Loaded	Cat 740 Unloaded
	VLU (kip)	11.8	24.5	17.8	19.0	17.5	54.9	26.3
Int.	VLD (kip)	9.4	19.6	14.2	15.2	14.0	30.2	14.5
Ext.	VLD (kip)	9.4	19.6	14.2	15.2	14.0	41.2	19.7
Int.	VLL (kip)	8.3	17.2	12.5	13.3	12.3	31.6	15.1
Ext.	VLL (kip)	8.3	17.2	12.5	13.3	12.3	37.1	17.8

4.4 Distributed Live Load Stresses per Girder

The unit stress per stringer due to the applied moment on rectangular members shall be determined by the following equation:

fb = M/S see tabulated values below

where, M = distributed moment per girder (lb-in)
S = section modulus of rectangular section (in3)

S = bd2/6 = *1774.5* *in.3*

where, b = bending member width (in) = *7* *in.*
d = bending member depth (in) = *39* *in.*

4.0 Applied Loads (Span 2)

CODE REFERENCE

The unit stress in shear parallel to grain due to applied loading shall be determined by the following equation: 13.6.5.2

$f_v = 3V/2bd$ see tabulated values below 13-9

where, V = vertical shear per girder (lb)

4.4.1 Dead Load

Stress	Int. Gir.	Ext. Gir.
fb+ (psi)	576	669
fv (psi)	35.2	40.7

4.4.2 Live Load

Gir.	Stress	H-15 Truck	HS-20 Truck	Type 3 Truck	Type 3S2 Truck	Type 3-3 Truck	Cat 740 Loaded	Cat 740 Unloaded
Int.	fb+ (psi)	1104	2180	1618	1672	1472	3459	1588
Int.	fv (psi)	45.4	94.2	68.5	73.1	67.3	173.4	83.1
Ext.	fb+ (psi)	1104	2180	1618	1672	1472	4717	2166
Ext.	fv (psi)	45.4	94.2	68.5	73.1	67.3	203.6	97.5

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SUBJECT:	Railroad Creek Bridge			CHECKED		DATE:	

5.0 Applied Loads (Spans 1 & 3)

CODE REFERENCE

5.1 Dead Loads per Girder

The dead load of each component on the bridge was calculated by hand and then input into a STAAD model to determine the maximum moments and shears along the bridge.

	Int. Gir.	Ext. Gir.	
M- (kip-ft)	22	25.2	STAAD
V (kip)	2.5	2.8	STAAD

The maximum negative moment was taken at the support.

The magnitude of vertical shear shall be the maximum shear occurring at a distance from the support equal to the bending member depth, d. — 13.6.5.2

where, d = *39* *in.*

5.2 Undistributed Live Loads per Wheel Line

The vehicular wheel line live loads for each type of truck were modeled in STAAD as moving wheel loads. The maximum undistributed wheel line moments and shears without impact are as follows:

	H-15 Truck	HS-20 Truck	Type 3 Truck	Type 3S2 Truck	Type 3-3 Truck	Cat 740 Loaded	Cat 740 Unloaded	
M- (kip-ft)	150	200	178	163	147	495	267	STAAD
V (kip)	12	16	17.0	15.5	14	52.9	21.4	STAAD

The maximum negative moment was taken at the support.

For vehicle live loads, the maximum vertical shear shall be taken at a distance from the support equal to three times the bending member depth, 3d, or at the span quarter point, L/4, whichever is the lesser from the support. — 13.6.5.2

where, 3d = *9.8* *ft.*
L = *12.5* *ft.*
L/4 = *3.125* *ft.* governs

Impact is not applied to timber structures. — BDM 13.1.3

5.0 Applied Loads (Spans 1 & 3)

CODE REFERENCE

5.3 Distributed Live Loads per Girder

5.3.1 Moment

The distributed vehicular live load moment per girder shall be calculated by multiplying the distribution factors by the respective undistributed wheel line live loads tabulated above. The bending moment per girder is summarized as follows:

Gir.		H-15 Truck	HS-20 Truck	Type 3 Truck	Type 3S2 Truck	Type 3-3 Truck	Cat 740 Loaded	Cat 740 Unloaded
Int.	M- (kip-ft)	120	160	142	130	118	272	147
Ext.	M- (kip-ft)	120	160	142	130	118	371	200

5.3.2 Shear

The distributed vehicular live load shear per girder shall be determined by the following expression: 13.6.5.2

VLL = 0.50[0.6VLU + VLD] 13-10

where, VLU = vertical shear due to undistributed wheel loads (kip)
VLD = vertical shear due to wheel load distributed as specified for moment (kip)

Gir.		H-15 Truck	HS-20 Truck	Type 3 Truck	Type 3S2 Truck	Type 3-3 Truck	Cat 740 Loaded	Cat 740 Unloaded
	VLU (kip)	12.0	16.0	17.0	15.5	14.0	52.9	21.4
Int.	VLD (kip)	9.6	12.8	13.6	12.4	11.2	29.1	11.8
Ext.	VLD (kip)	9.6	12.8	13.6	12.4	11.2	39.7	16.1
Int.	VLL (kip)	8.4	11.2	11.9	10.9	9.8	30.4	12.3
Ext.	VLL (kip)	8.4	11.2	11.9	10.9	9.8	35.7	14.4

5.4 Distributed Live Load Stresses per Girder

The unit stress per stringer due to the applied moment on rectangular members shall be determined by the following equation:

fb = M/S see tabulated values below

where, M = distributed moment per girder (lb-in)
S = section modulus of rectangular section (in3)

S = bd2/6 = *1774.5* *in.3*

where, b = bending member width (in) = *7* *in.*
d = bending member depth (in) = *39* *in.*

5.0 Applied Loads (Spans 1 & 3)

CODE REFERENCE

The unit stress in shear parallel to grain due to applied loading shall be determined by the following equation: 13.6.5.2

fv = 3V/2bd see tabulated values below 13-9

where, V = vertical shear per girder (lb)

5.4.1 Dead Load

Stress	Int. Gir.	Ext. Gir.
fb- (psi)	149	170
fv (psi)	13.7	15.4

5.4.2 Live Load

Gir.	Stress	H-15 Truck	HS-20 Truck	Type 3 Truck	Type 3S2 Truck	Type 3-3 Truck	Cat 740 Loaded	Cat 740 Unloaded
Int.	fb- (psi)	811	1082	963	882	795	1841	993
Int.	fv (psi)	46.2	61.5	65.4	59.6	53.8	167.1	67.6
Ext.	fb- (psi)	811	1082	963	882	795	2511	1354
Ext.	fv (psi)	46.2	61.5	65.4	59.6	53.8	196.2	79.4

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SUBJECT:	Railroad Creek Bridge			CHECKED		DATE:	

6.0 Load Rating (Span 2)

CODE REFERENCE

6.1 Girder Capacities

Fb'in	=	allowable inventory bending stress……	*1784*	*psi*
Fb'op	=	allowable operating bending stress……	*2373*	*psi*
Fv'in	=	allowable inventory shear stress……	*267*	*psi*
Fv'op	=	allowable operating shear stress……	*355*	*psi*

6.2 Girder Applied Loads

	Dead Load	
Stress	Int. Gir.	Ext. Gir.
fb+ (psi)	576	669
fv (psi)	35	41

		Live Load						
Gir.	Stress	H-15 Truck	HS-20 Truck	Type 3 Truck	Type 3S2 Truck	Type 3-3 Truck	Cat 740 Loaded	Cat 740 Unloaded
Int.	fb+ (psi)	1104	2180	1618	1672	1472	3459	1588
Int.	fv (psi)	45	94	68	73	67	173	83
Ext.	fb+ (psi)	1104	2180	1618	1672	1472	4717	2166
Ext.	fv (psi)	45	94	68	73	67	204	98

6.3 Rating Factors

The allowable stress method is applicable to timber structures. The rating equation shall be taken as follows: BDM 13.1.3

$$RF = (Fa - Fd)/Fl$$ BDM 13.1.3-1

where, Fa = allowable stress (psi)
Fd = dead load stress (psi)
Fl = live load stress (psi)

6.3.1 Inventory Rating

		Inventory Rating Factor						
Gir.		H-15 Truck	HS-20 Truck	Type 3 Truck	Type 3S2 Truck	Type 3-3 Truck	Cat 740 Loaded	Cat 740 Unloaded
Int.	RFb+	1.09	0.55	0.75	0.72	0.82	0.35	0.76
Int.	RFv	5.10	2.46	3.38	3.17	3.44	1.33	2.79
Ext.	RFb+	1.01	0.51	0.69	0.67	0.76	0.24	0.51
Ext.	RFv	4.98	2.40	3.30	3.09	3.36	1.11	2.32
	MIN.	1.01	0.51	0.69	0.67	0.76	0.24	0.51

6.0 Load Rating (Span 2)

CODE REFERENCE

6.3.2 Operating Rating

For the operating rating, the allowable stress is increased by 33%. BDM 13.1.3

		Operating Rating Factor						
Gir.		H-15 Truck	HS-20 Truck	Type 3 Truck	Type 3S2 Truck	Type 3-3 Truck	Cat 740 Loaded	Cat 740 Unloaded
Int.	RFb+	1.63	0.82	1.11	1.07	1.22	0.52	1.13
Int.	RFv	7.04	3.39	4.67	4.37	4.75	1.84	3.85
Ext.	RFb+	1.54	0.78	1.05	1.02	1.16	0.36	0.79
Ext.	RFv	6.92	3.33	4.59	4.30	4.67	1.54	3.22
	MIN.	1.54	0.78	1.05	1.02	1.16	0.36	0.79

6.4 Conclusion

The load rating of the bridge in span 2 is governed by positive moment stresses in the exterior girders near midspan.

Span 2 controls the load rating for the entire bridge.

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SUBJECT:	Railroad Creek Bridge			CHECKED		DATE:	

7.0 Load Rating (Spans 1 & 3)

CODE REFERENCE

7.1 Girder Capacities

Fb'in	=	allowable inventory bending stress……	*1784*	*psi*
Fb'op	=	allowable operating bending stress……	*2373*	*psi*
Fv'in	=	allowable inventory shear stress……	*267*	*psi*
Fv'op	=	allowable operating shear stress……	*355*	*psi*

7.2 Girder Applied Loads

	Dead Load	
Stress	Int. Gir.	Ext. Gir.
fb- (psi)	149	170
fv (psi)	14	15

		Live Load						
Gir.	Stress	H-15 Truck	HS-20 Truck	Type 3 Truck	Type 3S2 Truck	Type 3-3 Truck	Cat 740 Loaded	Cat 740 Unloaded
Int.	fb- (psi)	811	1082	963	882	795	1841	993
Int.	fv (psi)	46	62	65	60	54	167	68
Ext.	fb- (psi)	811	1082	963	882	795	2511	1354
Ext.	fv (psi)	46	62	65	60	54	196	79

7.3 Rating Factors

The allowable stress method is applicable to timber structures. The rating equation shall be taken as follows: BDM 13.1.3

$$RF = (Fa - Fd)/Fl$$ BDM 13.1.3-1

where, Fa = allowable stress (psi)
Fd = dead load stress (psi)
Fl = live load stress (psi)

7.3.1 Inventory Rating

		Inventory Rating Factor						
Gir.		H-15 Truck	HS-20 Truck	Type 3 Truck	Type 3S2 Truck	Type 3-3 Truck	Cat 740 Loaded	Cat 740 Unloaded
Int.	RFb-	2.02	1.51	1.70	1.85	2.06	0.89	1.65
Int.	RFv	5.48	4.11	3.87	4.24	4.70	1.51	3.74
Ext.	RFb-	1.99	1.49	1.68	1.83	2.03	0.64	1.19
Ext.	RFv	5.44	4.08	3.84	4.21	4.67	1.28	3.17

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7.0 Load Rating (Spans 1 & 3)

CODE REFERENCE

7.3.2 Operating Rating

For the operating rating, the allowable stress is increased by 33%.

BDM 13.1.3

		Operating Rating Factor						
Gir.		H-15 Truck	HS-20 Truck	Type 3 Truck	Type 3S2 Truck	Type 3-3 Truck	Cat 740 Loaded	Cat 740 Unloaded
Int.	RFb+	2.74	2.06	2.31	2.52	2.80	1.21	2.24
Int.	RFv	7.39	5.54	5.21	5.72	6.33	2.04	5.04
Ext.	RFb+	2.71	2.04	2.29	2.50	2.77	0.88	1.63
Ext.	RFv	7.35	5.51	5.19	5.69	6.30	1.73	4.27

7.4 Conclusion

The load rating of the bridge in spans 1 & 3 is governed by negative moment stresses in the exterior girders at the supports .

The load rating of the entire bridge is governed by loads in Span 2.

4. Holden Village Vehicle Bridge

Bridge Description

The Holden Village Vehicle Bridge is a single, simple span steel bridge with a span length of 80'-0". The superstructure is a Hamilton Standard EZ Bridge U80/L-90/U-102 with a treated deck. The bridge is 18'-0" wide with a roadway width of 16'-0". The superstructure consists of four longitudinal W36x182 steel girders with a variable spacing of 4'-0", 5'-0" and 4'-0" between girders. Transverse W8x13 steel stringers are placed across the girders at 2'-6" spacing to support the bridge deck. The bridge deck is a 4" thick treated timber deck with a 3" thick untreated wearing surface. A guard railing is provided along both sides of the bridge and is made of steel W-beam rail attached to steel posts which are connected to the ends of the transverse stringers at a spacing of 5'-0".

The girder steel is either A588 "Cor-Ten" or A572 grade 50 or A709 grade 50 that leads to yield strength of 50 ksi. The transverse stringer steel grade is unknown and thus has been assumed to have yield strength of 50 ksi for this load rating. The stringer size is applied as W8x13 in loading rating, which needs to be verified.

LFR method is applied to rate the bridge. Both the longitudinal steel girder and transverse steel stringer are analyzed. The maximum positive moment at mid-span and maximum shear at support for girder are checked. The maximum positive moment at mid-span, negative moment at support, and maximum shear at support are checked for the transverse stringers. The timber deck and girder splice were not checked.

The following are some recent photos of the Holden Mine Vehicle Bridge…

It is found the bridge have loading rating factors of 1.11 at inventory level and 1.86 at operating level for deign HS-20 truck and three typical legal truck. For specialized truck CAT 740 (80tons), at inventory level the load rating factors are 0.75 for fully loaded and 0.95 for unloaded truck; at operating level the CAT 740 has a rating factor 1.25 for fully loaded and 1.58 for unloaded truck.

4.b Load Rating Calculations

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PROJECT Holden Mine Load Rating JOB NO. 10177.01 BY GJN

Bridge Rating Summary

PE Stamp

Bridge Name:	Holden Village Vehicle Bridge
Span Types:	Steel W36x182 Girders
Bridge Length:	80'-0"
Rated By:	GC
Checked By:	
Date:	February 9, 2011

Inspection Report Date		Substructure Condition	Good
Rating Method	LFR	Deck Condition	Good
Overlay Thickness	N/A	Superstructure Condition	Good

Truck	Inventory Rating	Operating Rating	Controlling Point
HS-20	1.11	1.86	Shear in Transv. Stringer
AASHTO Type 3	2.10	3.50	Shear in Transv. Stringer
AASHTO Type 3S2	2.30	3.84	Shear in Transv. Stringer
AASHTO Type 3-3	1.90	3.18	Positive Moment in Longit. Girder Midspan
Cat 740 Truck (Loaded)	0.75	1.25	Shear in Transv. Stringer & Positive Moment in Longit. Girder Midspan
Cat 740 Truck (Empty)	0.95	1.58	Shear in Transv. Stringer & Positive Moment in Longit. Girder Midspan

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PROJECT: Holden Mine Bridges Load Rating JOB # 10177.01 DATE: 02/09/11
SUBJECT: Holden Village Vehicle Bridge BY: GenMiao Chen SHEET #

Load Rating Summary

Bridge Description

Holden Village Vehicle Bridge is a single, simple steel bridge with a span length 80'-0". The superstructure is a Hamilton Standard EZ Bridge U80/L-90/U-102 with a treated deck. The whole bridge width is 18'-0" and roadway is 16'-0" wide. The cross section consists of 4 longitudinal W36x182 steel girders with variable spacing 4'-0", 5'-0" and 4'-0". Transverse W8x13 steel stringers are placed on girders with spacing 2'-6". The bridge deck includes 4" thick treated timber deck and 3" thick untreated wearing surface. The guard railing on both sides is made of steel W-beam rail attached to steel posts which are connected to stringer ends with spacing 5'-0".

The girder steel is either A588 "Cor-Ten" or A572 grade 50 or A709 grade 50 that leads to yield strength of 50 ksi. The stringer steel is to be verified and 50 ksi is applied while load rating. The stringer size is applied as W8x13 in loading rating. Both steel properties and size of stringer need to be verified.

Load Rating Factor

LFR method is applied to rate the bridge. Both the longitudinal steel girder and transverse steel stringer are analyzed. The maximum positive moment at mid-span and maximum shear at support for girder are checked. The maximum positive moment at mid-span, negative moment at support, and maximum shear at support are checked for stringer. The timber deck and girder splice are not checked. The deflection is not check either.

It is found the bridge have loading rating factors of 1.11 at inventory level and 1.86 at operating level for deign HS-20 truck and three typical legal truck. For specialized truck CAT 740 (80tons), at inventory level the load rating factors are 0.75 for fully loaded and 0.95 for unloaded truck; at operating level the CAT 740 has a rating factor 1.25 for fully loaded and 1.58 for unloaded truck.

W36x182 Girder

TruckType	HS-20	Type 3	Type 3S2	Type3-3	Cat 740	Cat 740, unloaded
Inventory	1.54	2.12	1.84	1.90	0.76	1.69
Operating	2.57	3.54	3.08	3.18	1.27	2.82

W8x13 Stringer

TruckType	HS-20	Type 3	Type 3S2	Type3-3	Cat 740	Cat 740, unloaded
Inventory	1.11	2.10	2.30	2.23	0.75	0.95
Operating	1.86	3.50	3.84	3.72	1.25	1.58

Final Bridge Rating Factor

TruckType	HS-20	Type 3	Type 3S2	Type3-3	Cat 740	Cat 740, unloaded
Inventory	**1.11**	**2.10**	**1.84**	**1.90**	**0.75**	**0.95**
Operating	**1.86**	**3.50**	**3.08**	**3.18**	**1.25**	**1.58**

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PROJECT:	Holden Mine Bridges Load Rating	JOB #	10177.01	DATE:	02/08/11
SUBJECT:	Holden Village Vehicle Bridge	BY:	GenMiao Chen	SHEET #	

Load Rating Criteria & Bridge General Information

Load Rating Criterias

1. Bridge Design Manual (LRFD) (BDM), Washington Department of Transportation, M23-50.04, August 2010.
2.The Manual for Bridge Evaluation (MBE), AASHTO First Edtion 2008 with interim 2010 revisions.
3. AASHTO Standard Specification for Highway Bridges (AASHTO Standard), 17th Edition 2002.

BDM 13.1 Requirements

"For new bridge designed prior to October 1 2010, partially reconstructed or rehabilitated bridges where part of the existing structure is designed by the allowable stress method or by the load factor method (LFR), and existing bridges, NBI ratings can be based on either the LFR or LRFR methods. The rating facotrs shall be based on HS loading and reported in tons when using LFR method."

This bridge was designed by the load factor method based on AASHTO Standard Specification. For load rating of this bridge, HS loading will be used and LFR load rating method (LFR) will be applied.

MBE Load Rating Method

Procedure
MBE section 6 Part B-Allowable Stress Rating and Load Factor rating is followed for this bridge load rating.

Load rating levels
Inventory level and operating level

Live load
Design live load: HS-20
Legal load: Type 3 Unit, Type 3S2 Unit, and Type 3-3 Unit
Specialized vehicle: CAT 740 Articulated Truck

Structural components to be rated:
Longitudinal steel girder
Transverse steel stringer

Holden Village Vehicle Bridge Data

Span:	80ft
Year built:	2004
Girder material:	A588 cor ten or A572 Grade 50 or A709 Grade 50
Yield strength:	50 ksi
Girder:	W36x182 Hamilton EZ Bridge
Girder Spacing:	(4'-0")+(5'-0")+(4'-0")
Stringer:	W8x13, To Be Verified.
String Spacing:	2'-6"
Cross frame:	4
Bridge width:	18 ft
Roadway width:	16 ft
Lane Number:	1
Deck:	4x12 treated wood deck
Wearing surface:	3x12 untreated wood

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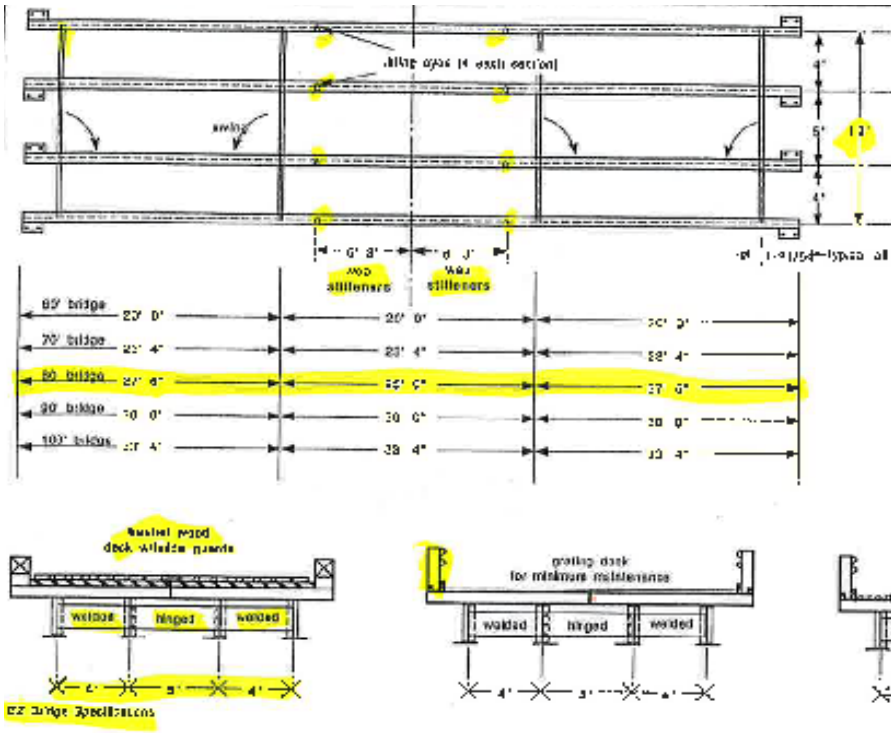
SUBJECT: Holden Village Vehicle Bridge BY: GenMiao Chen SHEET #

Dead Load

1. Bridge Layout

Span length=	80	ft
Bridge width=	18	ft
Roadway width=	16	ft

Standard Hamilton EZ bridge layout



Beam schedule: W36x182 for span length 80 feet.

BEAM SCHEDULE
USGVL-55 LOADING

Length	Beam	wt. LB +dead
80	W36 x 182	37,500
90	W36 x 210	74,200
100	W36 x 232	91,200

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SUBJECT: Holden Village Vehicle Bridge BY: GenMiao Chen SHEET #

Dead Load

2. Structural Dead Load

Longitudinal Girder W36x182

Each Girder=	182	plf
Girder Number=	4	4 girders
w1=	**728**	plf, whole bridge section

Transvers Stringer W8x13

Span=	80	ft
Each stringer=	13	plf
Spacing=	2.5	ft
Stringer Numbers=	33	
Length=	18	ft, use bridge width
Total weight=	7722	lbs
w2=	**96.5**	plf, whole bridge section

Wood deck, 3" untreated surface and 4" treated deck

Width=	16	ft
t=	7.0	inch
unit weight=	50	pcf, BDM 13.2.1
w3=	**466.7**	plf, whole bridge section

Metal Railing

Post W8x15, Guess

Span=	80	ft
Each post=	15	plf
Height=	3.33	3'-4", measure from picture
Spacing=	5.0	ft
Post Number=	34	both sides
Total weight=	1700	lbs
linear weight=	21.25	plf

Guardrail W-beam

weight=	8.77	plf
both sides=	17.54	plf

Post+Rail

w4=	**38.8**	plf

Cross diaphragm, W16x40

Span=	80	ft
Number=	4	
Length=	13	ft
unit weight=	40	plf
total weigth=	2080	lbs
w5=	**26.0**	plf

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SUBJECT: Holden Village Vehicle Bridge BY: GenMiao Chen SHEET #

Dead Load

Miscellaneous

Steel connection, assume 6%

percentage= 6%

w6= **51.0** plf

3. Longitudinal Steel I-Girder Forces

Unfactored Dead Load Moment

Maximum moment at mid-span

$M_{max}=qL^2/8$

L= 80 ft

		q	$M_{Mid-Span}$
		plf	k-f
Girder, w1		728.0	582.4
Stringer, w2		96.5	77.2
Wood Deck, w3		466.7	373.3
Railing, w4		38.8	31.0
Diaphragm, w5		26.0	20.8
Miscellaneous, w6		51.0	40.8
Whole Bridge	DC	940.3	752.3
	DW	466.7	373.3
	DL	1407.0	1125.6
Per Girder	**DC**	**235.1**	**188.1**
	DW	**116.7**	**93.3**
	DL	**351.8**	**281.4**

Unfactored Dead Load Shear

Maximum shear support locations

$V_{max}=qL/2$

L= 80 ft

		q	$V_{support}$
		plf	k-f
Girder, w1		728.0	29.1
Stringer, w2		96.5	3.9
Wood Deck, w3		466.7	18.7
Railing, w4		38.8	1.6
Diaphragm, w5		26.0	1.0
Miscellaneous, w6		51.0	2.0
Whole Bridge	DC	940.3	37.6
	DW	466.7	18.7
	DL	1407.0	56.3
Per Girder	**DC**	**235.1**	**9.4**
	DW	**116.7**	**4.7**
	DL	**351.8**	**14.1**

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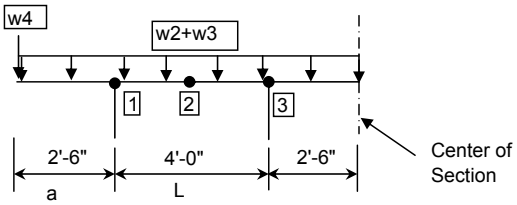
Dead Load

4. Transverse Steel I-Stringer Forces

Stringer carries dead loads due to deck, railing and selfweight.



Stringer spacing=	2.5	ft
Post spacing=	5.0	ft
a=	2.5	ft, cantilever
L=	4	ft, middle span
w2, selfweight=	13	plf
w3, Deck=	72.9	plf
w4, railing=	93.9	lbs

Unfactored Dead Load Moment at point 1, 2 and 3

Uniformly distributed load (w2 &w3)

$R1=R3=q(2a+L)/2$

$M_1=M_3=qa^2/2$

$M2=q(a+0.5L)^2/2-R1(L/2)$

	q	R1	R3	M_1 (M_3)	M_2	M_3
	plf	lbs	lbs	lb-ft	lb-ft	lb-ft
Stringer, w2	13.0	58.5	58.5	-40.6	-14.6	-40.6
Wood Deck, w3	72.9	328.1	328.1	-227.9	-82.0	-227.9

Concentrated load at cantilever end (w4)

R1=P(L+a)/L, upward

R3=pa/L, sownward

M_1=-pa

M_2=-p(a+0.5L)+R1(L/2)

M_3=0

	P	R1	R3	M_1 (M_3)	M_2	M_3
	lbs	lbs	lbs	lb-ft	lb-ft	lb-ft
Railing, w4	93.9	152.5	-58.7	-234.6	-117.3	0.0

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SUBJECT: Holden Village Vehicle Bridge BY: GenMiao Chen SHEET #

Dead Load

Maximum moment in stringer

	M_1 (M_3)	M_2	M_3
	lb-ft	lb-ft	lb-ft
Stringer, w2	-40.6	-14.6	-40.6
Wood Deck, w3	-227.9	-82.0	-227.9
Railing, w4	-234.6	-117.3	0.0
DC	**-275.3**	**-131.9**	**-40.6**
DW	**-227.9**	**-82.0**	**-227.9**
DL	**-503.1**	**-214.0**	**-268.5**

Unfactored Dead Load Shear

Uniformly distributed load, w2 & w3
V1=V3=max(qa, R1-qa)
V2=0

	q	R1	R2	V1	V2	V3
	plf	lbs	lbs	lbs	lbs	lbs
Stringer, w2	13.0	58.5	58.5	32.5	0.0	32.5
Wood Deck, w3	72.9	328.1	328.1	182.3	0.0	182.3

Concentated load, w4
V1=max(p, R1-P)
V2=V3=P-R1

	P	R1	R3	V1	V2	V3
	lbs	lbs	lbs	lbs	lbs	lbs
Railing, w4	93.9	152.5	-58.7	93.9	58.7	58.7

Maximum shear in stringer

	V1	V2	V3
	lbs	lbs	lbs
Stringer, w2	32.5	0.0	32.5
Wood Deck, w3	182.3	0.0	182.3
Railing, w4	93.9	58.7	58.7
DC	**126.4**	**58.7**	**91.2**
DW	**182.3**	**0.0**	**182.3**
DL	**308.6**	**58.7**	**273.4**

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PROJECT:	Holden Mine Bridges Load Rating	JOB #	10177.01	DATE:	02/09/11
SUBJECT:	Holden Village Vehicle Bridge	BY:	GMC	SHEET #	

1. W36x182 Girder Load Rating

2/9/2011

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PROJECT:	Holden Mine Bridges Load Rating	JOB #	10177.01	DATE:	02/08/11
SUBJECT:	Holden Village Vehicle Bridge	BY:	GenMiao Chen	SHEET #	

Live Load Distribution Factor(LLDF), for Girder W36x182

Longitudinal Steel Girder W36x182 *References: MBE 6B.7.3 & AASHTO Standard 3.23*

1. Bending Moment Load Distribution Factor

Interior Girder, AASHTO Stardard 3.23.2 & Table 3.23.1

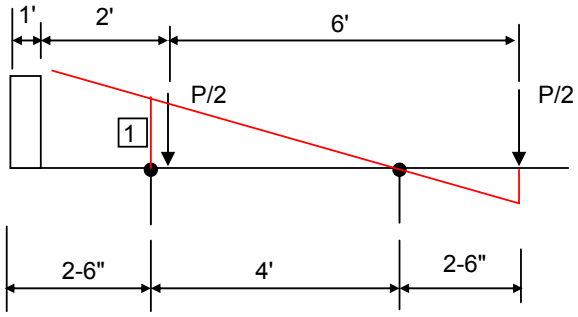
Deck is Timber Plank

One traffic lane distribution of wheel loads

DF=S/ 4.00

S1=	4.0	ft
S2=	5.0	ft
S3=	4.0	ft
S=	4.33	ft
DF_{int}=	**1.083**	**wheel load**

Exterior Girder, Lever Rule by AASHTO Standard 3.23.2.3.1.2 & 3.23.2.3.1.4



DF=P/2*3.5/4-P/2*2.5/4

DF=	0.125	Lane Load
	0.25	Wheel Load
DF Min=	1.083	Whenot less than interior girder
DF_{ext}=	**1.083**	**Wheel Load**

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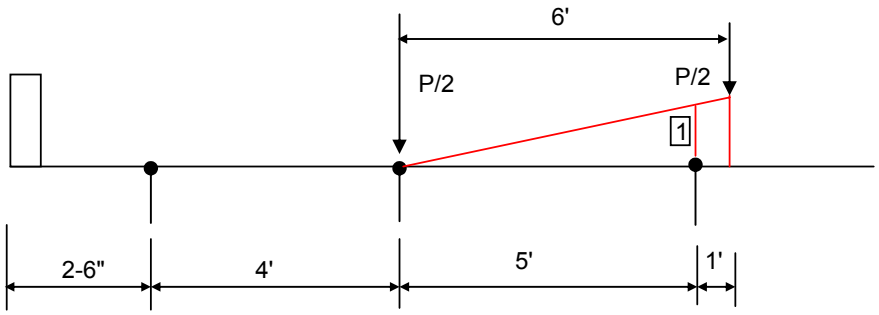
SUBJECT: Holden Village Vehicle Bridge BY: GenMiao Chen SHEET #

Live Load Distribution Factor(LLDF), for Girder W36x182

2. Shear Load Distribution Factor, AASHTO Standard 3.23.1

Interior Girder, Lever Rule



DF=P/2*6/5

DF_{int}=	0.600	Lane load
DF_{int}=	**1.200**	**Wheel load**

Exterior Girder, Lever Rule

Same as the previous moment distribution factor calculation

DF_{int}=	0.250	Wheel load
DF Min=	1.200	Wheel Load, AASHTO Standard 3.23.2.3.1.4
DF_{ext}=	**1.200**	**Wheel Load**

3. Summary of Distribution Factor , Wheel Load

	Moment	Shear
Interior Girder	1.083	1.200
Exterior Girder	1.083	1.200

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Live Load, for Girder W36x182

Longitudinal Steel Girder W36x182

1. Live Load Impact

I=50/(L+125), less than 30% AASHTO Standard 3.8.2
L= 80 ft
I= **0.244** Impact Factor MBE 6B.7.4
I'= **0.100** Impact Factor Assume 10% for permit loading (Cat 740)
MBE 6B.7.4, C6A.4.4.3

2. Live Load Moments, Wheel Line

Maximum moment at mid-span from Table C6B-1 & C6B-2, MBE Appendix C6B, in ft-kips, impact included
Note: A finite element model by Staad Program was created to verify the moment and obtain shear for live load.

	Design load	Posting Load			Cat 740		
Truck	HS-20	Type 3	Type 3S2	Type3-3	Loaded	Unloaded	
W, kips	72	50	72	80	160	73	
W, tons	36	25	36	40	80	36.5	
M, ft-k	582.4	423.9	487.1	471.9	1330	602	No Impact
M, ft-k	724.5	527.3	605.9	587.0	1463.0	662.2	With Impact

Distribution of live load moment
DF= 1.083 Moment distribution factor
Maximum Moment at Mid-Span

TruckType	HS-20	Type 3	Type 3S2	Type3-3	Cat 740	Cat 740, unloaded	
Wheel Load	724.5	527.3	605.9	587.0	1463.0	662.2	
Per Girder	**784.9**	**571.2**	**656.4**	**635.9**	**1584.9**	**717.4**	With Impact

3. Live Load Shear, Wheel Line

At Support, MBE Appendix G6B & H6B, in ft-kips
Note: A finite element model by Staad Program was created to verify the moment and obtain shear for live load.

L= 80 ft
X= 80 ft
L-X= 0 ft
(L-X)/L= 0

TruckType	HS-20	Type 3	Type 3S2	Type3-3	Cat 740	Cat 740, unloaded	
Shear, kips	31.8	22.7	27.6	28.05	70.29	33.3	No Impact
	39.6	28.2	34.4	34.9	77.3	36.6	With Impact

Distribution of live load shear
DF= 1.200 Shear distribution factor
Maximum Shear at Support

TruckType	HS-20	Type 3	Type 3S2	Type3-3	Cat 740	Cat 740, unloaded
Wheel Load	39.6	28.2	34.4	34.9	77.3	36.6
Per Girder	**47.5**	**33.8**	**41.2**	**41.9**	**92.8**	**44.0**

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SUBJECT: Holden Village Vehicle Bridge BY: GenMiao Chen SHEET #

Capacity by Load Factor Method, W36x182

Longitudinal Steel Girder W36x182

Reference: MBE 6B.6.3

1. Material and Section Properties

Material

Structural steel applies Grade 50
AASHTO Standard Table 10.2A
F_y= 50000 psi

Section properties

	Area	Depth		Web	Flange					Weight
	A	d	D	t_w	b_f	t_f	I_x	S_x	Z_x	w
	in^2	in	inch	in	in	in	in^4	in^3	in^3	plf
W36x182	53.6	36.33	32.125	0.725	12.075	1.18	11300	623	718	182

2. Bending Capacity

1.152488

Compact section

b_f/t_f=	10.2	<, ok	21.7	Table 10.48.1.2A
D/t_w=	44.3	<, ok	101	Table 10.48.1.2A
L_b=	2.5	ft, stringer spacing 2'-6"		
r_y=	2.55	inch		
Lb/ry=	11.8	<, ok	39	Table 10.48.1.2A

$M_u=F_yZ_x$ AASHTO EQ 10-92

M_u= **2992** k-ft

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SUBJECT:	Holden Village Vehicle Bridge	BY:	GenMiao Chen	SHEET #	

3. Shear Capacity

Plastic shear V_p:

$V_p=0.58F_yDt_w$ AASHTO EQ 10-115

$V_p=$ 675.4 kips

Web stiffener:

From the EZ Bridge figures, web stiffener was provided. The spacing is 12'-6" at middle.

S= 12.5 ft

3D= 8.0 ft

S > 3D AASHTO 10.48.8.3

So it was unstiffened web:

k= 5.0 AASHTO 10.48.8.1

$6000\sqrt{k}/\sqrt{F_y}=$ 60.0

$D/t_w=$ 44.3

C= 1.0 At support where stiffener spacing <3D, omit conservatively)

Shear capacity

$V_u=CV_p$ AASHTO EQ 10-113

$V_u=$ **675** kips

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Rating Factor by Load Factor Method

Longitudinal Steel Girder W36x182

1. Load factor Method Equation

MBE 6B.5

$$RF = \frac{C - A_1 D}{A_2 L(1+I)}$$

MBE EQ 6B.5.1-1

RT=(RF)W

MBE EQ 6B.5.1-2

Rating Level	A_1	A_2
Inventory	1.3	2.17
Operating	1.3	1.3

2. Rating Factor for Maximum Moment at Mid-Span

$C=M_u$= 2992 k-f
M_{DC}= 188 k-f
M_{DW}= 93 k-f
$D=M_{DL}$= 281 k-f

	TruckType	HS-20	Type 3	Type 3S2	Type3-3	Cat 740	Cat 740, unloaded
Capacity	C	2991.667	2992	2992	2992	2992	2992
Dead Load	D	281	281	281	281	281	281
Live Load	L+I	785	571	656	636	1585	717
RF	**Inventory**	**1.54**	**2.12**	**1.84**	**1.90**	**0.76**	**1.69**
	Operating	**2.57**	**3.54**	**3.08**	**3.18**	**1.27**	**2.82**

3. Rating Factor for Maximum Shear at Support

$C=V_u$= 675 kips
V_{DC}= 9.4 kips
V_{DW}= 4.7 kips
$D=V_{DL}$= 14.1 kips

	TruckType	HS-20	Type 3	Type 3S2	Type3-3	Cat 740	Cat 740, unloaded
Capacity	C	675.4	675.4	675.4	675.4	675.4	675.4
Dead Load	D	14.1	14.1	14.1	14.1	14.1	14.1
Live Load	L+I	47.5	33.8	41.2	41.9	92.8	44.0
RF	**Inventory**	**6.38**	**8.95**	**7.34**	**7.23**	**3.26**	**6.89**
	Operating	**10.65**	**14.93**	**12.26**	**12.07**	**5.45**	**11.50**

4. Load Rating Factor Summary for W36x182 Girder

	TruckType	HS-20	Type 3	Type 3S2	Type3-3	Cat 740	Cat 740, unloaded
	W, tons	36	25	36	40	80	36.5
Inventory	RF	**1.54**	**2.12**	**1.84**	**1.90**	**0.76**	**1.69**
	RT, tons	56	53	66	76	61	62
Operating	RF	**2.57**	**3.54**	**3.08**	**3.18**	**1.27**	**2.82**
	RT, tons	93	88	111	127	102	103

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PROJECT:	Holden Mine Bridges Load Rating	JOB #	10177.01	DATE:	02/09/11
SUBJECT:	Holden Village Vehicle Bridge	BY:	GMC	SHEET #	

2. W8x13 Stringer Load Rating

2/9/2011

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PROJECT: Holden Mine Bridges Load Rating JOB # 10177.01 DATE: 02/08/11
SUBJECT: Holden Village Vehicle Bridge BY: GenMiao Chen SHEET #

Live Load Distribution Factor(LLDF), for Stringer W8x13

References: AASHTO Standard 3.23

Transverse Steel Stringer W8x13

1. Bending Moment

AASHTO Stardard 3.23.3 & Table 3.23.3.1
Timber plank on steel stringers
Distribution of wheel loads in transverse beams
DF=S/ **4**
S= 2.5 ft
DF_m= 0.625 wheel load

2. Shear

DF_v= 1.000 Lever Rule, Wheel load applies on stringer directly

3. Summary of Distribution Factor, Wheel Load

Moment	Shear
0.625	1.000

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PROJECT: Holden Mine Bridges Load Rating JOB # 10177.01 DATE: 02/08/11
SUBJECT: Holden Village Vehicle Bridge BY: GenMiao Chen SHEET #

Live Load for Stringer W8x13

Transverse Steel Stringer W8x13

1. Live Load Impact

I=50/(L+125), less than 30% AASHTO Standard 3.8.2

L= 80 ft

I= **0.244** Impact Factor MBE 6B.7.4

I= **0.100** Impact Factor 10% for permit loading (Cat 740) MBE 6B.7.4, C6A.4.4.3

2. Live Load on Stringer, Moment

Maximum positive moment at mid-span and negative moment at support

Positive Moment at Mid-Span

DF_{moment}= 0.625

TruckType	HS-20	Type 3	Type 3S2	Type3-3	Cat 740	Cat 740, unloaded	
W, kips	72	50	72	80	160	73	
W, tons	36	25	36	40	80	36.5	
M, ft-k	9.03	4.8	4.38	4.52	8.55	6.78	No impact
M, ft-k	11.23	5.97	5.44	5.62	9.40	7.45	w/ impact
Per Stringer	**7.02**	**3.73**	**3.40**	**3.51**	**5.88**	**4.66**	w/ DF

Negaitive Moment at Support

DF_{moment}= 0.625

R-Factor= 0.900 10% reduce at support for negative moment

TruckType	HS-20	Type 3	Type 3S2	Type3-3	Cat 740	Cat 740, unloaded	
W, kips	72	50	72	80	160	73	
W, tons	36	25	36	40	80	36.5	
M, ft-k	-13.01	-6.91	-6.30	-6.50	-23.43	-18.57	No Reduction
M, ft-k	-11.71	-6.22	-5.67	-5.85	-21.09	-16.71	No impact
M, ft-k	-14.56	-7.74	-7.05	-7.28	-23.19	-18.38	w/ impact
Per Stringer	**-9.10**	**-4.83**	**-4.41**	**-4.55**	**-14.50**	**-11.49**	w/ DF

3. Live Load on Stringer, Shear

Shear locates at d=6" from the support center

DF_{shear}= 1.000

TruckType	HS-20	Type 3	Type 3S2	Type3-3	Cat 740	Cat 740, unloaded	
Shear, kips	14.58	7.74	7.06	7.28	24.43	19.36	No Impact
	18.13	9.63	8.78	9.06	26.87	21.30	With Impact
Per Stringer	**18.13**	**9.63**	**8.78**	**9.06**	**26.87**	**21.30**	w/ DF

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PROJECT: Holden Mine Bridges Load Rating JOB # 10177.01 DATE: 02/08/11
SUBJECT: Holden Village Vehicle Bridge BY: GenMiao Chen SHEET #

Capacity by Load Factor Method, W8x13

Transverse Steel Stringer W8x13

Reference: MBE 6B.5

1. Material and Section Properties

Material

Structural steel applies M270 Grade 36
AASHTO Standard Table 10.2A

F_y= 50000 psi Assume same material as longitudinal girder, **To BE Verified.**

Section properties

	Area	Depth		Web	Flange					Weight
	A	d	D	t_w	b_f	t_f	I_x	S_x	Z_x	w
	in^2	in	inch	in	in	in	in^4	in^3	in^3	plf
W8x13	3.84	7.99	6.625	0.23	4	0.255	39.6	9.91	11.4	13

2. Bending Capacity

Compact section

b_f/t_f= 15.6 <, ok 21.7 Table 10.48.1.2A
D/t_w= 28.8 <, ok 101 Table 10.48.1.2A
L_b= 0 ft, continued deck
r_y= 0.843 inch
L_b/ry= 0.0 <, ok 39 Table 10.48.1.2A

$M_u=F_yZ_x$ AASHTO EQ 10-92
M_u= **47.5** k-ft

3. Shear Capacity

Plastic shear V_p:

$V_p=0.58F_yDt_w$ AASHTO EQ 10-115
V_p= 44.2 kips

For unstiffened web:

k= 5.0 AASHTO 10.48.8.1
$6000\sqrt{k}/\sqrt{F_y}$= 60.0
D/t_w= 28.8
C= 1.0

Shear capacity

$V_u=CV_p$ AASHTO EQ 10-113
V_u= **44.2** kips

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PROJECT: Holden Mine Bridges Load Rating JOB # 10177.01 DATE: 02/09/11
SUBJECT: Holden Village Vehicle Bridge BY: GenMiao Chen SHEET #

Rating Factor by Load Factor Method

Transverse Steel Stringer W8x13

1. Load Factor Method Equation

MBE 6B.5

$$RF = \frac{C - A_1 D}{A_2 L(1+I)}$$

MBE EQ 6B.5.1-1

RT=(RF)W

MBE EQ 6B.5.1-2

Rating Level	A_1	A_2
Inventory	1.3	2.17
Operating	1.3	1.3

W8x13 Steel Stringer

2. Rating factor for Maximum Moment

$C=M_u$= 47.5 k-f

	Negative	Positive	
M_{DC}=	-0.28	-0.13	k-f
M_{DW}=	-0.23	-0.08	k-f
$D=M_{DL}$=	-0.50	-0.21	k-f

Positive moment at mid-span

	TruckType	HS-20	Type 3	Type 3S2	Type3-3	Cat 740	Cat 740, unloaded
Capacity	C	47.5	47.5	47.5	47.5	47.5	47.5
Dead Load	D	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
Live Load	L+I	7.02	3.73	3.40	3.51	5.88	4.66
RF	**Inventory**	**3.14**	**5.90**	**6.47**	**6.27**	**3.75**	**4.73**
	Operating	**5.23**	**9.85**	**10.80**	**10.46**	**6.25**	**7.89**

Negative moment at support

	TruckType	HS-20	Type 3	Type 3S2	Type3-3	Cat 740	Cat 740, unloaded
Capacity	C	-47.5	-47.5	-47.5	-47.5	-47.5	-47.5
Dead Load	D	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Live Load	L+I	-9.10	-4.83	-4.41	-4.55	-14.50	-11.49
RF	**Inventory**	**2.37**	**4.47**	**4.90**	**4.74**	**1.49**	**1.88**
	Operating	**3.96**	**7.45**	**8.17**	**7.92**	**2.49**	**3.14**

3. Rating Factor for Maximum Shear at Support

$C=V_u$= 44.2 kips
V_{DC}= 0.13 kips
V_{DW}= 0.18 kips
$D=V_{DL}$= 0.31 kips

	TruckType	HS-20	Type 3	Type 3S2	Type3-3	Cat 740	Cat 740, unloaded
Capacity	C	44.2	44.2	44.2	44.2	44.2	44.2
Dead Load	D	0.31	0.31	0.31	0.31	0.31	0.31
Live Load	L+I	18.1	9.6	8.8	9.1	26.9	21.3
RF	**Inventory**	**1.11**	**2.10**	**2.30**	**2.23**	**0.75**	**0.95**
	Operating	**1.86**	**3.50**	**3.84**	**3.72**	**1.25**	**1.58**

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PROJECT: Holden Mine Bridges Load Rating JOB # 10177.01 DATE: 02/09/11
SUBJECT: Holden Village Vehicle Bridge BY: GenMiao Chen SHEET #

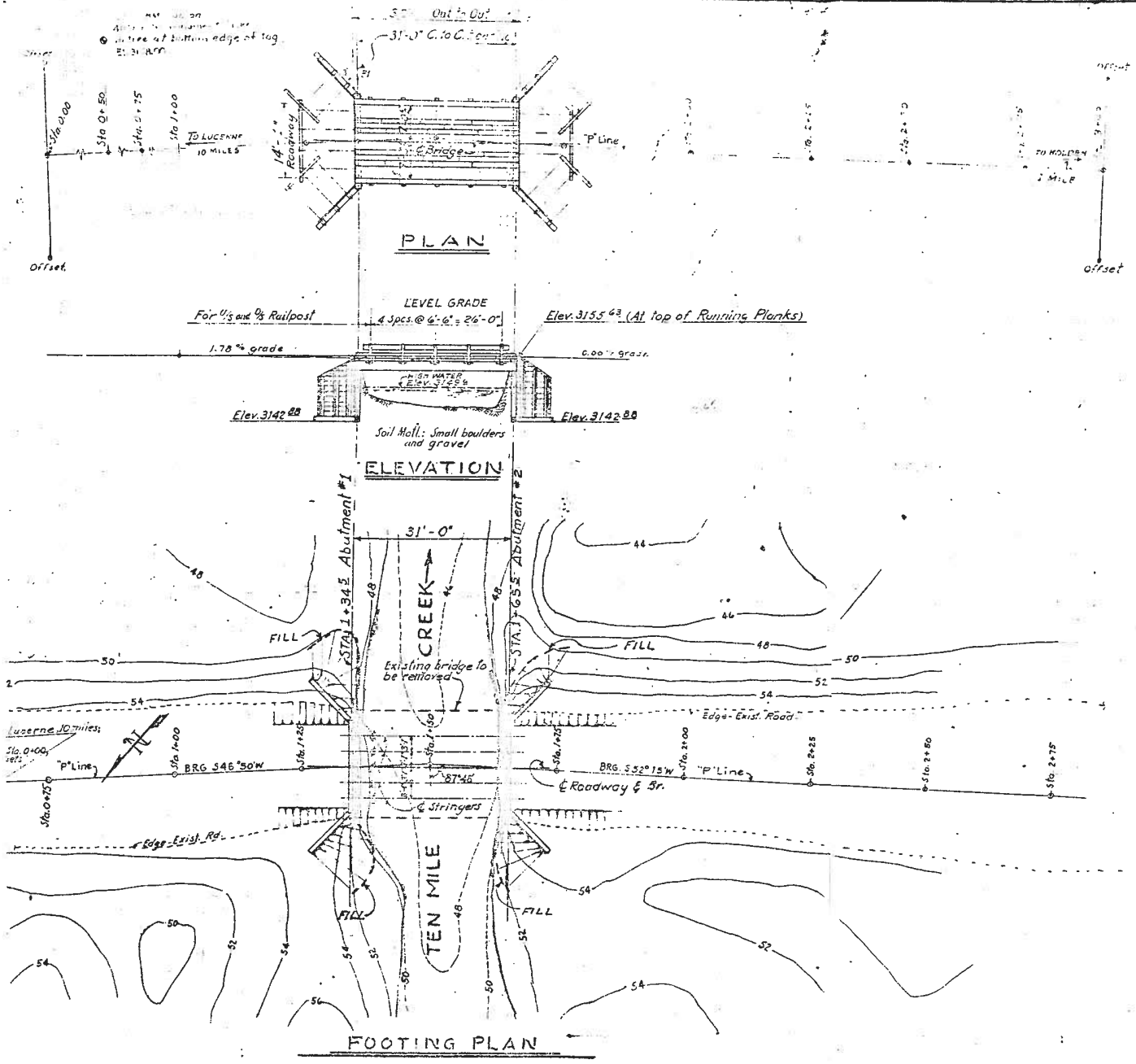
Rating Factor by Load Factor Method

4. Load Rating Factor Summary for W8x13 Stringer

	TruckType	HS-20	Type 3	Type 3S2	Type3-3	Cat 740	Cat 740, unloaded
	W, tons	36	25	36	40	80	36.5
Inventory	RF	**1.11**	2.10	2.30	2.23	**0.75**	**0.95**
	RT, tons	40	52	83	89	60	35
Operating	RF	**1.86**	3.50	3.84	3.72	**1.25**	**1.58**
	RT, tons	67	87	138	149	100	58

5. Appendix

5.a Ten Mile Creek Bridge As-Built Plans



GENERAL NOTES

Bridge Dimensions and Loading For This Site:
Abutment Height= 8'-7" Span Length= 31'-0"
Loading= H20-Sno-L**

CONSTRUCTION: U.S. Forest Service R6 Construction Detail Specification Item No's. 52, 202, 206 & 256.

ESTIMATED QUANTITIES

Item	Quantity
Excavation	154 Cu Yds
	1369 MBM
	0.495 MBM
256 Removal & Disposal of Existing Bridge	Lump Sum

† Includes all Stock Hardware Items

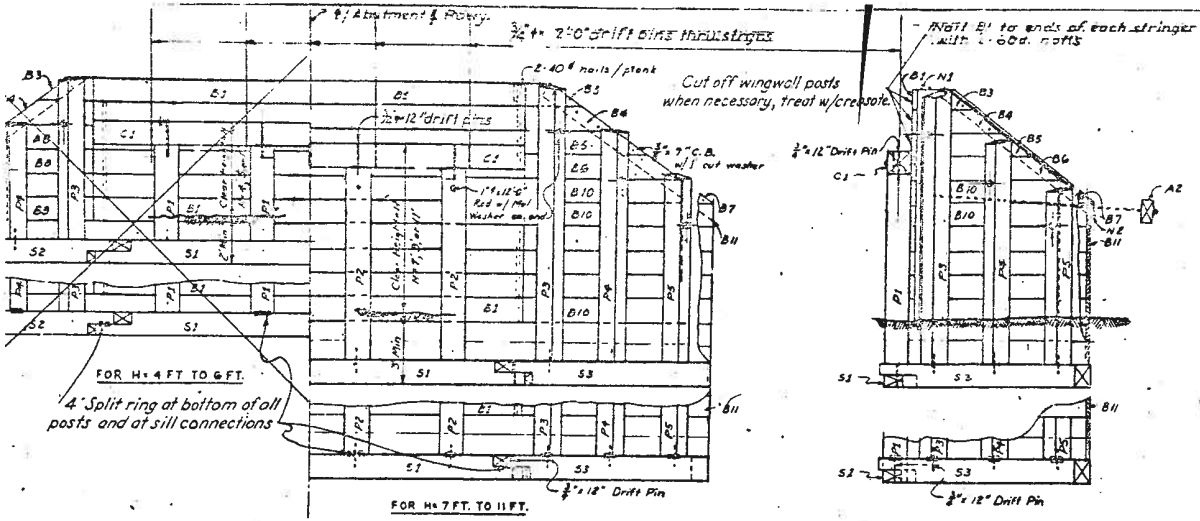
DRAWING # 31031

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
REGION SIX W. W. GANO, REGIONAL ENGINEER
WENATCHEE
NATIONAL FOREST
TEN MILE CREEK BRIDGE
SINGLE LANE LOADING H20-S16-L72
ROAD NO. 7137
GENERAL PLAN & ELEVATION
DESIGNED C.W.L. DRAWN W.A.C. TRACED
SCALE 1" = 10'-0"
APPROVED

BILL OF MATERIALS FOR SUPERSTRUCTURE
TREATED LUMBER

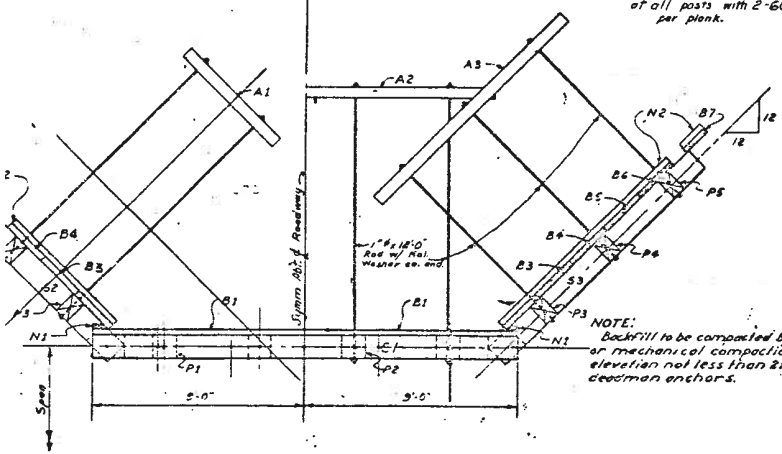
STRINGERS-RGH. | WHEEL GUARDS-S4S | FILL BLOCKS S4S DECK LUMBER-DRG RGH | POST | TOTAL QUANTITY | INTREATED "L"

| MARK | No. | LOADING H20-S16 | LOADING H20-S16 | LENGTH | No. | MARK | No. | MARK | No. | MARK

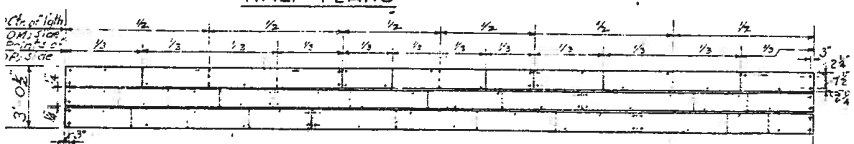


HALF ELEVATIONS

END VIEW



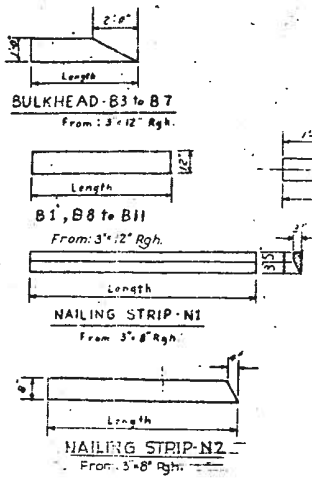
HALF PLANS

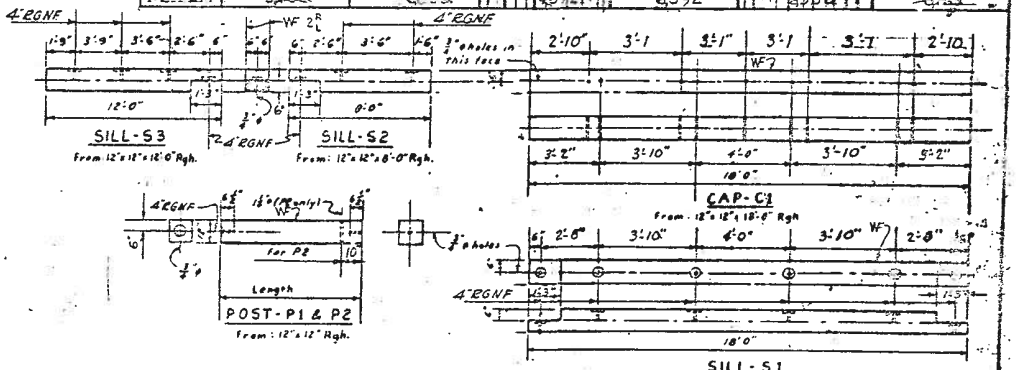


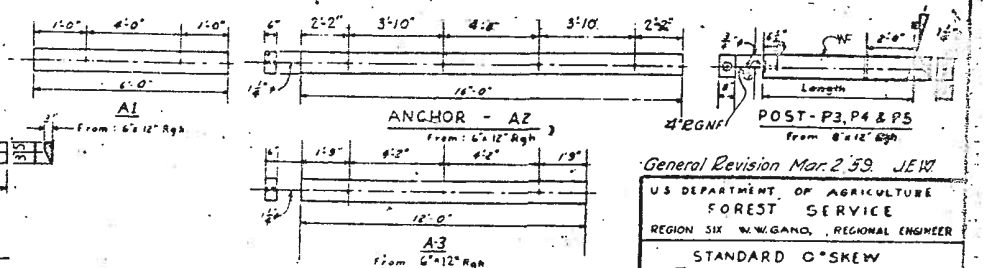
Use 4" x 12" Random Lengths – Untreated, Rough Plank = 32'-0" Total Length.
Drill 5/16" holes for 7/8" x 6" Iron Spikes (pairs). Stagger holes @ max. 3'-0" O.C. along nailing edge and two inches to ends. Kerf top & bot. sides as shown. Stagger joint positions by 2'-0" min.

RUNNING PLANK LAYOUT

Note: None







Working faces (Mk "WF") are to be used in laying off ℄ of holes.

4"RGNF = 4" Split ring groove - Near face

BILL OF MATERIALS FOR TWO ABUTMENTS

TREATED LUMBER FOR TWO ABUTMENTS (All rough unless shown otherwise)

PIECE MARK	GRADE PARA NO	H= 4 FT NO	SIZE	LENGTH	H= 7 FT NO	SIZE	LENGTH	H= 11 FT NO	SIZE	LENGTH
S1		2	12"x12"	16'-0"	2	12"x12"	16'-0"	2	12"x12"	16'-0"
C1	"	2	12"x12"	18'-0"	2	12"x12"	18'-0"	2	12"x12"	18'-0"
S2	"	4	12"x12"	8'-0"	4	12"x12"	8'-0"	4	12"x12"	8'-0"
S3	"							4	12"x12"	12'-0"
P2	"							8	12"x12"	8'-0"
P1	"	8	12"x12"	4'-0"	8	12"x12"	5'-0"			
P3	124b	4	8"x12"	7'-0"	4	8"x12"	8'-0"	4	8"x12"	11'-7"
P4	"	4	8"x12"	5'-3"	4	8"x12"	6'-3"	4	8"x12"	9'-10"
P5	"							4	8"x12"	8'-0"
A1		4	6"x12"	6'-0"	4	6"x12"	6'-0"			
A2								2	6"x12"	16'-0"
A3								4	6"x12"	12'-0"
B1	123b	16	3"x12"	10'-0"	16	3"x12"	18'-0"	24	3"x12"	18'-0"
B3	"	4	3"x12"	4'-0"	4	3"x12"	4'-0"	4	3"x12"	4'-0"
B4	"	4	3"x12"	6'-0"	4	3"x12"	6'-0"	4	3"x12"	6'-0"
B5	"							4	3"x12"	8'-0"
B6	"							4	3"x12"	10'-0"
B7	"									
B8	"	20	3"x12"	6'-0"	24	3"x12"	6'-0"			
B9	"									
B10	"							32	3"x12"	10'-0"
B11	"									
N1	"	4	3"x8"	6'-0"	4	3"x8"	7'-0"	6	3"x8"	11'-9"
N2	"	4	3"x8"	2'-10"	4	3"x8"	2'-10"	6	3"x8"	9'-2"
TOTAL FBM		3,264			5,022			6,392		

PIECE MARK	GRADE PARA NO	H= 11 FT NO	SIZE	LENGTH
S1		2	12"x12"	16'-0"
C1	"	2	12"x12"	18'-0"
S2	"	4	12"x12"	8'-0"
S3	"	4	12"x12"	12'-0"
P2	"	8	12"x12"	8'-0"
P1	"			
P3	124b	4	8"x12"	15'-0"
P4	"	4	8"x12"	13'-11"
P5	"	4	8"x12"	11'-3"
A1				
A2		2	6"x12"	16'-0"
A3		4	6"x12"	12'-0"
B1	123b	80	3"x12"	18'-0"
B3	"	4	3"x12"	4'-0"
B4	"	4	3"x12"	6'-0"
B5	"	4	3"x12"	8'-0"
B6	"	4	3"x12"	10'-0"
B7	"	4	3"x12"	12'-0"
B8	"			
B9	"			
B10	"			
B11	"	40	3"x12"	18'-0"
N1	"	4	3"x8"	15'-0"
N2	"	4	3"x8"	11'-9"
TOTAL FBM				

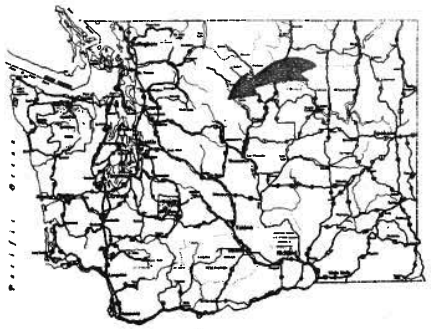
General Revision Mar. 2 '59 JEW

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
REGION SIX W.W. GANG, REGIONAL ENGINEER

STANDARD 0° SKEW
TEN MILE CREEK BRIDGE
TREATED TIMBER ABUTMENT
(FOR 16FT ROADWAY)
CLEAR HEIGHTS 4 FT. TO 11 FT.

Designed [illegible] Drawn W.P.S. Checked W.B.H.
Scale: As Noted Checked [illegible]

5.b Railroad Creek Bridge As-Built Plans



KEY MAP OF WASHINGTON SHOWING LOCATION OF PROJECT

UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE — REGION SIX

WENATCHEE NATIONAL FOREST

CHELAN RANGER DISTRICT

PLANS FOR PROPOSED

RAILROAD CR. BRIDGE & APPROACHES

PROJECT NAME

PROJECT NUMBER 3100-0.1

PROJECT LENGTH 0.1 MILES

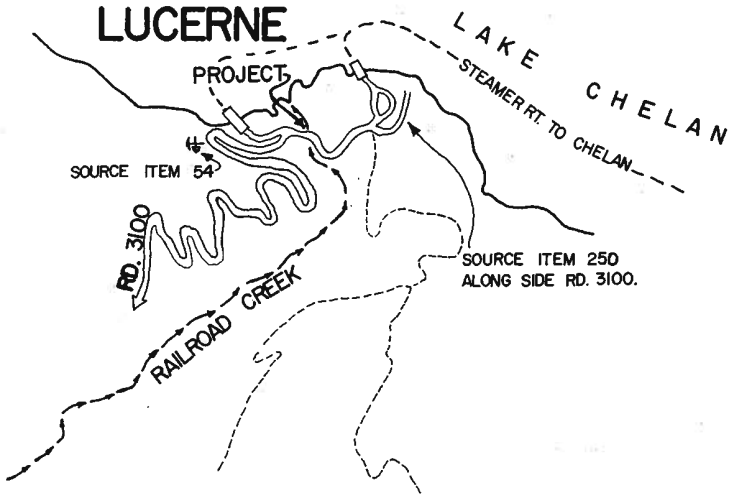
TYPE OF WORK CONSTRUCTION

TIMBER SALE NAME

PLAN NO. W-70-62

INDEX TO SHEETS	
NO.	DESCRIPTION
1	TITLE
2	GENERAL PLAN & ELEV.
3-4	PIER & SUPERSTRUCTURE DETAILS
5	APPROACH, PLAN & PROFILE

SCALES:	PLAN	PROFILE
ORIGINAL	1" = 100'	1" = 100' HORIZ. & 10' VERT.
REDUCED	1" = 200'	1" = 200' HORIZ. & 20' VERT.



LEGEND

- Paved Highway
- Gravel Surfaced Road
- Project Location
- Non Surfaced Road
- Other Proposed Projects

VICINITY MAP

0 1/8 1/4 1/2 1

SCALE IN MILES

RECOMMENDED:

DISTRICT ENGR. ASST. DATE 9/17/70

Harold D. Hostin act. 9/17/70

DISTRICT RANGER DATE

REVIEWED:

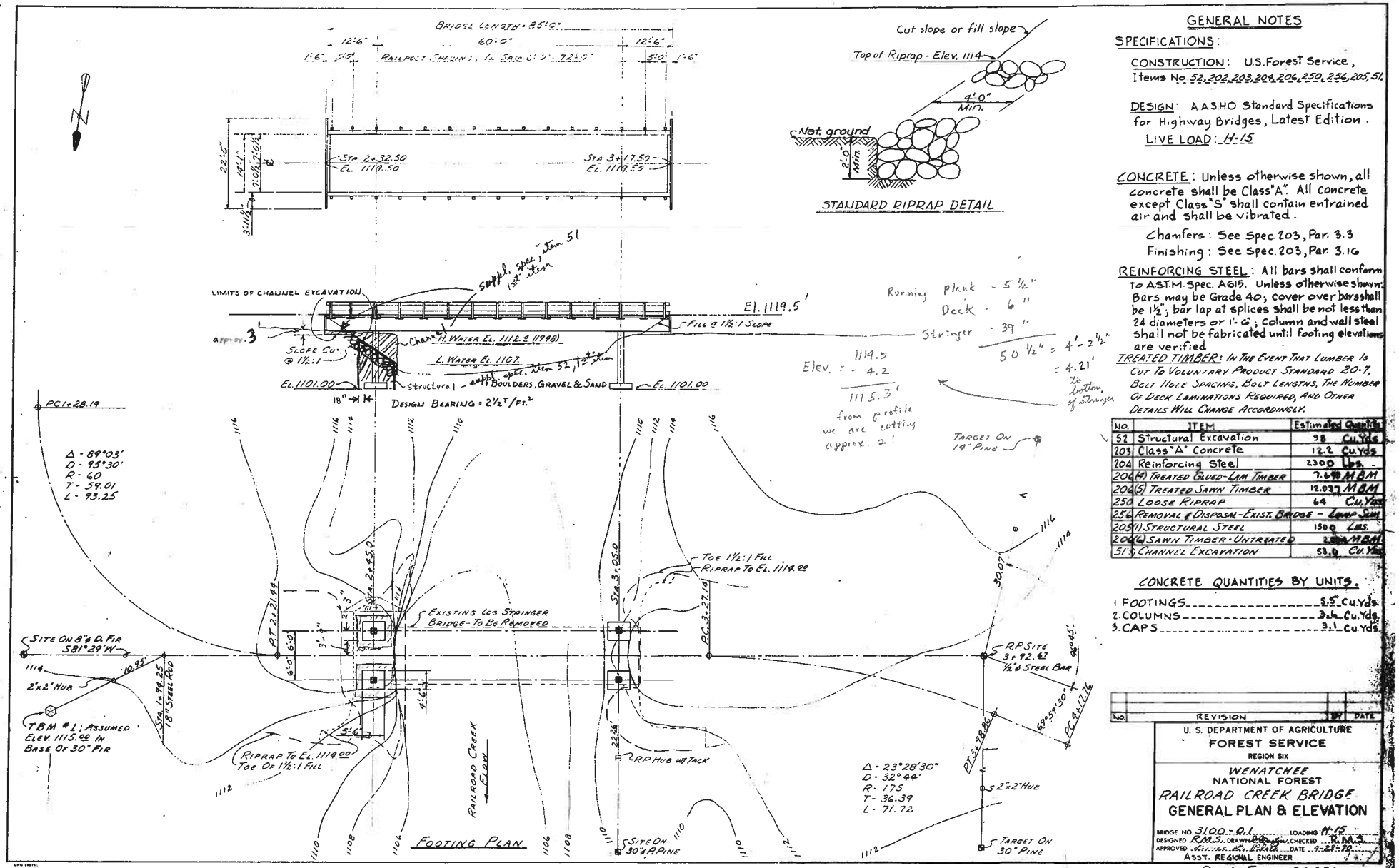
ENGR. STAFF OFFICER 9/23/70 DATE

APPROVED:

FOREST SUPERVISOR 9/23/70 DATE

R6-5610-42a Rev. Dec. 1962

GPO 999342



GENERAL NOTES

SPECIFICATIONS:

CONSTRUCTION: U.S. Forest Service, Items No. 52, 202, 203, 204, 206, 250, 256, 205, 51.

DESIGN: AASHO Standard Specifications for Highway Bridges, Latest Edition.

LIVE LOAD: H-15

CONCRETE: Unless otherwise shown, all concrete shall be Class "A". All concrete except Class "S" shall contain entrained air and shall be vibrated.

Chamfers: See Spec. 203, Par. 3.3

Finishing: See Spec. 203, Par. 3.16

REINFORCING STEEL: All bars shall conform to A.S.T.M. Spec. A615. Unless otherwise shown: Bars may be Grade 40; cover over bars shall be 1½"; bar lap at splices shall be not less than 24 diameters or 1'-6"; column and wall steel shall not be fabricated until footing elevations are verified.

TREATED TIMBER: In the event that lumber is cut to voluntary product standard 20-7, bolt hole spacing, bolt lengths, the number of deck laminations required, and other details will change accordingly.

No.	ITEM	Estimated Quantity
52	Structural Excavation	98 Cu. Yds.
203	Class "A" Concrete	12.2 Cu. Yds.
204	Reinforcing Steel	2300 Lbs.
206 (H)	Treated Glued-Lam Timber	7.6 M BM
206 (S)	Treated Sawn Timber	12.0 M BM
250	Loose Riprap	64 Cu. Yds.
256	Removal & Disposal - Exist. Bridge	Lump Sum
205 (1)	Structural Steel	1500 Lbs.
206 (U)	Sawn Timber - Untreated	2.8 M BM
51 S	Channel Excavation	53.0 Cu. Yds.

CONCRETE QUANTITIES BY UNITS.

1. FOOTINGS ..... 5.5 Cu. Yds.
2. COLUMNS ..... 3.4 Cu. Yds.
3. CAPS ..... 3.1 Cu. Yds.

No.	REVISION	BY	DATE

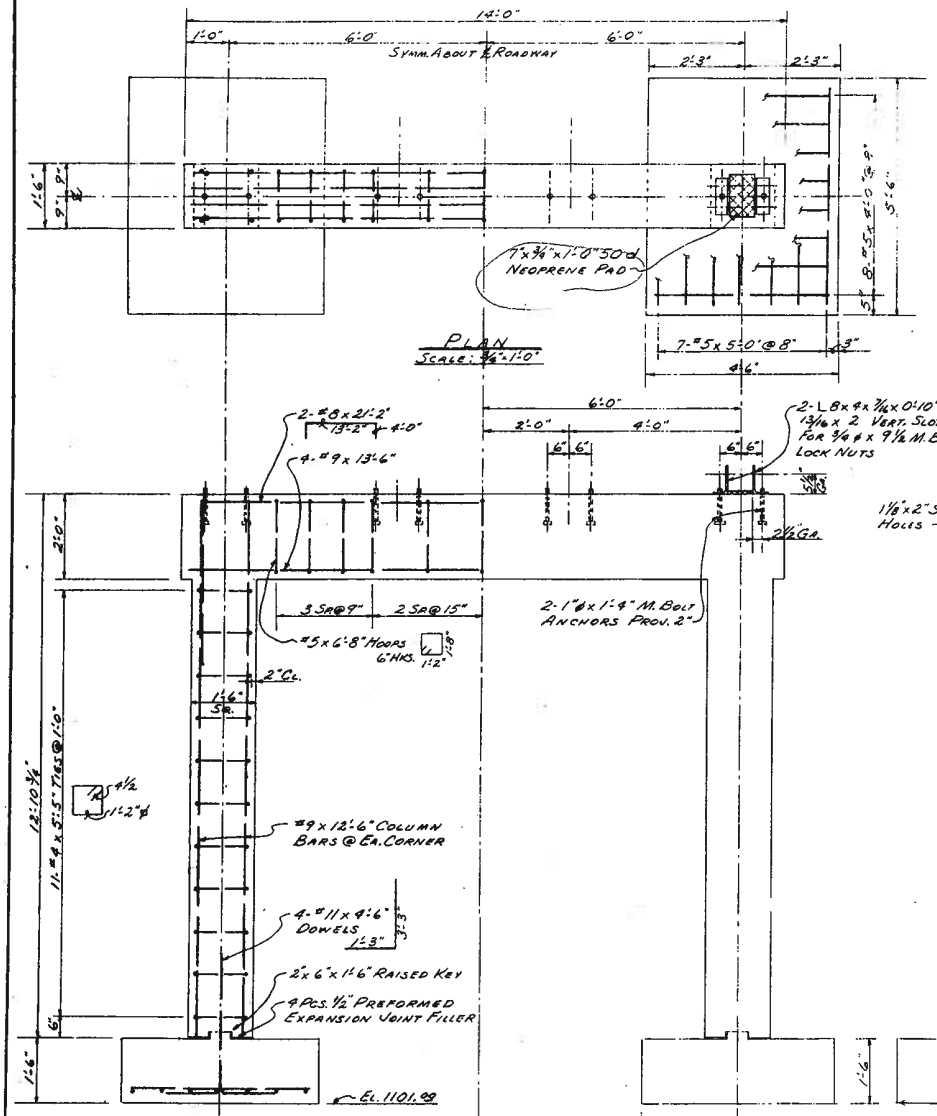
U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
REGION SIX

WENATCHEE NATIONAL FOREST

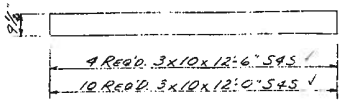
RAILROAD CREEK BRIDGE
GENERAL PLAN & ELEVATION

BRIDGE NO. 3100-0.1 LOADING H-15
DESIGNED R.M.S. DRAWN [illegible] CHECKED R.M.S.
APPROVED [illegible] DATE 9-28-70
ASST. REGIONAL ENGINEER

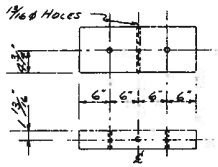
SHEET 2 of 5 R-33491



★ Number Of Deck Laminations Calculated At 6.4/Ft. +1% Extra



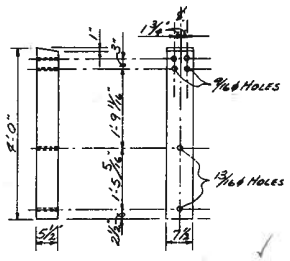
RAILING



30 Req'd. 9 x 10 x 2'-0" S4S As Shown - Bottom Fill Block

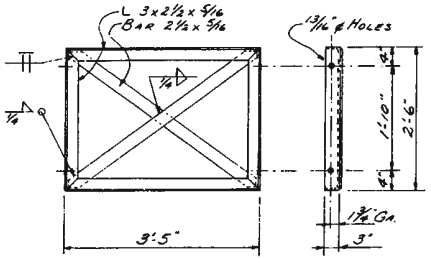
30 Req'd. 4 x 10 x 2'-0" S4S Omit ℄ Horiz. Hole - Top Fill Block

FILL BLOCKS



30 Req'd. 6 x 8 x 4'-0" S4S

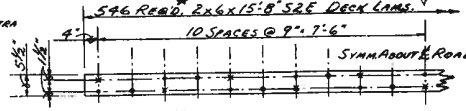
RAILPOST



9 Ass'y Req'd.

DIAPHRAGM

5 @ 5'-6" x 2'-6" x 2" 52E Deck Lams. ✓



Nailing Sequence - Toenail Alternate Lams To Each Girder With 2-20d Galv. Nails. Lams To Be Nailed In Series Of 3 Lams In The Following Order, With 30d Galv. Nails; • = Nail In First Lam, o = 2nd Lam, x = 3rd Lam

DECK LAMINATIONS

SPECIFICATIONS:

GLUED-LAMINATED TIMBER Shall Conform In All Respects To The Requirements Of "Standard Specifications For Structural Glued-Laminated Douglas Fir (Coast Region) Timber," Latest Edition, Issued By The West Coast Lumber Inspection Bureau, And To U. S. Commercial Standard C.S 253, Latest Edition. Stresses Are 2000 f For Wet Condition Of Use With Industrial Appearance Grade, Except That Knotholes Or Loose Knots In Excess Of 2" Dia. Shall Be Replaced With Interlocking Wood Patches Or Filler As Designated In Item 206. Resorcinol Or Phenol-Resorcinol Types Of Adhesives Conforming To C.S 253 Shall Be Used In All Joints. Members Shall Have An A.I.T.C. Quality Mark And An American Institute Of Timber Construction Certificate Of Conformance.

SAWN LUMBER Shall Be Douglas Fir, Coast Region, Construction Grade, Except Railing, And Graded According To Par. 123-b, 124-b And 125-b Of The "Standard Grading And Dressing Rules No. 15" Of West Coast Lumber Inspection Bureau. Lumber 3" Thick And Over Shall Be Incised. Railing Shall Be Select Structural Graded As Per W.C.L.I.B. Par. 123-a.

TREATMENT: Railings Shall Be Treated As Per Spec. Item No. 202, Par. 3.15. All Other Lumber, Except Running Planks, Shall Be Pressure Treated With Pentachlorophenol Or ~~50/50 Creosote~~ - Petroleum Solution As Per Spec. Item No. 206. Incising And Painting Of Railings Is Omitted. Supp. Spec.

STRUCTURAL STEEL Shall Conform To A.S.T.M. Spec. A36. Fabrication And Welding Shall Conform To A.A.S.H.O. Std. Spec's. For Highway Bridges, Section 10, And American Welding Society Spec's. For "Welded Highway And Railway Bridges," Latest Editions.

GALVANIZING: Hardware Shall Be Galvanized In Accordance With A.S.T.M. Spec. A153. Structural Steel To Be Galvanized As Per A.S.T.M. Spec. A123.

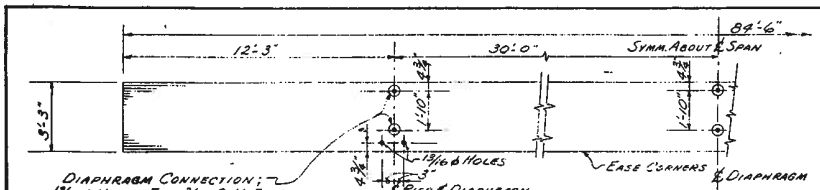
U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
REGION SIX
WENATCHEE
NATIONAL FOREST

RAILROAD CREEK BRIDGE
PIER & SUPERSTRUCTURE DETAILS

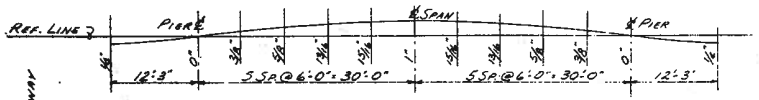
BRIDGE NO. 3100-Q.1 LOADING H-15
DESIGNED R.M.S. DRAWN [illegible] CHECKED R.M.S.
APPROVED [illegible] DATE 7-6-71
BRIDGE ENGINEER

SHEET 3 of 5 R-[illegible]2

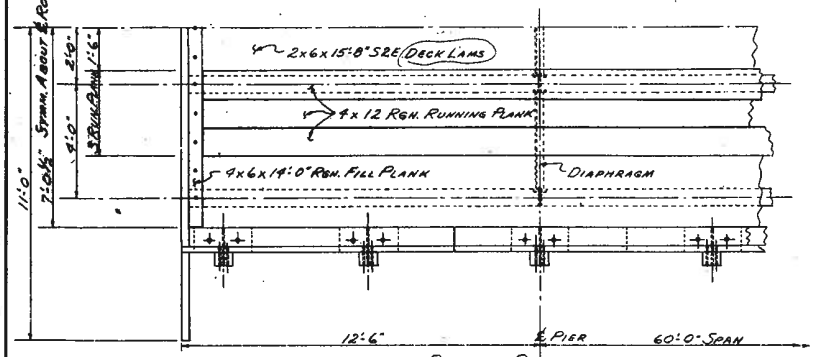
✓ on Bill of Mat'ls.



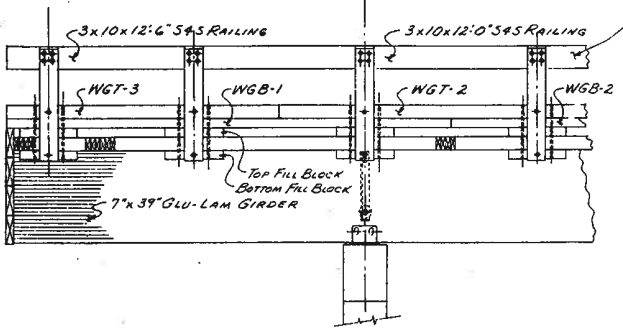
HALF ELEVATION: GLU-LAM GIRDER
SCALE: NONE



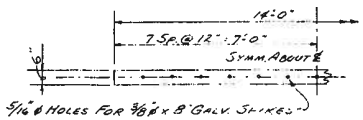
CAMBER DIAGRAM: GLU-LAM GIRDER



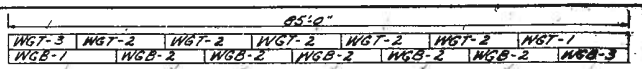
PARTIAL PLAN
SCALE: 1½"=1'-0"



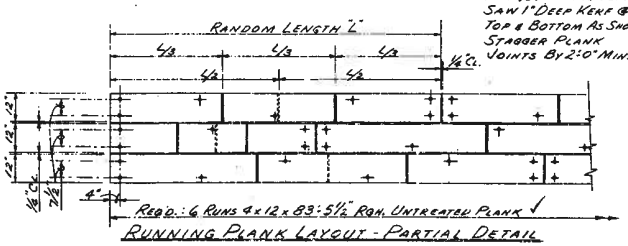
PARTIAL ELEVATION
SCALE: ½"=1'-0"



2 REQ'D.: 9"x6"x19'-0" RGH.
FILL PLANK

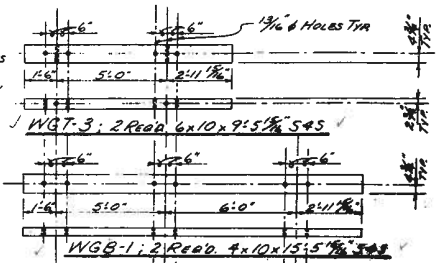


WHEELGUARD PLACEMENT-ELEVATION

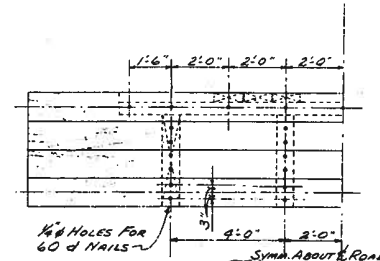


REQ'D.: 6 RUNS 9"x12"x83'-5½" RGH. UNTREATED PLANK
RUNNING PLANK LAYOUT - PARTIAL DETAIL

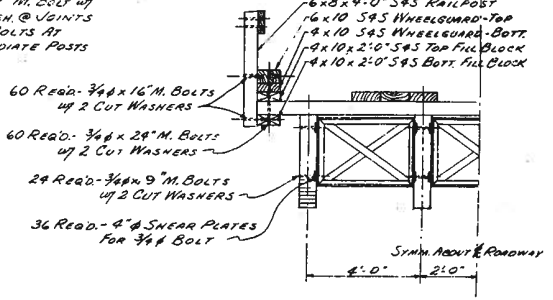
RUNNING PLANK NOTE:
2 HOLES EA. END PLUS STAGGERED HOLES AT 3'-0" MAX., 5/16 ø HOLES FOR 3/8 ø x 8 GALV. SPIKES SAW 1" DEEP KERF @ TOP & BOTTOM AS SHOWN STAGGER PLANK JOINTS BY 2'-0" MIN.



WHEELGUARD DETAILS
SCALE: 3/4"=1'-0"



HALF END ELEVATION
SCALE: ½"=1'-0"



HALF CROSS SECTION
SCALE: ½"=1'-0"

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
REGION SIX

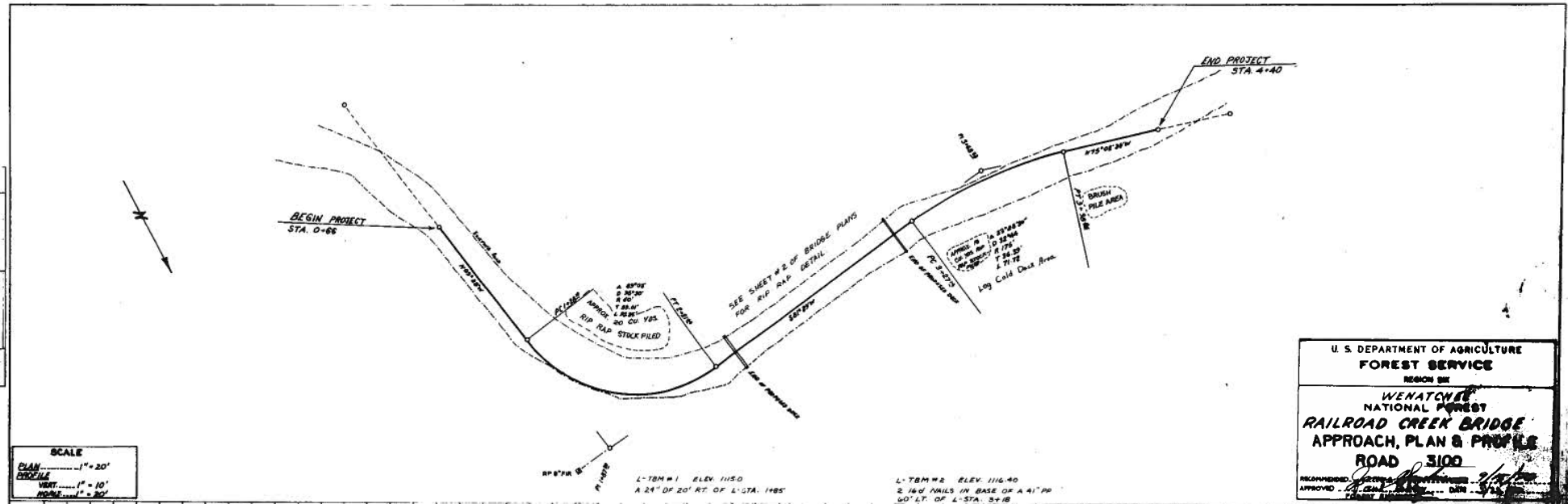
WENATCHEE
NATIONAL FOREST

RAILROAD CREEK BRIDGE
SUPERSTRUCTURE SECTIONS & DETAILS

BRIDGE NO. 3100:Q:1 LOADING H-15
DESIGNED R.M.S. DRAWN BY [illegible] CHECKED R.M.S.
APPROVED [illegible] DATE 8-6-70
BRIDGE ENGINEER

SHEET 4 of 5 R-33433

✓ on Bill of Mats.



SCALE
PLAN ..... 1" = 20'
PROFILE
VERT. ..... 1" = 10'
HORIZ. ..... 1" = 20'

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
REGION SIX
WENATCHEE NATIONAL FOREST
RAILROAD CREEK BRIDGE
APPROACH, PLAN & PROFILE
ROAD 3100
RECOMMENDED ..... DIST. RANGER
APPROVED ..... FOREST SUPERVISOR

TYPICAL GRADING SECTION

NOTES:

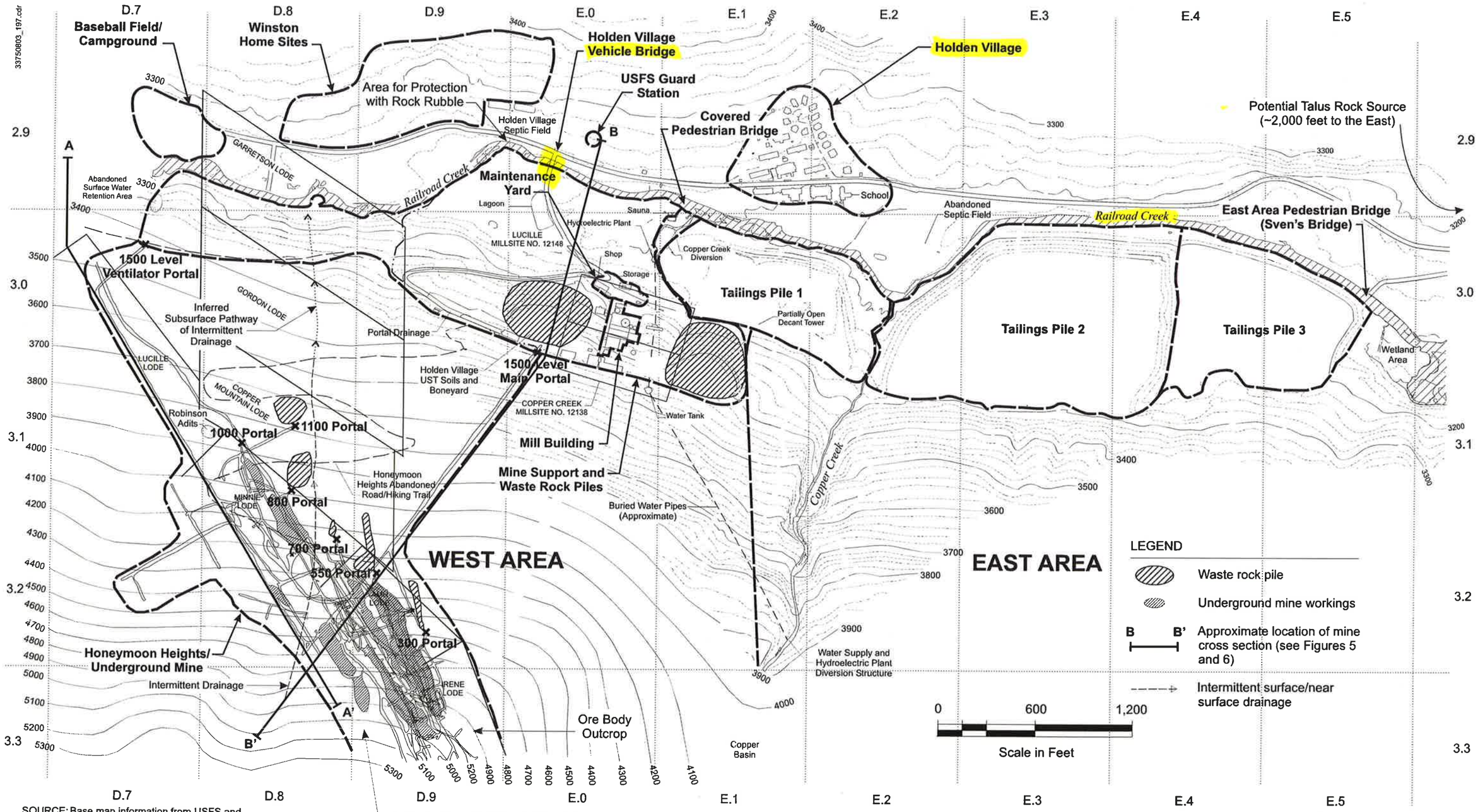
1. BEARINGS MAGNETIC TO 92 DEG. WEST AND ROAD RUNS ON AN EXTENSIVE FILL.
2. BORROW PIT MAP:
BEGIN AT 1.2 MILE SIGNED STATION APPROXIMATELY 2.8 MILES FROM SITE AND PICK UP RIP RAP ALONG MAIN ROAD GOING WEST FOR .10 MI. OR TO THE TURNING BLOCK WELL MARKED PIT.

K&E PLATE 1, PLAN-PROFILE

SHEET 5 OF 5

5.c Holden Village Vehicle Bridge As-Built Plans

33750803_197.cdr



SOURCE: Base map information from USFS and Washington DNR, DEM CD ROM

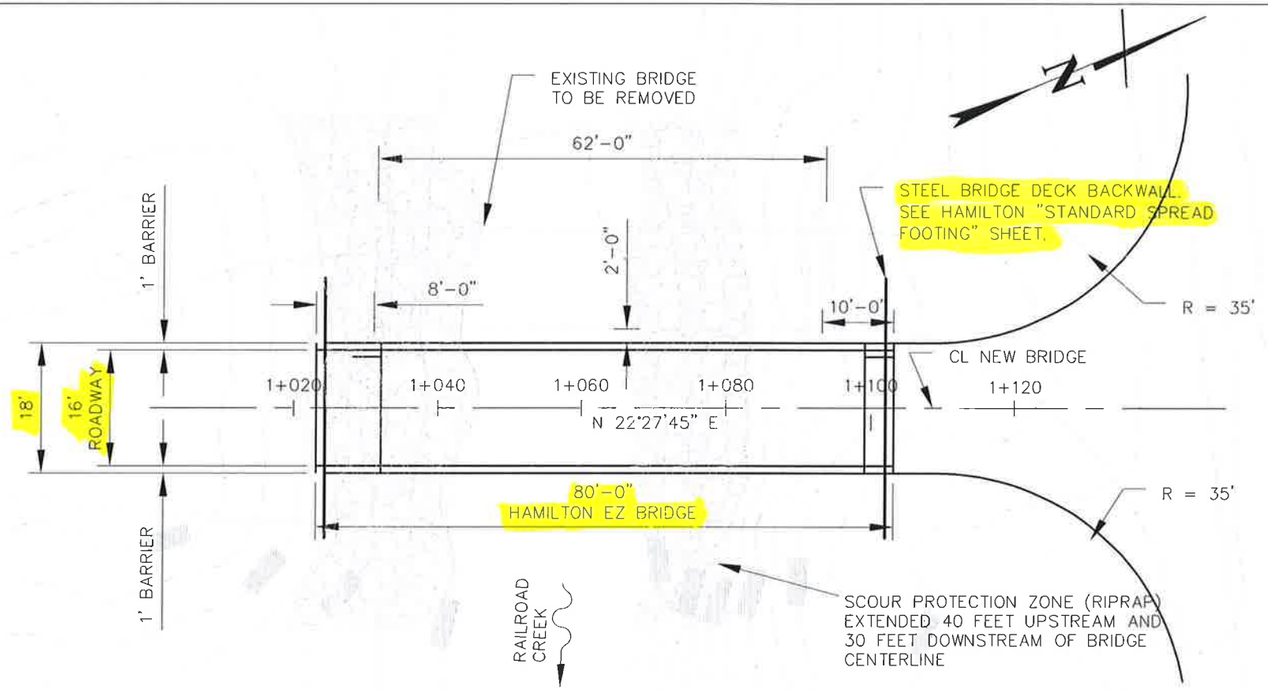
Reflects the collective extent of the 300, 550, 700, 000, 1000, 1100, 1500, and 2325-levels of the underground mine.

Job No. 33750803

Figure 1

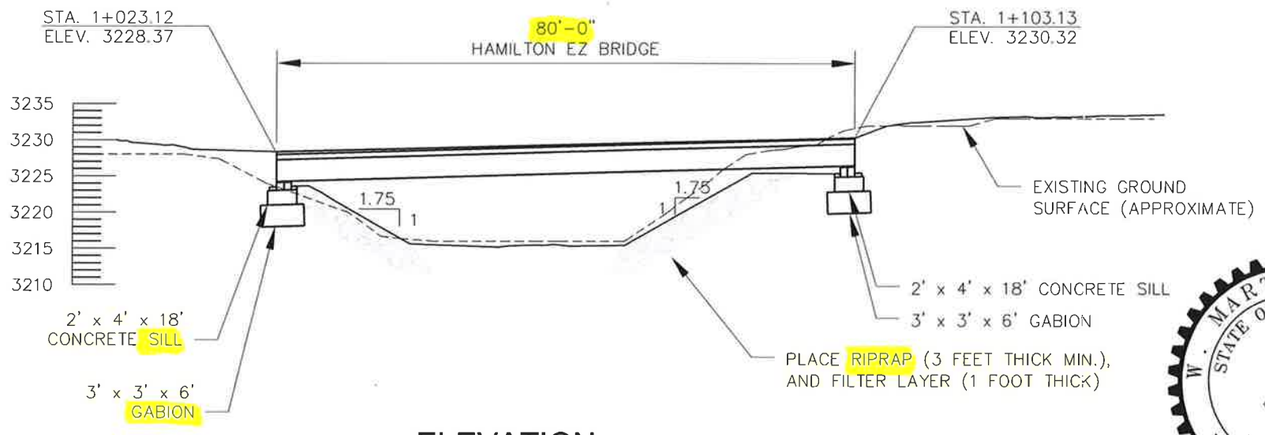
Holden Mine Site Map with Principal Underground Mine Workings

URS



PLAN

SCALE: 1" = 20'



ELEVATION

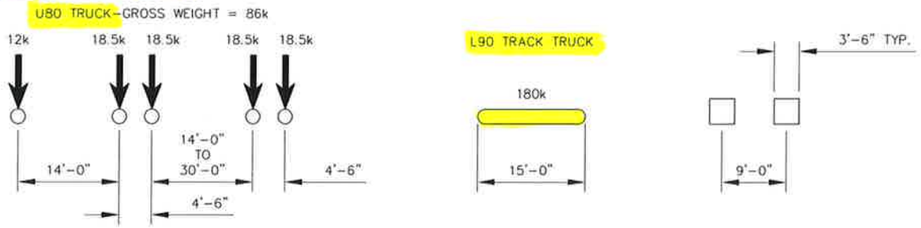
SCALE: 1" = 20'

ALIGNMENT CONTROL		
STATION	NORTHING	EASTING
1+000	437514.0	1653155.6
1+149.3	437651.9	1653212.7

NOTES:

ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE STATE OF WASHINGTON, DEPARTMENT OF TRANSPORTATION, STANDARD SPECIFICATIONS FOR ROAD, BRIDGE AND MUNICIPAL CONSTRUCTION.

THE BRIDGE SHALL BE A HAMILTON STANDARD BRIDGE CONFIGURATION U80/L-90/U-102 WITH A TREATED WOOD DECK.



INFORMATION ON PREFABRICATED BRIDGE DECK, SUPPORT GIRDERS AND CONNECTIONS SHALL BE TAKEN FROM HAMILTON SHOP DRAWINGS.

ABUTMENT FOOTING CONCRETE SHALL BE 4000 PSI MINIMUM 28-DAY COMPRESSIVE STRENGTH (CLASS 4000).

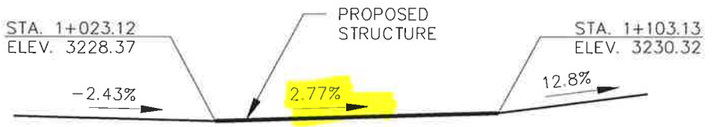
ABUTMENT FOOTING REINFORCING BARS SHALL BE ASTM A706, fy=60000PSI.

FIELD VERIFY HORIZONTAL AND VERTICAL ALIGNMENT TO MATCH ESTABLISHED USGS 1929 VERTICAL DATUM. A BENCHMARK IS LOCATED AT HOLDEN VILLAGE.

TOPOGRAPHIC CONTOURS WERE OBTAINED FROM AERIAL PHOTOGRAPHS AND SHOULD BE CONSIDERED APPROXIMATE.

HYDRAULIC DATA		
DISCHARGE	2693 cfs	–
RECURRENCE INTERVAL	50 years	100 years
HW ELEVATION	–	3220 ft

INFORMATION ON BASE AND FLOOD FLOW QUANTITIES AND FLOWS SHALL BE TAKEN FROM URS HYDRAULICS/HYDROLOGY DESIGN MEMORANDUM DATED MAY 12, 2004 (BASED ON DATA FROM DRAFT FINAL REMEDIAL INVESTIGATION REPORT, HOLDEN MINE SITE, JULY 28, 1999 BY DAMES AND MOORE).



GRADELINE DIAGRAM

SCALE: NTS

MARTIN MCCABE
STATE OF WASHINGTON
00000
REGISTERED
PROFESSIONAL ENGINEER
EXPIRES: / /

0 20 FEET 40

HORIZONTAL SCALE
VERTICAL SCALE = 1:1 HORIZ. SCALE
GROUND SURFACE APPROXIMATE

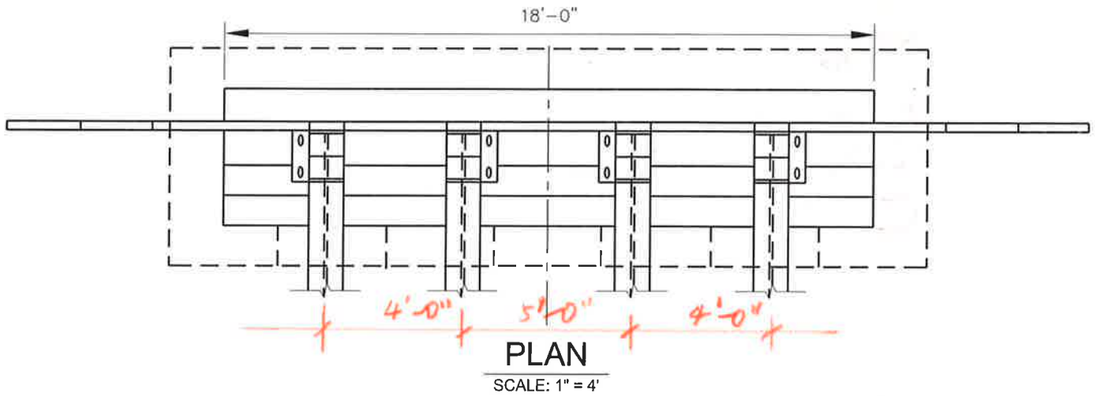
FIGURE 2: BRIDGE PLAN AND ELEVATION

JUNE 13, 2004
33750803

HOLDEN SITE
HOLDEN VILLAGE, WA

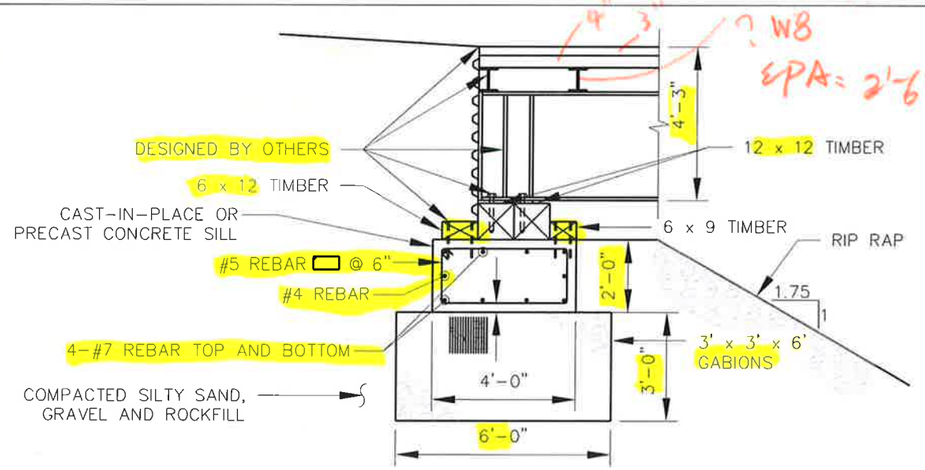
URS

I:\WM&RD\HOLDEN\2004 Bridge Work\holdencontours2.dwg Jul 28, 2004 - 2:33pm



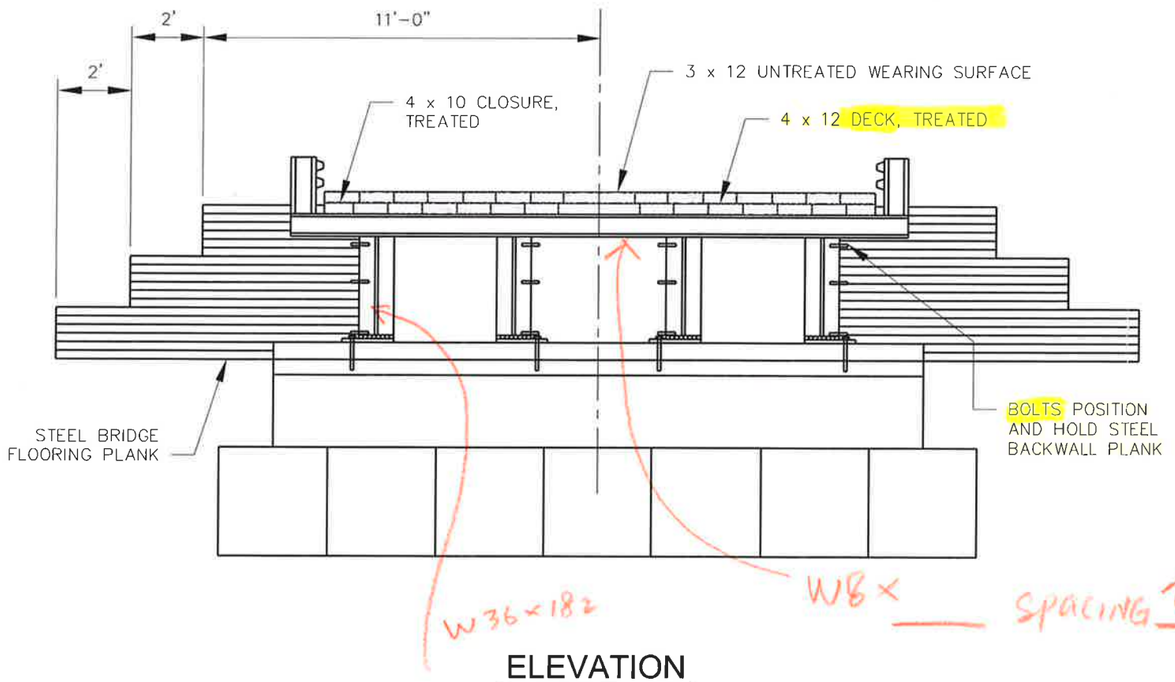
PLAN

SCALE: 1" = 4'



TYPICAL ABUTMENT SECTION

SCALE: 1" = 4'



ELEVATION

SCALE: 1" = 4'

NOTES:

SOIL ALLOWABLE BEARING PRESSURE IS 8000 PSF ON NATIVE SILTY GRAVELLY SAND, OR COMPACTED ROCKFILL ON APPROVED SUBGRADE, OR GABION WALL. FINE GRAINED SILT OR CLAY PRESENT AT THE SUBGRADE LEVEL FOR THE FOOTINGS OR GABION WALL SHALL BE OVEREXCAVATED AND REPLACED WITH GRANULAR COMPACTED FILL AS INDICATED BY THE ENGINEER.

INFORMATION REGARDING ABUTMENT SUBSURFACE CONDITIONS, SUBGRADE PREPARATION, FILL MATERIALS AND PLACEMENT, GABION WALLS AND SLOPES AND OTHER GEOTECHNICAL ISSUES SHALL BE TAKEN FROM URS GEOTECHNICAL DESIGN MEMORANDUM DATED MAY 10, 2004.

GABIONS SHALL BE CONSTRUCTED AND PLACED PER WSDOT STANDARD PLAN D-6, AND WSDOT STANDARD SPECIFICATION 9-27.3 GABION CRIBBING. GABION BASKETS SHALL BE GALVANIZED FOR CORROSION RESISTANCE.

BACKFILL BEHIND GABIONS WITH NATIVE MATERIAL WITH NOT LESS THAN 75% ROCK, WITH DIMENSIONS NOT EXCEEDING 15" IN DIAMETER. BACKFILL LIFTS ARE NOT TO EXCEED 24", AND SHALL BE COMPACTED BY THE HAULING AND PLACING EQUIPMENT.

RIP RAP MATERIAL SHALL BE PER WSDOT 9-13.1(2) LIGHT LOOSE RIPRAP OR EQUIVALENT, PLACED TO LINE AND GRADE SHOWN ON DRAWINGS OR AS OTHERWISE DIRECTED IN THE FIELD BY THE ENGINEER.

FIGURE 3: ABUTMENT DETAILS

URS

MARTIN MCCABE — STATE OF WASHINGTON — 00000 — REGISTERED PROFESSIONAL ENGINEER

EXPIRES: / /

JULY 12, 2004
33750803

HOLDEN SITE
HOLDEN VILLAGE, WA

I:\WA&RD\HOLDEN\2004 Bridge Work\holden2.dwg Jul 28, 2004 - 2:32pm

5.d Vehicle Configurations

6B.7.2.2—Truck Loads

The live or moving loads to be applied on the deck for determining the rating should be the Standard AASHTO "HS" loading.

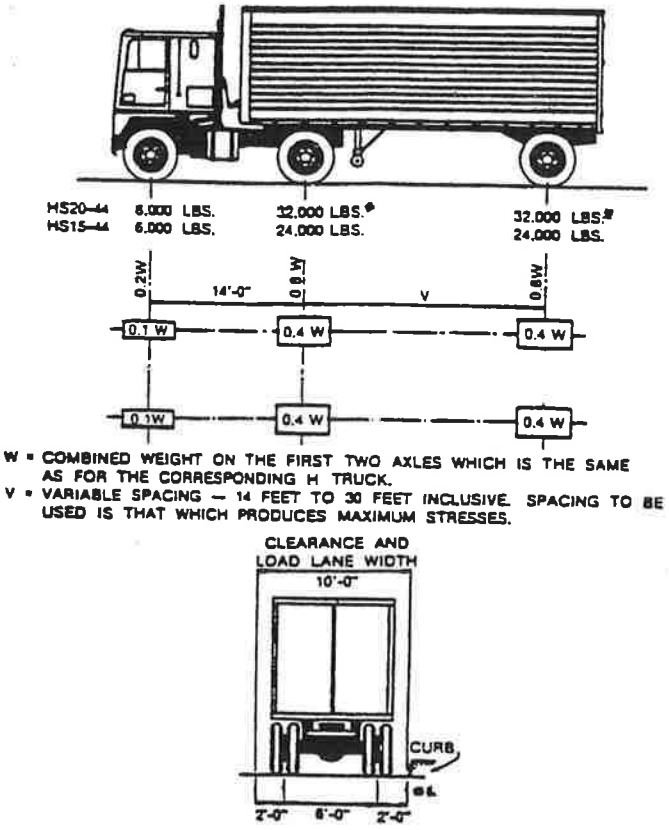
The number of traffic lanes to be loaded, and the transverse placement of wheel lines should be in conformance with the current AASHTO Standard Specifications and the following:

Roadway widths from 18 to 20 ft should have two design lanes, each equal to one-half the roadway width. Live loadings should be centered in these lanes. Roadway widths less than 18 ft should carry one traffic lane only.

When conditions of traffic movements and volume would warrant it, fewer traffic lanes than specified by AASHTO may be considered.

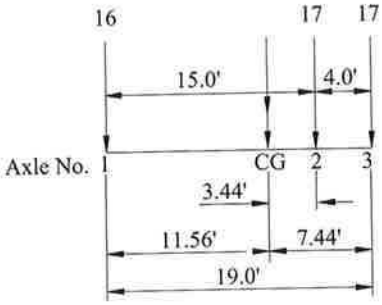
C6B.7.2.2

The probability of having a series of closely spaced heavy vehicles of the maximum allowable weight becomes greater as the maximum allowed weight for each unit becomes less. That is, it is more likely to have a train of light-weight vehicles than to have a train of heavy-weight vehicles. This makes it necessary to consider more than one vehicle in the same lane under some conditions. For example, vehicles should be spaced at distances of 30 ft clear or more in the same lane to produce maximum load effect when the safe loading per vehicle or vehicle combinations is less than 12 tons.



*In the design of timber floors and orthotropic steel decks (excluding transverse beams) for HS20 loading, one-axle load of 24,000 pounds or two-axle loads of 16,000 pounds each, spaced 4 feet apart may be used, whichever produces the greater stress, instead of the 32,000-pound axle shown.

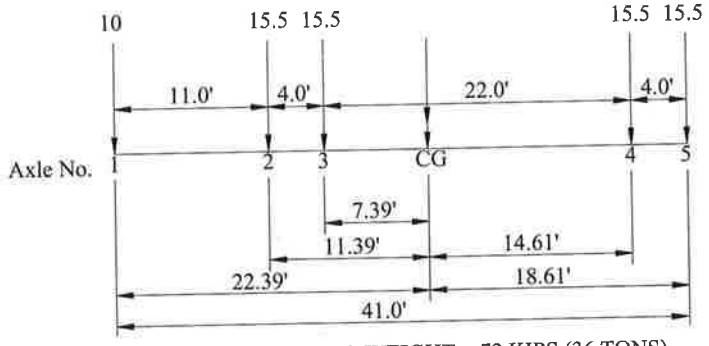
Figure 6B.7.2-1—Standard HS Truck



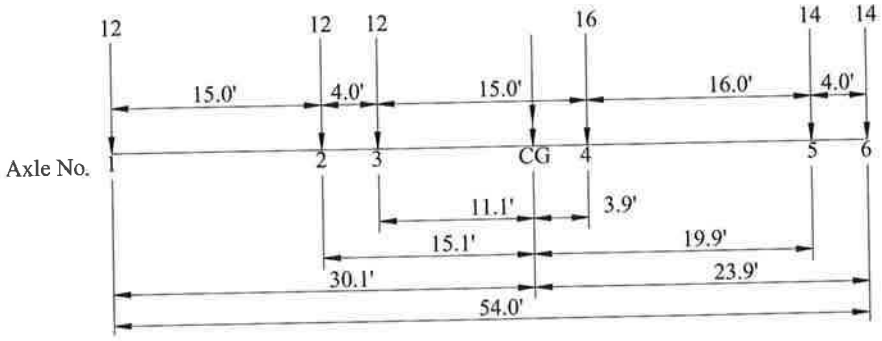
INDICATED CONCENTRATIONS ARE AXLE LOADS IN KIPS

CG=CENTER OF GRAVITY

TYPE 3 UNIT WEIGHT = 50 KIPS (25 TONS)



TYPE 3S2 UNIT WEIGHT = 72 KIPS (36 TONS)



TYPE 3-3 UNIT WEIGHT = 80 KIPS (40 TONS)

Figure 6B.9.2-1—Typical Legal Loads Used for Posting

740
Articulated Truck

CATERPILLAR®

Engine		
Engine Model	Cat® C15 ACERT™	
Gross Power – SAE J1995	350 kW	469 hp
Net Power – SAE J1349	338 kW	453 hp

Weights		
Rated Payload	39.5 tonnes	43.5 tons
Body Capacities		
Heaped SAE 2:1	24 m^3	31.4 yd^3

740 Articulated Truck Specifications

Engine

Engine Model	Cat® C15 ACERT™	
Gross Power – SAE J1995	350 kW	469 hp
Net Power – SAE J1349	338 kW	453 hp
Net Power – ISO 9249	342 kW	458 hp
Net Power – EEC 80/1269	342 kW	458 hp
Bore	137 mm	5.4 in
Stroke	171.5 mm	6.75 in
Displacement	15.2 L	926 in^3

- The power ratings apply at rated speed of 1,800 rpm when tested under the conditions for the specified standard.
- The net power advertised is the power available at the flywheel when the engine is equipped with alternator, air cleaner, muffler and fan at minimum speed.
- Net power when the fan is at maximum speed is 330 kW (442 hp) per the SAE reference conditions.
- The 740 meets EPA Tier 3/EU Stage 3a emission specifications for the U.S. and Europe through 2010.
- No engine derating required below 2438 m (8,000 ft.).

Weights

Rated Payload	39.5 tonnes	43.5 tons

Body Capacities

Heaped SAE 2:1	24 m^3	31.4 yd^3
Struck	18.5 m^3	24.2 yd^3
Tailgate Struck	19.5 m^3	25.5 yd^3
Tailgate Heaped 2:1	25.5 m^3	33.5 yd^3

Transmission

Forward 1	8.9 km/h	5.5 mph
Forward 2	12.1 km/h	7.5 mph
Forward 3	16.4 km/h	10.2 mph
Forward 4	22 km/h	13.7 mph
Forward 5	30 km/h	18.6 mph
Forward 6	40 km/h	25.1 mph
Forward 7	54.7 km/h	34 mph
Reverse 1	8.4 km/h	5.2 mph
Reverse 2	11.6 km/h	7.2 mph

Sound Levels

Interior Cab	79 dB(A)

- The operator sound exposure Leq (equivalent sound pressure level) measured according to the work cycle procedures specified in ANSI/SAE J1166 OCT 98 is 79 dB(A), for the cab offered by Caterpillar, when properly installed and maintained and tested with the doors and windows closed.
- Hearing protection may be needed when operating with an open operator station and cab (when not properly maintained or doors/windows open) for extended periods or in noisy environments.

Operating Weights

Front Axle – Empty	19 400 kg	42,770 lb
Center Axle – Empty	7200 kg	15,873 lb
Rear Axle – Empty	6500 kg	14,330 lb
Total – Empty	33 100 kg	72,973 lb
Front Axle – Rated Load	5200 kg	11,464 lb
Center Axle – Rated Load	17 150 kg	37,809 lb
Rear Axle – Rated Load	17 150 kg	37,809 lb
Total – Rated Load	39 500 kg	87,083 lb
Front Axle – Loaded	24 600 kg	54,234 lb
Center Axle – Loaded	24 350 kg	53,683 lb
Rear Axle – Loaded	23 650 kg	52,139 lb
Total – Loaded	72 600 kg	160,055 lb

Body Plate Thickness

Front	8 mm	0.31 in
Scow	16 mm	0.63 in
Side	12 mm	0.47 in
Base	16 mm	0.63 in

Service Refill Capacities

Fuel Tank	532 L	140.5 gal
Cooling System	80 L	21.1 gal
Hydraulic System	328 L	86.6 gal
Engine Crankcase	38 L	9.5 gal
Transmission	72 L	19 gal
Final Drives/ Differential	72 L	19 gal
Output Transfer Gear Box	18 L	4.8 gal

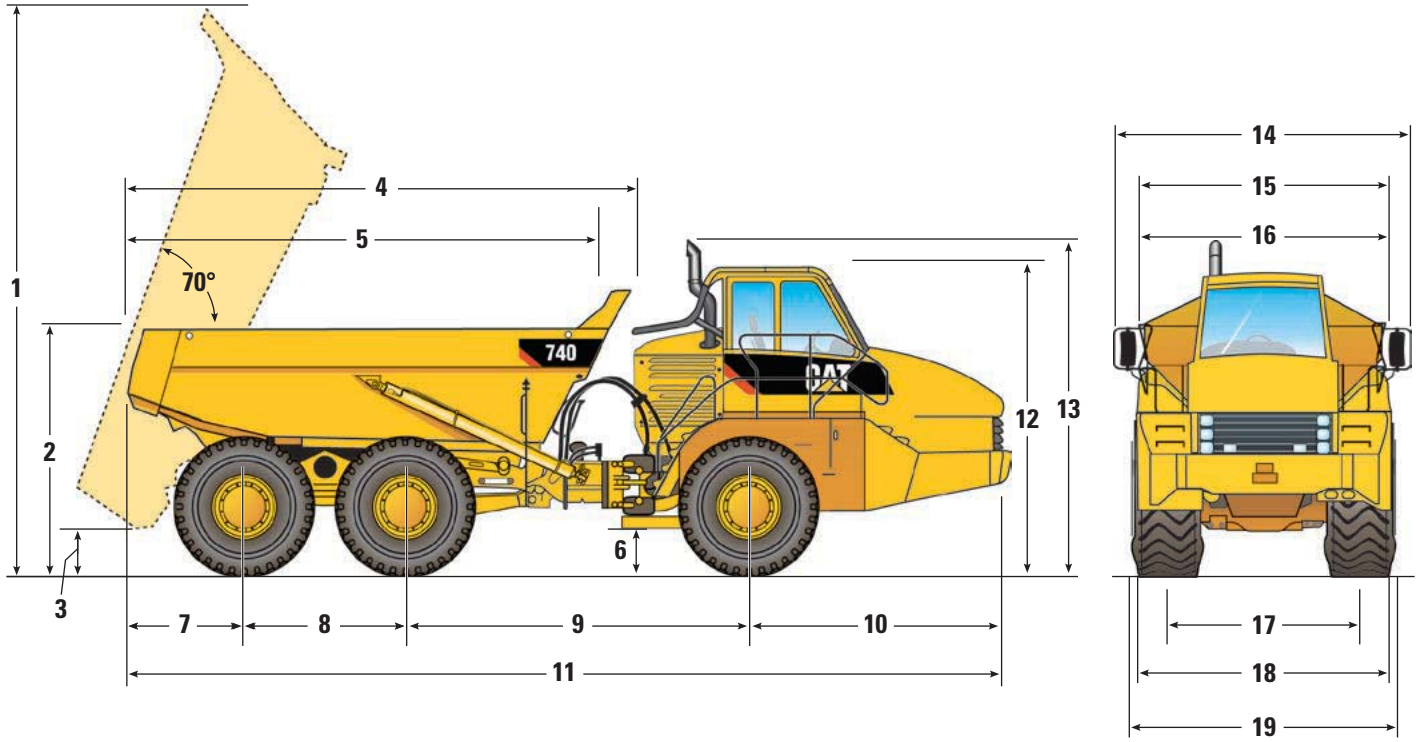
Body Hoist

Raise time	12 Seconds
Lower time	7 Seconds

Standards

Brakes	ISO 3450 – 1996
Cab/FOPS	ISO 3449 Level II – 2005
Cab/ROPS	ISO 3471 – 2008
Steering	ISO 5010 – 2007

Dimensions



	mm	ft
1	7092	23.4
2	3239	10.6
3	697	2.3
4	6288	20.6
5*	5734	18.8
6	577	1.8
7	1458	4.7
8	1966	6.4
9	4244	13.9
10	3221	10.5

	mm	ft
11	10 889	35.7
12	3745	12.3
13**	4049	13.3
14	3823	12.5
15***	3705	12.14
16	3418	11.2
17	2687	8.8
18	3430	11.2
19****	3520	11.5

*Inside of body.
**Exhaust stack can be removed for transportation.
***If equipped with a scissor tailgate.
****Max-unladen over tire bulge.

APPENDIX E

2011 EARLY WORKS IMPLEMENTATION DESIGN CALCULATIONS

HOLDEN BYPASS ROAD CUT SLOPE
STABILITY EVALUATION

Client:	*Rio Tinto.*		**Sheet:**	*1* **of** *6*	
Project:	*Holden Mine*		**Date:**	*2/15/11*	
Description:	*Holden By Pass Road Cut Slopes Stability Evaluation*		**Job No:**	*1008679*	
		By:	*P. Pellicer*	**Chkd By:**	*CTW*

HOLDEN MINE- HOLDEN BYPASS ROAD CUT SLOPE STABILITY EVALUATION

Revisioning							
Rev.	**Date**	**Description**	**By**	**Checked**	**Date**	**Reviewed**	**Date**
A	*02/15/11*	*First Issue*	*P. Pellicer*	*C. Weber*	*3/11/11*		
B							

Location and Format

Electronic copies of these calculations are located in the project files system at:

Objective

The objective of this calculation is to evaluate the general stability of cut slopes associated with the construction of the Holden bypass road.

Client: *Rio Tinto.* **Sheet:** *2* **of** *6*
Project: *Holden Mine* **Date:** *2/15/11*
Description: *Holden By Pass Road Cut Slopes Stability Evaluation* **Job No:** *1008679*
By: *P. Pellicer* **Chkd By:** *CTW*

Design Basis

The evaluation of the proposed cut slopes was performed in general accordance with WDOT and USDA Forest Service guidelines (Ref 1 and 2).

The relevant design criteria in terms of stability are as presented in the following table:

Table 1 – Design Basis (Stability)

Item	Criteria	Data Source
Minimum Stability Requirements		
Minimum Static Factor of Safety	1.25	2

Client:	*Rio Tinto.*	**Sheet:** *3*	**of** *6*
Project:	*Holden Mine*	**Date:**	*2/15/11*
Description:	*Holden By Pass Road Cut Slopes Stability Evaluation*	**Job No:**	*1008679*
		By: *P. Pellicer*	**Chkd By:** *CTW*

Introduction

The Holden bypass road has been designed to provide access for heavy construction equipment from the existing forest service road 8301 onto the top of the tailing piles, (TP-1, TP-2, and TP-3). The bypass road alignment starts East of Holden Village heading South across Railroad creek until it reaches the South side of the valley. The road turns West and traverses the valley wall, onto the top of TP-1 and TP-2. Once the road reaches TP-2, it generally follows the contact of the tailing material and the south valley wall, continuing west.

The majority of road construction cuts are isolated to the portion of roadway from the start of the traverse East of TP-1 until the road reaches the top of TP-2.

Methodology

Cut slopes along this portion of road way have been designed with 1.5H:1V slopes.

An Infinite slope analysis was performed to evaluate the general stability of these slopes. Since the cut slopes are not a critical component of a retention structure or foundation system, they were not analyzed for seismic stability.

USDA Forest Service guidelines only state that road cut slopes should be "reasonably stable" (Ref 1). WDOT design guidelines were utilized to quantify an acceptable static factor of safety for cut slope stability (Ref 2).

Geometry

Cut slopes along this portion of roadway have been designed with 1.5H:1V slopes (33.7^0).

Loading Conditions and Material Properties

Material properties were estimated utilizing test pit logs performed by URS. Test pit logs are attached. The test pits were not performed specifically to investigate the soils associated with the development of the By-Pass road. However, it is believed they provide a general characterization of the soils which will be encountered during road construction. The test pits were performed along the alignment of an existing road, which will generally provide the basis for the bypass Road. The layout of the by-pass road and approximate test pit locations are presented in Attachment A.

The test pit logs generally characterize the soils to be exposed by the road cuts as dense to very dense Glacial Till and Colluvium. The Glacial Till and Colluviums were generally mantled by 0.5 to 4.5 feet of forest duff, and silty SAND, which is believed to be imported fill utilized for construction of the existing roadway. The cut slopes to be constructed in association with the By-pass road will be above these materials and should only encounter the native Till and Colluvium. Test pit logs are provided in Attachment B.

The Glacial Till and Colluviums were characterized as dense to very dense Silty Gravel to poorly graded Gravel (USCS – GM to GP). Existing cut slopes above the existing road were noted to be between 40 – 45°. Native slopes were noted to be approximately 29° at one test pit location.

Based on published typical values for Dense GM to GP material and the observation of existing cut slopes of between 40 – 45°, a friction angle of 41° was assumed for the native soils. Any cohesion associated with the presence of silt was ignored, providing a conservative estimate of the soil strength.

Client:	*Rio Tinto.*		**Sheet:**	*4*	**of** *6*
Project:	*Holden Mine*		**Date:**	*2/15/11*	
Description:	*Holden By Pass Road Cut Slopes Stability Evaluation*		**Job No:**	*1008679*	
		By: *P. Pellicer*	**Chkd By:**	*CTW*	

Results

Infinite slope stability evaluation:

$$F.S. = \frac{TAN\ \phi}{TAN\ \beta}$$

Where:
ϕ *= Friction Angle of Soil = 41°*
β *= Slope Angle = 33.7°*

F.S. = 1.3

Conclusions

For the assumptions and conditions considered in this analysis, the cut slopes have a static FOS against slope failure that meets the minimum requirements for slope stability.

Surficial raveling of the slopes may be anticipated. However, as the slopes are re-vegetated, the occurrence of raveling should be minimized. It is anticipated the slopes will be mulched and seeded shortly after construction, which will minimize raveling due to surface water erosion.

Client:	*Rio Tinto.*		**Sheet:** *5*	**of**	*6*
Project:	*Holden Mine*		**Date:**	*2/15/11*	
Description:	*Holden By Pass Road Cut Slopes Stability Evaluation*		**Job No:**	*1008679*	
		By: *P. Pellicer*	**Chkd By:**	*CTW*	

Attachments

Attachment A *– Plan View of Roadway alignment and Approximate test pit locations*

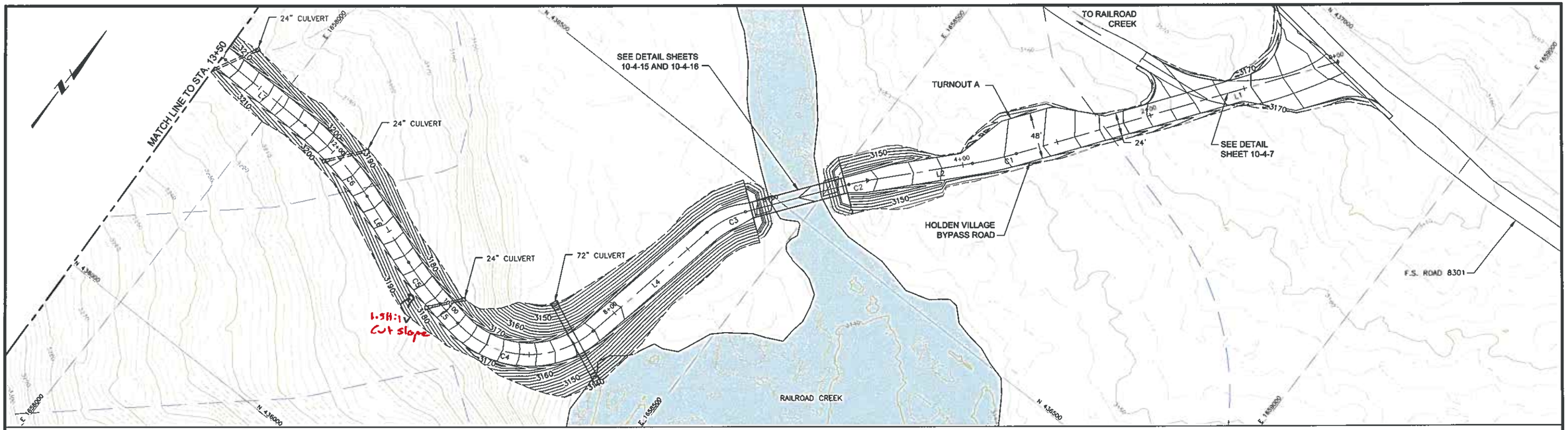
Attachment B *– URS Test Pit Logs*

References

1. USDA Forest Service*, FSH 7709.56 – Road Preconstruction Handbook, 1994*
2. WDOT, Geotechnical Design Manual, 2010
3. Holtz Robert C., Kovacs William D., An Introduction to Geotechnical Engineering, 1981

Client:	*Rio Tinto*			
Project:	*Holden Mine*		**Date:**	*2/15/11*
Description:	*Holden By Pass Road Cut Slopes Stability Evaluation*		**Job No:**	*1008679*
		By:	*P. Pellicer*	**Chkd By:**

Attachment A – Plan View of Roadway Alignment and Approximate Test Pit Locations



LEGEND:

L44 LINE AND CURVE DESIGNATIONS
C47 SEE SHEET 10-4-8 FOR LINE AND CURVE TABLES

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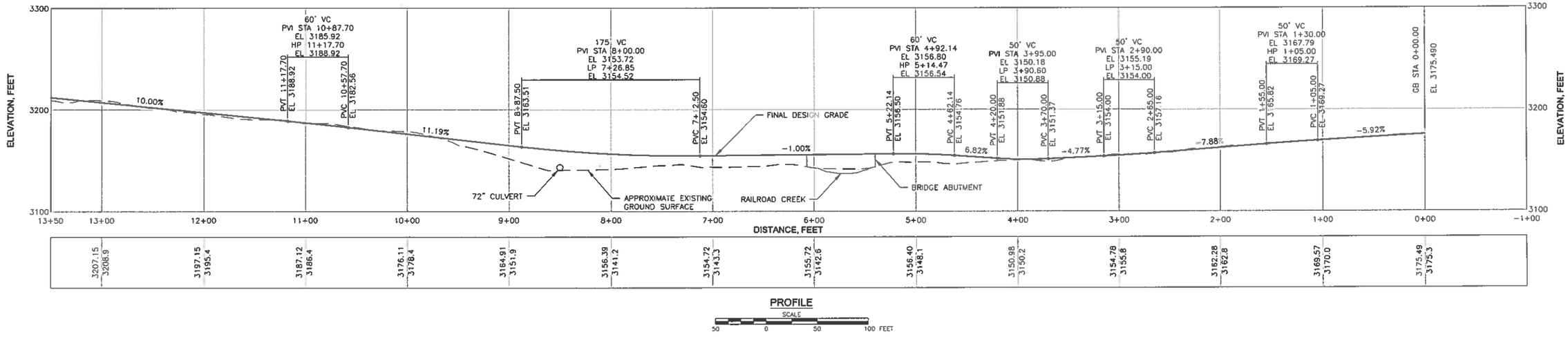
CONTOUR INTERVAL = 2 FEET



PROFILE
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DRAFT 3/2/11

A	ISSUED FOR INFRASTRUCTURE DESIGN REPORT – DRAFT CLIENT REVIEW	F.A.	P.G.C.	03/07/11	

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DRAWING REFERENCE(S):
* COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
* TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.
* AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA-FSA-APFO, PUBLICATION DATE: 2009.
* INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE DESIGN REPORT
TITLE: HOLDEN VILLAGE BYPASS ROAD STA 0+00 TO STA 13+50

MWH

SHEET 10-4-2 of 74
REVISION A
FILE NAME 1008679D264

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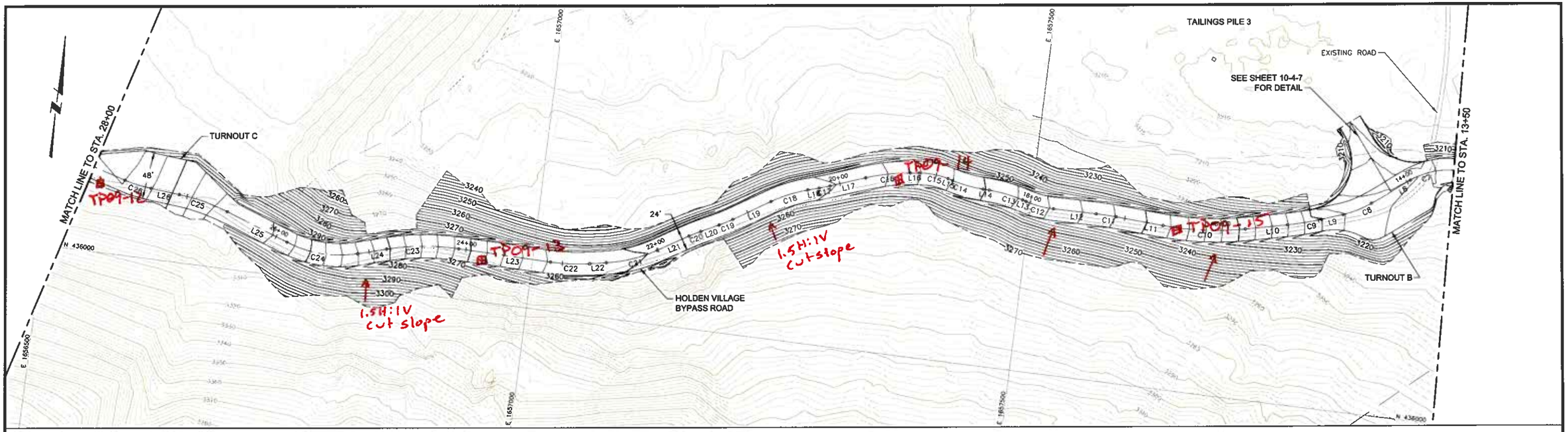
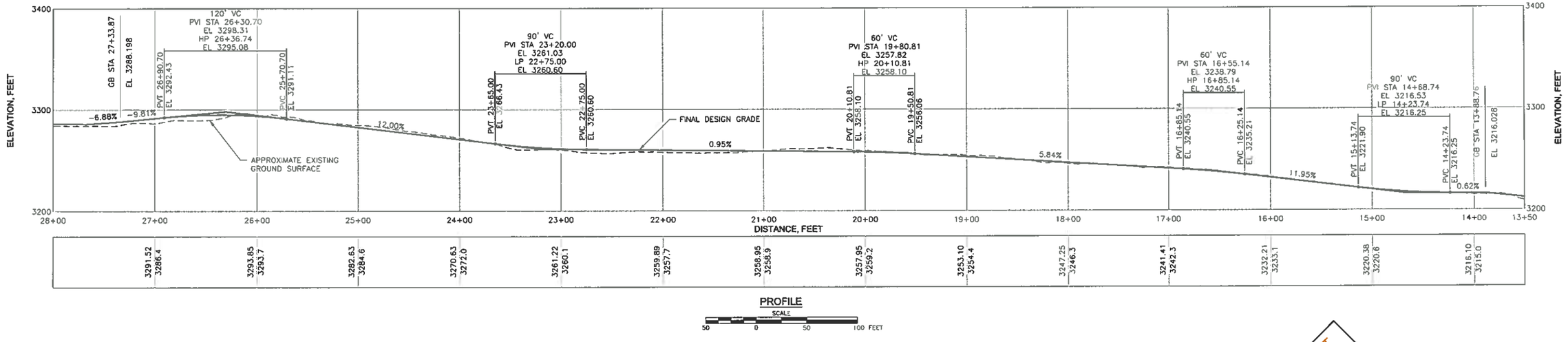


LEGEND:

L44 LINE AND CURVE DESIGNATIONS
C47 SEE SHEET 10-4-8 FOR LINE AND CURVE TABLES

PLAN
SCALE
50 0 50 100 FEET
CONTOUR INTERVAL = 2 FEET



PROFILE
SCALE
50 0 50 100 FEET

DRAFT 3/2/11

A	ISSUED FOR INFRASTRUCTURE DESIGN REPORT – DRAFT CLIENT REVIEW	F.A.	P.G.C.	03/07/11	

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DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHUCHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE DESIGN REPORT
TITLE: HOLDEN VILLAGE BYPASS ROAD STA 13+50 TO STA 28+00

MWH

SHEET 10-4-3 of 74 REVISION A
FILE NAME 1008679D265

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Client:	*Rio Tinto*			
Project:	*Holden Mine*		**Date:**	*2/15/11*
Description:	*Holden By Pass Road Cut Slopes Stability Evaluation*		**Job No:**	*1008679*
		By:	*P. Pellicer*	**Chkd By:**

Attachment B – URS Test Pit Logs

Project: Holden Mine 2009 Field Program
Project Location: Holden, Chelan County, Washington
Project Number: 33760997

Log of Test Pit TP09-12

Sheet 1 of 1

Date(s) Excavated	5/24/2009	Logged By	B. Gray	Checked By	D. Coberley
Excavation Method	Tracked Excavator	Excavation Contractor	Cragg Courtney	Total Depth of Test Pit	6 feet
Excavator Type	Cat 320C Tracked Excavator	Excavator Operator	4 yd Bucket	Ground Surface Elevation	3286.00
Groundwater Level		Sampling Method	None		
Excavation Backfill	Cuttings	Location	South of Tailings Pile 2, Northing 436072, Easting 1656521		

Elevation feet	Depth, feet	SAMPLES Type	SAMPLES Number	pH (s.u.)	Conductivity (uS)	Graphic Log	USCS	MATERIAL DESCRIPTION	Fines Content (% <#200 Sieve)	Dry Unit Weight, pcf	Moisture Content, %	REMARKS AND OTHER TESTS
	0						OL	Forest duff.				
3285							SM	Silty SAND, loose to medium dense, moist, brown. (Tailings)				
	2						SM	Silty SAND with gravel, sand fine, gravel fine to coarse, loose to medium dense, moist, light grayish-brown with mottled brown. (Likely slope wash to 17 to 24 inches bgs. Thickness varies from 4 to 7 inches)				
							GM	Silty GRAVEL with sand, trace clay and cobbles, gravel fine to coarse angular to subangular, very dense, moist, olive gray. (Glacial Till)				
3280	6							Excavation completed at a depth of 6 ft below the ground surface.				
								No water observed in trench.				
	8							Estimated slope angle above trench ~29°				
	10											
3275												
	12											
	14											
3270	16											
	18											
	20											

GEO_SEA_TP_HOLDEN Z:\2009 FIELD SEASON\FIELD DATA\GINT\TEST PIT AND BORING LOGS - HOLDEN 2009 FIELD SEASON 2009-12-22.GPJ HOLDENMINE.GLB URSSEA3.GDT 1/13/10

URS

Figure B.1-32

Project: Holden Mine 2009 Field Program
Project Location: Holden, Chelan County, Washington
Project Number: 33760997

Log of Test Pit TP09-13

Sheet 1 of 1

Date(s) Excavated	5/24/2009	Logged By	B. Gray	Checked By	D. Coberley
Excavation Method	Tracked Excavator	Excavation Contractor	Cragg Courtney	Total Depth of Test Pit	7.5 feet
Excavator Type	Cat 320C Tracked Excavator	Excavator Operator	4 yd Bucket	Ground Surface Elevation	3266.00
Groundwater Level	0.5	Sampling Method	Bulk Sample		
Excavation Backfill	Cuttings	Location	South of Tailings Pile 3, Northing 436022, Easting 1656992		

Elevation feet	Depth, feet	SAMPLES Type	SAMPLES Number	pH (s.u.)	Conductivity (uS)	Graphic Log	USCS	MATERIAL DESCRIPTION	Fines Content (%<#200 Sieve)	Dry Unit Weight, pcf	Moisture Content, %	REMARKS AND OTHER TESTS
	0						OL	Forest duff. 0.5 ft ▼				
3265		G	0.5-1.5				GW	Well-graded GRAVEL with silt, sand and organic matter, gravel fine to medium subangular, loose to medium dense, moist (wet at lower contact), brownish gray to brown. (Possible Fill)				
	2						PT	PEAT with sand and silt, medium stiff, wet, brown. (Buried organic layer)				
							GM	Silty GRAVEL with sand and cobbles, gravel fine to coarse subangular, dense to very dense, wet, light olive gray to light grayish brown. (Weathered Glacial Till) - Glacial till appears slightly oxidized and weathered but remains very dense and difficult to excavate. Cobbles may comprise 30-35% of till unit.				
3260	6											
	8							Excavation completed at a depth of 7.5 ft below the ground surface. 90% of water seepage occuring between base of GW and top of till. Estimate 2-4 gpm in 6'x6'x4' trench. Trench located below decommissioned access road. Surface gravel is likely fill and second peat unit is likely original ground surface.				
3255	10											
	12											
	14											
3250	16											
	18											
	20											

GEO_SEA_TP_HOLDEN Z:\2009 FIELD SEASON\FIELD DATA\GINT\TEST PIT AND BORING LOGS - HOLDEN 2009 FIELD SEASON 2009-12-22.GPJ HOLDENMINE.GLB URSSEA3.GDT 1/13/10

URS

Figure B.1-33

Project: Holden Mine 2009 Field Program
Project Location: Holden, Chelan County, Washington
Project Number: 33760997

Log of Test Pit TP09-14

Sheet 1 of 1

Date(s) Excavated	5/24/2009	Logged By	B. Gray	Checked By	D. Coberley
Excavation Method	Tracked Excavator	Excavation Contractor	Cragg Courtney	Total Depth of Test Pit	17 feet
Excavator Type	Cat 320C Tracked Excavator	Excavator Operator	4 yd Bucket	Ground Surface Elevation	3263.00
Groundwater Level		Sampling Method	Bulk Sample		
Excavation Backfill	Cuttings	Location	South of Tailings Pile 3, Northing 436152, Easting 1657322		

Elevation feet	Depth, feet	SAMPLES Type	SAMPLES Number	pH (s.u.)	Conductivity (uS)	Graphic Log	USCS	MATERIAL DESCRIPTION	Fines Content (% <#200 Sieve)	Dry Unit Weight, pcf	Moisture Content, %	REMARKS AND OTHER TESTS
	0						OL	Forest duff.				
			1-1.5'				SM/ML	Silty SAND to sandy SILT with gravel and cobbles, gravel fine to coarse, cobbles to 8 inches in diameter, medium dense to dense, moist, light grayish brown, (cobbles ~20% of sample). (Likely Colluvium) - Unit appears similar to thick colluvial sequence observed in boring DS-8D, but with increased cobble content.				
3260	2											
	4							- Cobble content decreasing at 3.5 ft				
							GP	Poorly-graded GRAVEL with sand, cobbles and boulders, gravel fine to coarse angular, dense, moist, brown. (Colluvium) - Similar unit observed in TP09-11 and TP09-11A which is likely derived from an avalanche deposition. 30-40% cobbles and boulders, boulders to 2 ft in diameter (c-axis).				
3255	8											
	10											
	12											
3250								- Increases in sand content. Moisture content increases to wet.				
	14											
	16											
3245	18							Excavation completed at a depth of 17 ft below the ground surface.				
	20											

GEO_SEA_TP_HOLDEN Z:\2009 FIELD SEASON\FIELD DATA\GINT\TEST PIT AND BORING LOGS - HOLDEN 2009 FIELD SEASON 2009-12-22.GPJ HOLDENMINE.GLB URSSEA3.GDT 1/13/10

URS

Figure B.1-34

Project: Holden Mine 2009 Field Program
Project Location: Holden, Chelan County, Washington
Project Number: 33760997

Log of Test Pit TP09-15

Sheet 1 of 1

Date(s) Excavated	5/24/2009	Logged By	B. Gray	Checked By	D. Coberley
Excavation Method	Tracked Excavator	Excavation Contractor	Cragg Courtney	Total Depth of Test Pit	15 feet
Excavator Type	Cat 320C Tracked Excavator	Excavator Operator	4 yd Bucket	Ground Surface Elevation	3235.00
Groundwater Level	12	Sampling Method	Bulk Sample		
Excavation Backfill	Cuttings	Location	South of Tailings Pile 3, Northing 436156, Easting 1657693		

Elevation feet	Depth, feet	SAMPLES Type	SAMPLES Number	pH (s.u.)	Conductivity (uS)	Graphic Log	USCS	MATERIAL DESCRIPTION	Fines Content (%<#200 Sieve)	Dry Unit Weight, pcf	Moisture Content, %	REMARKS AND OTHER TESTS
3235	0						OL	Forest duff.				
							GP/GM	Poorly-graded GRAVEL with silt and sand, cobbles and boulders , gravel fine to coarse angular to subangular, sand fine, dense, moist, reddish brown, boulders up to 3 ft in diameter. (Colluvium)				
	2											
		C	2.5-3.5'					- Color grades to light olive gray at 2.5 ft	7.3		7	
	4											
3230												
	6											
	8											
3225	10							- Possible slight increase in sand content				
	12							12 ft ▼				
	14											
3220												
	16							Excavation completed at a depth of 15 ft below the ground surface.				
								Slope above is a cut slope for the current access road, ~20' high and 40-45°.				
	18							Water infiltration observed at 12 ft below grade. Flow emanated from small seep in SW (upslope) corner of trench, estimated 0.1 gpm or less. After digging to 14.5', flow increased to 0.3-0.5 gpm from same seep.				
3215	20											

GEO_SEA_TP_HOLDEN Z:\2009 FIELD SEASON\FIELD DATA\GINT\TEST PIT AND BORING LOGS - HOLDEN 2009 FIELD SEASON 2009-12-22.GPJ HOLDENMINE.GLB URSSEA3.GDT 1/13/10

URS

Figure B.1-35

HOLDEN BYPASS ROAD AND FS RD
8301 FILL SLOPE STABILITY EVALUATION

Client:	*Rio Tinto.*		**Sheet:**	*1*	**of** *6*
Project:	*Holden Mine*		**Date:**	*2/15/11*	
Description:	*Holden By Pass Road and FS Road 8301 Fill Slope Stability Evaluation*		**Job No:**	*1008679*	
		By: *P. Pellicer*	**Chkd By:**	*CTW*	

HOLDEN MINE- HOLDEN BYPASS ROAD AND FS RD 8301 FILL SLOPE STABILITY EVALUATION

Revisioning							
Rev.	**Date**	**Description**	**By**	**Checked**	**Date**	**Reviewed**	**Date**
A	*02/15/11*	*First Issue*	*P. Pellicer*	*C. Weber*	*3/14/2011*		
B							

Location and Format

Electronic copies of these calculations are located in the project files system at:

Objective

The objective of this calculation is to evaluate the general stability of Fill slopes associated with the construction of the Holden bypass road and Turn out improvements along FS road 8301.

Client:	*Rio Tinto.*		**Sheet:**	*2* **of** *6*	
Project:	*Holden Mine*		**Date:**	*2/15/11*	
Description:	*Holden By Pass Road and FS Road 8301 Fill Slope Stability Evaluation*		**Job No:**	*1008679*	
		By:	*P. Pellicer*	**Chkd By:**	*CTW*

Design Basis

The evaluation of the proposed Fill slopes was performed in general accordance with WDOT and USDA Forest Service guidelines (Ref 1 and 2)

The relevant design criteria in terms of stability are as presented in the following tables:

Table 1 – Design Basis (Stability)

Item	*Criteria*	*Data Source*
Minimum Stability Requirements		
Minimum Static Factor of Safety	*1.25*	*2*

Client:	*Rio Tinto.*	**Sheet:** *3* **of** *6*	
Project:	*Holden Mine*	**Date:**	*2/15/11*
Description:	*Holden By Pass Road and FS Road 8301 Fill Slope Stability Evaluation*	**Job No:**	*1008679*
		By: *P. Pellicer*	**Chkd By:** *CTW*

Introduction

The Holden bypass road has been designed to provide access for heavy construction equipment from the existing forest service road 8301 onto the top of the tailing piles, (TP-1, TP-2, and TP-3). The bypass road alignment starts East of Holden Village heading South across Railroad creek until it reaches the South side of the valley. The road turns West and traverses the valley wall, onto the top of TP-1 and TP-2. Once the road reaches TP-2, it generally follows the contact of the tailing material and the south valley wall, continuing west.

Fill slopes associated with the by-pass road will vary in height from 1 foot up to 20 feet.

A total of 28 turn outs will be constructed along the alignment of FS Road 8301. The construction will generally consist of fill placement to expand existing turn outs or to create new turn outs. The amount and extent of fill will vary at each location. Fill associated with turn out construction will generally be less than 15 feet in depth.

Both the turn outs and the Bypass road will need to accommodate a fully loaded Caterpillar 740 articulated truck.

Methodology

Due to the relatively steep topography, fill slopes associated with road construction have been designed with 1.5H:1V slopes.

Stability analysis evaluated both infinite slope type failures and circular failure surfaces. Since the fill slopes are not a critical component of a retention structure or foundation system, they were not analyzed for seismic stability. The stability analysis utilizes isolated surcharge loads to model the effect of a fully loaded Caterpillar 740 articulated truck operating in the roadways.

These slope stability calculations were performed using Slope/W version 7.15 (Geoslope, 2009). Slope/W is a two-dimensional computer program that performs slope stability computations using limit equilibrium methods. The Morgenstern-Price method (Morgenstern and Price, 1965) with a half-sine function for interslice forces was selected for performing the computations in Slope/W. The method uses both circular and non-circular shear surfaces and satisfies both moment and force equilibrium.

USDA Forest Service guidelines only states that road fill slopes should be "reasonably stable" (Ref 1). WDOT design guidelines were utilized to quantify an acceptable static factor of safety for fill slope stability (Ref 2).

Geometry

Fill slopes have been designed with 1.5H:1V slopes (33.7^0), Three roadway sections were analyzed in the areas with the deepest fill, resulting in the longest fill slopes. The locations of the sections are presented in Attachment A.

Loading Conditions and Material Properties

Fill material which will be utilized for construction of the road ways will be supplied from the existing Dan's Camp borrow area. In 2010, MWH performed 10 test pit excavations to characterize the potential borrow material. Test pit logs are presented in Attachment B.

In general, the logs show three primary types of material present at Dan's Camp.

- *SILT to Silty SAND (ML, SM/ML).*

Client:	*Rio Tinto.*	**Sheet:** *4*	**of** *6*
Project:	*Holden Mine*	**Date:**	*2/15/11*
Description:	*Holden By Pass Road and FS Road 8301 Fill Slope Stability Evaluation*	**Job No:**	*1008679*
		By: *P. Pellicer*	**Chkd By:** *CTW*

- *Poorly graded GRAVEL (GP)*
- *Gravely SAND (SP to SW)*

The silt and silty sand material is not considered suitable for use as structural fill for road construction and is not part of this stability evaluation.

Both the poorly graded Gravel and Gravelly Sand are considered suitable fill material. Material properties were estimated utilizing the soil description provided on the test pit logs and a published correlation relating initial porosity, effective normal stress and grain size with friction angles for granular material.

For the purpose of evaluating the strength of the placed fill material, all fill material was assumed to be a medium to fine poorly graded SAND. This assumption is conservative and discounts the additional strength provided by the presence of Gravel material in the fill soil.

The strength of fill material was estimated utilizing a correlation presented by Terzaghi et al (Ref 5). The correlation is provided in Figure 19.4 (Attachment C).

To utilize Figure 19.4, the anticipated effective normal stress (σ_n'), grain size distribution, and initial porosity of the soil must be estimated.

- *Maximum effective normal stress: $\sigma_n' = h*\rho$*
  Based on grading plans, a maximum fill height (h) of 20 feet is anticipated. A density (ρ) of 130 pcf was assumed for placed fill, resulting in a maximum σ_n'=2,600 psf (125 kPa)

- *Initial porosity: n_o*
  Based on typical published values, n_o can range from 50 to 29 for loose to dense uniform fine to medium sands. The proposed fill material will consist of a sand gravel mixture compacted to a minimum of 95% of the maximum dry density as estimated by the modified proctor method. Based on the placement criteria, the initial porosity should be towards the lower end of this range. A conservative assumed initial porosity of 39 was selected which is closer to the middle of the published range.

Utilizing Figure 19.4 with an assumed maximum σ_n'=2,600 psf (125 kPa), an initial porosity of n_o=39 and a soil texture consisting of uniform sand, an estimated friction angle of 44 degrees was selected for the fill material. This is the minimum estimated friction angle, as the effective stress reduces, the frictional may increase by 1 to 2 degrees, for the purpose of this evaluation this was neglected.

Existing subgrade materials were assumed to have a friction angle of approximately 41 degrees.

Truck Loading:
Caterpillar 740 Articulating trucks are anticipated to be the largest vehicles which will utilize both roadways. Both roadways will be utilized for one-way traffic which will result in vehicles temporarily parked along the edge of the road. The effect of the trucks on fill slope stability was modeled using 2 small strip surcharge loads. The magnitude of each strip load was estimated utilizing a tire inflation pressure of 50 psi (7200 psf) (Ref 6). Each surcharge correlates to a tire width of 2.5 feet and are spaced at 9 feet center to center. Dimensions for the Cat 740 are provided in Attachment C.

Client:	*Rio Tinto.*	**Sheet:** *5* **of** *6*	
Project:	*Holden Mine*	**Date:**	*2/15/11*
Description:	*Holden By Pass Road and FS Road 8301 Fill Slope Stability Evaluation*	**Job No:**	*1008679*
		By: *P. Pellicer*	**Chkd By:** *CTW*

Results

Infinite slope stability evaluation:

$$F.S. = \frac{TAN\ \phi}{TAN\ \beta}$$

Where:
ϕ *= Friction Angle of Soil =* 44^0
β *= Slope Angle =* 33.7^0

F.S. = 1.4

Stability evaluation with Truck Loading:
The results of the static stability analysis with the truck load imposed on the fill slopes are summarized in Table 2.

Table 2 – Stability Analysis Results

Section	Recommended FOS	Calculated FOS
A-A'	1.25	1.4
B-B'	1.25	1.28
C-C'	1.25	1.5

Print outs of the Slope/W sections are provided in Attachment D.

Conclusions

For the assumptions and conditions considered in this analysis, the cut slopes have a static FOS against slope failure that meets the minimum requirements for slope stability.

Surficial raveling of the slopes may be anticipated. However, as the slopes are re-vegetated, the occurrence of raveling should be minimized. It is anticipated the slopes will be mulched and seeded shortly after construction, which will minimize raveling due to surface water erosion

Client:	*Rio Tinto.*	**Sheet:** *6* **of** *6*	
Project:	*Holden Mine*	**Date:**	*2/15/11*
Description:	*Holden By Pass Road and FS Road 8301 Fill Slope Stability Evaluation*	**Job No:**	*1008679*
		By: *P. Pellicer*	**Chkd By:** *CTW*

Attachments

Attachment A *– Plan View of Roadway alignment and Approximate test pit locations*

Attachment B *– URS Test Pit Logs*

Attachment C *– Referenced Figures, Tables and Charts*

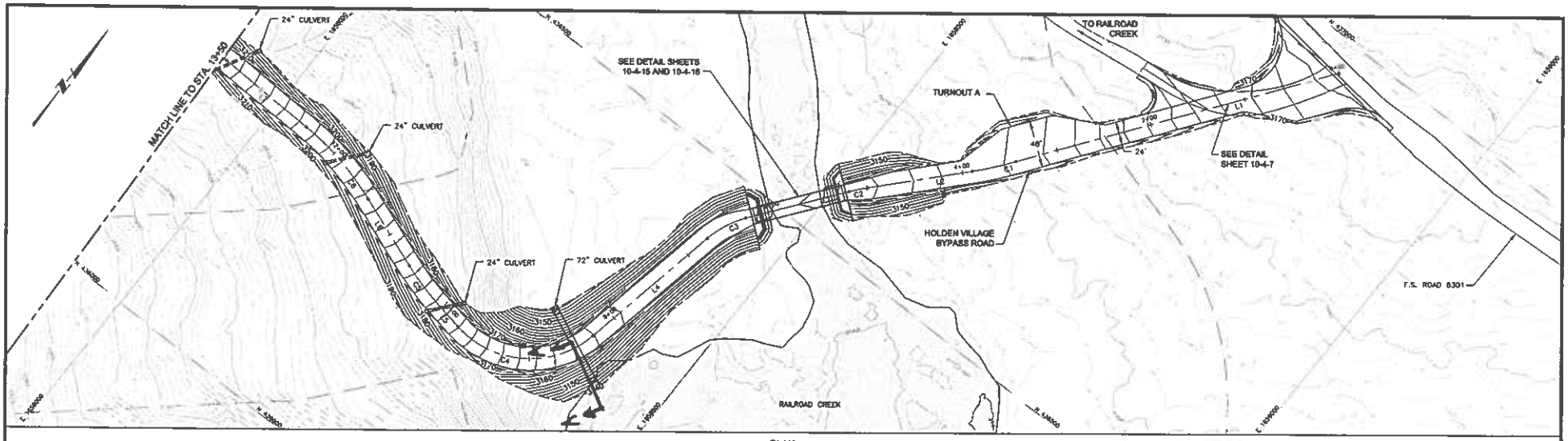
Attachment D *– Slope/W Results*

References

1. USDA Forest Service, *FSH 7709.56 – Road Preconstruction Handbook, 1994*
2. WDOT, Geotechnical Design Manual, 2010
3. Holtz Robert C., Kovacs William D., An Introduction to Geotechnical Engineering, 1981
4. *Geoslope International, Ltd. (Geoslope), 2009. GEOSLOPE, Version 7.15*
5. *Terzaghi K, Peck R.B., Mesri G, Soil Mechanics in Engineering Practice, 1996*
6. *Caterpillar Inc., Caterpillar Performance Handbook, Edition 36, 2006*

Client:	*Rio Tinto*			
Project:	*Holden Mine*		**Date:**	*2/15/11*
Description:	*Holden By Pass Road and FS Road 8301*		**Job No:**	*1008679*
	Fill Slopes Stability Evaluation	**By:**	*P. Pellicer*	**Chkd By:**

Attachment A – Plan View of Roadway Alignment and Approximate Test Pit Locations



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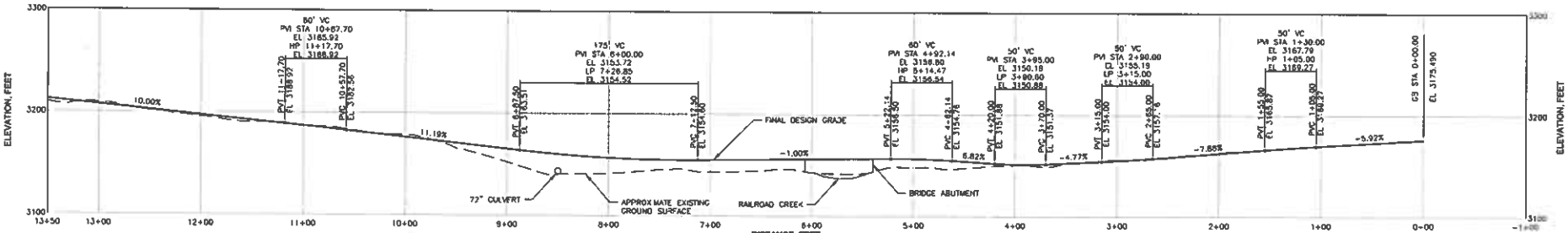
LEGEND:

L44 LINE AND CURVE DESIGNATIONS
C47 SEE SHEET 10-4-8 FOR LINE AND CURVE TABLES



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- INVENTORIED ROADLESS AREA FROM OKELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

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PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE DESIGN REPORT
TITLE: HOLDEN VILLAGE BYPASS ROAD STA 0+00 TO STA 13+50

MWH

SHEET 10-4-2 of 74
REVISION A
FILE NAME 10086780284

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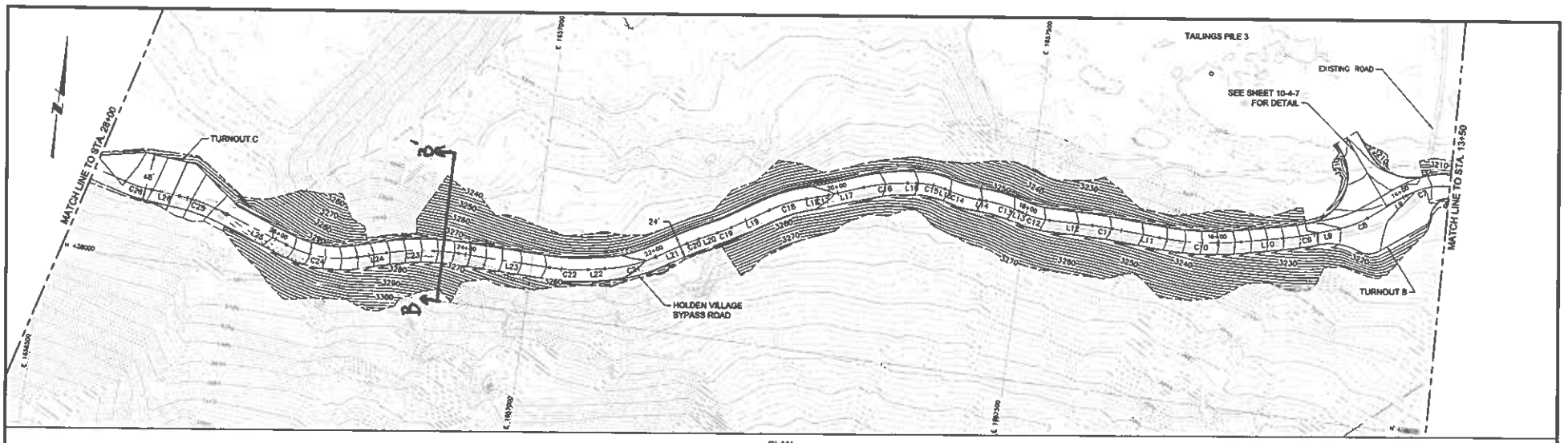

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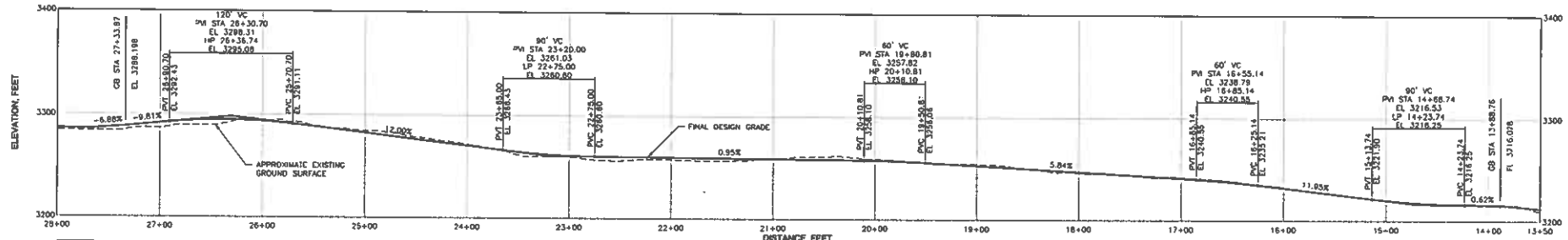
CONTOUR INTERVAL = 2 FEET

LEGEND:

L44 LINE AND CURVE DESIGNATIONS
C47 SEE SHEET 10-4-8 FOR LINE AND CURVE TABLES



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DRAFT 3/2/11

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- PAVEMENTORED ROADLESS AREA FROM OKLAN RANGER DISTRICT (APPENDIX C OF THE FORCET PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

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DRAWN BY	F. ANDRADE 02/28/11
CHECKED BY	D. RODRIGUEZ
APPROVED BY	P. CROUSE 02/28/11
PROJECT MANAGER	R. SCHLICHER 02/28/11
CLIENT APPROVAL	
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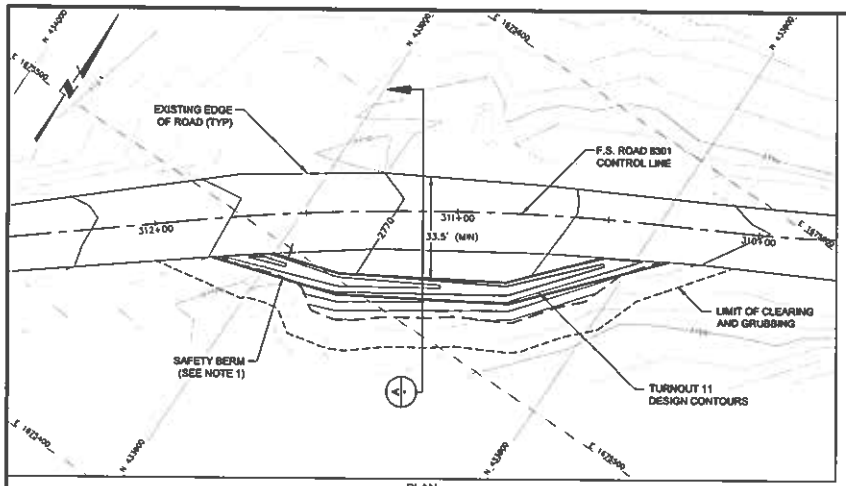
PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE DESIGN REPORT
TITLE: HOLDEN VILLAGE BYPASS ROAD STA 13+50 TO STA 28+00

MWH

SHEET 10-4-3 of 74 REVISION A
FILE NAME 10086790265



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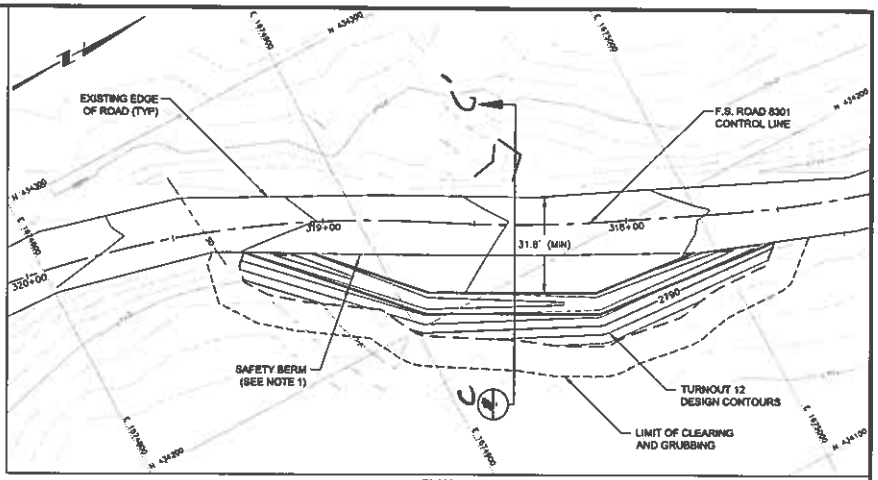

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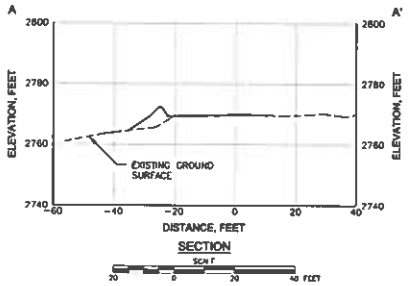
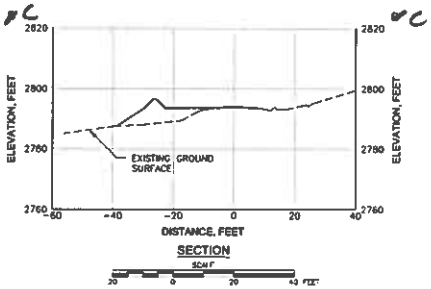


SECTION

SCALE: 20 0 20 40 FEET

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. CUT VOLUME INCLUDES STRIPPING OF 12" OF TOPSOIL WITHIN THE TURNOUT AREA PLUS THE DESIGN FILL.



SECTION

SCALE: 20 0 20 40 FEET

TURNOUT 11 DESIGN

EARTHWORKS[2]		
CUT, CY	FILL, CY	NET, CY
101	167	151 (FILL)

TURNOUT 12 DESIGN

EARTHWORKS[2]		
CUT, CY	FILL, CY	NET, CY
143	478	475 (FILL)

DRAFT 3/2/11

REV.	DESCRIPTION	F.A. TECH	P.G.C. ENG	03/07/11 DATE
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* F.S. ROAD 8301 TOPOGRAPHY RECEIVED FROM ERLANDSEN DATED JANUARY 18, 2011.

DESIGNED BY	P. PELLICER	02/28/11
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CHECKED BY	O. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
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CLIENT REFERENCE NO.		

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PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE DESIGN REPORT
TITLE: TURNOUTS 11 AND 12

MWH

SHEET: 10-3-17 of 74
REVISION: A
FILE NAME: 1008679D275

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Client:	*Rio Tinto*			
Project:	*Holden Mine*		**Date:**	*2/15/11*
Description:	*Holden By Pass Road and FS Road 8301*		**Job No:**	*1008679*
	Fill Slopes Stability Evaluation	**By:**	*P. Pellicer*	**Chkd By:**

Attachment B –Test Pit Logs

TRENCH SAMPLE LOG FORM
TRENCH PROFILE

DC

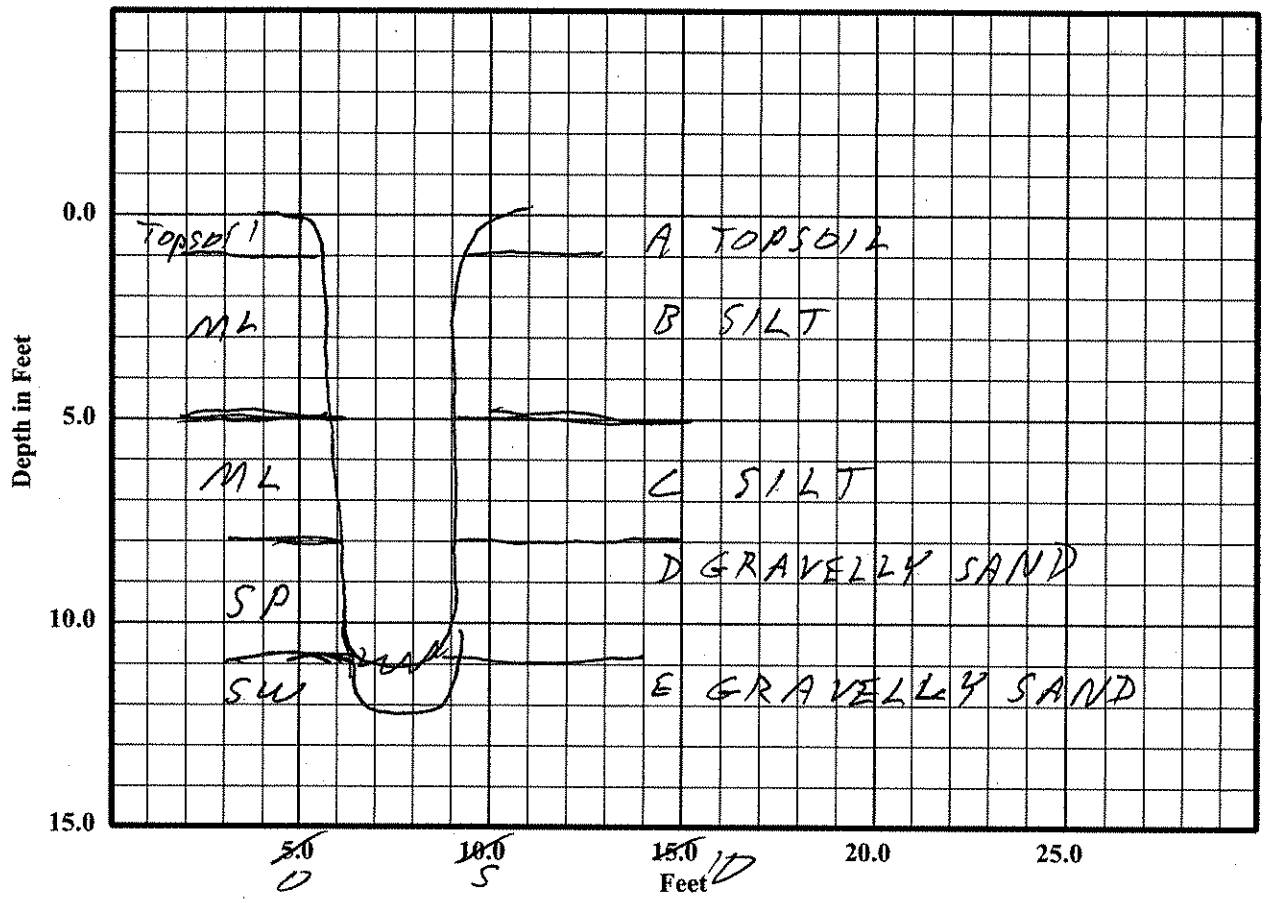
Site Location Dan's Camp Trench Number TP-DC-1 Date 9/26/10

Coordinates: Inside Stake _____ Outside Stake _____

Native/Fill Stake _____

Logged By Patrick Naylor

TRENCH PROFILE



Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

A (0-1') TOPSOIL - Silty sand, organic (roots, needles)

B (1'-5') SILT - Lt. tan, loose, sl. moist, NP, 5% subang. gravel, 10% v. fine sand, tr. ~~subang~~ organics (roots). (ML)

C (5'-8') SILT - Lt. tan, sl. moist, loose, NP, 5-10% subang. gravel, 5-10% v. fine sand, 1-2% organics (roots, burnt wood). (ML)

D (8'-11') GRAVELLY SAND - Tan, sl. moist, loose, 10% subang. to subrnd. gravel, 90% round sand → tr. coarse, 10% med., 90% fine, poorly graded, well sorted. Gradually increasing gravel & occas. round cobble w/depth. Alluvium. (SP)

Begin Trench _____ Finish Trench _____

Total Depth 12' Total Length _____

Sample 11'-12' (1 5-gal bucket)

HOLDEN MINE
TRENCH SAMPLE LOG FORM
TRENCH PROFILE

TRENCH SAMPLE LOG FORM
TRENCH PROFILE

DC

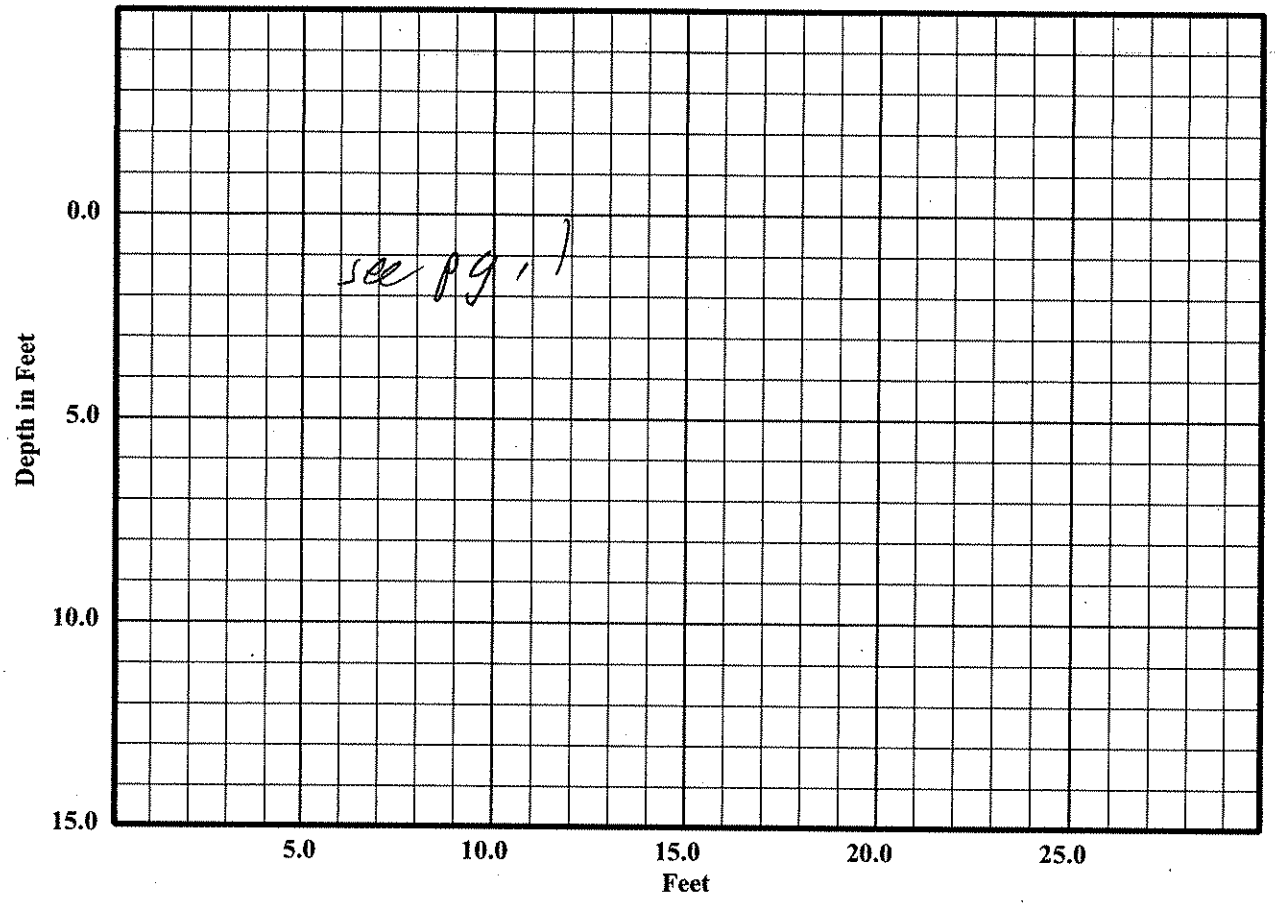
Site Location Dan's Camp Trench Number TP-DL-1 Date 9/26/10

Coordinates: Inside Stake _____ Outside Stake _____

Native/Fill Stake _____

Logged By P. Naylor

TRENCH PROFILE



Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

(11'-12') GRAVELLY SAND - Gray, sl. moist, loose, gravel subang. to subrnd., sand subrnd. to rnd, sand → 20% coarse, 30% med., 50% fine, mod. well graded, poorly sorted. Alluvium. (SW)

Begin Trench _____ Finish Trench _____

Total Depth 12' Total Length _____

TRENCH SAMPLE LOG FORM
TRENCH PROFILE

DC

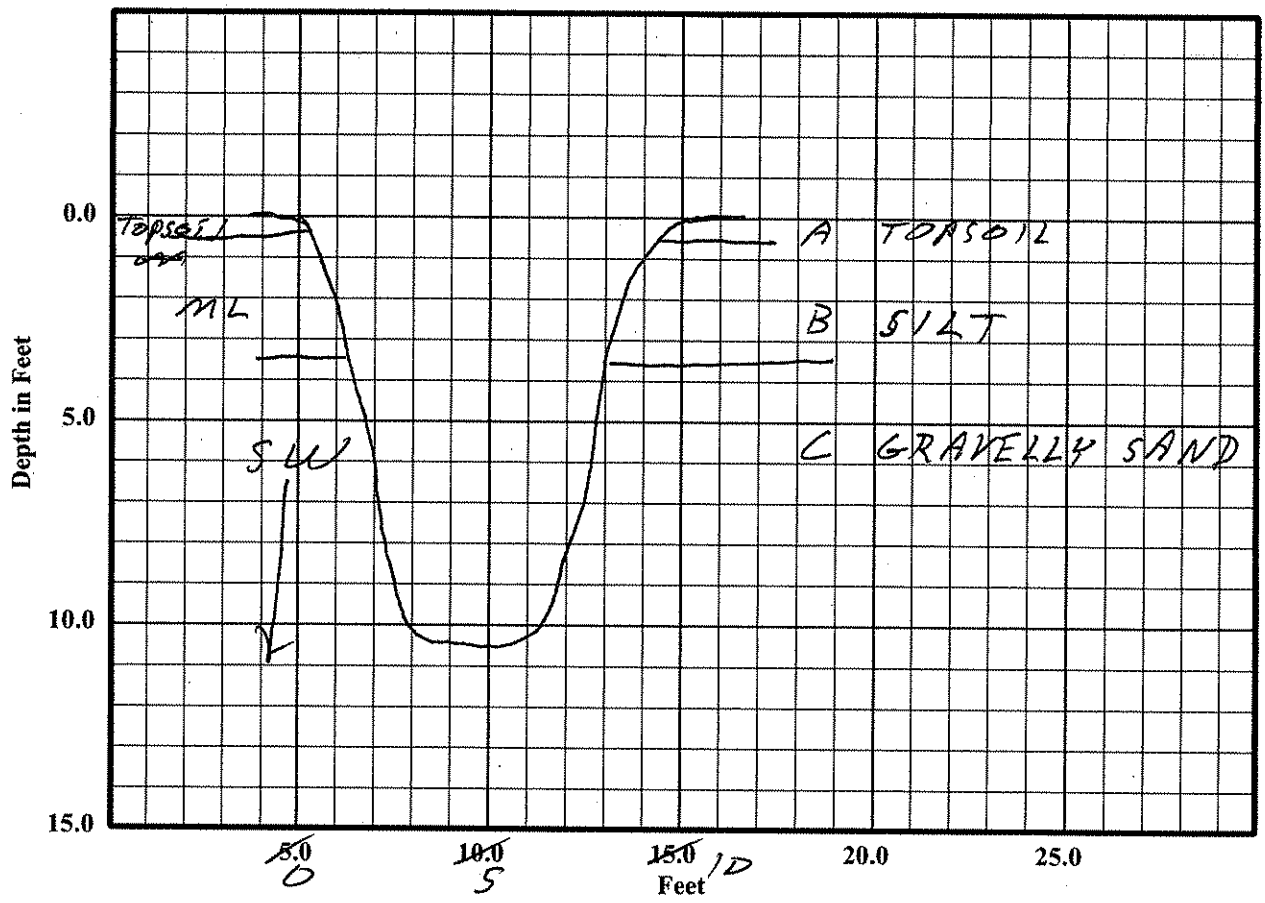
Site Location Dan's Camp Trench Number TP-DC-2 Date 9/26/10

Coordinates: Inside Stake _____ Outside Stake _____

Native/Fill Stake _____

Logged By Patrick Naylor

TRENCH PROFILE



Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

A (0-0.5') TOPSOIL - Dk. brown, silt, abundant organics

B (0.5'-4.2') SILT - Lt. tan, dry, loose, NP, tr. subang. to subrnd. gravel, 5% fine sand, tr. organics (roots & burnt wood). Gravel increasing w/depth. Silt is very close to fine sand. (ML)

C (4.2'-10.3') GRAVELLY SAND - Gray/multicolored, sl. moist, loose, 15% ~~sand & gravel~~ subang. to subrnd. fine gravel, tr. rnd. cobble, 85% subang. to subrnd. sand → 40% coarse, 30% med., 30% fine, well graded, poorly sorted. Cobble increases a little w/depth. Alluvium. (SW)

Begin Trench _____ Finish Trench _____

Total Depth 10.3' Total Length _____

Sample 5'-6' (2 5gal buckets)

HOLDEN MINE
TRENCH SAMPLE LOG FORM
TRENCH PROFILE

TRENCH SAMPLE LOG FORM
TRENCH PROFILE

DC

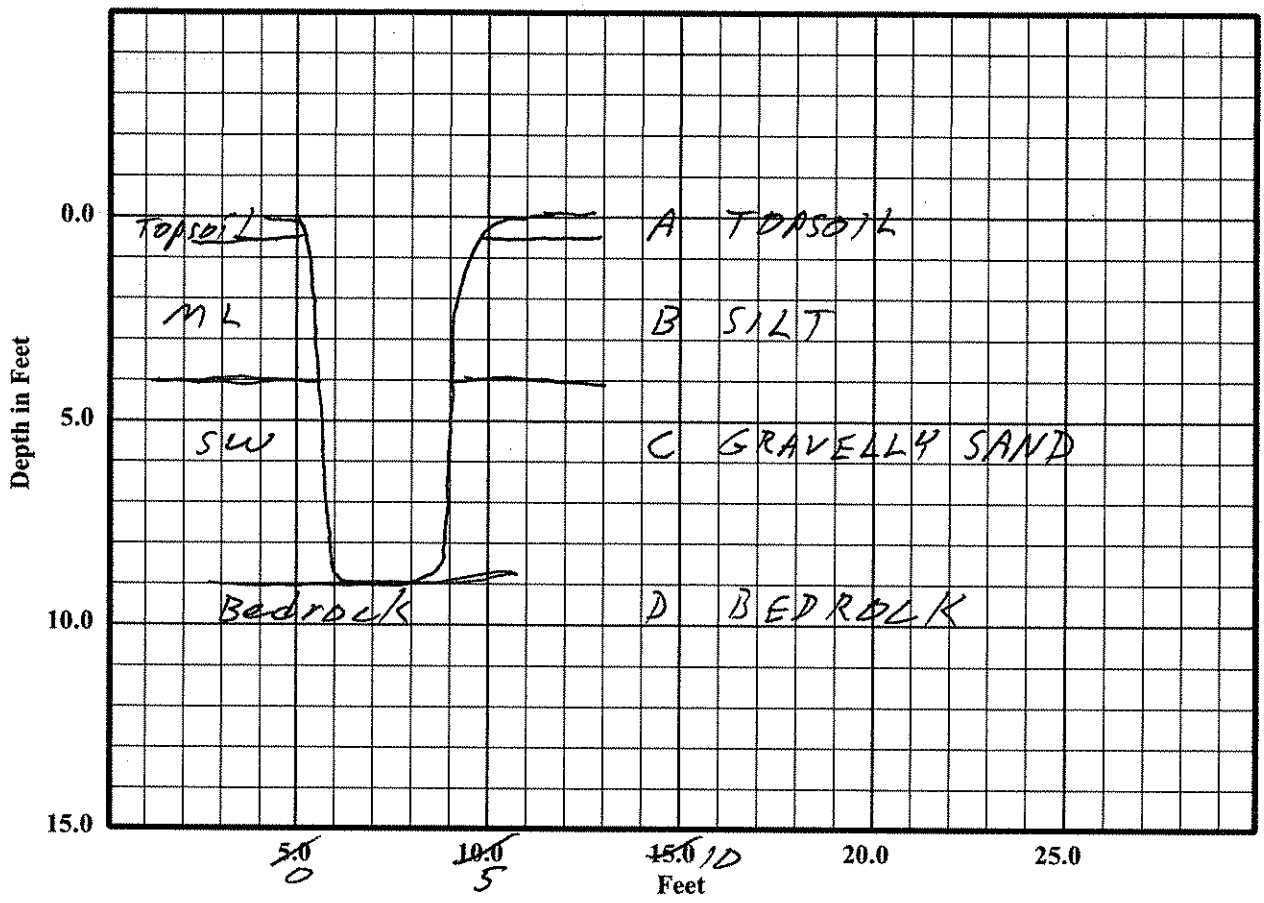
Site Location Dan's Camp Trench Number TP-DC-3 Date 9/26/10

Coordinates: Inside Stake _____ Outside Stake _____

Native/Fill Stake _____

Logged By Patrick Naylor

TRENCH PROFILE



Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

A (0-0.3') TOPSOIL - dk. brown, sl. moist, organic silt.

B (0.3'-4') SILT - Lt. tan, sl. moist, loose, NP, tr. organics, ~~tr.~~ subang. fine to med. gravel, silt is very nearly a fine sand. (ML)

C (4'-9') GRAVELLY SAND - Gray/multicolored, sl. moist, loose, ~~gravel~~ 10% subang. gravel, 90% subrnd. to subang. sand → 40% coarse, 30% med., 30% fine, tr. cobble, well graded, poorly sorted. Most gravel & cobble occurs @ 4'-5'. Alluvium. (SW)

D (9') BEDROCK → refusal.

Begin Trench _____ Finish Trench _____

Total Depth 9.0' Total Length _____

Sample 5.5'-6.5' (2 5-gal buckets)

HOLDEN MINE
TRENCH SAMPLE LOG FORM
TRENCH PROFILE

TRENCH SAMPLE LOG FORM
TRENCH PROFILE

DC TP-DC-4

Page 1 of 1

Site Location Dans Camp Trench Number ~~DC-TP-4~~ Date 10/3/10

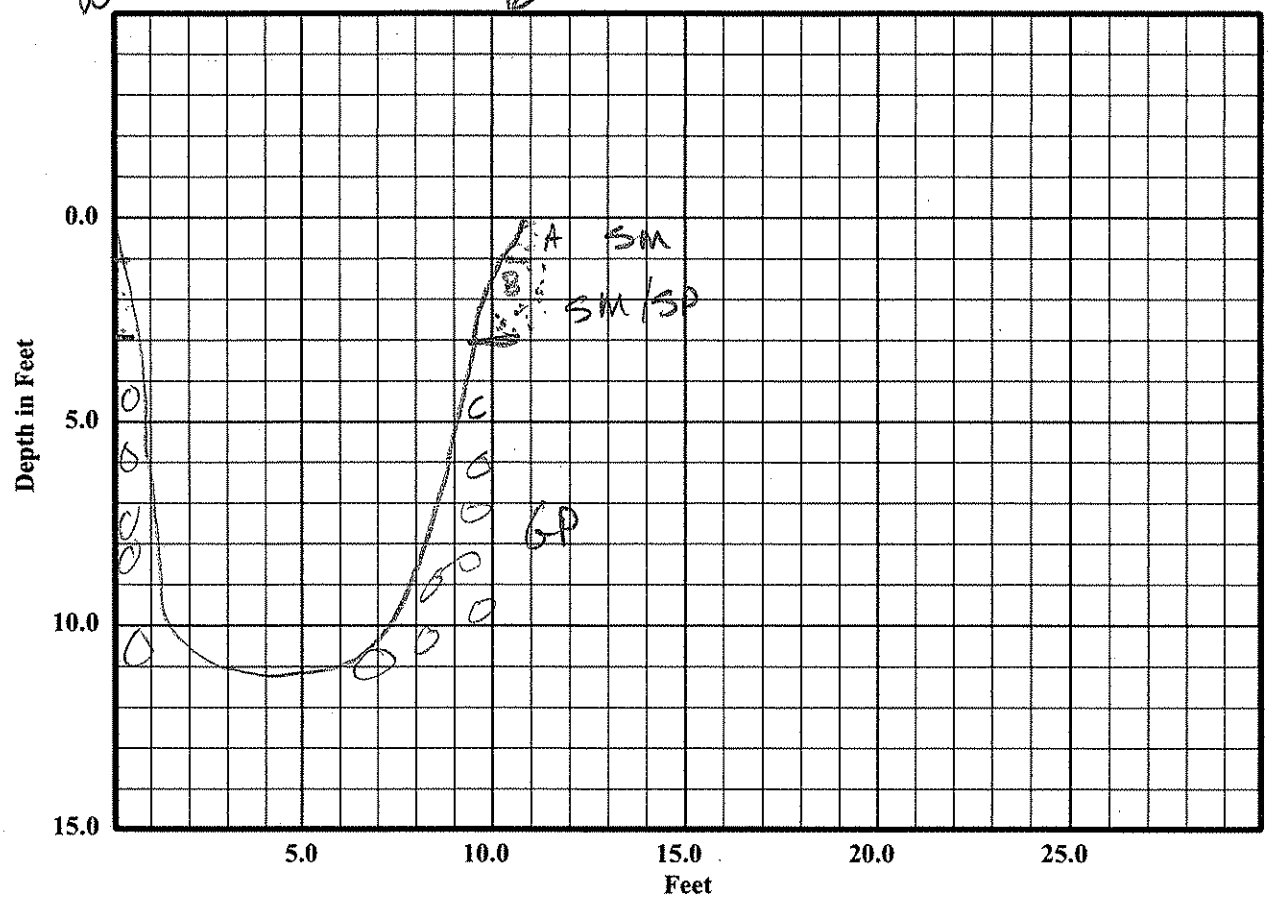
Coordinates: Inside Stake _____ Outside Stake _____

Native/Fill Stake _____

Logged By Bill Bragden

TP-5 Pit

W — TRENCH PROFILE — E



Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

0-1' A (SM) Thin layer of silty fine sand top soil, light yellowish brown (10YR 6/4), NP, 30% silt, 70% fine sand <5% fine gravel, few roots and organics, dry

1-3' B (SM/SP) Silty fine sand, yellowish brown (10YR 5/4) NP, 20% silt, 80% fine to med sand, trace organics & roots, dry

3-10.5 C (GP) fine to coarse sandy fine & coarse gravel w/ some cobbles and few boulders to 1.4', subrounded, gray (N5) w/ pockets of yellowish brown (10YR 6/4) NP, dry

* Collected 1 5gallon buckets of material 3-10.5'

Begin Trench 1040 Finish Trench 1110

Total Depth 10.5' Total Length 11'

HOLDEN MINE
TRENCH SAMPLE LOG FORM
TRENCH PROFILE

TRENCH SAMPLE LOG FORM
TRENCH PROFILE TP-DC-5

DC

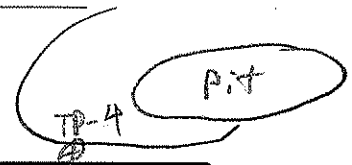
Page 1 of 1

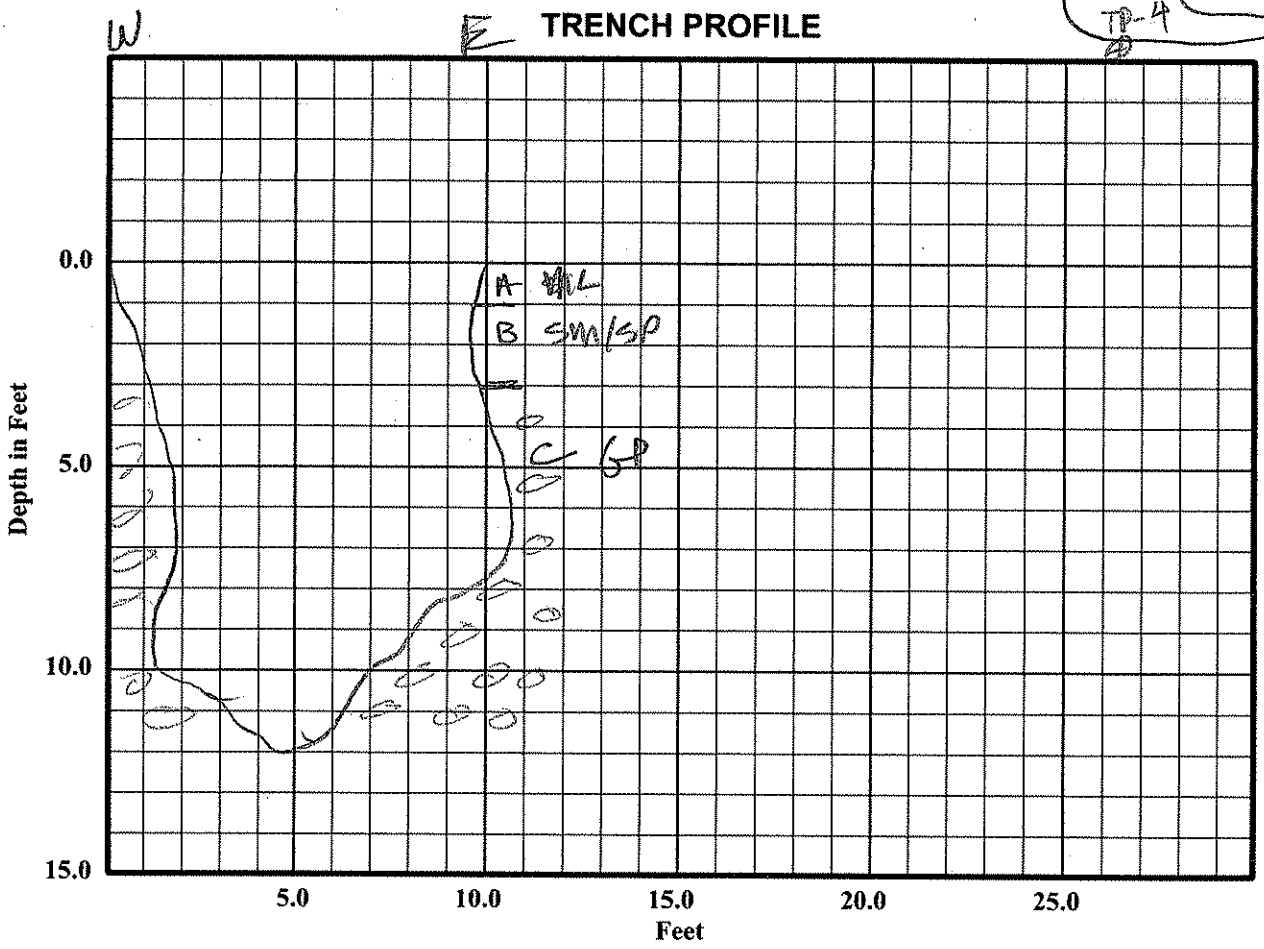
Site Location Dome Camp Trench Number ~~DC-TP-5~~ Date 10/3/10

Coordinates: Inside Stake _____ Outside Stake _____

Native/Fill Stake _____

Logged By Bill Bragdon





Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

0-1.0'(ML) Top soil or silt, dark yellowish brown (10YR 3/4) NP, dry w/ trace fine sand & fine gravel, abundant organics & roots.

1-3'(SM/SP) Silty fine sand, yellowish brown (10YR 5/4) NP 20-30% slt 70-80% sand with <5% fine gravel, dry, trace roots.

3-12 fine to coarse sandy fine & coarse gravel w/ trace silt & cobbles (GP) gray (N5) w/ pockets of yellowish brown (10YR 6/4), NP, dry 40% sand, 50% gravel 5-10% silt Collected 2 5gallon buckets 3-12

* No artifacts

Begin Trench 1115 Finish Trench 1148

Total Depth 12' Total Length 10'

HOLDEN MINE
TRENCH SAMPLE LOG FORM
TRENCH PROFILE

TRENCH SAMPLE LOG FORM
TRENCH PROFILE TP-DC-6

DC

Site Location Davis Camp Trench Number ~~DC-TP-6~~ Date 10/3/10

Coordinates: Inside Stake _____ Outside Stake _____

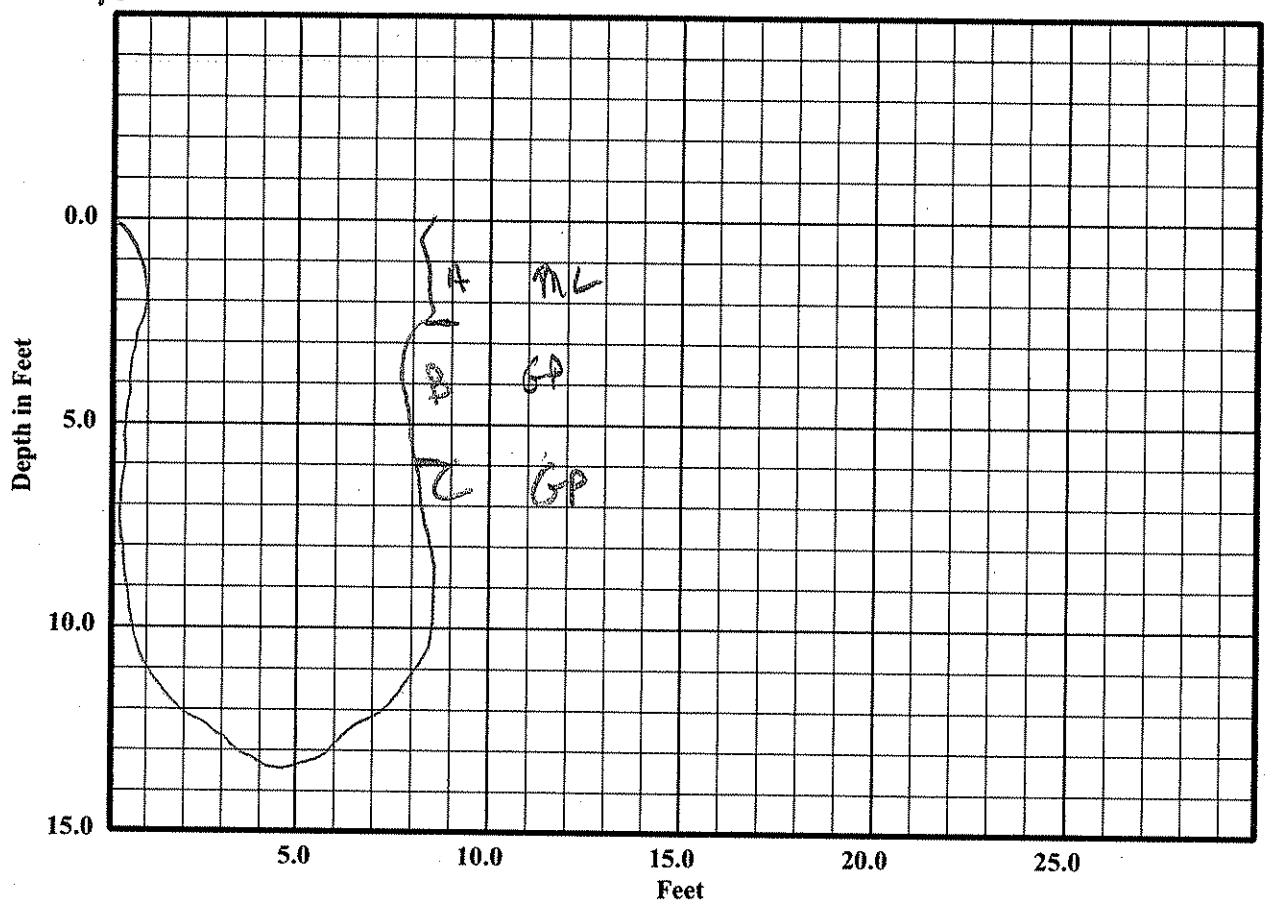
Native/Fill Stake _____

Logged By Bill Brogdon

TP-6 PIT

N S

TRENCH PROFILE



Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

A 0-2.5 (ML) silt w/ some fine & coarse sand and trace fine & coarse gravel, abundant roots, light yellowish brown (10YR 6/4), NP, dry

B 2.5-6 (GP) fine to coarse sandy fine & coarse gravel w/ cobbles and boulders, subrounded, yellowish brown (10YR 5/4), NP, dry trace roots. 40% sand 60% gravel

C 6-12 (GP) fine to coarse sandy fine & coarse gravel w/ abundant cobbles & boulders, gray (N5) to yellowish brown (10YR 6/4) 20% sand 80% gravel,

* 1-5gallon bucket collected, very dry and soil mixed

Begin Trench 1151 Finish Trench 1215

Total Depth 12 Total Length 9

HOLDEN MINE
TRENCH SAMPLE LOG FORM
TRENCH PROFILE

TRENCH SAMPLE LOG FORM
TRENCH PROFILE TP-DC-7

DC

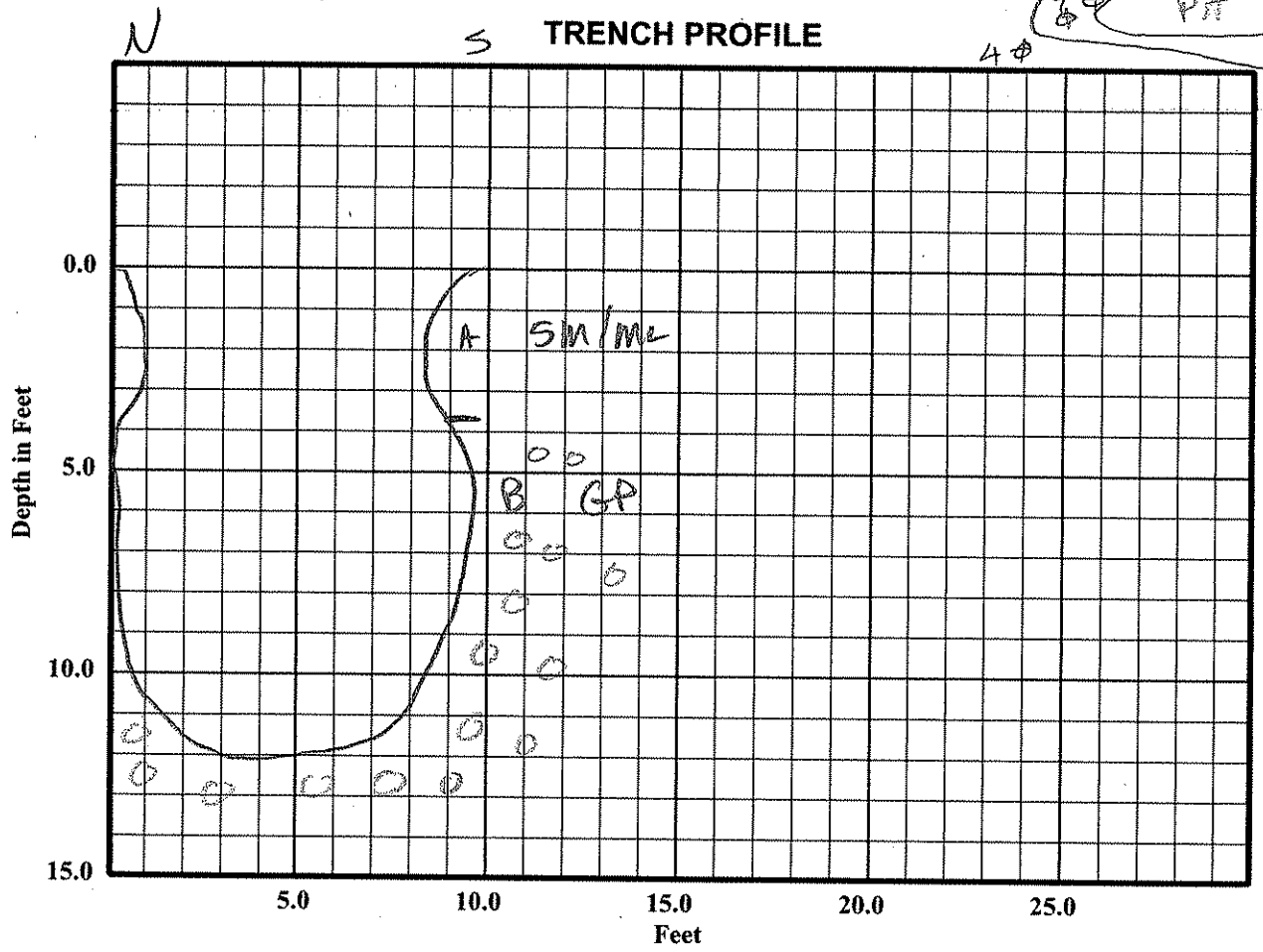
Page 1 of 1

Site Location Dams Camp Trench Number ~~DC-TP-7~~ Date 10/3/10

Coordinates: Inside Stake Outside Stake

Native/Fill Stake

Logged By Bill Bragdon



Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

A 0-3.5' fine to coarse sandy silt (SM/ML) light yellowish brown (10YR 5/4), some roots and organics, 30% sand 70% silt.

B 3.5-12 (GP) fine to coarse sandy fine & coarse gravel with abundant cobbles and boulders, very dry, excavation caving, gray (N5) to dark grayish brown (10YR 4/2). subrounded and boulders up to 2', 30% sand 70% gravel

2 Scallon buckets

Begin Trench 1218 Finish Trench 1242

Total Depth 12 Total Length 10'

HOLDEN MINE
TRENCH SAMPLE LOG FORM
TRENCH PROFILE

TRENCH SAMPLE LOG FORM
TRENCH PROFILE TP-DC-8

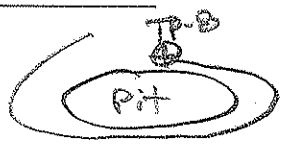
DC

Site Location Dams Camp Trench Number ~~DC-TP-8~~ Date 10/3/10

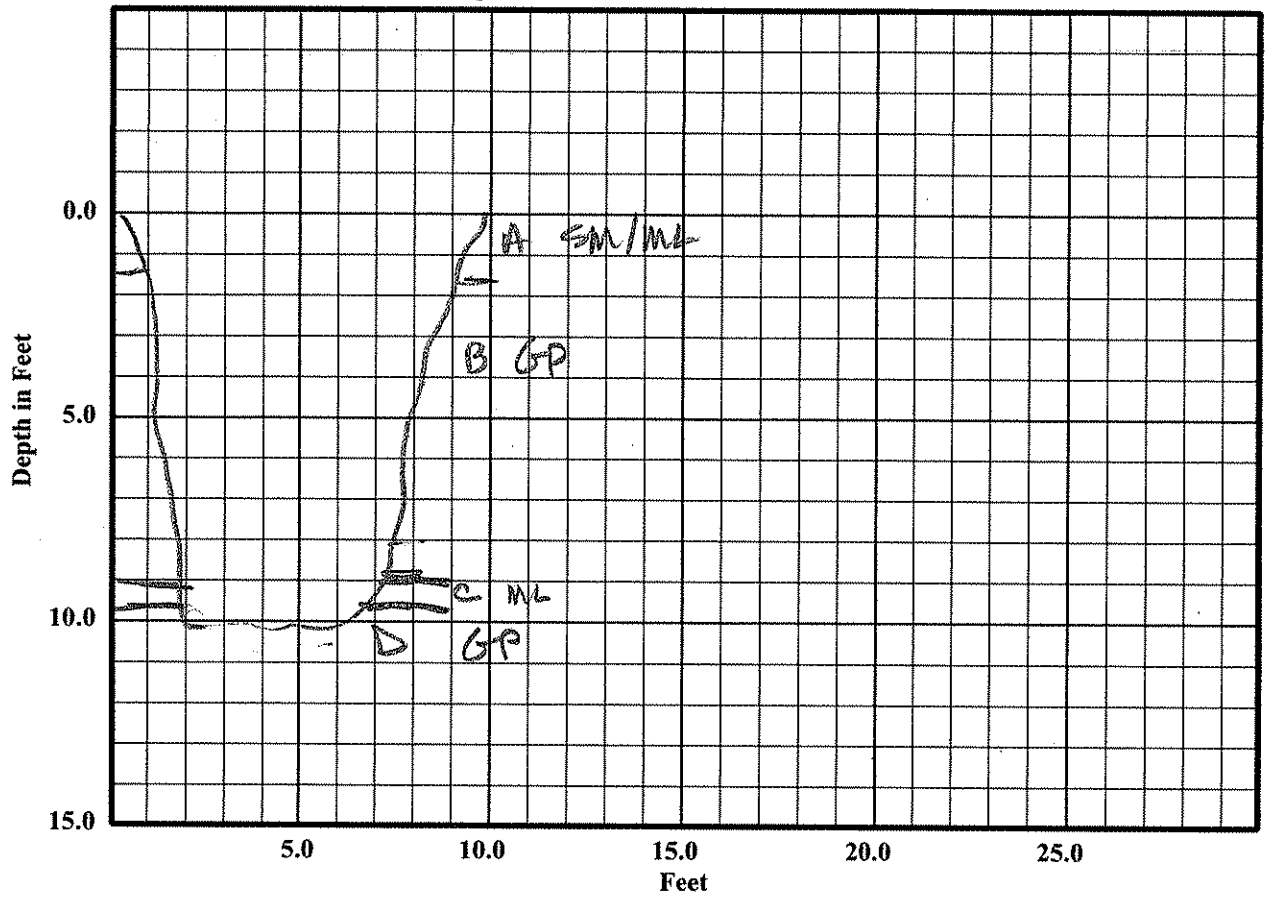
Coordinates: Inside Stake _____ Outside Stake _____

Native/Fill Stake _____

Logged By Bill Brayden



TRENCH PROFILE



Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

0-1.5 fine sandy silt (SM/ML), light yellowish brown (10YR 5/4) some roots and organics, 30% sand 70% silt

B&D (GP) fine to coarse sandy fine & coarse gravel w/ some cobbles and boulders, yellowish brown (10YR 5/4), dry, NP 30% sand 70% gravel. 2 buckets 1.5-10' mixed soil

C (ML) silt with bedding and some roots, light brownish gray (10YR 6/2) with pale brown (10YR 6/3)

Begin Trench 1246 Finish Trench 1250

Total Depth 10' Total Length 10

HOLDEN MINE
TRENCH SAMPLE LOG FORM
TRENCH PROFILE

TRENCH SAMPLE LOG FORM
TRENCH PROFILE TP-DC-9

DC

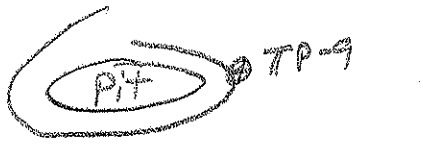
Page 1 of 1

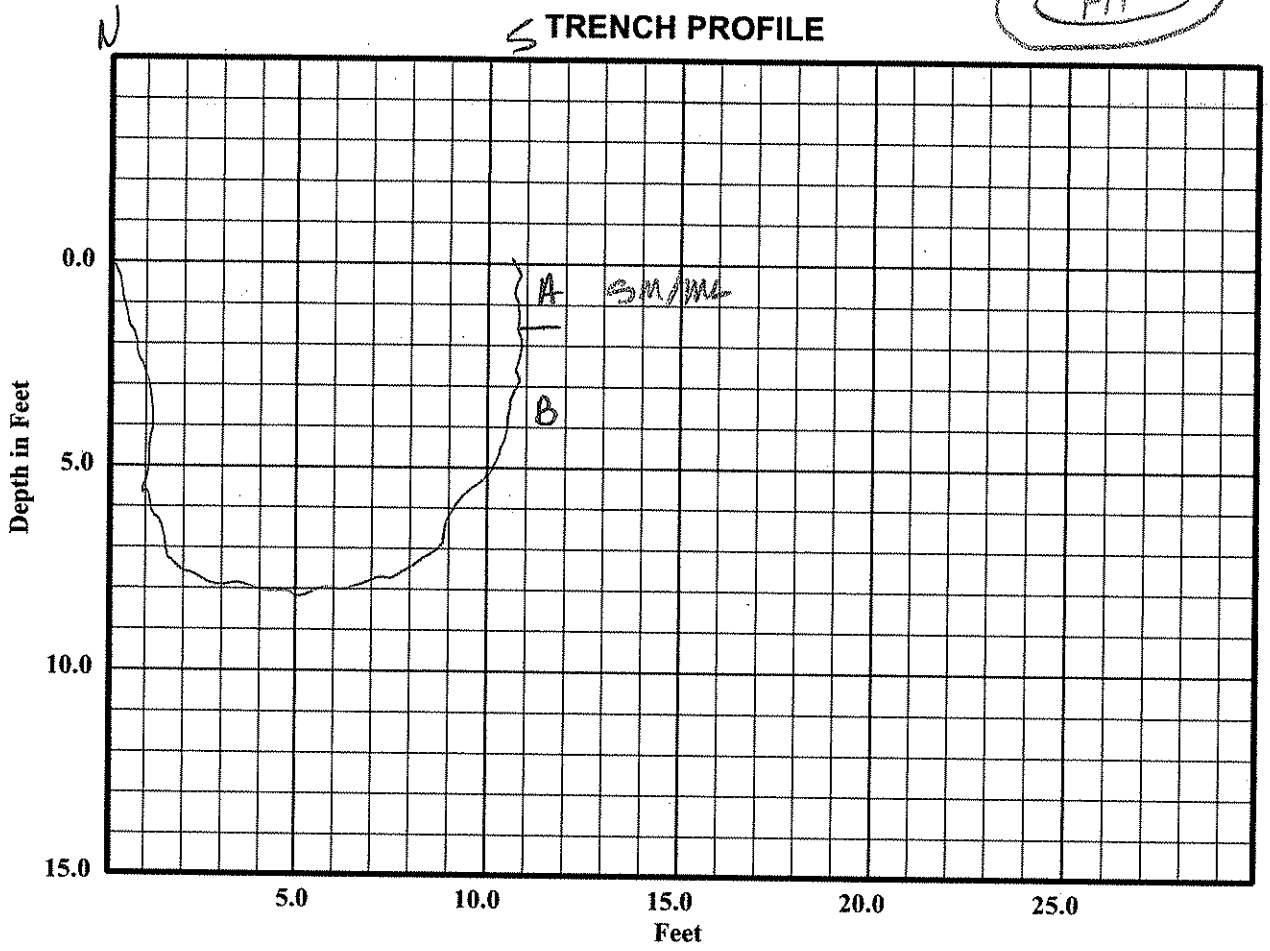
Site Location Dams Camp Trench Number ~~DC-TP-9~~ Date 10/5/10

Coordinates: Inside Stake _____ Outside Stake _____

Native/Fill Stake _____

Logged By Bill Bragdon





Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

(SM/ML)

A 0-1.5 fine sandy silt, light yellowish brown w/ roots, NP, dry 30% sand 70% silt (10YR 6/4)

B 1.5-8 fine to coarse sandy fine and coarse gravel with cobbles and boulders to 1.9', light yellowish brown (10YR 6/4) to gray (N5), very dry, side walls caving, trace roots 30% sand 70% gravel
2 5 gallon buckets.

Begin Trench 1321 Finish Trench 1400

Total Depth 8 Total Length 11'

HOLDEN MINE
TRENCH SAMPLE LOG FORM
TRENCH PROFILE

TRENCH SAMPLE LOG FORM
TRENCH PROFILE TP-DC-10

DC

Page 1 of 1

Site Location Dams Camp Trench Number ~~DC TP-10~~ Date 10/3/10

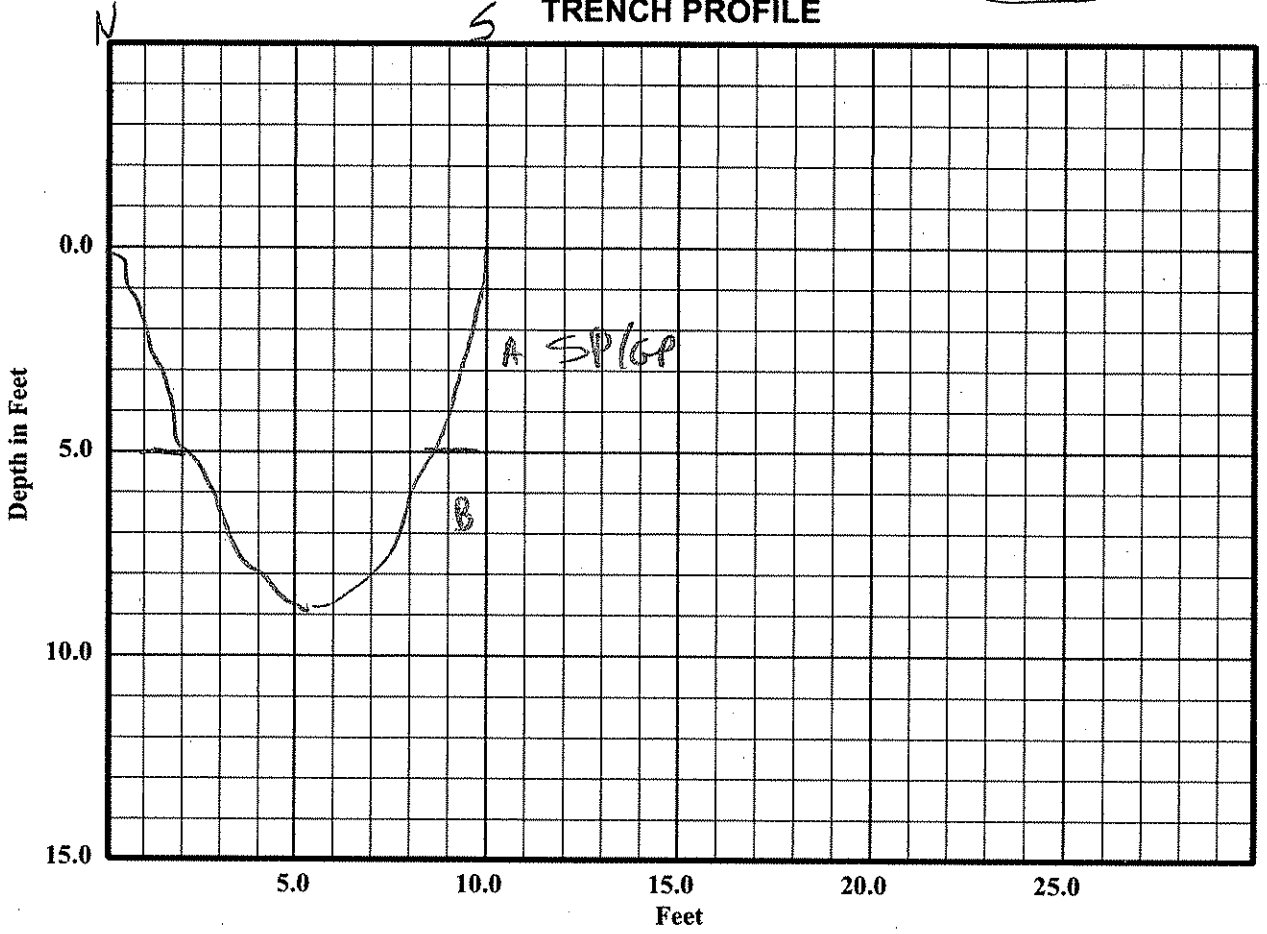
Coordinates: Inside Stake _____ Outside Stake _____

Native/Fill Stake _____

Logged By Bill Bragdon

TP10

TRENCH PROFILE



Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

A 0-5 fine to coarse sandy fine & coarse gravel, very clean material, very dry, NP, light yellowish brown (10YR 6/4) 50% sand 50% gravel (SP/GP)

B fine to coarse sandy fine & coarse gravel w/trace silt, dark yellowish brown (10YR 4/4) very dry, NP 30% sand 70% gravel, few cobbles 2 5gallon buckets.

Begin Trench 1400 Finish Trench 1930

Total Depth 9 Total Length 10

HOLDEN MINE
TRENCH SAMPLE LOG FORM
TRENCH PROFILE

Client:	*Rio Tinto*			
Project:	*Holden Mine*		**Date:**	*2/15/11*
Description:	*Holden By Pass Road and FS Road 8301*		**Job No:**	*1008679*
	Fill Slopes Stability Evaluation	**By:**	*P. Pellicer*	**Chkd By:**

Attachment C –Reference Figures, Tables and Charts

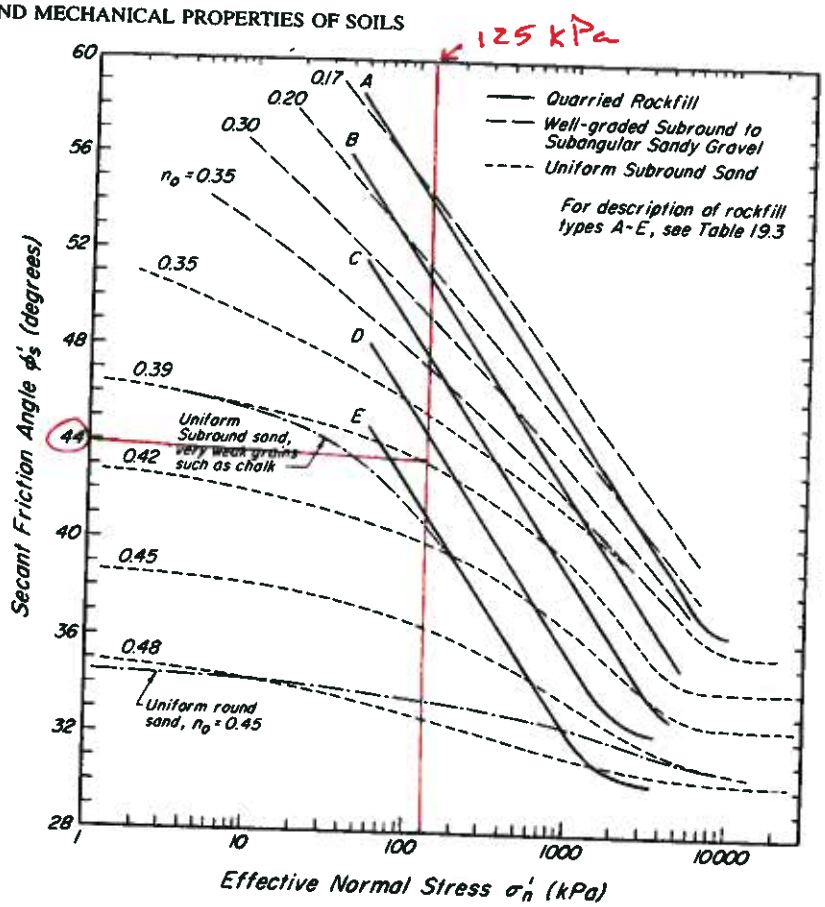


Figure 19.4 Values of secant friction angle for granular soils.

Table 19.3 Unconfined Compressive Strength of Particles for Rockfill Grades in Fig. 19.4

Rockfill Grade	Particle q_u (MPa)
A	≥220
B	165–220
C	125–165
D	85–125
E	≤85

19.4 by starting with the values of ϕ_s' for the strong particles at low σ_n' and merging to the corresponding rockfill as σ_n' increases. The procedure is illustrated in Fig. 19.4 for a uniform, subrounded sand with very weak grains of material such as chalk.

Because undisturbed sampling of granular soils is difficult, the friction angle ϕ' of sand deposits is often estimated from the results of *in situ* penetration tests (e.g., Schmertmann 1975, Broms and Flodin 1988). In quartz sands, in which compressibility associated with grain crushing is not a significant factor, the friction angle ϕ' and the effective confining pressure $\sigma_{ho}' = K_o \sigma_{vo}'$ are the main factors that determine the penetration resistance. It is, therefore, reasonable to expect that, for normally consolidated young sands, a correlation should exist between ϕ' and the penetration resistance measured by the dynamic standard penetration test DSPT (Article 11.3.2) or the push-cone penetration test PCPT (Article 11.4.2), when the penetration resistances are normalized to take into account the effective confining pressure. The normalized values for the PCPT tip resistance q_c may be taken as

$$q_{c1} = q_c(100/\sigma_{vo}')^{1/2}$$

and for the DSPT as

$$(N_1)_{60} = N_{60}(100/\sigma_{vo}')^{1/2}$$

where σ_{vo}' is in kPa (Liao and Whitman 1985).

The best data on the correlation between ϕ' and q_c were obtained from q_c measurements in large calibration chambers (Holden 1971, Veismanis 1974, Parkin et al. 1980, Chapman and Donald 1981, Baldi et al. 1981, Villet and Mitchell 1981). The friction angle ϕ' was determined from drained triaxial compression tests at confining pressures approximately equal to the values of σ_{ho}' in the calibration chamber. The correlation has been generally confirmed by predictions based on bearing capacity the-

TABLE 4-2 Typical Index Properties for Granular Soils*

	Particle Size and Gradation				Voids			
	Approx. Size Range (mm)		Approx.	Approx. Range	Void Ratio		Porosity (%)	
	D_{max}	D_{min}	D_{10} (mm)	C_u	e_{max} (loose)	e_{min} (dense)	n_{max} (loose)	n_{min} (dense)
1. Uniform materials:								
(a) Equal spheres	—	—	—	1.0	0.92	0.35	48	26
(b) Standard Ottawa sand	0.84	0.59	0.67	1.1	0.80	0.50	44	33 ←
(c) Clean, uniform sand (fine or medium)	—	—	—	1.2 to 2.0	1.0	0.40	50	29 ← Range used
(d) Uniform, inorganic silt	0.05	0.005	0.012	1.2 to 2.0	1.1	0.40	52	29
2. Well-graded materials:								
(a) Silty sand	2.0	0.005	0.02	5 to 10	0.90	0.30	47	23
(b) Clean, fine to coarse sand	2.0	0.05	0.09	4 to 6	0.95	0.20	49	17
(c) Micaceous sand	—	—	—	—	1.2	0.40	55	29
(d) Silty sand and gravel	100	0.005	0.02	15 to 300	0.85	0.14	46	12

*Modified after B. K. Hough (1969), *Basic Soils Engineering*, © 1969 by the Ronald Press, Co. Reprinted by permission of John Wiley & Sons, Inc.

TABLE 4-2 Continued

	Density (Mg/m³)†						
	Dry Density, ρ_d			Wet Density, ρ		Submerged Density, ρ'	
	Min. (loose)	100% Mod. Proctor	Max. (dense)	Min. (loose)	Max. (dense)	Min. (loose)	Max. (dense)
1. Uniform materials:							
(a) Equal spheres (theoretical values)	—	—	—	—	—	—	—
(b) Standard Ottawa sand	1.49	—	1.78	1.51	2.12	0.93	1.12
(c) Clean, uniform sand (fine or medium)	1.35	1.86	1.92	1.37	2.20	0.85	1.18
(d) Uniform, inorganic silt	1.29	—	1.92	1.31	2.20	0.83	1.18
2. Well-graded materials:							
(a) Silty sand	1.41	1.98	2.06	1.43	2.30	0.88	1.28
(b) Clean, fine to course sand	1.38	2.14	2.23	1.40	2.39	0.86	1.40
(c) Micaceous sand	1.23	—	1.95	1.24	2.23	0.77	1.23
(d) Silty sand and gravel	1.44	—	2.36	1.46	2.51	0.91	1.49

†Tabulation is based on $\rho_s = 2.65$ Mg/m³. Multiply by 62.4 to obtain lbf/ft³.

130

$\rho_{d\,max} = \frac{\rho_s}{1+e_{min}}$

$\rho_{d\,min} = \frac{\rho_s}{1+e_{max}}$

740
Articulated Truck

CATERPILLAR®

Engine		
Engine Model	Cat® C15 ACERT™	
Gross Power – SAE J1995	350 kW	469 hp
Net Power – SAE J1349	338 kW	453 hp

Weights		
Rated Payload	39.5 tonnes	43.5 tons
Body Capacities		
Heaped SAE 2:1	24 m^3	31.4 yd^3

740 Articulated Truck Specifications

Engine

Engine Model	Cat® C15 ACERT™	
Gross Power – SAE J1995	350 kW	469 hp
Net Power – SAE J1349	338 kW	453 hp
Net Power – ISO 9249	342 kW	458 hp
Net Power – EEC 80/1269	342 kW	458 hp
Bore	137 mm	5.4 in
Stroke	171.5 mm	6.75 in
Displacement	15.2 L	926 in^3

- The power ratings apply at rated speed of 1,800 rpm when tested under the conditions for the specified standard.
- The net power advertised is the power available at the flywheel when the engine is equipped with alternator, air cleaner, muffler and fan at minimum speed.
- Net power when the fan is at maximum speed is 330 kW (442 hp) per the SAE reference conditions.
- The 740 meets EPA Tier 3/EU Stage 3a emission specifications for the U.S. and Europe through 2010.
- No engine derating required below 2438 m (8,000 ft.).

Weights

Rated Payload	39.5 tonnes	43.5 tons

Body Capacities

Heaped SAE 2:1	24 m^3	31.4 yd^3
Struck	18.5 m^3	24.2 yd^3
Tailgate Struck	19.5 m^3	25.5 yd^3
Tailgate Heaped 2:1	25.5 m^3	33.5 yd^3

Transmission

Forward 1	8.9 km/h	5.5 mph
Forward 2	12.1 km/h	7.5 mph
Forward 3	16.4 km/h	10.2 mph
Forward 4	22 km/h	13.7 mph
Forward 5	30 km/h	18.6 mph
Forward 6	40 km/h	25.1 mph
Forward 7	54.7 km/h	34 mph
Reverse 1	8.4 km/h	5.2 mph
Reverse 2	11.6 km/h	7.2 mph

Sound Levels

Interior Cab	79 dB(A)

- The operator sound exposure Leq (equivalent sound pressure level) measured according to the work cycle procedures specified in ANSI/SAE J1166 OCT 98 is 79 dB(A), for the cab offered by Caterpillar, when properly installed and maintained and tested with the doors and windows closed.
- Hearing protection may be needed when operating with an open operator station and cab (when not properly maintained or doors/windows open) for extended periods or in noisy environments.

Operating Weights

Front Axle – Empty	19 400 kg	42,770 lb
Center Axle – Empty	7200 kg	15,873 lb
Rear Axle – Empty	6500 kg	14,330 lb
Total – Empty	33 100 kg	72,973 lb
Front Axle – Rated Load	5200 kg	11,464 lb
Center Axle – Rated Load	17 150 kg	37,809 lb
Rear Axle – Rated Load	17 150 kg	37,809 lb
Total – Rated Load	39 500 kg	87,083 lb
Front Axle – Loaded	24 600 kg	54,234 lb
Center Axle – Loaded	24 350 kg	53,683 lb
Rear Axle – Loaded	23 650 kg	52,139 lb
Total – Loaded	72 600 kg	160,055 lb

Body Plate Thickness

Front	8 mm	0.31 in
Scow	16 mm	0.63 in
Side	12 mm	0.47 in
Base	16 mm	0.63 in

Service Refill Capacities

Fuel Tank	532 L	140.5 gal
Cooling System	80 L	21.1 gal
Hydraulic System	328 L	86.6 gal
Engine Crankcase	38 L	9.5 gal
Transmission	72 L	19 gal
Final Drives/ Differential	72 L	19 gal
Output Transfer Gear Box	18 L	4.8 gal

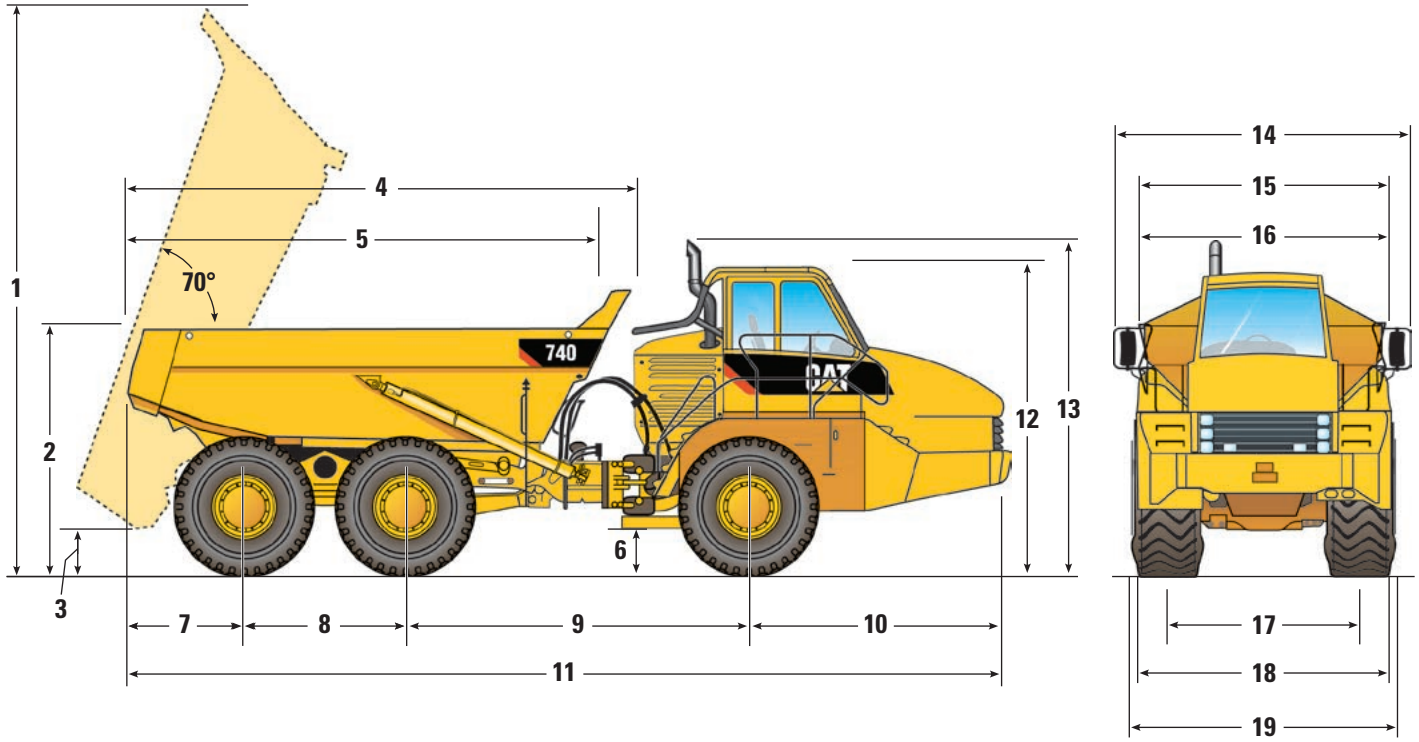
Body Hoist

Raise time	12 Seconds
Lower time	7 Seconds

Standards

Brakes	ISO 3450 – 1996
Cab/FOPS	ISO 3449 Level II – 2005
Cab/ROPS	ISO 3471 – 2008
Steering	ISO 5010 – 2007

Dimensions



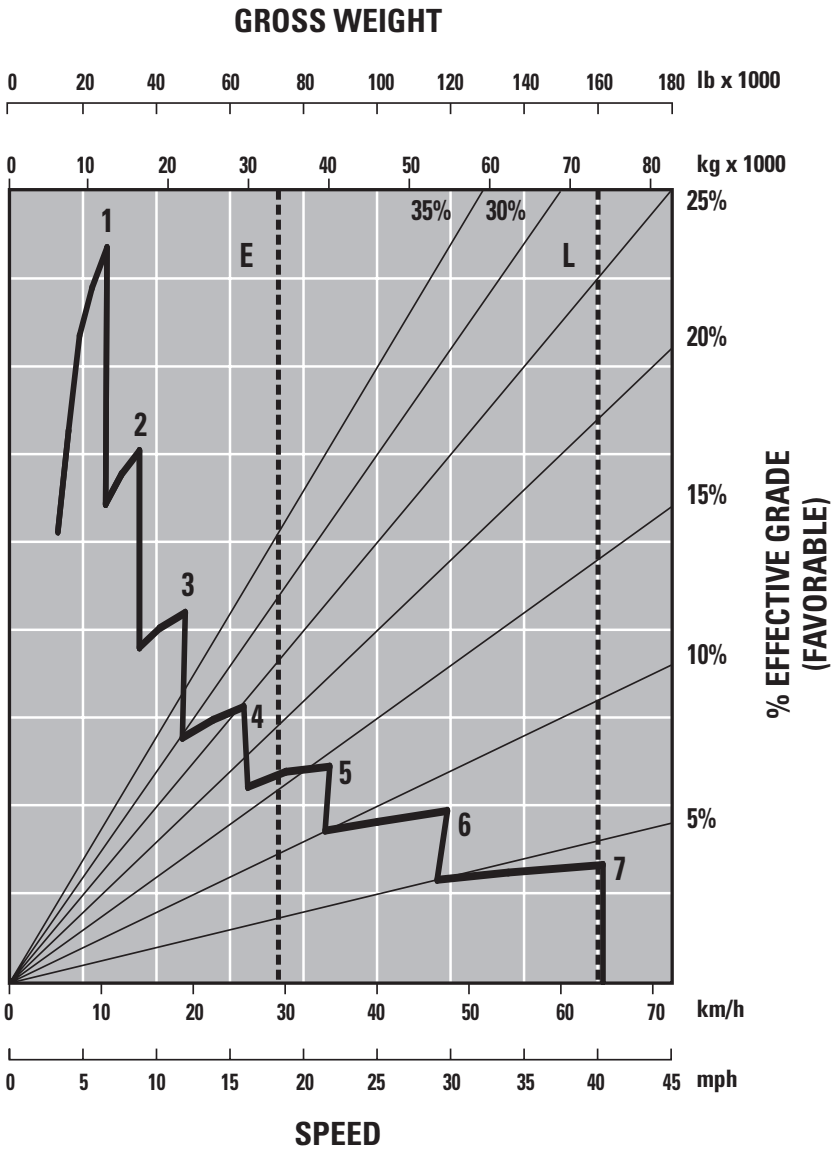
	mm	ft
1	7092	23.4
2	3239	10.6
3	697	2.3
4	6288	20.6
5*	5734	18.8
6	577	1.8
7	1458	4.7
8	1966	6.4
9	4244	13.9
10	3221	10.5

	mm	ft
11	10 889	35.7
12	3745	12.3
13**	4049	13.3
14	3823	12.5
15***	3705	12.14
16	3418	11.2
17	2687	8.8
18	3430	11.2
19****	3520	11.5

*Inside of body.
**Exhaust stack can be removed for transportation.
***If equipped with a scissor tailgate.
****Max-unladen over tire bulge.

Retarding Performance

To determine performance, read from Gross Weight down to % Effective Grade. Effective Grade equals actual % favorable grade plus 1% for each 10 kg/metric ton (20 lb/ton) of Rolling Resistance. From this point, read horizontally to the curve with the highest attainable speed range. Then, go down to Maximum Speed. Retarding effect on these curves represents full application of the retarder.

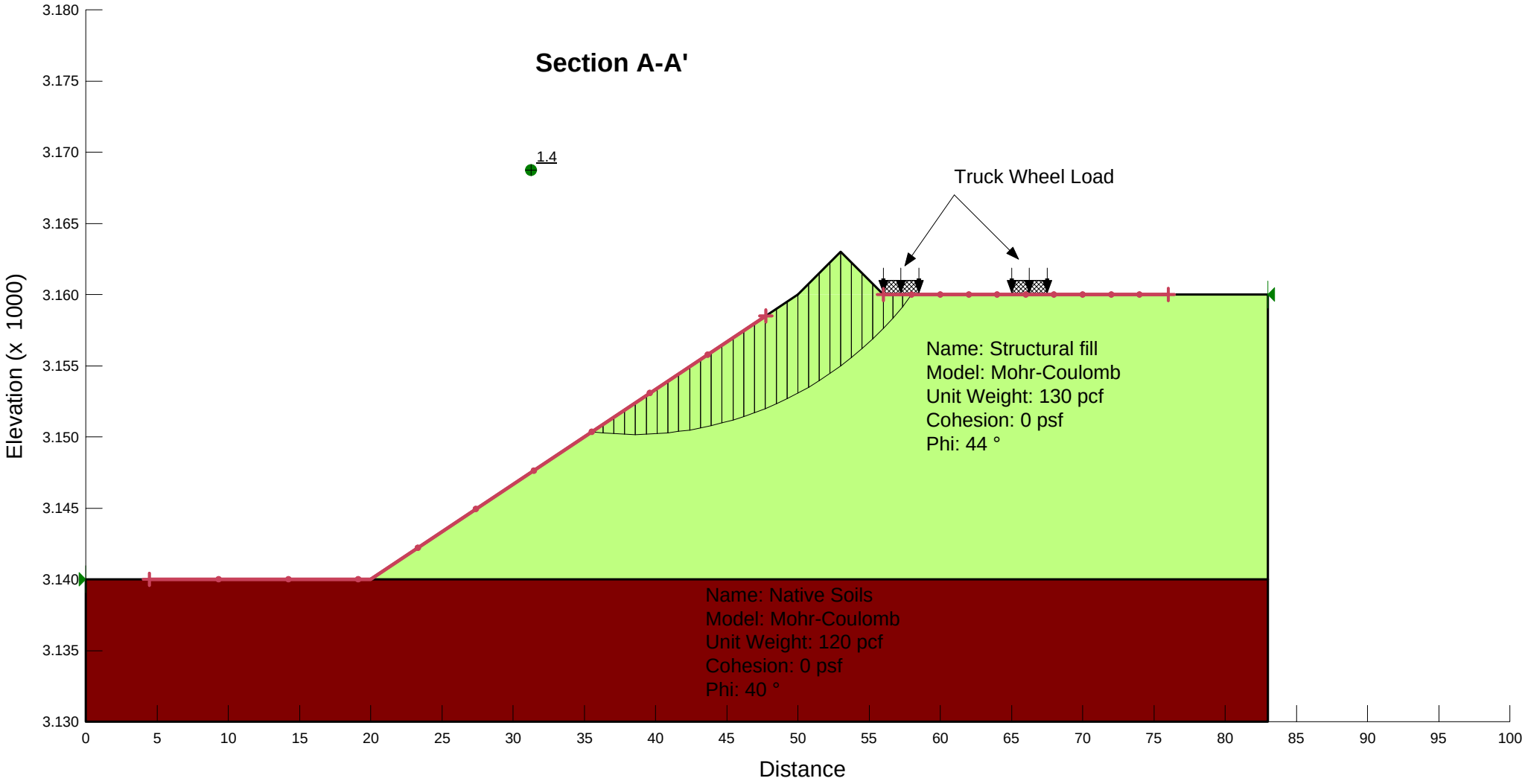


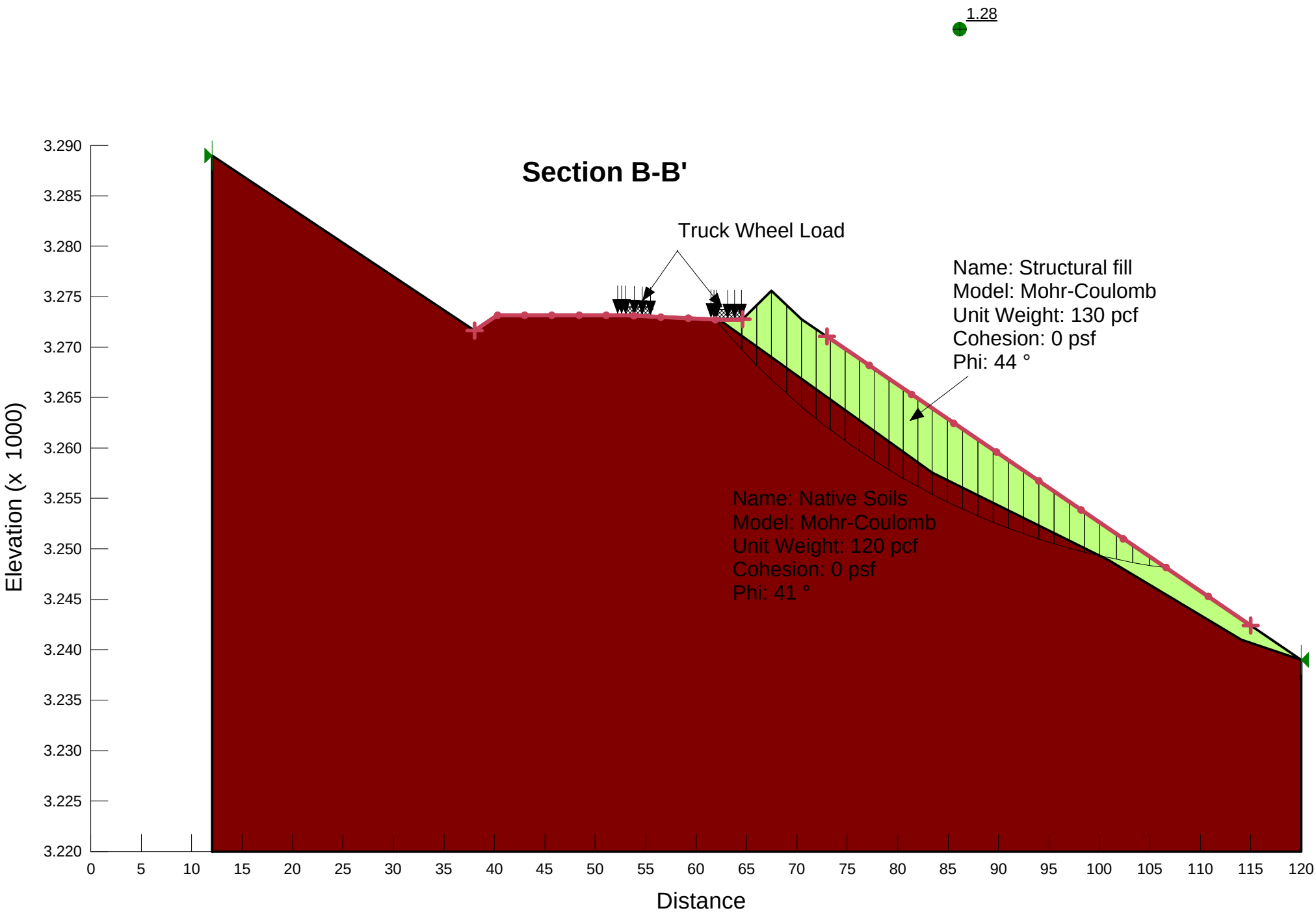
1 – 1st Gear
2 – 2nd Gear
3 – 3rd Gear
4 – 4th Gear
5 – 5th Gear
6 – 6th Gear
7 – 7th Gear

E – Empty 33 100 kg (72,973 lb)
L – Loaded 72 600 kg (160,055 lb)

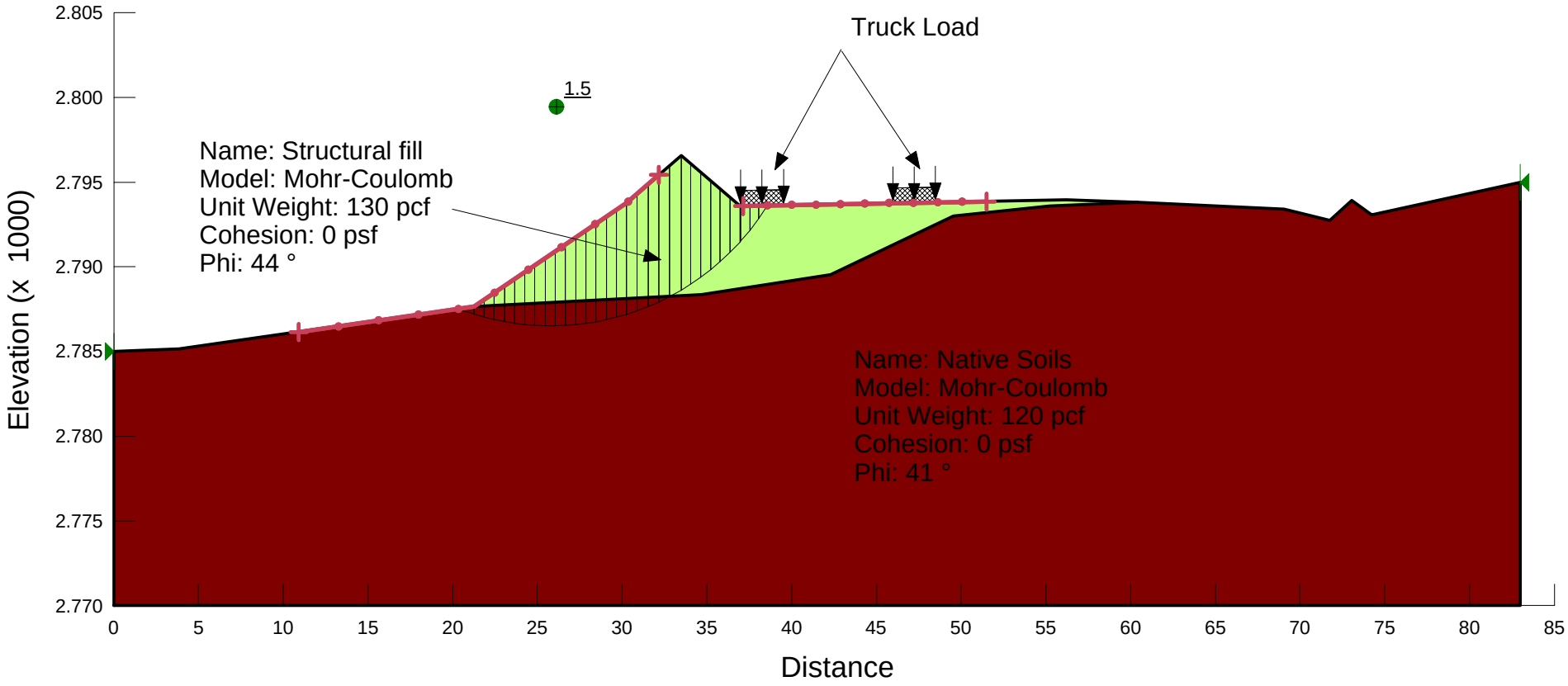
Client:	*Rio Tinto*			
Project:	*Holden Mine*		**Date:**	*2/15/11*
Description:	*Holden By Pass Road and FS Road 8301 Fill Slopes Stability Evaluation*		**Job No:**	*1008679*
		By:	*P. Pellicer*	**Chkd By:**

Attachment D –Slope/W Results


Section A-A'
1.4
Truck Wheel Load
Name: Structural fill
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 44 °
Name: Native Soils
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion: 0 psf
Phi: 40 °
Elevation (x 1000)
3.180
3.175
3.170
3.165
3.160
3.155
3.150
3.145
3.140
3.135
3.130
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Distance


1.28
Section B-B'
Truck Wheel Load
Name: Structural fill
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 44 °
Name: Native Soils
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion: 0 psf
Phi: 41 °
Elevation (x 1000)
3.290
3.285
3.280
3.275
3.270
3.265
3.260
3.255
3.250
3.245
3.240
3.235
3.230
3.225
3.220
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120
Distance

Section C-C'


Truck Load
1.5
Name: Structural fill
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 44 °
Name: Native Soils
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion: 0 psf
Phi: 41 °
Elevation (x 1000)
2.805
2.800
2.795
2.790
2.785
2.780
2.775
2.770
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
Distance

HOLDEN BYPASS ROAD BRIDGE
ABUTMENT SLOPE STABILITY EVALUATION

Client:	*Rio Tinto.*	**Sheet:** *1* **of** *6*	
Project:	*Holden Mine*	**Date:**	*2/15/11*
Description:	*Holden By Pass Road Bridge Abutment Slope Stability Evaluation*	**Job No:**	*1008679*
		By: *P. Pellicer*	**Chkd By:** *P. Crouse*

HOLDEN MINE- HOLDEN BYPASS ROAD BRIDGE ABUTMENT SLOPE STABILITY EVALUATION

Revisioning							
Rev.	**Date**	**Description**	**By**	**Checked**	**Date**	**Reviewed**	**Date**
A	*03/15/11*	*First Issue*	*P. Pellicer*	*P. Crouse*	*4/17/11*		
B							

Location and Format

Electronic copies of these calculations are located in the project files system at:

Objective

The objective of this calculation is to evaluate the general stability of the Holden bypass road Bridge Abutment slopes.

Client: *Rio Tinto.*
Project: *Holden Mine*
Description: *Holden By Pass Road Bridge Abutment Slope Stability Evaluation*

Sheet: *2* **of** *6*
Date: *2/15/11*
Job No: *1008679*
By: *P. Pellicer* **Chkd By:** *P. Crouse*

Design Basis

The evaluation of the proposed bridge abutment slopes was performed in general accordance with WDOT and USDA Forest Service guidelines (Ref 1 and 2)

The relevant design criteria in terms of stability are as presented in the following table:

Table 1 – Design Basis (Stability)

Item	*Criteria*	*Data Source*
Minimum Stability Requirements		
Minimum Static Factor of Safety	*1.5*	*2*
Minimum Psuedo-Static Factor of Safety	*1.1*	*2*

Client:	*Rio Tinto.*	**Sheet:** *3* **of** *6*	
Project:	*Holden Mine*	**Date:**	*2/15/11*
Description:	*Holden By Pass Road Bridge Abutment Slope Stability Evaluation*	**Job No:**	*1008679*
		By: *P. Pellicer*	**Chkd By:** *P. Crouse*

Introduction

The Holden bypass road has been designed to provide access for heavy construction equipment from the existing forest service road 8301 onto the top of the tailing piles, (TP-1, TP-2, and TP-3). The bypass road alignment starts East of Holden Village heading South across Railroad creek until it reaches the South side of the valley. The road turns West and traverses the valley wall, onto the top of TP-1 and TP-2. Once the road reaches TP-2, it generally follows the contact of the tailing material and the south valley wall, continuing west.

Bridge abutments have been designed utilizing fill placed with 1.5H:1V slopes, and fill heights between 6.5 to 7.5 feet below the bridge structure.. The height of the abutment slopes are controlled by the predicted water surface profile of railroad creek, based on a 100yr storm flow. The abutment geometry is designed to provide passage of the 100 yr storm flow plus 5 feet of freeboard between the predicted high water level and the lowest structural member of the bridge.

The abutments will support a 100 foot long pre-engineered bridge founded on concrete shallow foundation. Although the specific bridge manufacture has not been selected, preliminary discussion with suppliers indicate the concrete footing will be required to support a 292 kip design load. The bridge design load includes, the bridge superstructure deadload (including wearing course), and vehicle live load including impact factor. Load estimates are provided in Attachment C. Snow load is not considered in the loading calculation.

Methodology

Bridge abutments were evaluated for both local and global failure modes, under static and pseudo-static conditions. Both circular and block failure planes were utilized to identify the critical failure mechanism.

The stability analysis models the bridge load as a 5200 psf surcharge load with a width of 3.5 feet to model the bridge dead load and the live load due to a fully loaded Caterpillar 740 articulated truck on the bridge. The footing width and applied load are taken from preliminary design values supplied by a bridge vendor (see Attachment C).

These slope stability calculations were performed using Slope/W version 7.15 (Geoslope, 2009). Slope/W is a two-dimensional computer program that performs slope stability computations using limit equilibrium methods. The Morgenstern-Price method (Morgenstern and Price, 1965) with a half-sine function for interslice forces was selected for performing the computations in Slope/W. The method uses both circular and non-circular shear surfaces and satisfies both moment and force equilibrium.

WDOT design guidelines were utilized to quantify an acceptable static factor of safety for bridge abutment slope stability (Ref 2).

Both abutments have similar geometry and foundation soils, therefore the analysis performed for the north abutment are applicable to the south abutment.

The initial slope stability analysis performed indicated that an acceptable FOS could not be achieved utilizing the design geometry and available soil properties. Due to the relatively long span of the bridge, it was not deemed practical to flatten the abutment slopes to improve the slope stability FOS. Therefore, Geosynthetics were utilized to reinforce the slope in the area of the predicted critical failure envelopes. An iterative approach was used to determine the most efficient use and placement of the geosynthetic re-enforcing fabric.

Geometry

Client:	*Rio Tinto.*	**Sheet:** *4* **of** *6*	
Project:	*Holden Mine*	**Date:**	*2/15/11*
Description:	*Holden By Pass Road Bridge Abutment Slope Stability Evaluation*	**Job No:**	*1008679*
		By: *P. Pellicer*	**Chkd By:** *P. Crouse*

Fill slopes have been designed with 1.5H:1V slopes (33.7^0), Abutment sections were analyzed at the centerline of the bridge structure, perpendicular to the fill slope. The locations of the sections are presented in Attachment A. Two water surfaces were utilized to check the abutment stability, the first correlates with a the bank full condition (water surface elevation 3143.5 ft) and the second correlates with the 100 yr flood event (water surface elevation 3147 ft.)

Loading Conditions and Material Properties

Fill material which will be utilized for construction of the abutments will be supplied from the local Alluvial materials or Dan's Camp borrow area. In 2010, MWH performed 10 test pit excavations to characterize the potential borrow material. Material properties assigned for fill material originating from Dan's Camp are discussed in the "Holden Mine Road Fill Slope Stability" calculation package, The strength characteristics determined in the reference calculation package are considered applicable to other Alluvial material which may be used to construct the abutments

To summarize:
Material present at Dan's Camp.

- *SILT to Silty SAND (ML, SM/ML).*
- *Poorly graded GRAVEL (GP)*
- *Gravely SAND (SP to SW)*

The silt and silty sand material is not considered suitable for use as structural fill for road construction and is not part of this stability evaluation.

Both the poorly graded Gravel and Gravelly Sand are considered suitable fill material. Material properties were estimated utilizing the soil description provided on the test pit logs and a published correlation relating initial porosity, effective normal stress and grain size with friction angles for granular material.

An estimated friction angle of 44 degrees was selected for the fill material.

Existing subgrade materials were assumed to have a friction angle of approximately 40 degrees, based on field observation of the test pits performed in the vicinity of the bridge abutments.

The reinforcement selected consists of a 12 oz. non-woven needlepunched geotextile with a Ultimate tensile strength (q_{ult}) of 300 lbs as determined by ASTM D4632 (Carthage Mills FX-120HS or equivelant).

Following guidelines outlined by Koerner (Ref 3) an allowable tensile strength (q_{allow})was determined utilizing the following equation:

$$q_{allow} = q_{ult} * \frac{1}{FS_{ID} * FS_{CR} * FS_{CD} * FS_{BD}}$$

Where:
q_{allow}*=Allowable tensile strength*
q_{ult}*= Ultimate tensile strength*
FS_{ID}*= The factor of safety for installation damage*
FS_{CR}*= The factor of safety for creep*
FS_{CD}*= The factor of safety for chemical degradation*
FS_{BD}*= The factor of safety for biological degradation*

Based on recommended values for the referenced factors of safety presented in Table 2.12 from reference 2 (provided in attachment C)
The following values were selected:
FS_{ID}*= 1.25*
FS_{CR}*= 2*

Client:	*Rio Tinto.*	**Sheet:** *5* **of** *6*	
Project:	*Holden Mine*	**Date:**	*2/15/11*
Description:	*Holden By Pass Road Bridge Abutment Slope Stability Evaluation*	**Job No:**	*1008679*
		By: *P. Pellicer*	**Chkd By:** *P. Crouse*

FS_{CD}= 1
FS_{BD}= 1

Therefore for the reinforcing geotextile:

$q_{allow} = 300\ lbs * \frac{1}{1.25*2*1*1}$= 120 lbs

Results

Utilizing the methodology and material properties outlined, an iterative approach was applied to optimize the number of geotextile layers and the placement of the geotextile.
:
The results of the stability analysis with the bridge load imposed on the abutment slopes are summarized in Table 2.

Table 2 – Stability Analysis Results

Loading	Recommended FOS	Calculated FOS
Static	1.5	1.7
MDE Pseudo-static	1.1	1.2
100 year Flood - Static	1.5	1.6

Print outs of the Slope/W sections are provided in Attachment D.

To achieve the calculated FOS, the native alluvial material will need to be excavated to an elevation of 3141.5 feet. The excavated area will need to be backfilled with controlled fill reinforced with 5 layers of geotextile space at 18 inch intervals vertically starting at elevation 3141.5 feet. The Geotextile reinforcement should extend a minimum of 5 feet beyond the end of the bridge to ensure all possible critical failure planes are intersected.

Based on the stress developed by the SLOPE /W model, within the geotextile a minimum anchorage length of 2.5 feet is required to achieve the q_{allow} of the geotextile. The minimum anchorage length is greatly exceeded by the proposed extent of the geotextile.

Conclusions

For the assumptions and conditions considered in this analysis, the bridge abutments have a static FOS and pseudo-static FOS against slope failure that meets the minimum requirements for slope stability.

Client:	*Rio Tinto.*	**Sheet:** *6* **of** *6*	
Project:	*Holden Mine*	**Date:**	*2/15/11*
Description:	*Holden By Pass Road Bridge Abutment Slope Stability Evaluation*	**Job No:**	*1008679*
		By: *P. Pellicer*	**Chkd By:** *P. Crouse*

Attachments

Attachment A *– Plan View and Section of Bridge Abutments*

Attachment B *–Test Pit Logs*

Attachment C *– Referenced Figures, Tables and Charts*

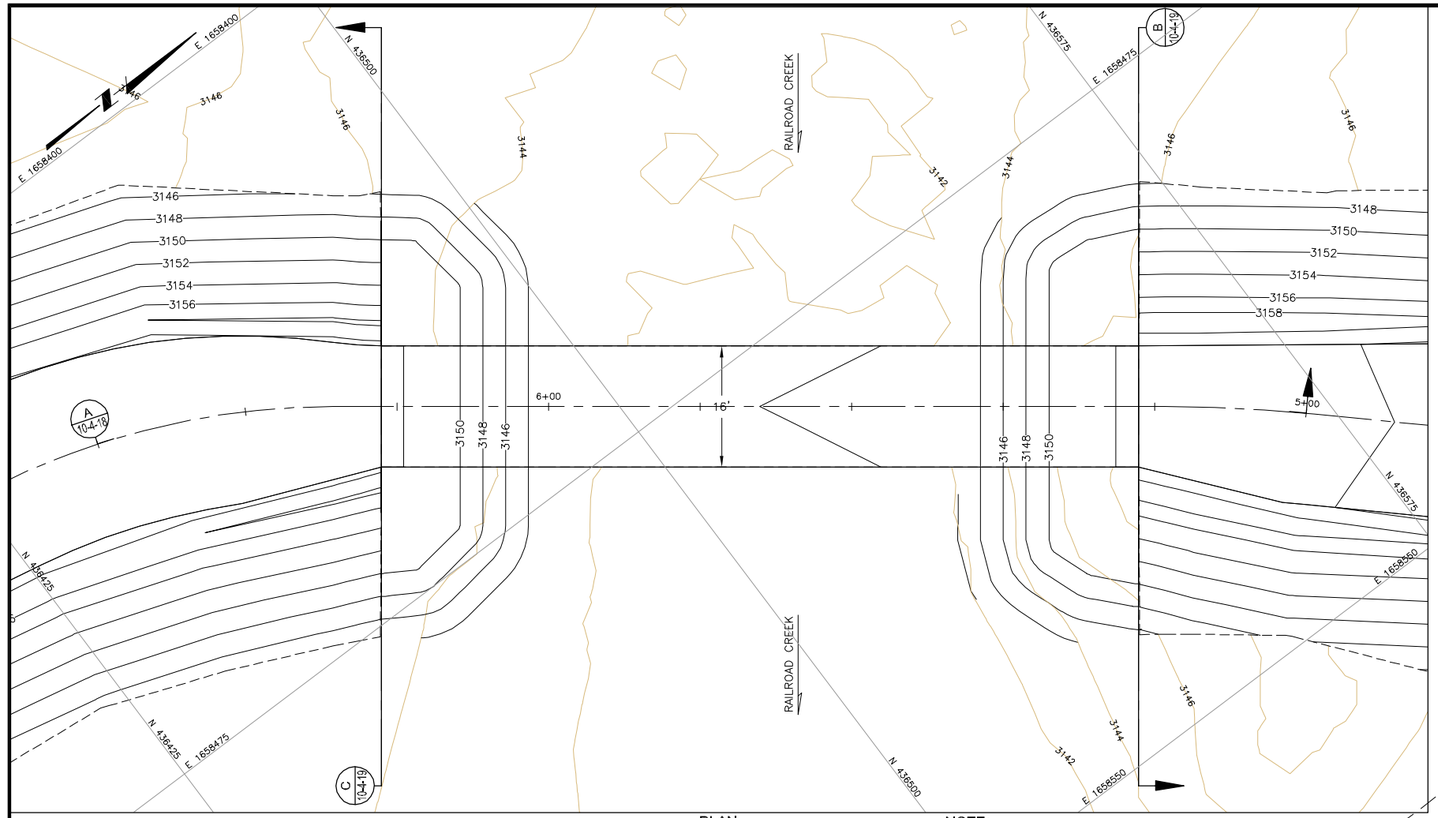
Attachment D *– Slope/W Results*

References

1. USDA Forest Service, *FSH 7709.56 – Road Preconstruction Handbook, 1994*
2. WDOT, Geotechnical Design Manual, 2010
3. Koerner, Robert M, *Designing with Geosynthetics*, second Ed. 1990
4. *Geoslope International, Ltd. (Geoslope), 2009. GEOSLOPE, Version 7.15*

Client:	*Rio Tinto*			
Project:	*Holden Mine*		**Date:**	*2/15/11*
Description:	*Holden By Pass Road and FS Road 8301 Fill Slopes Stability Evaluation*		**Job No:**	*1008679*
		By:	*P. Pellicer*	**Chkd By:**

Attachment A – Plan View of Roadway Alignment and Approximate Test Pit Locations

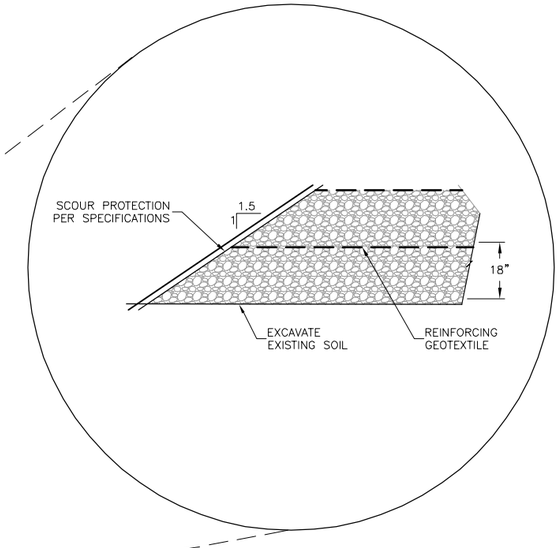


PLAN

SCALE
10 0 10 20 FEET
CONTOUR INTERVAL = 2 FEET

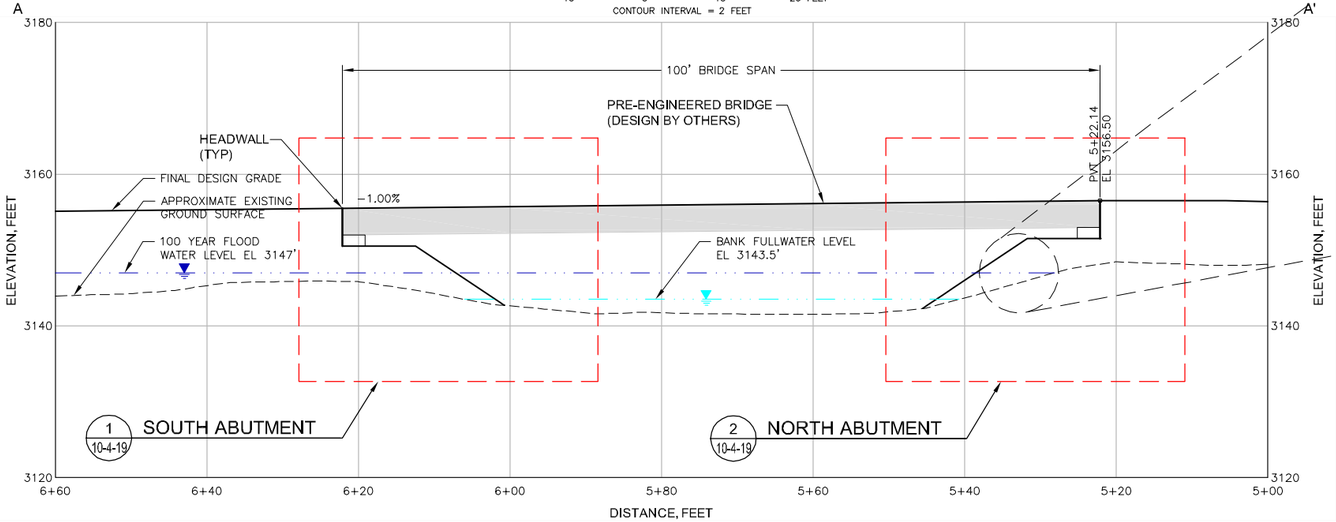
NOTE:

1. FOR PLAN LOCATION SEE SHEET 10-4-1.



3 - REINFORCING GEOTEXTILE TERMINATION

SCALE
2 0 2 4 FEET



ELEVATION

A 10-4-18 BRIDGE

SCALE
10 0 10 20 FEET

ISSUE REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

DISCLAIMER:
THIS DRAWING WAS DEVELOPED THROUGH THE APPLICATION OF PROFESSIONAL ENGINEERING SKILL AND PROPRIETARY METHODOLOGIES, PROCESSES AND KNOW HOW OF MWH AS AUTHOR ALL PURSUANT TO THE TERMS OF A CONTRACTUAL SCOPE OF WORK GOVERNING ITS PREPARATION. THIS DRAWING MAY NOT BE USED OR MODIFIED OTHER THAN IN STRICT ACCORDANCE WITH THE TERMS OF THE GOVERNING CONTRACT AND SCOPE OF WORK OR OTHERWISE ABSENT THE INVOLVEMENT AND CONSENT OF THE AUTHOR. ANY ALTERATION OR ADAPTATION OF THIS DRAWING SHALL BE CONSISTENT WITH THE AUTHOR'S CONTRACTUAL AND PROPRIETARY RIGHTS AND BE AT USER'S SOLE RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY OF MWH.

DRAWING REFERENCE(S):
- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BRIDGE PLAN AND SECTION

MWH

SHEET 10-4-18 | REVISION B
FILE NAME 1008679D260

M:\Clients-O-Z\Rio Tinto\1008679 - Holden Mine\013-Sheet Set\Infrastructure Improvements\Holden Village Bypass Road\1008679D260 4/15/2011 3:52:04 PM

Client:	*Rio Tinto*			
Project:	*Holden Mine*		**Date:**	*2/15/11*
Description:	*Holden By Pass Road and FS Road 8301*		**Job No:**	*1008679*
	Fill Slopes Stability Evaluation	**By:**	*P. Pellicer*	**Chkd By:**

Attachment B –Test Pit Logs

TRENCH SAMPLE LOG FORM
TRENCH PROFILE

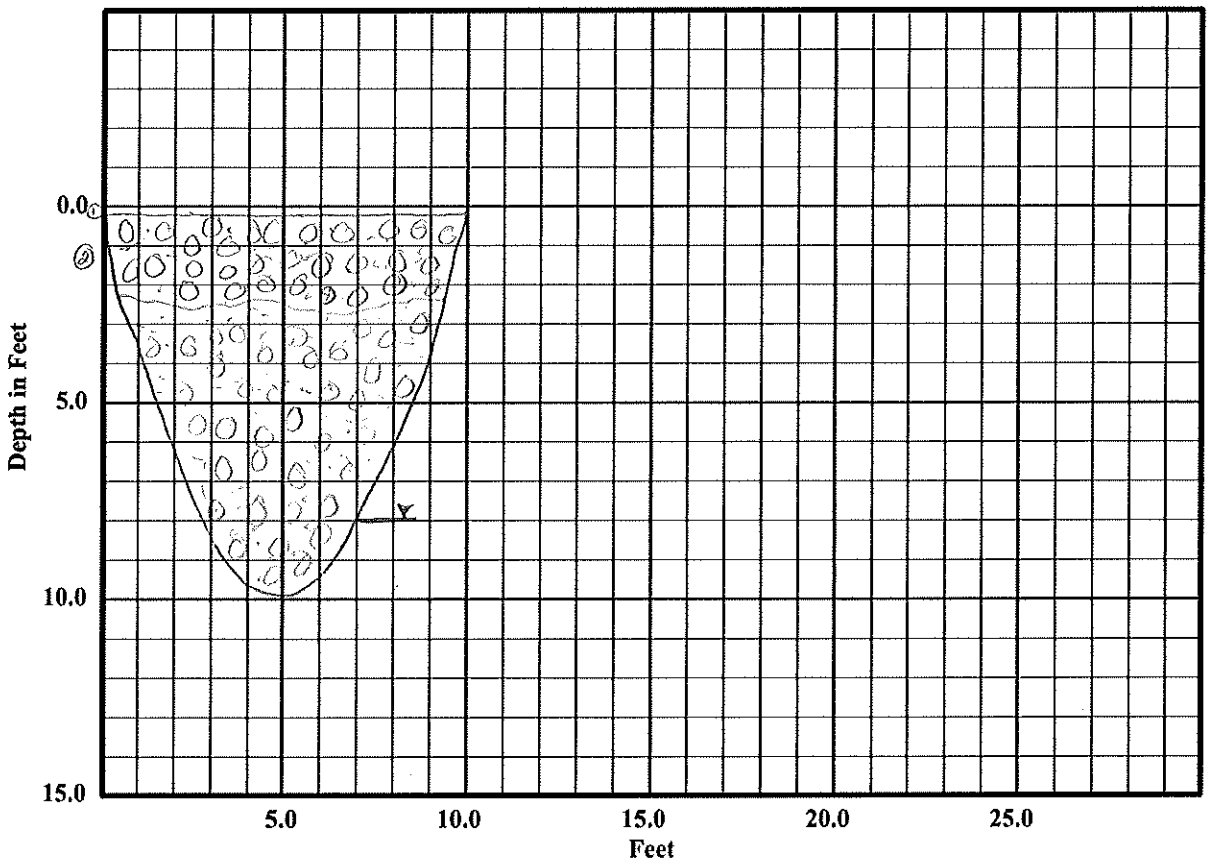
Site Location Holden Mine **Trench Number** TP-BF-S **Date** 11/16/10

Coordinates: Inside Stake _____ **Outside Stake** _____

Native/Fill Stake N:4436477.64 E:1658467.02 el.: 3145.64 ft.

Logged By Christina Breuckman

TRENCH PROFILE



Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

① 1-2" (on south side of test pit) wind blown tailing material, Reddish tan color, due to Fe oxidation. Silty to Clayey SAND (SM-SC), fine to Medium grained sand (90%), non-plastic to slightly plastic silt / clay (10%).

② 0-3', gravely SAND (SP) with cobbles, brown color, medium to coarse grained, angular to subangular sand (60-70%), fine to coarse grained, subangular to sub-rounded gravel (10-15%), subangular to subrounded cobbles (10-15%). Slight cohesion.

③ 3-10', gravely SAND (SP) with cobbles, brown and Reddish brown areas, medium to coarse grained, angular to subangular sand (60-70%), fine to coarse grained, subangular to angular gravel (10-15%), subangular to subrounded cobbles (10-15%) igneous origin, max size: 10", material non-cohesive and sloughs back into itself at ~30° angle of Repose. There is a log at the base of the test pit (~6" dia.), alluvial deposition

Begin Trench _____ **Finish Trench** _____

Total Depth 10' **Total Length** 10'

TRENCH SAMPLE LOG FORM
TRENCH PROFILE

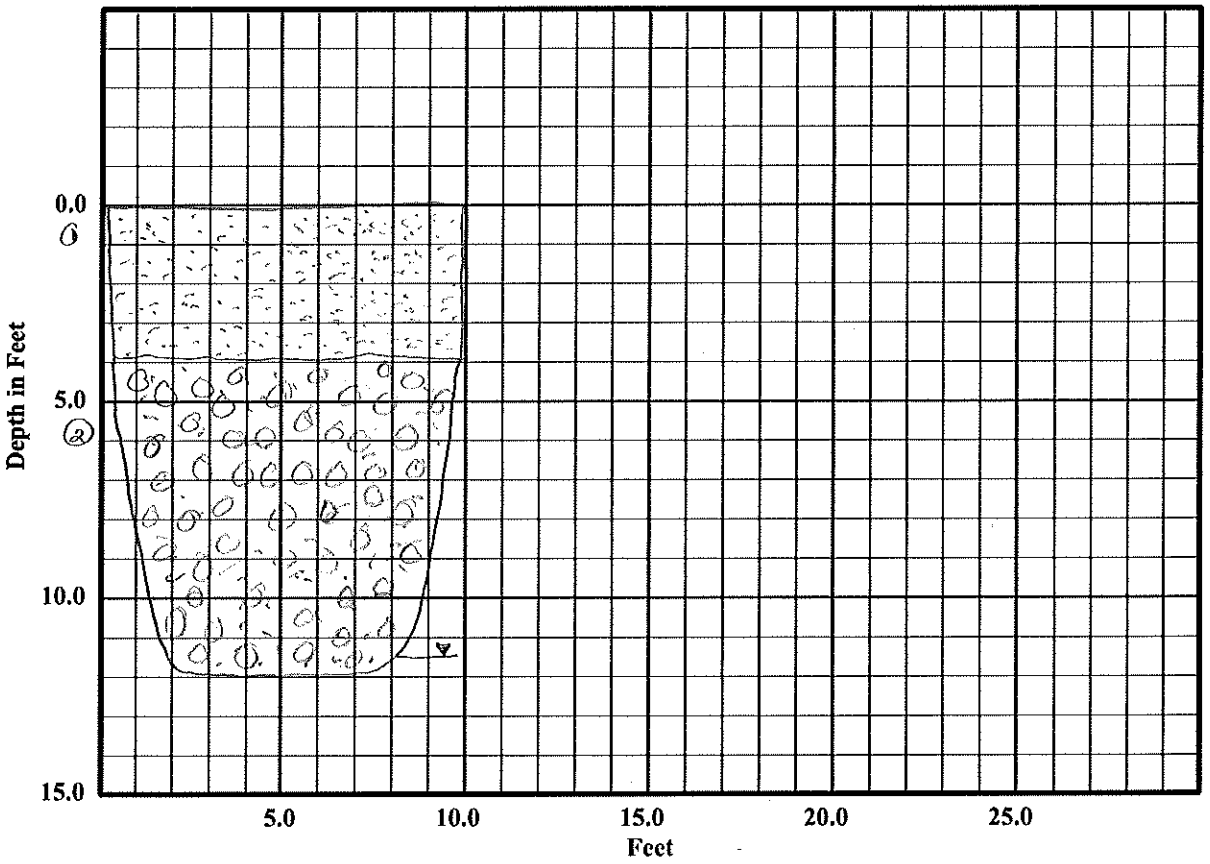
Site Location Holden Mine **Trench Number** TP-BF-N **Date** 11/16/10

Coordinates: Inside Stake _____ **Outside Stake** _____

Native/Fill Stake N: 436557.38 E: 1658613.02 El.: 3142.94 ft.

Logged By Christina Brueckman

TRENCH PROFILE



Subsurface description and filed USCS Classifications
(USCS name, color, size and angularity or plasticity, density, moisture content, additional facts and debris encountered)

① 0'-4', silty SAND (SM) fine grained sand (90%), non-plastic, medium brown silt (10%), Root material and vegetation, hold nearly vertical walls during excavation

② 4'-12', sandy GRAVEL (GP) w/ cobbles and trace silt, fine to coarse grained, subangular to subrounded gravel (50-60%), fine to coarse, subangular to subrounded sand (20-30%), subangular to subrounded cobbles (5-10%), max size of 12" dia, cobbles are igneous origin, soil is reddish brown from fe oxidation, no cohesion

Begin Trench _____ **Finish Trench** _____

Total Depth 12' **Total Length** 10'

Client:	*Rio Tinto*			
Project:	*Holden Mine*		**Date:**	*2/15/11*
Description:	*Holden By Pass Road and FS Road 8301 Fill Slopes Stability Evaluation*		**Job No:**	*1008679*
		By:	*P. Pellicer*	**Chkd By:**

Attachment C –Reference Figures, Tables and Charts

BIG R BRIDGE

P.O. Box 1290
Greeley, Colorado
80632-1290
Phone. 970-356-9600
Toll Free. 800-234-0734
Fax. 970-356-9621
www.bigrbridge.com

→	3a	30" x 42" x 16' Pre-Cast Concrete Bridge Sills – 100ft bridge. The use of Big R pre-cast concrete sills requires the buyer to determine suitability based on size of structure, seismic, and soil bearing capacity at location of installation. Load at footing is 5,210 PSF.	2 ea.	Lump Sum Includes Freight	[redacted]
	4	Galvanized Sheet Pile (10ga) Back Wall Set 2pc- 19ft long 2pc- 24ft long	Set	Lump Sum Includes Freight	[redacted]

Shop drawings will be provided, signed and sealed by a Professional Engineer registered in the State of Washington.

AASHTO Bridge Specifications require steel fabricators to be certified under the AISC Quality Certification Program. Big R Bridge is certified for Simple and Major Steel Bridges with a Fracture Critical and Sophisticated Paint Endorsement.

The following items are not included with this proposal:

- third-party inspection of bridge during fabrication,
- design, excavation and construction of bridge abutments,
- anchor bolt supply and installation,
- unloading and assembly of bridge at the project site,

Prices are FOB: Greeley, CO with freight allowed to **Chelan, Washington.** Delivery will be to a common stockpile accessible by standard highway tractor-trailer, buyer to unload and assemble. Shop drawings will be provided, signed and sealed by a Professional Engineer registered in the State of Washington. Prices do not include sales tax (if applicable).

BIG R BRIDGE	Project: Holden Copper Mine	By:	Wags
	Job No.: 2010-03295	Date:	2/4/2011
	Subject: BEARING REACTIONS	Page:	1 of 1

Unfactored Bearing Reactions in Kips

	Bearing Reaction	Max at Interior Stringer			Max at Exterior Stringer			Total @ Abutment		
		P	H	L	P	H	L	P	H	L
HL93	DC	13.71			17.13			61.69		
	DW	16.80			11.20			56.00		
	LL	44.29			44.29			97.02		
	LL+IM	54.12			54.12			118.55		
Owner Specified	LL	66.43			66.43			145.51		
	LL+IM	82.32			82.32			180.32		
	WS	-14.00	2.45			2.45		-14.00	9.79	
	TU			5.63			5.63			22.52
	EQ		29.42	58.85		29.42	58.85		117.69	235.38

Notes: DC = Dead Load
DW = Wearing Surface Load
LL = Vehicle Live Load
LL+IM = Vehicle Live Load including Dynamic Load Allowance
WS = Wind Load
TU = Thermal Load
EQ = Seismic Load
Wind Load Uplift assumes full 20 psf of deck is applied to one stringer line.

P is vertical load
H is horizontal load transverse to the structure
L is horizontal load longitudinal to the structure

Earthquake Loads:

Per AASHTO LRFD Bridge Design Specifications, 4th Edition - 2007, Section 3.10.9.1, single span bridges need only the connection between bridge span and the abutment designed for seismic loads. The minimum support length should also be met, this is the responsibility of the abutment designer.

Span Length = L = 100 ft

Tributarry Permanent Load = W = 58.846 k (Total Bridge Weight / Number of Stringers)

Seismic Load = $\gamma R_u = \gamma W A_s$ = 58.846 k — 3.10.9.1

γ = ***1*** — Table 3.4.1-1

Acceleration Coefficient = $A_s = F_{pga} PGA$ = 1 — (3.10.4.2-2)

PGA = 1 — Fig 3.10.2.1-1

F_{pga} = 1 — Table 3.10.3.2-1

Site Class = D — Table 3.10.3.1-1

AASHTO Ref

TABLE 2.12 RECOMMENDED PARTIAL FACTOR OF SAFETY VALUES FOR USE IN EQUATION 2.18

Application area	Various partial factors of safety			
	Installation damage	Creep*	Chemical degradation	Biological degradation
separation	1.1 to 2.5	1.0 to 1.2	1.0 to 1.5	1.0 to 1.2
cushioning	1.1 to 2.0	1.2 to 1.5	1.0 to 2.0	1.0 to 1.2
unpaved roads	1.1 to 2.0	1.5 to 2.5	1.0 to 1.5	1.0 to 1.2
walls	1.1 to 2.0	2.0 to 4.0	1.0 to 1.5	1.0 to 1.3
embankments	1.1 to 2.0	2.0 to 3.0	1.0 to 1.5	1.0 to 1.3
bearing capacity	1.1 to 2.0	2.0 to 4.0	1.0 to 1.5	1.0 to 1.3
slope stabilization	1.1 to 1.5	1.5 to 2.0	1.0 to 1.5	1.0 to 1.3
pavement overlays	1.1 to 1.5	1.0 to 1.2	1.0 to 1.5	1.0 to 1.1
railroads	1.5 to 3.0	1.0 to 1.5	1.5 to 2.0	1.0 to 1.2
flexible forms	1.1 to 1.5	1.5 to 3.0	1.0 to 1.5	1.0 to 1.1
silt fences	1.1 to 1.5	1.5 to 2.5	1.0 to 1.5	1.0 to 1.1

*The low end of the range refers to results that have been compensated for creep in the performance of the tests.

$$T_{allow} = T_{ult}\left(\frac{1}{FS_{ID} \times FS_{CR} \times FS_{CD} \times FS_{BD}}\right) \tag{2.18}$$

where

T_{allow} = the allowable tensile strength,
T_{ult} = the ultimate tensile strength,
FS_{ID} = the factor of safety for installation damage,
FS_{CR} = the factor of safety for creep,
FS_{CD} = the factor of safety for chemical degradation, and
FS_{BD} = the factor of safety for biological degradation.

Note that this equation could just as well have been formulated as fractional multipliers (≤ 1.0) and placed in the numerator of the equation. It is placed in this form because other studies have done likewise (e.g., Voskamp and Risseeuw [37]). While the equation indicates tensile strength, it can equally well be applied to burst strength, tear strength, puncture strength, seam strength, etc.

For problems dealing with flow through or within a geotextile, the formulation takes the following form with typical values given in Table 2.13. Note that these values must be tempered with site-specific conditions as was the case with the previous table.

$$q_{allow} = q_{ult}\left(\frac{1}{FS_{SCB} \times FS_{CR} \times FS_{IN} \times FS_{CC} \times FS_{BC}}\right) \tag{2.19}$$

Carthage Mills **Product Data**

■ FX®–120HS

Carthage Mills' FX®–120HS is a multipurpose nonwoven geotextile of 100% polypropylene staple fibers which are formed into a random network, needlepunched and heatset for dimensional stability. Carthage Mills' FX®–120HS is inert to biological degradation and resistant to naturally encountered chemicals, alkalis, and acids.

PROPERTY	TEST METHOD	DATA	
		METRIC	ENGLISH
☐ **Mechanical** Grab Tensile Strength	ASTM D 4632	1.34 kN	300 lbs
Grab Tensile Elongation		50%	
Mullen Burst	ASTM D 3786	3995 kPa	580 psi
Trapezoidal Tear	ASTM D 4533	0.51 kN	115 lbs
Puncture	ASTM D 4833	0.78 kN	175 lbs
CBR Puncture	ASTM D 6241	3.67 kN	825 lbs
☐ **Endurance** UV Resistance	ASTM D 4355	70% @ 500 hrs	
☐ **Hydraulics / Filtration** Permittivity [1]	ASTM D 4491	0.90 sec^{-1}	
Water Flow Rate [1]		2648 lpm/m^2	65 gpm/ft^2
Apparent Opening Size (AOS) [1]	ASTM D 4751	0.150 mm	100 US Std. Sieve
☐ **Physical** Mass Per Unit Area (Typical)	ASTM D 5261	406.8 g/m^2	12.0 oz/yd^2
Thickness (Typical)	ASTM D 5199	3.05 mm	120 mils
Standard Roll Sizes / Packaging / Weight	Measured (Typical)	3.81 m x 109.7 m 418 m^2 181.4 kg	12.5 ft x 360 ft 500 yd^2 400 lbs
		4.57 m x 91.5 m 418 m^2 181.4 kg	15.0 ft x 300 ft 500 yd^2 400 lbs

[1] At the time of manufacturing. Handling, storage and shipping may change these properties.

- Unless otherwise stated, all values stated here are Minimum Average Roll Values (MARV), are calculated as the Typical minus two standard deviations and are based on a 97.7% confidence level.
- The properties reported above are effective 01/05/09 and are subject to change without notice.

Seller makes no warranty, expressed or implied, concerning the product furnished hereunder other than at the time of delivery it shall be of the quality and specification stated herein. Any implied warranty of fitness for a particular purpose is expressly excluded, and, to the extent that it is contrary to the foregoing sentence, any implied warranty of merchantability is expressly excluded. Any recommendations made by seller concerning the uses or applications of said product are believed reliable and seller makes no warranty of results to be obtained. If the product does not meet Carthage Mills current published specifications, and the customer gives notice to Carthage Mills before installing the product, then Carthage Mills will replace the product without charge or refund the purchase price.

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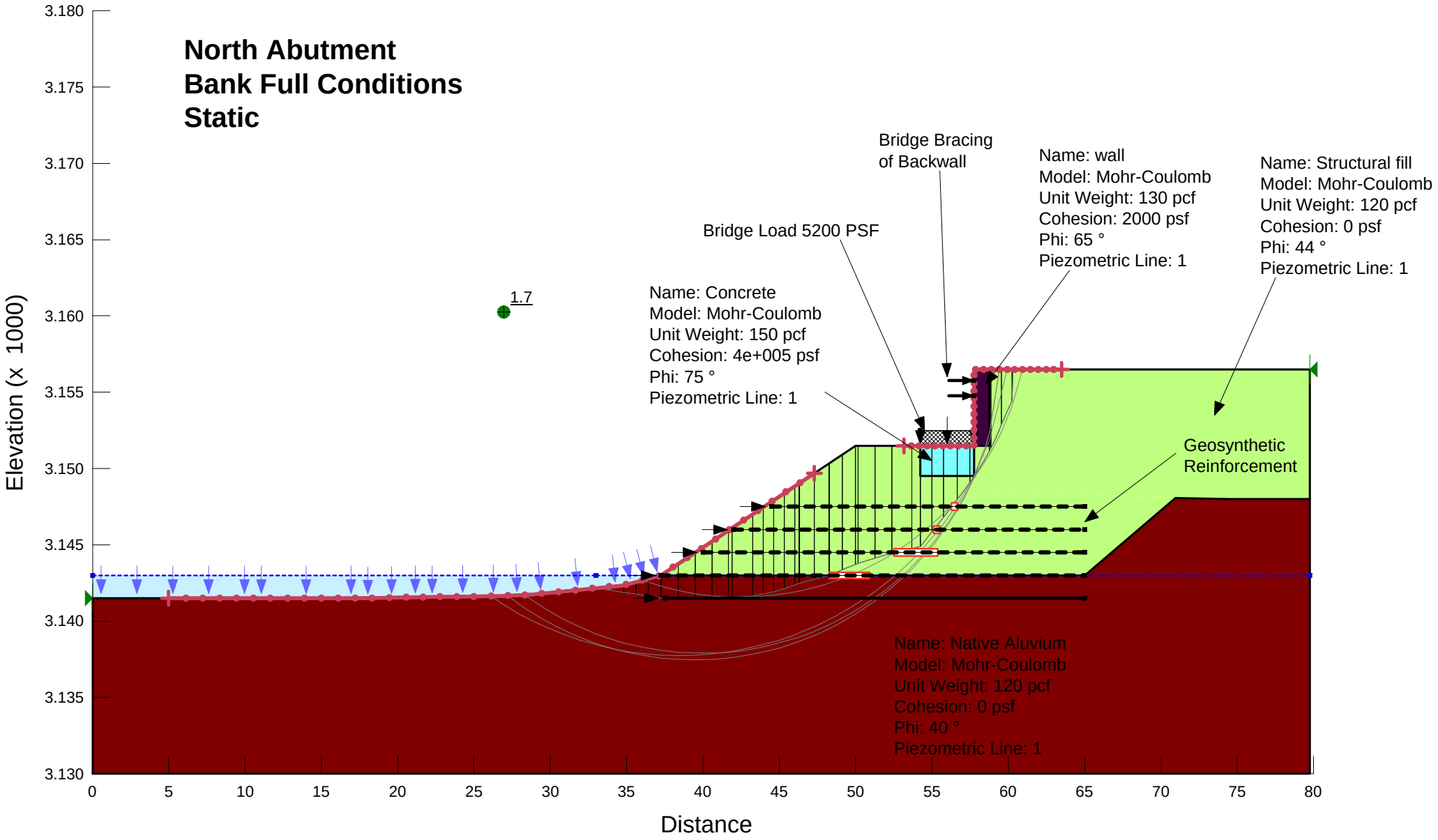
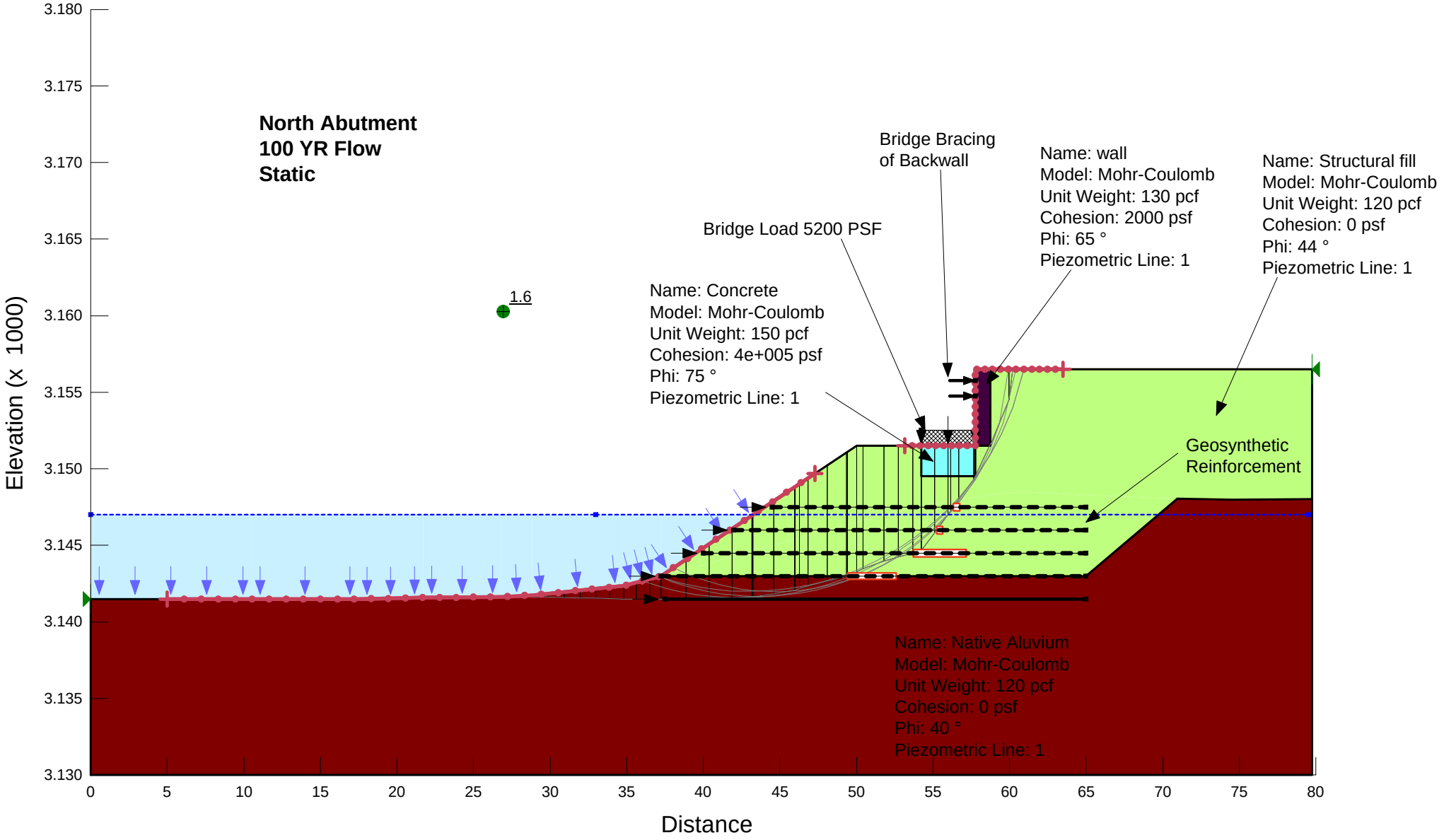
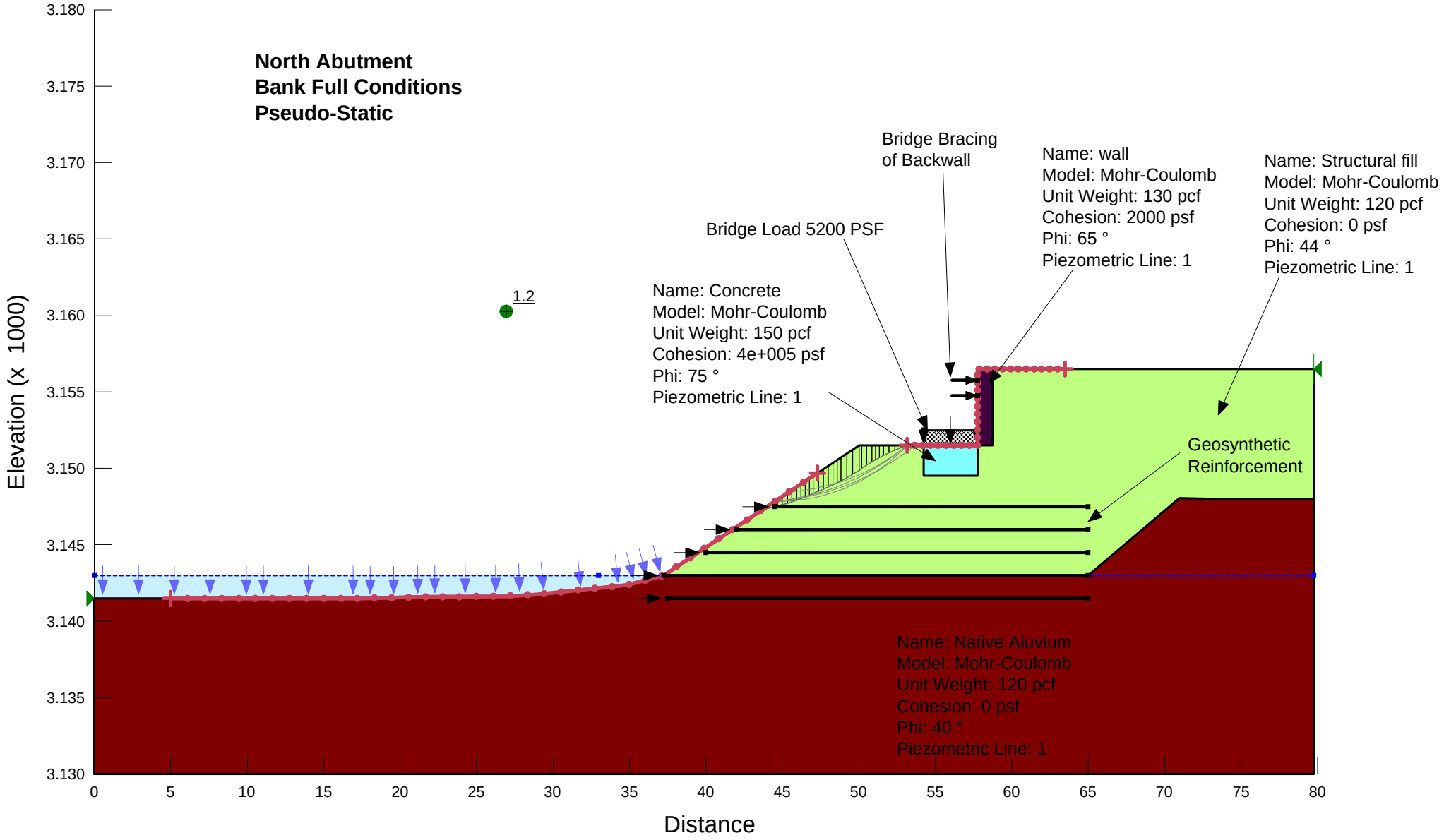
info@carthagemills.com

Client:	*Rio Tinto*			
Project:	*Holden Mine*		**Date:**	*2/15/11*
Description:	*Holden By Pass Road and FS Road 8301 Fill Slopes Stability Evaluation*		**Job No:**	*1008679*
		By:	*P. Pellicer*	**Chkd By:**

Attachment D –Slope/W Results


North Abutment
Bank Full Conditions
Static
Bridge Bracing
of Backwall
Name: wall
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 2000 psf
Phi: 65 °
Piezometric Line: 1
Name: Structural fill
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion: 0 psf
Phi: 44 °
Piezometric Line: 1
Bridge Load 5200 PSF
1.7
Name: Concrete
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion: 4e+005 psf
Phi: 75 °
Piezometric Line: 1
Geosynthetic
Reinforcement
Name: Native Aluvium
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion: 0 psf
Phi: 40 °
Piezometric Line: 1
Elevation (x 1000)
3.180
3.175
3.170
3.165
3.160
3.155
3.150
3.145
3.140
3.135
3.130
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
Distance


North Abutment
100 YR Flow
Static
Bridge Bracing
of Backwall
Name: wall
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 2000 psf
Phi: 65 °
Piezometric Line: 1
Name: Structural fill
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion: 0 psf
Phi: 44 °
Piezometric Line: 1
Bridge Load 5200 PSF
Name: Concrete
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion: 4e+005 psf
Phi: 75 °
Piezometric Line: 1
1.6
Geosynthetic
Reinforcement
Name: Native Aluvium
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion: 0 psf
Phi: 40 °
Piezometric Line: 1
Elevation (x 1000)
3.180
3.175
3.170
3.165
3.160
3.155
3.150
3.145
3.140
3.135
3.130
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
Distance


North Abutment
Bank Full Conditions
Pseudo-Static
Bridge Bracing
of Backwall
Name: wall
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 2000 psf
Phi: 65 °
Piezometric Line: 1
Name: Structural fill
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion: 0 psf
Phi: 44 °
Piezometric Line: 1
Bridge Load 5200 PSF
1.2
Name: Concrete
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion: 4e+005 psf
Phi: 75 °
Piezometric Line: 1
Geosynthetic
Reinforcement
Name: Native Aluvium
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion: 0 psf
Phi: 40 °
Piezometric Line: 1
Elevation (x 1000)
3.180
3.175
3.170
3.165
3.160
3.155
3.150
3.145
3.140
3.135
3.130
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
Distance

HOLDEN BYPASS ROAD BRIDGE
FOOTING BEARING CAPACITY

Client:	*Rio Tinto.*		**Sheet:**	*1*	**of** *6*
Project:	*Holden Mine*		**Date:**	*3/15/11*	
Description:	*Holden By Pass Road Bridge Footing Bearing Capacity Evaluation*		**Job No:**	*1008679*	
		By: *P. Pellicer*	**Chkd By:**	*CTW*	

HOLDEN MINE- HOLDEN BYPASS ROAD BRIDGE FOOTING BEARING CAPACITY

Revisioning							
Rev.	**Date**	**Description**	**By**	**Checked**	**Date**	**Reviewed**	**Date**
A	*03/10/11*	*First Issue*	*P. Pellicer*	*C. Weber*	*3/31/11*		
B							

Location and Format

Electronic copies of these calculations are located in the project files system at:

Objective

The objective of this calculation is to evaluate the factor of safety (FOS) against bearing capacity failure for shallow footings associated with the Holden by-pass road bridge.

Client:	*Rio Tinto.*		**Sheet:**	*2*	**of** *6*
Project:	*Holden Mine*		**Date:**	*3/15/11*	
Description:	*Holden By Pass Road Bridge Footing Bearing Capacity Evaluation*		**Job No:**	*1008679*	
		By:	*P. Pellicer*	**Chkd By:**	*CTW*

Design Basis

The evaluation of the proposed allowable bearing capacity was performed in accordance with industry standards. The relevant design criteria in terms of stability are as presented in the following table:

Table 1 – Design Basis (Stability)

Item	*Criteria*	*Data Source*
Minimum Stability Requirements		
Required Allowable Bearing Capacity	*5210 psf*	*Manufacturer*
Acceptable Factor of Safety	*>2*	*1*

Client:	*Rio Tinto.*	**Sheet:** *3* **of** *6*	
Project:	*Holden Mine*	**Date:**	*3/15/11*
Description:	*Holden By Pass Road Bridge Footing Bearing Capacity Evaluation*	**Job No:**	*1008679*
		By: *P. Pellicer*	**Chkd By:** *CTW*

Introduction

The Holden bypass road will incorporate a 100 foot single span bridge. Preliminary discussions with bridge vendors indicate that an allowable soil bearing capacity of 5210 psf will be required to support the bridge with a typical shallow footing.

A preliminary footing design provided by the vendor indicates the bridge super structure will be founded on a rigid concrete footing measuring 2.5 feet thick, 3.5 feet wide by 16 feet long (Attachment A). It was assumed the footing will be imbedded a minimum of 2 feet.

Methodology

The Meyerhof method for evaluating ultimate bearing capacity of a continuous footing located at the top of a slope was utilized (Ref 2).

Geometry

Footing dimensions utilized in this evaluation are as follows:
Footing Length (L)= 16 feet (proposed by vendor)
Footing Width (B) = 3.5 feet (proposed by vendor)
Footing Depth (D_f) = 2 feet (selected for design)

The overall design geometry is provided in Attachment B.

Loading Conditions and Material Properties

Material properties for fill to be utilized during road construction were previously estimated as part of the Road Fill Slope Stability Evaluation Calculation (MWH, 2011). From this calculation the fill material was characterized as a purely frictional material with an estimated ϕ = 44°, γ=130 pcf, and γ'= 67.6 pcf. To facilitate the use of the design charts, the soil friction angle was reduced to ϕ = 40°.

The water table beneath the footing was estimated using the bank full flow elevation of Railroad Creek and the 100 year flood elevation of Railroad Creek, as calculated by a HEC RAS evaluation. Water surface elevations for bank full conditions and 100 yr flood are 3143.5 ft and 3147 ft, respectively.

Results

Check the influence of ground water on bearing capacity:

Bank full flow conditions:
Based on the geometry shown in Attachment B, check the relationship of D_f, d and B. For bank full conditions:

Df = 2 ft
B= 3.5 ft
d = 7 ft

Client:	*Rio Tinto.*	**Sheet:** *4*	**of** *6*
Project:	*Holden Mine*	**Date:**	*3/15/11*
Description:	*Holden By Pass Road Bridge Footing Bearing Capacity Evaluation*	**Job No:**	*1008679*
		By: *P. Pellicer*	**Chkd By:** *CTW*

Utilize the Case IV criteria outline on pg 50 and 51 (Ref 2) presented in Attachment C.

$d > D_f + B$

7> 2+3.5

Therefore, ground water will not impact bearing capacity calculation. Use γ = 130 pcf for evaluation of bearing capacity.

100 yr flood conditions:

Based on the geometry shown in Attachment A, check the relationship of D_f, d and B. For 100 yr flood conditions:

D_f = 2 ft
B= 3.5 ft
d = 3.5 ft

Utilize Case III criteria outline on pg 50 and 51 (Ref 2) presented in Attachment C.

$D_f <= d <= B$

Therefore, ground water will impact bearing capacity calculation. Use an average unit weight of soil γ_{avg} for evaluation of the bearing capacity.

$$\gamma_{avg} = \gamma' + \left(\frac{d - D_f}{B}\right) * (\gamma - \gamma')$$

$$\gamma_{avg} = 67.6 + \left(\frac{3.5 - 2}{3.5}\right) * (130 - 67.6) = 94\ pcf$$

Calculate the ultimate bearing capacity q_u :

Utilizing the Meyerhof method provided in Attachment C:

$$q_u = \frac{1}{2}\gamma B N_{\gamma q}$$

Utilize Figure 4.41 presenting in Attachment C to estimate the value of $N_{\gamma q}$:
For the give geometry the ratio D_f/B = 0.57, b/B = 1.28, β = 33.7° and ϕ=40°.
Interpolation between the curves present in Figure 4.41 results in an estimated $N_{\gamma q}$ = 70

Bank full flow conditions:

$$q_u = \frac{1}{2}130pcf * 3.5ft * 70$$

$$q_u = 15{,}925\ psf$$

100 yr Flood Conditions:

$$q_u = \frac{1}{2}94pcf * 3.5ft * 70$$

$$q_u = 11{,}515\ psf$$

Client:	*Rio Tinto.*	**Sheet:** *5*	**of** *6*
Project:	*Holden Mine*	**Date:**	*3/15/11*
Description:	*Holden By Pass Road Bridge Footing Bearing Capacity Evaluation*	**Job No:**	*1008679*
		By: *P. Pellicer*	**Chkd By:** *CTW*

Calculate FOS:

$FS=\frac{q_u}{q_a}$

Where:
q_u = ultimate bearing capacity
q_a = Allowable bearing capacity

Bank full flow conditions:

$FS=\frac{15{,}925\ psf}{5210\ psf}$ = 3.0

100 yr Flood Conditions:

$FS=\frac{11{,}515\ psf}{5210\ psf}$ = 2.2

Conclusions

For the assumptions and conditions considered in this analysis, the soil within the proposed abutments will provide the allowable bearing capacity required to support the proposed bridge with an acceptable FOS.

The foundation dimensions and allowable bearing capacity, provided by the manufacturer, are only preliminary. Once a final bridge configuration and manufacturer are selected, the input parameters utilized in this evaluation well need to be reviewed to check their validity.

Client:	*Rio Tinto.*	**Sheet:** *6* **of** *6*	
Project:	*Holden Mine*	**Date:**	*3/15/11*
Description:	*Holden By Pass Road Bridge Footing Bearing Capacity Evaluation*	**Job No:**	*1008679*
		By: *P. Pellicer*	**Chkd By:** *CTW*

Attachments

Attachment A *– Preliminary Manufacturer Footing Design Parameters*

Attachment B *– Foundation and Abutment Geometry Sketch*

Attachment C *– Design Tables, Figures, and Charts*

References

1. Bowles, Joseph E. Foundation Analysis and Design, Fourth Edition, 1988
2. Das, Braja M. Shallow Foundations Bearing Capacity and Settlement, 1999

Client:	*Rio Tinto*			
Project:	*Holden Mine*		**Date:**	*3/15/11*
Description:	*Holden By Pass Road Bridge Footing Bearing Capacity Evaluation*		**Job No:**	*1008679*
		By:	*P. Pellicer*	**Chkd By:**

Attachment A – Preliminary Manufacturer Footing Design Parameters

BIG R BRIDGE

P.O. Box 1290
Greeley, Colorado
80632-1290
Phone. 970-356-9600
Toll Free. 800-234-0734
Fax. 970-356-9621
www.bigrbridge.com

→	3a	30" x 42" x 16' Pre-Cast Concrete Bridge Sills – 100ft bridge. The use of Big R pre-cast concrete sills requires the buyer to determine suitability based on size of structure, seismic, and soil bearing capacity at location of installation. Load at footing is 5,210 PSF.	2 ea.	Lump Sum Includes Freight	[redacted]
	4	Galvanized Sheet Pile (10ga) Back Wall Set 2pc- 19ft long 2pc- 24ft long	Set	Lump Sum Includes Freight	[redacted]

Shop drawings will be provided, signed and sealed by a Professional Engineer registered in the State of Washington.

AASHTO Bridge Specifications require steel fabricators to be certified under the AISC Quality Certification Program. Big R Bridge is certified for Simple and Major Steel Bridges with a Fracture Critical and Sophisticated Paint Endorsement.

The following items are not included with this proposal:

- third-party inspection of bridge during fabrication,
- design, excavation and construction of bridge abutments,
- anchor bolt supply and installation,
- unloading and assembly of bridge at the project site,

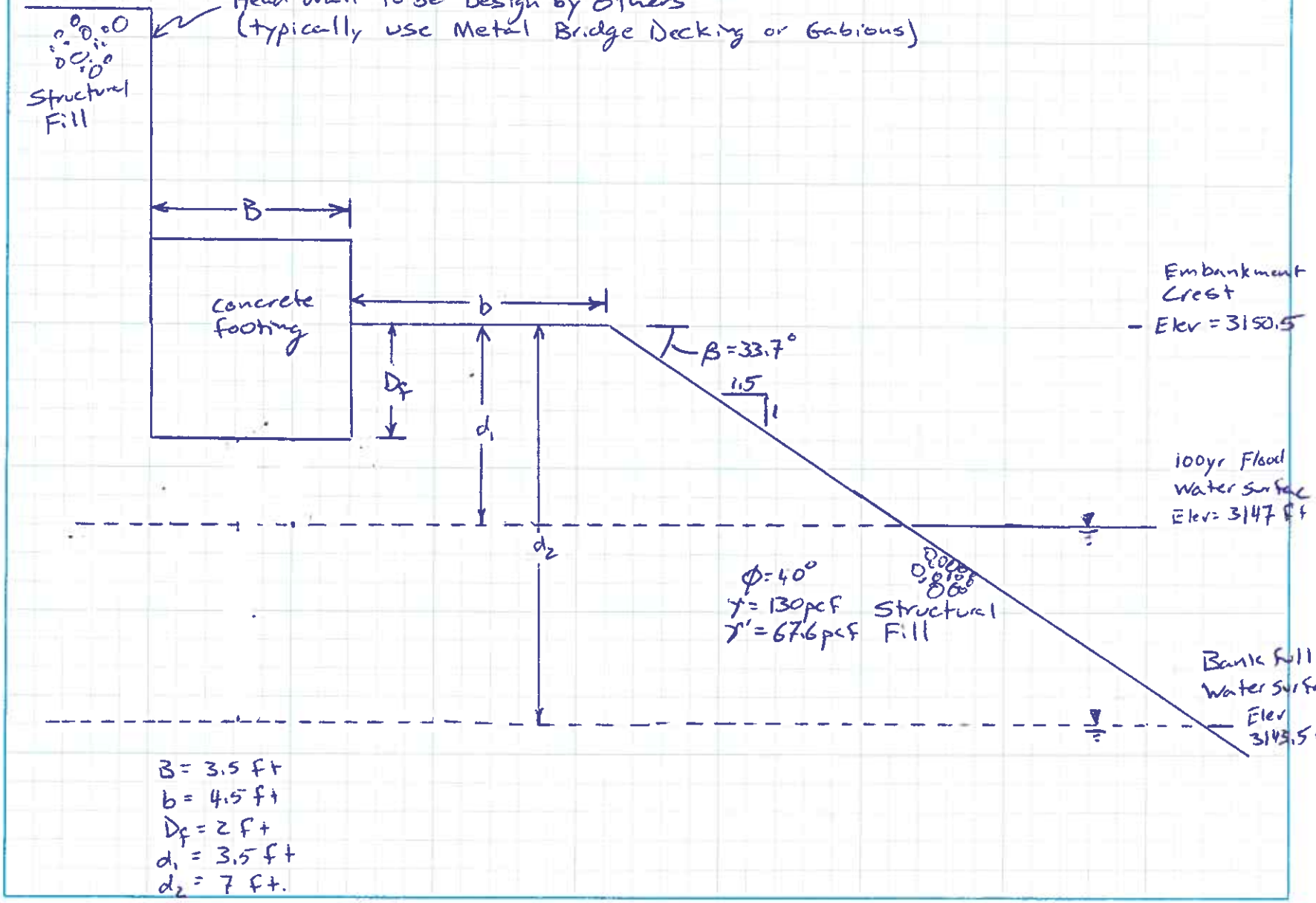
Prices are FOB: Greeley, CO with freight allowed to **Chelan, Washington.** Delivery will be to a common stockpile accessible by standard highway tractor-trailer, buyer to unload and assemble. Shop drawings will be provided, signed and sealed by a Professional Engineer registered in the State of Washington. Prices do not include sales tax (if applicable).

Client:	*Rio Tinto*			
Project:	*Holden Mine*		**Date:**	*3/15/11*
Description:	*Holden By Pass Road Bridge Footing Bearing Capacity Evaluation*		**Job No:**	*1008679*
		By:	*P. Pellicer*	**Chkd By:**

Attachment B – Foundation and Abutment Geometry Sketch

MWH

South Abutment



Client:	*Rio Tinto*			
Project:	*Holden Mine*		**Date:**	*3/15/11*
Description:	*Holden By Pass Road Bridge Footing Bearing Capacity Evaluation*		**Job No:**	*1008679*
		By:	*P. Pellicer*	**Chkd By:**

Attachment C – Reference Figures, Tables, and Charts

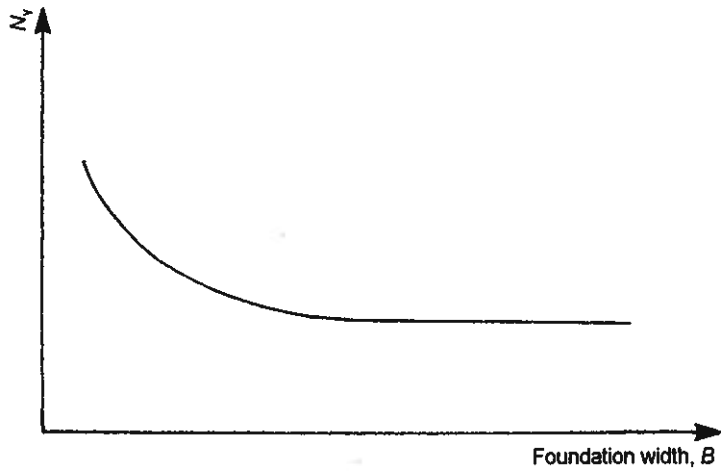


FIGURE 2.21 Nature of variation of N_γ with B

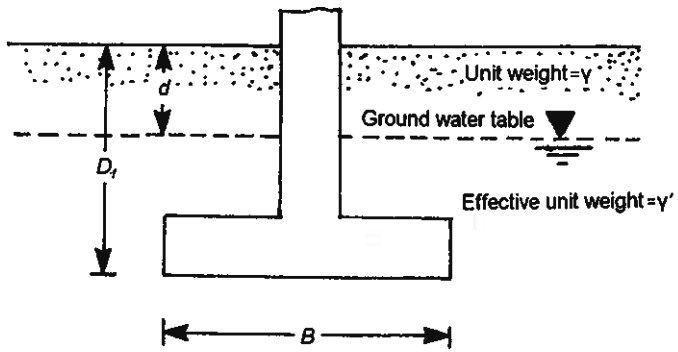


FIGURE 2.22 Effect of ground water table on ultimate bearing capacity

Case III– $D_f \le d \le B$

This condition is one in which the ground water table is located at or below the bottom of the foundation. In such case, $q = \gamma D_f$ and the last term γ should be replaced by an average effective unit weight of soil, $\bar{\gamma}$, or

$$\bar{\gamma} = \gamma' + \left(\frac{d - D_f}{B}\right)(\gamma - \gamma') \tag{2.82}$$

Case IV– $d > D_f + B$

For $d > D_f + B$, $q = \gamma D_f$ and the last term should remain γ. This implies that the ground water table has no effect on the ultimate capacity.

2.9 GENERAL BEARING CAPACITY EQUATION

The relationships to estimate the ultimate bearing capacity presented in the preceding sections are for continuous (strip) foundations. They do not give (a) the relationships for the ultimate bearing capacity for rectangular foundations (that is, $B/L > 0$; B = width and L = length), and (b) the effect of the depth of the foundation on the increase in the ultimate bearing capacity. Therefore, a general bearing capacity may be written as

$$q_u = cN_c\lambda_{cs}\lambda_{cd} + qN_q\lambda_{qs}\lambda_{qd} + \frac{1}{2}\gamma BN_\gamma\lambda_{\gamma s}\lambda_{\gamma d} \tag{2.83}$$

where λ_{cs}, λ_{qs}, $\lambda_{\gamma s}$ = shape factors
λ_{cd}, λ_{qd}, $\lambda_{\gamma d}$ = depth factors

Most of the shape and depth factors available in literature are empirical and/or semi-empirical, and they are given in Table 2.5.

It is recommended that, if Eqs.(2.67), (2.66), and (2.74) are used respectively for N_c, N_q, and N_γ, then DeBeer's shape factors and Hansen's depth factors should be used. However, if Eqs. (2.67), (2.66), and (2.72) are used for bearing capacity factors N_c, N_q, and N_γ, then Meyerhof's shape and depth factors should be used.

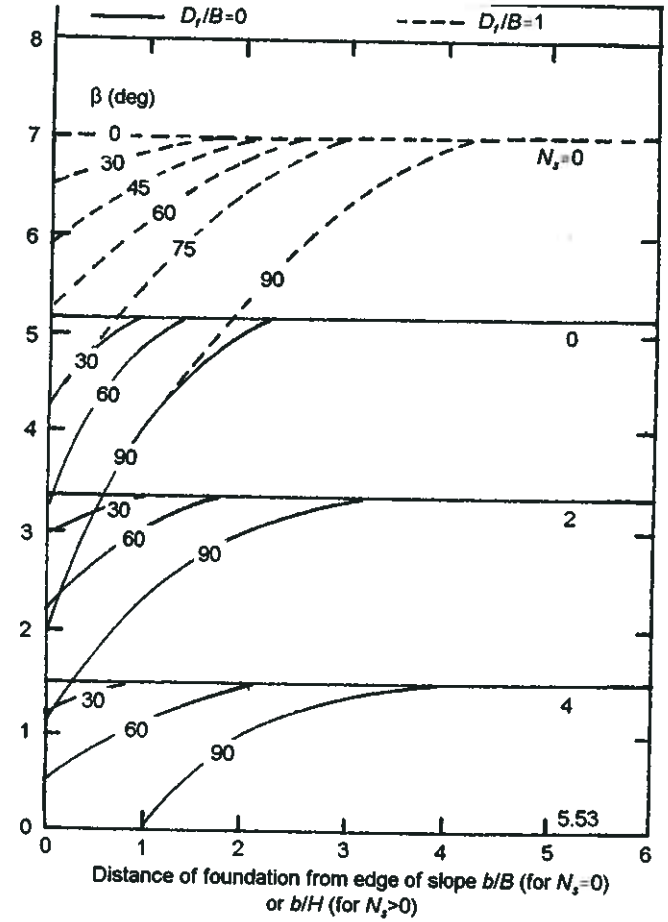
EXAMPLE 2.1

A shallow foundation is 0.6 m wide and 1.2 m long. Given $D_f = 0.6$ m. The soil supporting the foundation has the following parameters: $\phi = 25°$, $c = 48$ kN/m^2, and $\gamma = 18$ kN/m^3. Determine the ultimate vertical load that the foundation can carry by using

a. Prandtl's value of N_c [Eq. (2.67)], Reissner's value of N_q [Eq. (2.66)], Vesic's value of N_γ [Eq. (2.74)], and the shape and depth factors proposed by DeBeer and Hansen, respectively (Table 2.5).
b. Meyerhof's values of N_c, N_q, and N_γ [Eqs. (2.67), (2.66), and (2.72)] and the shape and depth factors proposed by Meyerhof [8] given in Table 2.5.

Solution From Eq. (2.83):

$$q_u = cN_c\lambda_{cs}\lambda_{cd} + qN_q\lambda_{qs}\lambda_{qd} + \frac{1}{2}\gamma BN_\gamma\lambda_{\gamma s}\lambda_{\gamma d}$$



JRE 4.40 Meyerhof's bearing capacity factor, N_{cq}, for a purely cohesive soil (foundation on top of a slope)

ehof [26] developed the theoretical variations of N_{cq} for a purely cohesive ($\phi = 0$) and $N_{\gamma q}$ for a granular soil ($c = 0$), and these variations are shown igs. 4.40 and 4.41. Note that, for purely cohesive soil (Fig. 4.40)

$$q_u = cN_{cq}$$

for granular soil (Fig. 4.41)

$$q_u = \frac{1}{2}\gamma BN_{\gamma q}$$

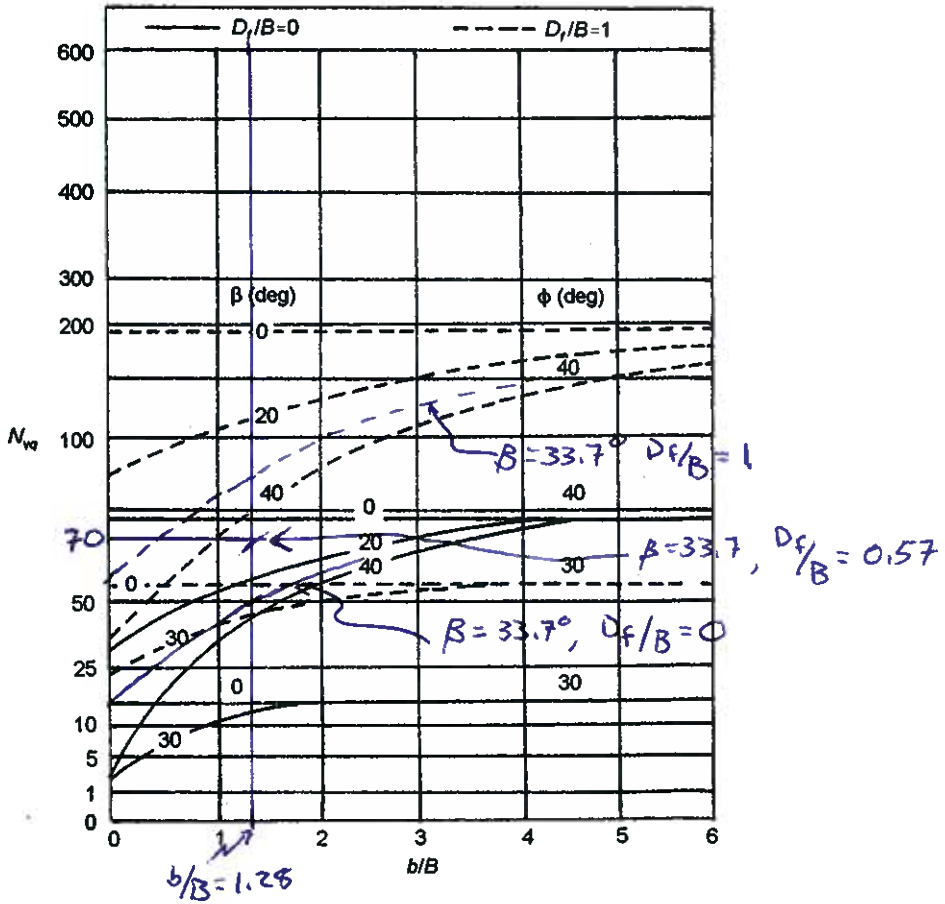


FIGURE 4.41 Meyerhof's bearing capacity factor, $N_{\gamma q}$, for a granular soil (foundation on top of a slope)

It is important to note that, in using Fig. 4.40, the stability number N_s should be taken as zero when $B < H$. If $B \geq H$ the curve for the actual stability number should be used.

Typical plots of load per unit area q versus settlement s obtained by the author from laboratory model tests in saturated clay soil (with $b/B = 0$, $D_f/B = 0$, $c_u = 27.5$ kN / m^2, and $B = 76.2$ mm) are shown in Fig. 4.42. It can be seen that, for similar foundation conditions, the settlement at ultimate load decreases with the increase in the slope angle β.

Solutions of Hansen [27] and Vesic [11]

Referring to the condition of $b = 0$ in Fig. 4.39 (that is, the foundation is

HOLDEN MINE RAILROAD CREEK HYDROLOGIC EVALUATION

Holden Mine Railroad Creek Hydrologic Conceptual Model for Remedial Design

MWH.

BUILDING A BETTER WORLD

MEMORANDUM

TO: Phil Crouse **DATE:** April 13, 2011

FROM: Chip Paulson

SUBJECT: **Holden Mine Railroad Creek Hydrologic Conceptual Model for Remedial Design**

1.0 INTRODUCTION

This memorandum presents the evaluation of the current Railroad Creek (RRC) hydrologic conceptual model for the Holden Mine remediation project. The purpose of the evaluation is to review the current hydrologic model for RRC developed by Intalco during the Remedial Investigation/Feasibility Study (RI/FS) phase of the project and develop a RRC hydrologic model for remedial design purposes. The RRC hydrologic model will be used for hydraulic evaluations of RRC for remedial design. The remedial design hydraulic studies will be presented in subsequent calculation briefs.

Extensive hydrologic studies have been documented during the RI/FS phase of the project and are summarized in this memorandum. The most recent of these documents are listed below:

- Appendix D: Draft Proposed Railroad Creek Realignment Technical Memorandum, URS, June 8, 2009
- Appendix E: Draft Hydrogeology Technical Memorandum, URS, July 10, 2009
- Draft Hydrogeology Technical Memorandum Addendum in Context of a Contingent Remedy Holden Mine Site, URS, February 24, 2010

Mr. Chip Paulson, a Principal Hydrologist with MWH performed a technical review of the hydrologic conceptual model developed during the RI/FS phase of the project to determine its applicability to the remedial design phase. Mr. Paulson's review consisted of determining if the current model is based on accepted practices in hydrologic analysis and appropriate interpretation of results. His review also included a teleconference meeting with URS senior hydrologists familiar with the Holden Mine project. Specific detailed calculations performed in previous analyses were not made available to MWH and were not checked, however independent model simulations produced similar results as documented during the RI/FS. Based on Mr Paulson's review of the RI/FS hydrologic conceptual model, it is appropriate to continue using the model for remedial design of the Railroad and Copper Creeks. A description of the review is provided in Section 2. Section 3 presents the proposed hydrology for the remedial design.

2.0 REVIEW SUMMARY

2.1 Draft Proposed Railroad Creek Realignment Technical Memorandum, URS, June 8, 2009

This report describes regional hydrologic analyses performed to validate the results of previous HEC-1 rainfall-runoff modelling used to generate peak flow estimates for Railroad Creek and Copper Creek at the Holden Mine site. Simulation techniques or regional methods were required because there is not sufficient onsite streamflow data to compute long-term peak discharge-frequency statistics. Regional

hydrologic methods generally showed that the HEC-1 peak flows tended to be conservative for Railroad Creek (i.e., higher than regional peak flow estimates), and within the range of regional peak flow estimates for Copper Creek. Details of the HEC-1 modelling were described in a previous report prepared by Dames &Moore (DRI, Dames & Moore, 1999).

The approach of the regional hydrologic analysis was to analyze stream gauge data from locations similar to the Railroad Creek and Copper Creek drainages at Holden. Transposition of peak flow frequency data from gauged to ungauged locations requires that the drainage basins be reasonably similar in size, climate, surface characteristics, and hydrologic properties, and that a reasonable period of record be available at the gauged site. The regional analysis considered data from the Stehekin River at Stehekin, the Entiat River near Ardenvoir, and six smaller basins in the Cascade Range. For Railroad Creek, the Stehekin River gauge was used as the basis of peak flow frequency data. For Copper Creek, the six small mountain basins were used in conjunction with the Stehekin River gage. Design hydrology recommended by URS is summarized in Table 1 below.

Based on the information developed during the RI/FS, these stream gauges are a reasonable basis for applying regional information to the estimation of stream flow frequency statistics for Railroad Creek and Copper Creek. Some modifications to the results of the analysis presented in the report were considered for use of the model in the remedial design. These include:

1. The report demonstrates that unit discharge (cfs per square mile) at the Stehekin River gage is well correlated with the unit discharge at the Railroad Creek at Lucerne gauge (drainage area of 65 mi^2). The assumption is made that the unit discharge at the Stehekin River gauge will also be well correlated with the unit discharge at the Railroad Creek at Holden location (31 mi^2) using the same regression approach. Page D2-7 states that based on limited data collected in 1997, flows at Holden are estimated to be 50% of flows at Lucerne. The drainage area ratios are 27.5/64.8 = 0.424 at RC-2 and 31/64.8 = 0.478 at RC-4. These are close to 0.50, suggesting that the 50% adjustment may be reasonable. However, the data set available for comparison is small. If additional stream flow measurements are made at the Holden Mine site during high flow periods, they could be used to compute the unit discharge at the Holden Mine site and compare it to the unit discharge at the Lucerne site. If a value significantly different from 0.50 is found, the estimated peak flows at Holden would have to be modified.

2. Peak flows for the Railroad Creek at Holden location were computed by first computing peak flow statistics for the Stehekin River gage, then adjusting them to the Holden site based on the ratio of drainage areas (27.5/321 = 0.086 for RC-4 and 31/321 = 0.097 for RC-2). The unit discharge information provided for the Railroad Creek at Lucerne gage shows that a straight drainage area factor does not agree with the regional regression analysis. The regional regression analysis between the Stekekin River gage and the Railroad Creek at Lucerne gage in Figure D2-5 shows a good fit linear regression that computes the Lucerne gage flow as 0.145 times the Stehekin gage flow. In comparison, the ratio of drainage areas at this sites is 64.8/321 = 0.202. The regression transposition factor (0.145) is less than the drainage area ratio (0.202) used in the RI/FS analysis, but the unit discharge at the Holden Mine site is expected to be higher than the unit discharge at Lucerne (because the drainage area is smaller), so the net effect will be that the peak flows at Holden do not differ significantly from the values presented in Table D2-1. In subsequent discussions with URS hydrologists, it was agreed that this difference is within the level of accuracy of stream flow measurements and the transposition analysis, so no change to the previous analysis was warranted.

3. In the regional flood frequency analyses based on Stehekin River gage flows, Copper Creek peak discharge values were estimated as the difference between estimates at RC-4 and RC-2, which are located upstream and downstream of the Copper Creek confluence. This approach is only valid if the Railroad Creek and Copper Creek flood peaks are always coincident in every year. Given the difference in drainage areas (about 30 square miles versus 3.5 square miles) it is unlikely that all flood peaks are coincident. This method will tend to underestimate peak flows on Copper Creek, which may help explain why the results of the Stehekin River transposition analysis for Copper Creek as shown in Table D2-1 are consistently lower than the HEC-1 results or the results based on an analysis of other small Cascade Range drainages. The results from the Stehekin River will be not be transposed to Copper Creek for the remedial design. Rather, the HEC-1 results from the 1999 Dames and Moore analysis are considered the most reliable flows for Copper Creek.

The recommended design flows presented by URS in Table D2-4 were based on narrative geomorphic criteria combined with results of the log-Pearson III peak flow transposition, as described on pages D2-8 and D2-9. While the narrative descriptions can be helpful in some cases, it is recommended that the remedial design be based on results of the log-Pearson III statistical analysis to provide a better understanding of the risk of flood damage.

Selected Copper Creek flows for recurrence intervals up to 100-years will be all based on the HEC-1 results for the remedial design, consistent with the URS approach.

Table 1. Summary of RI/FS (by URS) Recommended Holden Mine Design Hydrology

Channel Feature	Railroad Cr at Holden above Copper Cr – Rec'd design flo) (cfs_	Railroad Cr at Holden above Copper Cr – Closest LPIII peak flow (cfs)	Railroad Cr at Holden below Copper Cr – Rec'd design flow (cfs)	Railroad Cr at Holden below Copper Cr – Closest LPIII peak flow (cfs)	Copper Cr at mouth – Rec'd design flow (cfs)	Copper Cr at mouth – Closest LPIII or HEC-1 Peak flow (cfs)
Floodplain interaction flow	670	828 (2-yr)	750	933 (2-yr)	86	105 (2-yr)
Basic channel stability flow	830	1,302 (10-yr)	1,000	1,467 (10-yr)	170	166 (10-yr)
Berm overtopping flow	1,700	1,710 (50-yr)	2,000	1,928 (50-yr)	300	302 (50-yr)
Overall system stability flow	2,150	1,883 (100-yr)	2,500	2,123 (100-yr)	350	350 (100-yr)
Check flow	2,720	N.C	3,400	N.C.	680	N.C.

N.C. = No comparable flow in URS report

2.2 Draft Hydrogeology Technical Memorandum Addendum in Context of a Contingent Remedy

This document is the most recent update to the RI/FS conceptual hydrologic model. Section 3.2.2 in the document presents an update of selected hydrologic data collected at the Holden Mine site. Onsite streamflow data collected from 1997 through 2009 is summarized in Table 3-1a. Data summarizes flow measurements made during spring and summer high runoff periods and during the fall low flow period. Continuous river stages were recorded at the site, but a reliable rating curve was not available to convert all measured stages to discharges. Flow data presented in Table 3-1a is apparently intermittently

measured discharge. Discharges measured during the high runoff period probably do not represent the annual maximum discharge.

The range of flows presented in Table 3-1a can be compared to the selected design flows in Table D2-4 in the previously discussed document to check for consistency. This comparison is made in Table 2 below, and results in the following conclusions.

- Low flows are generally within the range of values selected by URS for fish passage design, supporting selection of these design flows.
- Maximum recorded values are all less than or equal to the 2-yr discharge computed using the log-Pearson III transposition from the Stehekin River gage. It could be expected that with 6 years of data a value closer to the 5-yr peak might occur. However, as noted above, the maximum recorded values for each year may not be the actual peak discharge for that year. Thus it is difficult to reach any firm conclusions regarding the validity of the peak discharge frequency estimates based on these observed values.

Table 2. Comparison of Historical Holden Streamflows and RI/FS Design Flows

Year of Historical Data / Return Period	RC-2 (Railroad Cr upstream of Copper Cr) – Maximum Recorded Flow (cfs)	RC-2 (Railroad Cr upstream of Copper Cr) – Base Flow (cfs)	RC-4 (Railroad Cr downstream of Copper Cr) – Maximum Recorded Flow (cfs)	RC-4 (Railroad Cr downstream of Copper Cr) – Base Flow (cfs)
1997	822	99	823	88
1998	647	-	508	-
2001	94	-	95	-
2003	150	-	120	55
2008	345	40	397	39
2009	102	26	91	25
Low/High Fish Passage	-	40/160	-	40/160
2-yr	828	-	933	-
5-yr	1,144	-	1,256	-
10-yr	1,302	-	1,467	-
50-yr	1,710	-	1,928	-
100-yr	1,883	-	2,123	-

-

2.3 Recommendations for Remedial Design

Based on review of the documents and discussions with the previous hydrologist, the conceptual hydrologic model for Railroad and Copper Creeks used for the remedial design will include the following.

1. The use of the Stehekin River, Entiat River, and other regional stream gauge data to estimate peak flow characteristics for Railroad Creek and Copper Creek at the Holden site is appropriate based on similarity in drainage basin features and available periods of record.

2. The transposition of peak flow frequency data from the Stehekin River stream gauge to the Railroad Creek at the Holden Mine site will be used for the remedial design of Railroad Creek.

3. Copper Creek peak flows for remedial design will be based on the HEC-1 model results as developed by Dames and Moore in 1999.

4. The fish passage design flows developed during the RI/FS will be used for remedial design since they are consistent with measured flows at the Holden site from 1997 to 2009.

3.0 RESULTS OF HYDROLOGIC ANALYSIS

Design hydrology for Railroad Creek is based on the regional log-Pearson III analysis developed by URS. Discharges up to the 100-year return period were adopted from the URS analysis. Discharges for higher return periods were determined by extrapolation using a log fit trendline. Results are shown in Table 3 and Figures 1 and 2. A "check flow" value was selected to represent the maximum potential flow at the site. The 100-year HEC-1 simulated discharge was used for this value because it is the largest estimated flow using any of the hydrologic methods applied to the site.

Design hydrology for Copper Creek is based on the HEC-1 model results developed originally by Dames and Moore and recommended by URS. Discharges up to the 100-year return period were adopted from the URS report. Discharges for higher return periods were determined by extrapolation using a log fit trendline. A "check flow" of 680 cfs was selected consistent with the URS analysis. This discharge is the largest flow computed by any of the methods evaluated, and comes from a log-Pearson III analysis using USGS "small basin" data from the Holden hydrologic region. Results are shown in Table 4 and Figure 3.

Table 3. Railroad Creek Design Flows

Return Period (yr)	Probability	Railroad Cr above Copper Cr (cfs)	Railroad Cr below Copper Cr (cfs)
-	Low flow fish passage	40	40
Q 10% exceedance	High flow fish passage	185	204
2	0.5	828	933
5	0.2	1114	1256
10	0.1	1302	1467
25	0.04	1536	1732
50	0.02	1710	1928
100	0.01	1883	2123
200	0.005	2083	2348
500	0.002	2327	2624
1000	0.001	2512	2833
-	Check flow	3140	3400

Table 4. Copper Creek Design Flows

Return Period (yrs)	Probability	Copper Cr at Railroad Cr Confluence (cfs)
1.5	0.67	60
2	0.5	86
5	0.2	140
10	0.1	173
50	0.02	302
100	0.01	350
200	0.005	394
500	0.002	457
1000	0.001	505
-	Check flow	680

Figure 1

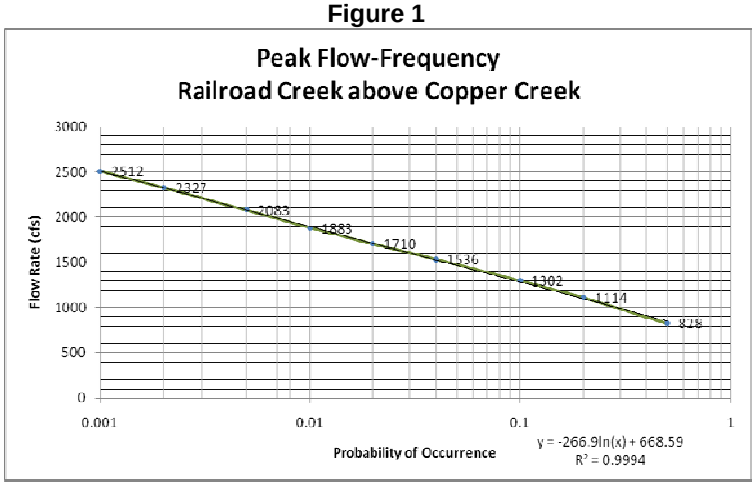


Figure 2

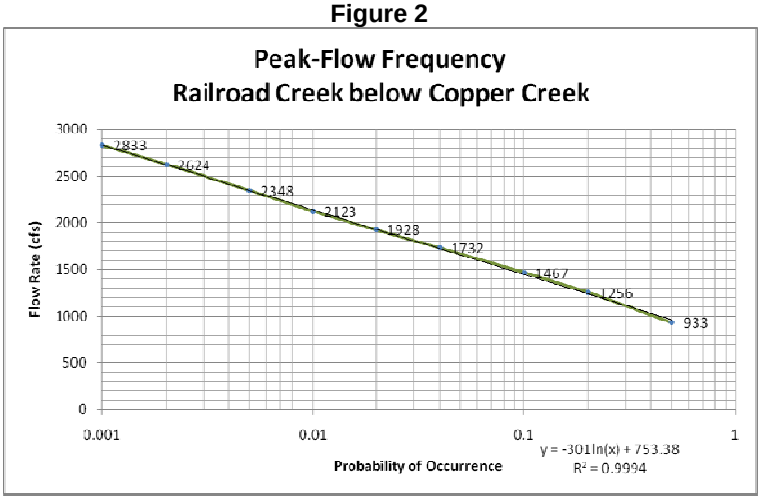
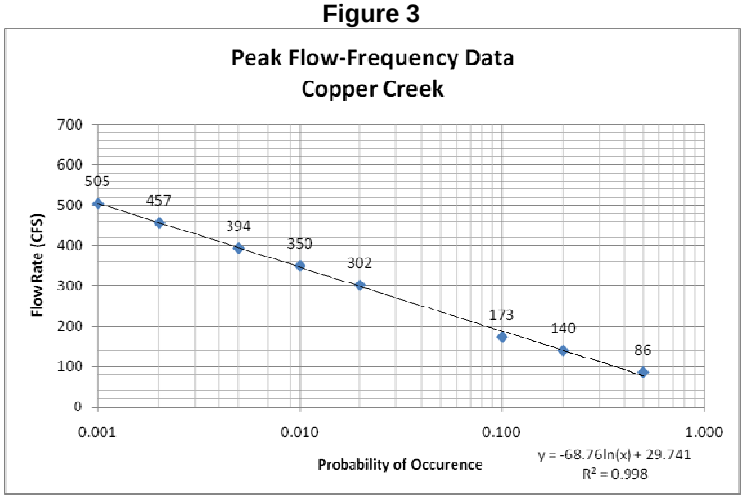


Figure 3



Floodplain Evaluation of Railroad Creek Existing Conditions

Client:	*Intalco*	**Sheet:**	*1*	**of**	*5*
Project:	*Holden Mine Remedial Design*	**Date:**		*4/8/2011*	
Description:	*Floodplain Evaluation of Railroad Creek Existing Conditions*	**Job No:**		*1008679*	
		By:	*L. Fuhrig*	**Chkd By:**	*PC*

Revisions	
Issue Date	**Description**
04/14/11	*Updated text and added calculations (excel)*

HOLDEN MINE - FLOODPLAIN EVALUATION OF RAILROAD CREEK EXISTING CONDITIONS

Revisioning					
Rev.	Date	Description	By	Checked	Date
A	*4/12/2011*	*First Issue*	*L. Fuhrig*	*J. Gregory*	*4/12/2011*
B	*4/16/2011*	*Updated Methodology, Conclusion*	*L. Fuhrig*	*P. Crouse*	*4/17/2011*

Location and Format

Electronic copies of these calculations are located in the project files system at:

Aconex Holden Online Document Management and Collaboration System for the Holden Mine Project Document Number 041411_HECRASrrc

The following calculations were generated using the following software:

U.S. Army Corps of Engineers River Analysis System (HEC-RAS version 4.0) software developed by the Hydrologic Engineering Center

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		By:	*L. Fuhrig*	**Chkd By:**	*PC*

Revisions

Issue Date	Description
04/14/11	*Updated text and added calculations (excel)*

Objective

1. Select the topography to use for hydrologic river routing of RRC.
2. Setup the HEC-RAS model for routing peak flows through the reconfigured RRC *3. Route peak flows generated from the 2, 10, 100, and 500-year recurrence storm intervals*

Design Basis

Railroad Creek peak flow-frequency curves developed using the hydrologic model developed during the RI/FS phase of the project (MWH 2011). See relevant calculations.

Topographic data from LIDAR survey of Holden site, August 2003.

Background/System Description/Givens

The RRC peak flow-frequency curves were developed from peak discharge data collected at streamgages in the same hydrologic region and transposed to the project site using drainage area adjustments. A Log-Pearson Type III (LPIII) flood frequency analysis was performed to determine the peak discharge in RRC associated with return periods from 2 years to 1000 years. A description of the flood hydrograph methodology is provided in a separate memorandum.

Existing conditions for the channel and floodplain are assumed to be as described by the 2003 LIDAR survey and 2003 and 2007 ground surveys.

Applicable Codes & Standards

Methodology

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04/14/11	*Updated text and added calculations (excel)*

HEC-RAS was used to route the peak flows using the existing configuration of Railroad Creek. The peak flows were determined above and below its confluence with Copper Creek. Routing simulations were conducted to estimate the water surface from a one-time storm event. The simulation results include a the limits of the floodplain, flow widths, flow depths, and velocities for the 2-, 10-, 100-, and 500-year return interval storm events.

HEC-RAS INPUTS
RRC topography used in preparing cross-sections for HEC-RAS was selected from two primary sources.: a LIDAR aerial survey of the Site in August 2003 and two ground surveys of 25 cross-sections along Railroad Creek from the west to the east end of the site. The ground surveys were conducted in 2003 and 2007. To determine the level of agreement between the two survey methods, a statistical analysis was done on the elevations of the points from the field survey and the elevations of the LIDAR survey using the same coordinates. The calculations display a column showing the differences in the LIDAR survey vs the ground survey, as well as a "weighted average" column that represents the average of these for each of the cross-sections that were surveyed.

A water surface was also modeled for the 2-, 10-, and 100-year return interval storm events using cross sections cut from the LIDAR data and the ground surveyed cross sections to determine how the difference in the two different sources of topography would effect the results of the model. As seen in the cross-sections at the upstream sides of the west and east foot bridges, the differences in water surface elevation were minimal, typically within one foot of each other.

The rationale used for the methods employed in the HEC-RAS modeling of Railroad Creek varied based on the nature of the specific input. Manning's n values, stream cross-section geometry, flow rates, and topographical information used in the HEC-RAS simulation are listed below.

The Manning's n values used for the RI/FS conceptual hydrologic model (URS, 2009) are consistent with the values recommended in the HEC-RAS manual as appropriate representations of Railroad Creek's main channel and floodplain. Railroad Creek's main channel is a clean, winding stream with some pools and stones, consistent with the chosen Manning's n value of 0.045. The floodplain surrounding Railroad Creek is primarily a heavily treed area and high flows will encounter low tree branches. A Manning's n of 0.137 is appropriate for this environment.

Assumptions

The cross-sections used in HEC-RAS are an adequate representation of the river geometry.

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Revisions	
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04/14/11	*Updated text and added calculations (excel)*

Conclusions

This analysis showed that the LIDAR surface was an average of 0.9 feet higher (weighted average) than the ground survey cross sections. The decision was made to use the LIDAR survey to represent the Railroad Creek topography in HEC-RAS. The primary reason for this decision is based on the LIDAR data having already been adjusted to represent "bare earth," thus the difference of only 0.9 feet between the two survey methods is reasonable. This difference in elevation will not significantly change the overall creek velocities used for designing riprap and other channel stabilization features. Additionally, the elevation difference represented by the LIDAR survey is within the level of accuracy of the hydrology itself. The LIDAR survey also has the advantage of being more comprehensive evaluation of the topography because it covers the entire mine site, whereas the surveyed cross sections only pertain to the specific surveyed locations. Using the LIDAR survey makes it easier to accurately plot flood boundaries between cross sections.

As seen in the calculations, the floodplain for the 100-yr storm event is expected to leave the main channel in several areas, namely the area just upstream of the vehicle bridge to the south of the main channel's banks, the area upstream of the west foot bridge, also to the south, an area approximately 300 ft upstream of the Copper Creek confluence to the north, and areas immediately across the stream from Tailings Pile 3 to the north and immediately east of Tailings Pile 3 to the south. It is notable that the first two areas mentioned are expected to only have small areas of ponding, where the other areas mentioned will have more widespread ponding. The average velocity in the channel for the 100-yr storm event is 7.6 ft/s. Higher velocities tend to occur in the bridge areas but no velocities greater than 11 ft/s were computed for this storm event.

The calculated flood event profiles can be seen in the attached maps. Section 2502.748 is a cross-section downstream from the Railroad Creek confluence with Copper Creek in a floodplain area with a relatively low bank. As seen in the calculations, the north bank at this cross-section will be exceeded at a discharge of 600

Attachments

LIDAR vs Ground Survey Evaluation
Summary and Computation of Design Discharges for Railroad Creek and Copper Creek
HEC-RAS Cross-Sections
HEC-RAS Model Inputs
Maps: 2-, 10-, 100-, 500-year Return Events
Holden Mine Railroad Creek Hydrologic Conceptual Model for Remedial Design (Memorandum)

Calculations

Please see attachments.

Revisions	
Issue Date	**Description**
04/14/11	*Updated text and added calculations (excel)*

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By: *L. Fuhrig* **Chkd By:**

LIDAR vs Ground Survey Evaluation

Point Number	Northing	Easting	Ground Survey Elevation less LIDAR Elevation (ft)	Cross-Section Average
2108	437271.6	1654115	-1.1135	-0.7531
2109	437291	1654127	-0.7813	
2110	437291.8	1654128	-0.3645	
10395	437242.6	1654200	0.0894	-0.6710
10396	437232.1	1654199	0.019	
10397	437225.1	1654198	-1.0711	
10398	437212.2	1654194	-1.7212	
2120	437216.7	1654384	0.1563	-0.4407
2121	437207.9	1654384	-1.0376	
2133	437117.9	1654691	-0.7926	0.0643
10359	437131.8	1654691	0.4539	
10360	437116.8	1654688	0.5317	
2142	437059.3	1654983	0.1236	0.2328
2143	437071.1	1654987	-1.2147	
2144	437083.5	1654993	0.2148	
10341	437082.7	1654994	1.1868	
10342	437073	1654989	1.1436	
10343	437062.8	1654983	0.0743	
10344	437050	1654977	-0.4657	
10345	437040.2	1654976	0.7998	
				0.5837
2150	436771.4	1655294	-0.0345	
10181	436774.6	1655293	0.6312	
10182	436778.9	1655288	1.3927	
10183	436797.2	1655293	2.0071	
2153	436806.3	1655289	-0.3882	
2154	436808	1655290	-0.1062	
10172	436983.6	1655596	-1.466	-1.0195
10173	436979.4	1655598	-1.1817	
10174	436972.1	1655603	-0.4109	
2167	436989.9	1655602	-1.7533	-1.1841
2168	436982.7	1655610	-1.6803	
2178	437105	1655709	-0.8989	
10165	437105	1655706	-0.4039	
2190	437241.8	1655903	-1.229	-0.8119
2191	437248.5	1655902	-0.5216	
2192	437257.3	1655900	-2.3843	
10151	437247	1655902	0.4087	
10152	437251.2	1655900	-0.3333	
2216	437247.4	1656188	-1.7629	-0.6306
2217	437256	1656187	-1.8565	
2218	437270.1	1656186	0.0859	
10139	437248.2	1656187	-0.2918	
10140	437265.2	1656185	0.6723	
2249	437266.4	1656791	-2.0307	-1.6102
2250	437256.6	1656790	-1.5076	
2251	437236	1656788	-1.2922	
4003	437484.1	1653372	-1.0248	-0.3328
4004	437474.7	1653367	-0.2236	
4005	437470.8	1653365	-0.2374	
4006	437464.2	1653360	-0.2579	
4007	437461	1653358	0.0798	

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Chkd By:

4106	437422.9	1653791	0.0728	-0.4238
4107	437415	1653791	-0.6529	
4108	437404.1	1653790	-0.5196	
4109	437396.3	1653789	-0.7675	
4110	437385.9	1653789	-0.4819	
4111	437382.1	1653788	0.3508	
4112	437379.9	1653788	0.0507	
10202	437381.2	1653790	0.2757	
10203	437383.8	1653789	-0.5566	
10204	437396.3	1653789	-1.3636	
10205	437408.1	1653790	-0.8381	
10206	437414.2	1653791	-0.428	
10207	437415.6	1653791	-0.6507	
4123	437377.5	1653645	-1.85	-1.3876
4124	437385.4	1653644	-1.4251	
4125	437399.2	1653644	-0.7274	
4126	437409.3	1653645	-1.5477	
4133	437436.5	1653499	-0.2307	-0.6290
4134	437432.7	1653499	-0.4762	
4135	437418.2	1653495	-0.6702	
4136	437406.3	1653491	-0.808	
10213	437436.1	1653500	-0.5752	
10214	437428.3	1653498	0.2928	
10215	437426.9	1653497	-0.3827	
10216	437416.3	1653495	-1.6472	
10217	437406.4	1653491	-1.1638	
4200	437555.8	1653189	-0.2195	-1.1373
4201	437560.6	1653190	-0.8625	
4202	437567.2	1653192	-1.4745	
4203	437573	1653194	-0.8754	
4204	437578.5	1653196	-0.8972	
4205	437579.6	1653196	-1.1317	
10241	437559.4	1653189	-1.9291	
10242	437569.4	1653193	-2.036	
10243	437578.3	1653195	-0.81	
10263	437682.1	1652903	-2.6204	-3.1879
10264	437690.8	1652905	-2.9124	
10265	437698.1	1652909	-4.031	
4282	437640.4	1652709	-0.0448	-0.5621
4283	437647.9	1652702	-0.263	
4284	437656.5	1652693	-1.3785	
4293	437677.9	1652793	-0.5724	-0.5426
4294	437682.3	1652793	0.3022	
4295	437688.9	1652792	-0.3451	
4296	437705.6	1652788	0.1525	
4297	437714	1652785	-0.2153	
4298	437719.1	1652784	-1.0048	
4299	437723.9	1652782	-1.6758	
4300	437727.5	1652781	-1.3973	
4301	437728.3	1652780	-0.1276	
4309	437620.9	1652690	-1.528	-1.1548
4310	437622.9	1652687	-1.1962	
4311	437624	1652684	-2.1897	
4312	437627	1652680	-0.675	
4313	437634.4	1652674	-0.185	
10006	436777.6	1658215	-0.4049	-0.4357
10007	436766.9	1658207	-0.4664	
10018	436916	1657992	-2.1746	-2.0866

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10019	436923.5	1657998	-1.9985	
10050	436157.9	1658832	-2.5345	-3.1528
10051	436148	1658830	-3.771	
10083	436548.3	1658423	1.6614	1.7765
10084	436561.3	1658430	1.7866	
10085	436574.6	1658439	1.8814	
10115	437079.2	1657647	-1.7881	-1.8546
10116	437086.9	1657648	-2.4935	
10117	437095.6	1657650	-1.2823	
10305	436287.3	1659400	2.4218	1.8608
10306	436262.5	1659411	1.2997	
10372	437216.6	1654437		
10325	437230.4	1657214	-3.0848	-2.1856
10326	437217	1657210	-2.5894	
10327	437202.5	1657208	-0.8825	
10411	437588.4	1653160	0.1166	-1.4106
10412	437583.9	1653158	-1.1807	
10413	437578	1653157	-2.1732	
10414	437570.3	1653156	-2.405	
10601	437634.7	1653042	-1.0949	-1.5175
10603	437631.7	1653041	-1.9401	
10617	437646.5	1653019	-2.4817	-1.6678
4233	437640.4	1653018	-0.8538	
10630	437651.4	1652983	-0.8919	-0.9041
4246	437648	1652981	-0.3478	
4248	437658.4	1652986	-1.4727	
4262	437670.5	1652953	-0.9323	-0.9323
		AVERAGE:	-0.7460	AVERAGE -0.8784

Client:	*Intalco*	**Sheet:**	*3*	**of**	*5*
Project:	*Holden Mine Remedial*	**Date:**	*4/18/2011*		
Descriptio	*Floodplain Evaluation of Railroad Creek Existing Conditions*	**Job No:**	*1008679*		
		By:	*L. Fuhrig*	**Chkd By:**	*JG*

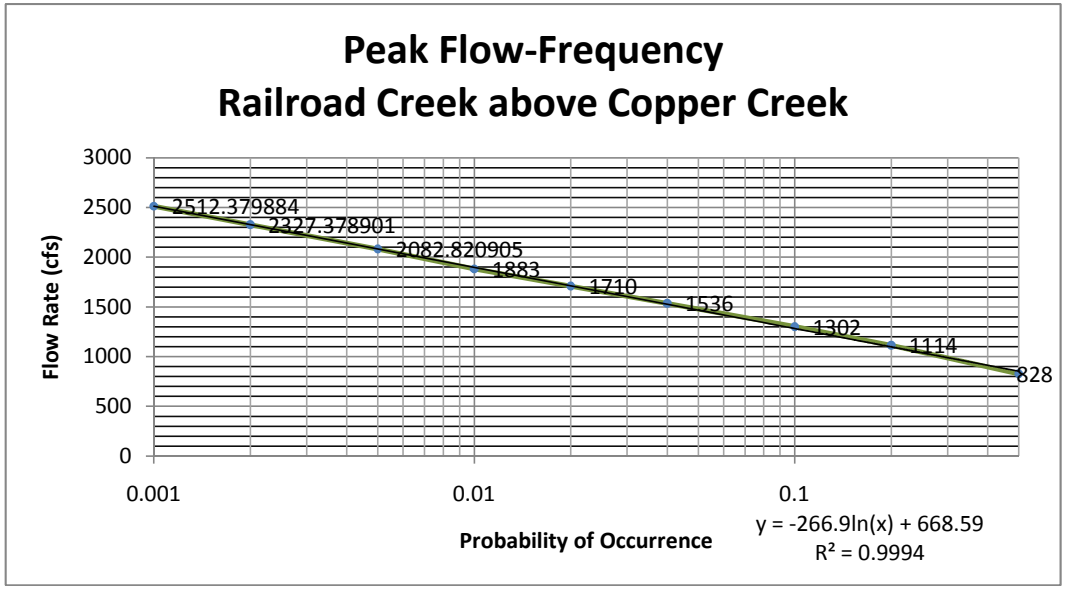
Summary and Computation of Design Discharges for Railroad Creek and Copper Creek

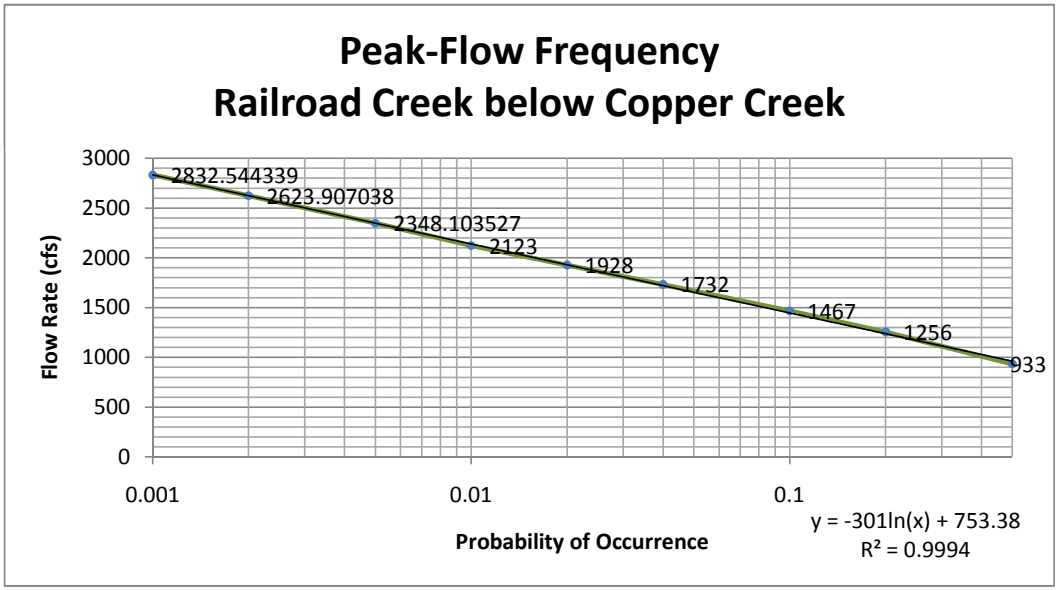
Railroad Creek:

Adopt LPIII peak Qs from the URS transposition from the Stehekin gage flood-frequency analysis, for Q2 - Q100. (MWH Memorandum from Chip Paulson, April 14, 2011). These results were considered to be more reliable than the original HEC-1 modeling by Dames and Moore in 1999.
Higher flows than Q100 were extrapolated based on the regression equation calculated for LPIII Q2 - Q100 flows, with a linear-log fit.

Return Period (yr)	Frequency	LPIII Q (27.5 mi^2 - above Copper CR)	LPIII Q (31 mi^2 - below Copper Cr)	
Low flow fish passage	-	40	40	
*Q 10% exceedance	-	185	204	
2	0.5	828	933	
5	0.2	1114	1256	
10	0.1	1302	1467	
25	0.04	1536	1732	
50	0.02	1710	1928	
100	0.01	1883	2123	
200	0.005	2083	2348	From linear-log fit
500	0.002	2327	2624	From linear-log fit
1000	0.001	2512	2833	From linear-log fit

*High flow for fish

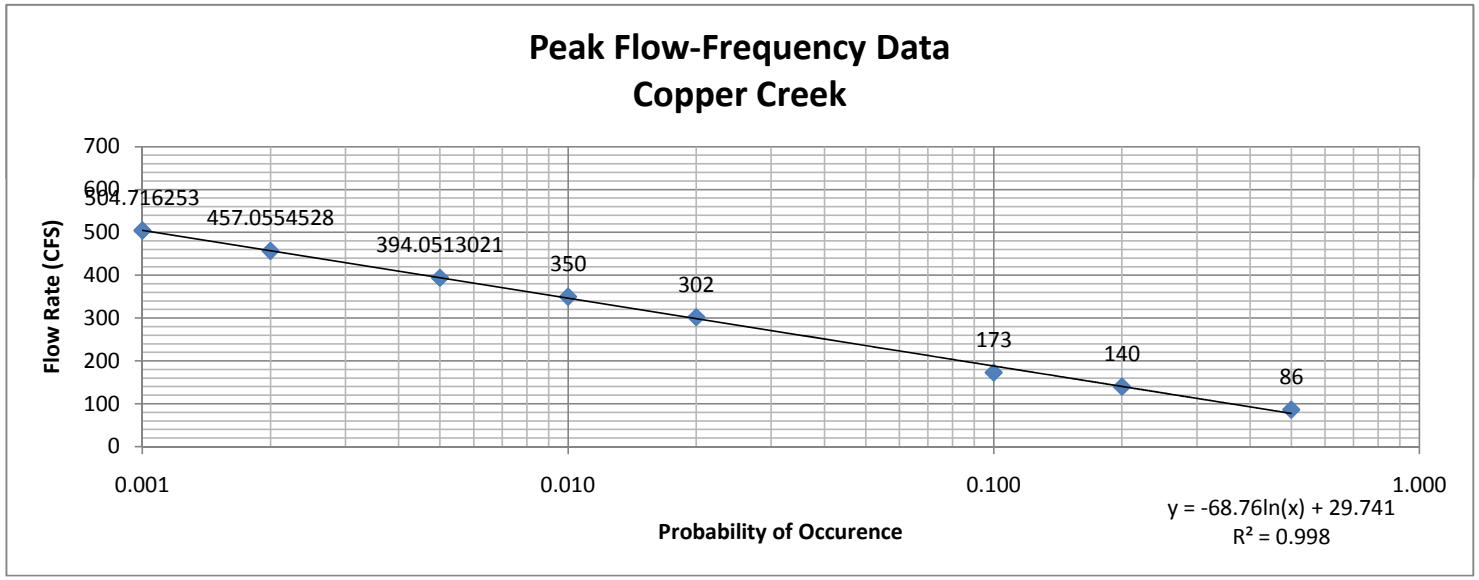

Peak Flow-Frequency
Railroad Creek above Copper Creek
Flow Rate (cfs)
3000
2500
2000
1500
1000
500
0
2512.379884
2327.378901
2082.820905
1883
1710
1536
1302
1114
828
0.001
0.01
0.1
Probability of Occurrence
y = -266.9ln(x) + 668.59
R² = 0.9994


Peak-Flow Frequency
Railroad Creek below Copper Creek
Flow Rate (cfs)
3000
2500
2000
1500
1000
500
0
2832.544339
2623.907038
2348.103527
2123
1928
1732
1467
1256
933
0.001
0.01
0.1
Probability of Occurrence
y = -301ln(x) + 753.38
R² = 0.9994

Copper Creek

Adopt the HEC-1 flows from Dames and Moore (1999), reported by URS (June 2009), for Q2 - Q100.
Higher flows than Q100 were computed based on the regression equation from a linear-log fit to the Q2 - Q100 flows.

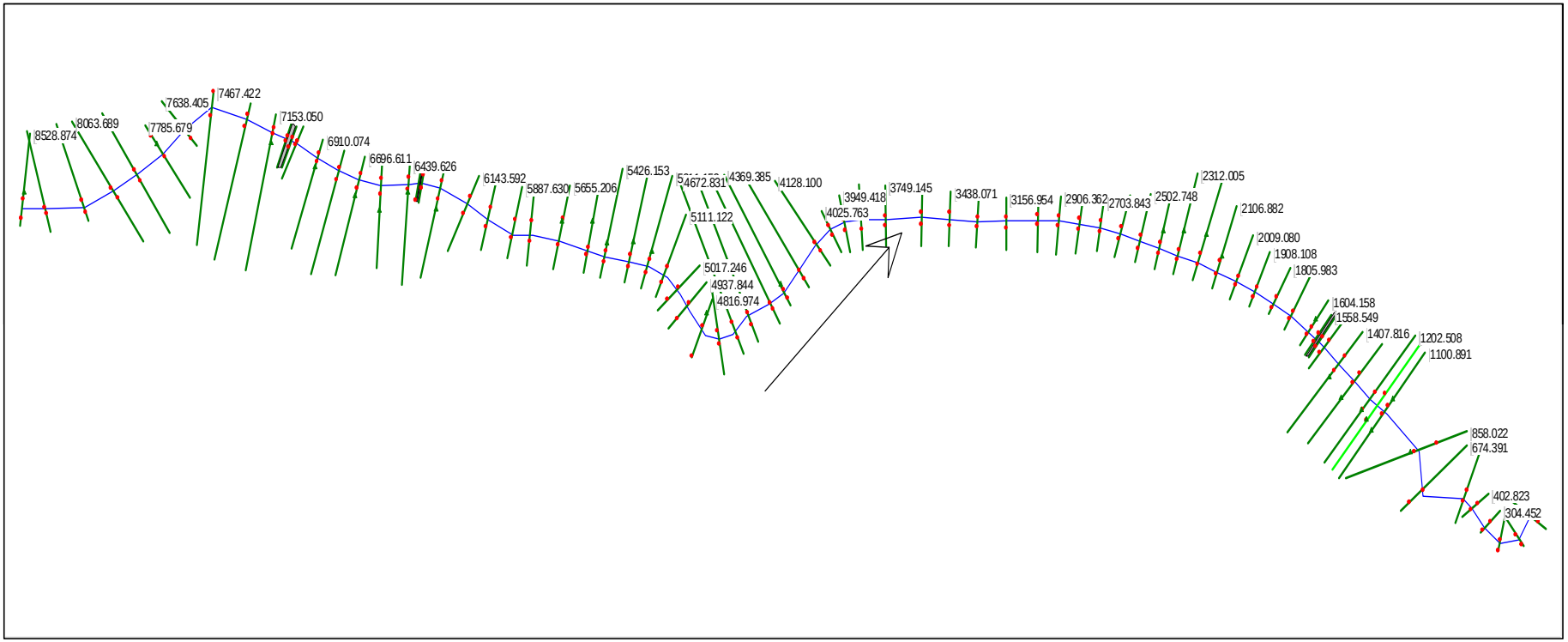
Return Period (yrs)	Probability	Q at Railroad Cr Confluence	
1.5	0.67	60	
2	0.5	86	
5	0.2	140	
10	0.1	173	
50	0.02	302	
100	0.01	350	
200	0.005	394	From linear-log fit
500	0.002	457	From linear-log fit
1000	0.001	505	From linear-log fit



Client:	*Intalco*		**Sheet:**	*4*	**of** *5*
Project:	*Holden Mine Remedial Design*		**Date:**		*4/18/2011*
Description:	*Floodplain Evaluation of Railroad Creek Existing Conditions*		**Job No:**		*1008679*
		By: *L. Fuhrig*	**Chkd By:**		*JG*

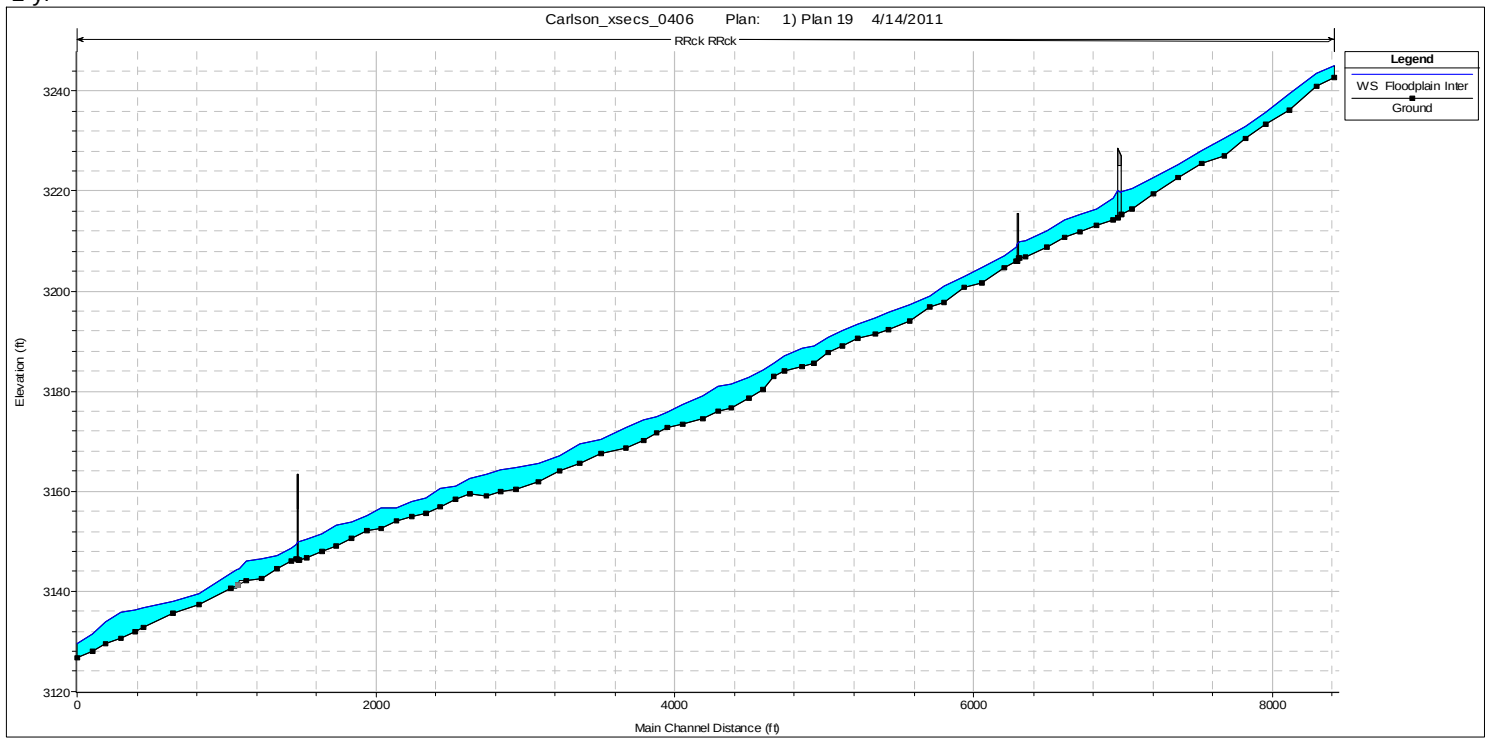
HEC-RAS Cross-Sections

HEC-RAS Plan View

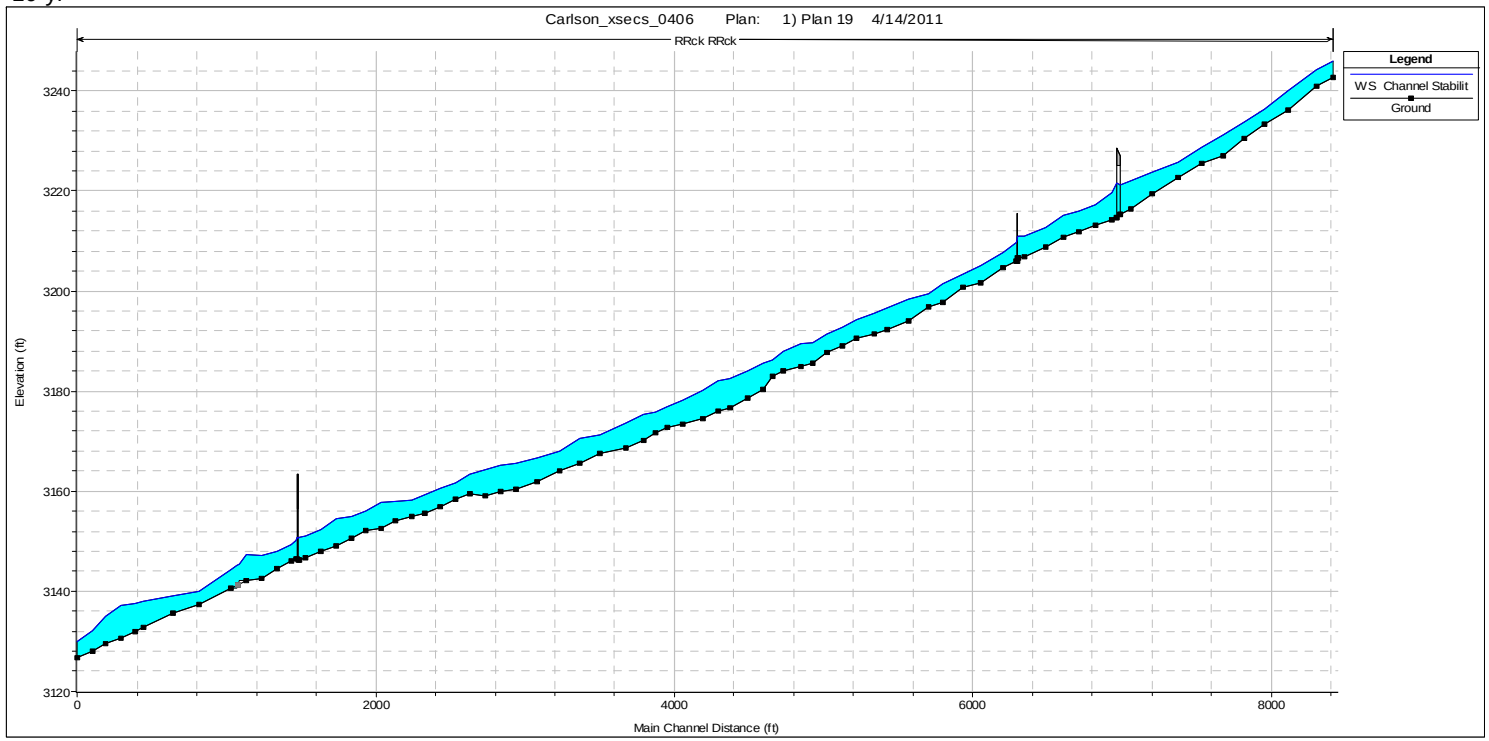


HEC-RAS Longitudinal Views

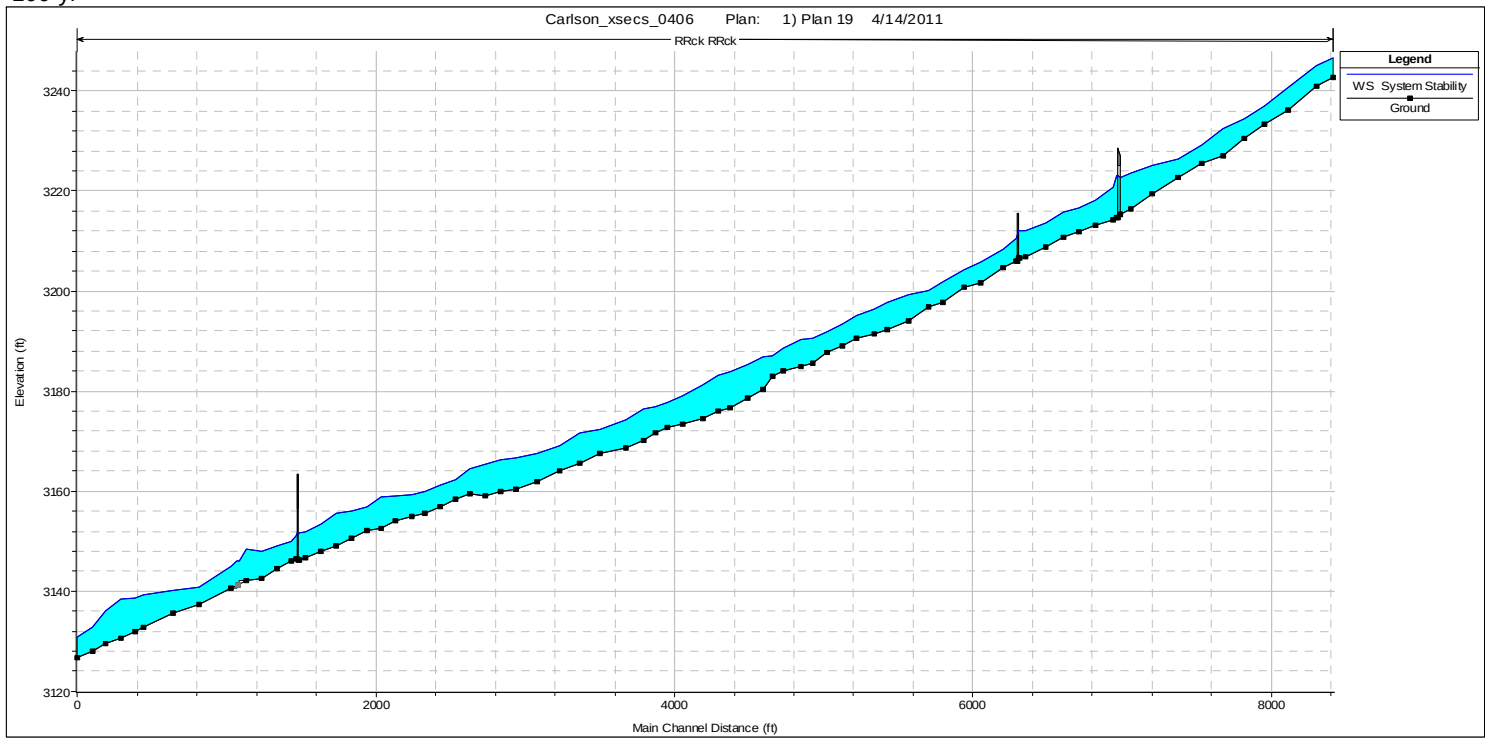
2-yr



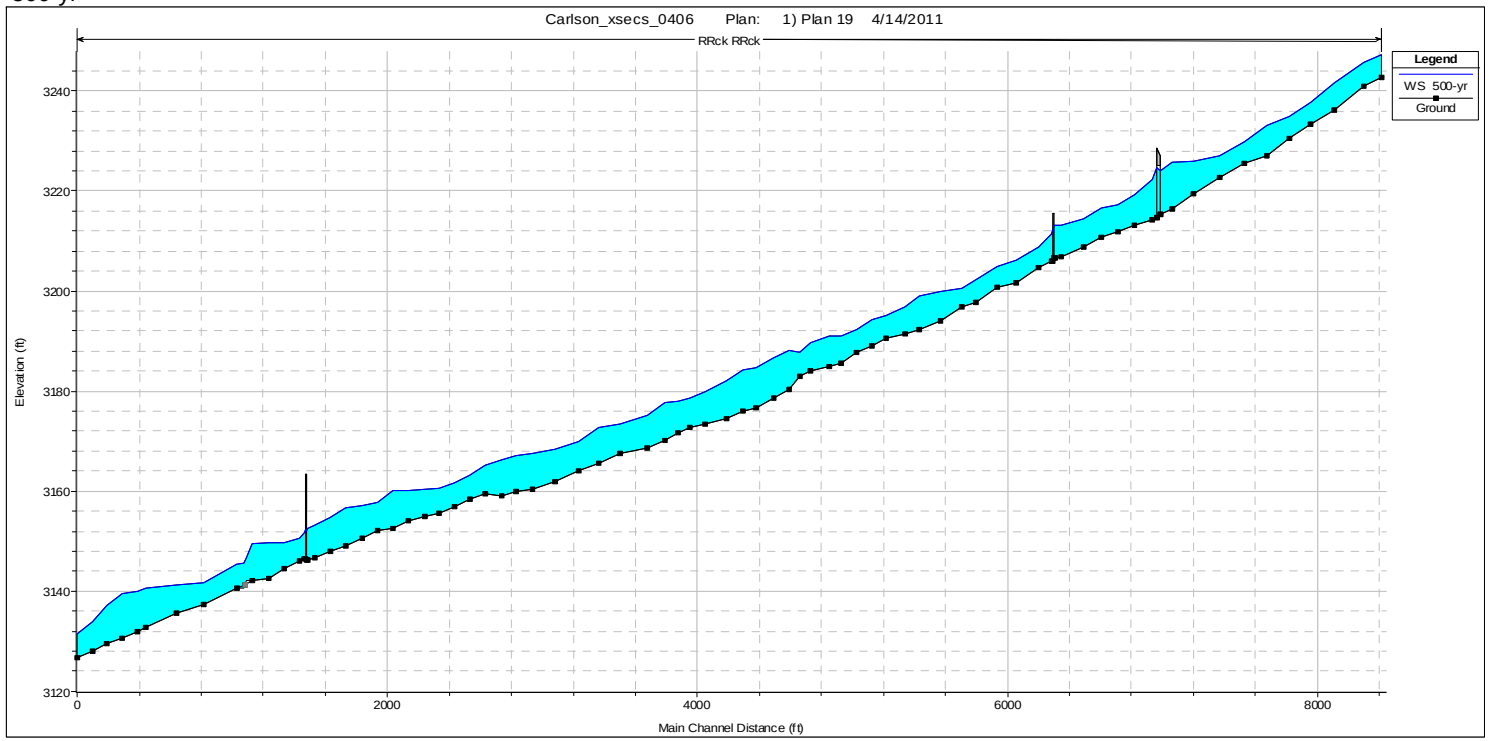
10-yr


Carlson_xsecs_0406 Plan: 1) Plan 19 4/14/2011
RRck RRck
Legend
WS Channel Stabilit
Ground
Elevation (ft)
3240
3220
3200
3180
3160
3140
3120
0
2000
4000
6000
8000
Main Channel Distance (ft)

100-yr

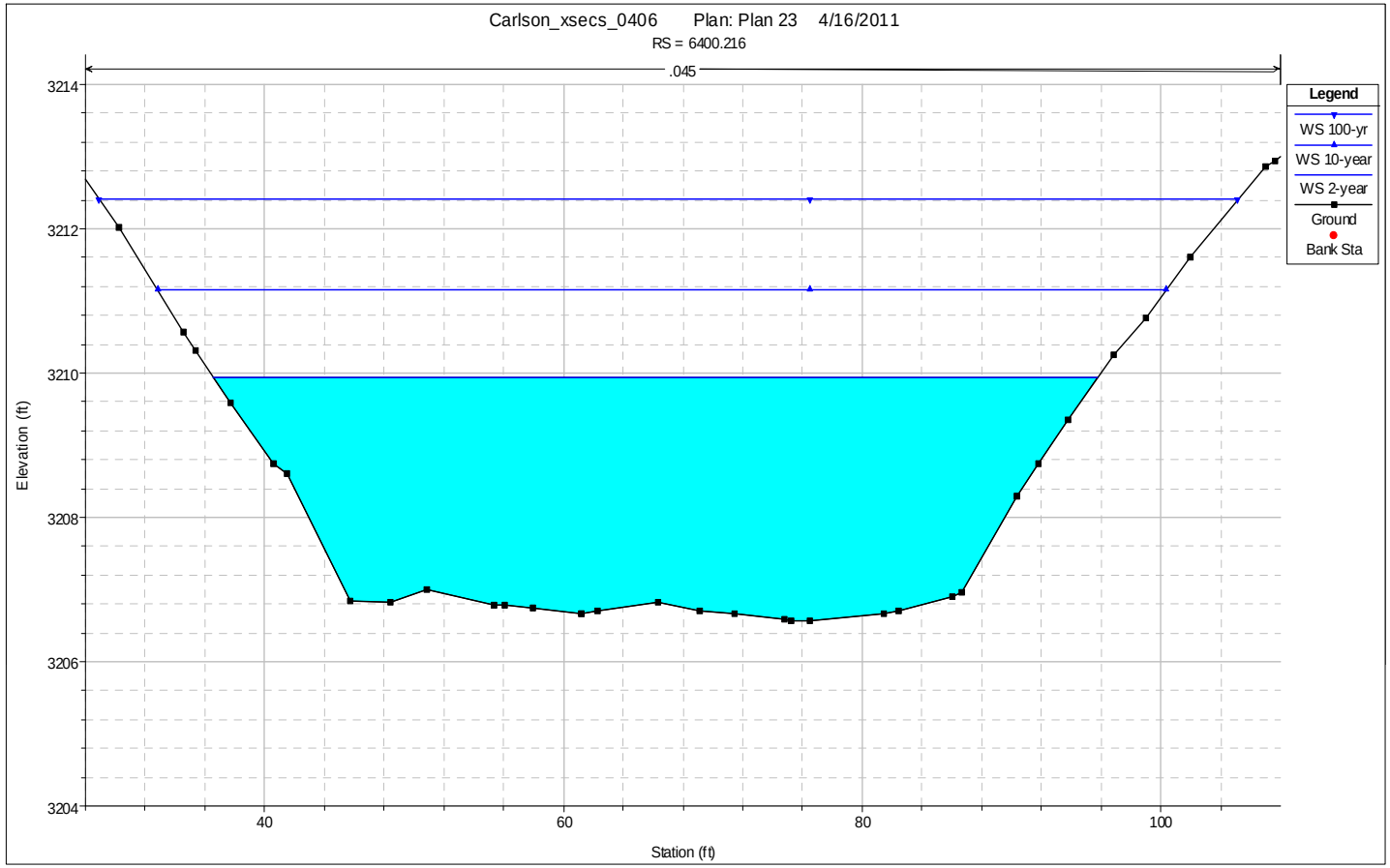

Carlson_xsecs_0406 Plan: 1) Plan 19 4/14/2011
RRck RRck
Legend
WS System Stability
Ground
Elevation (ft)
3240
3220
3200
3180
3160
3140
3120
0
2000
4000
6000
8000
Main Channel Distance (ft)

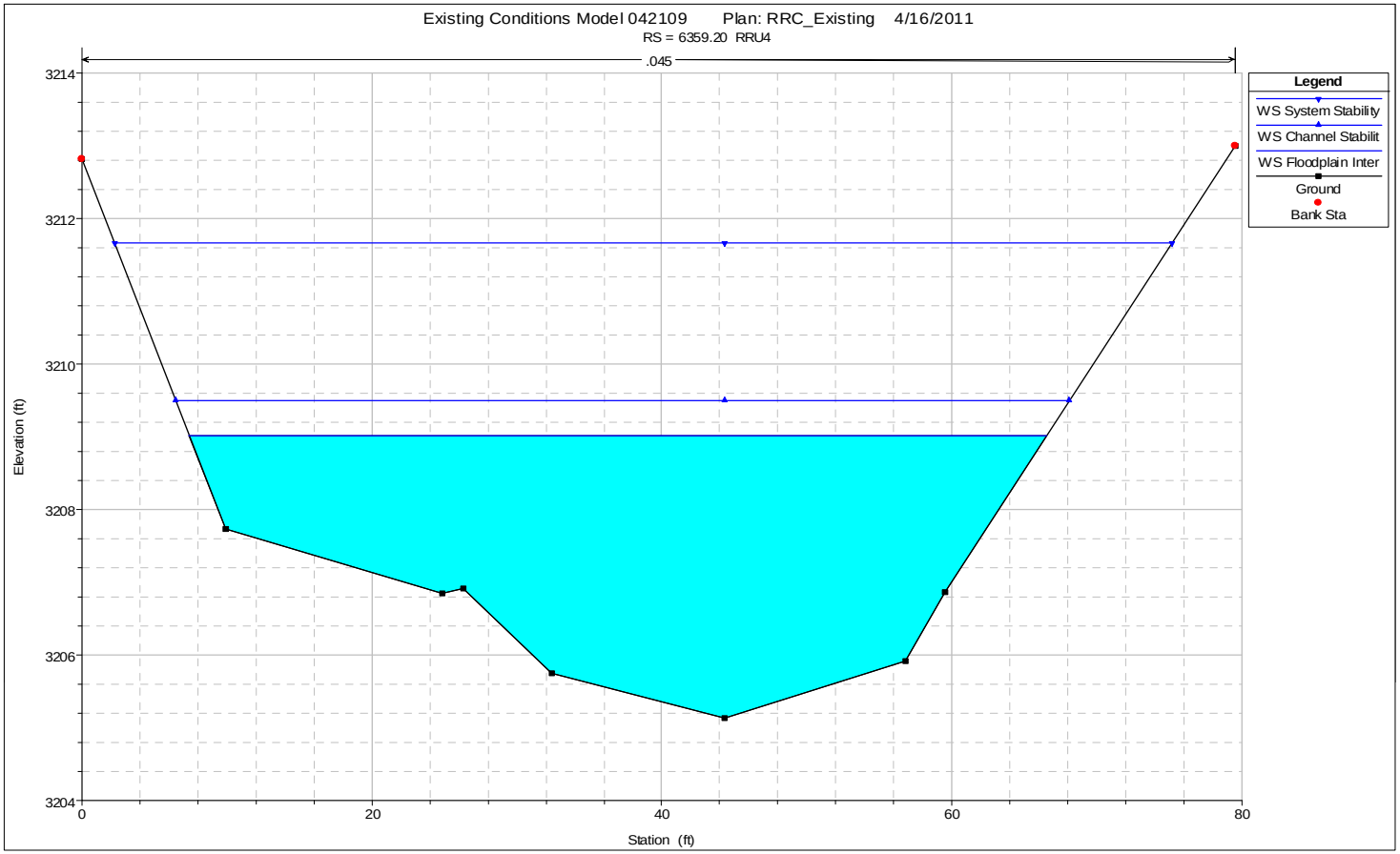
500-yr


Carlson_xsecs_0406 Plan: 1) Plan 19 4/14/2011
RRck RRck
Legend
WS 500-yr
Ground
Elevation (ft)
3240
3220
3200
3180
3160
3140
3120
0
2000
4000
6000
8000
Main Channel Distance (ft)

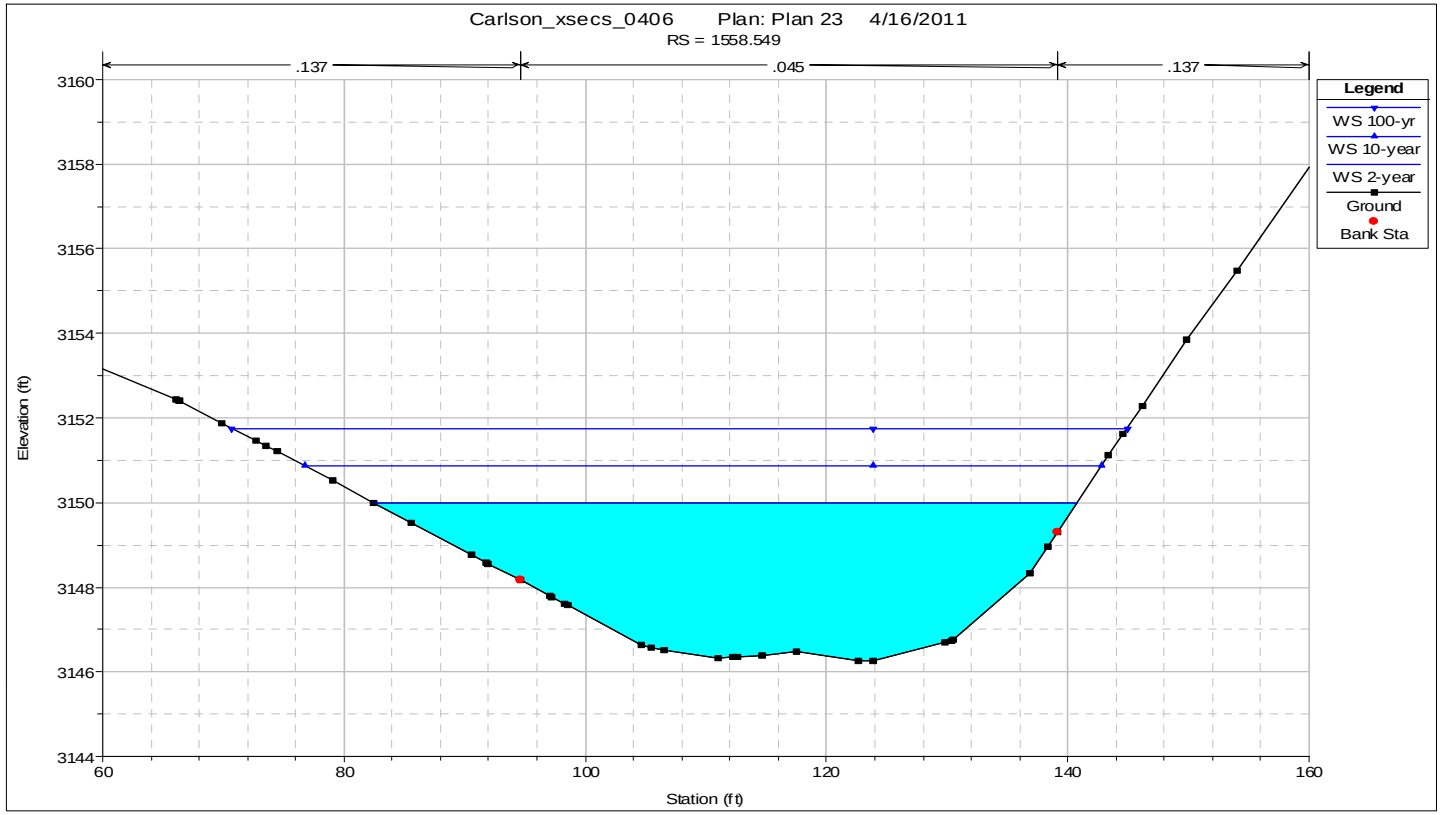
HEC-RAS Water Surface Profiles

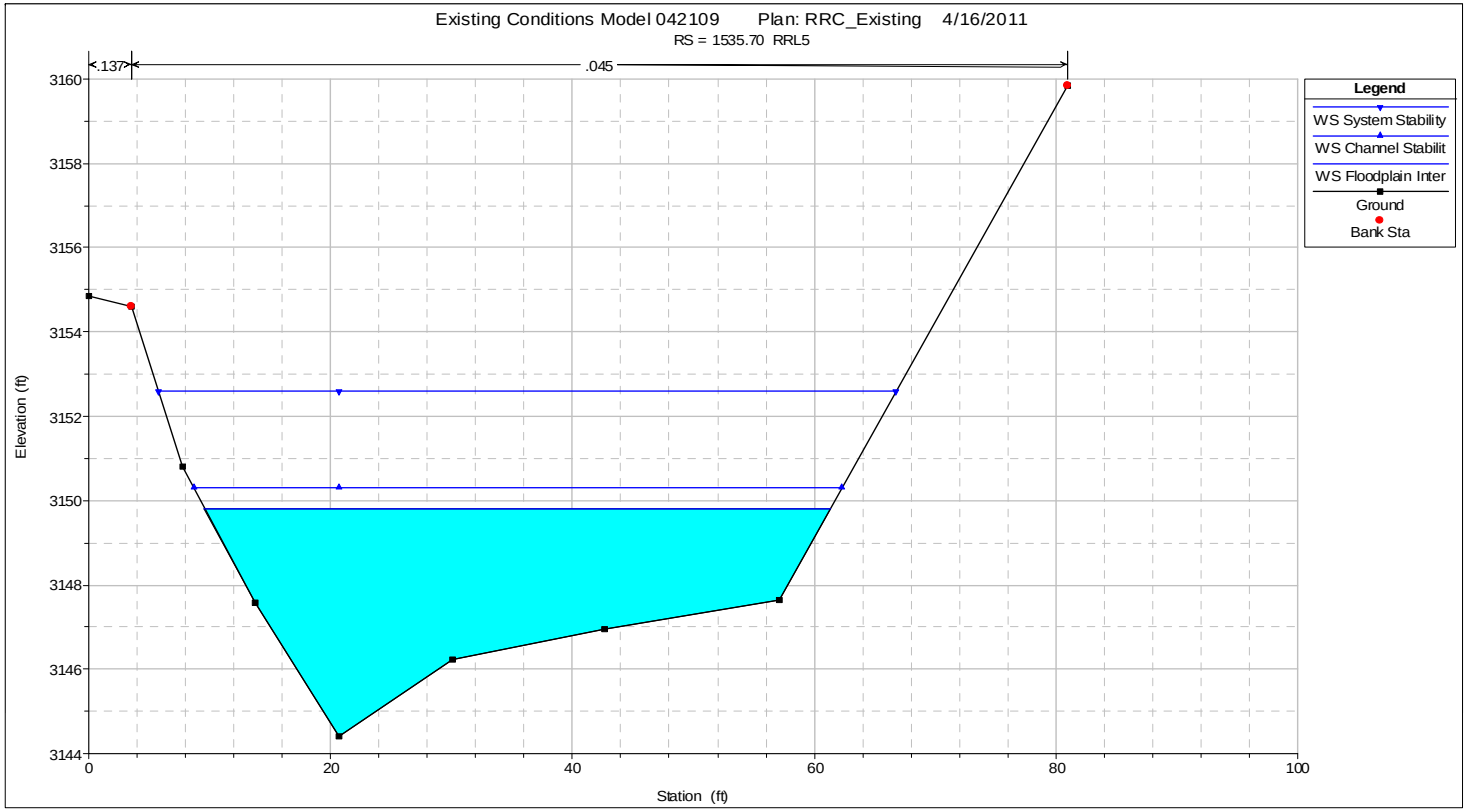
LIDAR and field survey comparison: station immediately upstream of west foot bridge



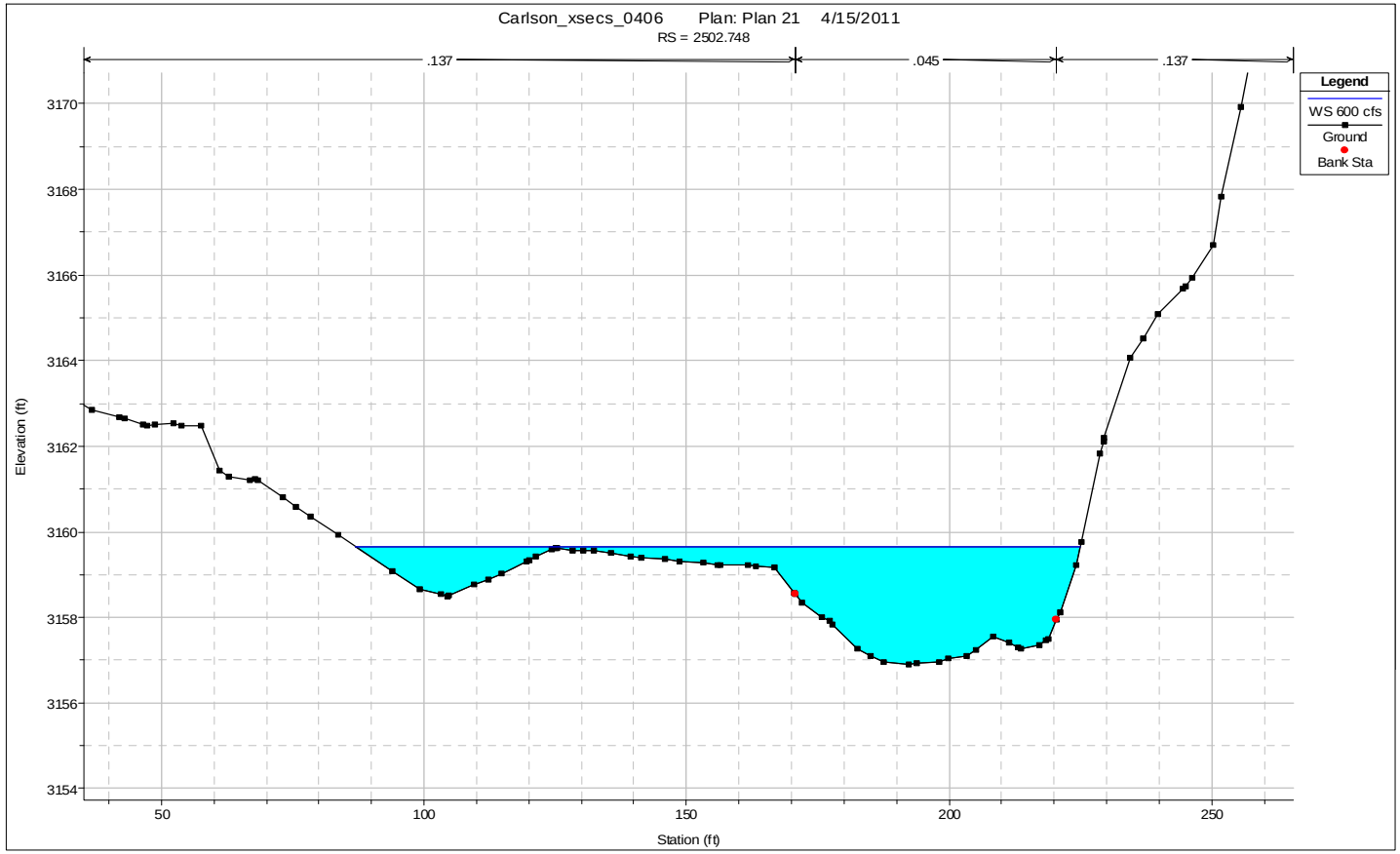

Existing Conditions Model 042109 Plan: RRC_Existing 4/16/2011
RS = 6359.20 RRU4
.045
Legend
WS System Stability
WS Channel Stabilit
WS Floodplain Inter
Ground
Bank Sta
Elevation (ft)
Station (ft)
3214
3212
3210
3208
3206
3204
0
20
40
60
80

LIDAR and field survey comparison: station immediately upstream of west foot bridge

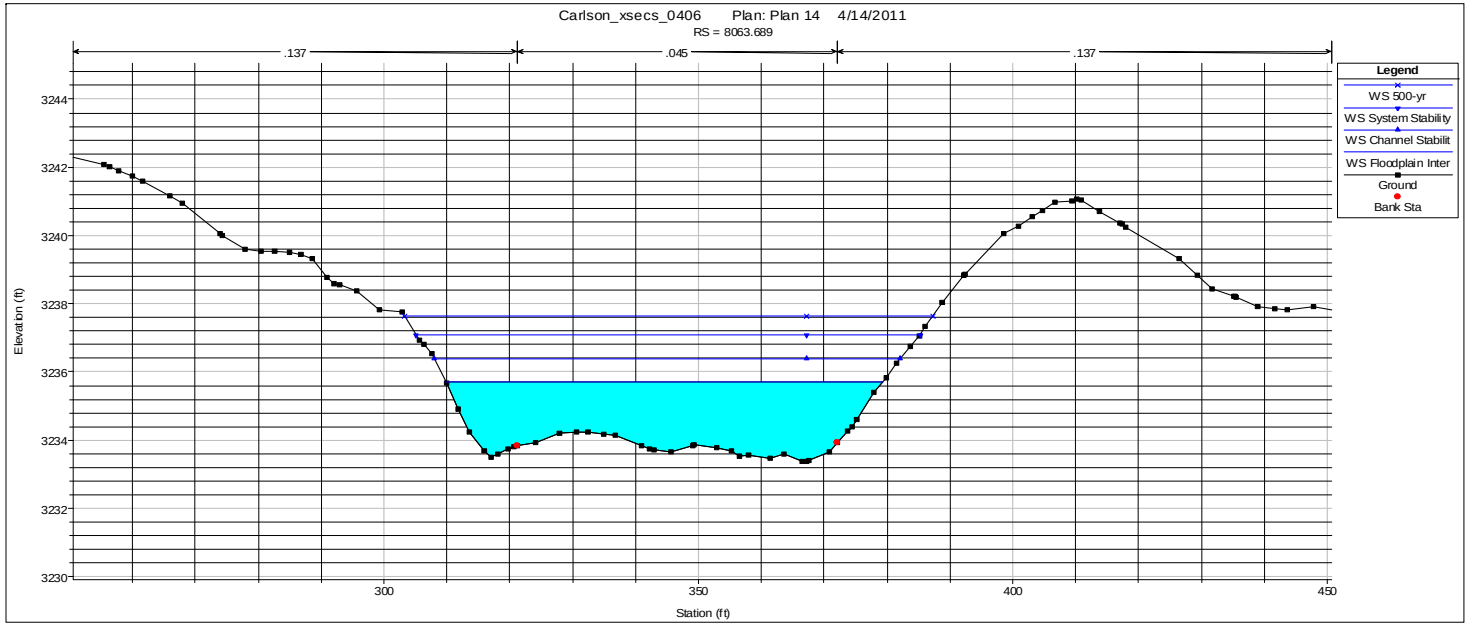



Existing Conditions Model 042109 Plan: RRC_Existing 4/16/2011
RS = 1535.70 RRL5
.137
.045
Legend
WS System Stability
WS Channel Stabilit
WS Floodplain Inter
Ground
Bank Sta
Elevation (ft)
Station (ft)
3160
3158
3156
3154
3152
3150
3148
3146
3144
0
20
40
60
80
100

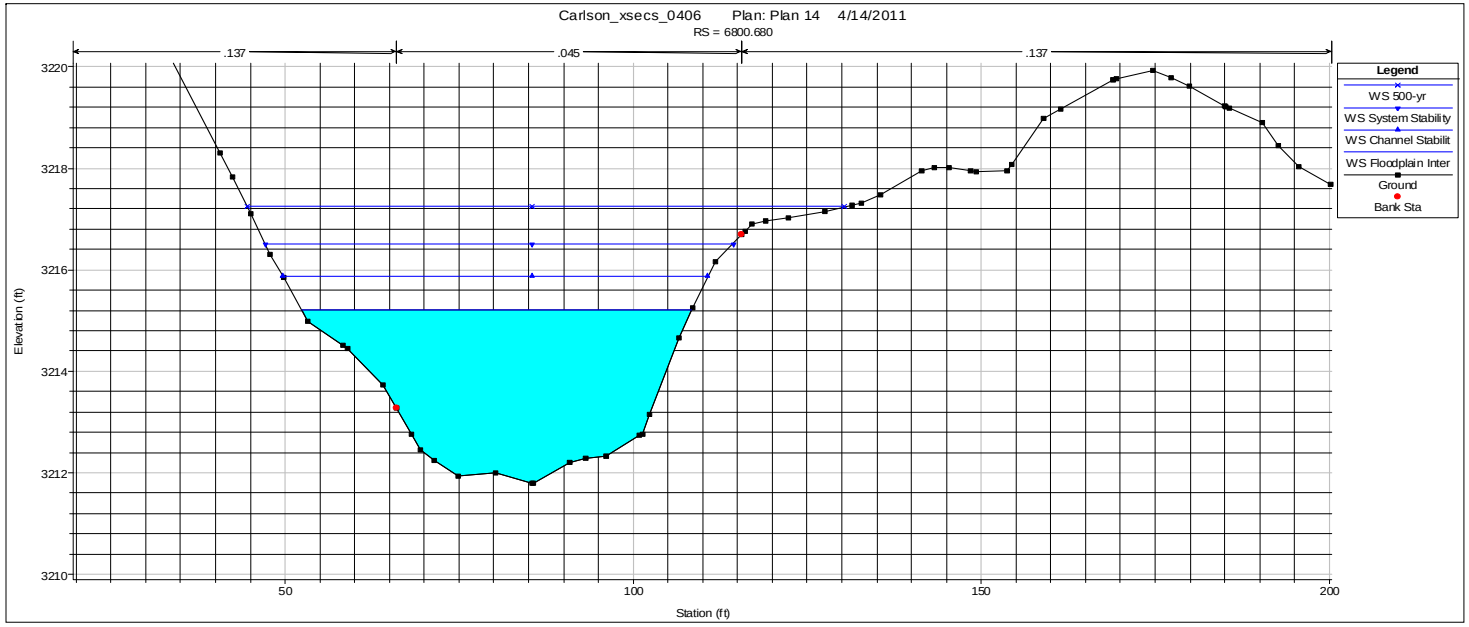
River Station 2502.748, showing the water surface exiting the bank at 600 cfs.



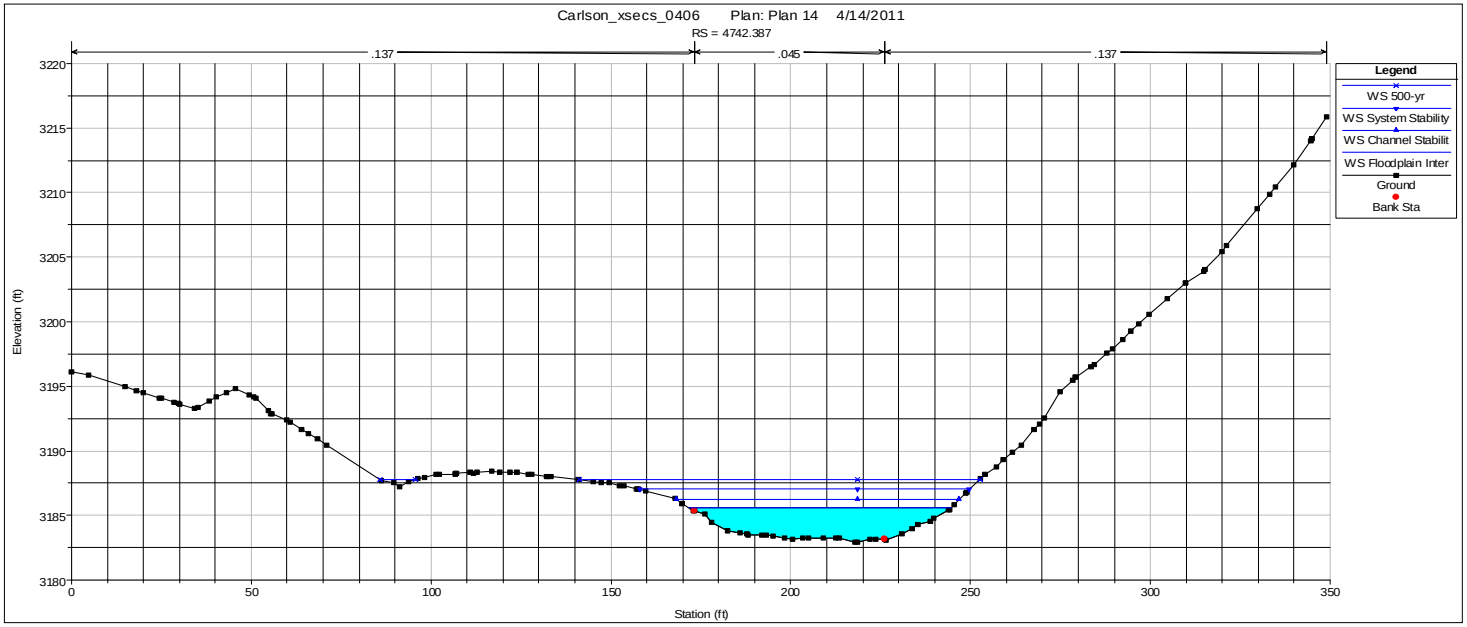
River Station 8063.689. All river stations below show the water surfaces at 2-, 10-, 100-, and 500-year event levels.



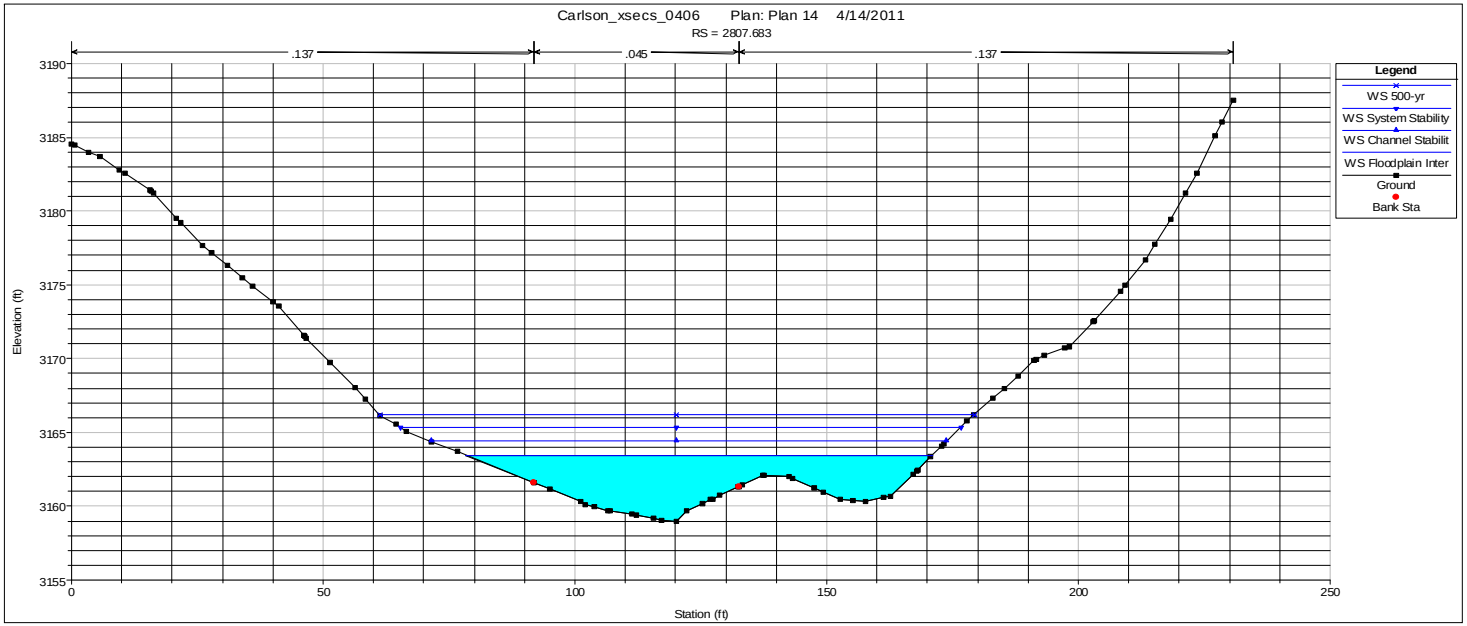
River Station 6800.680



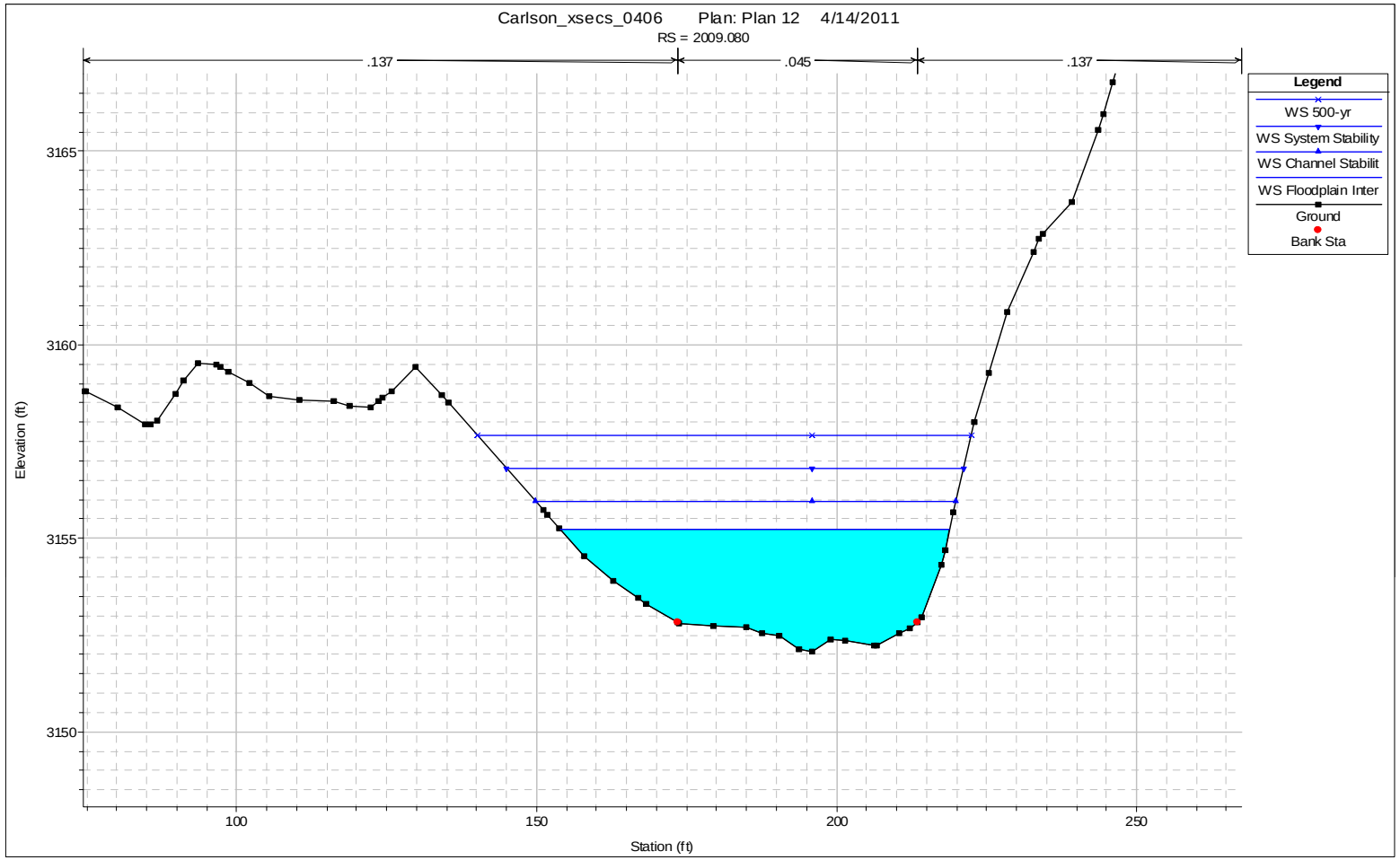
River Station 4742.387



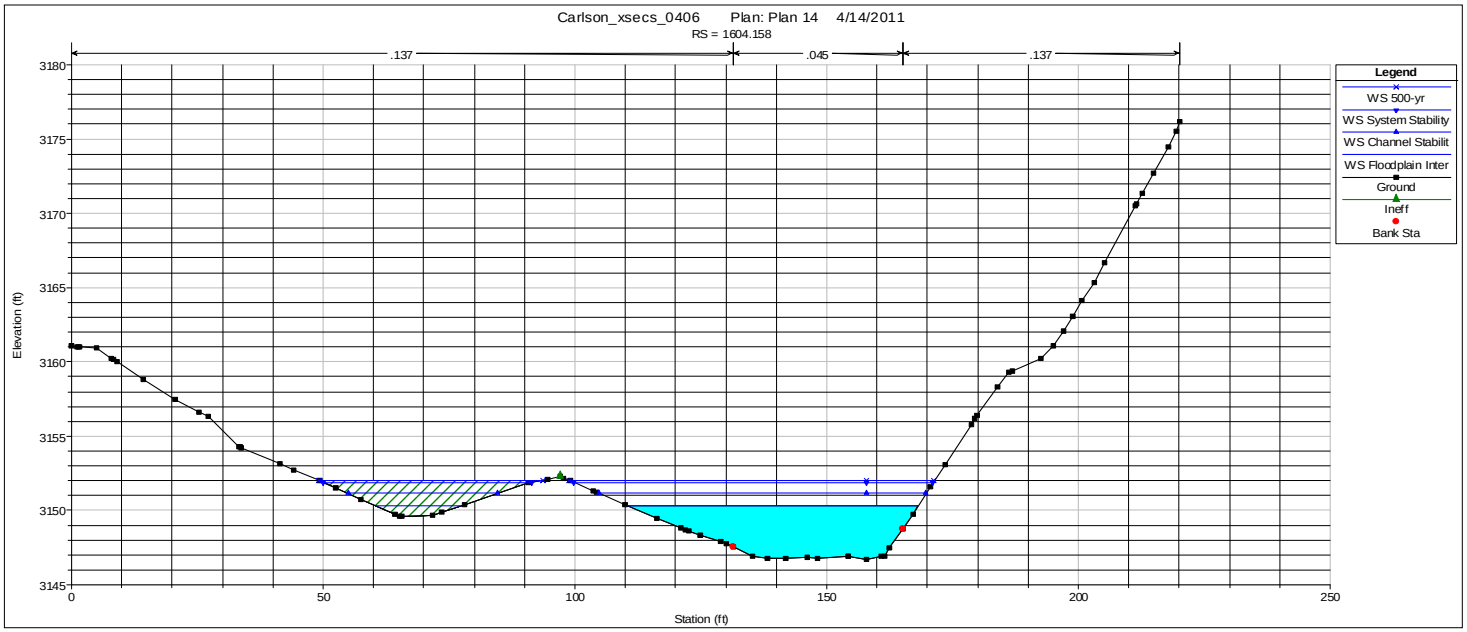
River Station 2807.683



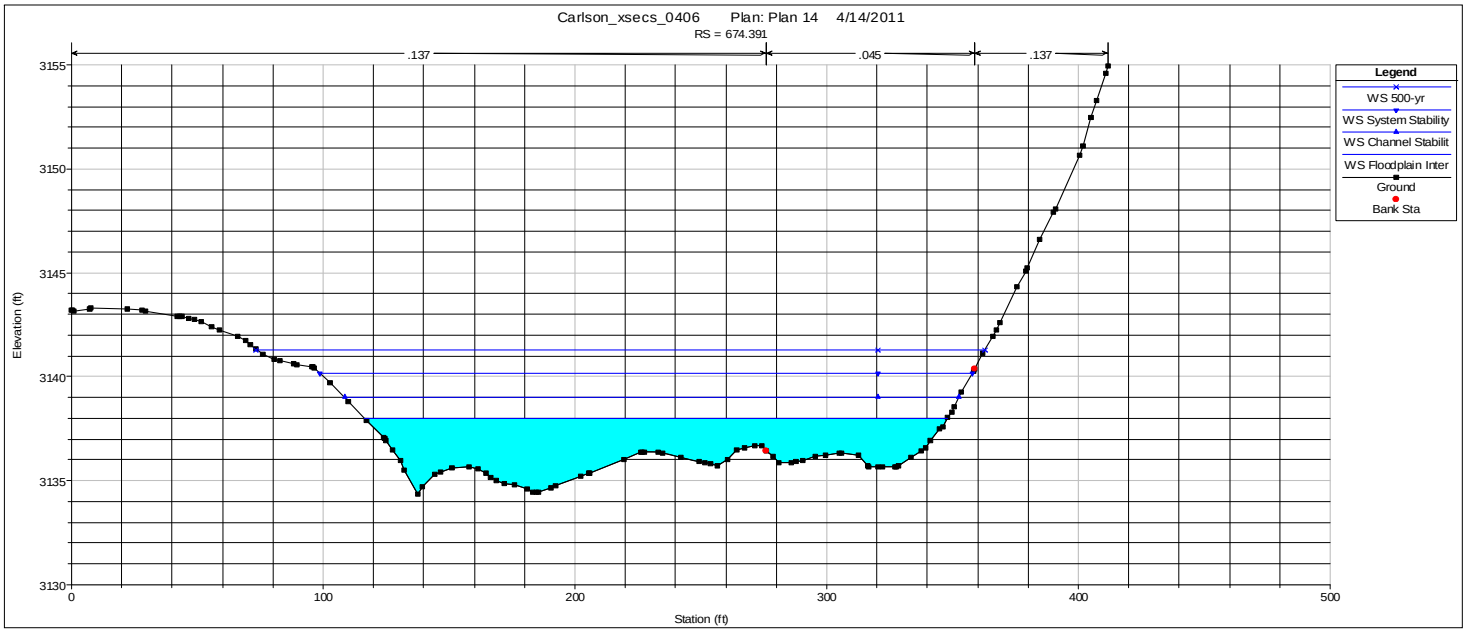
River Station 2009.080



River Station 1604.158 water surface profiles



River Station 674.391



Client: *Intalco* **Sheet:** *5* **of** *5*
Project: *Holden Mine Remedial Design* **Date:** *4/18/2011*
Description: *Floodplain Evaluation of Railroad Creek Existing Conditions* **Job No:** *1008679*
By: *L. Fuhrig* **Chkd By:** *JG*

HEC-RAS Model Inputs

Manning's n, all stations: 0.045 (in channel); 0.137 (outside left and right banks)
Contraction/Expansion coefficients: 0.1/0.3 (0.3/0.5 at the entrances and exits to vehicle bridge and west foot bridge)

Cross-section downstream distances (feet)

River Station	Left Bank	Centerline	Right Bank
8528.874	111.159	114.33	141.54
8410.982	181.491	188.23	185.841
8220.915	152.881	156.74	166.299
8063.689	134.899	135.22	133.412
7928.433	142.225	142.65	144.383
7785.679	142.28	145.59	149.814
7638.405	202.877	157.93	129.05
7467.422	187.617	173.66	168.618
7291.533	136.44	137.58	136.843
7153.05	73.59	71.4	71.154
7081.604	27.709	27.35	32.296
7068	Bridge	Bridge	Bridge
7054.258	27.614	27.3	34.891
7026.962	114.557	116.36	118.013
6910.074	110.095	109.39	116.282
6800.68	105.786	104.07	105.115
6696.611	107.488	114.94	121.797
6581.27	139.617	141.58	141.796
6439.626	49.16	39.41	42.552
6400.216	18.594	21.85	19.903
6389	Bridge	Bridge	Bridge
6378.367	91.363	86.64	90.922
6289.854	131.819	145.48	136.31
6143.592	106.801	118.39	123.468
6025.195	133.842	137.59	134.952
5887.63	84.356	95.35	93.391
5792.278	150.536	136.39	136.325
5655.206	163.328	139	139.462
5516.172	90.227	90.02	89.409
5426.153	118.402	117.93	118.269
5308.223	98.706	97.07	93.682
5211.153	100.612	99.57	92.131
5111.122	110.274	93.86	77.551
5017.246	76.29	79.4	84.296

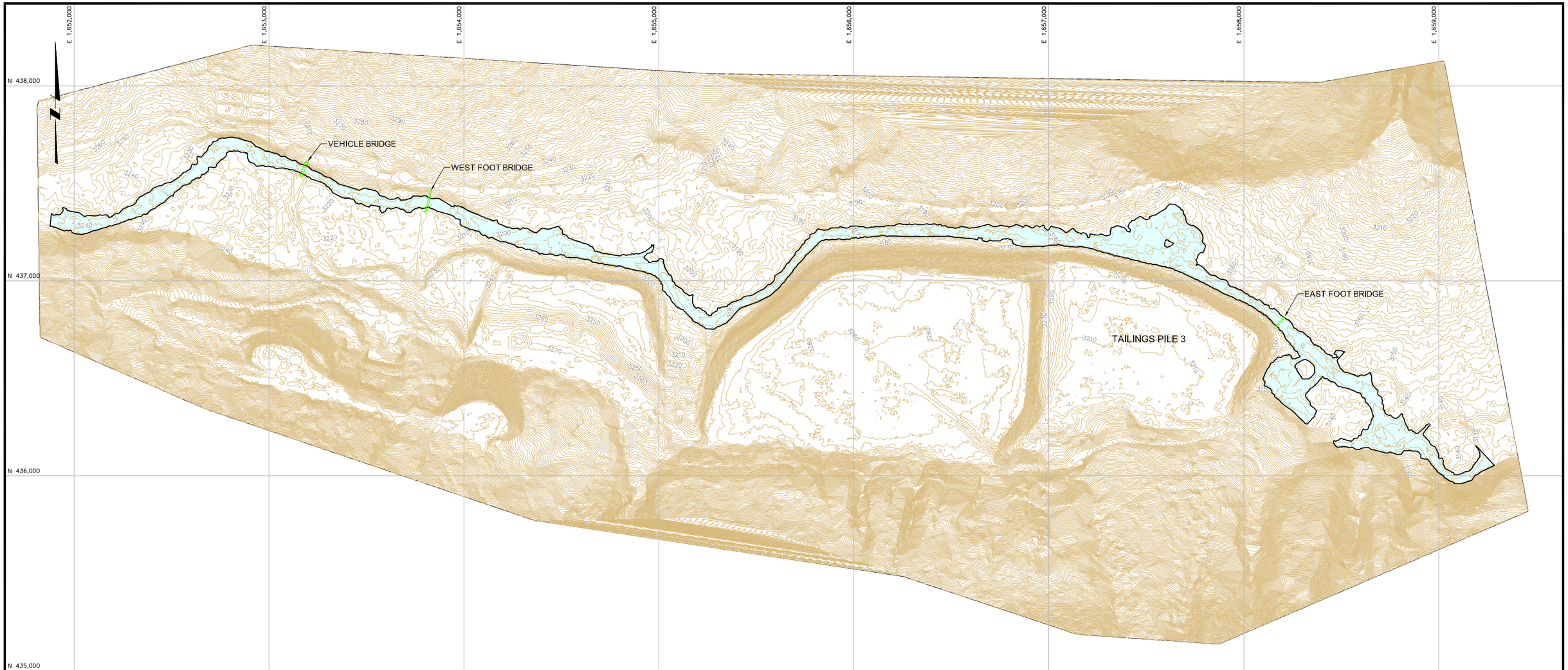
Bank stations (feet)

River Station	Left Bank	Right Bank
8528.874	261.689	334.267
8410.982	313.297	338.581
8220.915	325.013	377.594
8063.689	321.143	372.159
7928.433	269.369	320.649
7785.679	47.975	154.108
7638.405	132.835	203.934
7467.422	0	94.884
7291.533	46.261	93.003
7153.05	53.391	77.308
7081.604	56.391	77.308
7068	Bridge	Bridge
7054.258	48.097	88.968
7026.962	64.629	83.98
6910.074	56.813	87.83
6800.68	66.028	115.598
6696.611	66.997	125.947
6581.27	78.31	142.74
6439.626	51.163	101.392
6400.216	0	136.03
6389	Bridge	Bridge
6378.367	27.491	79.093
6289.854	36.279	113.983
6143.592	89.203	163.965
6025.195	99.598	180.514
5887.63	135.894	207.935
5792.278	137.298	217.268
5655.206	134.194	241.864
5516.172	266.092	294.303
5426.153	333.642	379.128
5308.223	331.866	377.923
5211.153	347.232	398.762
5111.122	223.932	292.576
5017.246	136.063	209.104

Ineffective flow areas (feet)

River Station	Elevation (L)	Elevation (R)
8528.874	3245.91	
7785.679	3231.91	
7153.05		3224.07
6910.074		3220.58
6696.611		3216.82
6581.27		3215.63
6439.626		3213.05
6289.854		3212.26
5655.206	3198.61	
5516.172	3197.08	
5426.153	3197.86	
5308.223	3195.04	
5211.153	3193.82	
4816.974	3188.73	
4369.385	3184.54	
2403.709	3159.04	
2312.005	3157.51	
2206.231	3157.37	
2106.882	3155.96	
1604.158	3152.27	
1407.816		3149.23
1304.798		3149
1202.508		3146.14
1151.69*		3145.715
1100.891	3148.31	3145.29
858.022		3142.13

4937.844	108.686	120.39	142.691	4937.844	117.795	204.859
4816.974	55.705	70.65	79.651	4816.974	117.189	251.097
4742.387	58.452	66.77	77.57	4742.387	173.397	226.142
4672.831	91.19	99.82	93.169	4672.831	612.779	683.123
4570.564	119.473	118.99	120.546	4570.564	591.187	642.552
4451.413	82.021	81.58	83.371	4451.413	583.112	610.161
4369.385	104.363	105.89	108.75	4369.385	538.805	575.048
4262.952	135.367	134.95	134.031	4262.952	447.339	487.275
4128.1	104.902	101.71	95.335	4128.1	311.637	353.218
4025.763	79.585	75.76	67.13	4025.763	64.87	107.021
3949.418	84.798	83	78.102	3949.418	98.043	140.907
3866.42	117.741	116.75	115.701	3866.42	124.352	174.965
3749.145	174.521	173.28	173.181	3749.145	118.326	156.447
3575.595	137.459	137.48	136.828	3575.595	95.736	143.081
3438.071	135.605	134.06	133.769	3438.071	81.065	131.646
3304.007	144.875	146.79	146.603	3304.007	85.135	121.2
3156.954	147.929	145.78	147.694	3156.954	75.785	120.148
3011.133	105.958	104.74	102.662	3011.133	67.343	109.076
2906.362	100.182	98.66	97.623	2906.362	75.002	115.881
2807.683	103.742	103.84	103.987	2807.683	91.763	132.609
2703.843	103.881	99.67	97.559	2703.843	79.209	118.635
2603.907	100.574	101.16	101.868	2603.907	128.347	175.672
2502.748	98.949	99.04	99.875	2502.748	170.631	220.493
2403.709	92.219	91.71	91.596	2403.709	214.102	255.401
2312.005	109.393	105.74	105.268	2312.005	313.183	354.919
2206.231	99.605	99.35	99.408	2206.231	310.425	359.853
2106.882	102.539	97.76	97.731	2106.882	229.987	285.613
2009.08	100.883	100.97	100.755	2009.08	173.441	213.407
1908.108	104.514	101.97	99.57	1908.108	151.998	196.555
1805.983	99.404	99.08	99.382	1805.983	134.198	180.856
1706.906	106.031	102.58	101.575	1706.906	161.501	196.54
1604.158	45.852	45.61	45.664	1604.158	131.386	165.148
1558.549	19.293	19.04	19.963	1558.549	94.582	139.12
1549	Bridge	Bridge	Bridge	1549	Bridge	Bridge
1539.514	38.438	35.25	33.74	1539.514	147.881	196.917
1504.221	97.741	96.4	96.933	1504.221	129.53	197.142
1407.816	101.654	103.01	105.716	1407.816	125.234	203.817
1304.798	102.501	102.29	112.068	1304.798	159.807	210.728
1202.508	49.43	50.79	56.16	1202.508	298.543	389.371
1151.69*	49.43	50.79	56.16	1151.69*	261.8	398.71
1100.891	266.758	215.07	203.151	1100.891	277.534	321.533
858.022	206.562	176.1	202.917	858.022	154.024	270.229
674.391	202.562	195.09	253.923	674.391	276.21	358.89
460.235	74.922	55.38	51.58	460.235	194.55	242.911
402.823	94.926	98.15	99.459	402.823	64.358	102.947
304.452	86.616	96.98	109.438	304.452	64.353	113.62
206.809	75.983	91.97	118.142	206.809	96.591	139.465
107.129	92.305	99.45	112.627	107.129	85.462	134.772
7.412	-	-	-	7.412	96.961	153.957



PLAN

SCALE
250' 0 250' 500'
CONTOUR INTERVAL = 2'

LEGEND:

1900 APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET

2 YEARS FLOOD PLANE AREA

DRAFT 4/16/11

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
A	DRAFT	CHF	LF	04/15/11

DRAWING REFERENCE(S):

DESIGNED BY	L. FUHRIG	04/15/11
DRAWN BY	C. FOWLER	04/15/11
CHECKED BY	L. FUHRIG	04/15/11
APPROVED BY		
PROJECT MANAGER		
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: HOLDEN MINE

TITLE: 2 YEARS FLOOD PLANE PLAN VIEW

MWH

FIGURE: 1

REVISION: A

FILE NAME: 1008679D397

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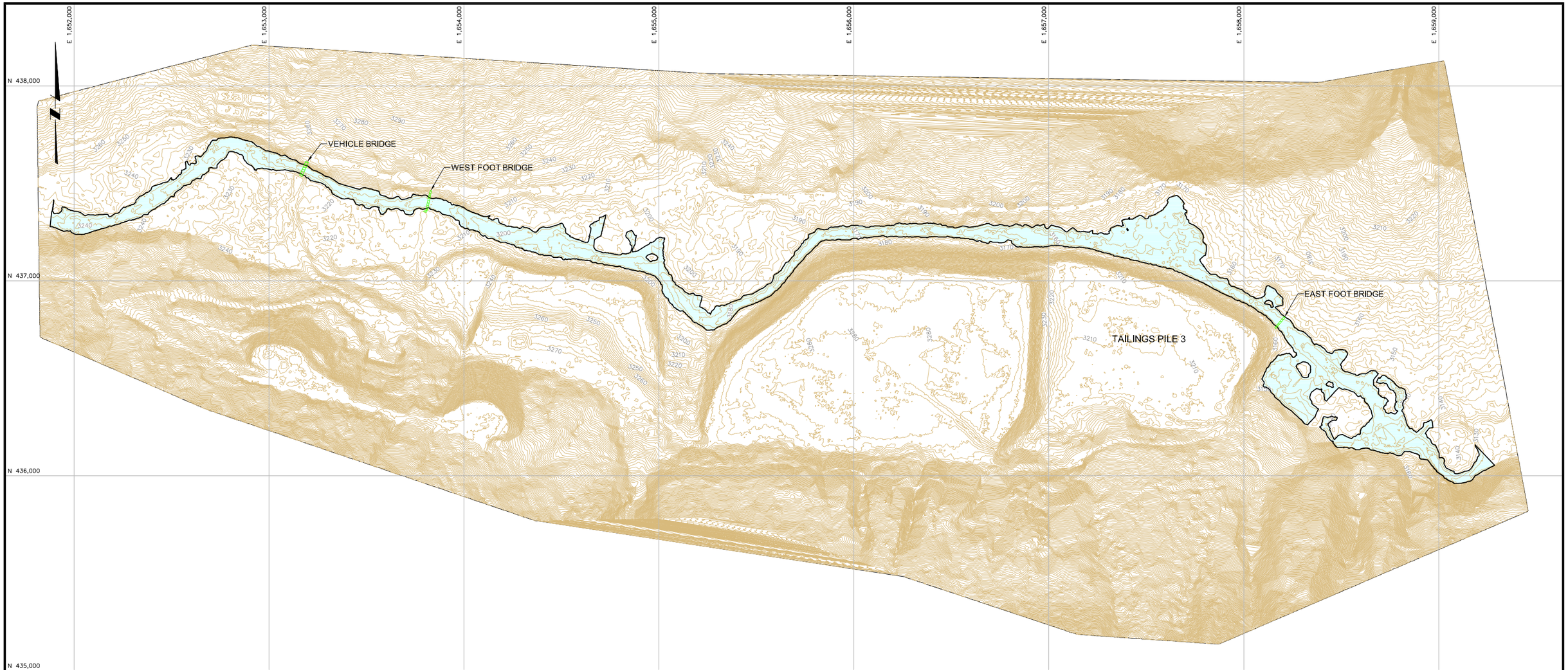

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LEGEND:

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10 YEARS FLOOD PLANE AREA

DRAFT 4/16/11

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
A	DRAFT	CHF	LF	04/15/11

DRAWING REFERENCE(S):

DESIGNED BY	L. FUHRIG	04/15/11
DRAWN BY	C. FOWLER	04/15/11
CHECKED BY	L. FUHRIG	04/15/11
APPROVED BY		
PROJECT MANAGER		
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: HOLDEN MINE

TITLE: 10 YEARS FLOOD PLANE PLAN VIEW

MWH

FIGURE: 2

REVISION: A

FILE NAME: 1008679D397

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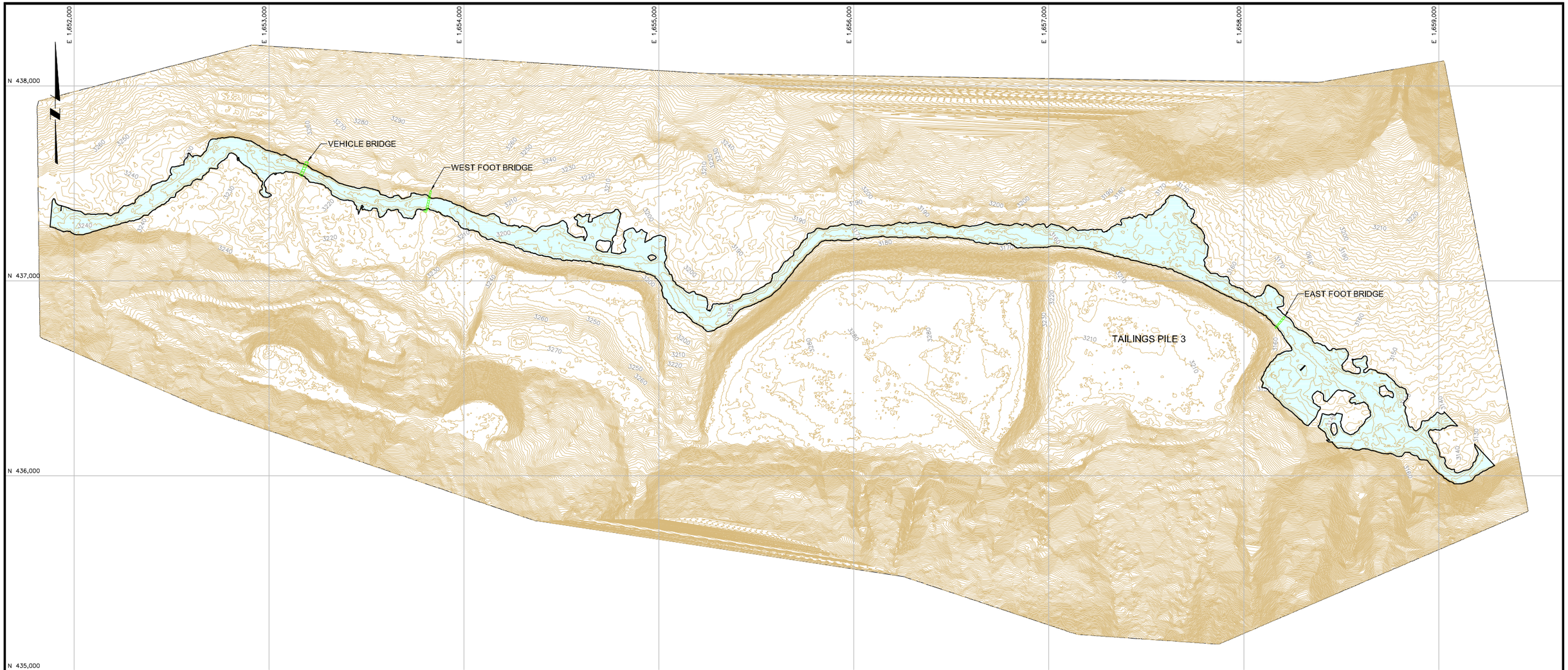

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SCALE
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LEGEND:

1900 — APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET

100 YEARS FLOOD PLANE AREA

DRAFT 4/16/11

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
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PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: HOLDEN MINE

TITLE: 100 YEARS FLOOD PLANE PLAN VIEW

MWH

FIGURE: 3

REVISION: A

FILE NAME: 1008679D397

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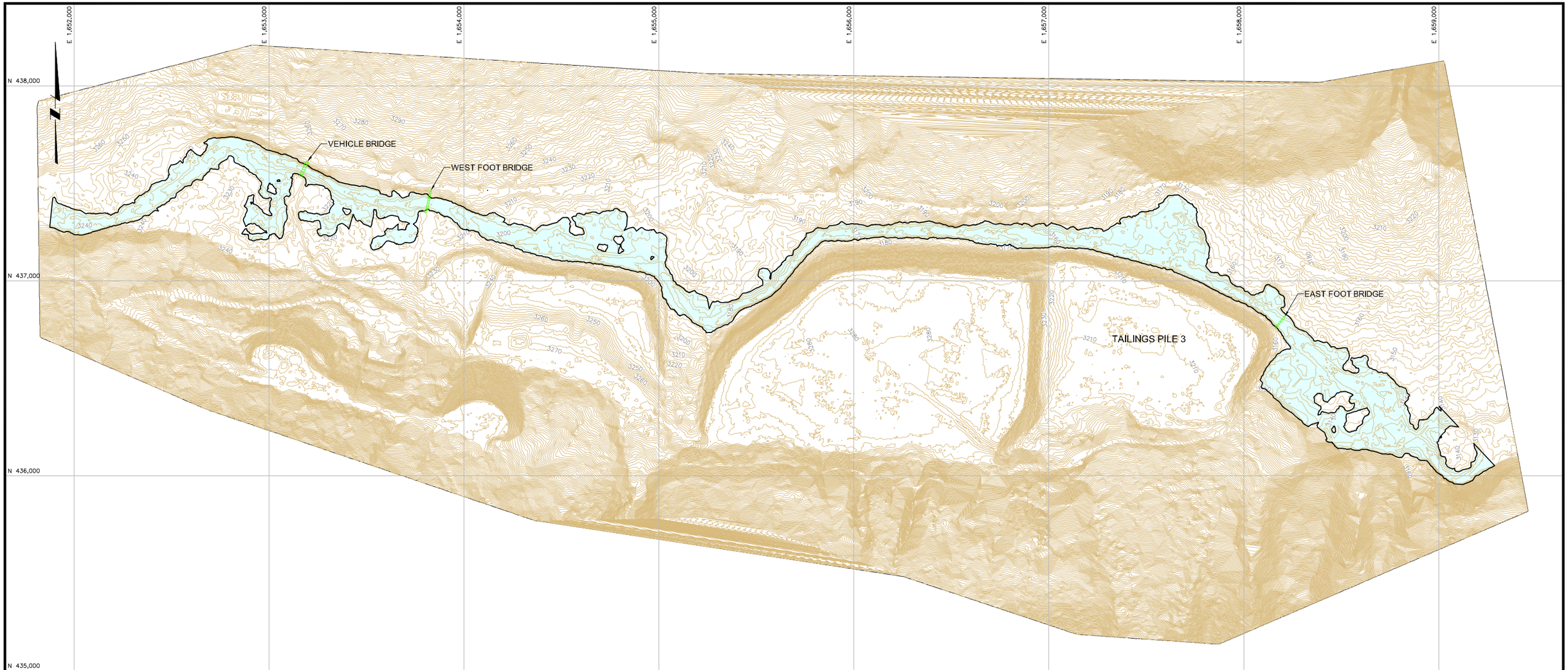

PLAN

SCALE
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CONTOUR INTERVAL = 2'

LEGEND:

1900 — APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET

500 YEARS FLOOD PLANE AREA

DRAFT 4/16/11

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PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: HOLDEN MINE

TITLE: 500 YEARS FLOOD PLANE PLAN VIEW

MWH

FIGURE: 4

REVISION: A

FILE NAME: 1008679D397

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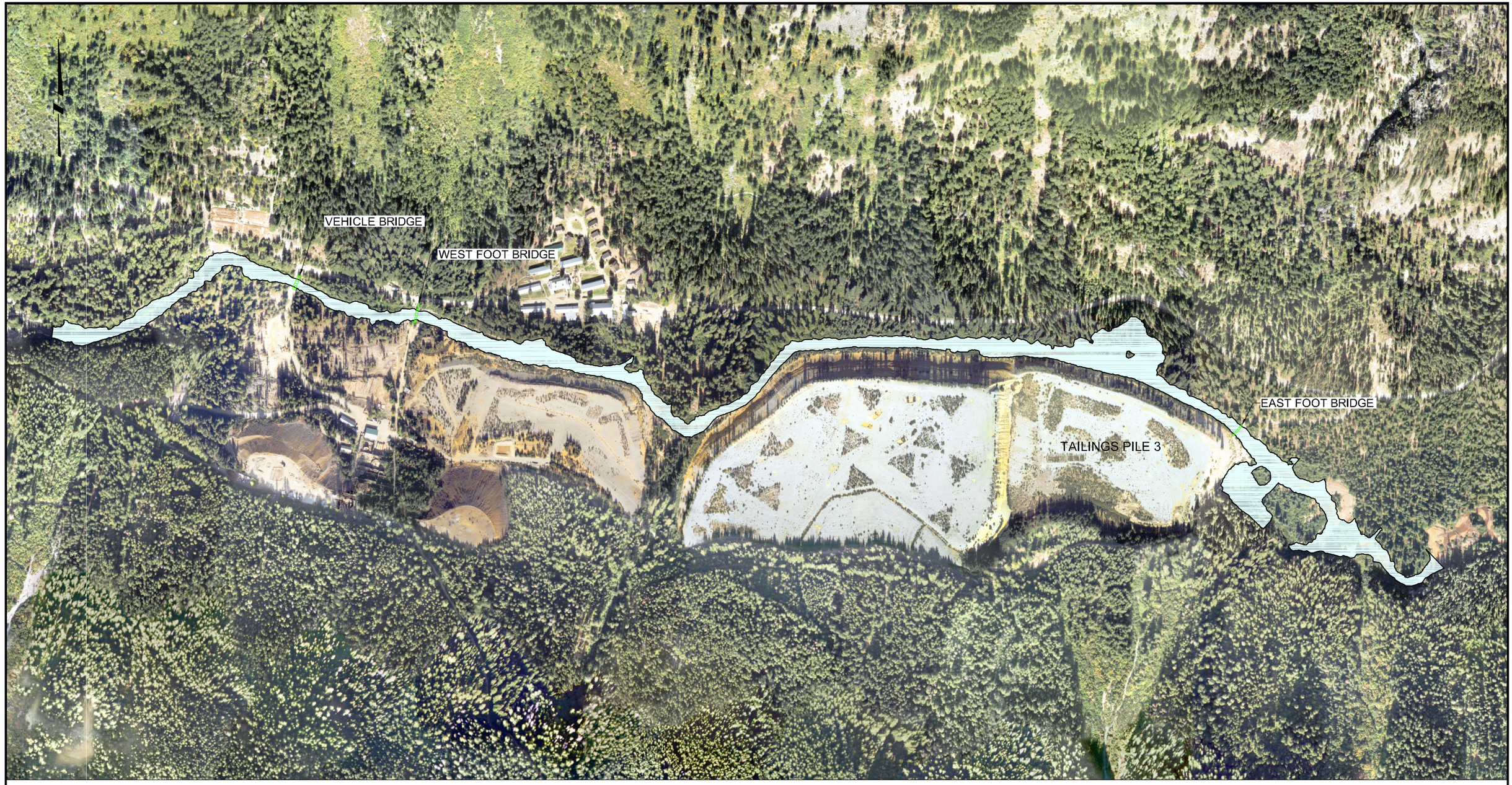

PLAN

SCALE

250' 0 250' 500'

LEGEND:

2 YEARS FLOOD PLANE AREA

DRAFT 4/16/11

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
A	DRAFT	CHF	LF	04/16/11

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PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: HOLDEN MINE

TITLE: 2 YEARS FLOOD PLANE PLAN VIEW

MWH

FIGURE: 5

REVISION: A

FILE NAME: 1008679D357

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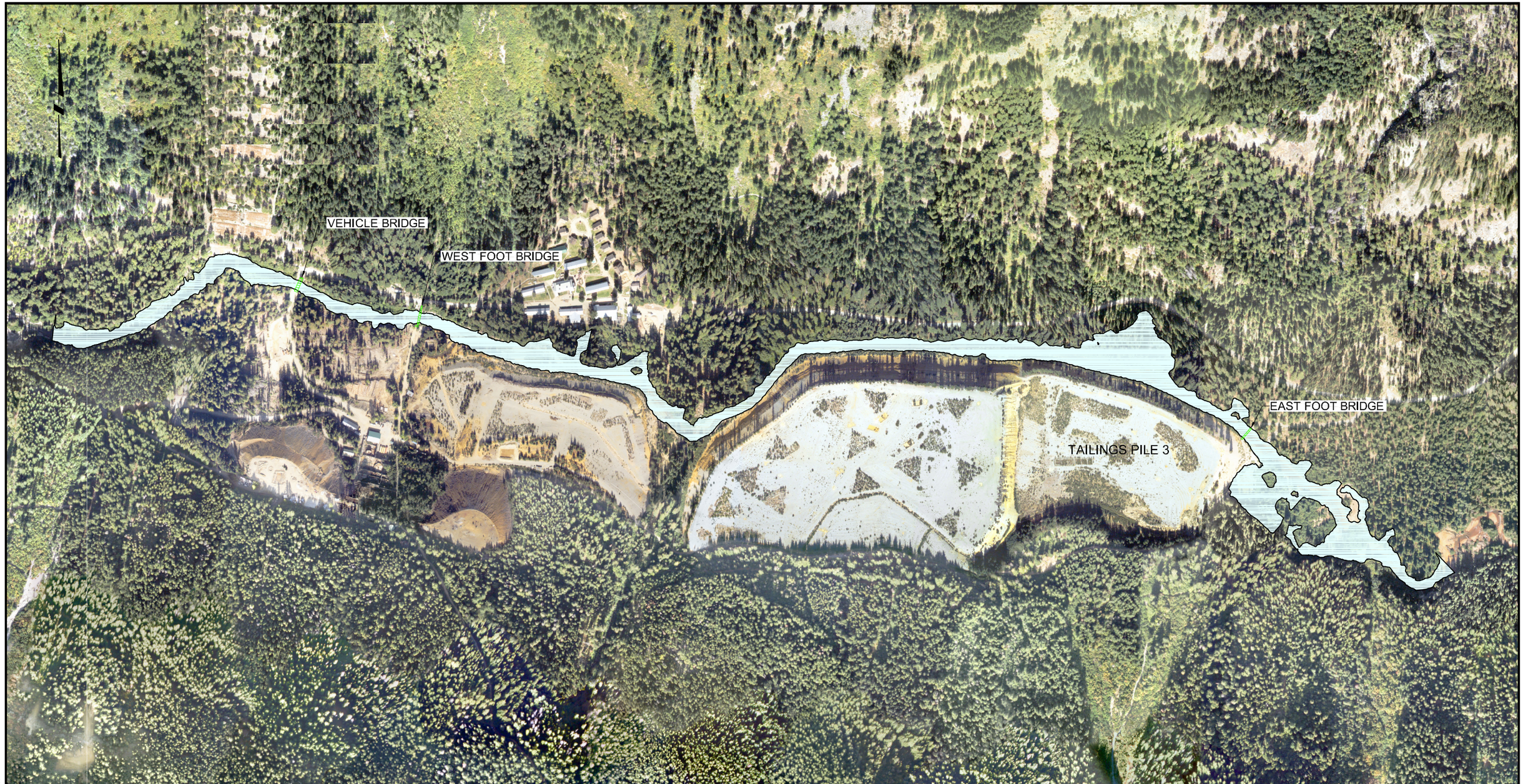

PLAN

SCALE

250' 0 250' 500'

LEGEND:

10 YEARS FLOOD PLANE AREA

DRAFT 4/16/11

REV	DESCRIPTION	TECH	ENG	DATE
A	DRAFT	CHF	LF	04/16/11

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PROJECT MANAGER		
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CLIENT REFERENCE NO.		

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PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: HOLDEN MINE

TITLE: 10 YEARS FLOOD PLANE PLAN VIEW

MWH

FIGURE: 6

REVISION: A

FILE NAME: 1008679D357

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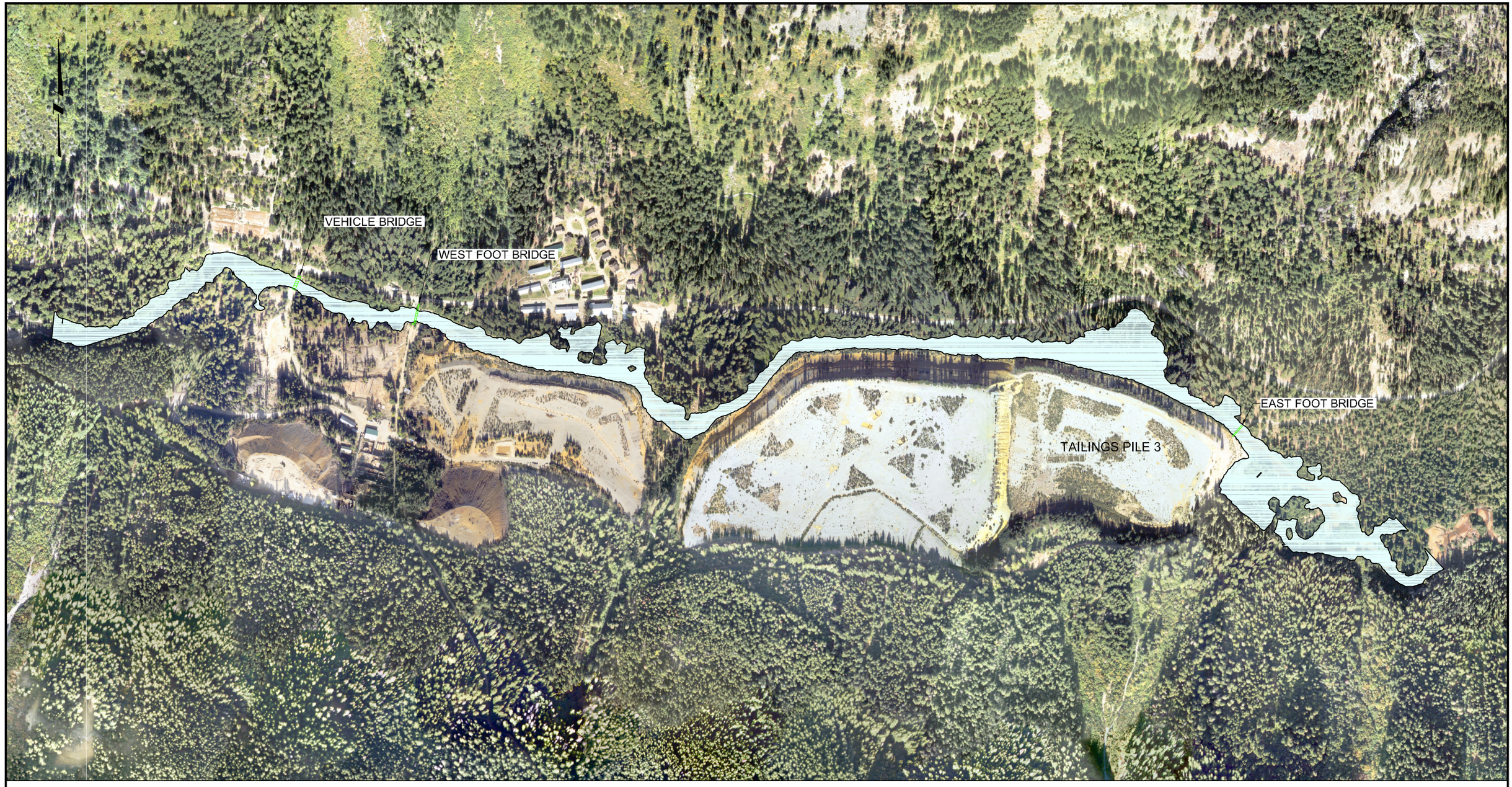

PLAN

SCALE

250' 0 250' 500'

LEGEND:

100 YEARS FLOOD PLANE AREA

DRAFT 4/16/11

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CLIENT REFERENCE NO.		

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PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: HOLDEN MINE

TITLE: 100 YEARS FLOOD PLANE PLAN VIEW

MWH

FIGURE: 7

REVISION: A

FILE NAME: 1008679D357

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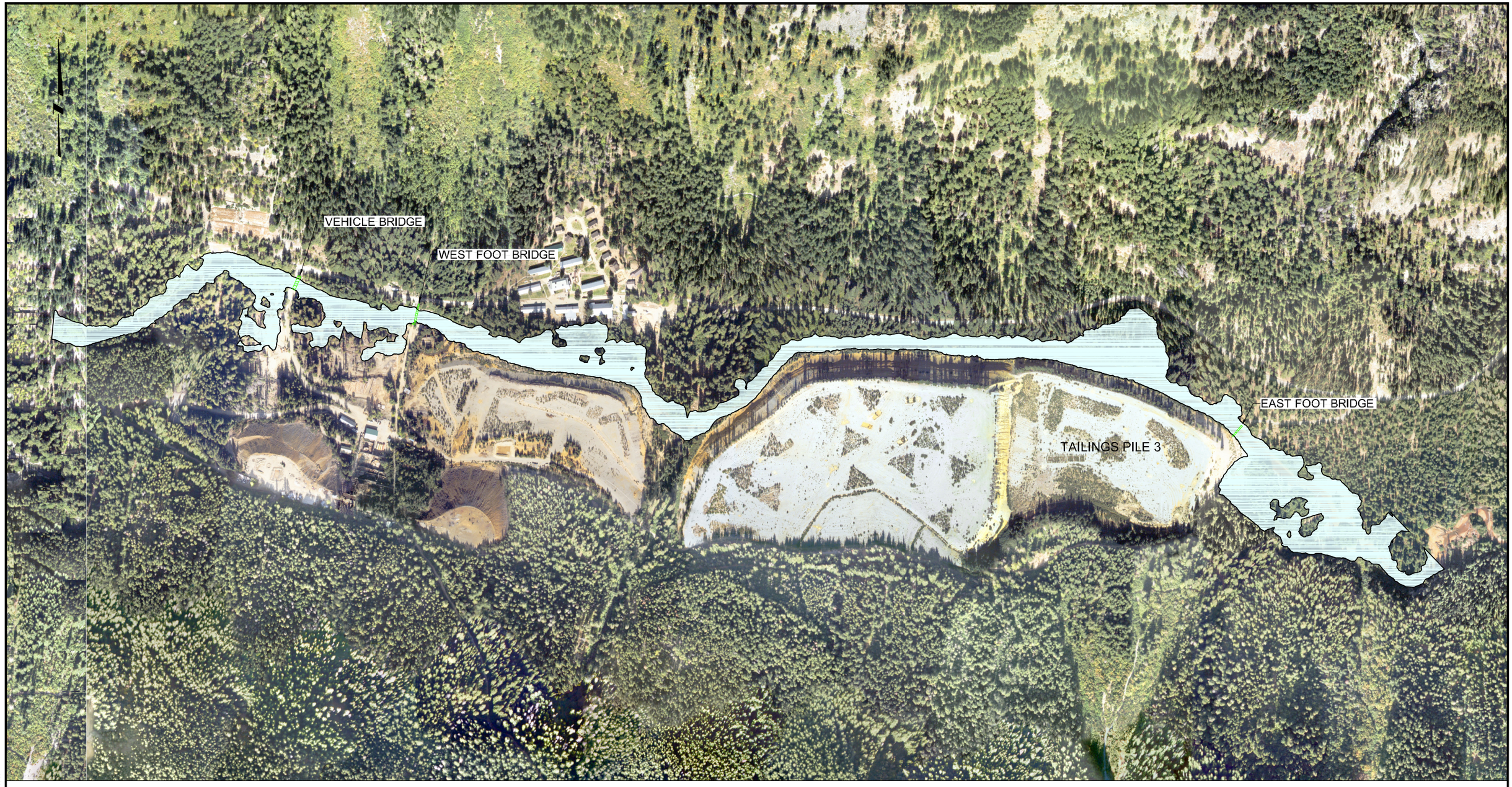

PLAN

SCALE

250' 0 250' 500'

LEGEND:

500 YEARS FLOOD PLANE AREA

DRAFT 4/16/11

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
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CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: HOLDEN MINE

TITLE: 500 YEARS FLOOD PLANE PLAN VIEW

MWH

FIGURE: 8

REVISION: A

FILE NAME: 1008679D357

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HOLDEN BYPASS ROAD BRIDGE
HEC-RAS EVALUATION

Client:	*Rio-Tinto*		**Sheet:** *1*	**of**	*9*
Project:	*Holden Mine*		**Date:**	*04/17/2011*	
Description:	*HEC-RAS Evaluation for New Holden Bypass Road Bridge to be Located East of Tailing Pile 3*		**Job No:**	*1008579*	
		By: *P. Pellicer*	**Chkd By:**	*P. Crouse*	

HOLDEN BYPASS ROAD BRIDGE
HEC-RAS EVALUATION

Revisioning					
Rev.	**Date**	**Description**	**By**	**Checked**	**Date**
A		*First Issue*	*P. Pellicer*	*P. Crouse*	*4/18/11*

Location and Format

Electronic copies of these calculations are located in the project files system at:

(put location of calculations in the electronic filing system here)

The following calculations were generated using the following software:

USACE Hydrologic Engineering Center River Analysis Center (HEC-RAS v4.1)
Autodesk AutoCAD Civil 3D 2011

=Objective

Evaluate the impact of the new Holden Bypass Road bridge abutments on the flow of Railroad Creek. Utilizing both 2yr and 100yr peak flow rates, evaluate:

- *The amount of clearance (freeboard) between the predicted water surface and the lowest structural member of the bridge superstructure.*
- *Changes to the flood plain as compared to existing conditions*

Design Basis

(HEC-RAS was used to develop a model of Railroad Creek where the proposed Holden Bypass Road bridge will be constructed. Utilizing input from the engineer or hydrologist, the program analyses pre-determined flows from Railroad Creek and the affect of the proposed bridge and abutments. The analysis determines the water surface level (among many other results) during any storm event at the location of the proposed bridge and both upstream and downstream of the bridge at pre-determined stations. Chapter 5 of the HEC-RAS Hydraulic Reference Manual (Modeling Bridges) describes the suggested procedures to be used during modeling of all types of bridges using the program. Therefore, all input variables and hydraulic equations reflect those recommended by USACE. Conditions of the proposed bridge, road, and surrounding existing ground were also used in the analysis to simulate actual build-out conditions.

Client:	*Rio-Tinto*	**Sheet:** *2*	**of** *9*
Project:	*Holden Mine*	**Date:**	*04/17/2011*
Description:	*HEC-RAS Evaluation for New Holden Bypass Road Bridge to be Located East of Tailing Pile 3*	**Job No:**	*1008579*
		By: *P. Pellicer*	**Chkd By:** *P. Crouse*

Background / System Description / Givens

The Holden bypass road has been designed to provide access for heavy construction equipment from the existing forest service road 8301 onto the top of the tailing piles, (TP-1, TP-2, and TP-3). The bypass road alignment starts East of Holden Village heading South across Railroad creek until it reaches the South side of the valley.

The bridge superstructure to cross Railroad Creek will be founded on earth fill abutments, which have been designed to accommodate a pre-engineered single lane bridge. The bridge superstructure will have an out to out length of 100' and an out to out width of 16 feet (which provides a 14 foot wide trafficable lane). A Plan view and Section of the abutments is presented in ***Attachment A****.*

Based on guidelines provided by the USDA Forest Service (Ref 5) bridge abutments must be designed to be built outside the "bank full width" of the stream, and provide passage of the 100 year storm flow plus 5 feet of freeboard to accommodate debris flow. For the purpose of bridge abutment layout the "bank full width" is considered to be tied to the flow of a 2 year event.

*Peak stream flows associated with the 2 year and 100 year events were previously estimated by MWH and are presented in design memorandum titled "****Mine Railroad Creek Hydrologic Conceptual Model for Remedial Design"*** *(Ref. 4)****.*** *Peak stream flows utilized to evaluate the bridge abutments are summarized in Table 1.*

Table 1. Railroad Creek Design Flows For Bridge abutment Evaluation

Return Interval	Flow (cfs)
2-yr	933
100-yr	2,123

Assumptions

The following assumptions were utilized for HEC-RAS modeling of the Holden Bypass Road Abutments:

- *Bridge section contraction and expansion coefficients were developed using tables within the HEC-RAS Hydraulic Reference Manual (Ref 2)*
- *Manning's n (roughness coefficient) values were determined in accordance with the HEC-RAS User's Manual, which references "Engineering Analysis of Fluvial Streams" by Simons, Li, and Associate (Ref 1).*
- *Steady flow conditions used*
- *Subcritical flow computations were used and checked against the Freud Number, which was less than 1.0, confirming assumptions of subcritical flow*
- *The energy equation (standard step method) was used to solve for the water surface profile because it treats a bridge in the same manner as a natural river cross-section, and design limits require no submergence*

Client:	*Rio-Tinto*	**Sheet:** *3* **of** *9*	
Project:	*Holden Mine*	**Date:**	*04/17/2011*
Description:	*HEC-RAS Evaluation for New Holden Bypass Road Bridge to be Located East of Tailing Pile 3*	**Job No:**	*1008579*
		By: *P. Pellicer*	**Chkd By:** *P. Crouse*

Methodology

Evaluation of the bridge abutments on the flow within Railroad creek was performed in general accordance with Army Corps of Engineering guidance documents for the modeling of bridges with the HEC-RAS model (Ref.1)

Utilizing the HEC-RAS model generated by MWH to evaluate existing conditions and flood plains (Ref 4). The following method outlined below was utilized to model the effect of the bridge abutments on storm flows within Railroad Creek.

- *Proposed bridge geometry was inserted into the model, in general accordance with guidelines shown in Figure 5.1, provided in **Attachment C.** Calculation outlining the application of the guidelines to this model are presented in **Attachment B**.*
- *Channel geometry was cut from the existing ground surface (LIDAR) using AutoCAD Civil 3D and inserted into the HEC-RAS model*
- *Bridge contraction and expansion coefficients were developed using the HEC-RAS Hydraulic Reference Manual tables and figures, then applied to the two upstream sections, and the downstream section closest to the bridge*
- *Mannings n values were chosen from tables within the HEC-RAS User's Manual*
- *Ineffective flow areas (where flow is not parallel to the channel and debris collects) were placed in the two sections upstream and downstream of the bridge abutments*
- *The model was run using the energy equation for water surface calculations, during which subcritical flows and Freud numbers were determined to be less than 1.0 within the bridge cross sections, which indicated subcritical flow was an appropriate assumption*
- *Sections and a profile displaying the water surfaces at 2- and 100-year storm events were displayed and printed for visual verification of the minimum 5' of freeboard between the water surface and lowest structural member of the bridge*
- *Utilizing the 100-year water surface generated by the HEC-RAS model with the bridge abutments in place, a graphical plot of the flood pain was overlaid onto the e100-year existing conditions flood plain, and visually checked for variations.*

Results

*Based on the assumption and methodology utilized the results of the HEC-RAS model are presented in **Attachment D**. The results indicate the maximum water surface elevation associated with the 100-year storm flow is 3146 feet, at the upstream edge of the proposed bridge.*

*The overlay of the 100-year flood plain associated with existing conditions, and the 100-year flood plain associated with post bridge construction conditions is presented in **Attachment E**. Only minor variation were noted upstream of the proposed bridge alignment.*

Client:	*Rio-Tinto*		**Sheet:** *4*	**of**	*9*
Project:	*Holden Mine*		**Date:**	*04/17/2011*	
Description:	*HEC-RAS Evaluation for New Holden Bypass Road Bridge to be Located East of Tailing Pile 3*		**Job No:**	*1008579*	
		By: *P. Pellicer*	**Chkd By:**	*P. Crouse*	

Conclusions

Based on the HEC-RAS evaluation of the new Holden Bypass Road bridge abutments, the estimated flow associated with the 100 year flow can pass beneath the bridge super structure (lowest Structural Member at elevation 3151.5 feet) with a minimum of 5 feet of freeboard. Graphical representation of the

The flood plain upstream of the bridge shows minor variations as compared to existing conditions. The variations appear to have no impact on existing Holden Village facilities and Operations.

Attachments

***Attachment A** – Bridge Abutment Plan view and Cross Sections*

***Attachment B** – HEC-RAS Bridge Model Cross-Section Set-up Calculation*

***Attachment C** – Design Tables, Figures, and Charts*
***Attachment D** – HEC-RAS Water Surface Sections and Profile*
***Attachment E** – 100 Year Flood Plain Comparison*

References

1. *HEC-RAS River Analysis System User's Manual, v4.1. US Army Corps of Engineers. January 2010.*
2. *HEC-RAS River Analysis System Hydraulic Reference Manual, v4.1. US Army Corps of Engineers. January 2010.*
3. *HEC-RAS v4.1. US Army Corps of Engineers. January 2010.*
4. *MWH, Holden Mine Railroad Creek Hydrologic Conceptual Model for Remedial Design, April, 2011*
5. *USDA Forest Service – Pacific Northwest Region (R-6) Transportation Structures Group, Guidelines for Bridge Design, 2005*

Client:	*Rio-Tinto*			*9*
Project:	*Holden Mine*		**Date:**	*04/17/2011*
Description:	*HEC-RAS Evaluation for New Holden Bypass Road Bridge to be Located East of Tailing Pile 3*		**Job No:**	*1008579*
		By:	*P. Pellicer*	**Chkd By:**

Attachment A – Bridge Abutment Plan view and Cross Sections

FORMER WINSTON HOME SITES
USFS GUARD STATION
HOLDEN VILLAGE
EXISTING BRIDGE
LAGOON AREA
LOWER WEST AREA
SHEET 10-4-6
HOLDEN VILLAGE HYDROELECTRIC PLANT
TAILINGS PILE 1
SEDIMENT POND TO REMAIN
WEST WASTE ROCK PILE
EAST WASTE ROCK PILE
SHEET 10-4-5
INVENTORIED ROADLESS AREA BOUNDARY
RAILROAD CREEK
TAILINGS PILE 2
TAILINGS PILE 3
EXISTING ACCESS ROAD
FS ROAD 8301
TENMILE CREEK
TO LUCERNE 9.5 MILES
SHEET 10-4-2
SHEET 10-4-4
SHEET 10-4-3
EXISTING ROAD
COPPER CREEK
HOLDEN VILLAGE BY-PASS ROAD
N 438000
N 437000
N 436000
E 1654000
E 1655000
E 1656000
E 1657000
E 1658000
E 1659000
69+41
65+00
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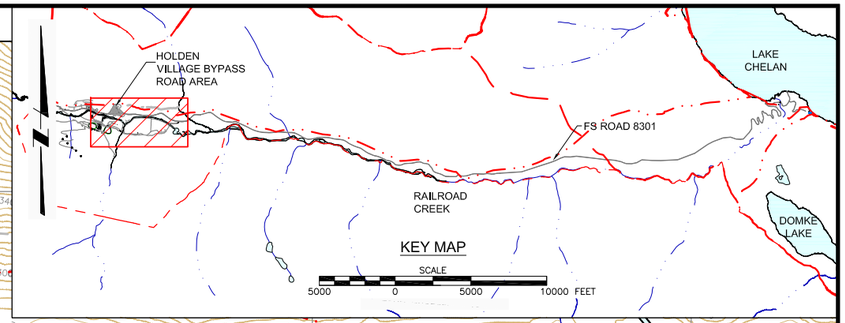
KEY MAP



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PLAN

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REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):
- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.
- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA–FSA–APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BYPASS ROAD KEY MAP

MWH

SHEET: 10-4-1
REVISION: B
FILE NAME: 1008679D238

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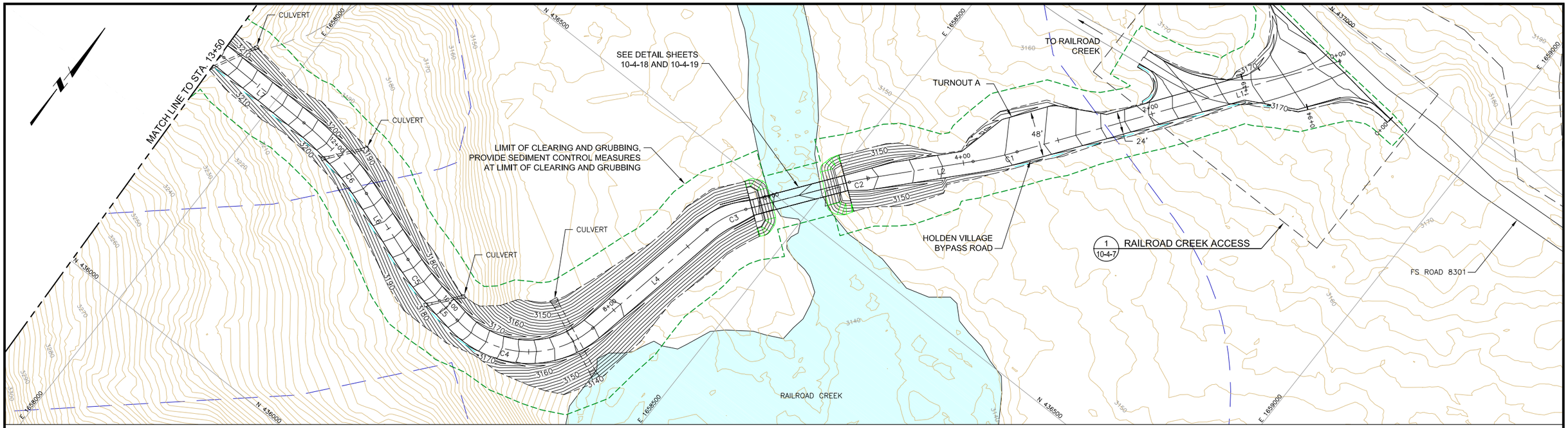

PLAN

SCALE

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LEGEND:

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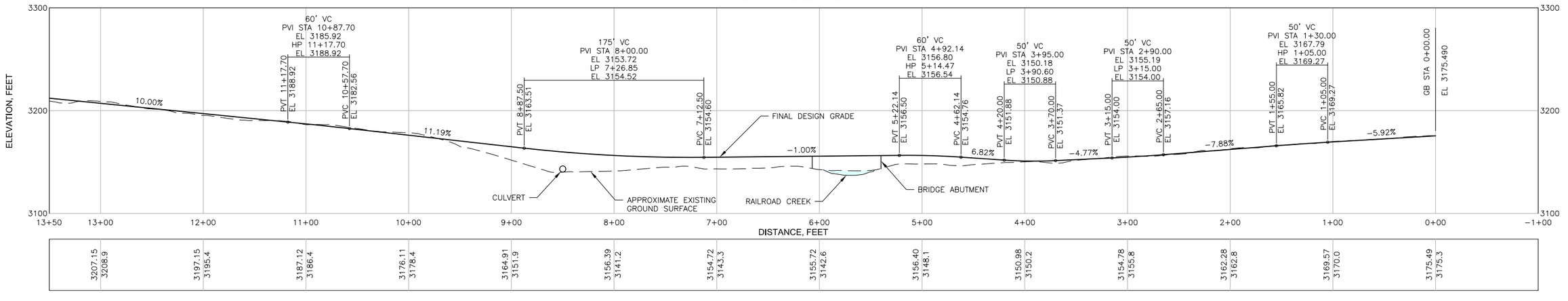
C47 SEE SHEET 10-4-8 FOR LINE AND CURVE TABLES



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3208.9	3195.4	3186.4	3178.4	3151.9
3156.39	3154.72	3155.72	3156.40	3150.98
3141.2	3143.3	3142.6	3148.1	3150.2
3154.78	3162.28	3169.57	3175.49	
3155.8	3162.8	3170.0	3175.3	

PROFILE

SCALE

50 0 50 100 FEET

NOTE:

1. LIMITS OF CLEARING AND GRUBBING BASED ON DESIGN CUT/FILL DAYLIGHT LIMITS PLUS 20 FEET HORIZONTALLY.

ISSUE / REV				
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.
- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA–FSA–APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: BYPASS ROAD STA 0+00 TO STA 13+50 PLAN AND PROFILE

MWH

SHEET: 10-4-2 REVISION: B

FILE NAME: 1008679D264

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Client:	*Rio-Tinto*			*9*
Project:	*Holden Mine*		**Date:**	*04/17/2011*
Description:	*HEC-RAS Evaluation for New Holden Bypass Road Bridge to be Located East of Tailing Pile 3*		**Job No:**	*1008579*
		By:	*P. Pellicer*	**Chkd By:**

Attachment B – HEC-RAS Bridge Model Cross-Section Set-up Calculation

MWH

By J GREGORY Date 4/14/11 Client Sheet 1 of 1

Chkd. By G CLARK Description HOLDEN BRIDGE FLOW CALCS (HEC-RAS) Job No. 1008679

EXPANSION RATIO:

$S_{RRCR} = \frac{4'}{329'} = 1.2\%$ OR 63 ft/mile

∴ USE 10'/mile (STEEPEST SLOPE AVAILABLE IN PROCEDURE)

$\frac{b}{B} = \frac{60'}{92'}$

$= .65$

∴ USE .5

$\frac{nob}{nc} = \frac{.137}{.045} = 3$

∴ USE 2 High

ER = 1.5

$Le = \left(\frac{90+90}{2}\right)1.5 = 135'$

$Lc = 1\left(\frac{90+90}{2}\right) = 90'$

$Le = \left(\frac{\overline{AB} + \overline{CD}}{2}\right)1.5$

$Lc = \frac{Le}{1.5}$

Table 5-1

Ranges of Expansion Ratios

		nob / nc = 1	nob / nc = 2	nob / nc = 4
b/B = 0.10	S = 1 ft/mile	1.4 – 3.6	1.3 – 3.0	1.2 – 2.1
	5 ft/mile	1.0 – 2.5	0.8 – 2.0	0.8 – 2.0
	10 ft/mile	1.0 – 2.2	0.8 – 2.0	0.8 – 2.0
b/B = 0.25	S = 1 ft/mile	1.6 – 3.0	1.4 – 2.5	1.2 – 2.0
	5 ft/mile	1.5 – 2.5	1.3 – 2.0	1.3 – 2.0
	10 ft/mile	1.5 – 2.0	1.3 – 2.0	1.3 – 2.0
b/B = 0.50	S = 1 ft/mile	1.4 – 2.6	1.3 – 1.9	1.2 – 1.4
	5 ft/mile	1.3 – 2.1	1.2 – 1.6	1.0 – 1.4
	10 ft/mile	1.3 – 2.0	1.2 – 1.5	1.0 – 1.4

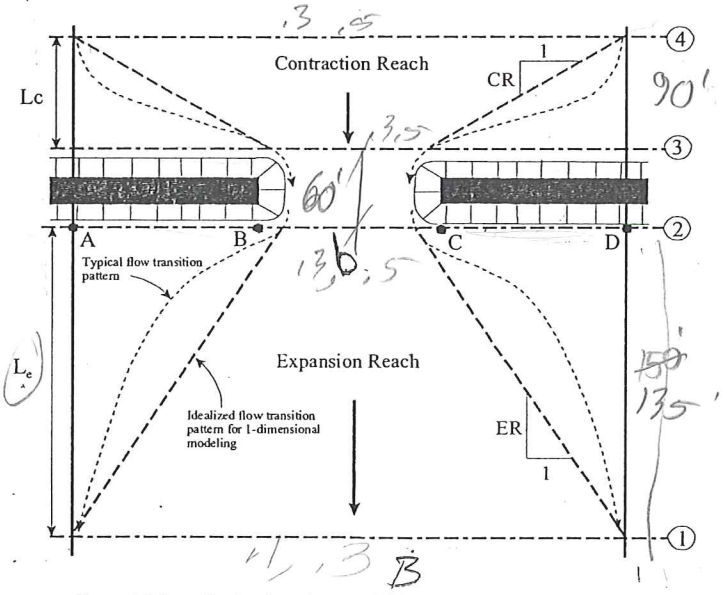


Figure 5-1 Cross Section Locations at a Bridge

A detailed study of flow contraction and expansion zones has been completed by the Hydrologic Engineering Center entitled "Flow Transitions in Bridge Backwater Analysis" (RD-42, HEC, 1995). The purpose of this study was to provide better guidance to hydraulic engineers performing water surface profile computations through bridges. Specifically the study focused on determining the expansion

Client:	*Rio-Tinto*			*9*
Project:	*Holden Mine*		**Date:**	*04/17/2011*
Description:	*HEC-RAS Evaluation for New Holden Bypass Road Bridge to be Located East of Tailing Pile 3*		**Job No:**	*1008579*
		By:	*P. Pellicer*	**Chkd By:**

Attachment C – Design Tables, Figures, and Charts

Table 5-1

Ranges of Expansion Ratios

		nob / nc = 1	nob / nc = 2	nob / nc = 4
b/B = 0.10	S = 1 ft/mile	1.4 – 3.6	1.3 – 3.0	1.2 – 2.1
	5 ft/mile	1.0 – 2.5	0.8 – 2.0	0.8 – 2.0
	10 ft/mile	1.0 – 2.2	0.8 – 2.0	0.8 – 2.0
b/B = 0.25	S = 1 ft/mile	1.6 – 3.0	1.4 – 2.5	1.2 – 2.0
	5 ft/mile	1.5 – 2.5	1.3 – 2.0	1.3 – 2.0
	10 ft/mile	1.5 – 2.0	1.3 – 2.0	1.3 – 2.0
b/B = 0.50	S = 1 ft/mile	1.4 – 2.6	1.3 – 1.9	1.2 – 1.4
	5 ft/mile	1.3 – 2.1	1.2 – 1.6	1.0 – 1.4
	10 ft/mile	1.3 – 2.0	1.2 – 1.5	1.0 – 1.4

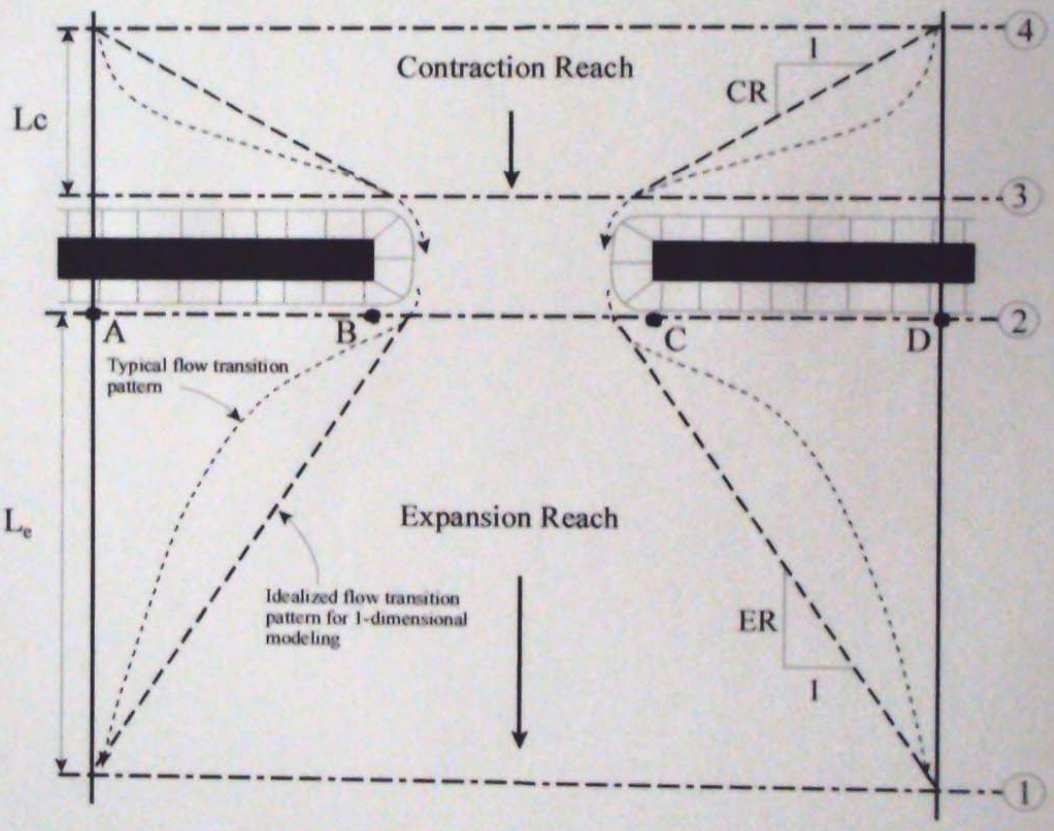
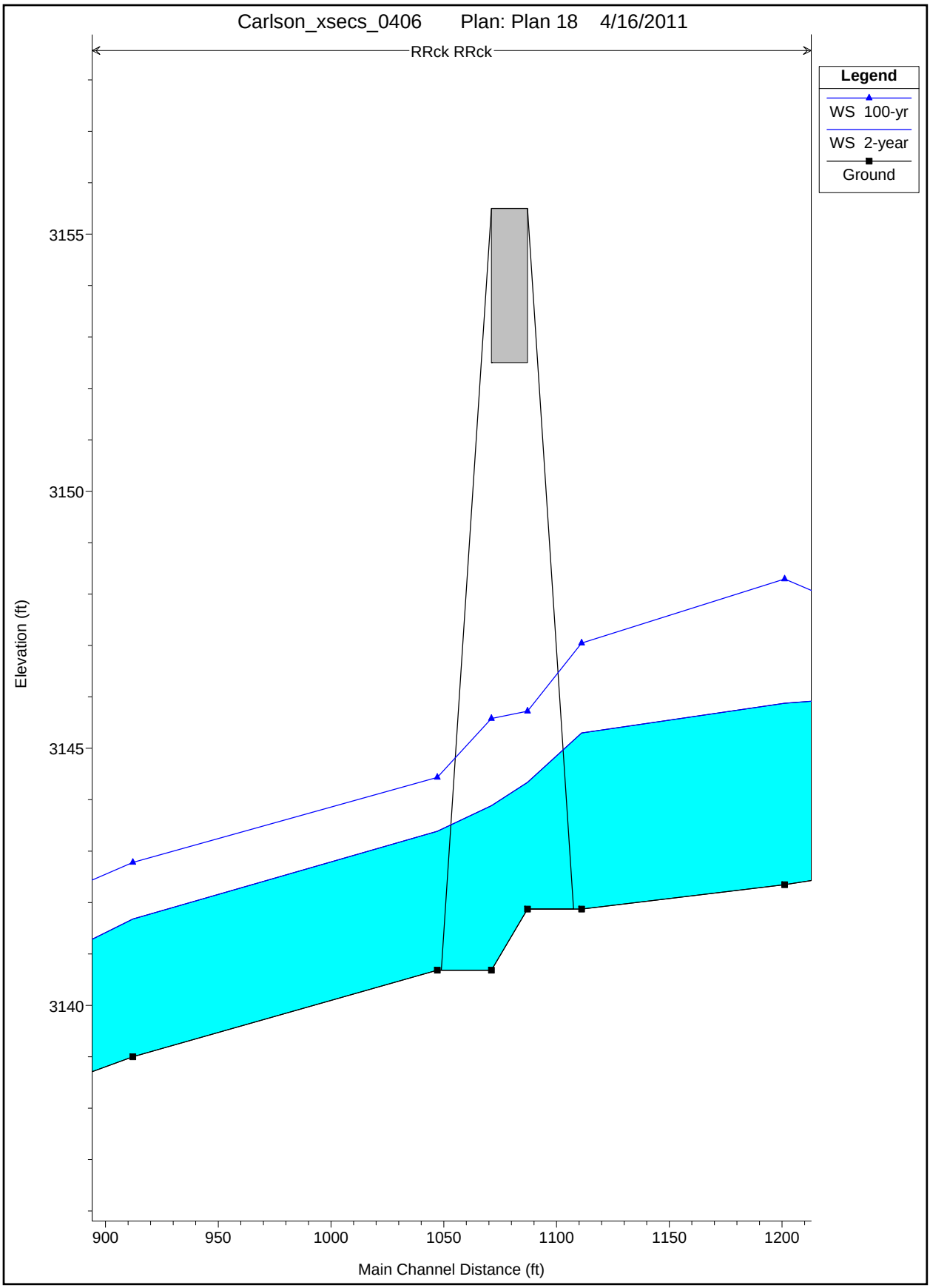


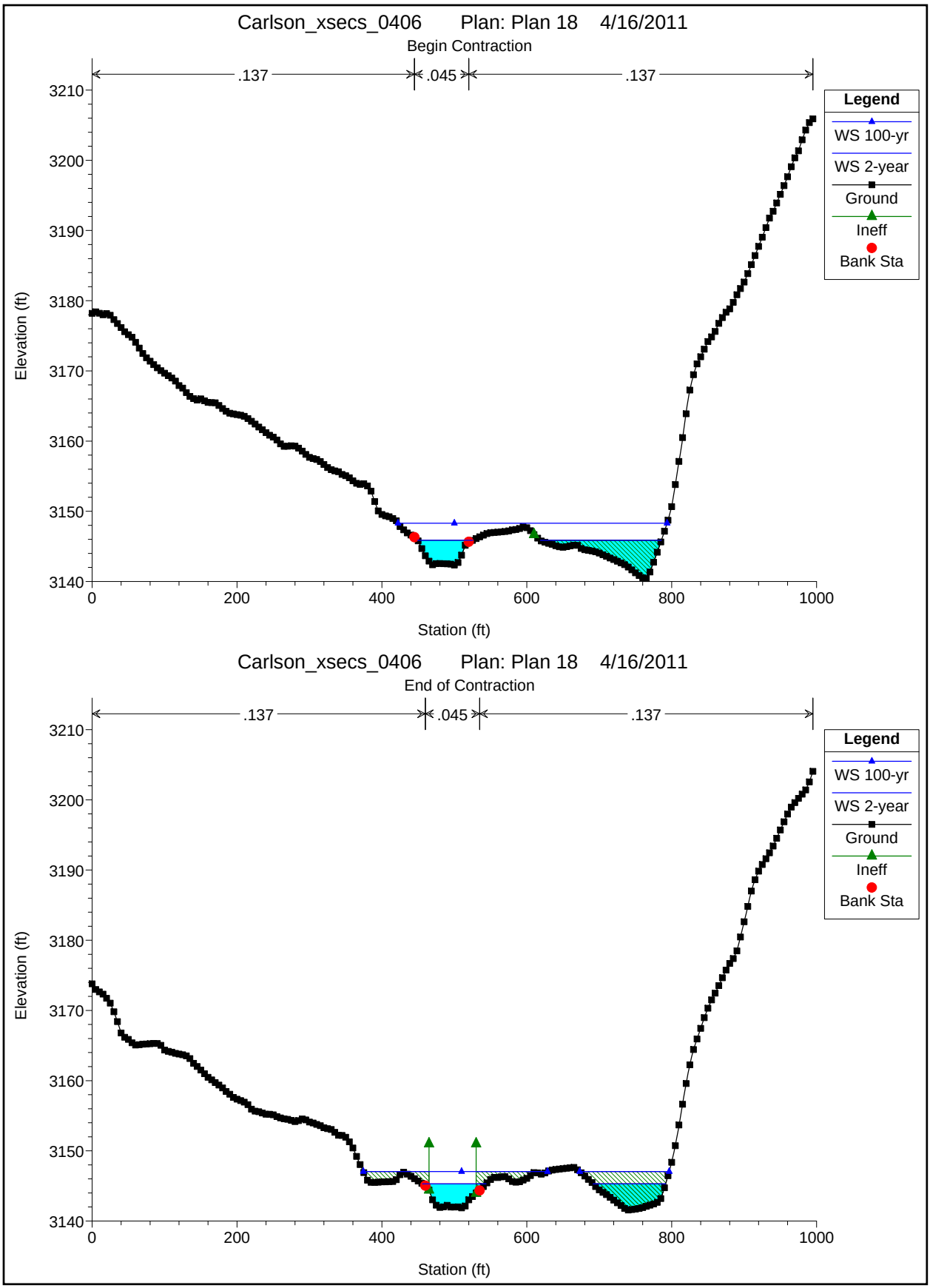
Figure 5-1 Cross Section Locations at a Bridge

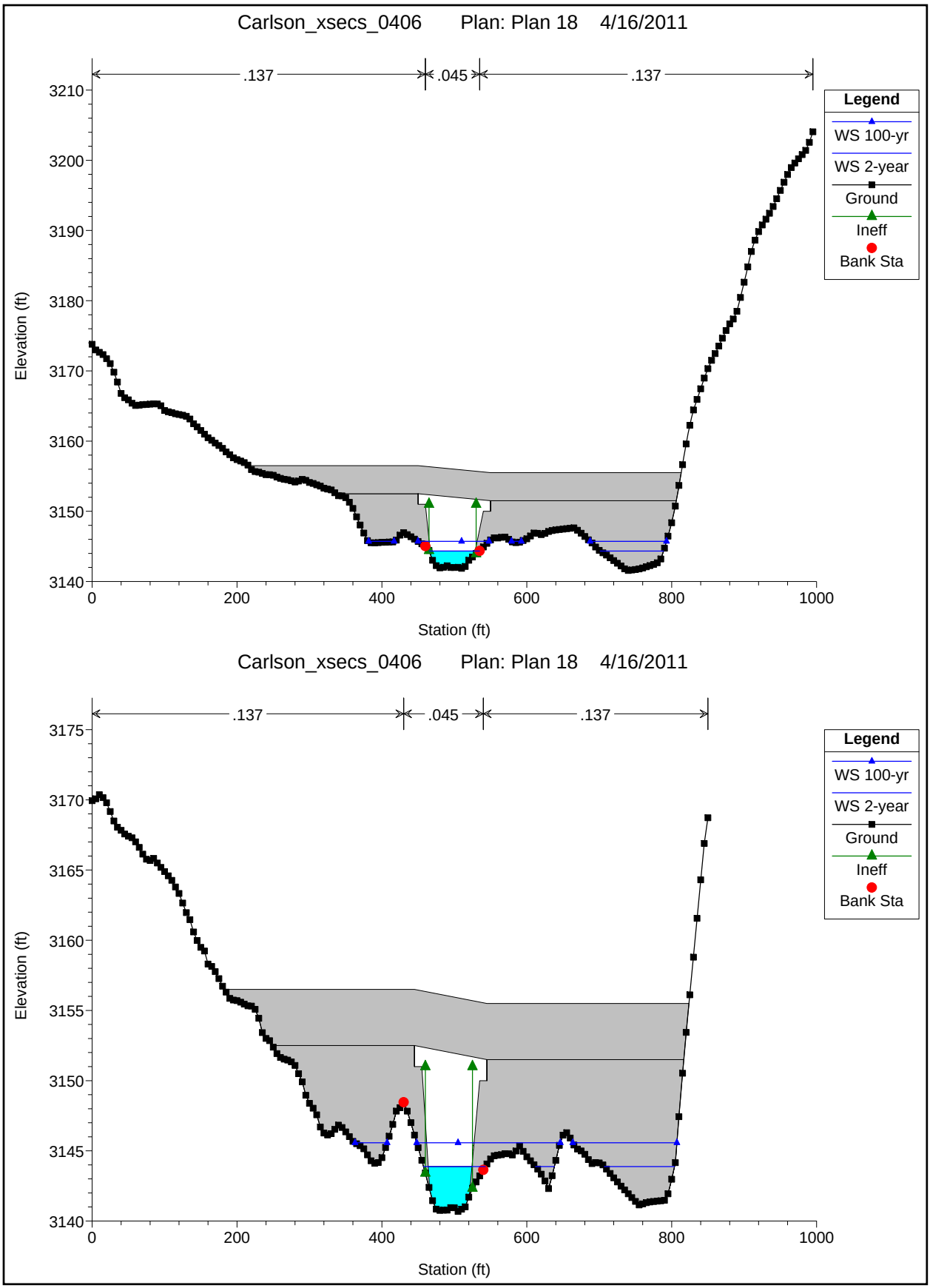
A detailed study of flow contraction and expansion zones has been completed by the Hydrologic Engineering Center entitled "Flow Transitions in Bridge Backwater Analysis" (RD-42, HEC, 1995). The purpose of this study was to provide better guidance to hydraulic engineers performing water surface profile computations through bridges. Specifically the study focused on determining the expansion

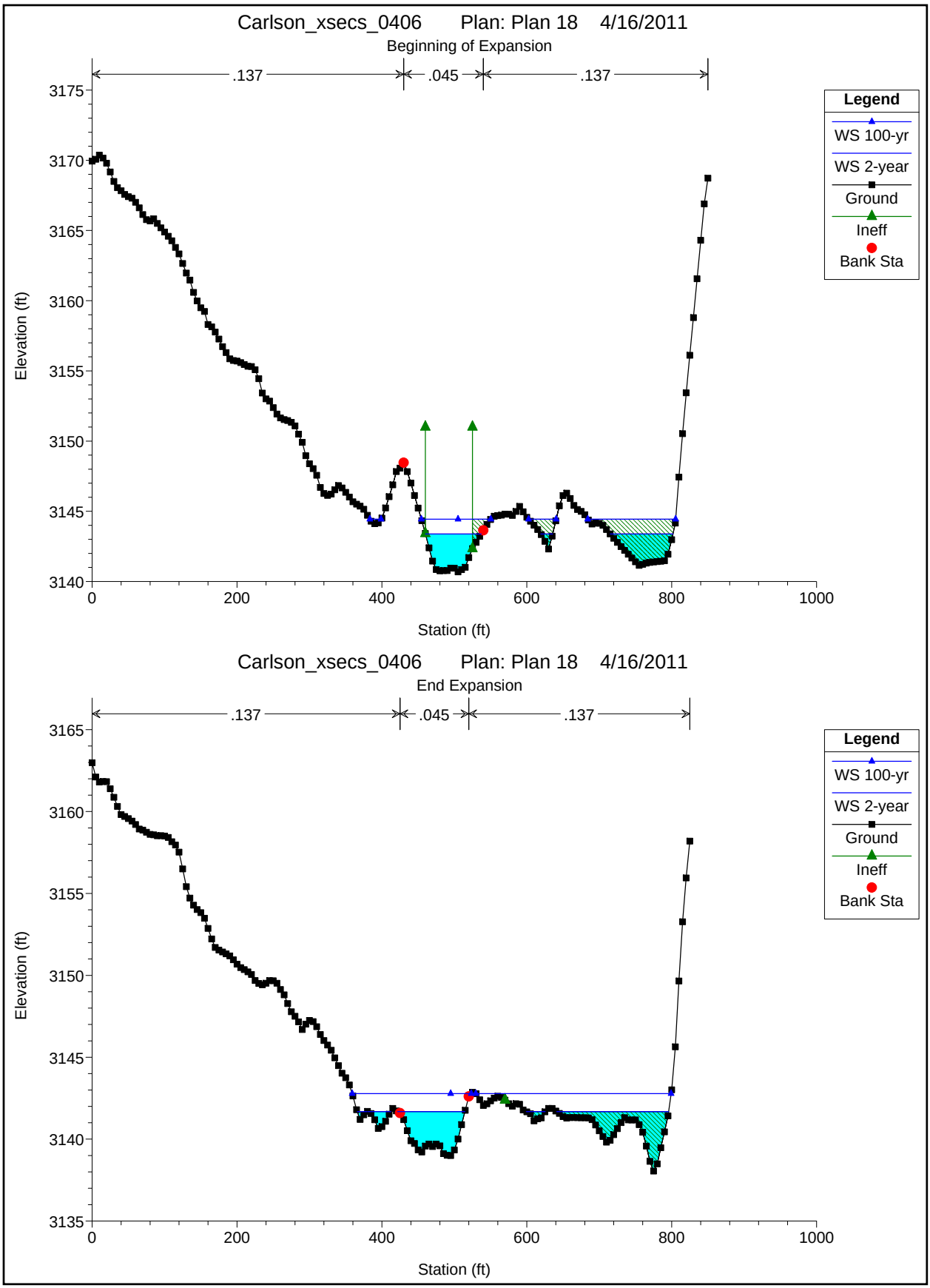
Client:	*Rio-Tinto*			*9*
Project:	*Holden Mine*		**Date:**	*04/17/2011*
Description:	*HEC-RAS Evaluation for New Holden Bypass Road Bridge to be Located East of Tailing Pile 3*		**Job No:**	*1008579*
		By:	*P. Pellicer*	**Chkd By:**

Attachment D – HEC-RAS Water Surface Sections and Profile


Carlson_xsecs_0406 Plan: Plan 18 4/16/2011
RRck RRck
Legend
WS 100-yr
WS 2-year
Ground
3155
3150
3145
3140
Elevation (ft)
900
950
1000
1050
1100
1150
1200
Main Channel Distance (ft)


Carlson_xsecs_0406 Plan: Plan 18 4/16/2011
Begin Contraction
.137
.045
.137
Legend
WS 100-yr
WS 2-year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
3210
3200
3190
3180
3170
3160
3150
3140
0
200
400
600
800
1000
Carlson_xsecs_0406 Plan: Plan 18 4/16/2011
End of Contraction
.137
.045
.137
Legend
WS 100-yr
WS 2-year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Carlson_xsecs_0406 Plan: Plan 18 4/16/2011
.137
.045
.137
Legend
WS 100-yr
WS 2-year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
3210
3200
3190
3180
3170
3160
3150
3140
0
200
400
600
800
1000
Carlson_xsecs_0406 Plan: Plan 18 4/16/2011
.137
.045
.137
Legend
WS 100-yr
WS 2-year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
3175
3170
3165
3160
3155
3150
3145
3140
0
200
400
600
800
1000


Carlson_xsecs_0406 Plan: Plan 18 4/16/2011
Beginning of Expansion
.137
.045
.137
Legend
WS 100-yr
WS 2-year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Carlson_xsecs_0406 Plan: Plan 18 4/16/2011
End Expansion
.137
.045
.137
Legend
WS 100-yr
WS 2-year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

Client:	*Rio-Tinto*			*9*
Project:	*Holden Mine*		**Date:**	*04/17/2011*
Description:	*HEC-RAS Evaluation for New Holden Bypass Road Bridge to be Located East of Tailing Pile 3*		**Job No:**	*1008579*
		By:	*P. Pellicer*	**Chkd By:**

Attachment E – 100 Year Flood Plain Comparison

E 1,652,000
E 1,653,000
E 1,654,000
E 1,655,000
E 1,656,000
E 1,657,000
E 1,658,000
E 1,659,000

N 438,000
N 437,000
N 436,000
N 435,000

VEHICLE BRIDGE
WEST FOOT BRIDGE
EAST FOOT BRIDGE
PROPOSED VEHICLE BRIDGE
TAILINGS PILE 3

PLAN

SCALE
250' 0 250' 500'
CONTOUR INTERVAL = 2'

LEGEND:

- 1900 — APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET
- 100 YEARS FLOOD PLANE AREA (BRIDGE)
- 100 YEARS FLOOD PLANE AREA

DRAFT 4/18/11

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
A	DRAFT	CHF	LF	04/15/11

DRAWING REFERENCE(S):

DESIGNED BY	L. FUHRIG	04/15/11
DRAWN BY	C. FOWLER	04/15/11
CHECKED BY	L. FUHRIG	04/15/11
APPROVED BY		
PROJECT MANAGER		
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: HOLDEN MINE
TITLE: 100 YEARS (BRIDGE) FLOOD PLANE PLAN VIEW
FIGURE: 9
REVISION: A
FILE NAME: 1008679D397

MWH

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POTABLE WATER SYSTEM PIPE HYDRAULICS

HEAD REQUIRED CALCULATION
Holden Village Potable Water System Relocation
Hydropower Location

Lift			**Basis**
Start	3224	feet NGVD	Filter room floor elevation
End	3462	feet NGVD	Storage reservoir top elevation
	238	total elevation difference in feet	

Pipe Losses

Transmission Line		Units	
Pipe Diameter	3.682	inches	Inside diameter of 4-inch HDPE, SDR 11
Pipe Area	0.0739	square feet	
Design Flow	60	gallons per minute	
Flow Velocity	1.808	feet per second	
Headloss	0.147	feet per 100 feet	Hazen-Williams for HDPE Pipe
Headloss (per 100'):	1.47	feet per 1,000 feet (assumed total length)	

Level 3 Valve Box			
3-inch check valve	0.40	feet	
3-inch gate valve	0.02	feet	
3-inch tee	0.21	feet	
3"x2.5" contraction	0.12	feet	
2.5-inch altitude control valve	2.39	feet	
2.5"x3" expansion	0.24	feet	
3-inch 90-degree bend (3)	0.12	feet	assumed, not shown in figure
Total	3.50	feet	

Total Headloss in Pipe and Level 3 Valve Box	4.97	feet

TOTAL PRESSURE REQUIRED - LIFT AND LINE LOSS	**243.0**	feet

Filtration System - Available Pressure		
Feed	334.5	feet (based on 145 psi)
Kinetico Differential Pressure	53.1	feet (based on 23 psi set point)
Strainrite Differential Pressure	57.7	feet (based on 23 psi set point)
Treated Water Pressure	**223.8**	feet (feed less differentials)

NET AVAILABLE HEAD	**-19.2**	feet (from Hydropower location)

Recommended Minimum Elevation for Relocation	**3253.2**	**feet NGVD (10 feet Safety Factor)**

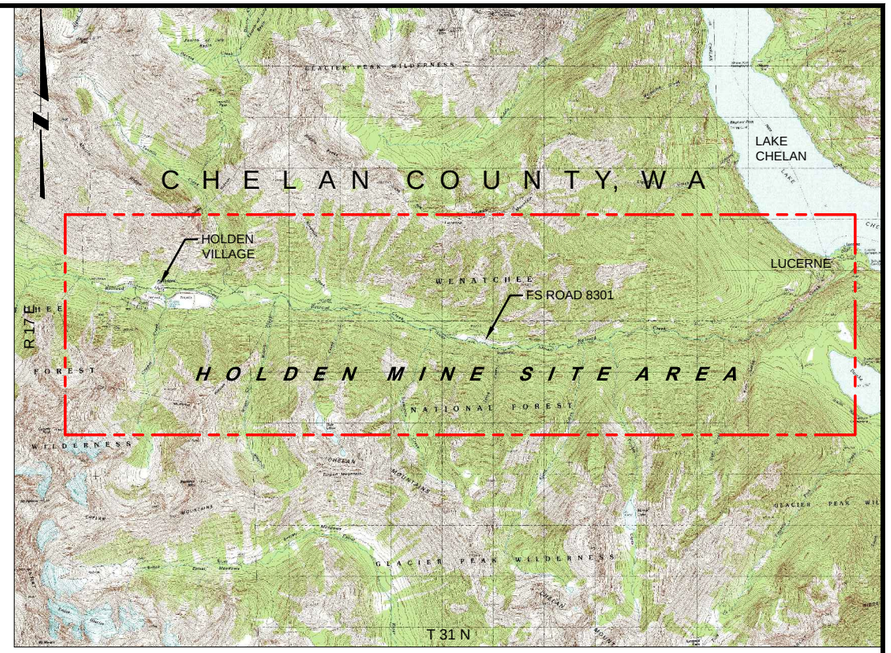
NOTES
Calculations assume no other pipe fittings other than those identified at the Level 3 Vault.

Fitting headloss coefficients estimated from typical published values.
Treated water pressure assumes worst case pressure loss in Kinetico and Strainrite filters.
Filter operating pressures and setpoints provided by Holden Village.

ATTACHMENT A

2011 EARLY WORKS IMPLEMENTATION DESIGN DRAWINGS

LOCATION MAP
NOT TO SCALE



VICINITY MAP
NOT TO SCALE

REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

prepared for

Intalco

CHELAN COUNTY, WASHINGTON

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

DESIGNED BY	D. RODRIGUEZ	04/04/11
DRAWN BY	F. ANDRADE	04/04/11
CHECKED BY	D. RODRIGUEZ	04/04/11
APPROVED BY	P. CROUSE	04/04/11
PROJECT MANAGER	R. SCHLICHER	04/04/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: COVER SHEET
SHEET: 1-1
REVISION: B
FILE NAME: 1008679D233

MWH

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REMEDIAL DESIGN FOR HOLDEN MINE				DRAWING ISSUE DATE						
REMEDIAL COMPONENT	SHEET NUMBER	DESCRIPTION	FILENAME	04-08-11	04-15-11	'	'	'	'	'
SECTION 1 GENERAL	1–1	COVER SHEET – 30% REMEDIAL DESIGN FOR HOLDEN	1008679D050	–	–					
	1–1	COVER SHEET – INFRASTRUCTURE	1008679D233	●	●					
	1–1	COVER SHEET – POTABLE WATER SYSTEM RELOCATION	1008679D225	–	–					
	1–2	INDEX OF DRAWINGS (1 OF 3)	1008679D002	●	●					
	1–3	INDEX OF DRAWINGS (2 OF 3)	1008679D044	●	●					
	1–4	INDEX OF DRAWINGS (3 OF 3)	1008679D334	●	●					
	1–5	MASTER LEGEND	1008679D037	●	●					
	1–6	GENERAL NOTES AND ACRONYMS	1008679D051	●	●					
	1–7	SITE LOCATION MAP	1008679D337	●	●					
	1–8	LOCAL GEOLOGIC MAP	1008679D374	●	●					
	1–9	EXISTING CONDITIONS	1008679D375	●	●					
	1–10	HOLDEN VILLAGE EXISTING CONDITIONS	1008679D269	●	●					
	1–11	EXISTING UTILITIES	1008679D364	●	●					
	1–12	REMEDIAL COMPONENTS	1008679DXXX	–	–					
	1–13	RECLAIMED SITE PLAN	1008679DXXX	–	–					
	1–14	RECLAIMED SITE PLAN	1008679DXXX	–	–					
	1–15	INVESTIGATION LOCATIONS (SHEET 1 OF 8)	1008679D366	●	●					
	1–16	INVESTIGATION LOCATIONS (SHEET 2 OF 8)	1008679D367	●	●					
	1–17	INVESTIGATION LOCATIONS (SHEET 3 OF 8)	1008679D368	●	●					
	1–18	INVESTIGATION LOCATIONS (SHEET 4 OF 8)	1008679D369	●	●					
	1–19	INVESTIGATION LOCATIONS (SHEET 5 OF 8)	1008679D370	●	●					
	1–20	INVESTIGATION LOCATIONS (SHEET 6 OF 8)	1008679D371	●	●					
	1–21	INVESTIGATION LOCATIONS (SHEET 7 OF 8)	1008679D372	●	●					
	1–22	INVESTIGATION LOCATIONS (SHEET 8 OF 8)	1008679D373	●	●					
	1–23	SITE BOUNDARIES MAP	1008679D376	●	●					
SECTION 2 SITE DEVEL-OPMENT	2–1	YEAR 1 SITE DEVELOPMENT	1008679D388	●	●					
	2–2	XX	1008679DXXX	–	–					
	2–3	XX	1008679DXXX	–	–					
SECTION 3 DEMOLITION	3–1	MILL DEMOLITION AND REGRADING PLAN	1008679DXXX	–	–					
	3–2	SRA AND LAGOON EXCAVATION AND REGRADING PLAN	1008679DXXX	–	–					
	3–3	DECANT DEMOLITION PLAN	1008679DXXX	–	–					
	3–4	CROSS SECTIONS	1008679DXXX	–	–					
	3–5	CROSS SECTIONS	1008679DXXX	–	–					
	3–6	HOLDEN VILLAGE WATER LINE RELOCATION PLAN	1008679DXXX	–	–					
	3–7	MILL DEMOLITION AND REGRADING PLAN	1008679DXXX	–	–					
	3–8	MILL DEMOLITION AND REGRADING PLAN	1008679DXXX	–	–					
	3–9	DETAILS	1008679DXXX	–	–					
SECTION 4 SURFACE WATER AND SEDIMENT CONTROL	4–1	DRAINAGE BASIN PLAN	1008679DXXX	–	–					
	4–2	SURFACE WATER AND SEDIMENT CONTROL LAYOUT	1008679DXXX	–	–					
	4–3	EAST SURFACE WATER DIVERSION CHANNEL PLAN AND PROFILE	1008679DXXX	–	–					
	4–4	EAST SURFACE WATER DIVERSION CHANNEL PLAN AND PROFILE	1008679DXXX	–	–					
	4–5	EAST SEDIMENT CONTROL STRUCTURE	1008679DXXX	–	–					
	4–6	WEST SURFACE WATER DIVERSION CHANNEL PLAN AND PROFILE	1008679DXXX	–	–					
	4–7	WEST SURFACE WATER DIVERSION CHANNEL PLAN AND PROFILE	1008679DXXX	–	–					
	4–8	WEST SEDIMENT CONTROL STRUCTURE	1008679DXXX	–	–					

REMEDIAL DESIGN FOR HOLDEN MINE				DRAWING ISSUE DATE						
REMEDIAL COMPONENT	SHEET NUMBER	DESCRIPTION	FILENAME	04-08-11	04-15-11	'	'	'	'	'
SECTION 4 SURFACE WATER AND SEDIMENT CONTROL	4–9	BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 1 OF 8)	1008679D297	●	●					
	4–10	BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 2 OF 8)	1008679D298	●	●					
	4–11	BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 3 OF 8)	1008679D299	●	●					
	4–12	BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 4 OF 8)	1008679D300	●	●					
	4–13	BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 5 OF 8)	1008679D301	●	●					
	4–14	BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 6 OF 8)	1008679D325	●	●					
	4–15	BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 7 OF 8)	1008679D326	●	●					
	4–16	BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 8 OF 8)	1008679D327	●	●					
SECTION 5 GRADING	5–1	GENERAL REGRADING PLAN	1008679DXXX	–	–					
	5–2	EAST REGRADING PLAN	1008679DXXX	–	–					
	5–3	WEST REGRADING PLAN	1008679DXXX	–	–					
	5–4	GENERAL REGRADING PLAN	1008679DXXX	–	–					
	5–5	CROSS SECTIONS	1008679DXXX	–	–					
	5–6	DETAILS	1008679DXXX	–	–					
	5–7	DETAILS	1008679DXXX	–	–					
SECTION 6 STREAM RESTORATION	6–1	STREAM REALIGNMENT PLAN	1008679DXXX	–	–					
	6–2	RAILROAD CREEK PLAN AND PROFILE	1008679DXXX	–	–					
	6–3	RAILROAD CREEK PLAN AND PROFILE	1008679DXXX	–	–					
	6–4	RAILROAD CREEK PLAN AND PROFILE	1008679DXXX	–	–					
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	6–6	RAILROAD CREEK PLAN AND PROFILE	1008679DXXX	–	–					
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	6–9	RAILROAD CREEK CROSS SECTIONS	1008679DXXX	–	–					
	6–10	RAILROAD CREEK CROSS SECTIONS	1008679DXXX	–	–					
	6–11	RAILROAD CREEK CROSS SECTIONS	1008679DXXX	–	–					
	6–12	COPPER CREEK PLAN AND PROFILE	1008679DXXX	–	–					
	6–13	COPPER CREEK PLAN AND PROFILE	1008679DXXX	–	–					
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	6–15	COPPER CREEK CROSS SECTIONS	1008679DXXX	–	–					
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	6–17	DETAILS	1008679DXXX	–	–					
	6–18	DETAILS	1008679DXXX	–	–					
SECTION 7 BARRIER WALL	7–1	BARRIER WALL ALIGNMENT PLAN	1008679DXXX	–	–					
	7–2	PLAN AND PROFILE	1008679DXXX	–	–					
	7–3	PLAN AND PROFILE	1008679DXXX	–	–					
	7–4	PLAN AND PROFILE	1008679DXXX	–	–					
	7–5	PLAN AND PROFILE	1008679DXXX	–	–					
	7–6	PLAN AND PROFILE	1008679DXXX	–	–					
	7–7	CROSS SECTION	1008679DXXX	–	–					
	7–8	CROSS SECTION	1008679DXXX	–	–					
	7–9	DETAILS	1008679DXXX	–	–					
	7–10	DETAILS	1008679DXXX	–	–					

LEGEND:

● SHEETS INCLUDED IN ISSUANCE

– SHEETS NOT INCLUDED IN ISSUANCE

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

DESIGNED BY	D. RODRIGUEZ	07/15/10
DRAWN BY	F. ANDRADE	07/15/10
CHECKED BY	D. RODRIGUEZ	07/15/10
APPROVED BY	P. CROUSE	
PROJECT MANAGER	R. SCHLICHER	
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE GENERAL

TITLE: INDEX OF DRAWINGS (1 OF 3)

MWH

SHEET: 1-2 | REVISION: B

FILE NAME: 1008679D002

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REMEDIAL DESIGN FOR HOLDEN MINE				DRAWING ISSUE DATE						
REMEDIAL COMPONENT	SHEET NUMBER	DRAWING TITLE	FILENAME	04-08-11	04-15-11	'	'	'	'	'
SECTION 8 SHALLOW GROUNDWATER COLLECTION SYSTEM	8-1	GROUNDWATER ELEVATION CONTOUR MAP	1008679DXXX	–	–					
	8-2	GROUNDWATER COLLECTION SYSTEM PLAN	1008679DXXX	–	–					
	8-3	EAST GROUNDWATER COLLECTION SYSTEM PLAN AND PROFILE	1008679DXXX	–	–					
	8-4	EAST GROUNDWATER COLLECTION SYSTEM PLAN AND PROFILE	1008679DXXX	–	–					
	8-5	WEST GROUNDWATER COLLECTION SYSTEM PLAN AND PROFILE	1008679DXXX	–	–					
	8-6	WEST GROUNDWATER COLLECTION SYSTEM PLAN AND PROFILE	1008679DXXX	–	–					
	8-7	CROSS SECTION	1008679DXXX	–	–					
	8-8	CROSS SECTION	1008679DXXX	–	–					
	8-9	DETAILS	1008679DXXX	–	–					
	8-10	DETAILS	1008679DXXX	–	–					
SECTION 9 QUARRY	9-1	POTENTIAL BORROW SOURCE LOCATION MAP	1008679D383	●	●					
	9-2	QUARRY MINE PLAN	1008679DXXX	–	–					
	9-3	COVER MATERIAL MINE PLAN	1008679DXXX	–	–					
	9-4	CROSS SECTIONS	1008679DXXX	–	–					
	9-5	CROSS SECTIONS	1008679DXXX	–	–					
	9-6	DETAILS	1008679DXXX	–	–					
	9-7	DETAILS	1008679DXXX	–	–					
SECTION 10 INFRASTRUCTURE / SHORELINE FACILITIES	10-2-1	XXX	1008679DXXX	–	–					
	10-2-2	XXX	1008679DXXX	–	–					
	10-2-3	XXX	1008679DXXX	–	–					
	10-2-4	XXX	1008679DXXX	–	–					
	10-2-5	XXX	1008679DXXX	–	–					
	10-2-6	XXX	1008679DXXX	–	–					
	10-2-7	XXX	1008679DXXX	–	–					
	10-2-8	XXX	1008679DXXX	–	–					
	10-2-9	XXX	1008679DXXX	–	–					
	10-2-10	XXX	1008679DXXX	–	–					
SECTION 10 INFRASTRUCTURE / FS ROAD 8301	10-3-1	FS ROAD 8301 KEY MAP	1008679D237	●	●					
	10-3-2	FS ROAD 8301 (STA 0+00 TO STA 58+00) PLAN AND PROFILE	1008679D246	●	●					
	10-3-3	FS ROAD 8301 (STA 58+00 TO STA 114+00) PLAN AND PROFILE	1008679D247	●	●					
	10-3-4	FS ROAD 8301 (STA 114+00 TO STA 172+50) PLAN AND PROFILE	1008679D248	●	●					
	10-3-5	FS ROAD 8301 (STA 172+50 TO STA 231+00) PLAN AND PROFILE	1008679D249	●	●					
	10-3-6	FS ROAD 8301 (STA 231+00 TO STA 289+50) PLAN AND PROFILE	1008679D250	●	●					
	10-3-7	FS ROAD 8301 (STA 289+50 TO STA 348+00) PLAN AND PROFILE	1008679D251	●	●					
	10-3-8	FS ROAD 8301 (STA 348+00 TO STA 406+50) PLAN AND PROFILE	1008679D252	●	●					
	10-3-9	FS ROAD 8301 (STA 406+50 TO STA 465+00) PLAN AND PROFILE	1008679D253	●	●					
	10-3-10	FS ROAD 8301 (STA 465+00 TO STA 523+50) PLAN AND PROFILE	1008679D254	●	●					
	10-3-11	FS ROAD 8301 (STA 523+50 TO STA 548+00) PLAN AND PROFILE	1008679D255	●	●					
	10-3-12	FS ROAD 8301 TURNOUTS 1 AND 2 GRADING PLAN	1008679D270	●	●					
	10-3-13	FS ROAD 8301 TURNOUTS 3 AND 4 GRADING PLAN	1008679D271	●	●					
	10-3-14	FS ROAD 8301 TURNOUTS 5 AND 6 GRADING PLAN	1008679D272	●	●					
	10-3-15	FS ROAD 8301 TURNOUTS 7 AND 8 GRADING PLAN	1008679D273	●	●					
	10-3-16	FS ROAD 8301 TURNOUTS 9 AND 10 GRADING PLAN	1008679D274	●	●					
	10-3-17	FS ROAD 8301 TURNOUTS 11 AND 12 GRADING PLAN	1008679D275	●	●					
	10-3-18	FS ROAD 8301 TURNOUTS 13 AND 14 GRADING PLAN	1008679D276	●	●					
	10-3-19	FS ROAD 8301 TURNOUTS 15 AND 16 GRADING PLAN	1008679D277	●	●					
	10-3-20	FS ROAD 8301 TURNOUTS 17 AND 18 GRADING PLAN	1008679D278	●	●					
	10-3-21	FS ROAD 8301 TURNOUTS 19 AND 20 GRADING PLAN	1008679D279	●	●					
	10-3-22	FS ROAD 8301 TURNOUTS 21 AND 22 GRADING PLAN	1008679D280	●	●					
	10-3-23	FS ROAD 8301 TURNOUTS 23 AND 24 GRADING PLAN	1008679D281	●	●					
	10-3-24	FS ROAD 8301 TURNOUTS 25 AND 26 GRADING PLAN	1008679D282	●	●					
	10-3-25	FS ROAD 8301 TURNOUTS 27 AND 28 GRADING PLAN	1008679D283	●	●					
	10-3-26	FS ROAD 8301 – DETAIL SHEET	1008679D236	●	●					
	10-3-27	EXISTING CULVERTS ALONG FS ROAD 8301 (SHEET 1 OF 2)	1008679D313	●	●					
	10-3-28	EXISTING CULVERTS ALONG FS ROAD 8301 (SHEET 2 OF 2)	1008679D314	●	●					
	10-3-29	EXISTING CULVERT PROFILES C1 THROUGH C20	1008679D330	●	●					
	10-3-30	EXISTING CULVERT PROFILES C21 THROUGH C40	1008679D331	●	●					
	10-3-31	EXISTING CULVERT PROFILES C41 THROUGH C55	1008679D332	●	●					
SECTION 10 INFRASTRUCTURE / HOLDEN VILLAGE BYPASS ROAD	10-4-1	BYPASS ROAD KEY MAP	1008679D238	●	●					
	10-4-2	BYPASS ROAD STA 0+00 TO STA 13+50 PLAN AND PROFILE	1008679D264	●	●					
	10-4-3	BYPASS ROAD STA 13+50 TO STA 28+00 PLAN AND PROFILE	1008679D265	●	●					
	10-4-4	BYPASS ROAD STA 28+00 TO STA 42+50 PLAN AND PROFILE	1008679D266	●	●					
	10-4-5	BYPASS ROAD STA 42+50 TO STA 57+00 PLAN AND PROFILE	1008679D267	●	●					
	10-4-6	BYPASS ROAD STA 57+00 TO STA 69+69 PLAN AND PROFILE	1008679D268	●	●					
	10-4-7	BYPASS ROAD DETAILS	1008679D311	●	●					
	10-4-8	BYPASS ROAD LINE AND CURVE TABLES	1008679D312	●	●					
	10-4-9	BYPASS ROAD CROSS SECTIONS	1008679D292	●	●					
	10-4-10	BYPASS ROAD CROSS SECTIONS	1008679D293	●	●					
	10-4-11	BYPASS ROAD CROSS SECTIONS	1008679D381	●	●					
	10-4-12	BYPASS ROAD CROSS SECTIONS	1008679D303	●	●					
	10-4-13	BYPASS ROAD CROSS SECTIONS	1008679D377	●	●					
	10-4-14	BYPASS ROAD CROSS SECTIONS	1008679D378	●	●					
	10-4-15	BYPASS ROAD CROSS SECTIONS	1008679D379	●	●					
	10-4-16	BYPASS ROAD CROSS SECTIONS	1008679D380	●	●					
	10-4-17	BYPASS ROAD CROSS SECTIONS	1008679D382	●	●					
	10-4-18	BRIDGE PLAN AND SECTION	1008679D260	●	●					
	10-4-19	BRIDGE ABUTMENT DETAILS	1008679D336	●	●					
	10-4-20	COPPER CREEK CULVERT PLAN	1008679D262	●	●					
	10-4-21	RAILROAD CREEK CULVERT PLAN	1008679D263	●	●					
	10-4-22	TYPICAL CULVERT INSTALLATION	1008679D335	●	●					
SECTION 10 INFRASTRUCTURE / HOLDEN VILLAGE FACILITIES	10-5-1	EXISTING POTABLE WATER SYSTEM	1008679D224	●	●					
	10-5-2	EXISTING POTABLE WATER SYSTEM GENERAL ARRANGEMENT	1008679D230	●	●					
	10-5-3	STRAINRITE FILTER DETAILS	1008679D231	●	●					
	10-5-4	KINETICO FILTERS DETAILS	1008679D232	●	●					
	10-5-5	POTABLE WATER SYSTEM VAULT DETAIL SHEET	1008679D242	●	●					
	10-5-6	RELOCATED POTABLE WATER SYSTEM	1008679D239	●	●					
	10-5-7	DETAIL SHEET	1008679D240	●	●					
	10-5-8	UTILITY LINE LOCATIONS	1008679D241	●	●					
	10-5-9	PIPING DIAGRAM TEMPORARY EQUIPMENT ENCLOSURE	1008679D348	●	●					
	10-5-10	EXISTING VALVE VAULT MODIFICATIONS	1008679D356	●	●					
	10-5-11	HOLDEN VILLAGE TEMPORARY MAINTENANCE FACILITY (PLAN)	1008679DXXX	–	–					
	10-5-12	HOLDEN VILLAGE TEMPORARY MAINTENANCE FACILITY (DETAILS)	1008679DXXX	–	–					

LEGEND:

● SHEETS INCLUDED IN ISSUANCE

– SHEETS NOT INCLUDED IN ISSUANCE

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
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DRAWING REFERENCE(S):

DESIGNED BY	D. RODRIGUEZ	07/15/10
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APPROVED BY	P. CROUSE	
PROJECT MANAGER	R. SCHLICHER	
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE GENERAL

TITLE: INDEX OF DRAWINGS (2 OF 3)

MWH

SHEET: 1-3

REVISION: B

FILE NAME: 1008679D044

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REMEDIAL DESIGN FOR HOLDEN MINE					DRAWING ISSUE DATE						
REMEDIAL COMPONENT	SHEET NUMBER	DRAWING TITLE	FILENAME		04-08-11	04-15-11	'	'	'	'	'
SECTION 10 INFRASTRUCTURE DESIGN REPORT / CONSTRUCTION SUPPORT FACILITIES	10-6-1	CONSTRUCTION SUPPORT FACILITIES (SHEET 1 OF 2)	1008679D308		●	●					
	10-6-2	CONSTRUCTION SUPPORT FACILITIES (SHEET 2 OF 2)	1008679D309		●	●					
	10-6-3	MATERIAL STORAGE AREA A	1008679D323		●	●					
	10-6-4	STAGING AREA B AND STAGING AREA C	1008679D322		●	●					
	10-6-5	FUEL AND MAINTENANCE AREA D	1008679D321		●	●					
	10-6-6	SAWN TIMBER STORAGE AREA E	1008679D320		●	●					
	10-6-7	CONSTRUCTION SUPPORT FACILITIES FS ROAD 8301 TURNOUT STA. 566+50	1008679D318		●	●					
SECTION 10-7 NOT USED	10-7-1	XXX	1008679DXXX		–	–					
	10-7-2	XXX	1008679DXXX		–	–					
	10-7-3	XXX	1008679DXXX		–	–					
	10-7-4	XXX	1008679DXXX		–	–					
	10-7-5	XXX	1008679DXXX		–	–					
	10-7-6	XXX	1008679DXXX		–	–					
	10-7-7	XXX	1008679DXXX		–	–					
	10-7-8	XXX	1008679DXXX		–	–					
SECTION 10-8 CAMP FACILITIES	10-8-1	XXX	1008679DXXX		–	–					
	10-8-2	XXX	1008679DXXX		–	–					
	10-8-3	XXX	1008679DXXX		–	–					
	10-8-4	XXX	1008679DXXX		–	–					
	10-8-5	XXX	1008679DXXX		–	–					
	10-8-6	XXX	1008679DXXX		–	–					
	10-8-7	XXX	1008679DXXX		–	–					
	10-8-8	XXX	1008679DXXX		–	–					
	10-8-9	XXX	1008679DXXX		–	–					
	10-8-10	XXX	1008679DXXX		–	–					
SECTION 10-9 BULKHEAD SUPPORT	10-9-1	BULKHEAD CONSTRUCTION SUPPORT WORK ELEMENTS	1008679D384		●	●					
	10-9-2	BULKHEAD CONSTRUCTION SUPPORT WORK ELEMENTS DETAIL	1008679D385		●	●					
	10-9-3	BULKHEAD CONSTRUCTION SUPPORT WORK ELEMENTS DETAIL	1008679D386		●	●					
	10-9-4	BULKHEAD CONSTRUCTION SUPPORT AREAS OF DISTURBANCE	1008679D387		●	●					
	10-9-5	BULKHEAD CONSTRUCTION SUPPORT SURFACE WATER RETENTION AREA	1008679D389		●	●					
	10-9-6	BULKHEAD CONSTRUCTION SUPPORT SURFACE WATER RETENTION AREA	1008679D390		●	●					

LEGEND:

● SHEETS INCLUDED IN ISSUANCE

– SHEETS NOT INCLUDED IN ISSUANCE

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B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
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DRAWN BY	F. ANDRADE	07/15/10
CHECKED BY	D. RODRIGUEZ	07/15/10
APPROVED BY	P. CROUSE	----
PROJECT MANAGER	R. SCHLICHER	
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE GENERAL

TITLE: INDEX OF DRAWINGS (3 OF 3)

MWH

SHEET: 1-4 | REVISION: B

FILE NAME: 1008679D334

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LEGEND:

- 5280 — APPROXIMATE EXISTING GROUND SURFACE CONTOURS AND ELEVATION, FEET
- 5275 — DESIGN CONTOUR AND ELEVATION, FEET
- PRIMARY HIGHWAY
- PAVED ROAD
- DIRT ROAD
- TRAIL
- CONTROL LINE AND/OR ROAD CENTERLINE
- WATERSHED BOUNDARY
- CREEK
- NATURAL DRAINAGE
- USFS RIPARIAN AND WETLAND DELINEATION
- SURFACE WATER FLOW DIRECTION
- GLACIER PEAK WILDERNESS BOUNDARY
- INVENTORIED ROADLESS AREA
- LATE SUCCESSIONAL RESERVE (LSR)
- APPROXIMATE LIMITS OF CLEARING AND GRUBBING
- COUNTY OR EQUIVALENT BOUNDARY
- CIVIL TOWNSHIP OR EQUIVALENT BOUNDARY
- INCORPORATED CITY OR EQUIVALENT BOUNDARY
- SECTION LINE
- PATENTED MINE CLAIM BOUNDARY
- NEW PIPELINE
- W — EXISTING POTABLE WATER PIPELINE
- RW — EXISTING RAW WATER PIPELINE
- X — FENCE
- E — ELECTRIC
- UGE — UNDERGROUND ELECTRIC
- OHP — OVERHEAD POWER
- SS — SANITARY SEWER
- ST — STORM SEWER
- W — POTABLE WATER PIPELINE

- AREAS OF POTENTIAL EARTH DISTURBANCE
- EXISTING VEGETATION
- 1% — PERCENT SLOPE
- 2 / 1 — SLOPE RATIO
- 3:1 — FILL SLOPE, H:V (HORIZONTAL TO VERTICAL)
- 3:1 — CUT SLOPE, H:V (HORIZONTAL TO VERTICAL)
- FINAL DESIGN ELEVATION 3156.43 / 3148.1 APPROXIMATE EXISTING GROUND SURFACE ELEVATION
- 50 — U.S. HIGHWAY
- 119 — STATE HIGHWAY
- 141 — COUNTY HIGHWAY
- Mi 2 — MILE MARKER
- A / 1 — PROFILE OR CROSS SECTION IDENTIFICATION; DRAWING NO. WHERE PROFILE/SECTION IS SHOWN
- 1 / 1 — DETAIL IDENTIFICATION; DRAWING No. WHERE DETAIL IS SHOWN
- 1 / - — DETAIL IDENTIFICATION; DETAIL SHOWN ON SAME SHEET AS ORIGINALLY IDENTIFIED

MISCELLANEOUS SYMBOLS:

- SECTION CORNER/CONTROL MONUMENT
- ALIQUOT SECTION CORNER
- 22 — SECTION NUMBER
- 5332.785 — HORIZONTAL AND VERTICAL SURVEY CONTROL POINT AND ELEVATION
- BENCH MARK
- CORNER MARKER POST
- MINE ADIT
- ARTESIAN WELL
- POWER POLE
- LIGHT POLE
- MANHOLE
- HORIZONTAL TANK
- VERTICAL TANK
- CULVERT
- STRUCTURE
- BRIDGE

INVESTIGATION LOCATION SYMBOLS:

- TP1-1BB — BATT TIP
- CPT-1 — CONE PENETROMETER TEST PROBE
- SG-1-WP — DRIVEN WELL POINT
- SB-1 — GEOTECHNICAL BORING EXPLORATION
- HB-1 — HAND AUGER
- TP2-9L — LYSIMETER
- P-1 (HC-1975) — PERMEABILITY TEST
- SP-3 — SEEP
- SG-1 — STAFF GAUGE
- P-1 — PORTAL DRAINAGE
- CH-3 — CORE HOLE
- RC-6-PW-12 — PORE WATER SAMPLER
- RC-7 — SURFACE WATER
- TP-5 — TEST PIT
- 1S/1I/1D — WELL (S = SHALLOW, I= INTERMEDIATE D = DEEP)
- 2010 MWH INVESTIGATION LOCATIONS
- 2009 URS INVESTIGATION LOCATIONS
- 2008 URS INVESTIGATION LOCATIONS
- HISTORICAL INVESTIGATION LOCATIONS (BY OTHERS)

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
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DRAWING REFERENCE(S):

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	C. LEE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: MASTER LEGEND

MWH

SHEET: 1-5 | REVISION: B

FILE NAME: 1008679D037

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GENERAL:

1. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING IMPROVEMENTS WHICH ARE TO REMAIN IN PLACE FROM DAMAGE. ALL IMPROVEMENTS DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE EXPEDITIOUSLY REPAIRED OR RECONSTRUCTED AT THE CONTRACTOR'S EXPENSE WITHOUT ADDITIONAL COMPENSATION.
2. ALL BUILDING COORDINATES ARE TO OUTSIDE CORNER OF COLUMN OR BUILDING.
3. CONTRACTOR SHALL RESTORE ALL SURVEY MONUMENTS THAT ARE DAMAGED OR DESTROYED DURING CONSTRUCTION.

UTILITIES:

1. PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR SHALL LOCATE ALL EXISTING UTILITIES IN AND AROUND THE AREAS OF NEW CONSTRUCTION. THE CONTRACTOR SHALL POTHOLE FOR EXISTING UTILITIES PRIOR TO SUBMITTAL OF SHOP DRAWINGS, FOR POINTS OF CONNECTIONS.
2. THE CONTRACTOR SHALL PROTECT ALL REMAINING EXISTING UTILITIES.
3. LOCATIONS OF UNDERGROUND UTILITIES SHOWN ON THE DRAWINGS WERE OBTAINED FROM AVAILABLE RECORDS. THE CONTRACTOR SHALL VERIFY ALL LOCATIONS AND ELEVATIONS AND SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT UTILITY LINES WHETHER SHOWN OR NOT SHOWN.
4. PRIOR TO ANY CONNECTION TO AN EXISTING UTILITY, THE CONTRACTOR SHALL COORDINATE WITH THE UTILITY OWNER.
5. PRIOR TO ANY EXCAVATION IN THE VICINITY OF ANY EXISTING UNDERGROUND FACILITIES, INCLUDING ALL WATER, SEWER, STORM DRAIN, GAS, PETROLEUM PRODUCTS, OR OTHER PIPELINES; ALL BURIED ELECTRIC POWER, COMMUNICATIONS, OR TELEVISION CABLES; ALL TRAFFIC SIGNAL AND STREET LIGHTING FACILITIES; AND ALL ROADWAY, STATE HIGHWAY, AND RAILROAD RIGHTS–OF–WAY, THE CONTRACTOR. SHALL NOTIFY THE RESPECTIVE AUTHORITIES REPRESENTING THE OWNERS OR AGENCIES RESPONSIBLE FOR SUCH FACILITIES NOT LESS THAN 3 DAYS NOR MORE THAN 7 DAYS PRIOR TO EXCAVATION SO THAT A REPRESENTATIVE OF SAID OWNERS OR AGENCIES CAN BE PRESENT DURING SUCH WORK IF THEY SO DESIRE. IN THE CASE OF THE UNDERGROUND UTILITY SERVICE ALERT CENTER, THIS NOTICE WILL GIVE THEM TIME TO MARK THE LOCATION OF THE UTILITIES. THE CONTRACTOR SHALL ALSO NOTIFY THE REGIONAL OR LOCAL UNDERGROUND SERVICE ALERT COMPANY AT LEAST 3 DAYS, BUT NO MORE THAN 7 DAYS, PRIOR TO SUCH EXCAVATION.

PIPING:

1. THE CONTRACTOR SHALL COMPLY WITH THE STATE DEPARTMENT OF HEALTH SERVICES CRITERIA FOR THE SEPARATION OF WATER MAINS AND SANITARY SEWERS.
2. THE CONTRACTOR SHALL PROVIDE A MINIMUM OF 36 INCHES OF COVER ON ALL PIPELINES UNLESS OTHERWISE SHOWN OR DIRECTED.
3. STRAIGHT SLOPES SHALL BE MAINTAINED BETWEEN INVERT ELEVATIONS SHOWN OR SPECIFIED.
4. THE CONTRACTOR SHALL ADJUST ALL VALVE BOXES, PULL BOXES AND MANHOLES TO FINISHED GRADE UNLESS OTHERWISE SHOWN OR SPECIFIED. MANHOLES IN OPEN FIELDS SHALL BE SET ONE FOOT ABOVE GRADE. APPROXIMATE RIM ELEVATIONS ARE SHOWN ON DRAWINGS.

EROSION CONTROL:

1. THE CONTRACTOR SHALL SUBMIT AN EROSION CONTROL PLAN FOR WORK PRIOR TO THE START OF CONSTRUCTION.
   a. ALL SLOPES SHALL BE PROTECTED FROM EROSION DURING ROUGH GRADING OPERATIONS AND THEREAFTER, UNTIL INSTALLATION OF FINAL GROUNDCOVER.
   b. ALL SLOPE PROTECTION SWALES SHALL BE CONSTRUCTED AT THE SAME TIME AS BANKS ARE GRADED.
   c. THE CONTRACTOR IS RESPONSIBLE FOR IMPLEMENTATION AND MAINTENANCE OF EROSION CONTROL MEASURES CONTAINED WITHIN THE CONTRACT SPECIFICATIONS OR AS REQUIRED BY THE CITY, DISTRICT, OR OTHER REGULATORY AUTHORITY. THE CONTRACTOR SHALL ALSO PROVIDE ANY ADDITIONAL EROSION CONTROL MEASURES (E.G. HYDROSEEDING, MULCHING OF STRAW, SAND BAGGING, DIVERSION DITCHES, ETC.) DICTATED BY FIELD CONDITIONS TO PREVENT EROSION OR THE INTRODUCTION OF DIRT, MUD, OR DEBRIS INTO EXISTING PUBLIC STREETS, WATERWAYS, OR ONTO ADJACENT PROPERTIES DURING ANY PHASE OF CONSTRUCTION OPERATIONS.

ACRONYMS:

AMSL	ABOVE MEAN SEA LEVEL
BH	BORE HOLE
CH	CORE HOLE
CGS	CLEARING, GRUBBING, STRIPPING
CMP	CORRUGATED METAL PIPE
CND	CONDUIT
CONT	CONTINUOUS
CPT	CORRUGATED POLYETHYLENE TUBING
℄	CENTER LINE
CY	CUBIC YARD
DI	DUCTILE IRON
DIA	DIAMETER
DS	DOWNSTREAM
EL	ELEVATION
ENV	ENVIRONMENTAL
EOP	EDGE OF PAVEMENT
EQUIV	EQUIVALENT
HOR	HORIZONTAL
HDPE	HIGH DENSITY POLYETHYLENE
ID	INSIDE DIAMETER
INV	INVERT
LCRS	LEACHATE COLLECTION AND RECOVERY SYSTEM
LLDPE	LINEAR LOW DENSITY POLYETHYLENE
LF	LINEAL FOOT
MAX	MAXIMUM
mil	1/1000TH OF AN INCH
MIN	MINIMUM
MW	MONITORING WELL
MH	MANHOLE
MSL	MEAN SEA LEVEL
NFWE	NO FREE WATER ENCOUNTERED
NO	NUMBER
NOM	NOMINAL
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
PC	POINT OF CURVE
PCC	POINT OF COMPOUND CURVE
PI	POINT OF INTERSECTION
PRC	POINT OF RETURN CURVE
PT	POINT OF TANGENCY
PVC	POINT OF VERTICAL TANGENT
PVC	POLYVINYL CHLORIDE
PSI	POUNDS PER SQUARE INCH
PVC	POINT OF VERTICAL CURVE
PVC	POLYVINYL CHLORIDE
RCP	REINFORCED CONCRETE PIPE
REQ'D	REQUIRED
R.O.W.	RIGHT OF WAY
SCH	SCHEDULE
SDR	STANDARD DIMENSIONAL RATIO
SDR	STANDARD DIMENSION RATIO
SPECS	SPECIFICATIONS
STA	STATION

ACRONYMS (CONT'D):

TOC	TOP OF CONCRETE
TP	TAILINGS PILE
TYP	TYPICAL
US	UPSTREAM
FS	UNITED STATES DEPARTMENT OF THE INTERIOR FOREST SERVICE
VERT	VERTICAL
VLDPE	VERY LOW DENSITY POLYETHYLENE

IMPERIAL UNITS:

" OR IN	INCHES
OZ	OUNCES
F	FAHRENHEIT
' OR FT	FEET
MI	MILES
YD	YARD
SQ MI	SQUARE MILES
AC	ACRE
AC–FT	ACRE–FEET
° OR DEGREES	DEGREES
4.9%	SLOPE GRADE

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

DESIGNED BY	D. RODRIGUEZ	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: GENERAL NOTES AND ACRONYMS

MWH

SHEET: 1-6
REVISION: B
FILE NAME: 1008679D051

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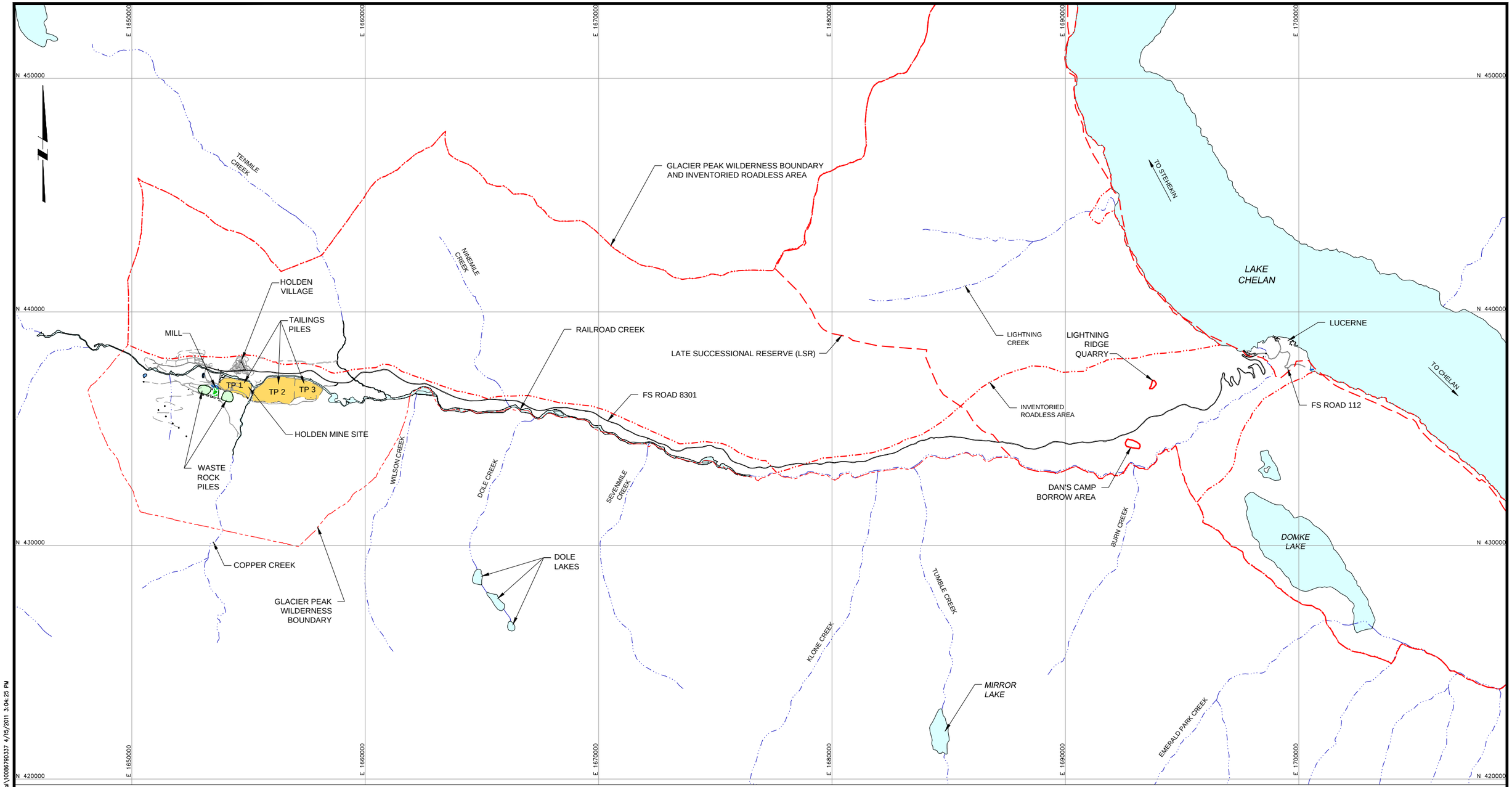

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ISSUE / REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT COMMENT AND REVIEW	FA	PC	04/08/11	

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DRAWING REFERENCE(S):
- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

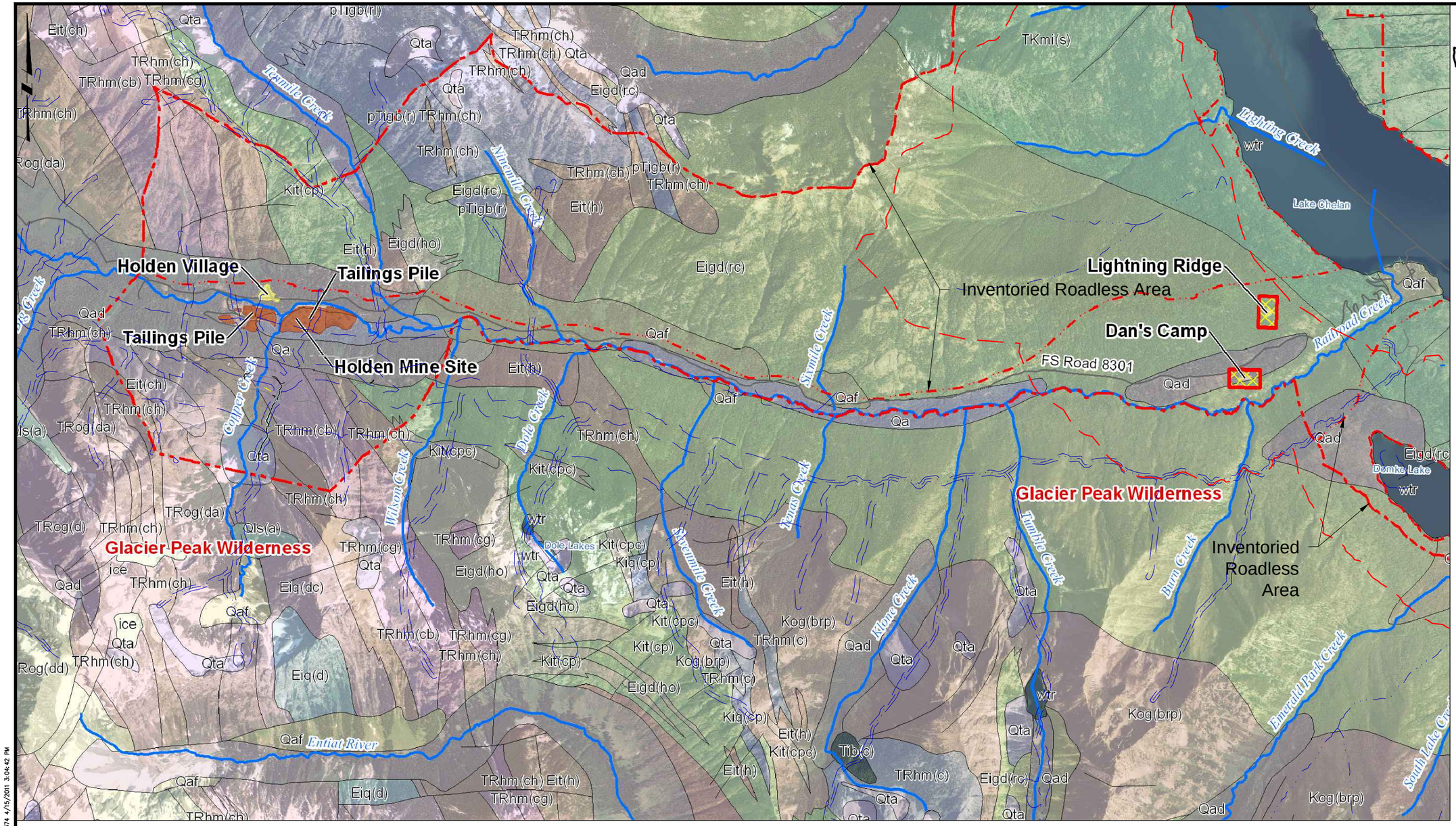
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: SITE LOCATION MAP

MWH

SHEET 1-7 | REVISION B

FILE NAME 1008679D337



KEY MAP
NTS

NOTE:

1. GLACIER PEAK WILDERNESS BOUNDARY LOCATION CONSIDERED APPROXIMATE AT THIS TIME (SOURCE U.S. FOREST SERVICE).

DATA REFERENCE(S):

1. IMAGERY SOURCE: NAIP 2009
2. SPATIAL REFERENCE: NAD 1983 STATE PLANE WASHINGTON NORTH FIPS 4601 FEET
3. DIGITAL DATA PROVIDED BY WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES, SCALE OF 1:100,000, DATED: OCTOBER 2008.

SCALE
2000 0 2000 4000 FEET

LEGEND:

- Potential Quarry and Borrow Sites Visited during the Reconnaissance
- Holden Village
- Tailings Pile
- Rivers/Streams
- Inventoried Roadless Area
- Glacier Peak Wilderness Boundary

- Eigd(ho), Holden, biotite granodiorite & granite
- Eigd(rc), Railroad Creek pluton
- Eiq(d), Duncan Hill pluton
- Eiq(dc), Duncan Hill pluton, contact complex
- Eit(ch), Copper Peak and Holden Lake plutons
- Eit(h), Holden, hornblende biotite tonalite
- Kiq(cp), Cardinal Peak pluton
- Kit(cp), Cardinal Peak pluton
- Kit(cpc), Cardinal Peak pluton, contact complex
- Kit(s), Seven Fingered Jack pluton
- Kog(brp), Bearcat Ridge pluton
- Kog(ef), Eldorado Orthogneiss, flaser gneiss
- Qa, Alluvium
- Qad, Alpine glacial deposits
- Qaf, Alluvial fan deposits
- Qls(a), rock avalanche deposits
- Qls, Landslide deposits
- Qta, Talus deposits
- TKmi(s), Skagit Gneiss
- TRhm(c), Cascade River unit, Chelan Mountains terrane
- TRhm(cb), Cascade River unit, Chelan Mountains terrane
- TRhm(cc), Cas. Riv. unit, Chelan Mtns. terr., Cas. Riv. Schist
- TRhm(cg), Cascade River unit, Chelan Mountains terrane
- TRhm(ch), Cas. Riv. unit, hornblende-bearing,Chelan Mtns. terr.
- TRog(d), Dumbell Mountain plutons
- TRog(da), Dumbell Mountain plutons, augen orthogneiss
- TRog(dd), Dumbell Mountain plutons, qtz diorite to tonalite orthogneiss
- i, ice
- pTigb(r), Riddle Peaks pluton
- pTigb(rl), Riddle Peaks pluton, layered

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
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A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.
- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA–FSA–APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	J. THOMPSON	04/04/11
DRAWN BY	R. WATT	04/04/11
CHECKED BY	D. RODRIGUEZ	04/04/11
APPROVED BY	P. CROUSE	04/04/11
PROJECT MANAGER	R. SCHLICHER	04/04/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: LOCAL GEOLOGIC MAP

MWH

1-8 | REVISION B
FILE NAME 1008679D374

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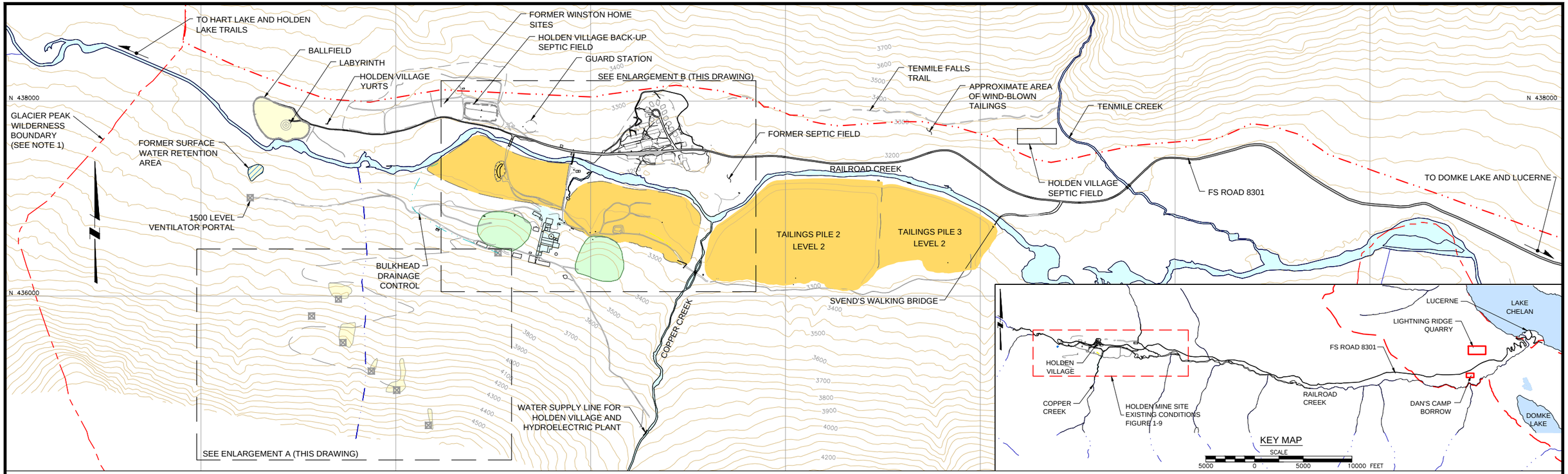
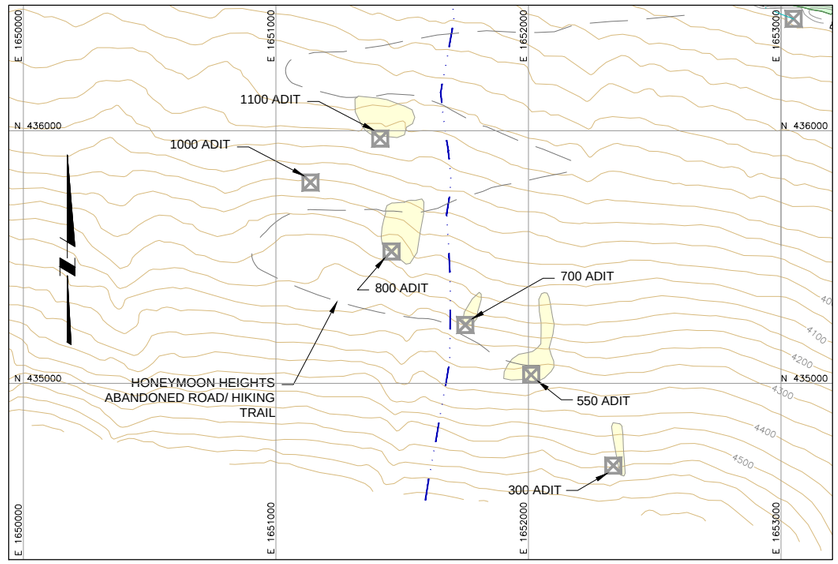


PLAN

SCALE

500 0 500 1000 FEET

CONTOUR INTERVAL = 50 FEET

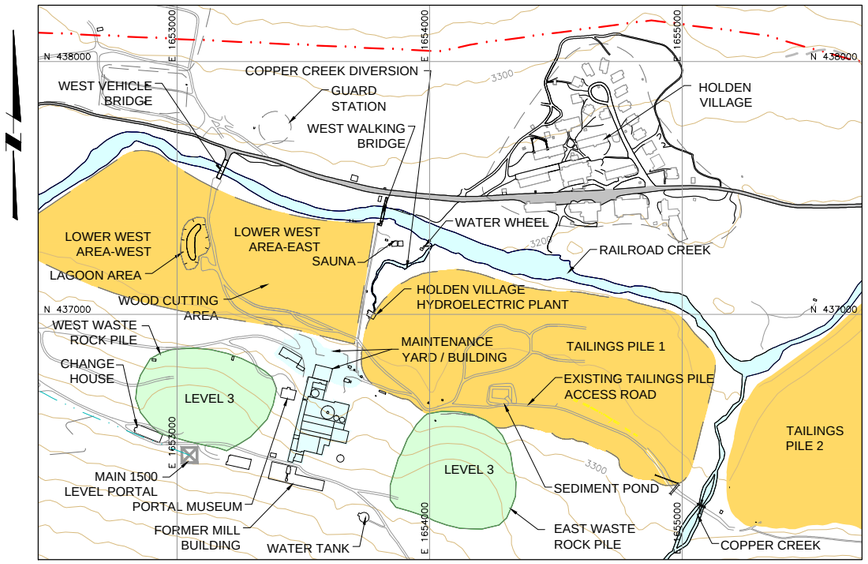


ENLARGEMENT A

SCALE

300 0 300 600 FEET

CONTOUR INTERVAL = 50 FEET



ENLARGEMENT B

SCALE

300 0 300 600 FEET

CONTOUR INTERVAL = 50 FEET

NOTE:

1. GLACIER PEAK WILDERNESS BOUNDARY LOCATION CONSIDERED APPROXIMATE AT THIS TIME (SOURCE: WILDERNESS.NET).

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
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- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	DJR/RTL	06/11/10
DRAWN BY	F. ANDRADE	06/11/10
CHECKED BY	D. RODRIGUEZ	06/11/10
APPROVED BY	R. LEESON	06/11/10
PROJECT MANAGER	R. SCHLICHER	06/11/10
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: EXISTING CONDITIONS

MWH

SHEET 1-9 | REVISION B

FILE NAME 1008679D375

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NOTE:

1. CHALET 2 WAS CONSTRUCTED AFTER AERIAL PHOTOGRAPH WAS TAKEN.

PLAN

SCALE

50 0 50 100 FEET

CONTOUR INTERVAL = 10 FEET

ISSUE/REV				
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER
DRAWN BY	G. PHILPOTT
CHECKED BY	D. RODRIGUEZ
APPROVED BY	P. CROUSE
PROJECT MANAGER	R. SCHLICHER
CLIENT APPROVAL	
CLIENT REFERENCE NO.	

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: HOLDEN VILLAGE EXISTING CONDITIONS

MWH

SHEET: 1-10

REVISION: A

FILE NAME: 1008679D269

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N 438000

E 1653000

E 1654000

E 1655000

N 437000

HOLDEN VILLAGE BACK-UP SEPTIC FIELD

USFS GUARD STATION

FS ROAD 8301

RETAINING WALL (TYP)

CULVERT (TYP)

HOLDEN VILLAGE

5150
3209.51'
FND-MON (3.5INBC)

SEPTIC LIFT STATION

SANITARY SEWER LINE

TO SEPTIC FIELD
(SEE DETAIL THIS SHEET)

LAGOON AREA

EXPOSED STEEL PIPE ENCASING CLEAN WATERLINE

LOWER WEST AREA

VALVE BOXES WITH WOOD COVERS

RAILROAD CREEK

RAILROAD CREEK

FORMER SEPTIC FIELD

CLEAN WATER LOCATE (8" PVC)

HYDROPLANT

APPROXIMATE CLEAN WATER LOCATE

1" PVC DOMESTIC

4" DI FIRE

14" EXPOSED PENSTOCK

ABANDONED WATER LINE

LEVEL 2 8 'X 8' CONCRETE VALVE VAULT

EMERGENCY CROSS OVER

SHOP/ TREATMENT PLANT

TAILINGS PILE 1

APPROXIMATE LOCATION OF POTABLE WATER LINE FROM RESERVOIR (8" PVC)

1500 MAIN PORTAL

3" HDPE SLIPLINED IN 8" STEEL FINISHED WATER WITH 3/4" CND CONTAINING SIGNAL WIRE FOR RESERVOIR TRANSDUCER AND ELECTRIC SERVICE FOR THIRD LEVEL VAULT LIGHTING

RESERVOIR FILL LINE LOCATE (3" HDPE)

125,000 GALLON RESERVOIR

LEVEL 3 VALVE VAULT

EXPOSED PENSTOCK

APPROXIMATE PENSTOCK LOCATION CONTINUES TO RAW WATER INTAKE ON COPPER CREEK

USFS MONUMENT E

TAILINGS PILE 2

COPPER CREEK

HOLDEN VILLAGE SEPTIC FIELD

HOLDEN VILLAGE SEPTIC FIELD

SEWER LINE

FS ROAD 8301

SCALE
200 0 200 400 FEET
CONTOUR INTERVAL = 10 FEET

PLAN

SCALE
100 0 100 200 FEET
CONTOUR INTERVAL = 10 FEET

NOTE:

1. UTILITY LINE LOCATIONS ARE BASED ON SURVEY PERFORMED BY ERLANDSEN, INC SURVEY UNDERGROUND UTILITY LOCATE SERVICES.

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
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- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	03/28/11
DRAWN BY	R. WATT	03/28/11
CHECKED BY	D. RODRIGUEZ	03/28/11
APPROVED BY	P. CROUSE	03/28/11
PROJECT MANAGER	R. SCHLICER	03/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: EXISTING UTILITIES

MWH

SHEET: 1-11

REVISION: B

FILE NAME: 1008679D364

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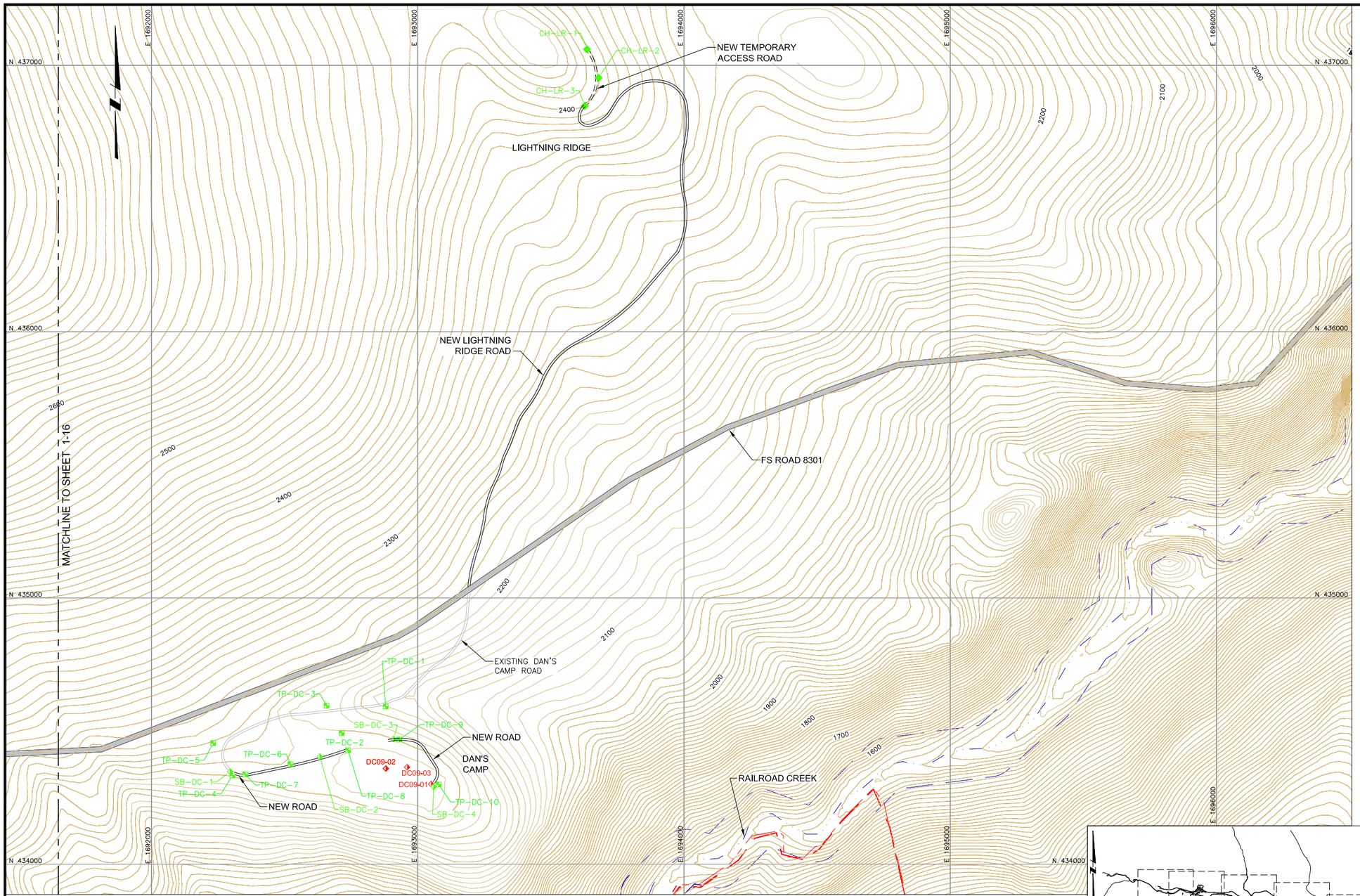
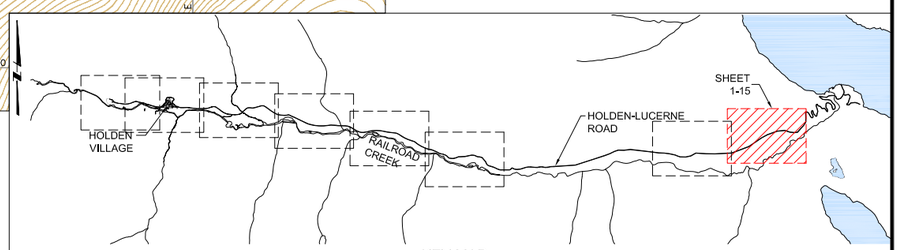


PLAN

SCALE
200 0 200 400 FEET
CONTOUR INTERVAL = 10 FEET

LEGEND:

TP1-1BB	BATT TIP
CPT-1	CONE PENETROMETER TEST PROBE
SG-1-WP	DRIVEN WELL POINT
SB-1	GEOTECHNICAL BORING EXPLORATION
HB-1	HAND AUGER
TP2-9L	LYSIMETER
P-1 (HC-1975)	PERMEABILITY TEST
SP-3	SEEP
SG-1	STAFF GAUGE
P-1	PORTAL DRAINAGE
CH-3	CORE HOLE
RC-6-PW-12	PORE WATER SAMPLER
RC-7	SURFACE WATER
TP-5	TEST PIT
1S/1I/1D	WELL (S = SHALLOW, I= INTERMEDIATE D = DEEP)
DS	DOWNSTREAM WELL
US	UPSTREAM WELL
NRC	NORTH OF RAILROAD CREEK WELL
PW	PUMPING WELL
TP1	TAILINGS PILE 1
TP2	TAILINGS PILE 2
TP3	TAILINGS PILE 3
THM	THREE AND ONE-HALF MILE
TM	TENMILE
UWTM	UPPER WEST TENMILE
LWTM	LOWER WEST TENMILE
RC	RAILROAD CREEK
DC	DAN'S CAMP
	CREEK FLOW DIRECTION
	INVENTORIED ROADLESS AREA
	GLACIER PEAK WILDERNESS BOUNDARY
	LATE SUCCESSIONAL RESERVE (LSR)
	2010 MWH INVESTIGATION LOCATIONS
	2009 URS INVESTIGATION LOCATIONS
	2008 URS INVESTIGATION LOCATIONS
	HISTORICAL INVESTIGATION LOCATIONS (BY OTHERS)



KEY MAP

SCALE
5000 0 5000 10000 FEET

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- AFTER URS DRAWING HOLDEN SAMPLING LOCATIONS (NO OBJECT DATA).
- MWH 2010 FIELD DATA SURVEY PROVIDED BY EHRLANDSEN SURVEYING DATED DECEMBER 27, 2010

DESIGNED BY	J. THOMPSON	03/28/11
DRAWN BY	R. WATT	03/28/11
CHECKED BY	D. RODRIGUEZ	03/28/11
APPROVED BY	P. CROUSE	03/28/11
PROJECT MANAGER	R. SCHLICHER	03/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: INVESTIGATION LOCATIONS (SHEET 1 OF 8)

MWH

SHEET 1-15 | REVISION B

FILE NAME 1008679D366

M:\Clients-Q-Z\Rio Tinto\1008679 - Holden Mine\013-Sheet Set\General\1008679D366 4/15/2011 4:27:55 PM

E 1687000
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2500
2400
2300
2200
2100
2000
THREE AND ONE-HALF MILE
NEW THREE AND ONE-HALF MILE TEMPORARY ROAD
FS ROAD 8301
RAILROAD CREEK
CH-THM-1
CH-THM-2
CH-THM-3
TP-THM-1
TP-THM-2
TP-THM-3
TP-THM-4
TP-THM-5
TP-THM-6
MATCHLINE TO SHEET 1-16

PLAN

SCALE
200 0 200 400 FEET
CONTOUR INTERVAL = 10 FEET

LEGEND:

- TP1-1BB — BATT TIP
- CPT-1 — CONE PENETROMETER TEST PROBE
- SG-1-WP — DRIVEN WELL POINT
- SB-1 — GEOTECHNICAL BORING EXPLORATION
- HB-1 — HAND AUGER
- TP2-9L — LYSIMETER
- P-1 (HC-1975) — PERMEABILITY TEST
- SP-3 — SEEP
- SG-1 — STAFF GAUGE
- P-1 — PORTAL DRAINAGE
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- DS — DOWNSTREAM WELL
- US — UPSTREAM WELL
- NRC — NORTH OF RAILROAD CREEK WELL
- PW — PUMPING WELL
- TP1 — TAILINGS PILE 1
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- TP3 — TAILINGS PILE 3
- THM — THREE AND ONE-HALF MILE
- TM — TENMILE
- UWTM — UPPER WEST TENMILE
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- RC — RAILROAD CREEK
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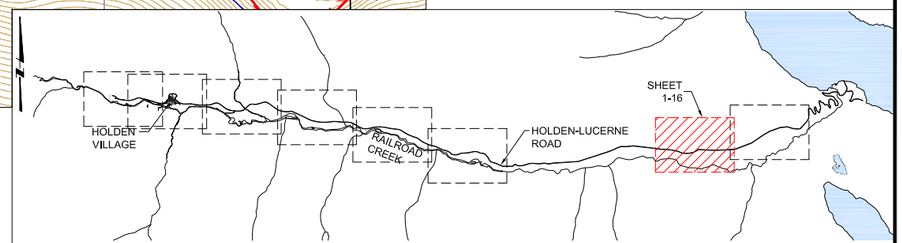

KEY MAP
SCALE
5000 0 5000 10000 FEET

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWN BY	R. WATT	03/28/11
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APPROVED BY	P. CROUSE	03/28/11
PROJECT MANAGER	R. SCHLICHER	03/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: INVESTIGATION LOCATIONS (SHEET 2 OF 8)

MWH

SHEET 1-16 | REVISION B
FILE NAME 1008679D367

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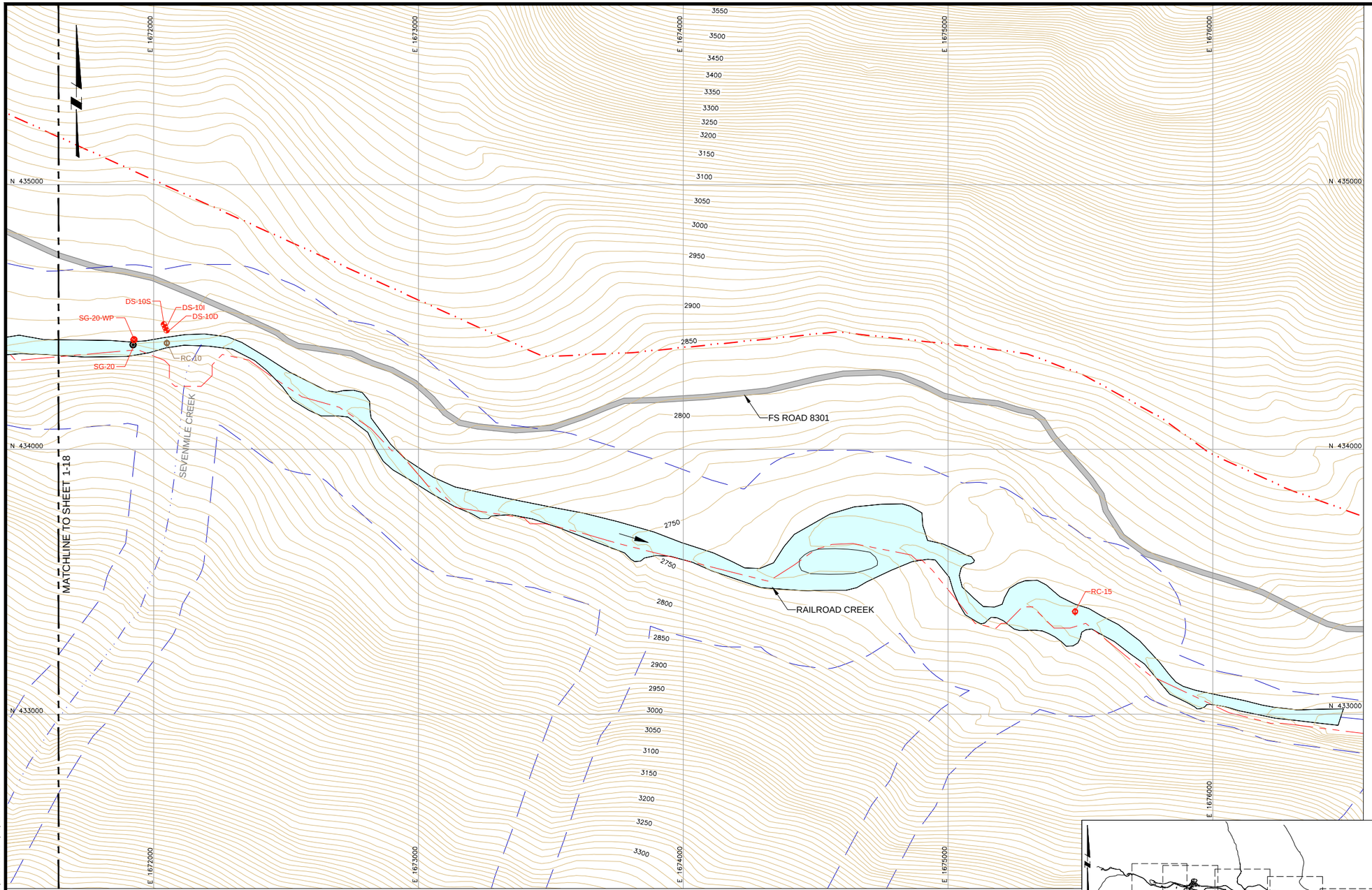

PLAN

SCALE

200 0 200 400 FEET

CONTOUR INTERVAL = 10 FEET

LEGEND:

- TP1-1BB — BATT TIP
- CPT-1 — CONE PENETROMETER TEST PROBE
- SG-1-WP — DRIVEN WELL POINT
- SB-1 — GEOTECHNICAL BORING EXPLORATION
- HB-1 — HAND AUGER
- TP2-9L — LYSIMETER
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- SP-3 — SEEP
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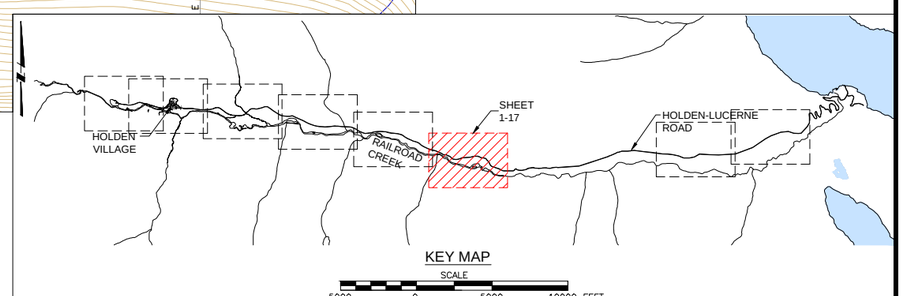

KEY MAP

SCALE

5000 0 5000 10000 FEET

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APPROVED BY	P. CROUSE	03/28/11
PROJECT MANAGER	R. SCHLICHER	03/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: INVESTIGATION LOCATIONS (SHEET 3 OF 8)

MWH

SHEET 1-17 | REVISION B

FILE NAME 1008679D368

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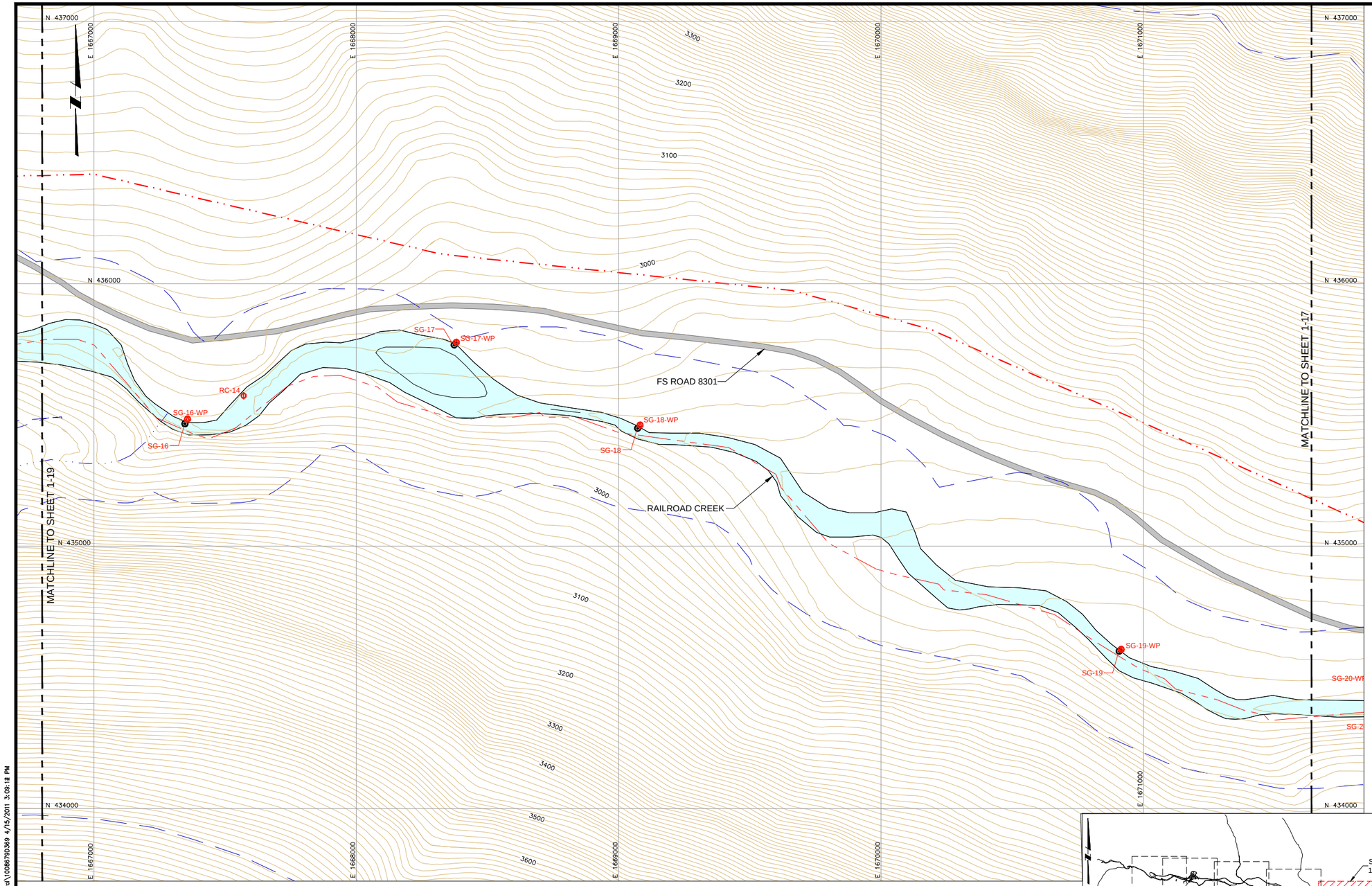

PLAN

SCALE
200 0 200 400 FEET
CONTOUR INTERVAL = 10 FEET

LEGEND:

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- CPT-1 — CONE PENETROMETER TEST PROBE
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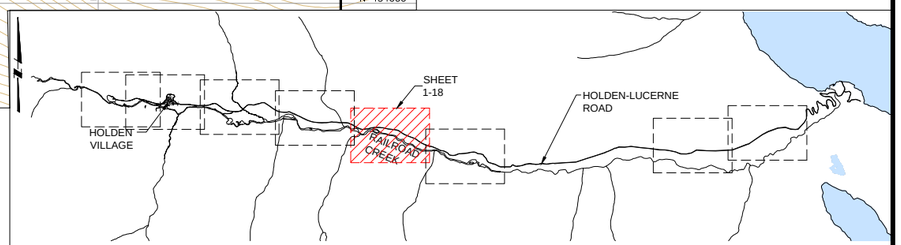

KEY MAP

SCALE
5000 0 5000 10000 FEET

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CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: INVESTIGATION LOCATIONS (SHEET 4 OF 8)

MWH

SHEET 1-18 | REVISION B
FILE NAME 1008679D369

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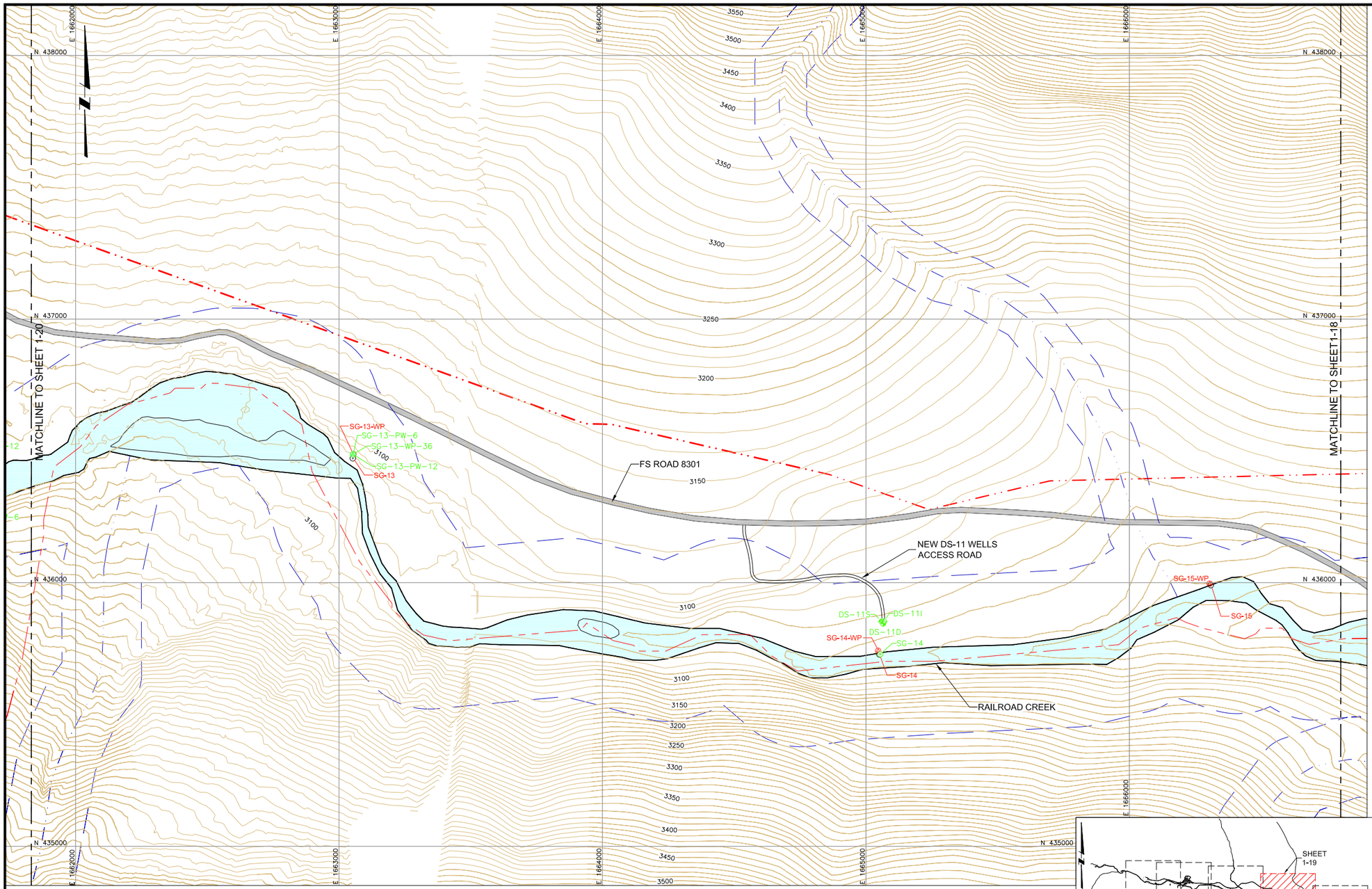

PLAN

SCALE
200 0 200 400 FEET
CONTOUR INTERVAL = 10 FEET

LEGEND:

TP1-1BB	BATT TIP
CPT-1	CONE PENETROMETER TEST PROBE
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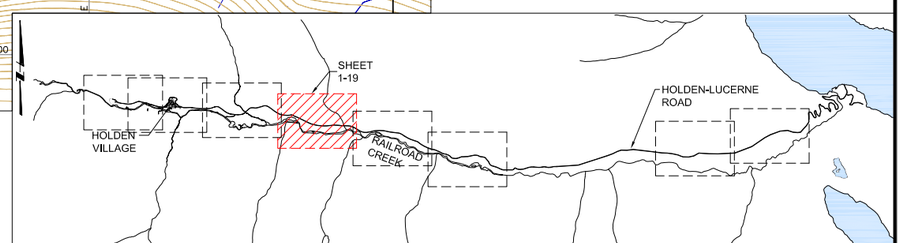

KEY MAP

SCALE
5000 0 5000 10000 FEET

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Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: INVESTIGATION LOCATIONS (SHEET 5 OF 8)

MWH

SHEET 1-19 | REVISION B
FILE NAME 1008679D370

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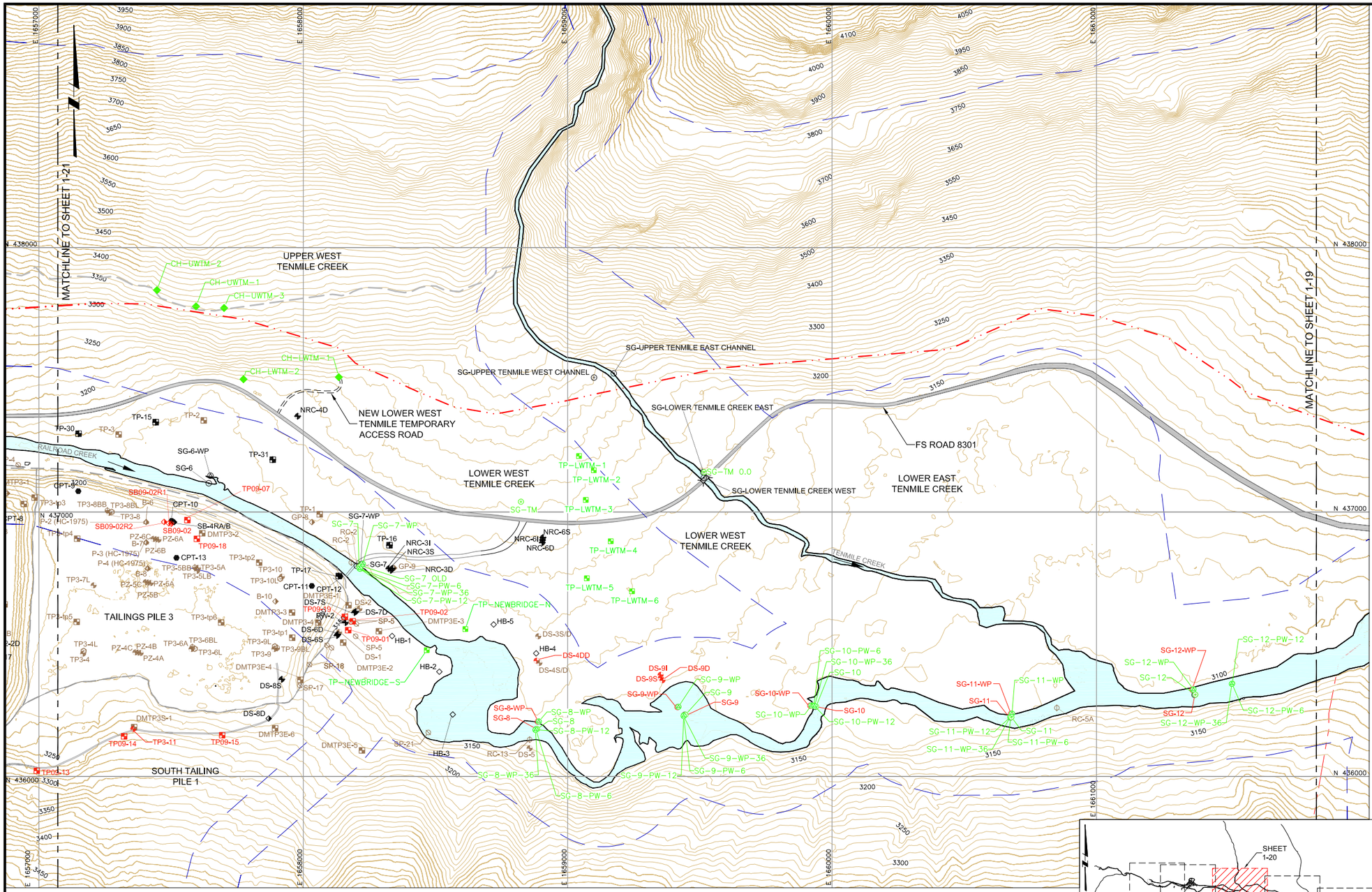

PLAN

SCALE
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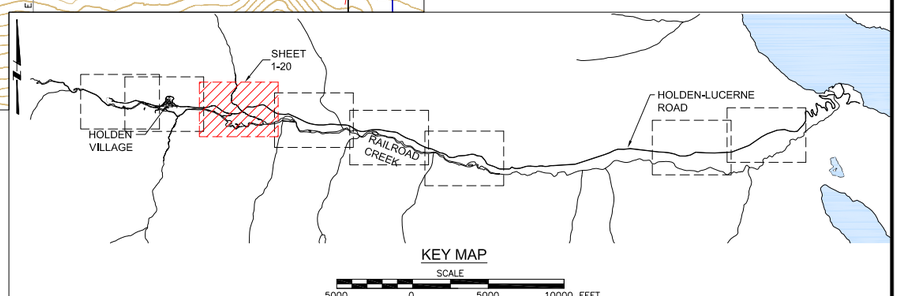
CONTOUR INTERVAL = 10 FEET



KEY MAP

SCALE
5000 0 5000 10000 FEET

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- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.
- AFTER URS DRAWING HOLDEN SAMPLING LOCATIONS (NO OBJECT DATA).
- MWH 2010 FIELD DATA SURVEY PROVIDED BY EHRLANDSEN SURVEYING DATED DECEMBER 27, 2010

DESIGNED BY	J. THOMPSON	03/28/11
DRAWN BY	R. WATT	03/28/11
CHECKED BY	D. RODRIGUEZ	03/28/11
APPROVED BY	P. CROUSE	03/28/11
PROJECT MANAGER	R. SCHLICHER	03/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: INVESTIGATION LOCATIONS (SHEET 6 OF 8)

MWH

SHEET 1-20 | REVISION A
FILE NAME 1008679D371

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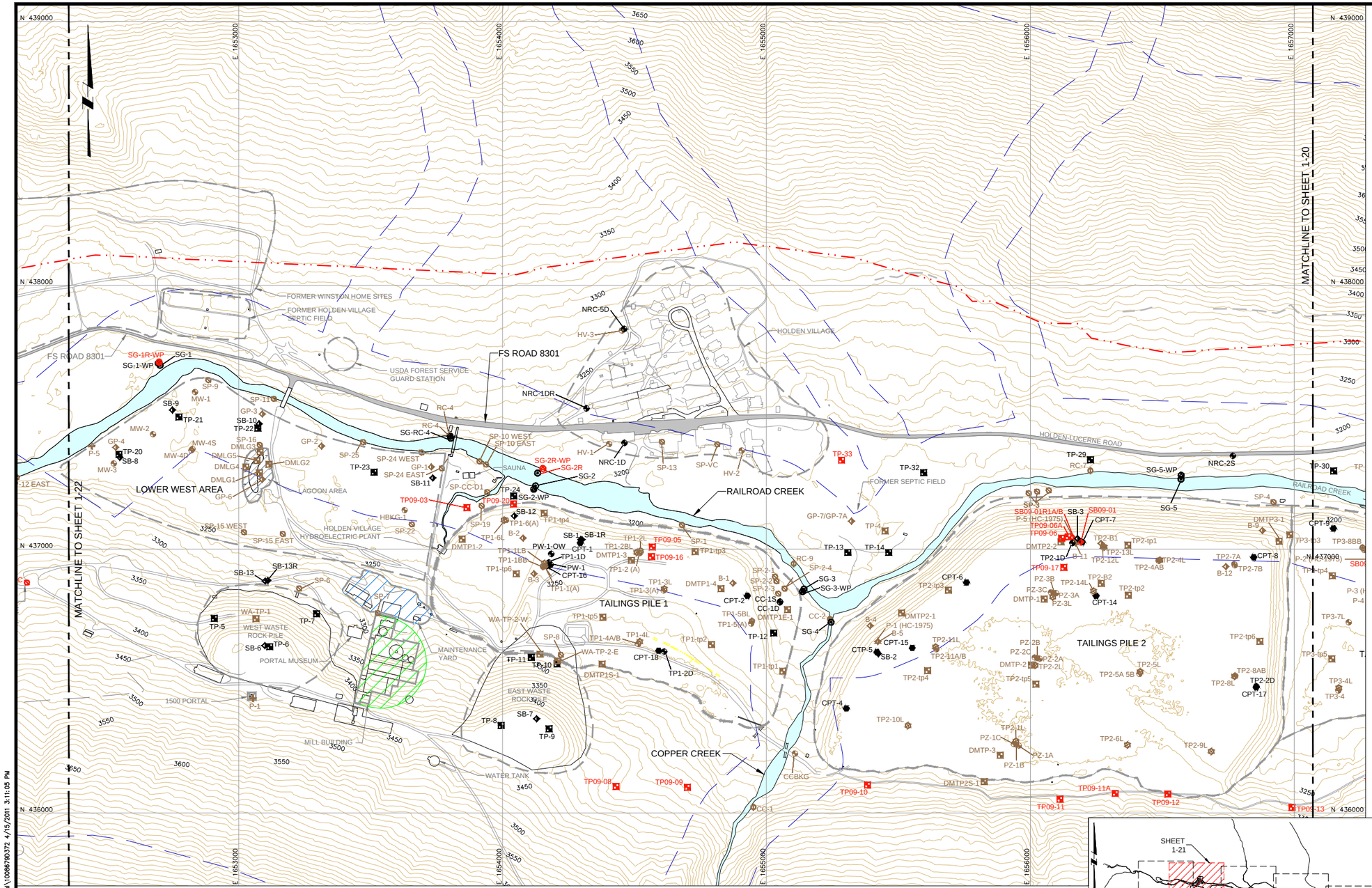


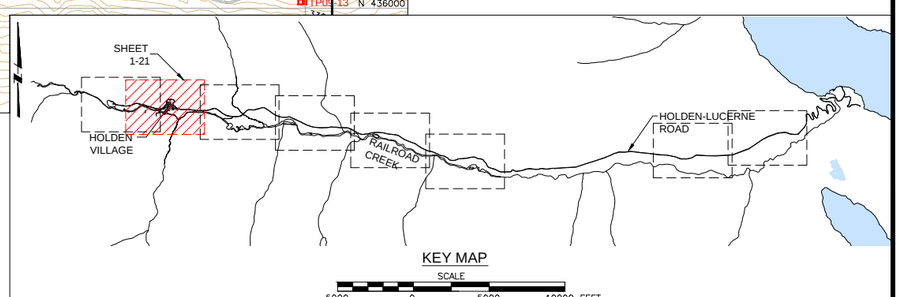
LEGEND:

TP1-1BB	BATT TIP
CPT-1	CONE PENETROMETER TEST PROBE
SG-1-WP	DRIVEN WELL POINT
SB-1	GEOTECHNICAL BORING EXPLORATION
HB-1	HAND AUGER
TP2-9L	LYSIMETER
P-1 (HC-1975)	PERMEABILITY TEST
SP-3	SEEP
SG-1	STAFF GAUGE
P-1	PORTAL DRAINAGE
CH-3	CORE HOLE
RC-6-PW-12	PORE WATER SAMPLER
RC-7	SURFACE WATER
TP-5	TEST PIT
1S/1I/1D	WELL (S = SHALLOW, I= INTERMEDIATE D = DEEP)
DS	DOWNSTREAM WELL
US	UPSTREAM WELL
NRC	NORTH OF RAILROAD CREEK WELL
PW	PUMPING WELL
TP1	TAILINGS PILE 1
TP2	TAILINGS PILE 2
TP3	TAILINGS PILE 3
THM	THREE AND ONE-HALF MILE
TM	TENMILE
UWTM	UPPER WEST TENMILE
LWTM	LOWER WEST TENMILE
RC	RAILROAD CREEK
DC	DAN'S CAMP

- CREEK FLOW DIRECTION
- INVENTORIED ROADLESS AREA
- GLACIER PEAK WILDERNESS BOUNDARY
- LATE SUCCESSIONAL RESERVE (LSR)
- APPROXIMATE LIMITS OF PRINCIPAL SITE FEATURES
- 2010 MWH INVESTIGATION LOCATIONS
- 2009 URS INVESTIGATION LOCATIONS
- 2008 URS INVESTIGATION LOCATIONS
- HISTORICAL INVESTIGATION LOCATIONS (BY OTHERS)

PLAN

SCALE
200 0 200 400 FEET
CONTOUR INTERVAL = 10 FEET



KEY MAP

SCALE
5000 0 5000 10000 FEET

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

DISCLAIMER:
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- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.
- AFTER URS DRAWING HOLDEN SAMPLING LOCATIONS (NO OBJECT DATA).
- MWH 2010 FIELD DATA SURVEY PROVIDED BY EHRLANDSEN SURVEYING DATED DECEMBER 27, 2010

DESIGNED BY	J. THOMPSON	03/28/11
DRAWN BY	R. WATT	03/28/11
CHECKED BY	D. RODRIGUEZ	03/28/11
APPROVED BY	P. CROUSE	03/28/11
PROJECT MANAGER	R. SCHLICHER	03/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: INVESTIGATION LOCATIONS (SHEET 7 OF 8)

MWH

SHEET 1-21 | REVISION B
FILE NAME 1008679D372

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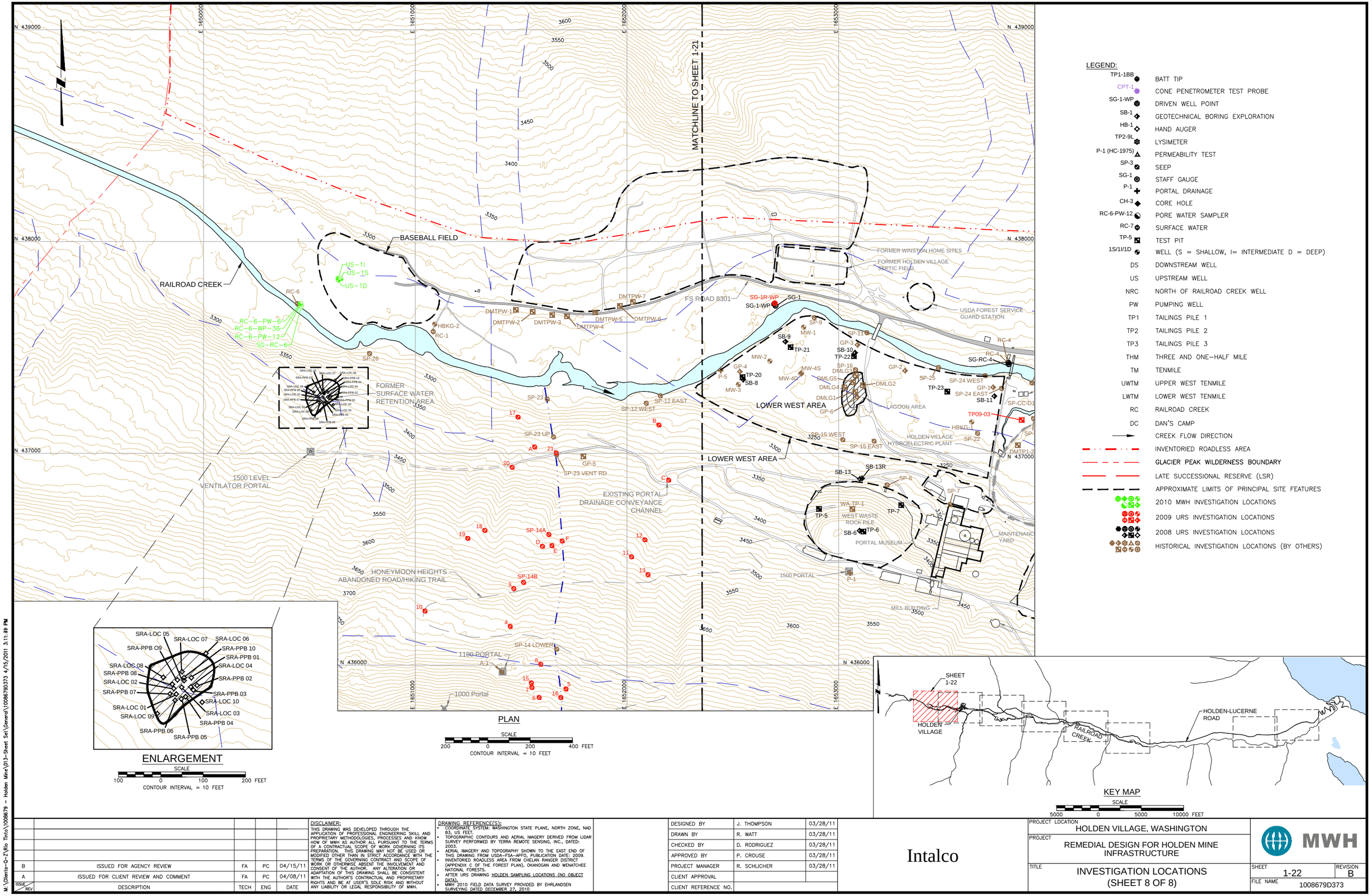

ENLARGEMENT

SCALE
100 0 100 200 FEET
CONTOUR INTERVAL = 10 FEET

PLAN

SCALE
200 0 200 400 FEET
CONTOUR INTERVAL = 10 FEET

KEY MAP

SCALE
5000 0 5000 10000 FEET

LEGEND:

- TP1-1BB — BATT TIP
- CPT-1 — CONE PENETROMETER TEST PROBE
- SG-1-WP — DRIVEN WELL POINT
- SB-1 — GEOTECHNICAL BORING EXPLORATION
- HB-1 — HAND AUGER
- TP2-9L — LYSIMETER
- P-1 (HC-1975) — PERMEABILITY TEST
- SP-3 — SEEP
- SG-1 — STAFF GAUGE
- P-1 — PORTAL DRAINAGE
- CH-3 — CORE HOLE
- RC-6-PW-12 — PORE WATER SAMPLER
- RC-7 — SURFACE WATER
- TP-5 — TEST PIT
- 1S/1I/1D — WELL (S = SHALLOW, I= INTERMEDIATE D = DEEP)
- DS — DOWNSTREAM WELL
- US — UPSTREAM WELL
- NRC — NORTH OF RAILROAD CREEK WELL
- PW — PUMPING WELL
- TP1 — TAILINGS PILE 1
- TP2 — TAILINGS PILE 2
- TP3 — TAILINGS PILE 3
- THM — THREE AND ONE—HALF MILE
- TM — TENMILE
- UWTM — UPPER WEST TENMILE
- LWTM — LOWER WEST TENMILE
- RC — RAILROAD CREEK
- DC — DAN'S CAMP
- CREEK FLOW DIRECTION
- INVENTORIED ROADLESS AREA
- GLACIER PEAK WILDERNESS BOUNDARY
- LATE SUCCESSIONAL RESERVE (LSR)
- APPROXIMATE LIMITS OF PRINCIPAL SITE FEATURES
- 2010 MWH INVESTIGATION LOCATIONS
- 2009 URS INVESTIGATION LOCATIONS
- 2008 URS INVESTIGATION LOCATIONS
- HISTORICAL INVESTIGATION LOCATIONS (BY OTHERS)

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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- AFTER URS DRAWING HOLDEN SAMPLING LOCATIONS (NO OBJECT DATA).
- MWH 2010 FIELD DATA SURVEY PROVIDED BY EHRLANDSEN SURVEYING DATED DECEMBER 27, 2010

DESIGNED BY	J. THOMPSON	03/28/11
DRAWN BY	R. WATT	03/28/11
CHECKED BY	D. RODRIGUEZ	03/28/11
APPROVED BY	P. CROUSE	03/28/11
PROJECT MANAGER	R. SCHLICHER	03/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: INVESTIGATION LOCATIONS (SHEET 8 OF 8)

MWH

SHEET 1-22 | REVISION B

FILE NAME 1008679D373

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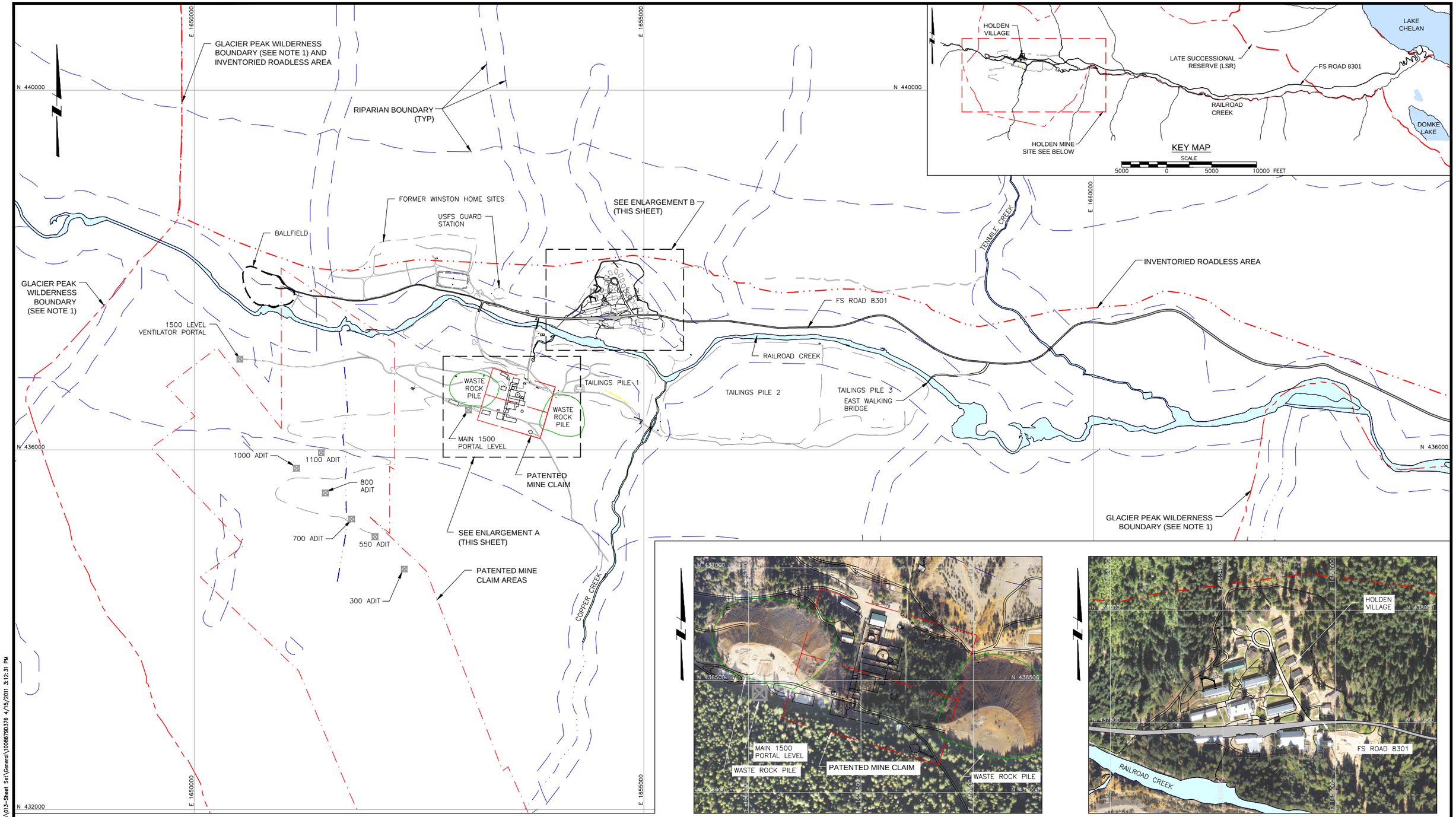

NOTE:

1. GLACIER PEAK WILDERNESS BOUNDARY LOCATION CONSIDERED APPROXIMATE AT THIS TIME (SOURCE: WILDERNESS.NET).

PLAN
SCALE
500 0 500 1000 FEET

ENLARGEMENT A
MILL FACILITIES
SCALE
200 0 200 400 FEET

ENLARGEMENT B
HOLDEN VILLAGE
SCALE
200 0 200 400 FEET

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DESIGNED BY	D. RODRIGUEZ	04/04/11
DRAWN BY	R. WATT	04/04/11
CHECKED BY	D. RODRIGUEZ	04/04/11
APPROVED BY	P. CROUSE	04/04/11
PROJECT MANAGER	R. SCHLICHER	04/04/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: SITE BOUNDARIES MAP

MWH

SHEET: 1-23
REVISION: B
FILE NAME: 1008679D376

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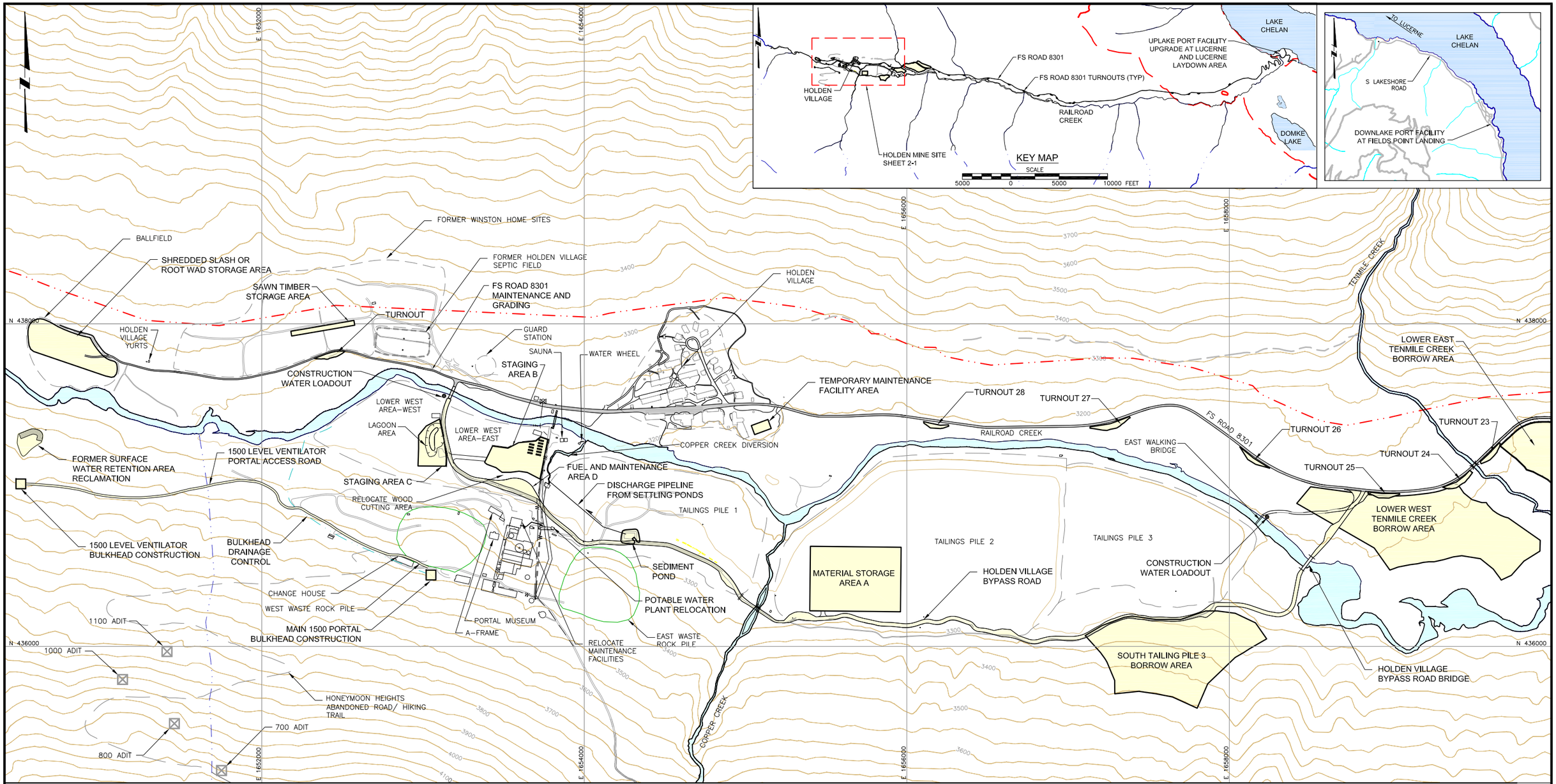

LEGEND:

YEAR 1 SITE DEVELOPMENT FEATURE

PLAN
SCALE
300 0 300 600 FEET
CONTOUR INTERVAL = 50 FEET

NOTES:

1. TURNOUTS SHOWN ON SHEETS 10–3–12 THROUGH 10–3–25, SHALL BE INCLUDED IN YEAR 1 SITE DEVELOPMENT.
2. THE WOOD CUTTING AREA SHALL BE RELOCATED TO THE SAWN TIMBER STORAGE AREA OR THE BALLFIELD.
3. THE MAINTENANCE FACILITIES SHALL BE RELOCATED.

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	F.A	P.G.C.	04/15/11
A	ISSUED FOR CLIENT COMMENT AND REVIEW	F.A.	P.G.C.	04/08/11

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DESIGNED BY	DJR/RTL	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: YEAR 1 SITE DEVELOPMENT
SHEET: 2-1
REVISION: B
FILE NAME: 1008679D388

MWH

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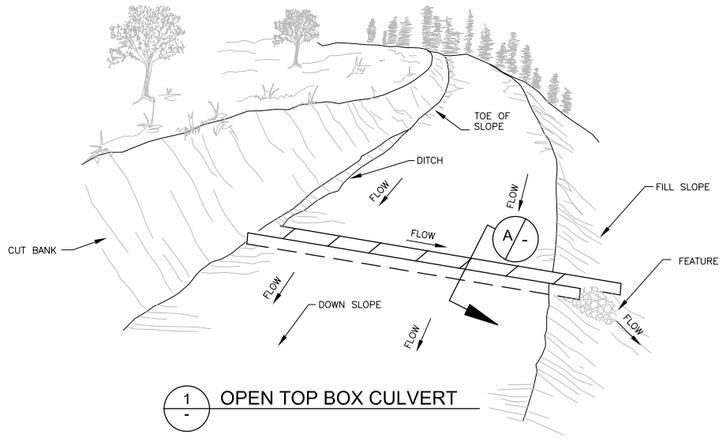
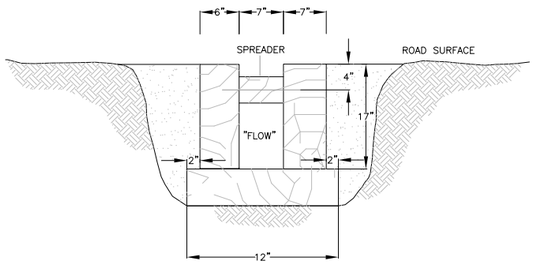
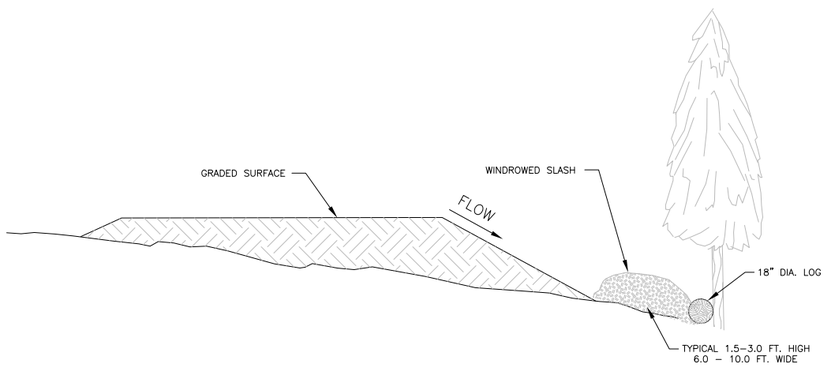


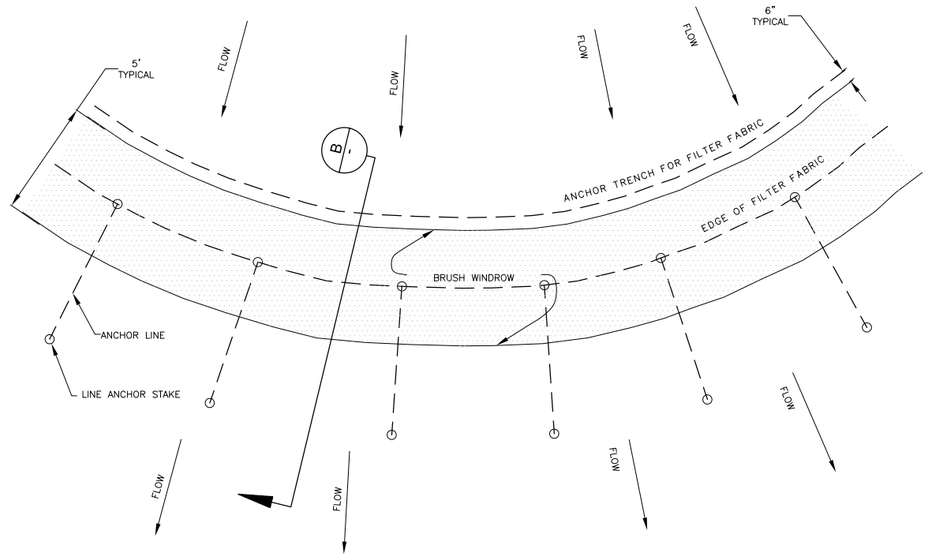
1 / - OPEN TOP BOX CULVERT



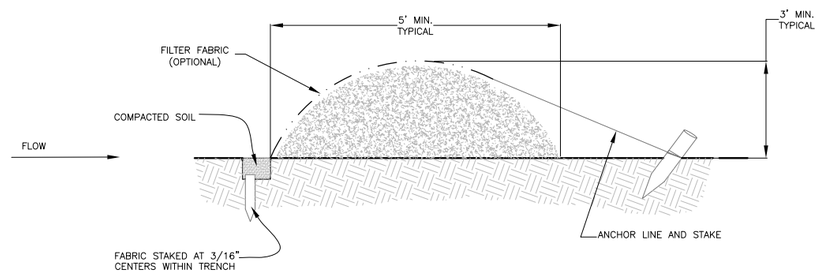
A / 1 OPEN TOP BOX CULVERT SECTION A-A'



2 / - SLASH FILTER WINDROW



3 / - BRUSH SEDIMENT BARRIER



B / - BRUSH SEDIMENT BARRIER B-B'

NOTES:

1. ALL BMPs ARE TYPICAL. SELECTION OF BMPs AND FINAL DESIGN DETAILS SHALL BE DETERMINED BY ENGINEER PRIOR TO CONSTRUCTION.
2. FIELD PLACEMENT SHALL BE DETERMINED BY ENGINEER DURING CONSTRUCTION.
3. THIS DRAWING IS NOT TO SCALE

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 1 OF 8)

MWH

SHEET: 4-9
REVISION: B
FILE NAME: 1008679D297

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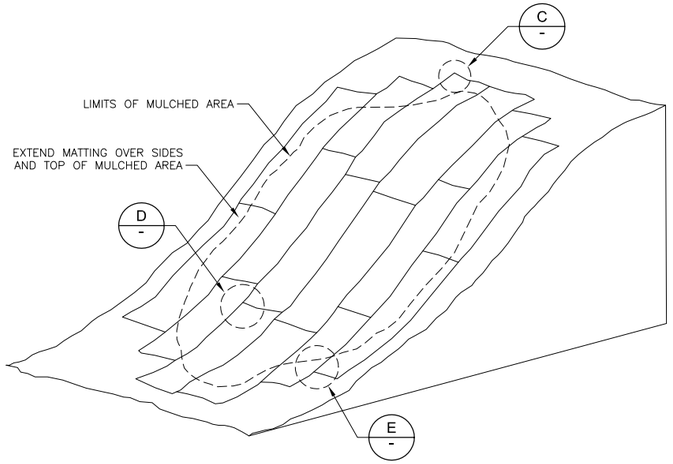
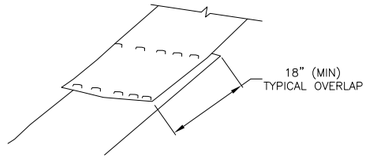
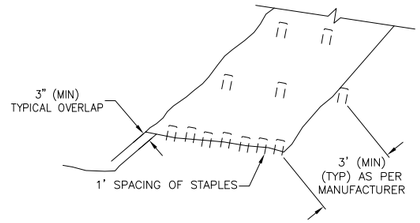


4 - EROSION CONTROL BLANKET



C - EROSION CONTROL BLANKET



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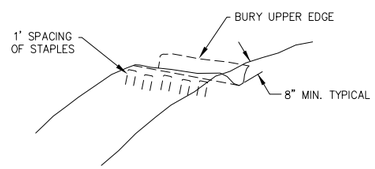

E - EROSION CONTROL BLANKET

NOTES:

1. ALL BMPs ARE TYPICAL. SELECTION OF BMPs AND FINAL DESIGN DETAILS SHALL BE DETERMINED BY ENGINEER PRIOR TO CONSTRUCTION.
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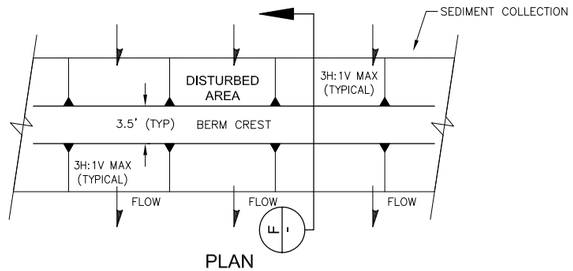
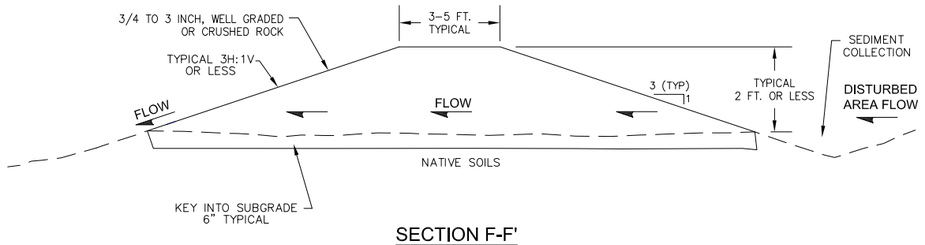
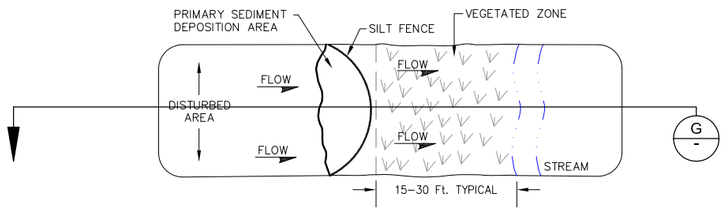


PLAN

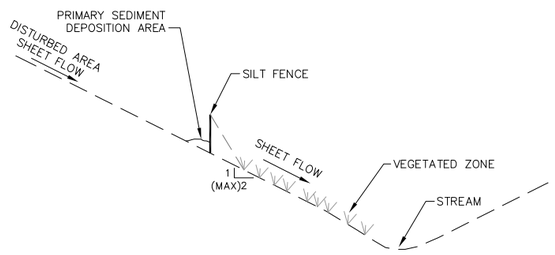


SECTION F-F'

5 - GRAVEL FILTER BERM



6 - VEGETATED BUFFER ZONE



G - VEGETATED BUFFER ZONE'

REV	DESCRIPTION	TECH	ENG	DATE
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A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

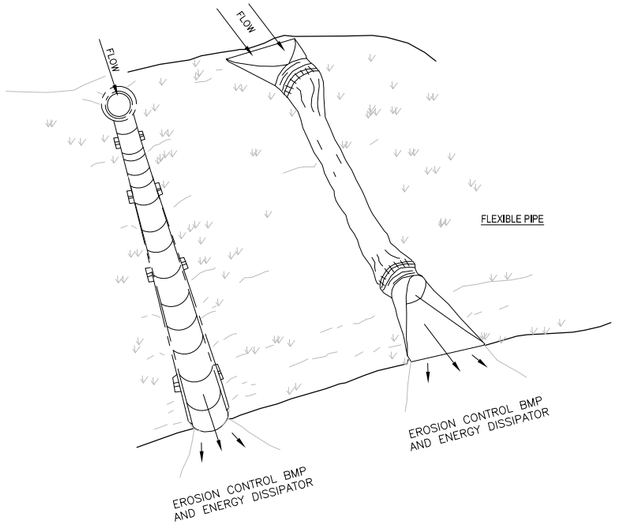
Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 2 OF 8)

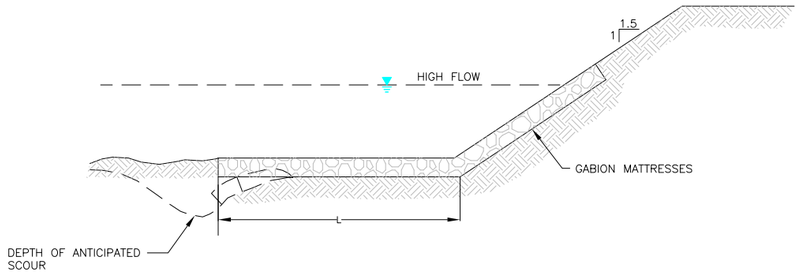
MWH

SHEET: 4-10
REVISION: B
FILE NAME: 1008679D298

M:\Clients-0-Z\Rio Tinto\1008679 - Holden Mine\013-Sheet Set\Surface Water And Sediment Control\1008679D298 4/15/2011 3:09:43 PM

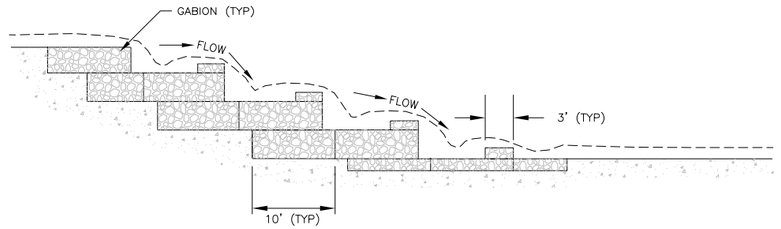


7 - NON-ROCK DROP STRUCTURES



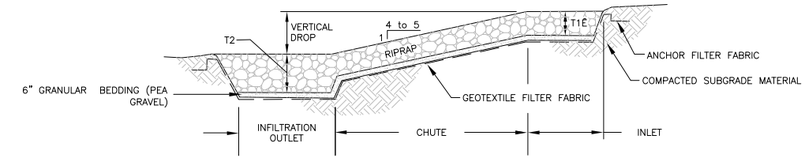
SECTION

9 - SLOPE STABILIZATION

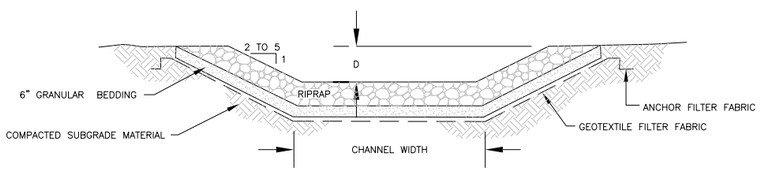


SECTION

10 - EROSION CONTROL

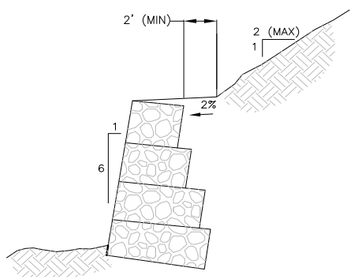


SECTION



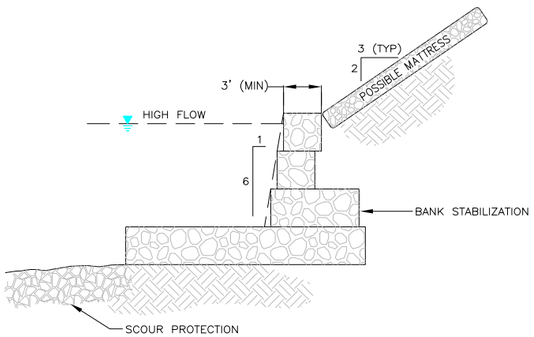
END VIEW

8 - TYPICAL RIPRAP DROP STRUCTURE



SECTION

RETAINING WALL



SECTION

BANK STABILIZATION

11 - GABIONS

M:\Clients-Q-Z\Rio Tinto\1008679 - Holden Mine\013-Sheet Set\Surface Water And Sediment Control\1008679D299 4/15/2011 3:09:48 PM

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
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CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

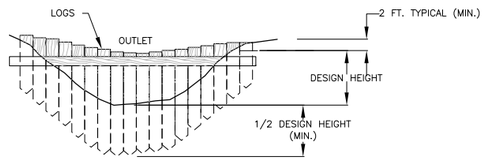
TITLE: BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 3 OF 8)

MWH

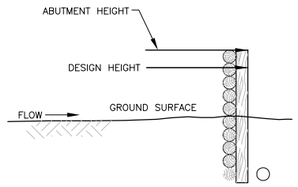
SHEET: 4-11

REVISION: B

FILE NAME: 1008679D299

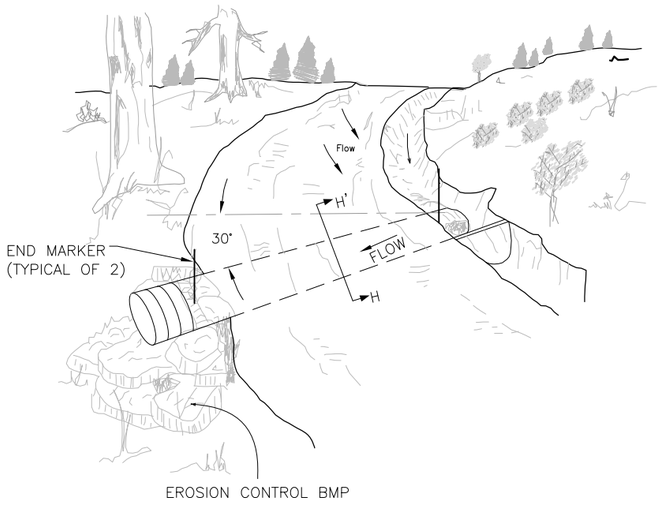


FRONT VIEW



SIDE VIEW

12 — LOG CHECK DAM



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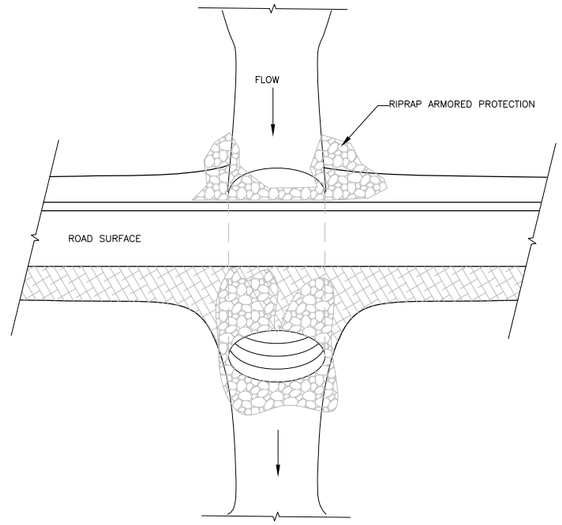
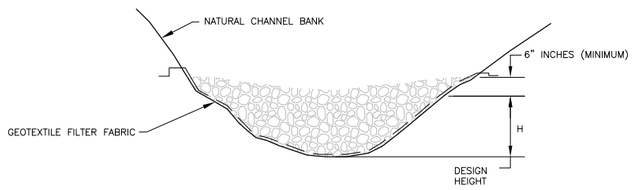


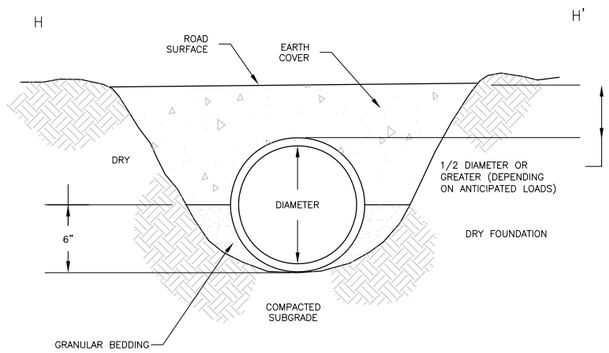
ISOMETRIC VIEW

SIDE VIEW



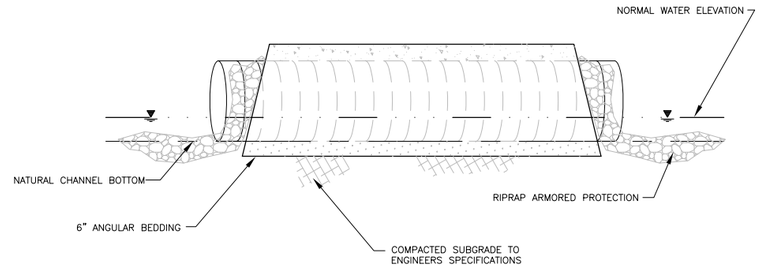
FRONT VIEW

13 — ROCK CHECK DAM



SECTION H-H'

14 — CULVERT CROSSING



ELEVATION

15 — CULVERT UNDER ROAD

NOTES:

1. ALL BMPs ARE TYPICAL. SELECTION OF BMPs AND FINAL DESIGN DETAILS SHALL BE DETERMINED BY ENGINEER PRIOR TO CONSTRUCTION.
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CLIENT APPROVAL		
CLIENT REFERENCE NO.		

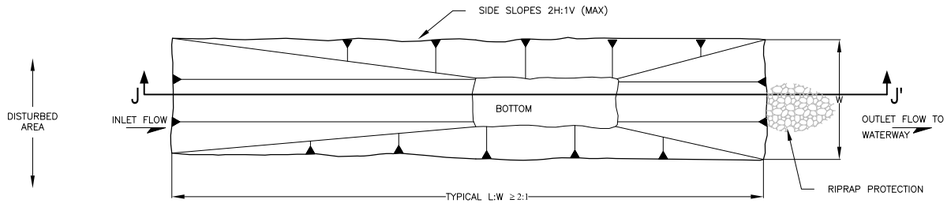
Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 4 OF 8)

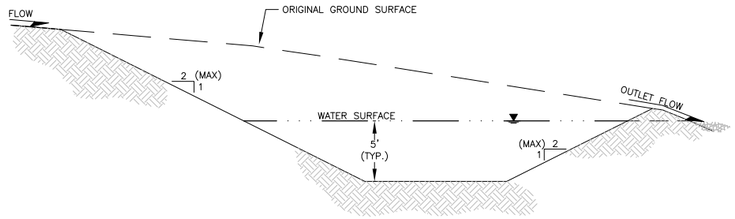
MWH

SHEET: 4-12
REVISION: B
FILE NAME: 1008679D300

M:\Clients--Q--Z\Rio Tinto\1008679 - Holden Mine\013-Sheet Set\Surface Water And Sediment Control\1008679D300 4/15/2011 3:09:54 PM

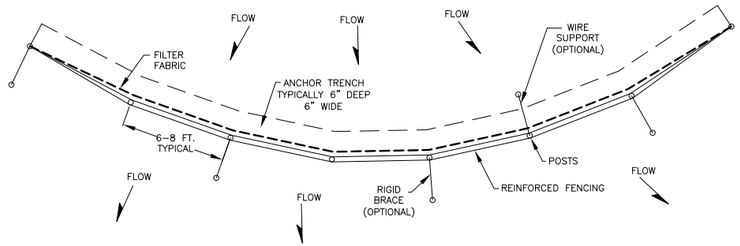


PLAN



SECTION J-J'

16 -- SEDIMENT TRAP OR CATCH BASIN



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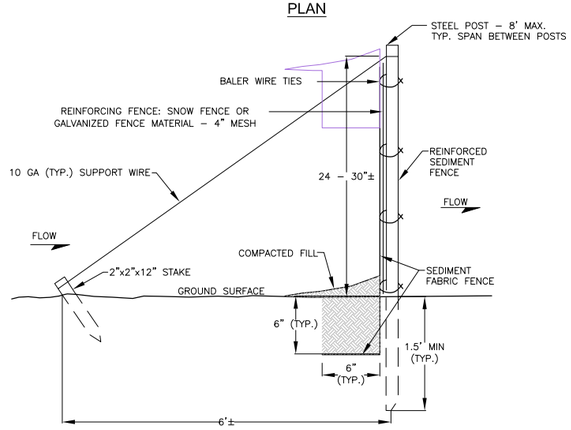
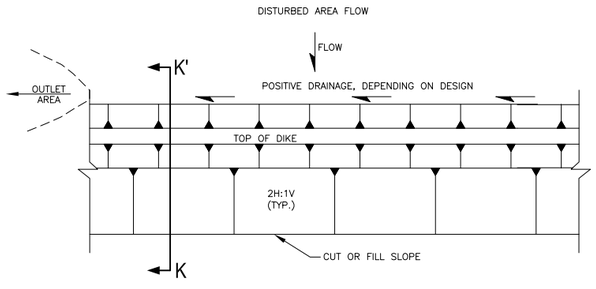


ELEVATION

18 -- TYPICAL FILTER FENCE INSTALLATION



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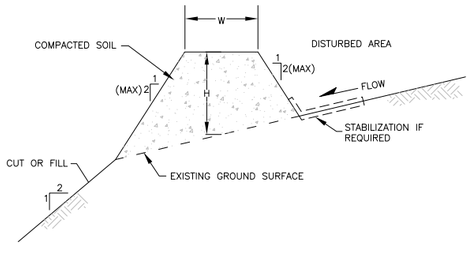
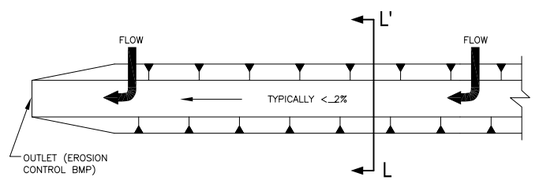


SECTION K-K'



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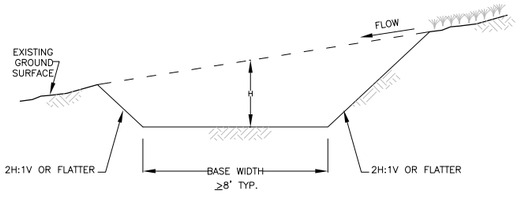

SECTION L-L'

NOTES:

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2. FIELD PLACEMENT SHALL BE DETERMINED BY ENGINEER DURING CONSTRUCTION.
3. THIS DRAWING IS NOT TO SCALE

17 -- DIVERSION DIKE

19 -- DIVERSION DITCH

REV	DESCRIPTION	TECH	ENG	DATE
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APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

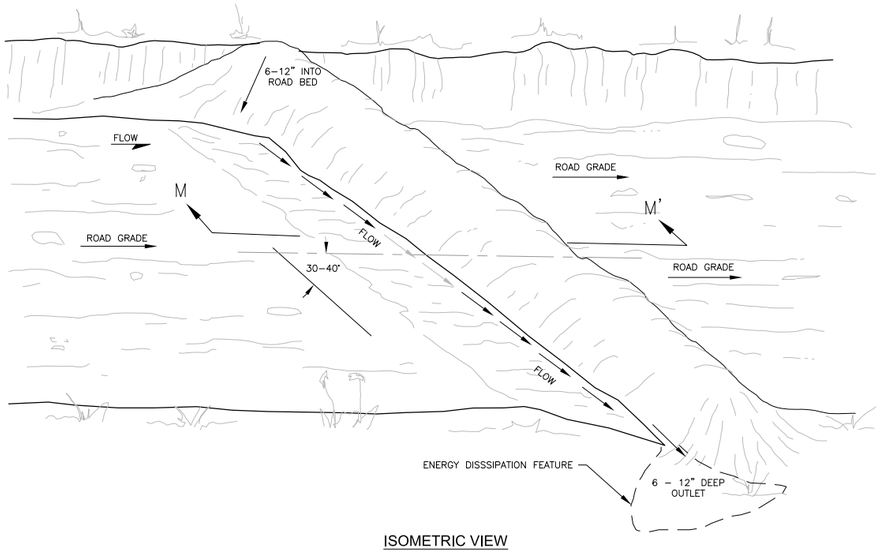
Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 5 OF 8)

MWH

SHEET: 4-13
REVISION: B
FILE NAME: 1008679D301

M:\Clients-Q-Z\Rio Tinto\1008679 - Holden Mine\013-Sheet Set\Surface Water And Sediment Control\1008679D301 4/15/2011 3:09:58 PM



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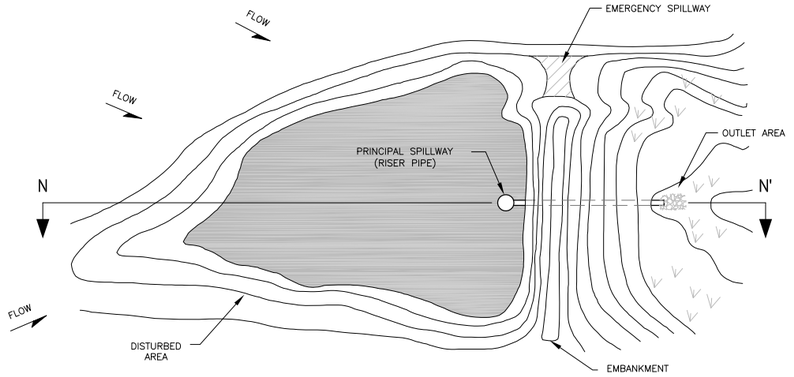
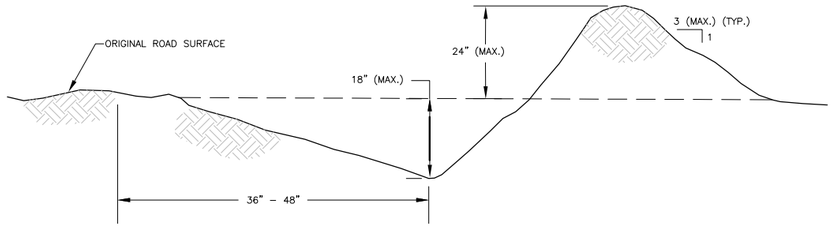
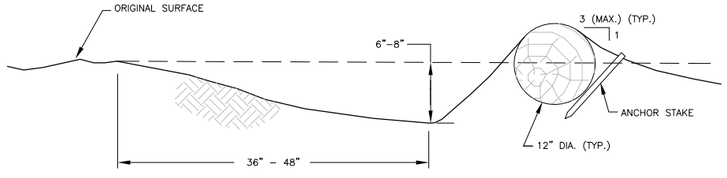


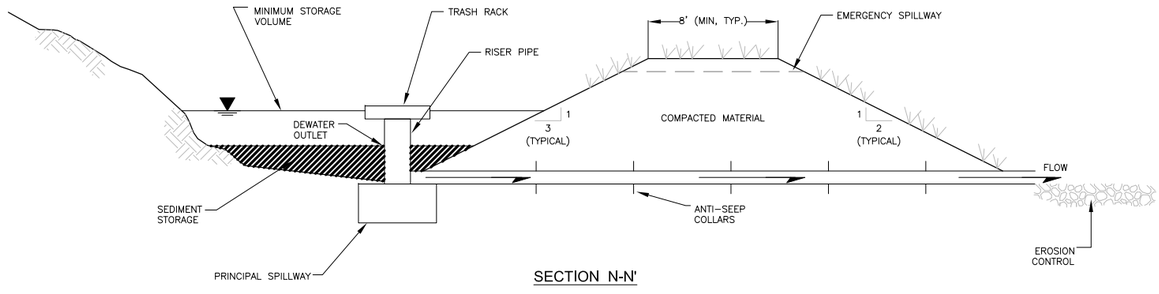
PLAN



M -- EARTHEN WATERBAR



20 -- EARTHEN AND LOG WATERBAR



SECTION N-N'

21 -- SEDIMENT DETENTION POND

NOTES:

1. ALL BMPs ARE TYPICAL. SELECTION OF BMPs AND FINAL DESIGN DETAILS SHALL BE DETERMINED BY ENGINEER PRIOR TO CONSTRUCTION.
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CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 6 OF 8)

MWH

SHEET: 4-14
REVISION: B
FILE NAME: 1008679D325

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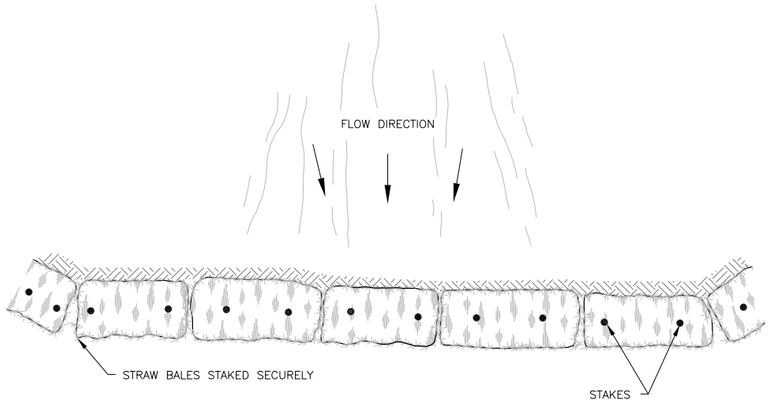
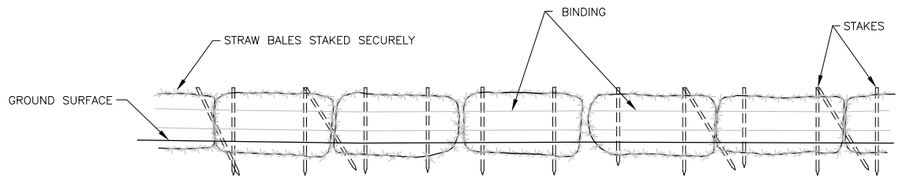
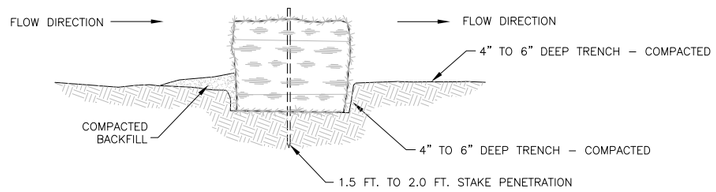


PLAN

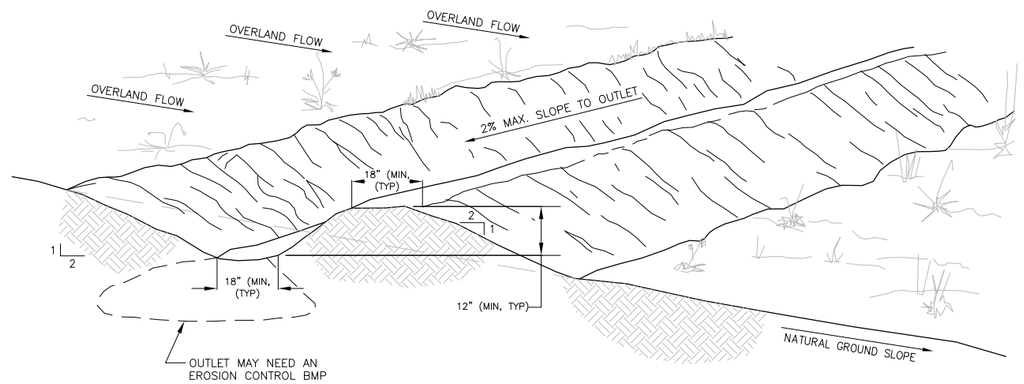


ELEVATION

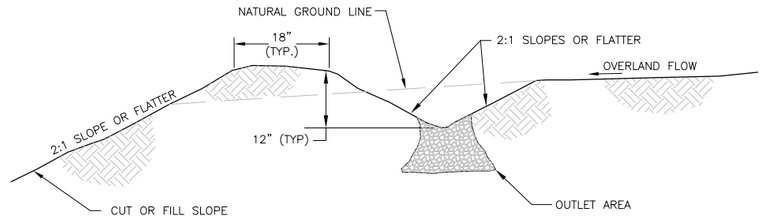


EMBEDDING DETAIL

22 - STRAW BALE BARRIER



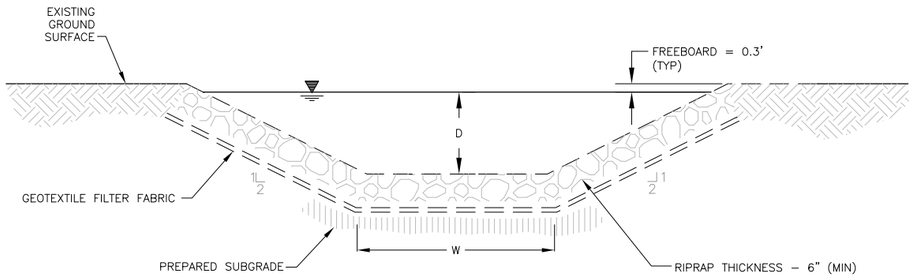
INTERCEPTOR TRENCH



END VIEW

NOTE:

1. BED OF TRENCH MAY BE RIP.RAPPED



D = DESIGN FLOW DEPTH
W = DESIGN WIDTH

NOTE:

1. A GEOTEXTILE FILTER FABRIC OR GRANULAR BEDDING MAY NOT ALWAYS BE NECESSARY.

23 - TYPICAL RIPRAP LINED DITCH

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DRAWING REFERENCE(S):

DESIGNED BY	P. PELLICER	02/28/11	
DRAWN BY	F. ANDRADE	02/28/11	
CHECKED BY	D. RODRIGUEZ	02/28/11	
APPROVED BY	P. CROUSE	02/28/11	
PROJECT MANAGER	R. SCHLICHER	02/28/11	
CLIENT APPROVAL			
CLIENT REFERENCE NO.			

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 7 OF 8)

MWH

SHEET: 4-15
REVISION: B
FILE NAME: 1008679D326

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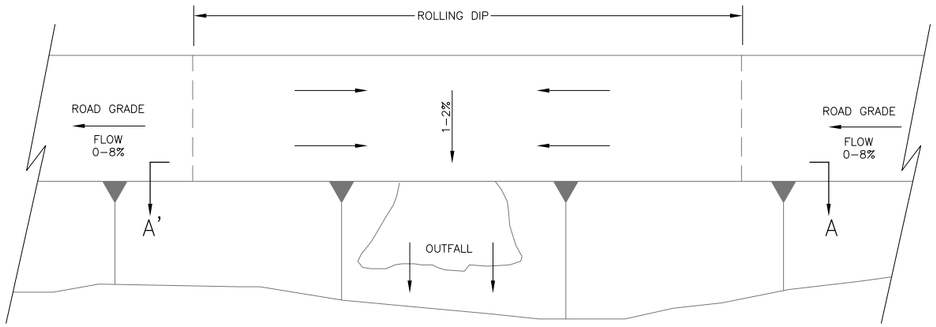

PLAN

A A'

SECTION A-A'

24 - ROLLING DIP

NOTE:

1. OUTFALL AREA MAY NEED AN EROSION CONTROL BMP.

NOTES:

1. ALL BMPs ARE TYPICAL. SELECTION OF BMPs AND FINAL DESIGN DETAILS TO BE DETERMINED BY ENGINEER PRIOR TO CONSTRUCTION.
2. FIELD PLACEMENT TO BE DETERMINED BY ENGINEER DURING CONSTRUCTION.
3. ALL DRAWINGS NOT TO SCALE.

ISSUE/REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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CHECKED BY	D. RODRIGUEZ	02/28/11	
APPROVED BY	P. CROUSE	02/28/11	
PROJECT MANAGER	R. SCHLICHER	02/28/11	
CLIENT APPROVAL			
CLIENT REFERENCE NO.			

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 8 OF 8)

MWH

SHEET: 4-16
REVISION: B
FILE NAME: 1008679D327

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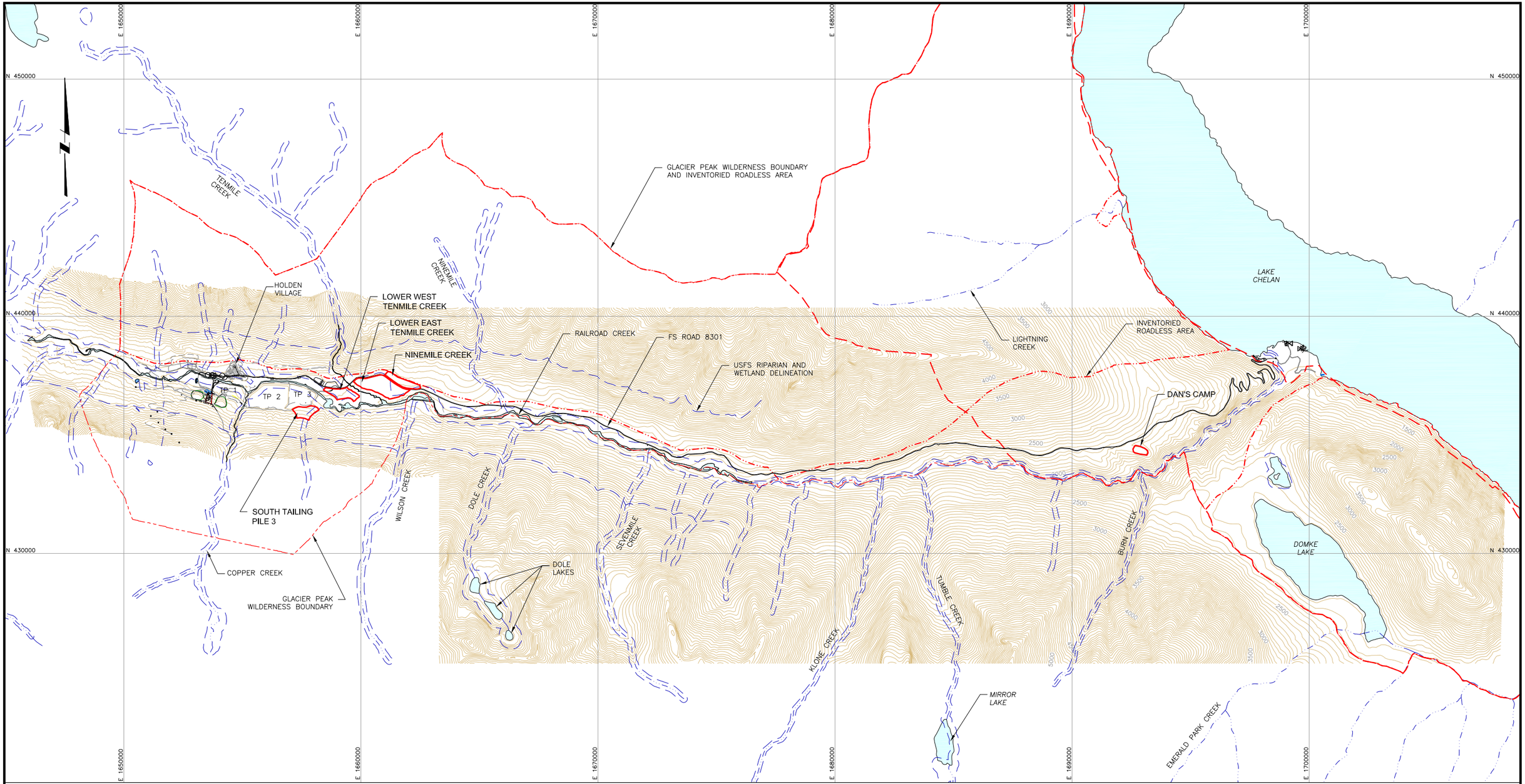

PLAN

SCALE

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CONTOUR INTERVAL = 50 FEET

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ISSUE / REV					
B	ISSUED FOR AGENCY REVIEW	F.A.	P.G.C.	04/15/11	
A	ISSUED FOR CLIENT COMMENT AND REVIEW	F.A.	P.G.C.	03/07/11	

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- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.
- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA–FSA–APFO, PUBLICATION DATE: 2009.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

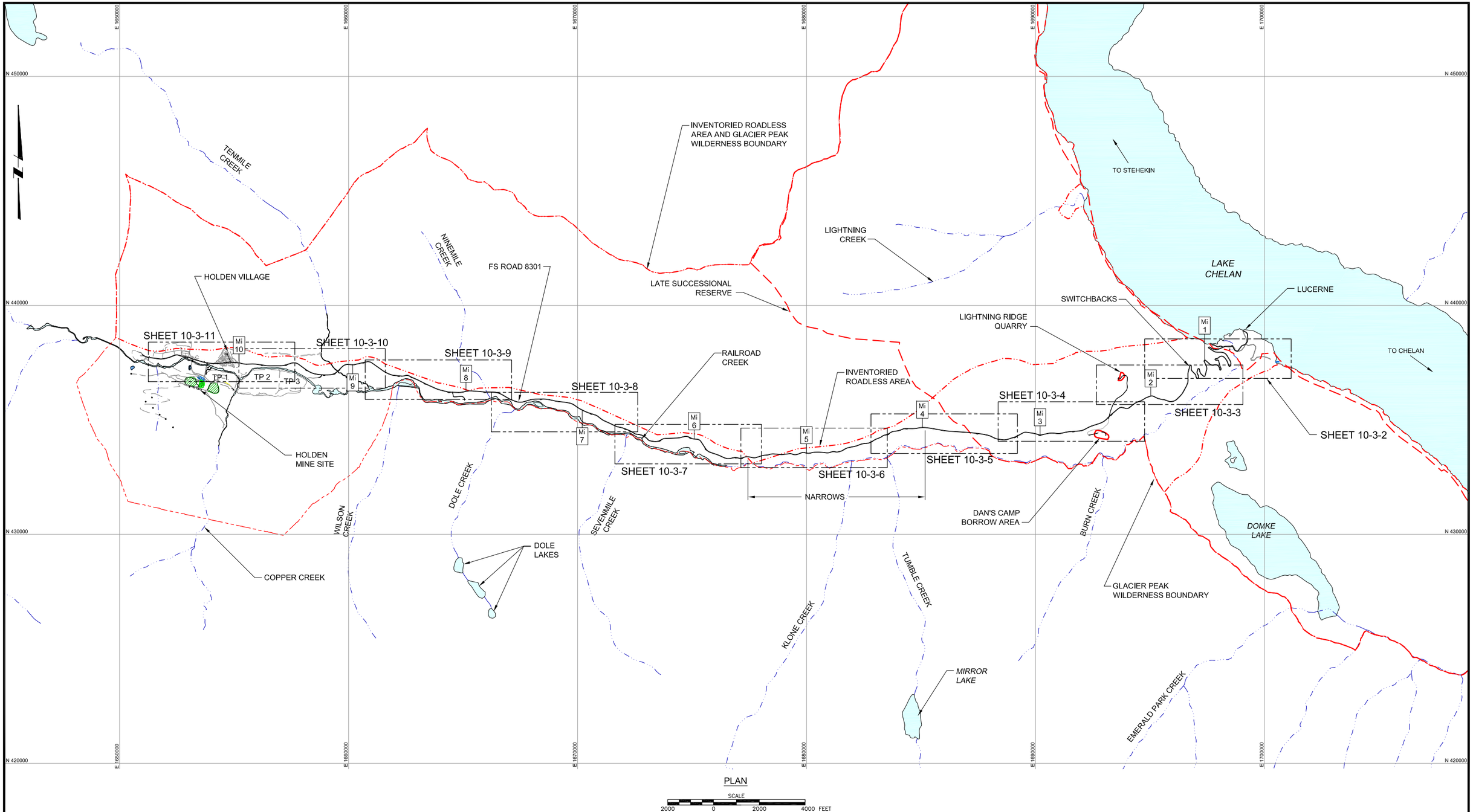
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: POTENTIAL BORROW SOURCE LOCATION MAP

MWH

SHEET 9-1 REVISION B

FILE NAME 1008679D383



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ISSUE REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.
- FS ROAD 8301 TOPOGRPAHY RECEIVED FROM ERLANDSEN DATED; JANUARY 18, 2011.

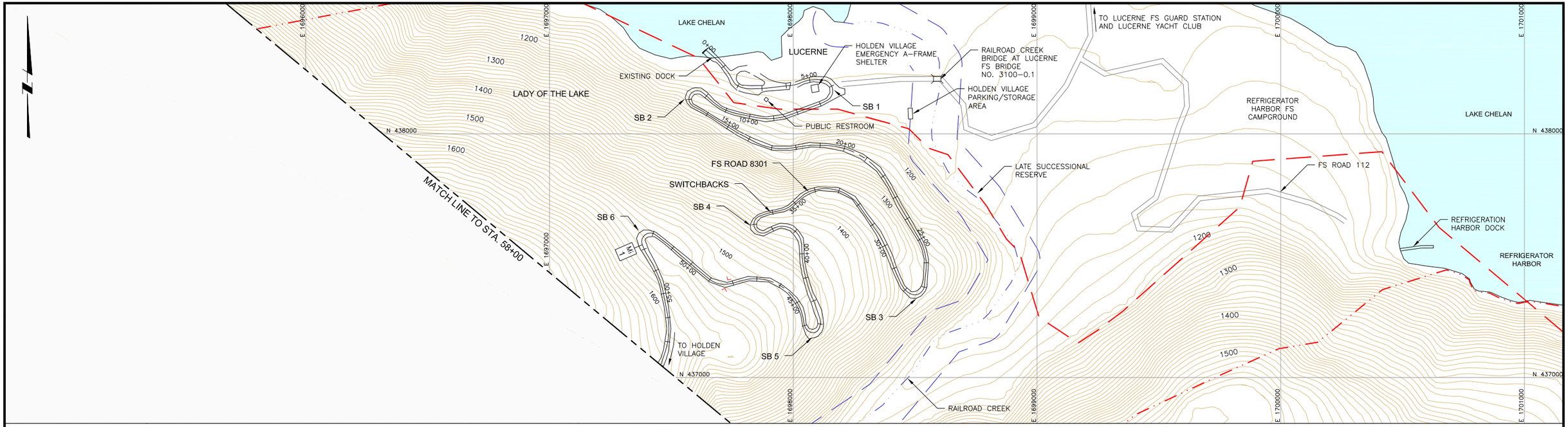
DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 KEY MAP

MWH

SHEET: 10-3-1
REVISION: B
FILE NAME: 1008679D237



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NOTE:

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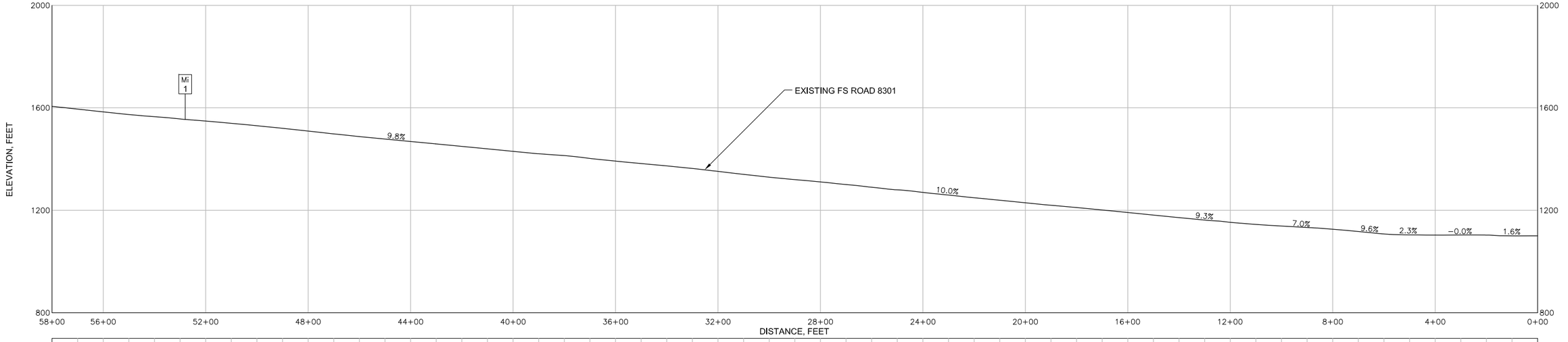

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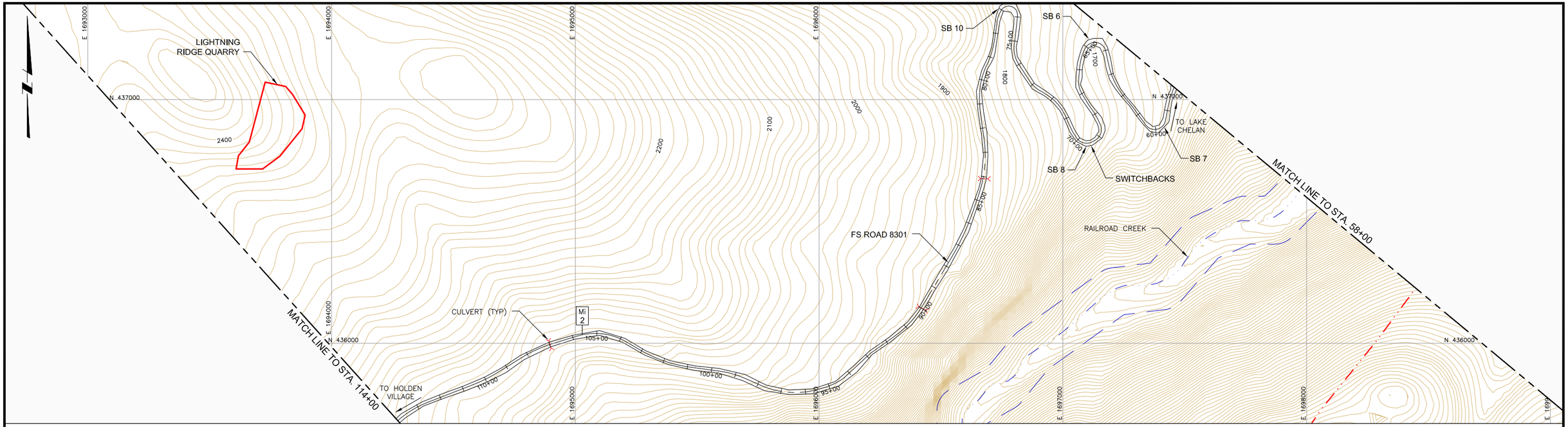

NOTE:

1. PLAN LOCATION SHOWN ON SHEET 10-3-1.

PLAN

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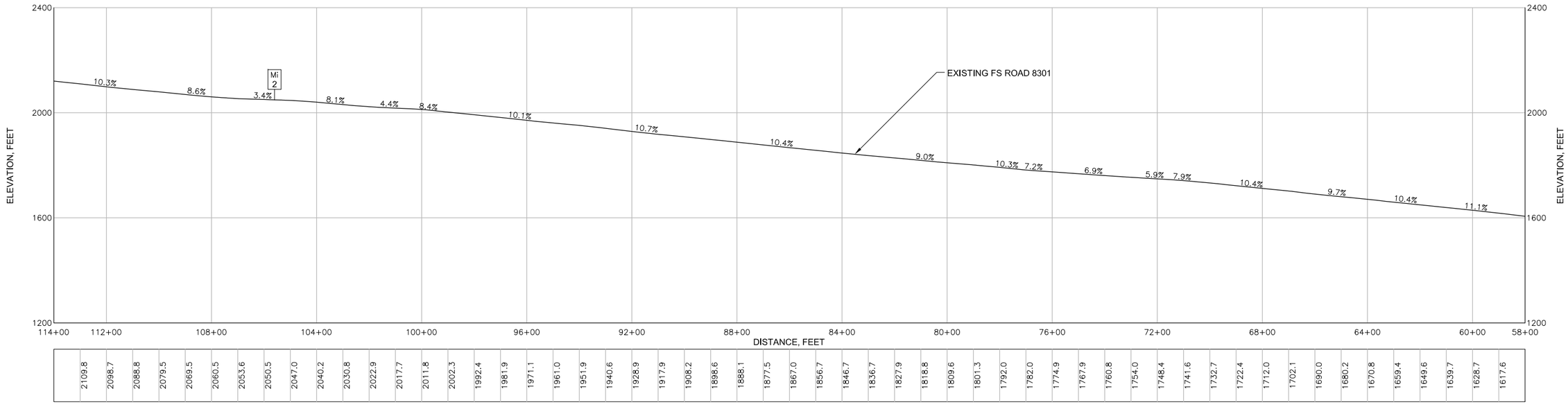
CONTOUR INTERVAL = 10 FEET



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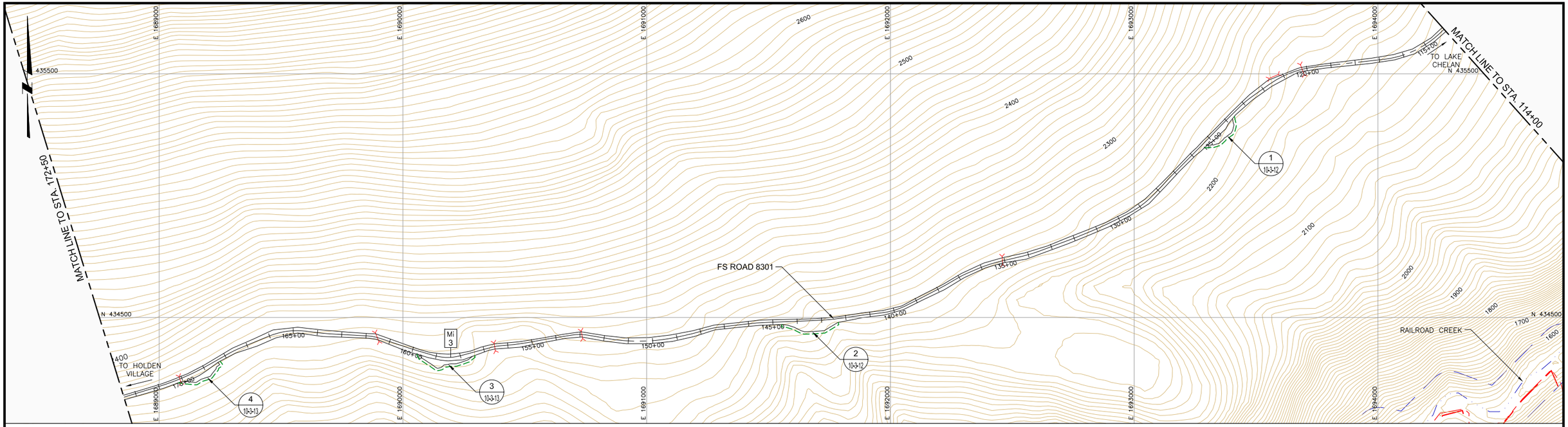

NOTE:

1. PLAN LOCATION SHOWN ON SHEET 10-3-1.

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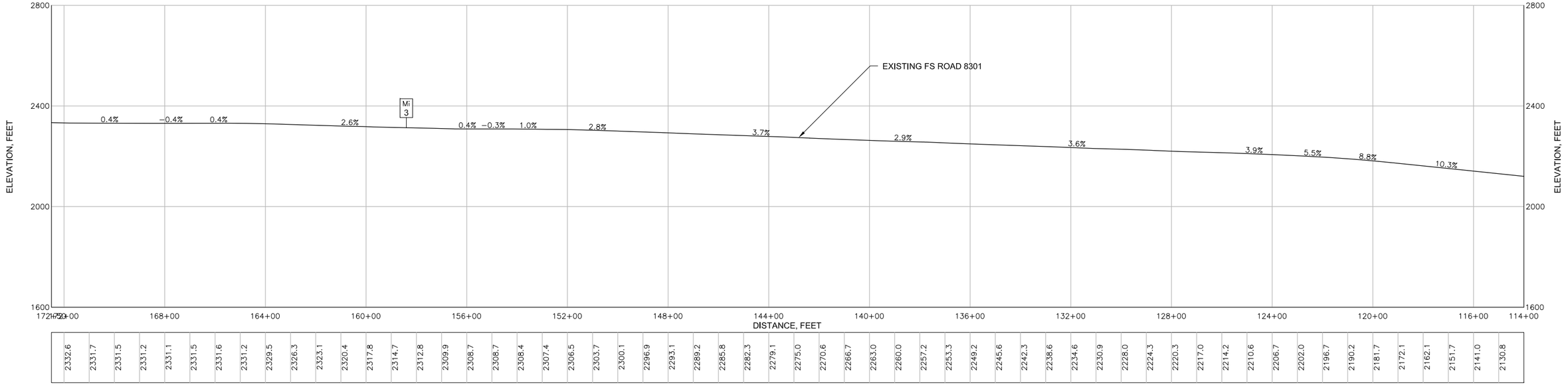
CONTOUR INTERVAL = 10 FEET



PROFILE
SCALE
200 0 200 400 FEET

NOTE:

1. GRADES SHOWN IN SECTION ARE AVERAGES, LOCALIZED STEEPER GRADES MAY EXIST.

ISSUE / REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
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- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA-FSA-APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/07/11	
DRAWN BY	F. ANDRADE	02/07/11	
CHECKED BY	D. RODRIGUEZ	02/08/11	
APPROVED BY	P. CROUSE	02/28/11	
PROJECT MANAGER	R. SCHLICHER	02/28/11	
CLIENT APPROVAL			
CLIENT REFERENCE NO.			

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 (STA 114+00 TO STA 172+50) PLAN AND PROFILE
SHEET: 10-3-4
REVISION: B
FILE NAME: 1008679D248

MWH

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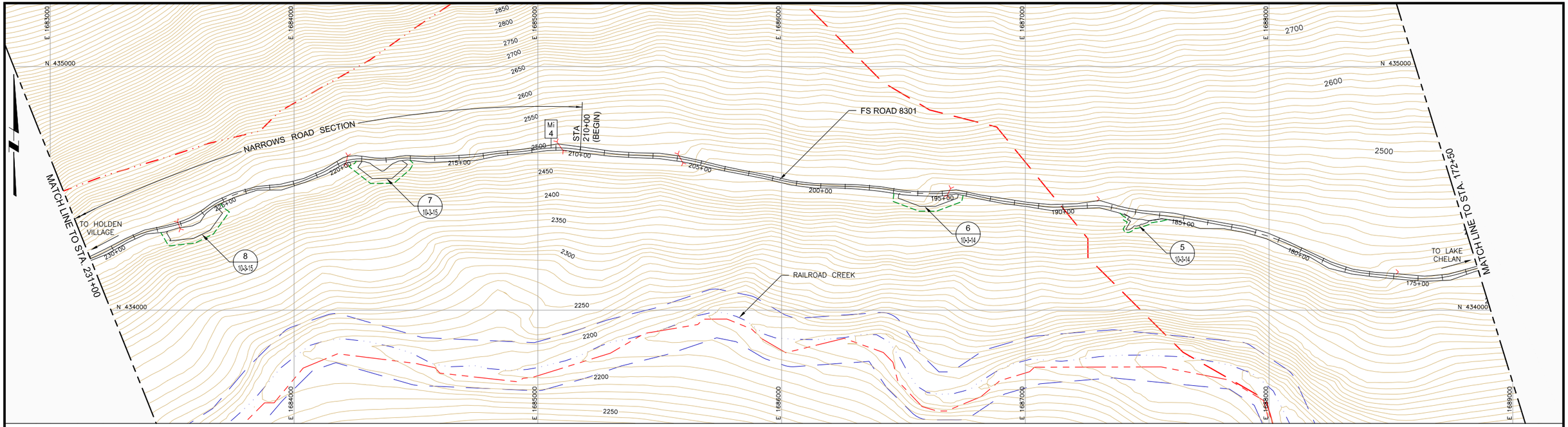

NOTE:

1. PLAN LOCATION SHOWN ON SHEET 10–3–1.

PLAN

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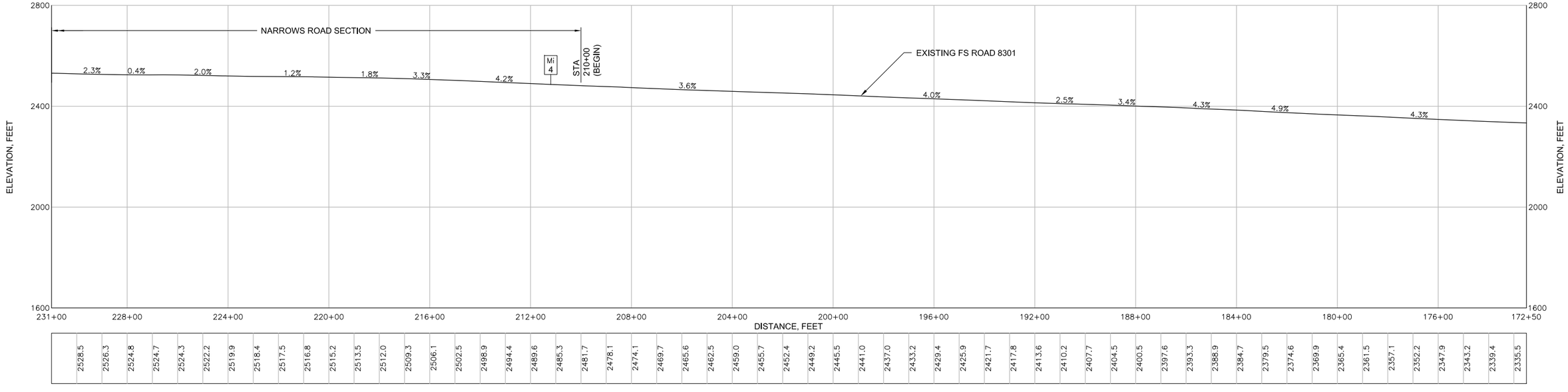
CONTOUR INTERVAL = 10 FEET



NOTE:

1. GRADES SHOWN ARE AVERAGES. LOCALIZED STEEPER GRADES MAY EXIST.

PROFILE

SCALE
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ISSUE / REV					
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DESIGNED BY	P. PELLICER	02/07/11
DRAWN BY	F. ANDRADE	02/07/11
CHECKED BY	D. RODRIGUEZ	02/08/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 (STA 172+50 TO STA 231+00) PLAN AND PROFILE

MWH

SHEET: 10-3-5
REVISION: B
FILE NAME: 1008679D249

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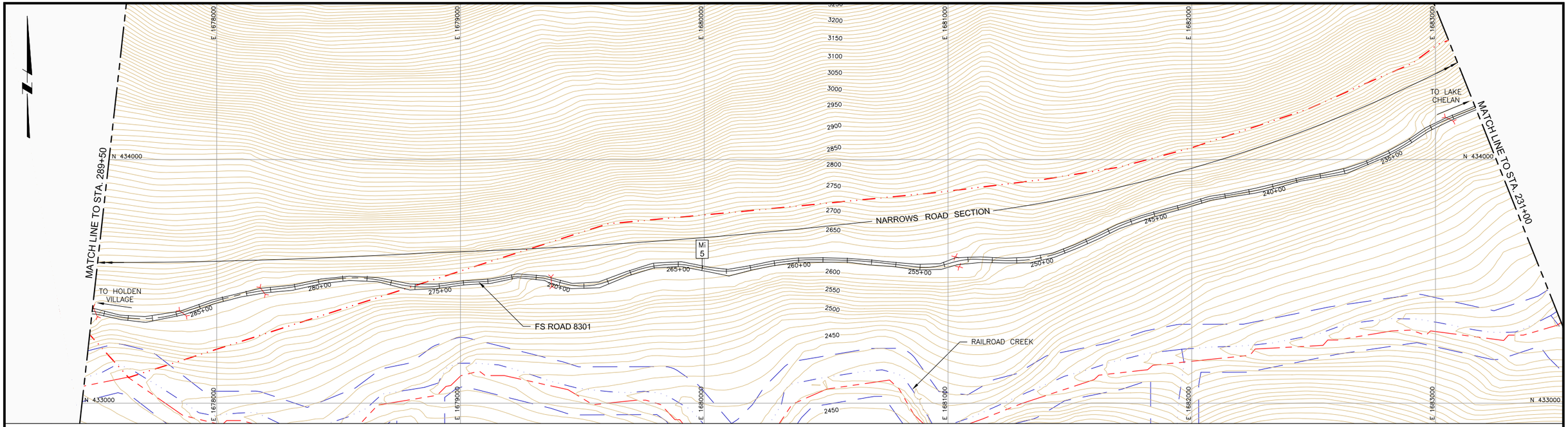

NOTE:

1. PLAN LOCATION SHOWN ON SHEET 10-3-1.

PLAN

SCALE

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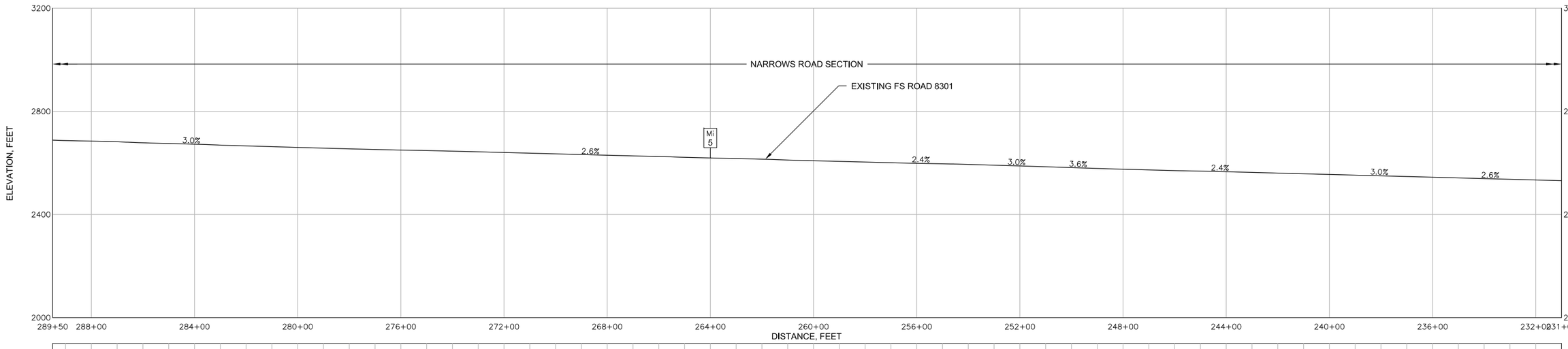
CONTOUR INTERVAL = 10 FEET



NOTE:

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PROFILE

SCALE

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ISSUE REV					
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DESIGNED BY	P. PELLICER	02/07/11
DRAWN BY	F. ANDRADE	02/07/11
CHECKED BY	D. RODRIGUEZ	02/08/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 (STA 231+00 TO STA 289+50) PLAN AND PROFILE

MWH

SHEET: 10-3-6

REVISION: A

FILE NAME: 1008679D250

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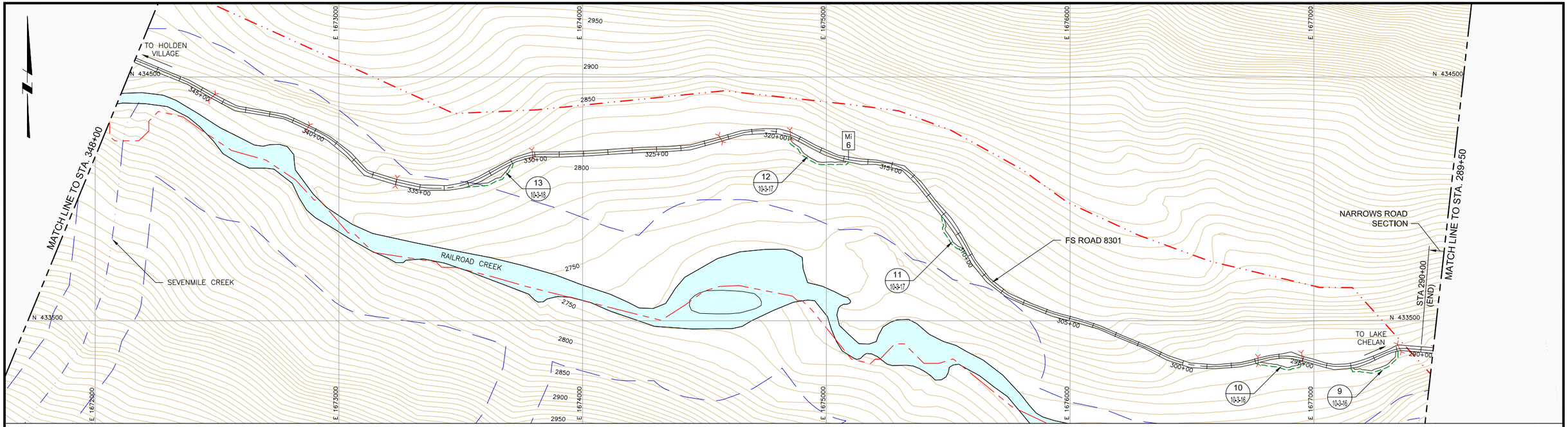

NOTE:

1. PLAN LOCATION SHOWN ON SHEET 10–3–1.

PLAN

SCALE

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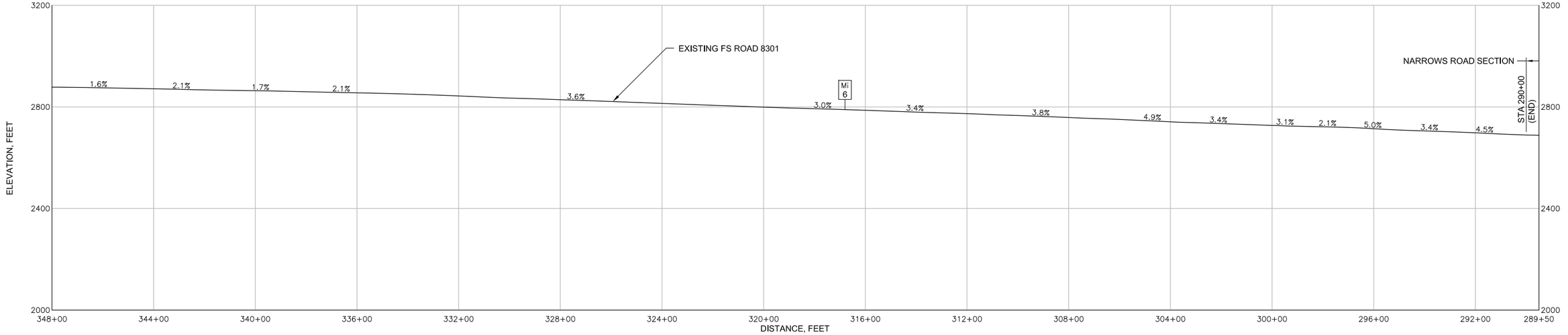
CONTOUR INTERVAL = 10 FEET



NOTE:

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PROFILE

SCALE

200 0 200 400 FEET

ISSUE / REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
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DESIGNED BY	P. PELLICER	02/07/11
DRAWN BY	F. ANDRADE	02/07/11
CHECKED BY	D. RODRIGUEZ	02/08/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 (STA 289+50 TO STA 348+00) PLAN AND PROFILE

MWH

SHEET: 10-3-7

REVISION: B

FILE NAME: 1008679D251

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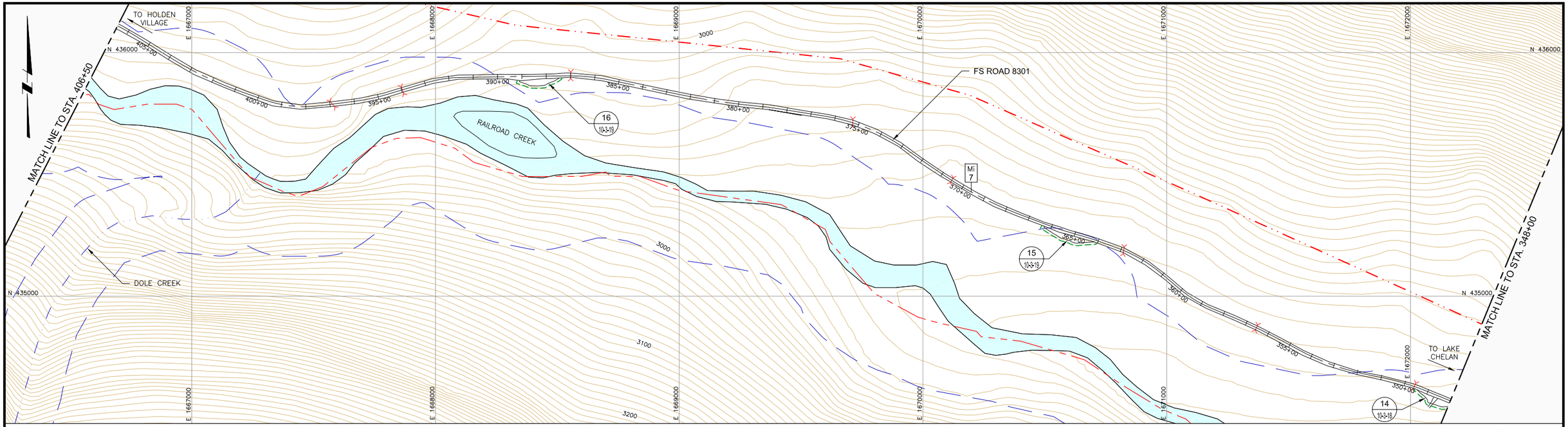

NOTE:

1. PLAN LOCATION SHOWN ON SHEET 10-3-1.

PLAN

SCALE

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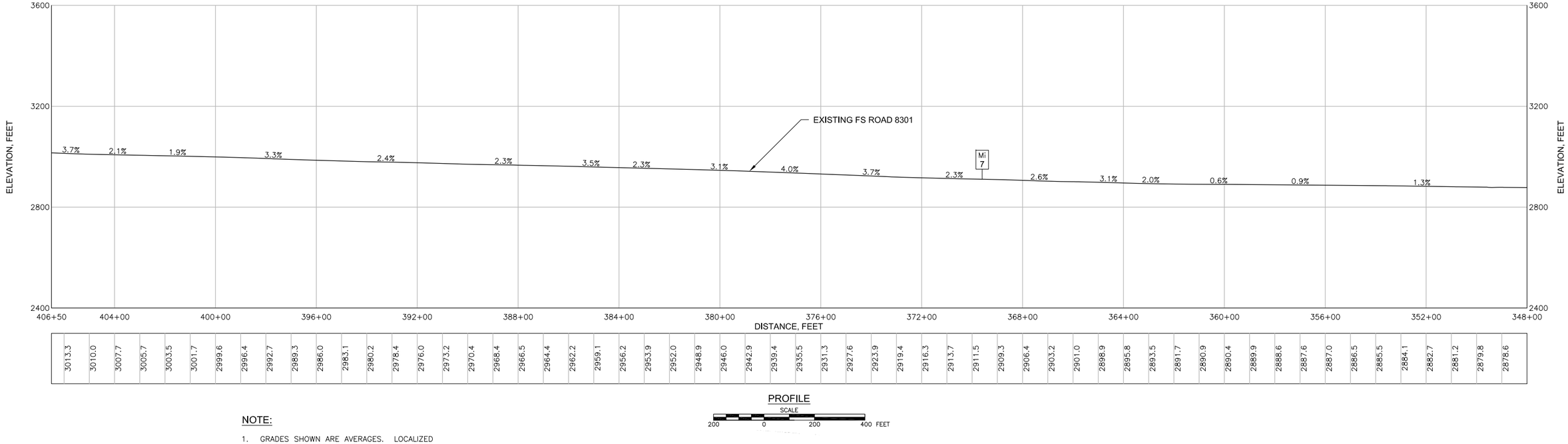
CONTOUR INTERVAL = 10 FEET



PROFILE

SCALE

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1. GRADES SHOWN ARE AVERAGES. LOCALIZED STEEPER GRADES MAY EXIST.

ISSUE / REV				
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/07/11
DRAWN BY	F. ANDRADE	02/07/11
CHECKED BY	D. RODRIGUEZ	02/08/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 (STA 348+00 TO STA 406+50) PLAN AND PROFILE

MWH

SHEET: 10-3-8

REVISION: A

FILE NAME: 1008679D252

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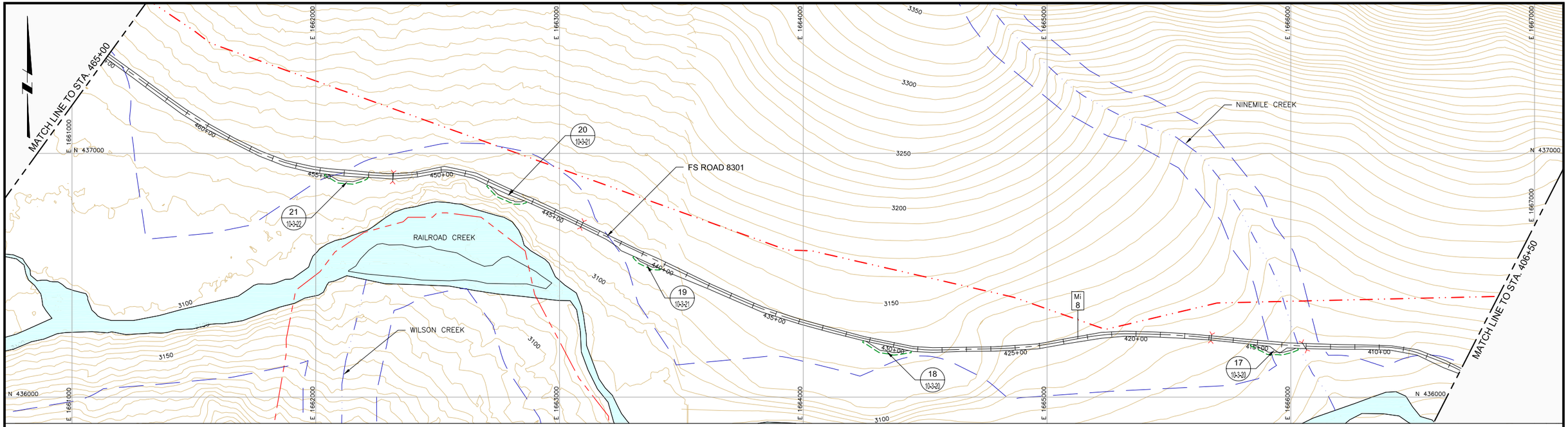


NOTE:

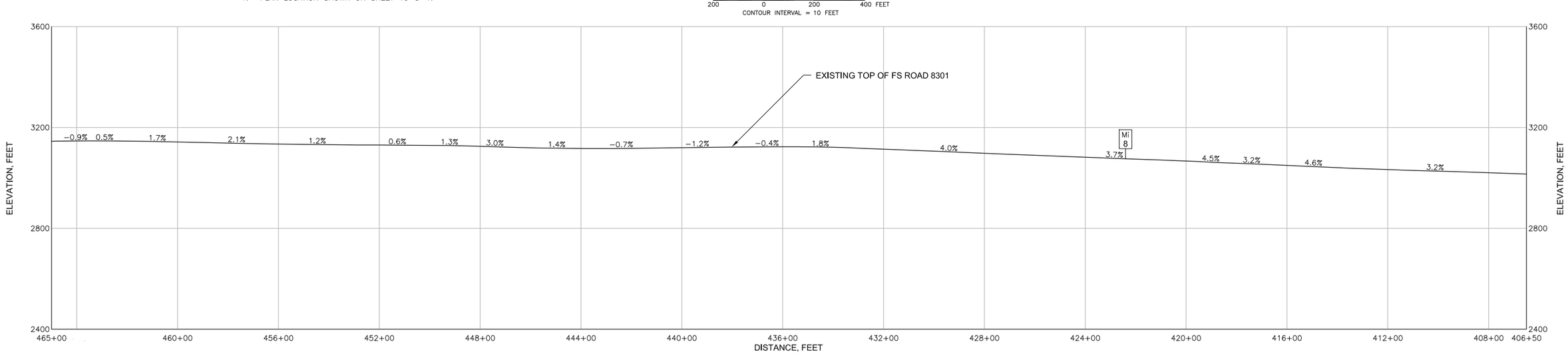
1. PLAN LOCATION SHOWN ON SHEET 10–3–1.

PLAN

SCALE

200 0 200 400 FEET

CONTOUR INTERVAL = 10 FEET



NOTE:

1. GRADES SHOWN ARE AVERAGES. LOCALIZED STEEPER GRADES MAY EXIST.

PROFILE

SCALE

200 0 200 400 FEET

ISSUE REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DESIGNED BY	P. PELLICER	02/07/11	
DRAWN BY	F. ANDRADE	02/07/11	
CHECKED BY	D. RODRIGUEZ	02/08/11	
APPROVED BY	P. CROUSE	02/28/11	
PROJECT MANAGER	R. SCHLICHER	02/28/11	
CLIENT APPROVAL			
CLIENT REFERENCE NO.			

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 (STA 406+50 TO STA 465+00) PLAN AND PROFILE

MWH

SHEET: 10-3-9

REVISION: B

FILE NAME: 1008679D253

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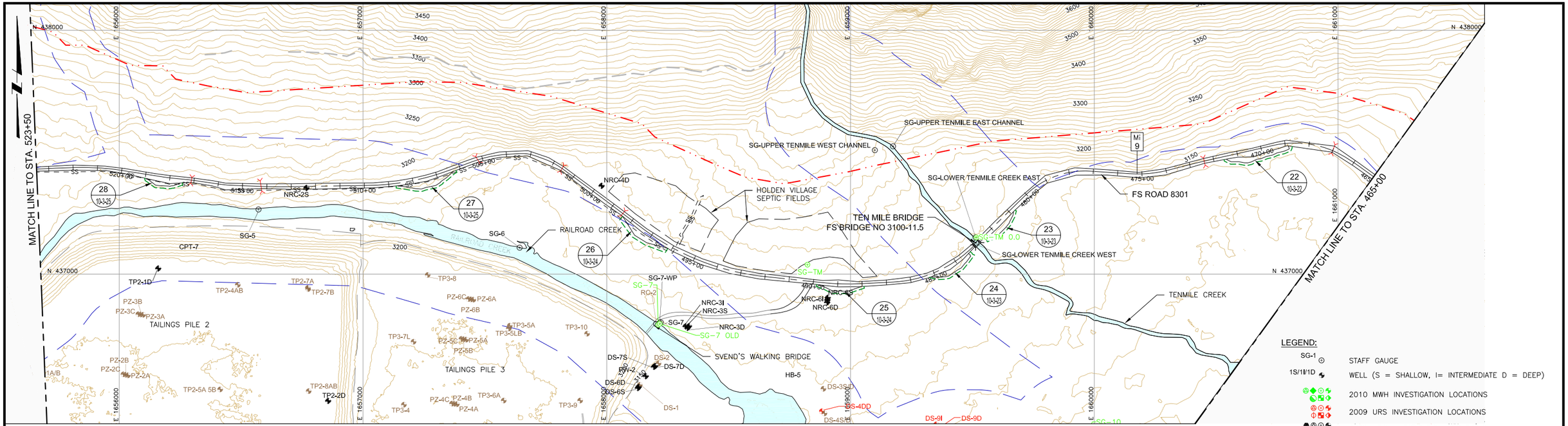


NOTE:

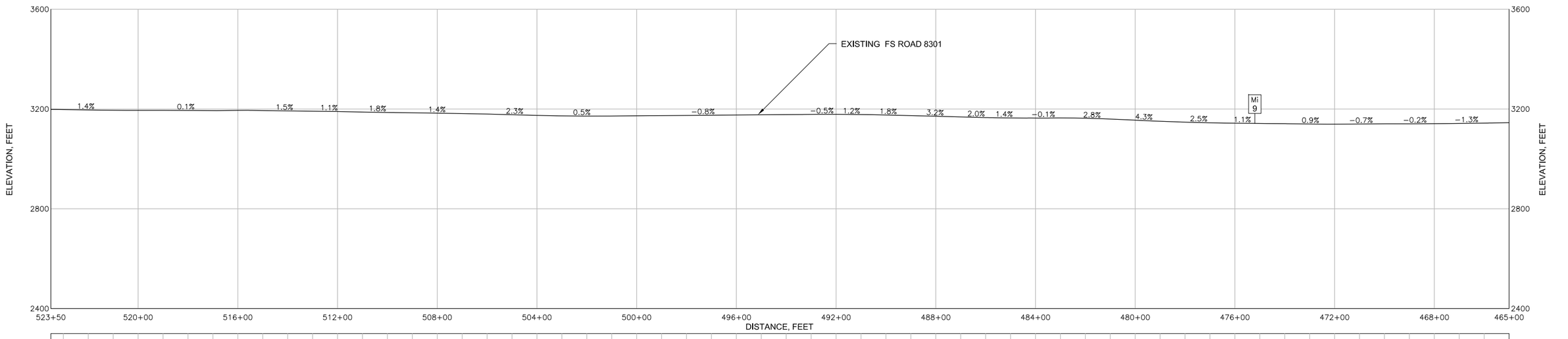
1. PLAN LOCATION SHOWN ON SHEET 10-3-1.

PLAN

SCALE

200 0 200 400 FEET

CONTOUR INTERVAL = 10 FEET



NOTE:

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PROFILE

SCALE

200 0 200 400 FEET

ISSUE / REV				
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWN BY	F. ANDRADE	02/07/11
CHECKED BY	D. RODRIGUEZ	02/08/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 (STA 465+00 TO STA 523+50) PLAN AND PROFILE

MWH

SHEET: 10-3-10

REVISION: A

FILE NAME: 1008679D254

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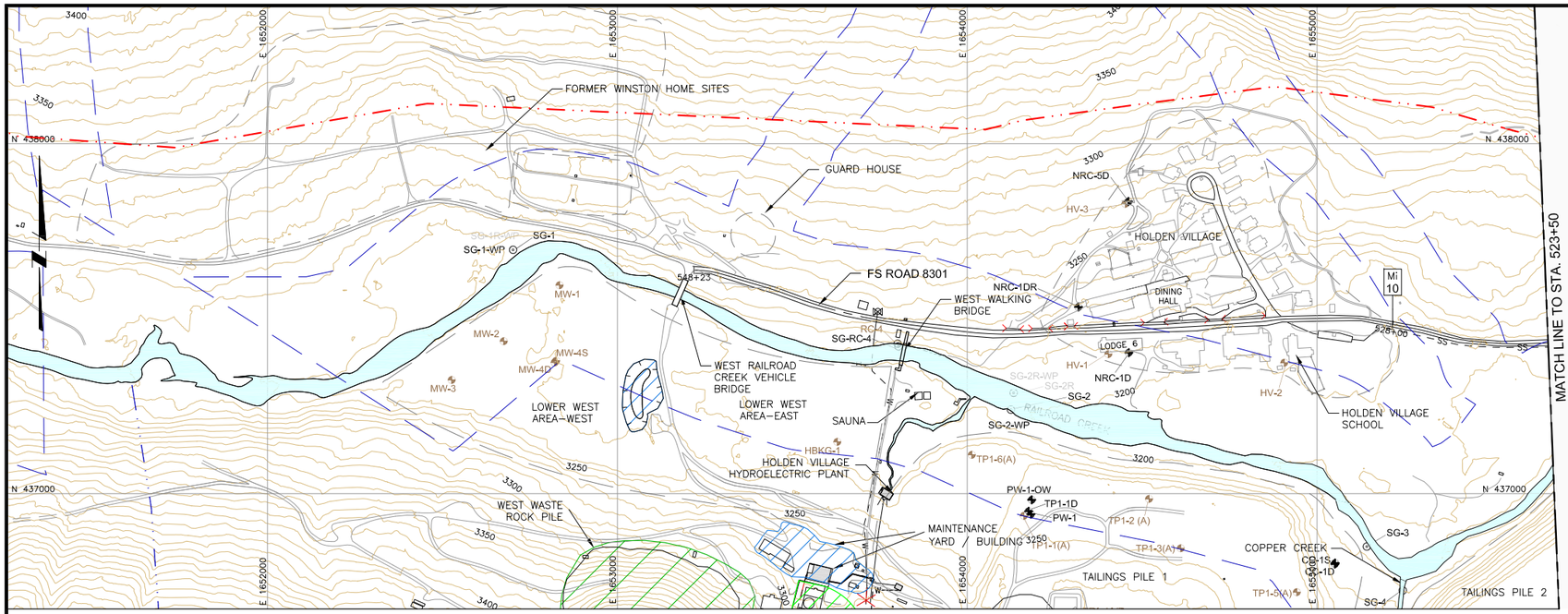
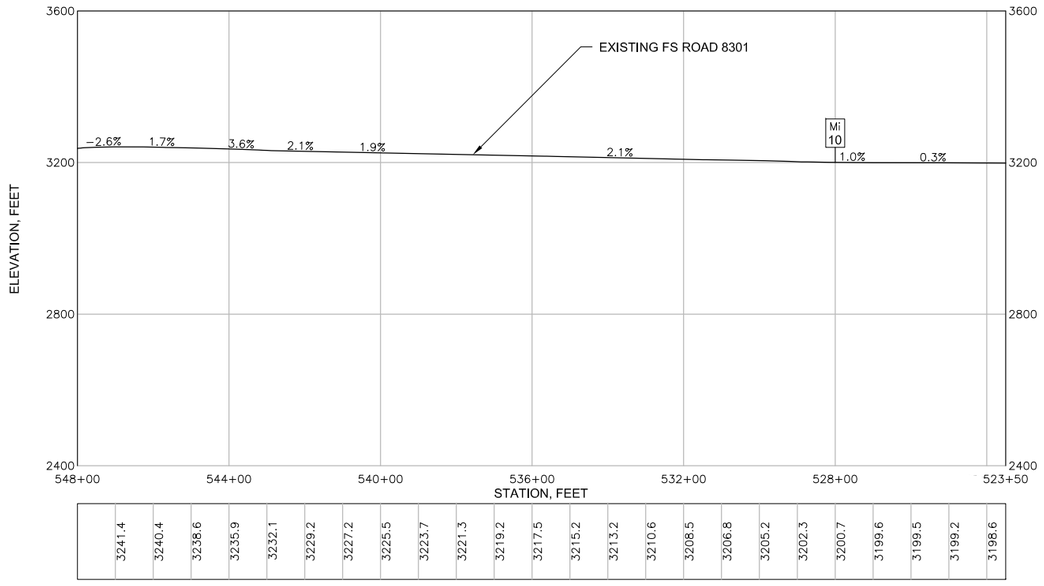


PLAN

SCALE

200 0 200 400 FEET

CONTOUR INTERVAL = 10 FEET



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PROFILE

SCALE

200 0 200 400 FEET

NOTE:

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LEGEND:

- SG-1 — STAFF GAUGE
- 1S/1I/1D — WELL (S = SHALLOW, I= INTERMEDIATE D = DEEP)
- 2010 MWH INVESTIGATION LOCATIONS
- 2009 URS INVESTIGATION LOCATIONS
- 2008 URS INVESTIGATION LOCATIONS
- HISTORICAL INVESTIGATION LOCATIONS (BY OTHERS)

ISSUE / REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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CHECKED BY	D. RODRIGUEZ	02/08/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 (STA 523+50 TO STA 548+00) PLAN AND PROFILE

MWH

SHEET: 10-3-11

REVISION: B

FILE NAME: 1008679D255

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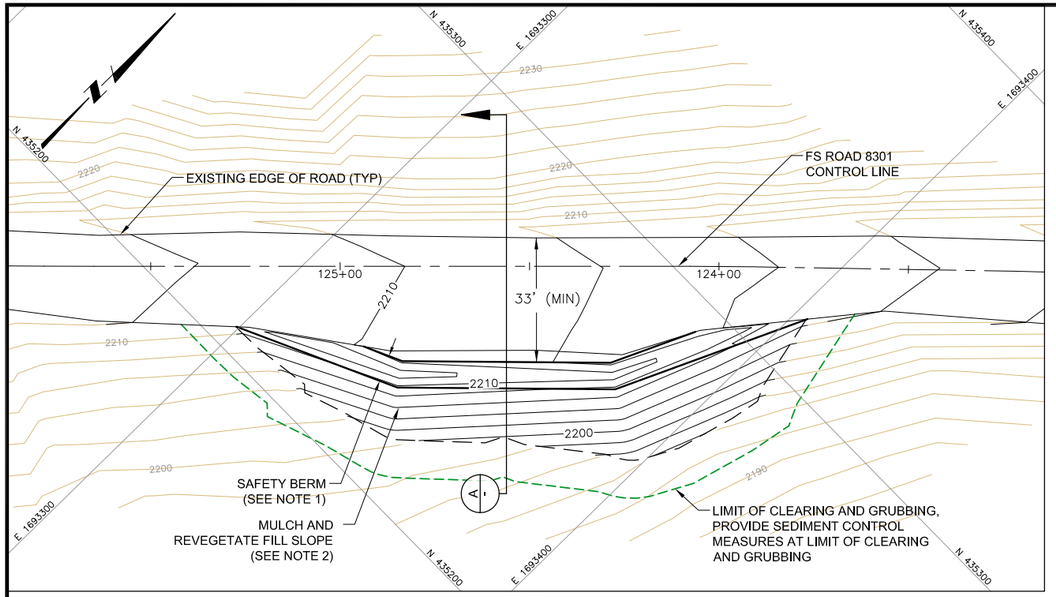
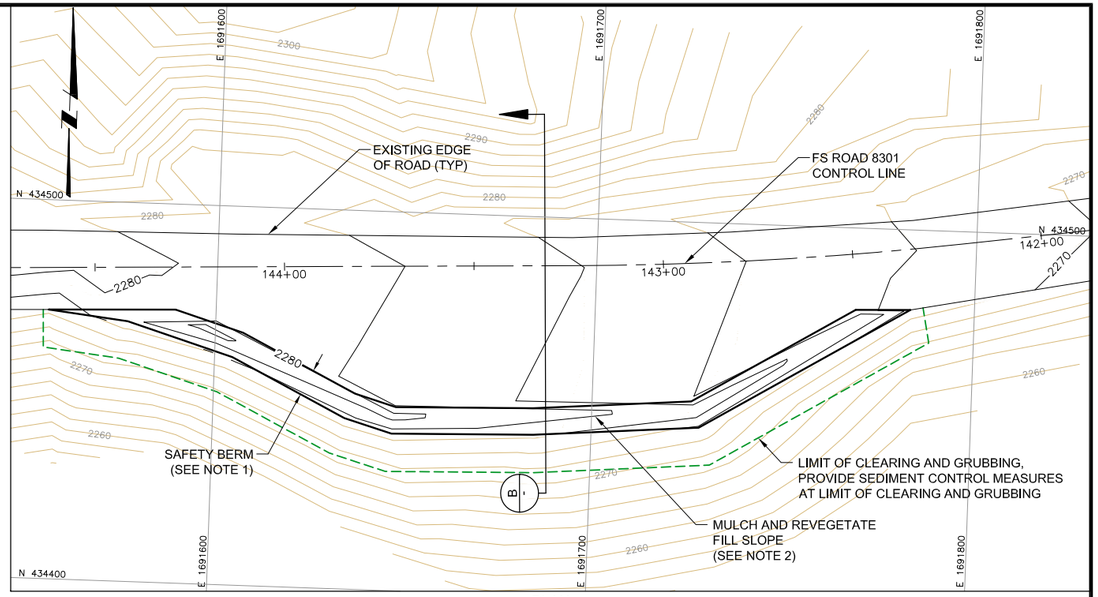
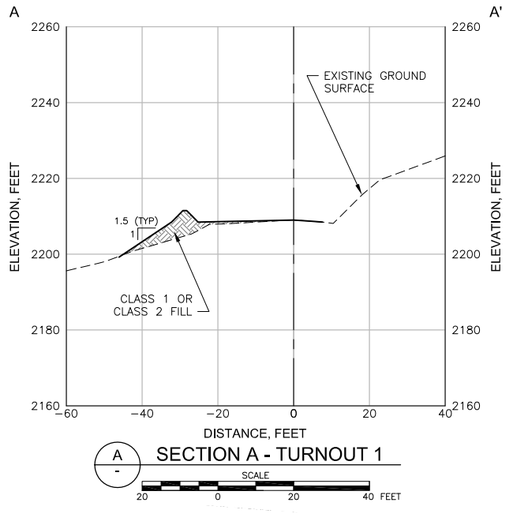
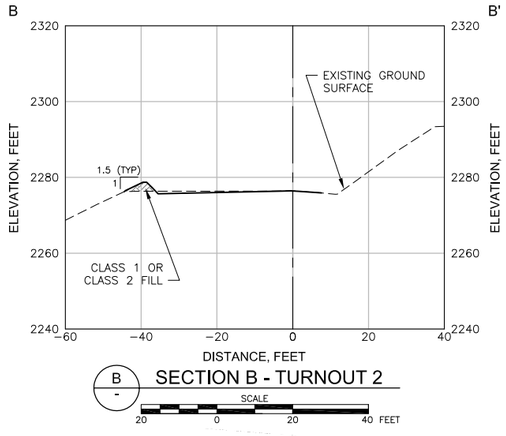


PLAN



PLAN





NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.

TURNOUT 1 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
613	2	307

TURNOUT 2 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
0	32	44

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 TURNOUTS 1 AND 2 GRADING PLAN

MWH

SHEET: 10-3-12

REVISION: B

FILE NAME: 1008679D270

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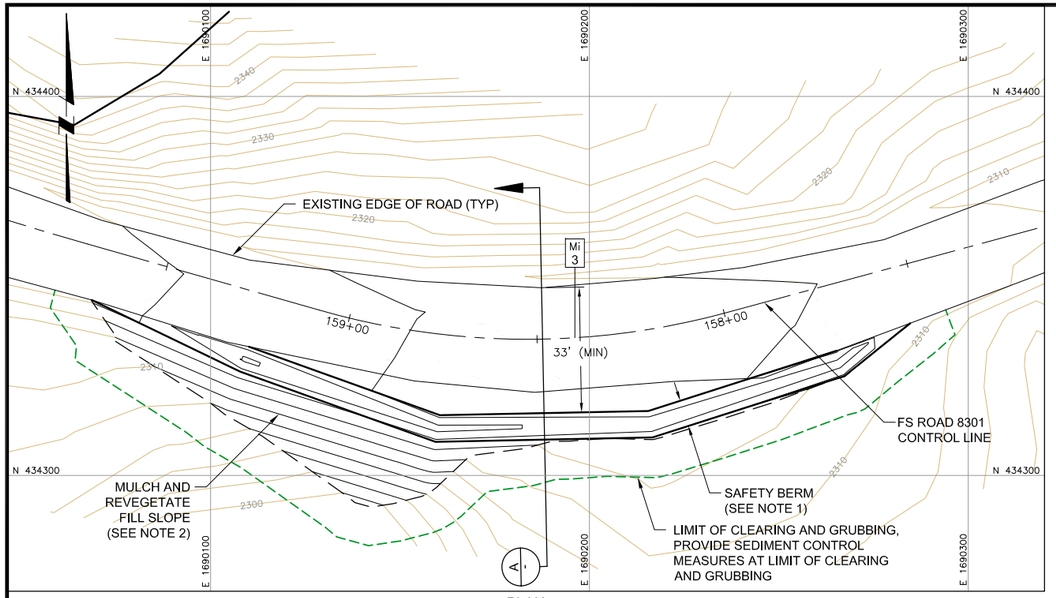

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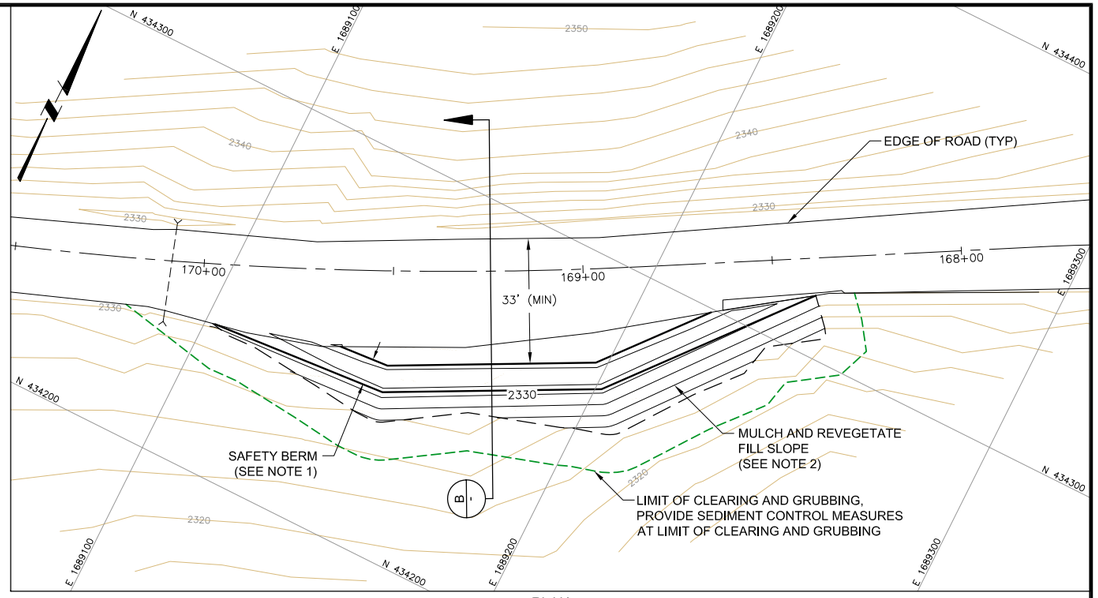

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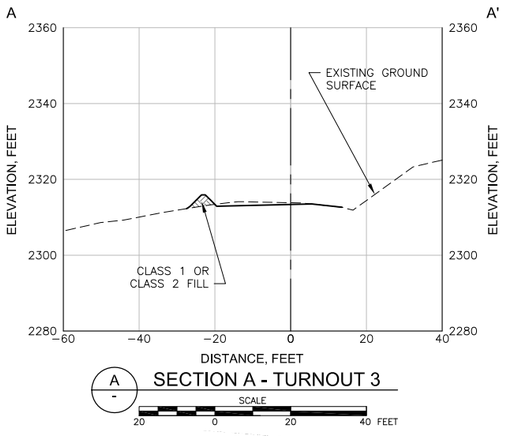
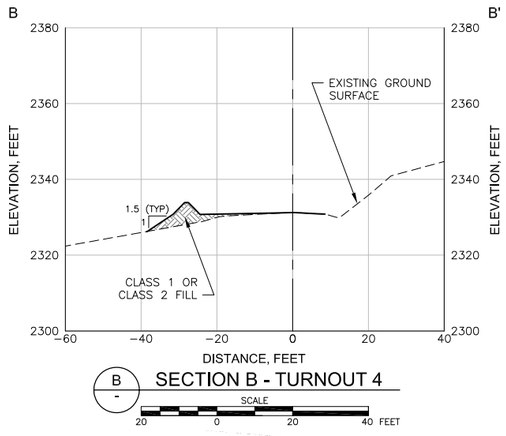


A - SECTION A - TURNOUT 3

SCALE 20 0 20 40 FEET



B - SECTION B - TURNOUT 4

SCALE 20 0 20 40 FEET

TURNOUT 3 - GRADING PLAN AND SECTION

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
724	51	217

TURNOUT 4 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
562	5	201

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 TURNOUTS 3 AND 4 GRADING PLAN

MWH

SHEET: 10-3-13

REVISION: B

FILE NAME: 1008679D271

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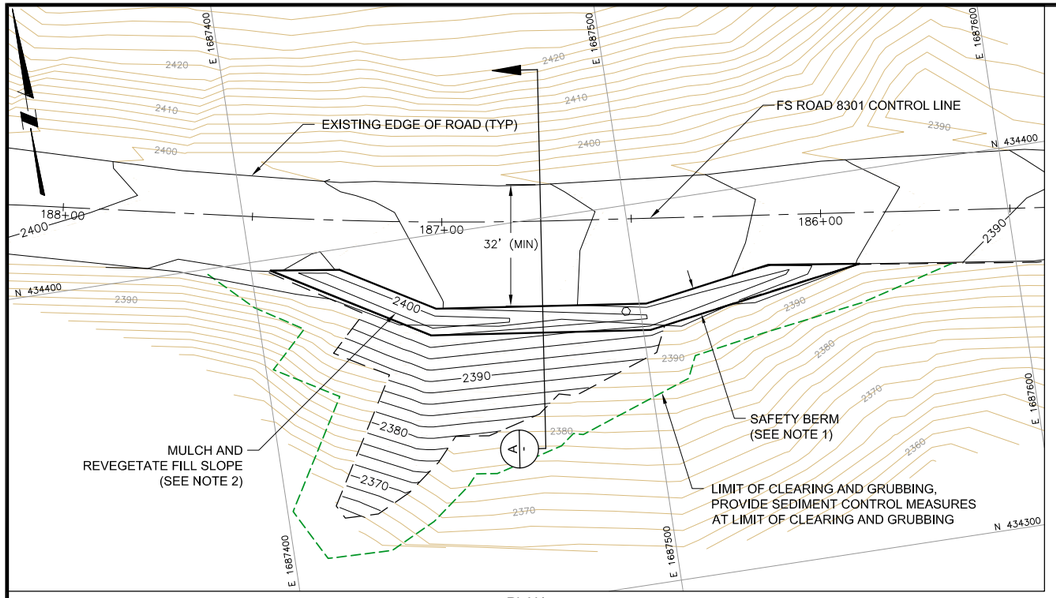
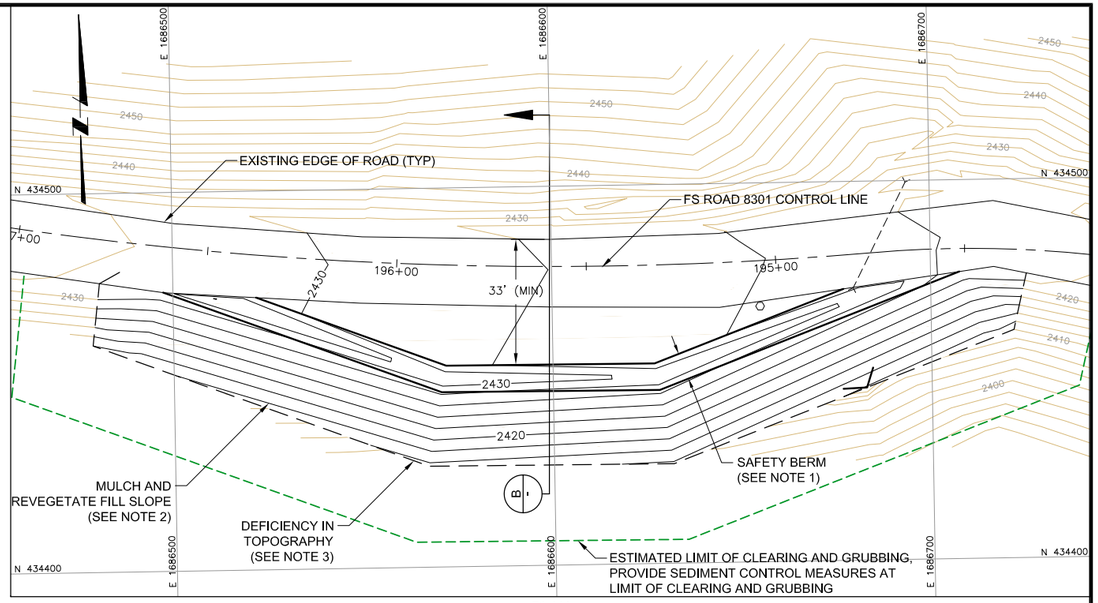
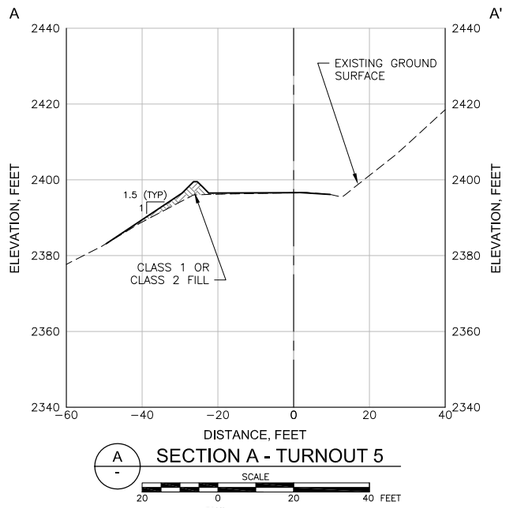
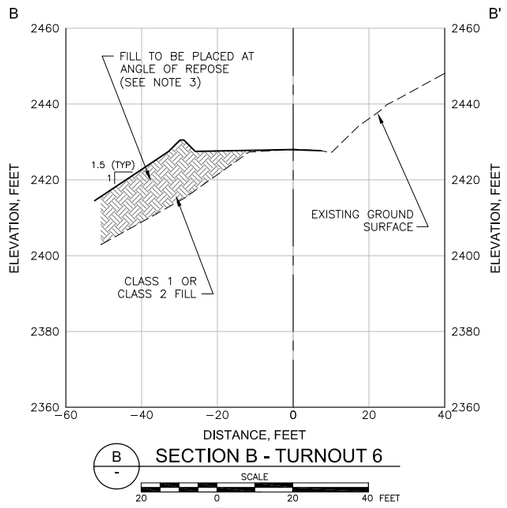


PLAN



PLAN





NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.
3. THE FINAL CONFIGURATION WILL BE BASED ON ADDITIONAL FIELD DATA AT THE TIME OF CONSTRUCTION.

TURNOUT 5 - GRADING PLAN AND SECTION

TURNOUT 6 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
643	30	127

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 TURNOUTS 5 AND 6 GRADING PLAN
SHEET: 10-3-14
REVISION: B
FILE NAME: 1008679D272

MWH

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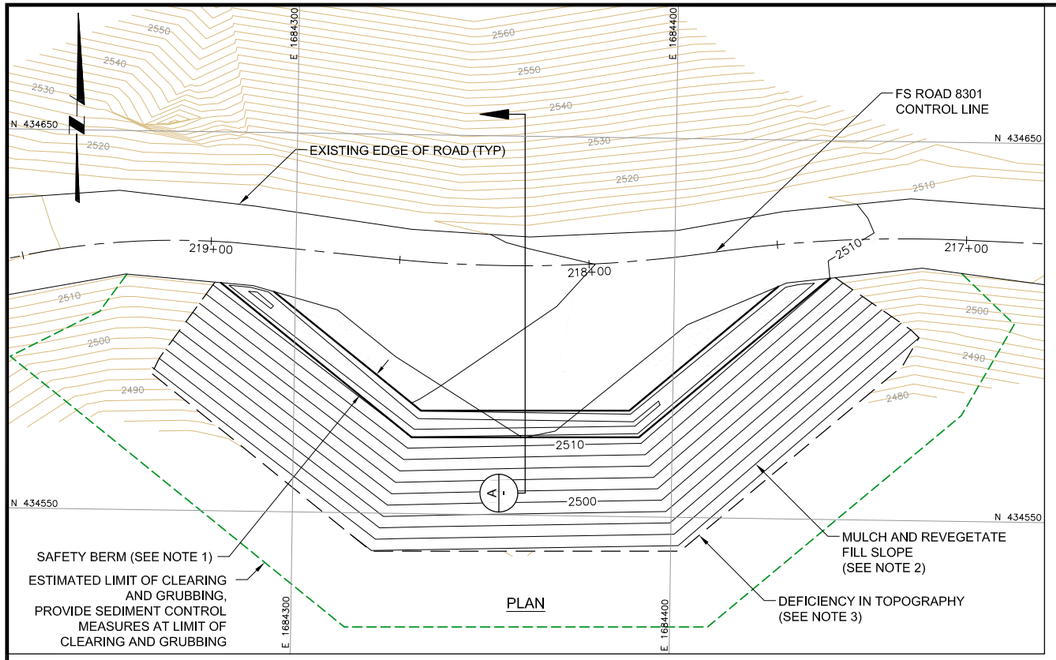
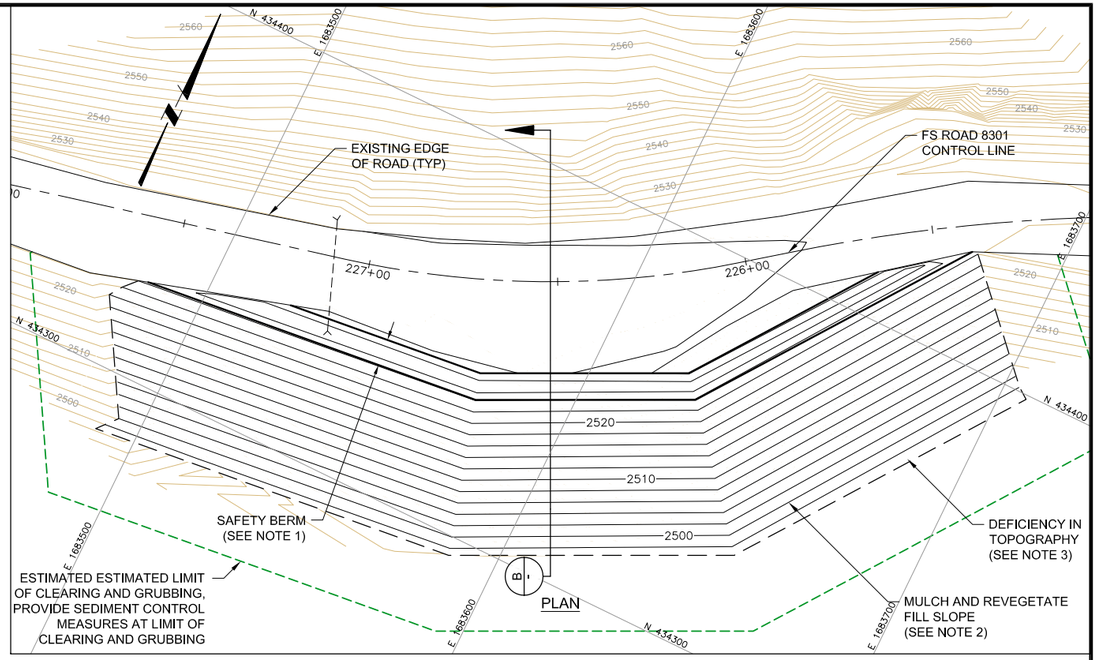
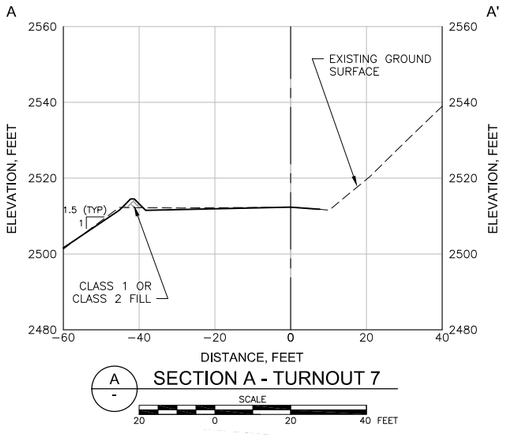


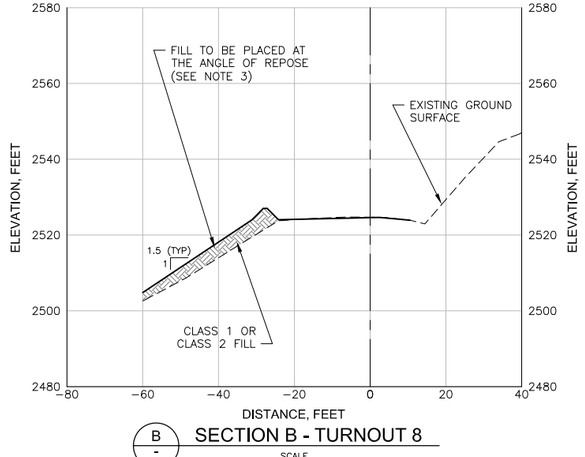




TURNOUT 7 - GRADING PLAN AND SECTION

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.
3. THE FINAL CONFIGURATION WILL BE BASED ON ADDITIONAL FIELD DATA AT THE TIME OF CONSTRUCTION.



TURNOUT 8 - GRADING PLAN AND SECTION

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

DISCLAIMER:
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DRAWING REFERENCE(S):
- FS ROAD 8301 TOPOGRPAHY RECEIVED FROM ERLANDSEN DATED; JANUARY 18, 2011.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 TURNOUTS 7 AND 8 GRADING PLAN

MWH

SHEET: 10-3-15
REVISION: B
FILE NAME: 1008679D273

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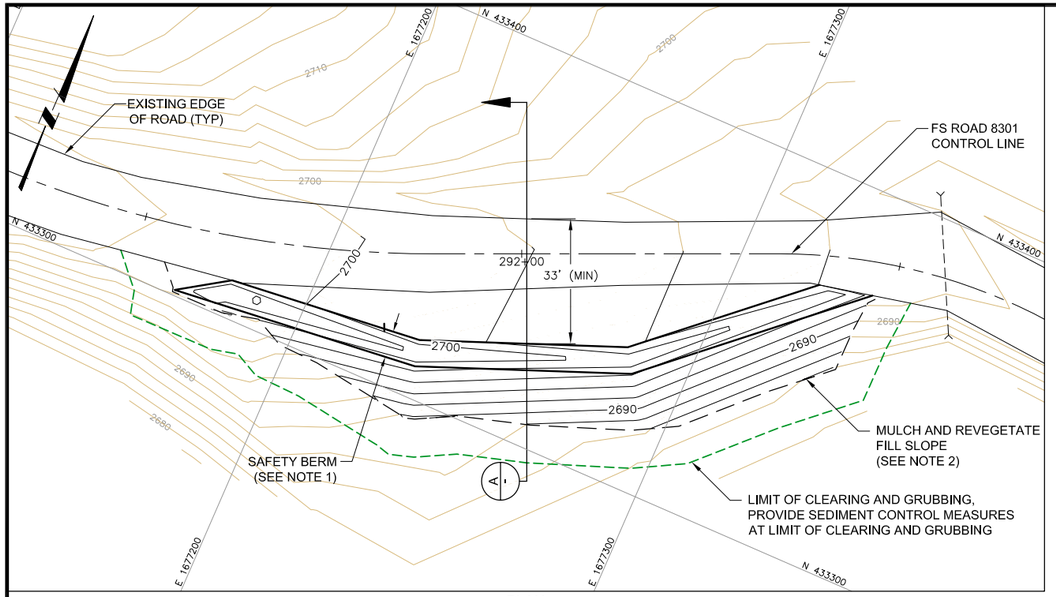

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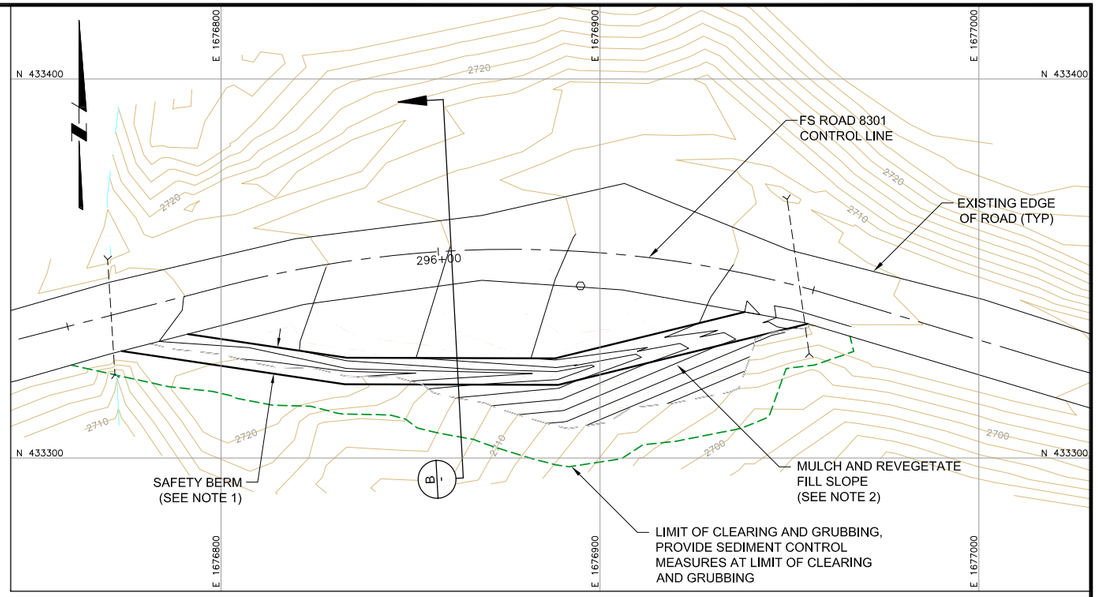

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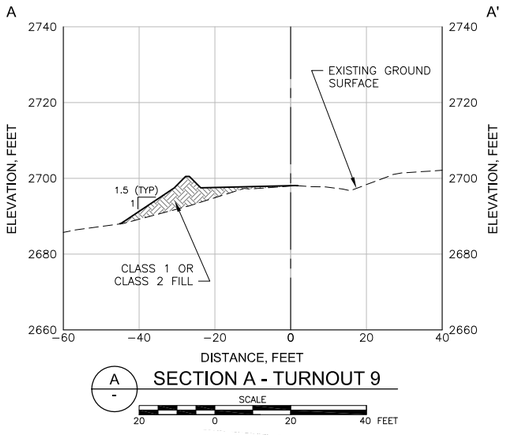

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.

TURNOUT 9 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
855	0	460

TURNOUT 10 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
679	32	83

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 TURNOUTS 9 AND 10 GRADING PLAN
SHEET: 10-3-16
REVISION: B
FILE NAME: 1008679D274

MWH

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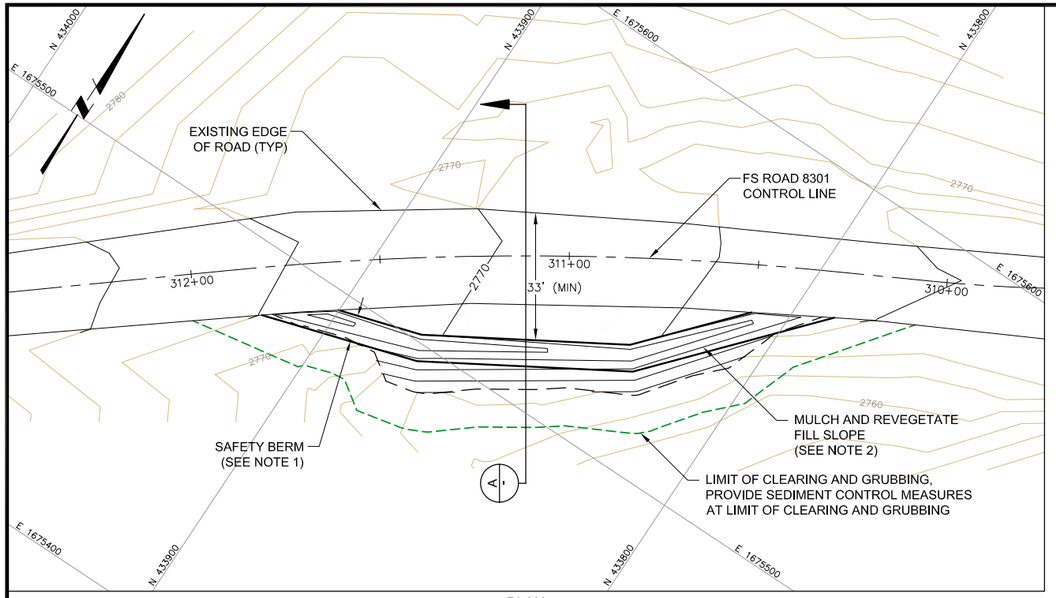

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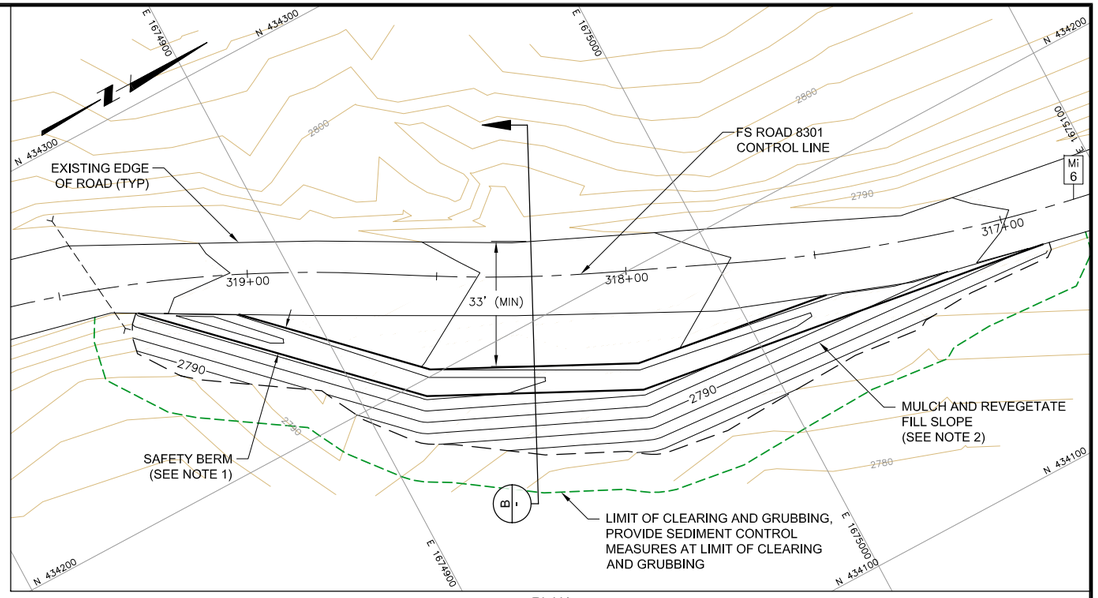

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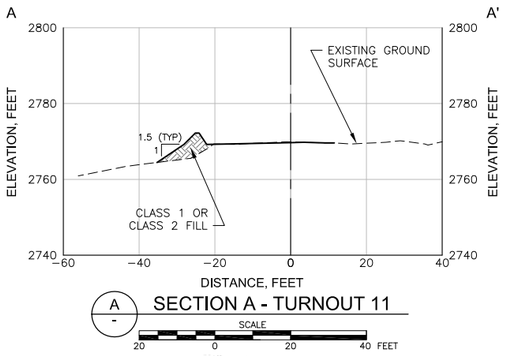
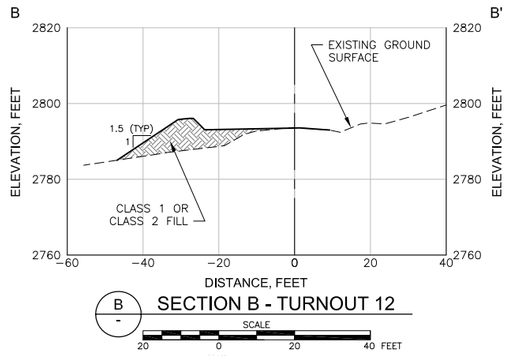


A - SECTION A - TURNOUT 11

SCALE
20 0 20 40 FEET

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.



B - SECTION B - TURNOUT 12

SCALE
20 0 20 40 FEET

TURNOUT 11 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
477	16	82

TURNOUT 12 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
1007	1	612

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

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DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 TURNOUTS 11 AND 12 GRADING PLAN

MWH

SHEET: 10-3-17
REVISION: B
FILE NAME: 1008679D275

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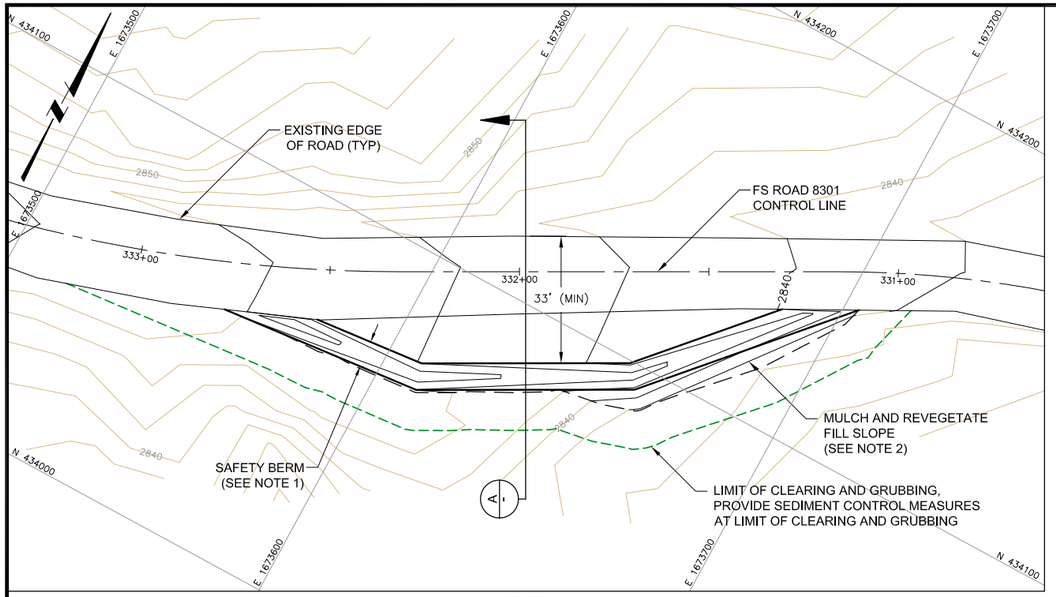

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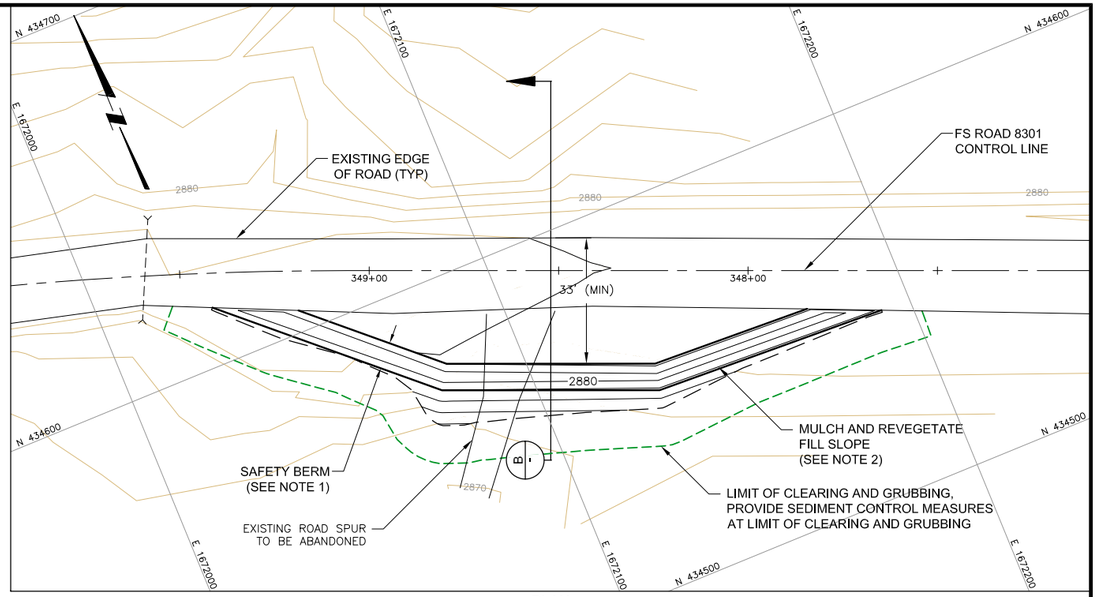

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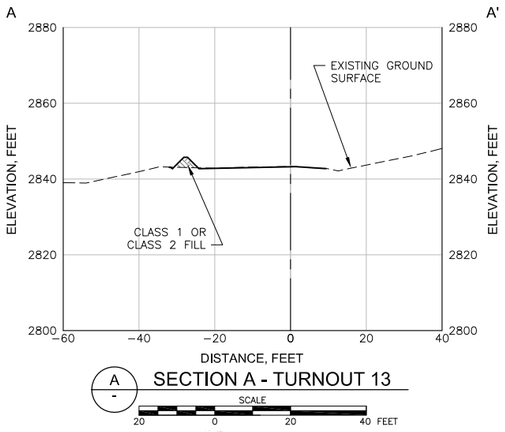
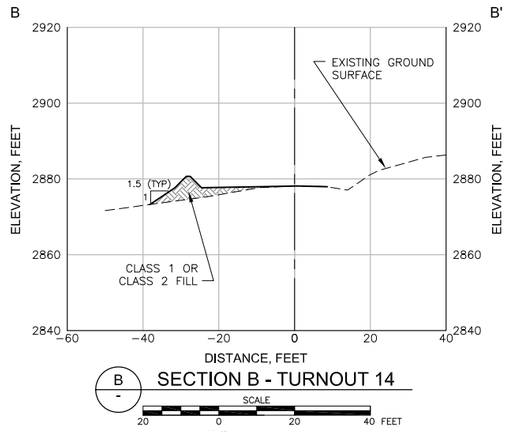


A — SECTION A - TURNOUT 13

SCALE 20 0 20 40 FEET

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.



B — SECTION B - TURNOUT 14

SCALE 20 0 20 40 FEET

TURNOUT 13 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
531	6	64

TURNOUT 14 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
593	2	133

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

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DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 TURNOUTS 13 AND 14 GRADING PLAN

MWH

SHEET 10-3-18 | REVISION B

FILE NAME 1008679D276

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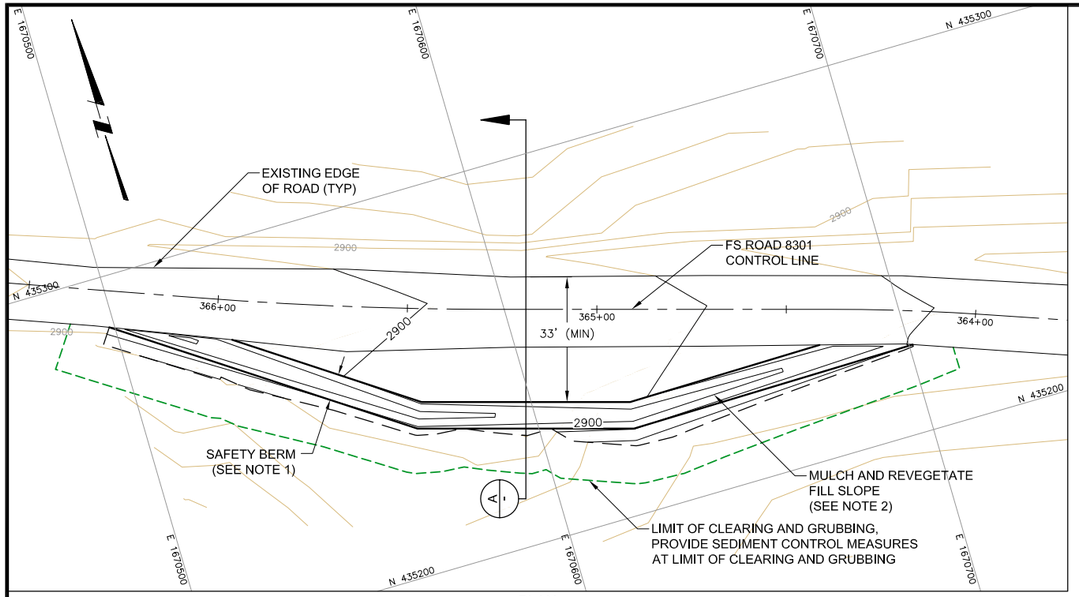

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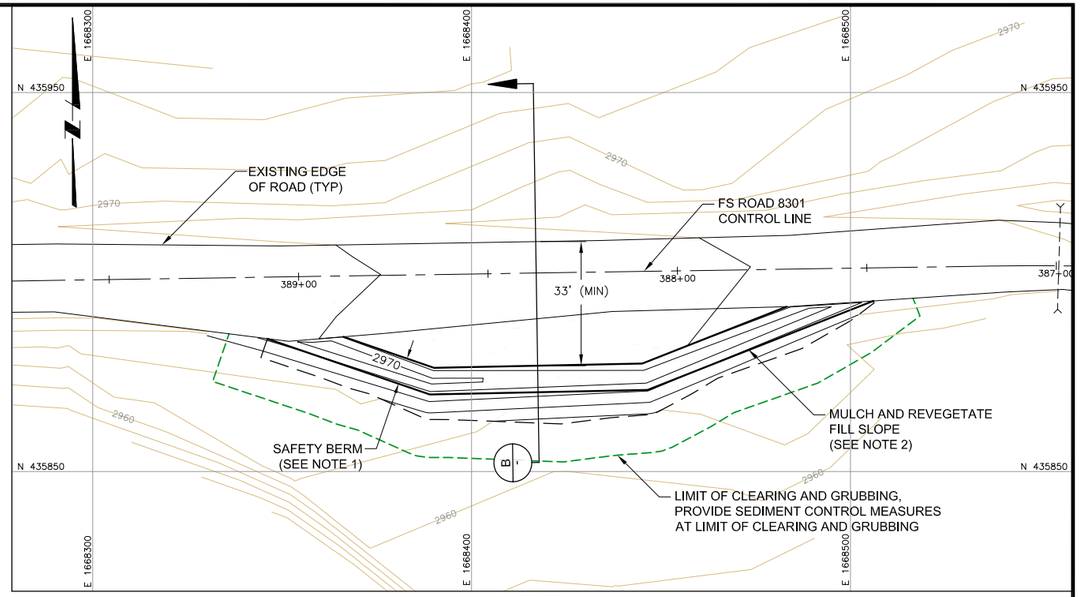

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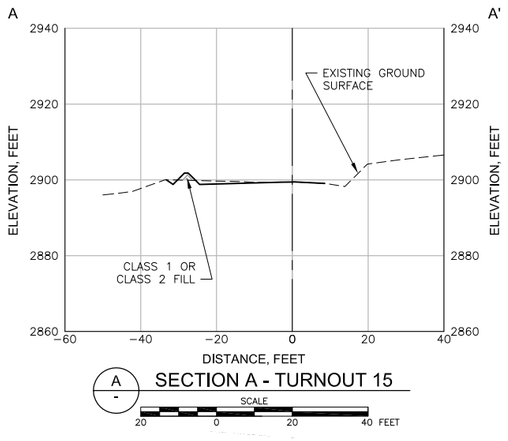
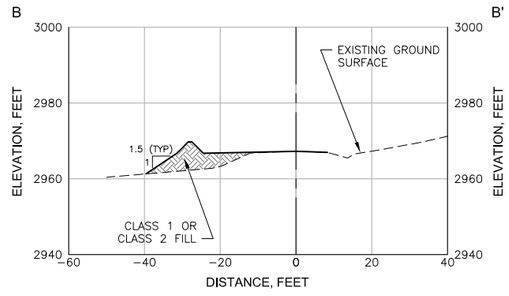


A - SECTION A - TURNOUT 15

SCALE
20 0 20 40 FEET

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.



B - SECTION B - TURNOUT 16

SCALE
20 0 20 40 FEET

TURNOUT 15 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
667	9	75

TURNOUT 16 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
571	0	195

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

- FS ROAD 8301 TOPOGRPAHY RECEIVED FROM ERLANDSEN DATED; JANUARY 18, 2011.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 TURNOUTS 15 AND 16 GRADING PLAN

MWH

SHEET: 10-3-19
REVISION: B
FILE NAME: 1008679D277

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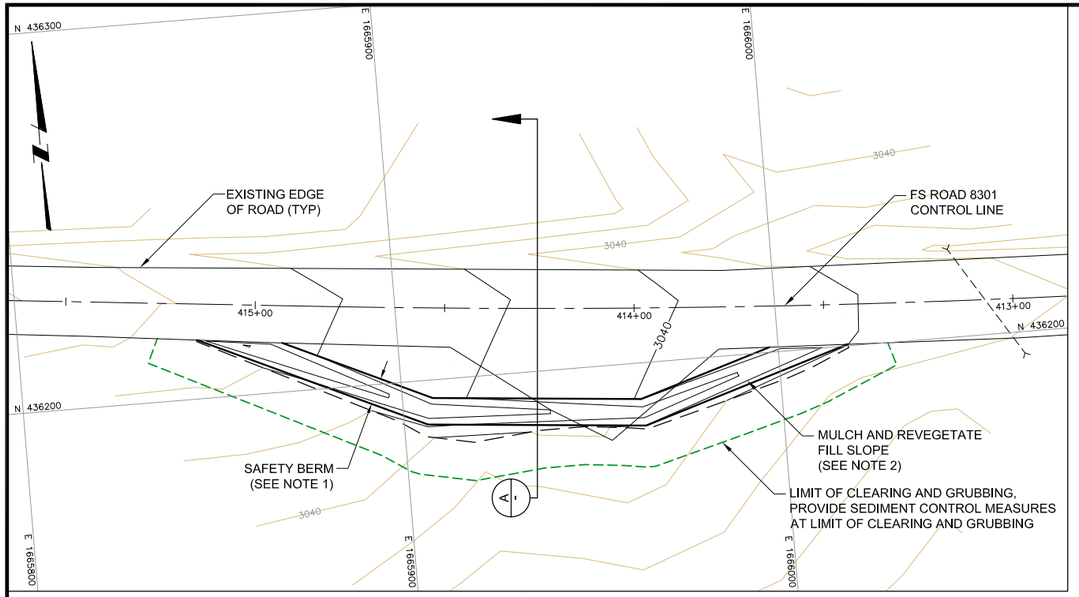

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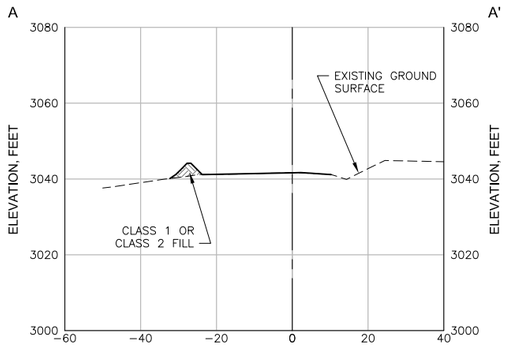


A - SECTION A - TURNOUT 17

SCALE

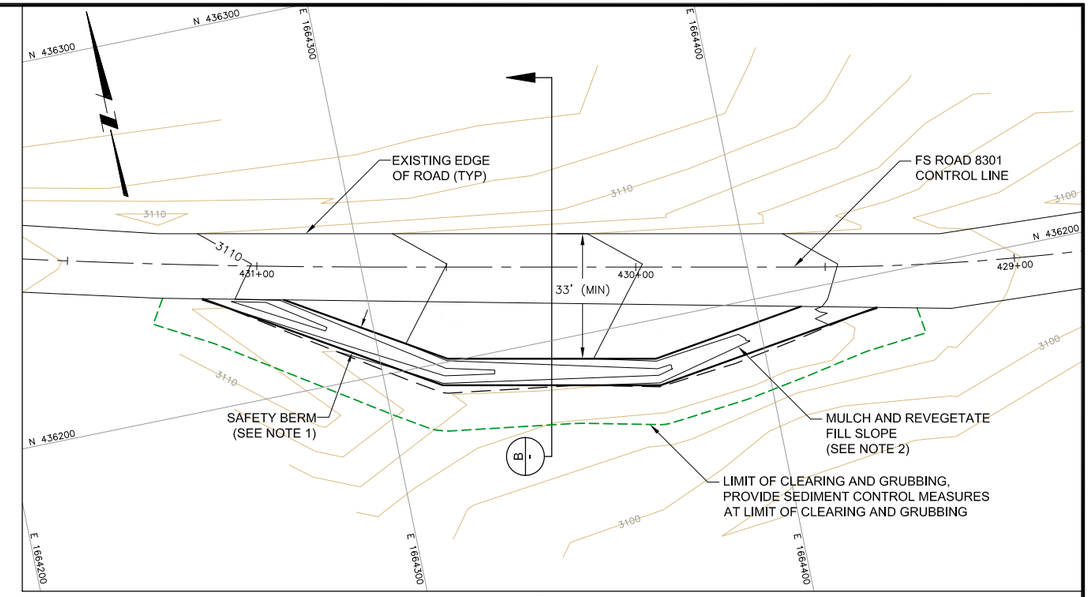
20 0 20 40 FEET

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.

TURNOUT 17 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
422	1	76



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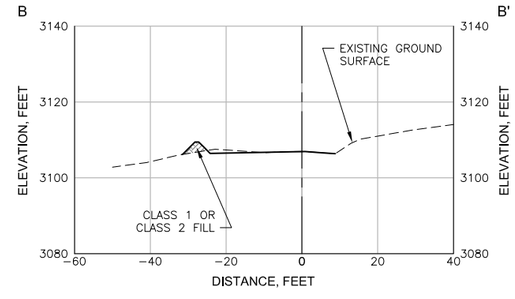

B - SECTION B - TURNOUT 18

SCALE

20 0 20 40 FEET

TURNOUT 18 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
536	115	117

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 TURNOUTS 17 AND 18 GRADING PLAN

MWH

SHEET: 10-3-20

REVISION: B

FILE NAME: 1008679D278

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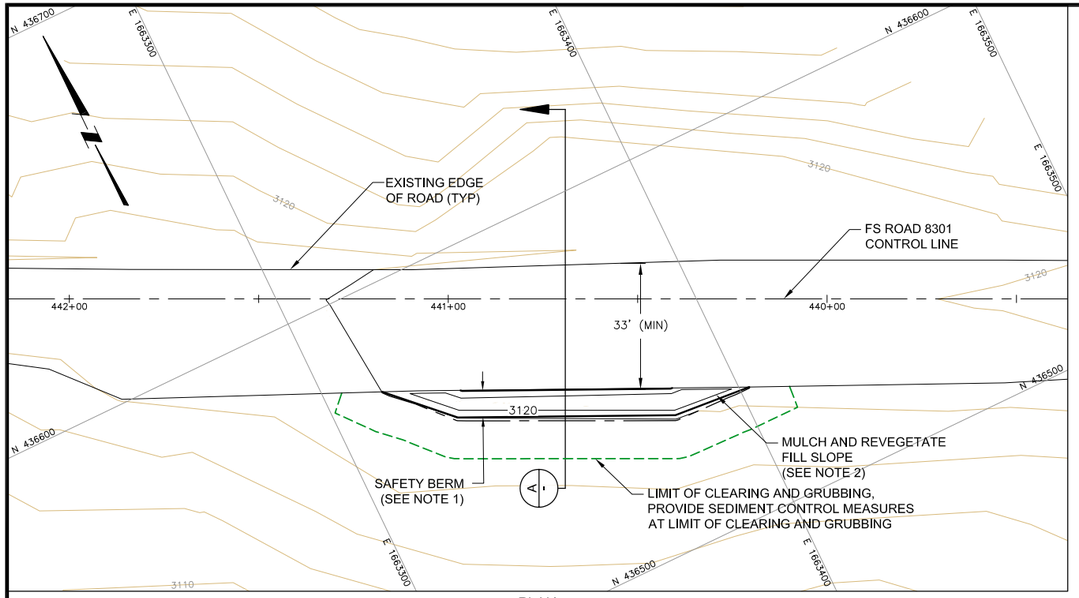

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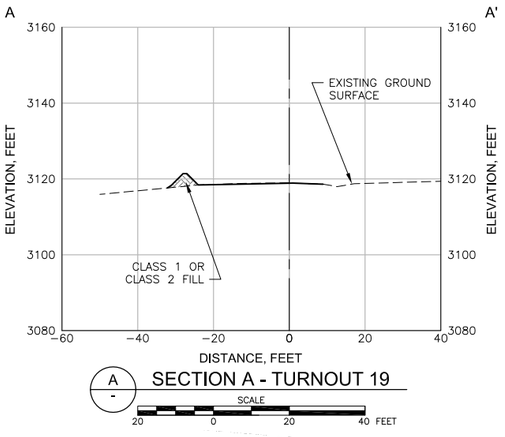
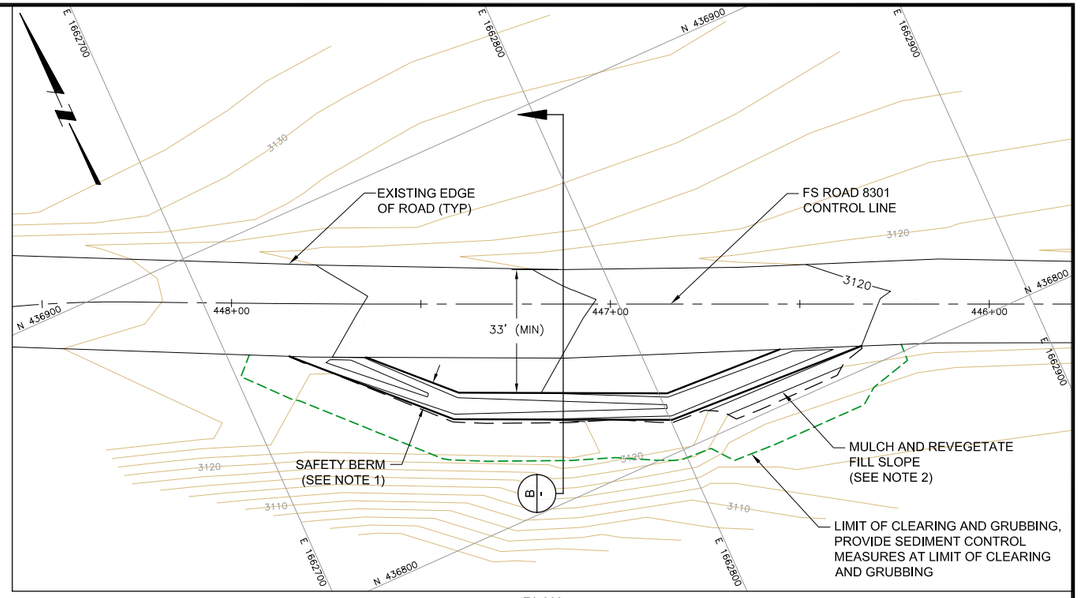


A
-
SECTION A - TURNOUT 19

SCALE
20 0 20 40 FEET

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.



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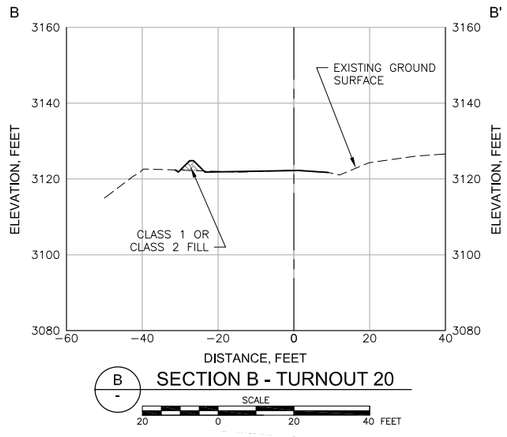

B
-
SECTION B - TURNOUT 20

SCALE
20 0 20 40 FEET

TURNOUT 19 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
206	5	15

TURNOUT 20 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
434	79	112

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

DISCLAIMER:
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DRAWING REFERENCE(S):
- FS ROAD 8301 TOPOGRPAHY RECEIVED FROM ERLANDSEN DATED; JANUARY 18, 2011.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 TURNOUTS 19 AND 20 GRADING PLAN

MWH

SHEET: 10-3-21
REVISION: B
FILE NAME: 1008679D279

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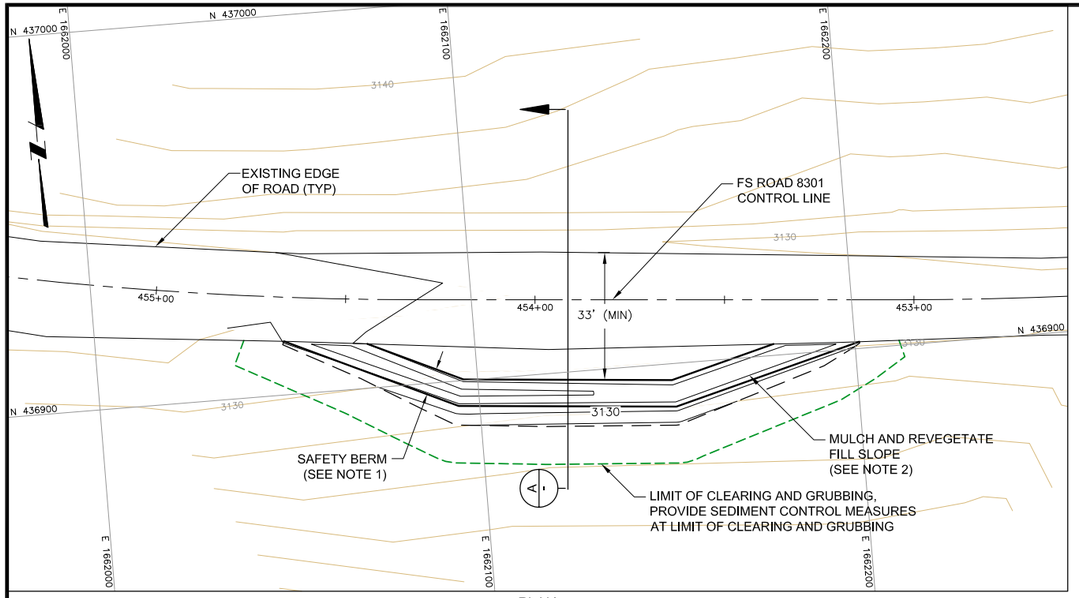

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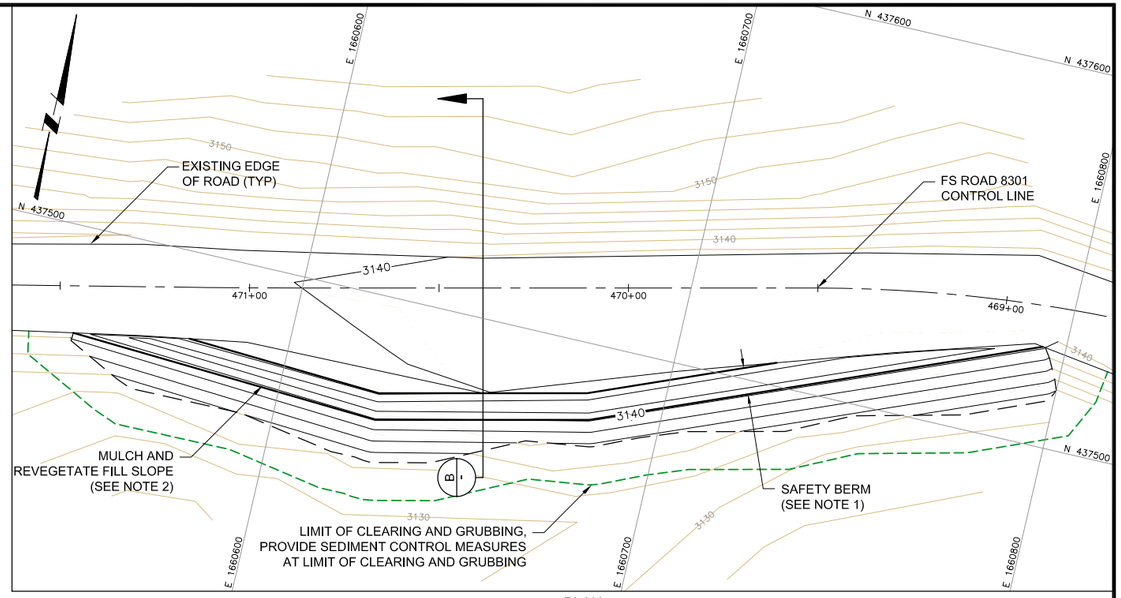

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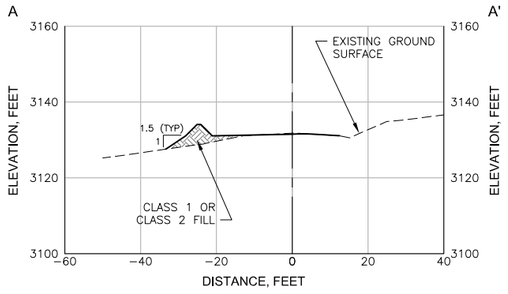
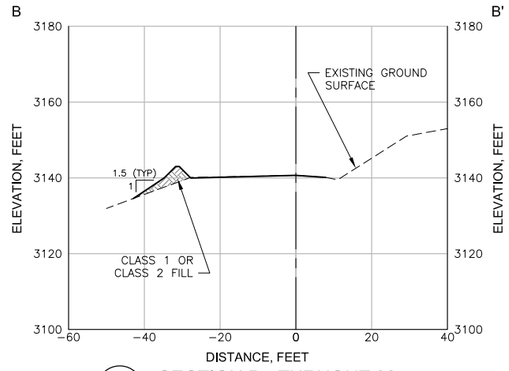


A - SECTION A - TURNOUT 21

SCALE 20 0 20 40 FEET

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.



B - SECTION B - TURNOUT 22

SCALE 20 0 20 40 FEET

TURNOUT 21 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
457	7	92

TURNOUT 22 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
882	1	285

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 TURNOUTS 21 AND 22 GRADING PLAN

MWH

SHEET: 10-3-22 | REVISION: B

FILE NAME: 1008679D280

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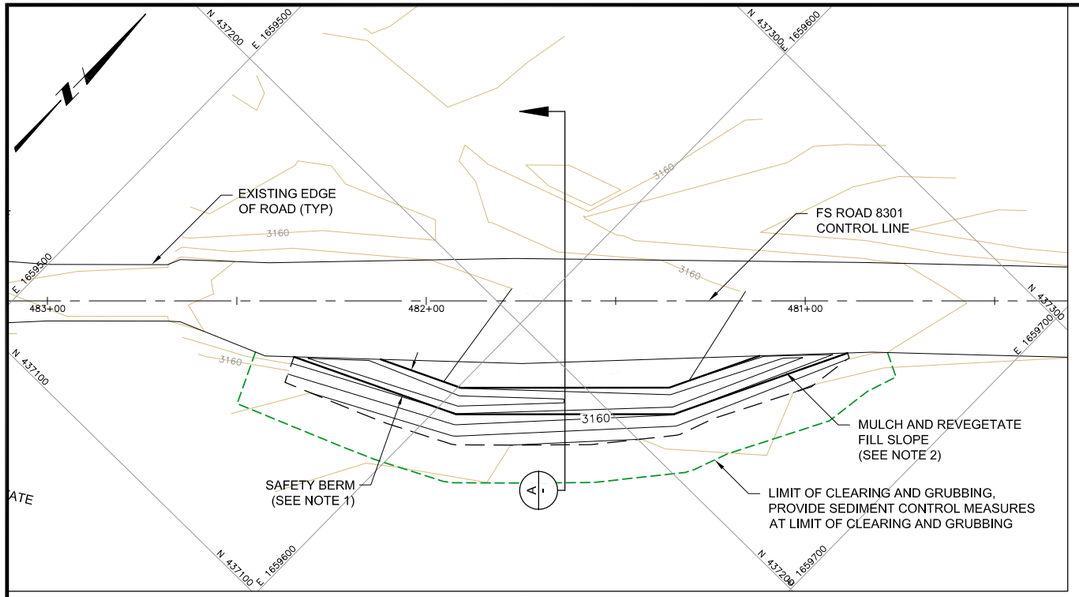

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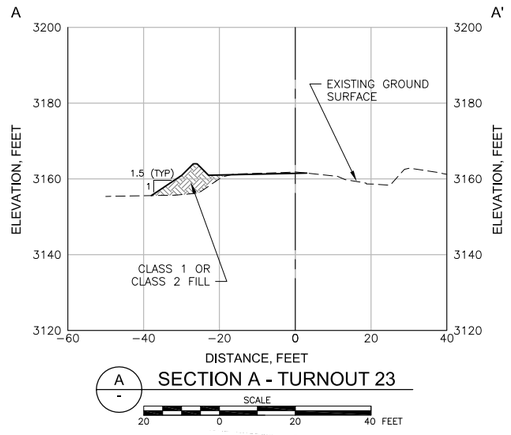


A — SECTION A - TURNOUT 23

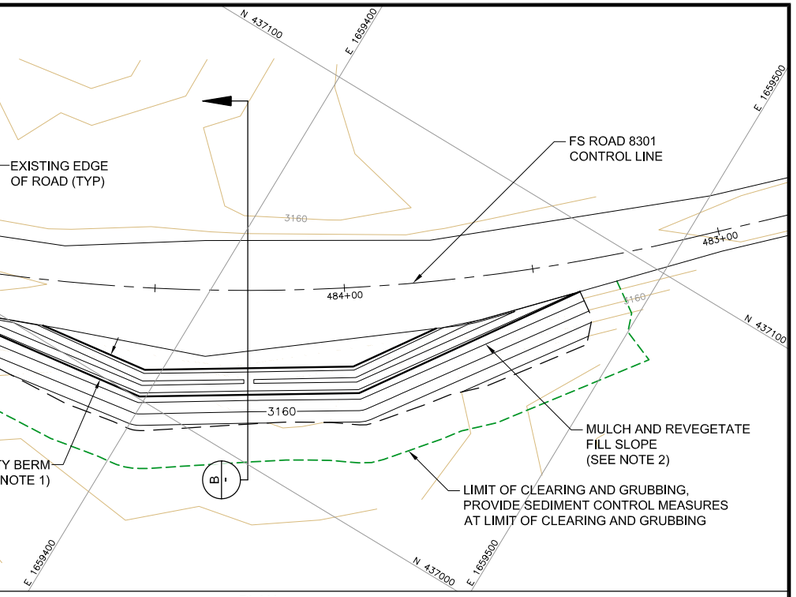
SCALE 20 0 20 40 FEET

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.

TURNOUT 23 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
500	4	178



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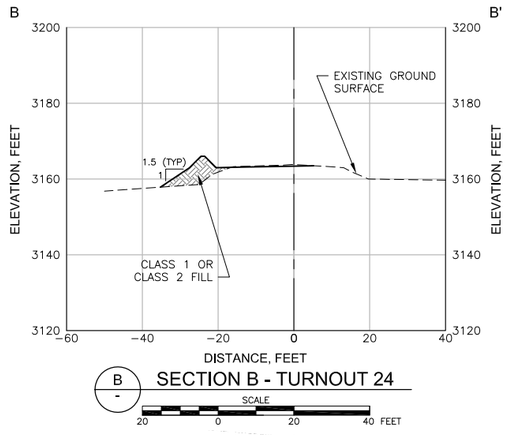

B — SECTION B - TURNOUT 24

SCALE 20 0 20 40 FEET

TURNOUT 24 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
634	122	337

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	PC		FA	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

DISCLAIMER:
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DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 TURNOUTS 23 AND 24 GRADING PLAN

MWH

SHEET: 10-3-23

REVISION: B

FILE NAME: 1008679D281

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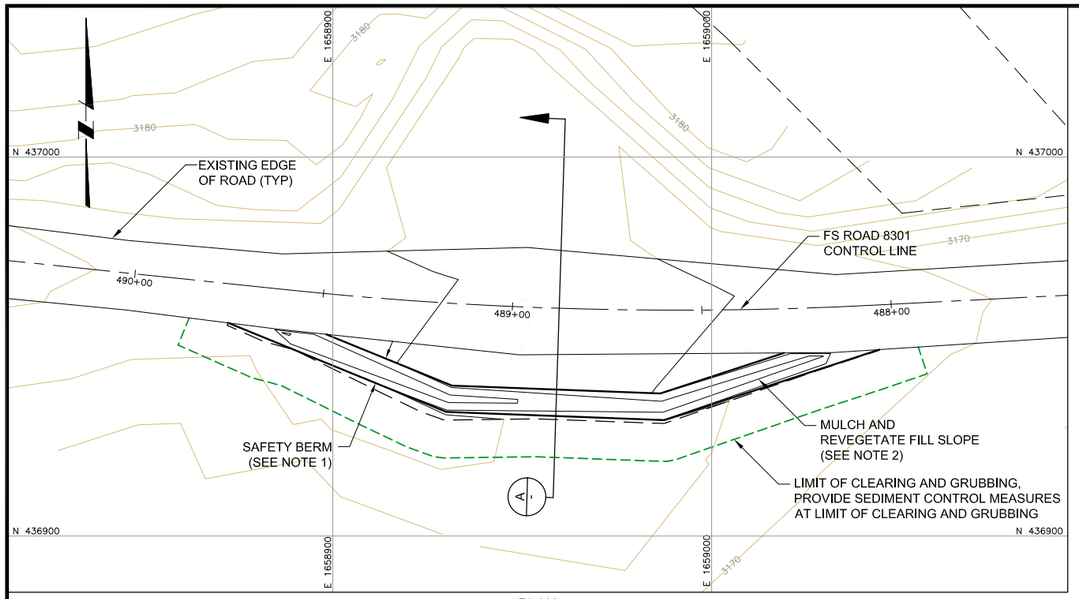

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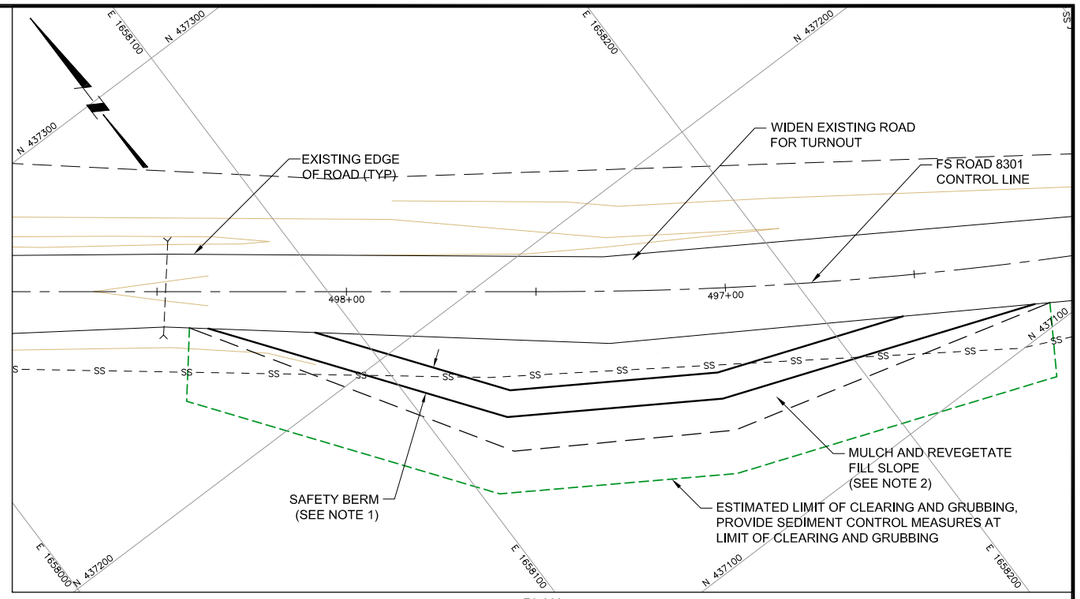
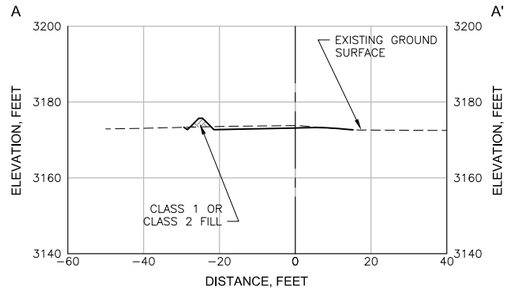


PLAN

TURNOUT 26 - GRADING PLAN

SCALE
20 0 20 40 FEET



A
-
SECTION A - TURNOUT 25

SCALE
20 0 20 40 FEET

TURNOUT 25 - GRADING PLAN AND SECTION

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.
3. CONTRACTOR TO LOCATE SANITARY SEWER PRIOR TO CONSTRUCTION. CONTRACTOR TO PROTECT SEWER LINE PER SPECIFICATIONS.
4. SEE SHEET 1-6, GENERAL NOTES.

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
458	52	9

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWN BY	F. ANDRADE	02/28/11
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PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 TURNOUTS 25 AND 26 GRADING PLAN

MWH

SHEET: 10-3-24
REVISION: B
FILE NAME: 1008679D282

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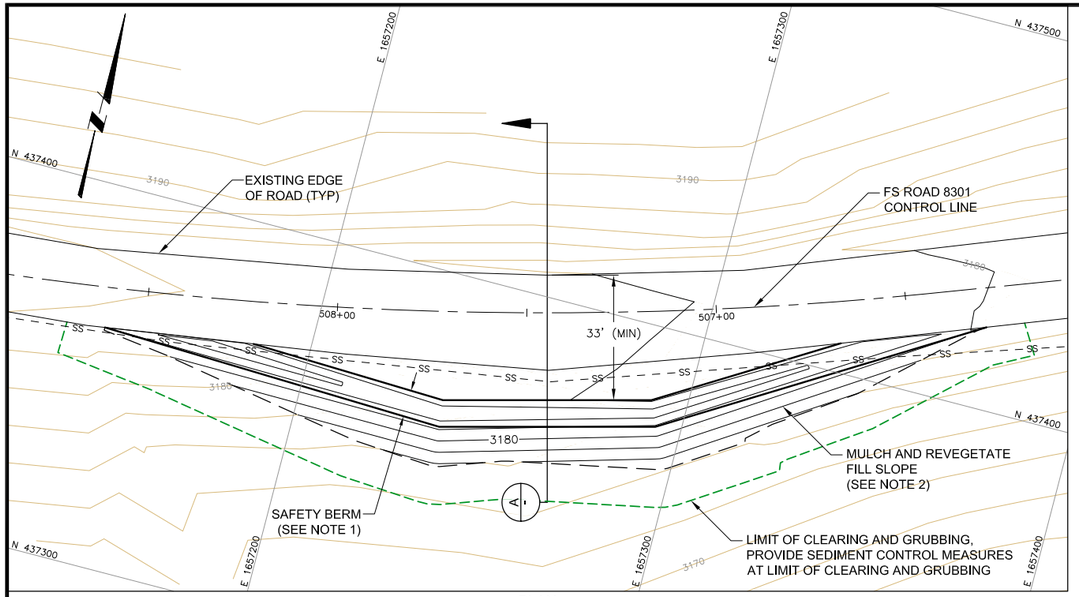
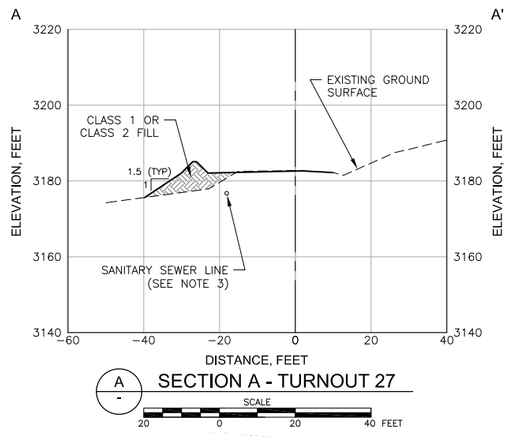


PLAN



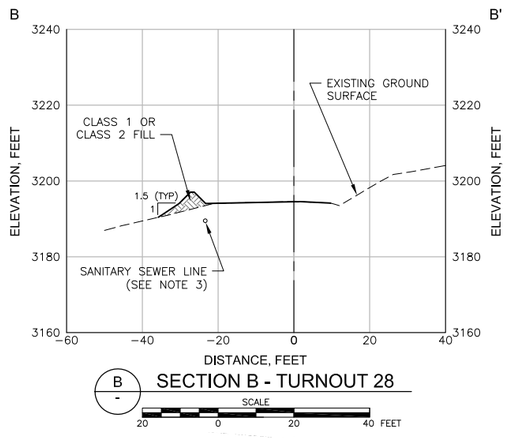
NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.
3. CONTRACTOR TO LOCATE SANITARY SEWER PRIOR TO CONSTRUCTION. CONTRACTOR TO PROTECT SEWER LINE PER SPECIFICATIONS.
4. SEE SHEET 1−6, GENERAL NOTES.

TURNOUT 27 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
797	4	294

PLAN



TURNOUT 28 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
362	3	61

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 TURNOUTS 27 AND 28 GRADING PLAN

MWH

SHEET: 10-3-25
REVISION: B
FILE NAME: 1008679D283

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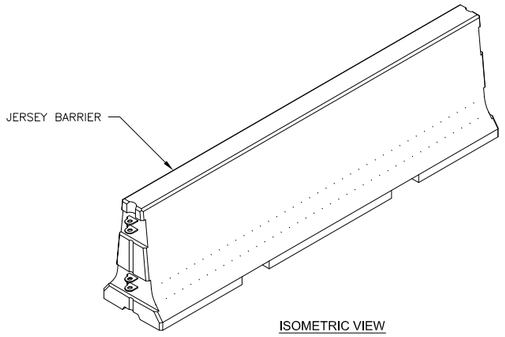

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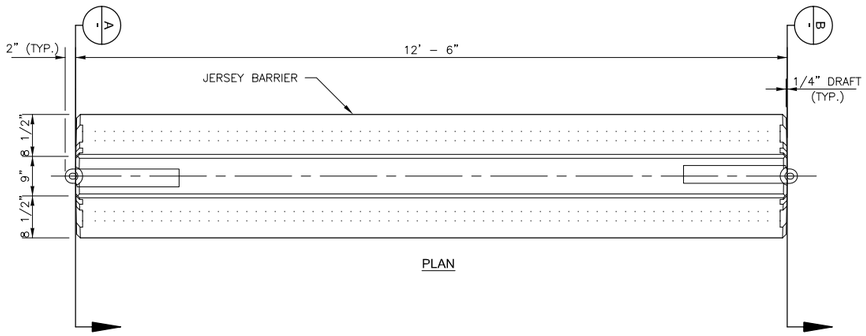
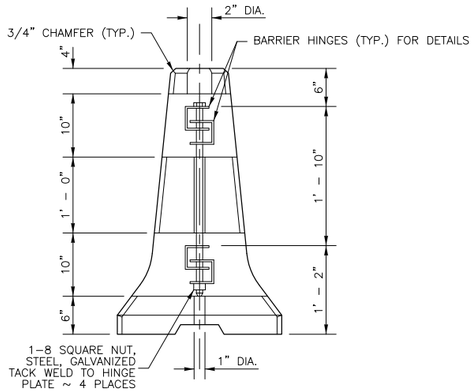


PLAN



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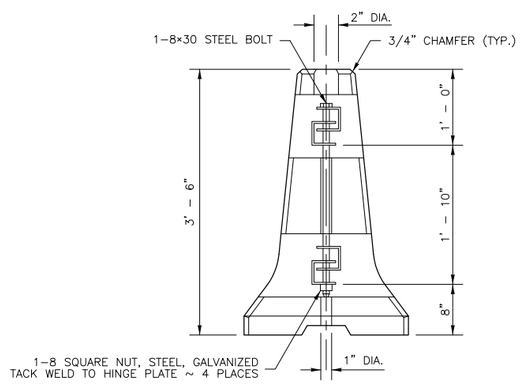
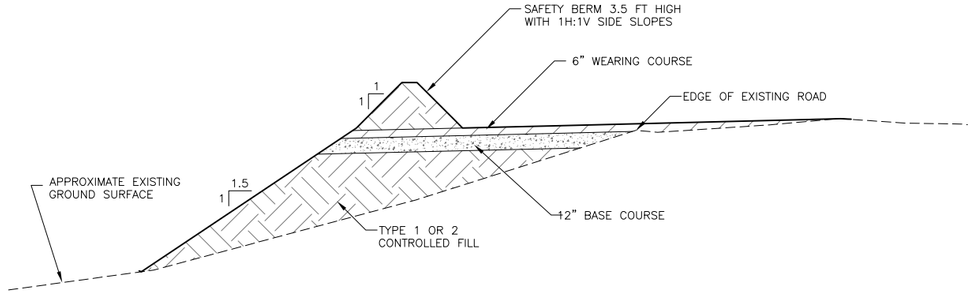
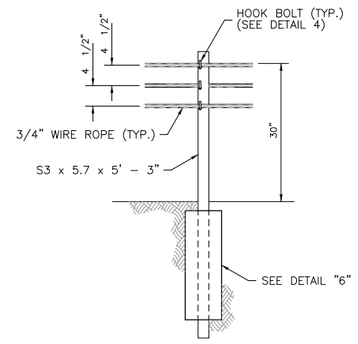


B SECTION B
N.T.S.

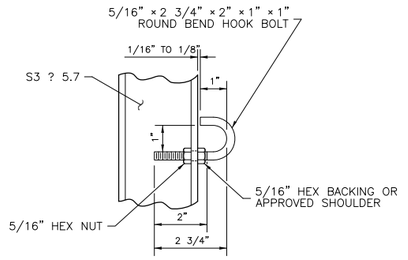
1 10-3-26 JERSEY BARRIER



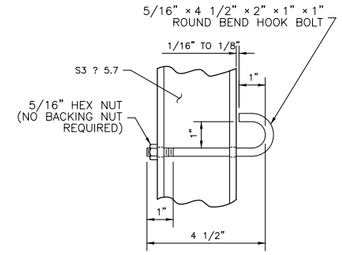
2 10-3-26 FS ROAD 8301 TURNOUT EXPANSION (TYP)



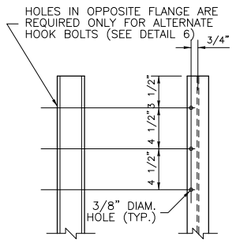
3 - CABLE BARRIER TYPE 2 OR 3



4 - HOOK BOLT



5 - ALTERNATE HOOK BOLT



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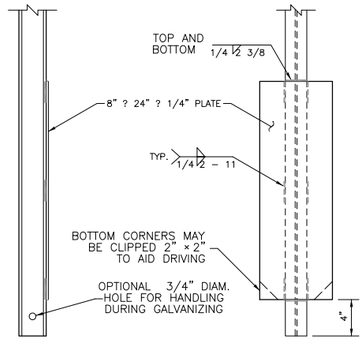

6 -

NOTES:

1. JERSEY BARRIERS MAY BE USED ON TANGENTS AND HORIZONTAL CURVES WITH RADII GREATER THAN 770'.
2. JERSEY BARRIER HINGES SHALL BE PLACED IN LOCATIONS SHOWN TO A TOLERANCE OF 3/32".
3. THIS DRAWING IS NOT TO SCALE.

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

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PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 - DETAIL SHEET

MWH

SHEET: 10-3-26
REVISION: B
FILE NAME: 1008679D236

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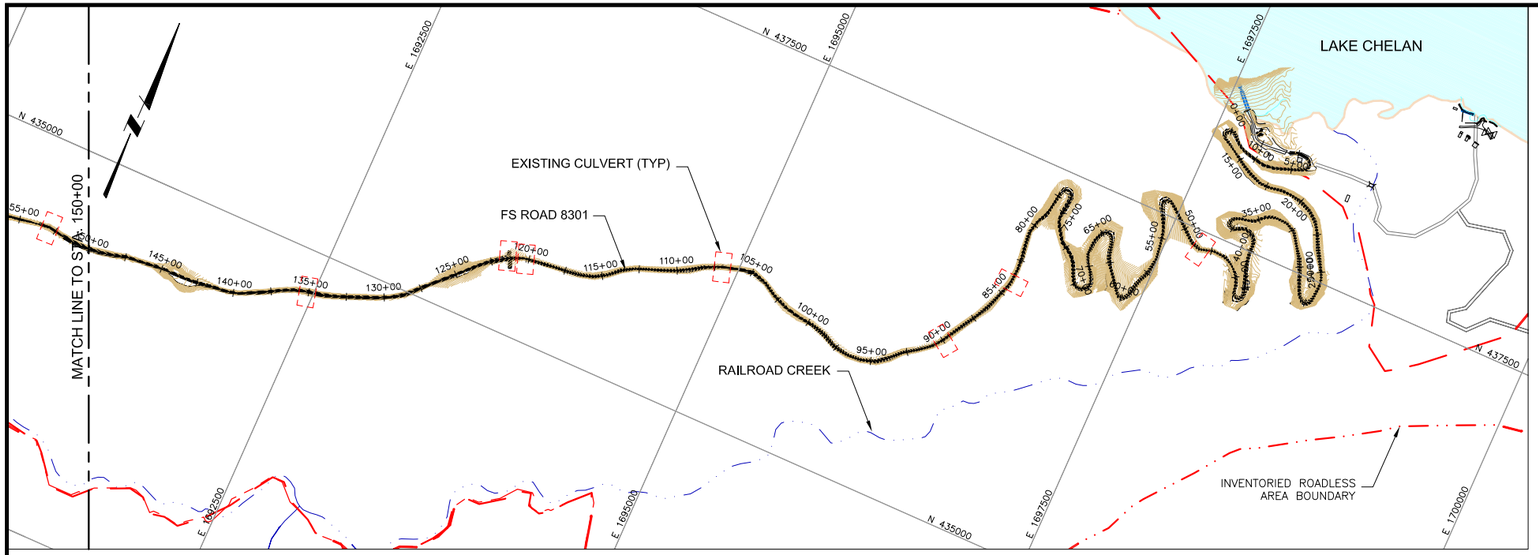

PLAN

SCALE
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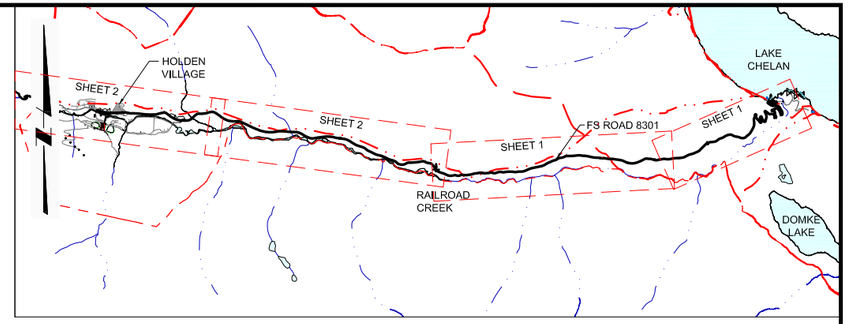
CONTOUR INTERVAL = 10 FEET



KEY MAP

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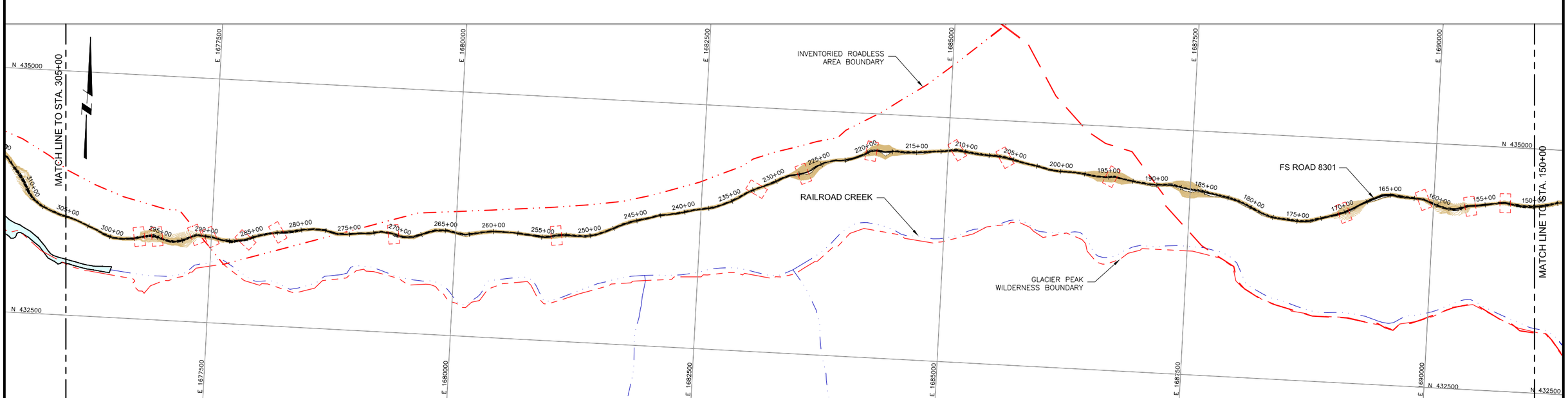

PLAN

SCALE
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CONTOUR INTERVAL = 10 FEET

REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):
- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- FS ROAD 8301 TOPOGRPAHY RECEIVED FROM ERLANDSEN DATED: JANUARY 18, 2011.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	R. WATT	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: EXISTING CULVERTS ALONG FS ROAD 8301 (SHEET 1 OF 2)

MWH

SHEET: 10-3-27
REVISION: B
FILE NAME: 1008679D313

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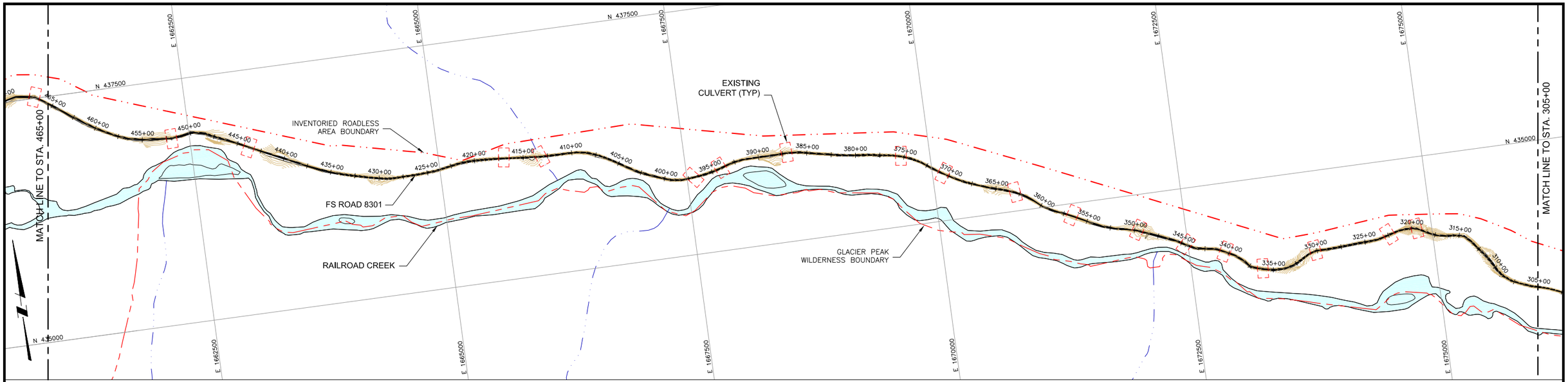

PLAN

SCALE
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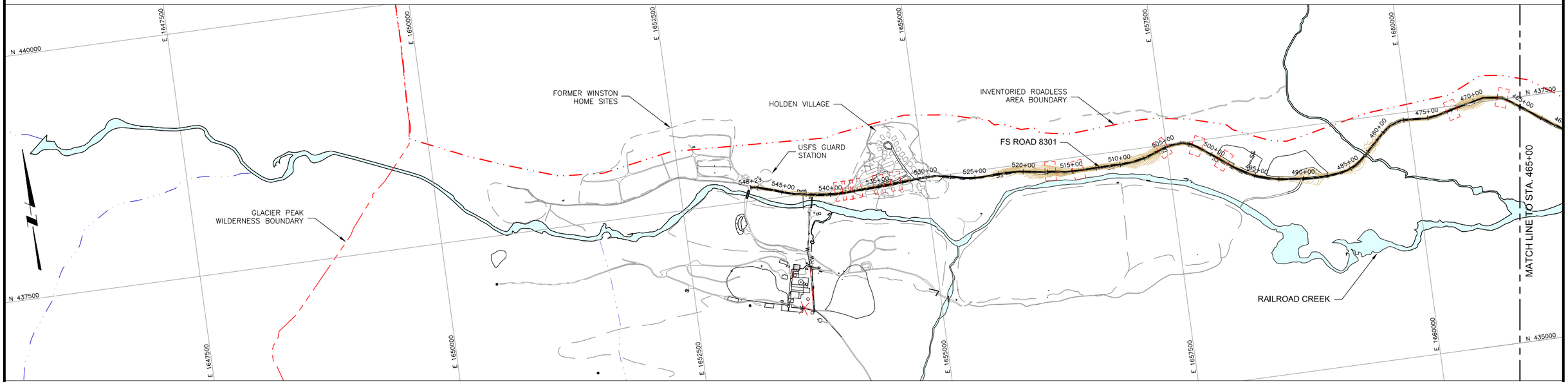

PLAN

SCALE
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CONTOUR INTERVAL = 10 FEET

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

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DRAWN BY	R. WATT	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: EXISTING CULVERTS ALONG FS ROAD 8301 (SHEET 2 OF 2)

MWH

SHEET: 10-3-28
REVISION: B
FILE NAME: 1008679D314

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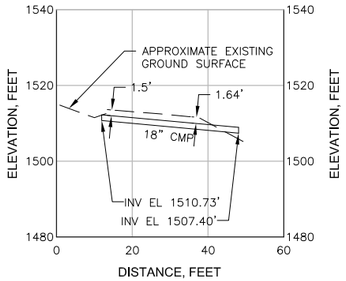
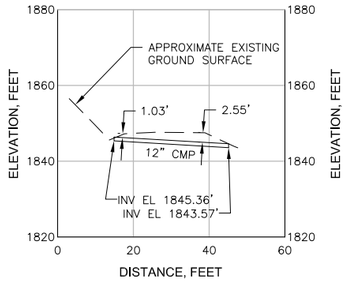
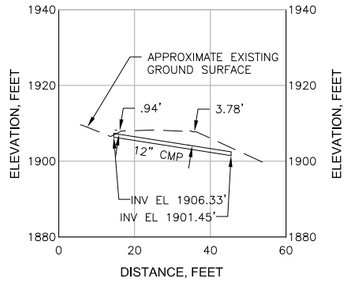


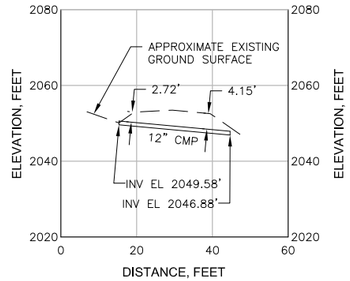
C1 - STA 48+28



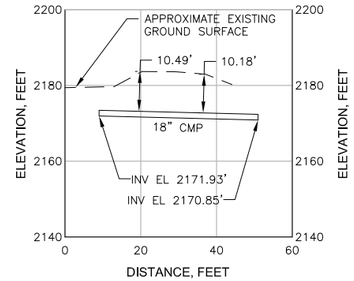
C2 - STA 84+09



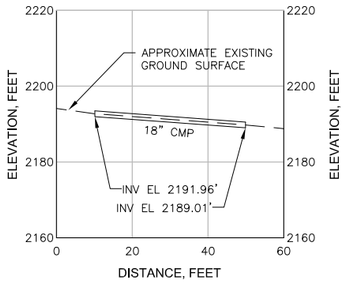
C3 - STA 90+00



C4 - STA 106+98



C5 - STA 120+19



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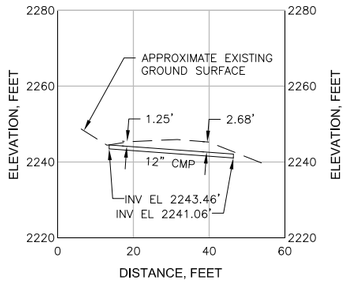
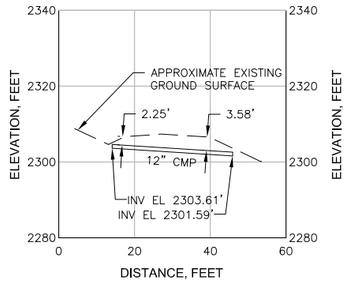
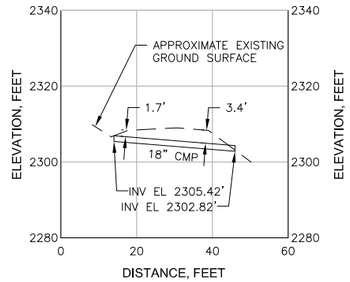


C7 - STA 135+09



C8 - STA 152+93



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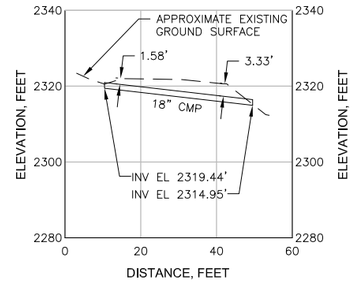

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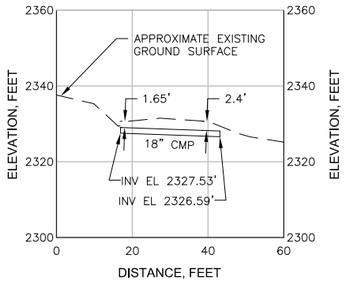
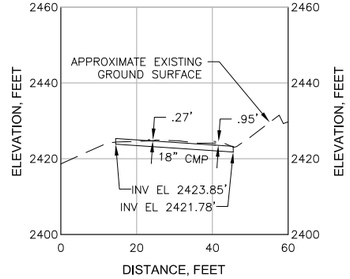


C11 - STA 170+09

C12 - STA 175+83

C13 - STA 188+52



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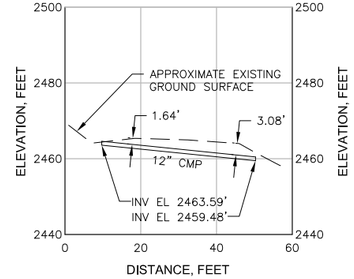

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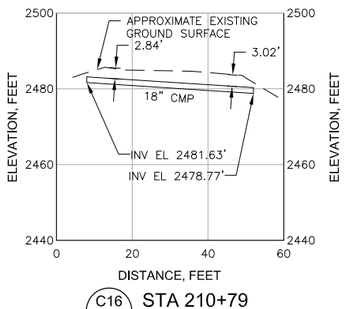
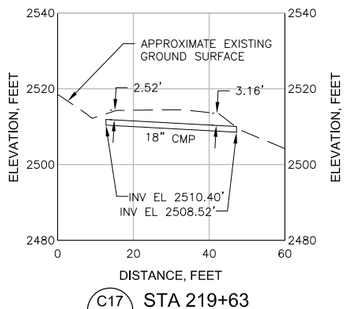
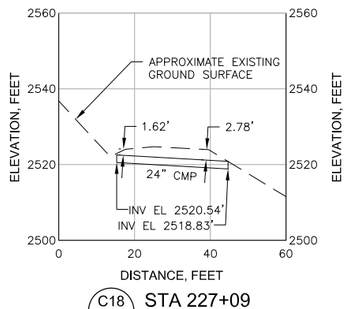


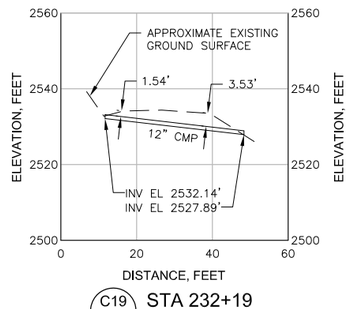
C16 - STA 210+79



C17 - STA 219+63



C18 - STA 227+09



C19 - STA 232+19

C20 - STA 249+81

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
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DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: EXISTING CULVERT PROFILES C1 THROUGH C20

MWH

SHEET: 10-3-29
REVISION: B
FILE NAME: 1008679D330

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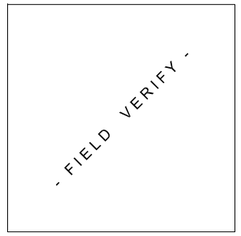
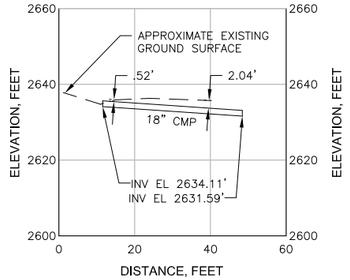
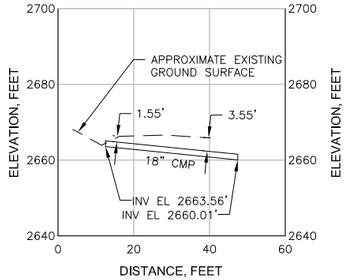


C21 - STA 253+46

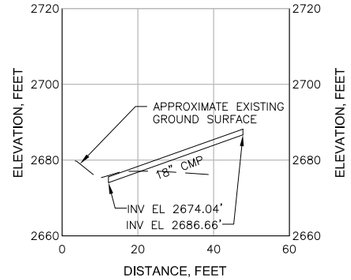
C22 - STA 253+46



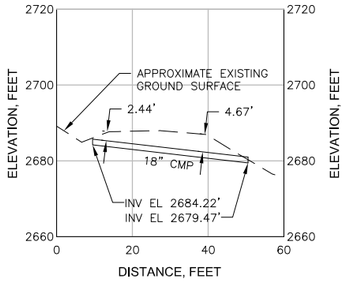
C23 - STA 270+37



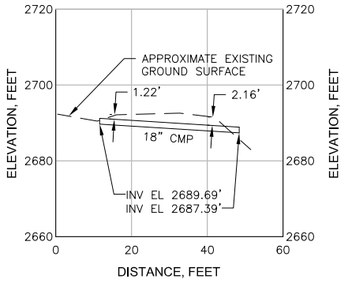
C24 - STA 282+33



C25 - STA 285+76



C26 - STA 289+38



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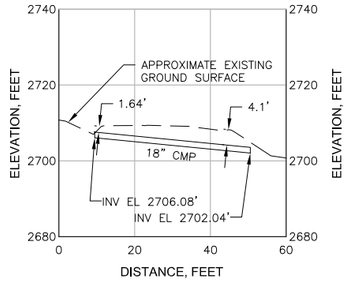
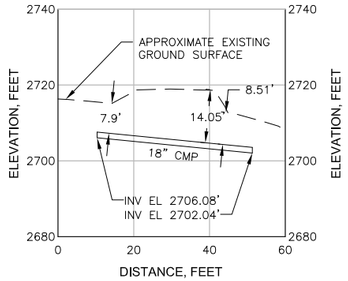


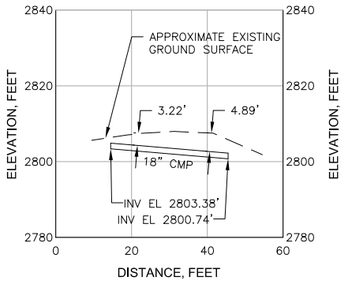
C28 - STA 295+04



C29 - STA 296+88

C30 - STA 310+25

C31 - STA 319+39



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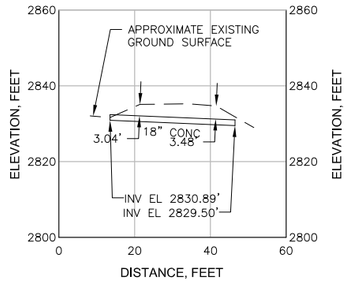
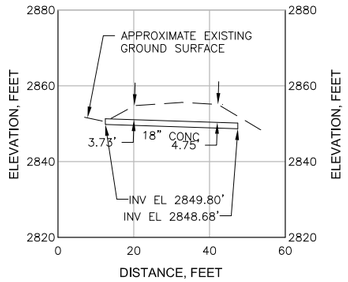
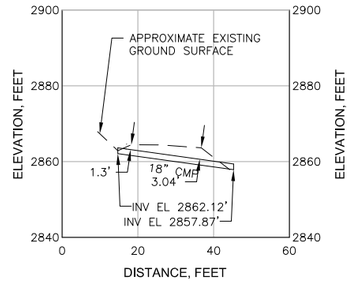


C33 - STA 330+09



C34 - STA 335+99



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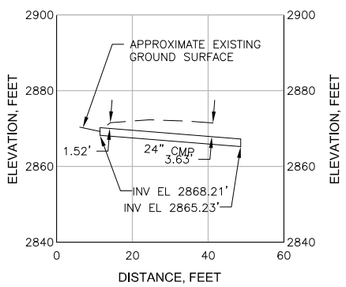
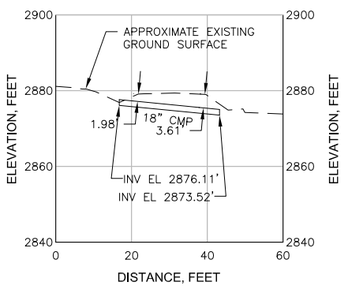
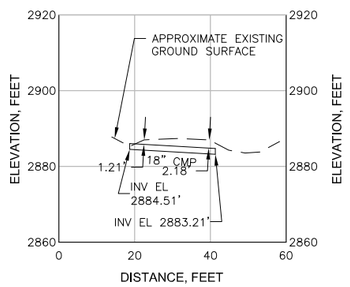


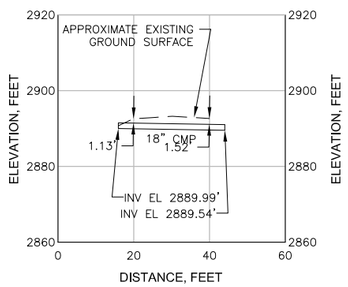
C36 - STA 344+26



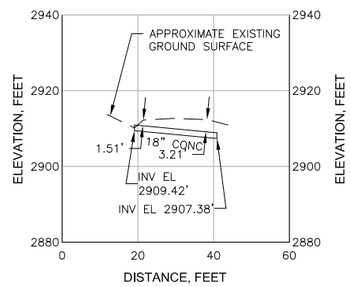
C37 - STA 349+59



C38 - STA 356+54



C39 - STA 366+89



C40 - STA 370+53

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: EXISTING CULVERT PROFILES C21 THROUGH C40

MWH

SHEET: 10-3-30
REVISION: B
FILE NAME: 1008679D331

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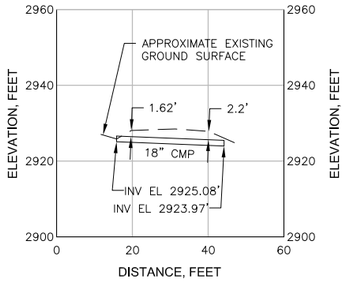
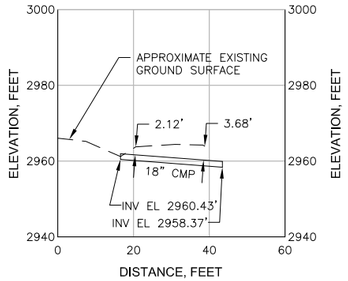
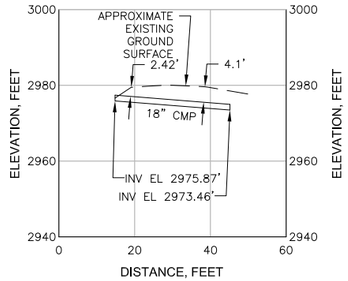


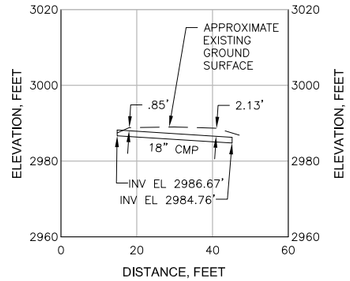
C41 - STA 375+24



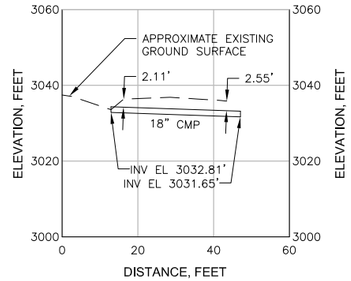
C42 - STA 386+99



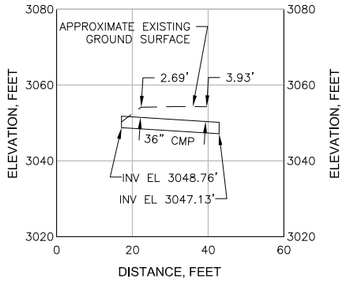
C43 - STA 393+96



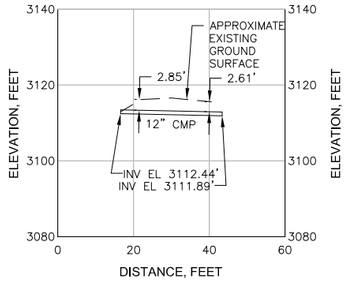
C44 - STA 396+90



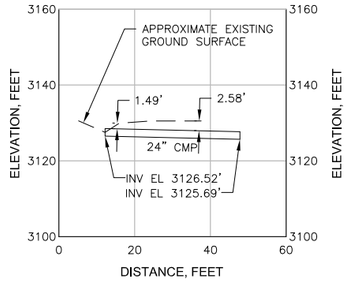
C45 - STA 413+07



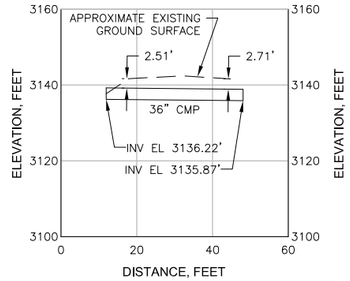
C46 - STA 416+91



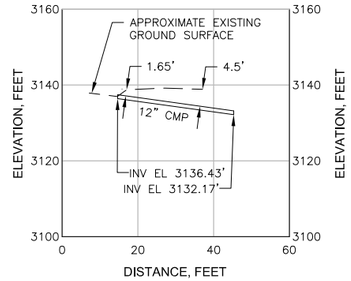
C47 - STA 443+77



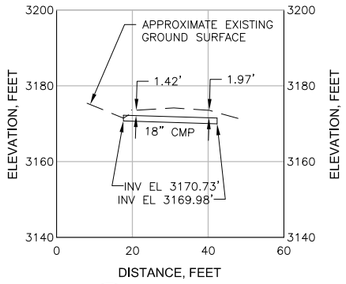
C48 - STA 451+99



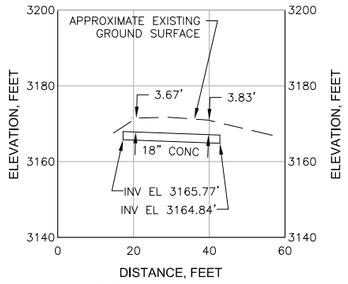
C49 - STA 467+00



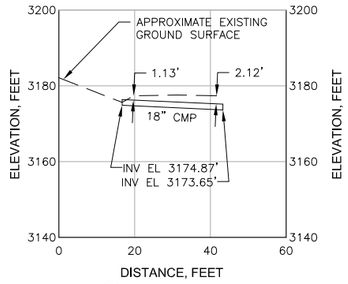
C50 - STA 472+39



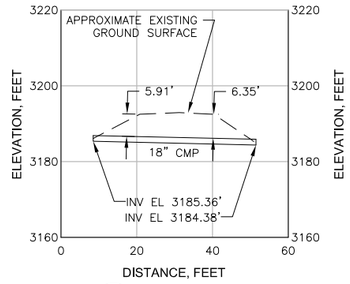
C51 - STA 498+48



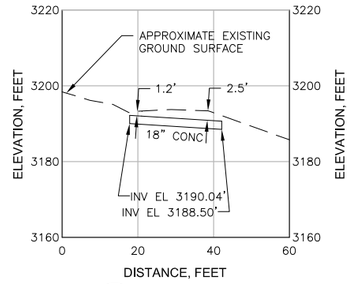
C52 - STA 501+58



C53 - STA 505+20



C54 - STA 514+24



C55 - STA 517+11

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: EXISTING CULVERT PROFILES C41 THROUGH C55

MWH

SHEET: 10-3-31

REVISION: B

FILE NAME: 1008679D332

M:\Clients-G-Z\Rio Tinto\1008679 - Holden Mine\013-Sheet Set\Infrastructure Improvements\FS Road 830\1008679D332 4/15/2011 3:26:36 PM

FORMER WINSTON HOME SITES
USFS GUARD STATION
HOLDEN VILLAGE
EXISTING BRIDGE
LAGOON AREA
LOWER WEST AREA
SHEET 10-4-6
HOLDEN VILLAGE HYDROELECTRIC PLANT
TAILINGS PILE 1
SEDIMENT POND TO REMAIN
WEST WASTE ROCK PILE
EAST WASTE ROCK PILE
SHEET 10-4-5
INVENTORIED ROADLESS AREA BOUNDARY
RAILROAD CREEK
TAILINGS PILE 2
TAILINGS PILE 3
EXISTING ACCESS ROAD
FS ROAD 8301
TENMILE CREEK
TO LUCERNE 9.5 MILES
SHEET 10-4-2
SHEET 10-4-4
SHEET 10-4-3
EXISTING ROAD
COPPER CREEK
HOLDEN VILLAGE BY-PASS ROAD
N 438000
N 437000
N 436000
E 1654000
E 1655000
E 1656000
E 1657000
E 1658000
E 1659000
69+41
65+00
60+00
55+00
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10+00
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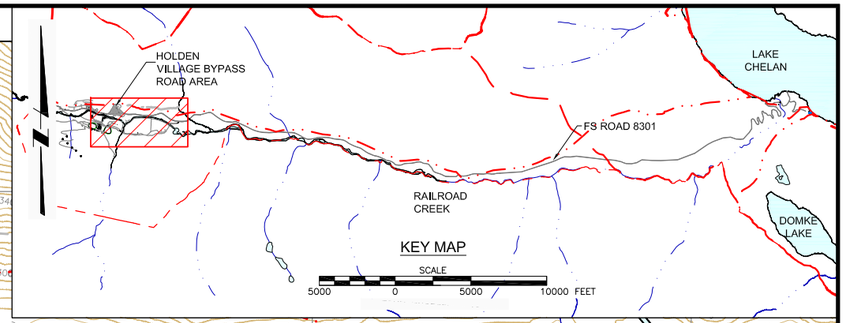
KEY MAP



SCALE
5000 0 5000 10000 FEET

PLAN

SCALE
200 0 200 400 FEET
CONTOUR INTERVAL = 10 FEET

REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.
- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA–FSA–APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BYPASS ROAD KEY MAP

MWH

SHEET: 10-4-1
REVISION: B
FILE NAME: 1008679D238

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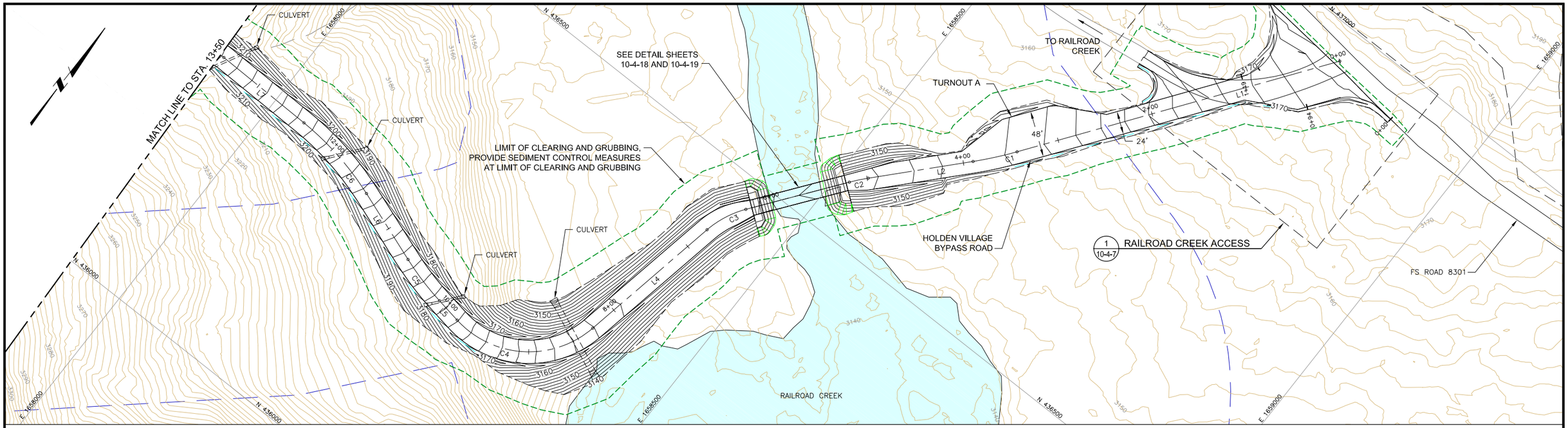

PLAN

SCALE

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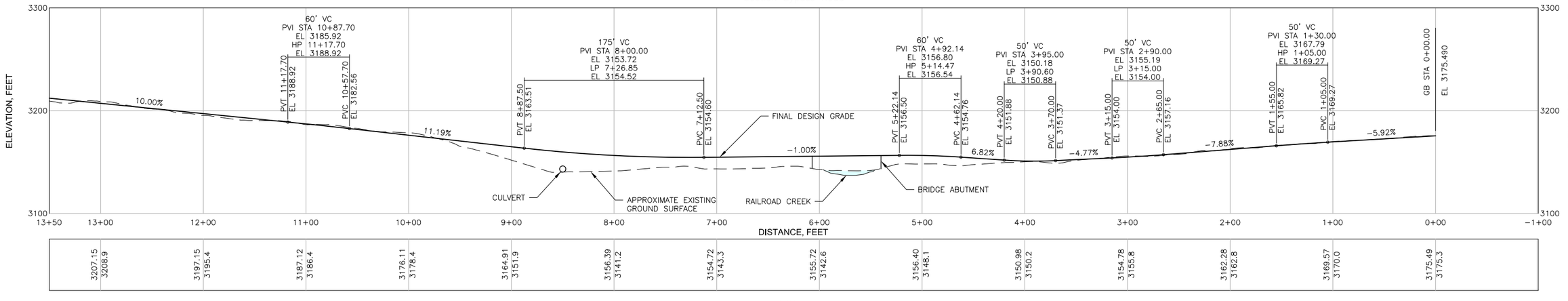
CONTOUR INTERVAL = 2 FEET

LEGEND:

L44 LINE AND CURVE DESIGNATIONS
C47 SEE SHEET 10-4-8 FOR LINE AND CURVE TABLES



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3141.2	3143.3	3142.6	3148.1	3150.2
3154.78	3162.28	3169.57	3175.49	
3155.8	3162.8	3170.0	3175.3	

PROFILE

SCALE

50 0 50 100 FEET

NOTE:

1. LIMITS OF CLEARING AND GRUBBING BASED ON DESIGN CUT/FILL DAYLIGHT LIMITS PLUS 20 FEET HORIZONTALLY.

ISSUE / REV				
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: BYPASS ROAD STA 0+00 TO STA 13+50 PLAN AND PROFILE

MWH

SHEET: 10-4-2 REVISION: B

FILE NAME: 1008679D264

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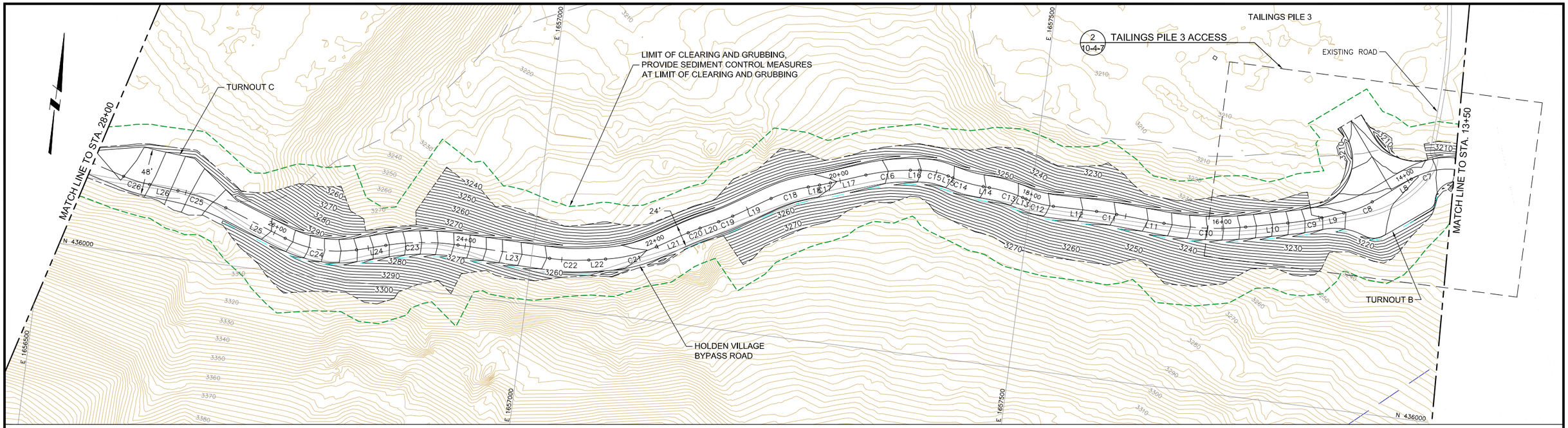

PLAN

SCALE

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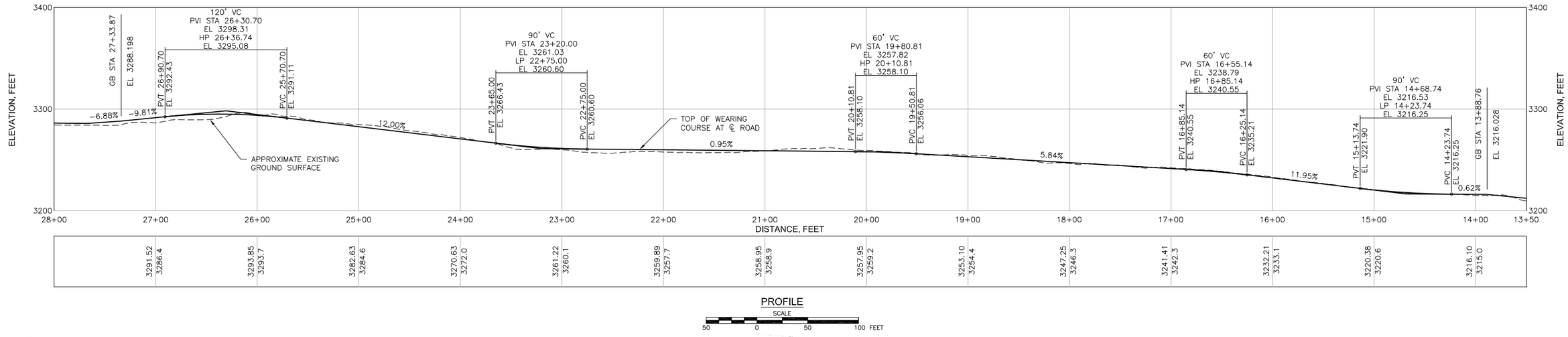
CONTOUR INTERVAL = 2 FEET

LEGEND:

L44 LINE AND CURVE DESIGNATIONS
C47 SEE SHEET 10-4-8 FOR LINE AND CURVE TABLES



PROFILE

SCALE

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NOTE:

1. LIMITS OF CLEARING AND GRUBBING BASED ON DESIGN CUT/FILL DAYLIGHT LIMITS PLUS 20 FEET HORIZONTALLY.

ISSUE/REV				
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
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PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BYPASS ROAD STA 13+50 TO STA 28+00 PLAN AND PROFILE

MWH

SHEET 10-4-3
REVISION B
FILE NAME 1008679D265

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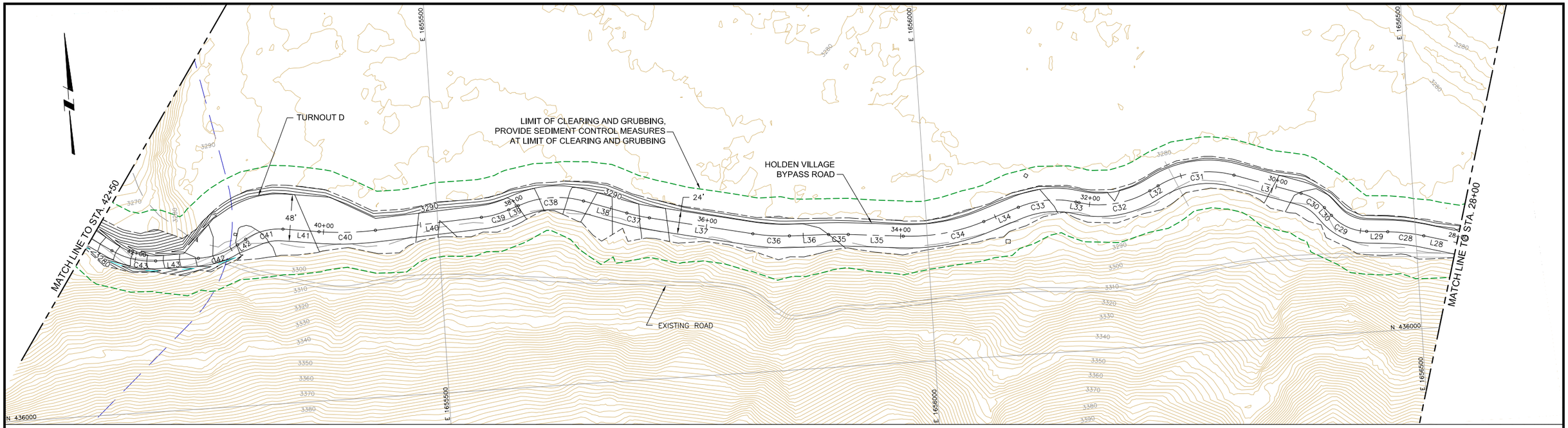

PLAN

SCALE

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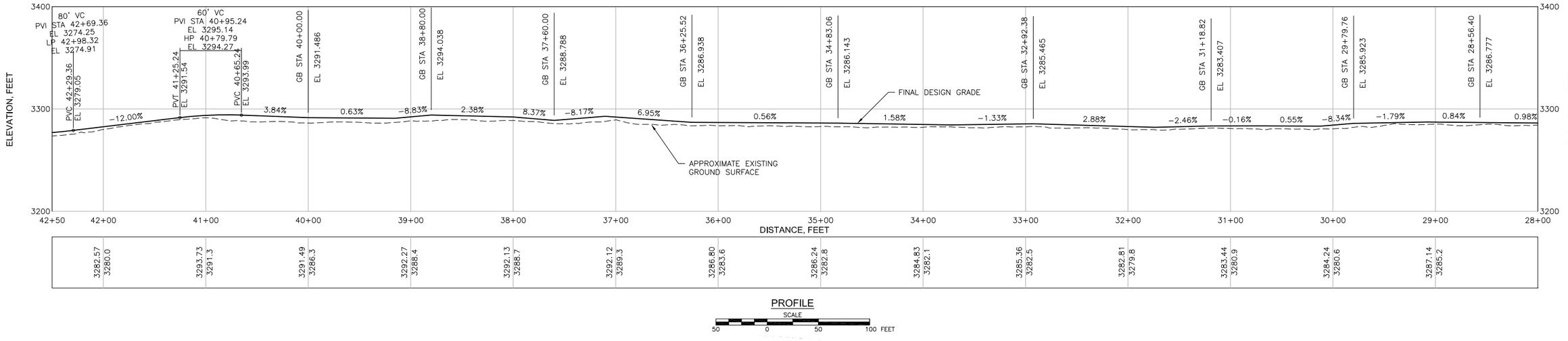
CONTOUR INTERVAL = 2 FEET

LEGEND:

L44 LINE AND CURVE DESIGNATIONS
C47 SEE SHEET 10-4-8 FOR LINE AND CURVE TABLES



PROFILE

SCALE

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NOTE:

1. LIMITS OF CLEARING AND GRUBBING BASED ON DESIGN CUT/FILL DAYLIGHT LIMITS PLUS 20 FEET HORIZONTALLY.

ISSUE / REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: BYPASS ROAD STA 28+00 TO STA 42+50 PLAN AND PROFILE

MWH

SHEET 10-4-4 REVISION B

FILE NAME 1008679D266

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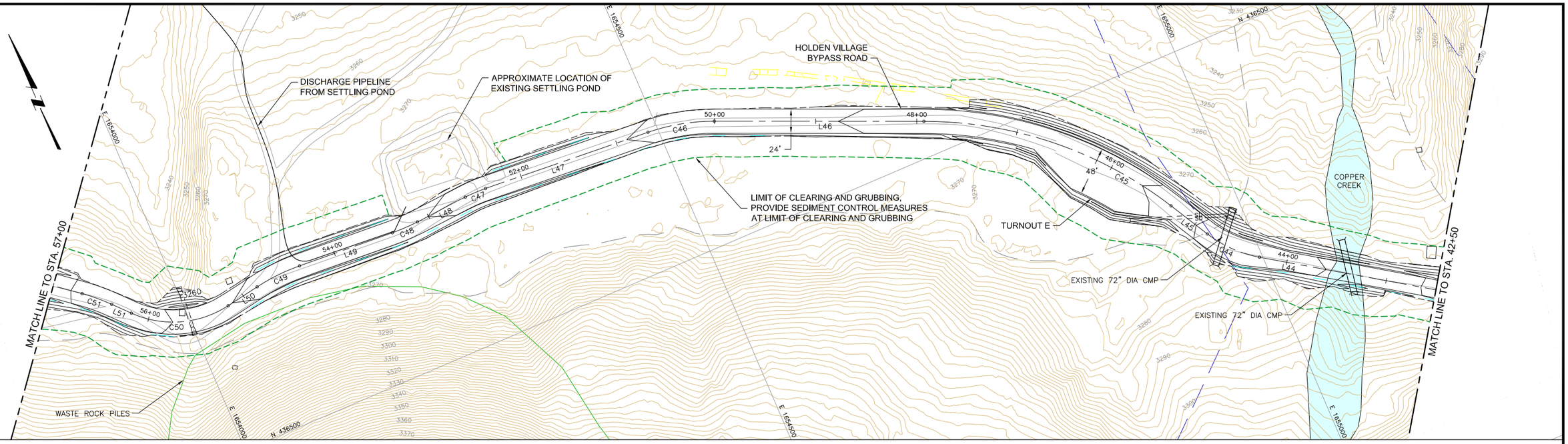


PLAN

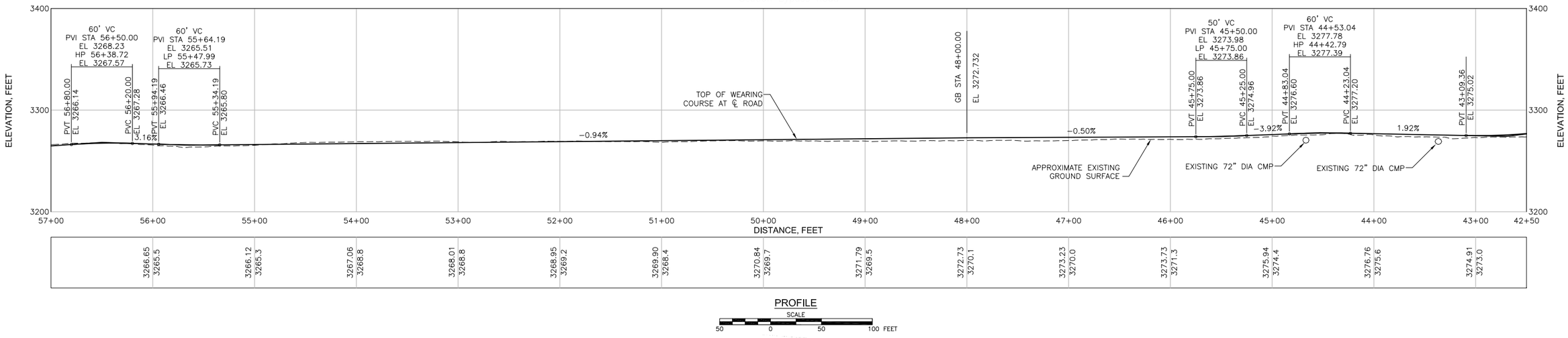
SCALE
50 0 50 100 FEET
CONTOUR INTERVAL = 2 FEET

LEGEND:

L44 LINE AND CURVE DESIGNATIONS
C47 SEE SHEET 10-4-8 FOR LINE AND CURVE TABLES

NOTE:

1. VERIFY DEPTH OF COVER OVER RAW WATER AND WATER LINES BY POTHOLING PRIOR TO STRIPPING AND GRUBBING FOR ROAD CONSTRUCTION.



PROFILE

SCALE
50 0 50 100 FEET

NOTE:

1. LIMITS OF CLEARING AND GRUBBING BASED ON DESIGN CUT/FILL DAYLIGHT LIMITS PLUS 20 FEET HORIZONTALLY.

ISSUE / REV				
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.
- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA-FSA-APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BYPASS ROAD STA 42+50 TO STA 57+00 PLAN AND PROFILE

MWH

SHEET: 10-4-5
REVISION: B
FILE NAME: 1008679D267

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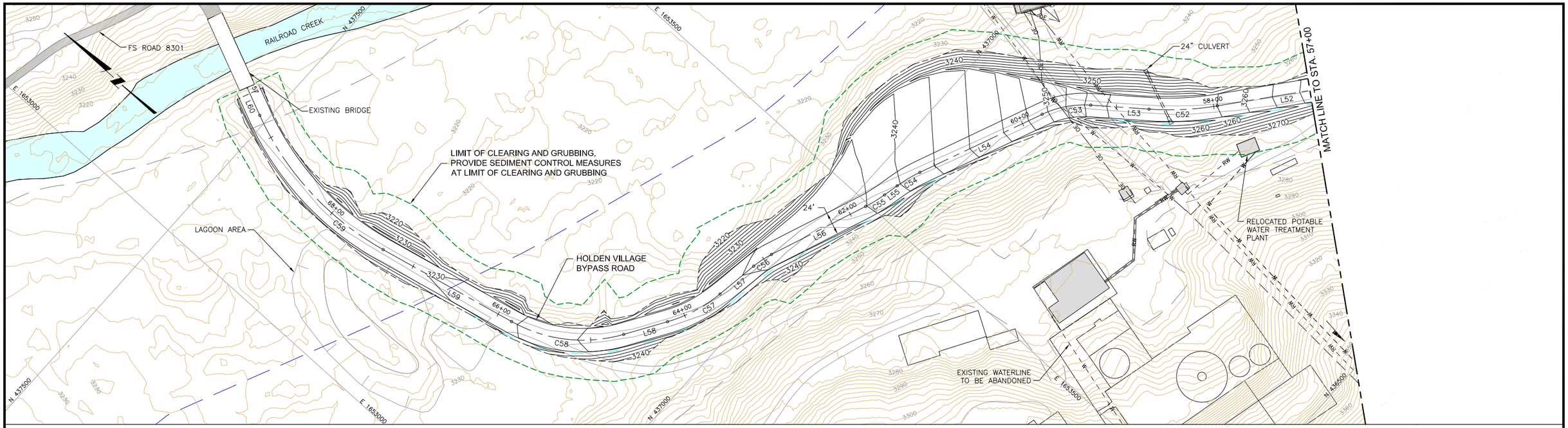

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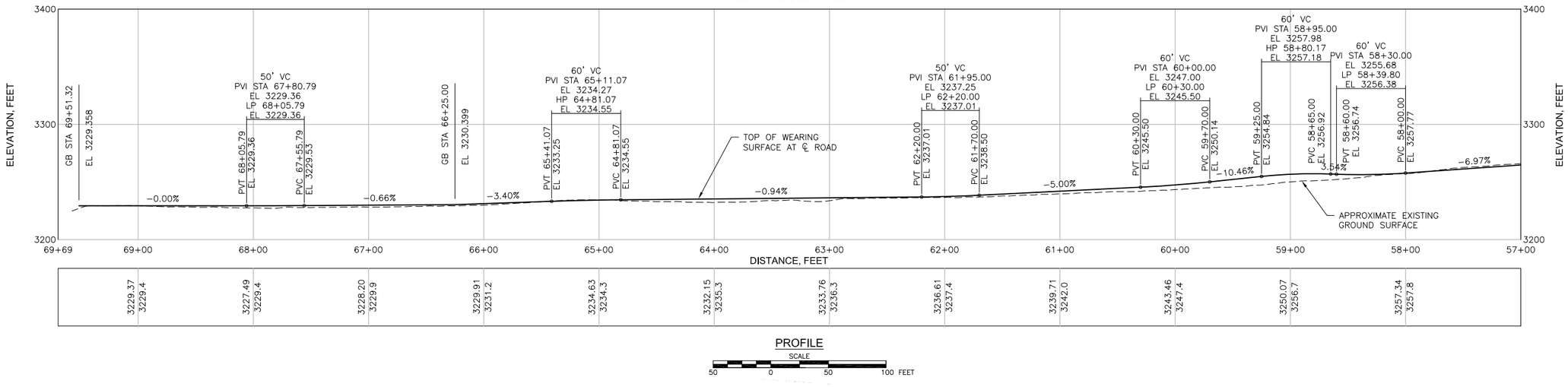
CONTOUR INTERVAL = 2 FEET

LEGEND:

L44 LINE AND CURVE DESIGNATIONS
C47 SEE SHEET 10-4-8 FOR LINE AND CURVE TABLES



PROFILE
SCALE
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NOTE:

1. LIMITS OF CLEARING AND GRUBBING BASED ON DESIGN CUT/FILL DAYLIGHT LIMITS PLUS 20 FEET HORIZONTALLY.

ISSUE/REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

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DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	03/01/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BYPASS ROAD STA 57+00 TO STA 69+69 PLAN AND PROFILE

MWH

SHEET 10-4-6
REVISION B
FILE NAME 1008679D268

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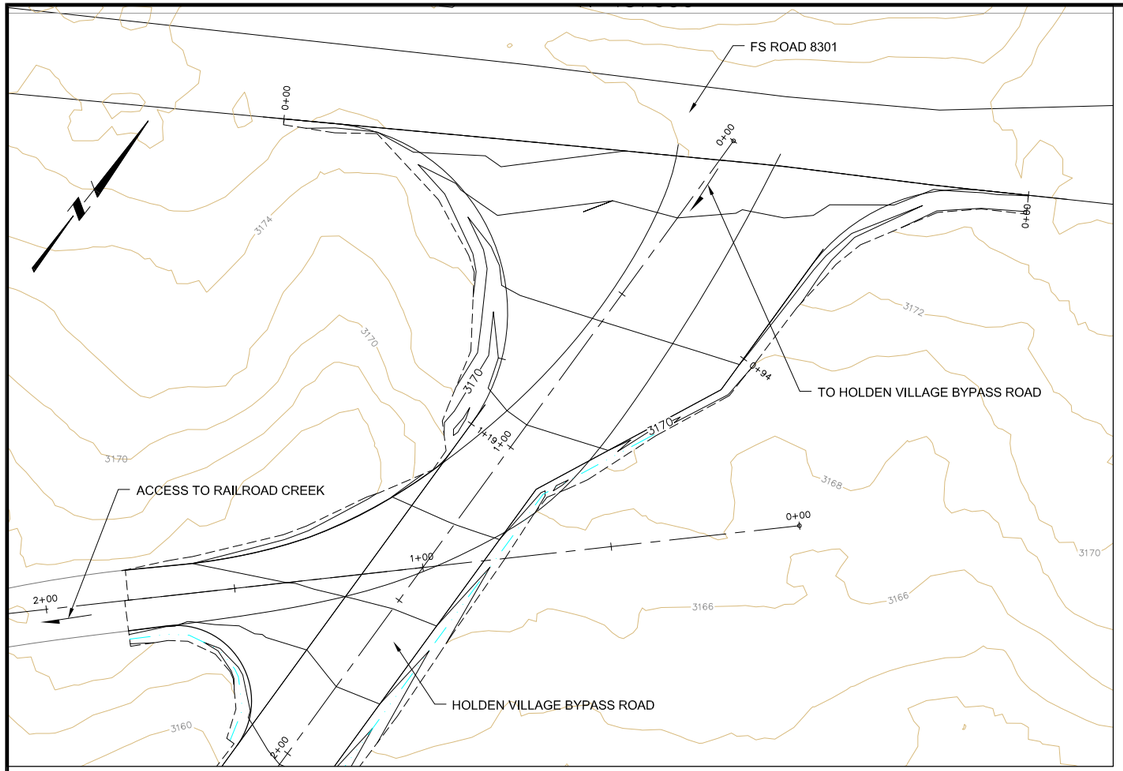

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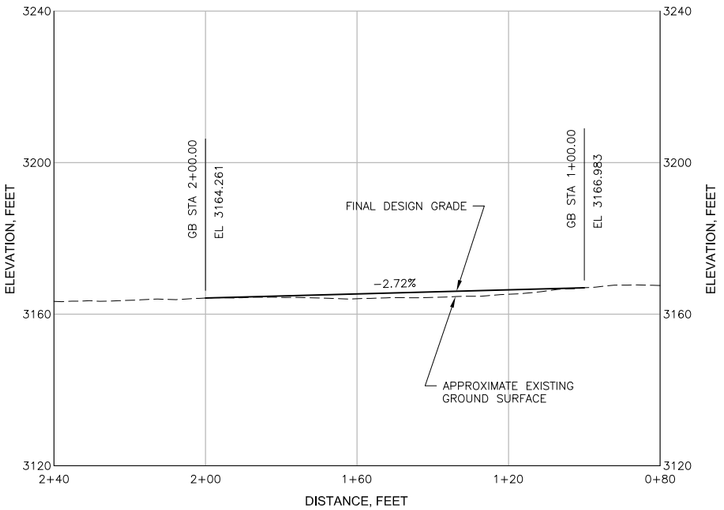
CONTOUR INTERVAL = 2 FEET



PROFILE

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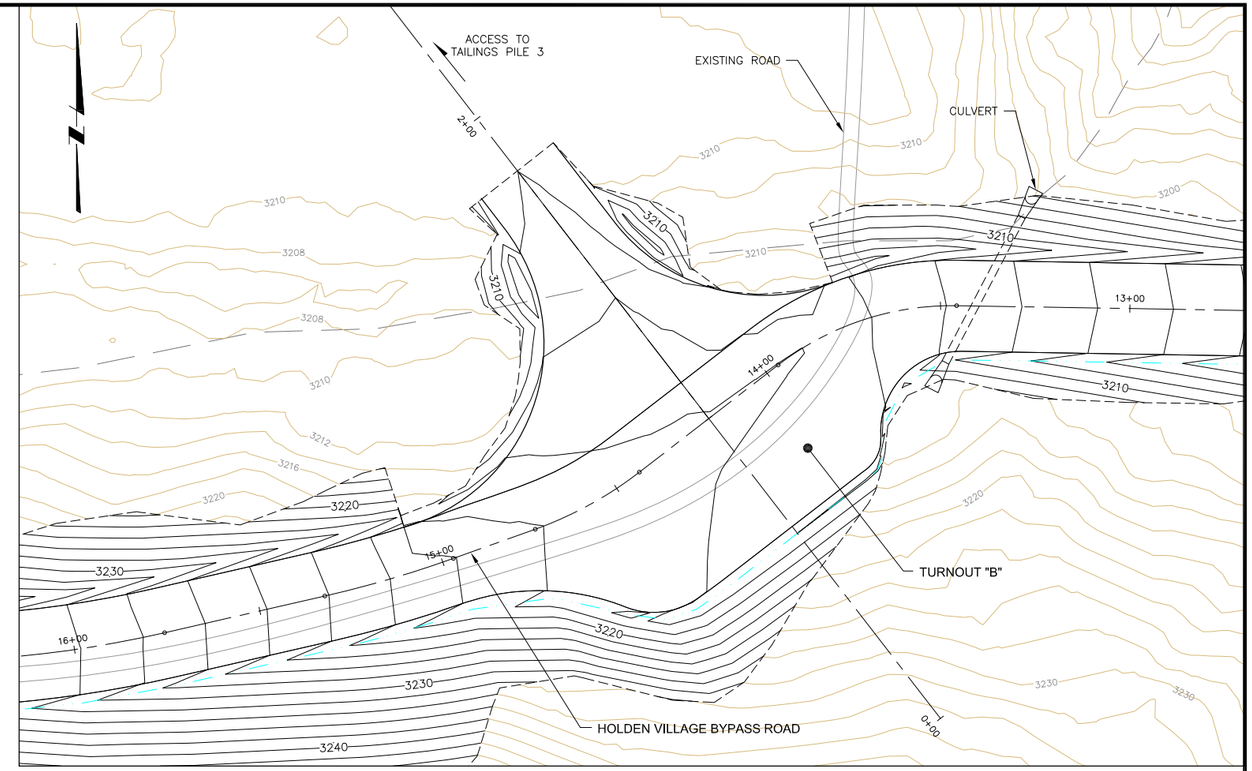

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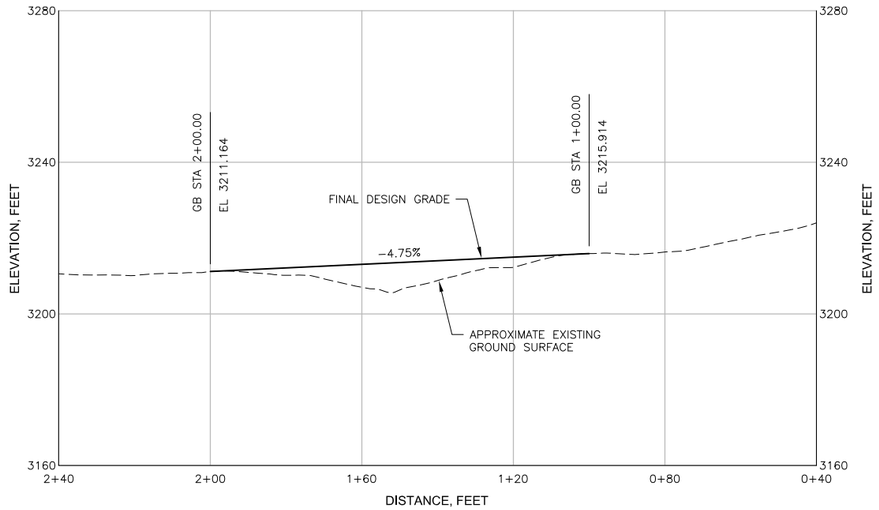
CONTOUR INTERVAL = 2 FEET



PROFILE

2 / 10-4-3 TAILINGS PILE 3 ACCESS
SCALE
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ISSUE / REV					
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CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BYPASS ROAD DETAILS
MWH
SHEET: 10-4-7
REVISION: B
FILE NAME: 1008679D311

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LINE TABLE					
LINE NO.	LENGTH	DIRECTION	STATION (PT)	START NORTHING	START EASTING
L1	343.76'	S36° 03' 40.55"W	0+00.00	436966.31	1658832.32
L2	108.93'	S42° 41' 02.85"W	3+90.00	436652.70	1658600.64
L3	109.72'	S37° 01' 05.78"W	5+18.70	436557.45	1658514.13
L4	154.71'	S11° 01' 31.29"W	6+73.79	436428.76	1658429.76
L5	26.69'	N80° 41' 54.00"W	9+82.57	436197.35	1658285.86
L6	79.96'	N70° 29' 53.18"W	10+62.67	436214.93	1658207.85
L7	105.99'	N89° 02' 57.76"W	12+39.76	436258.79	1658037.31
L8	46.28'	S52° 18' 29.55"W	13+96.34	436244.91	1657884.23
L9	22.95'	S70° 20' 05.82"W	14+74.08	436201.58	1657820.12
L10	43.40'	S77° 05' 25.37"W	15+32.40	436183.94	1657764.57
L11	49.37'	N86° 49' 58.35"W	16+59.98	436167.12	1657638.67
L12	44.70'	S89° 12' 17.48"W	17+30.10	436170.28	1657568.63
L13	3.71'	N74° 03' 51.65"W	18+04.00	436173.49	1657495.09
L14	6.35'	N87° 42' 38.09"W	18+43.44	436180.15	1657456.34
L15	5.22'	N75° 19' 55.55"W	18+82.19	436185.17	1657418.00
L16	9.32'	S83° 00' 10.79"W	19+17.66	436188.51	1657382.95
L17	37.26'	S69° 50' 23.07"W	19+72.92	436176.61	1657329.14
L18	11.75'	S73° 06' 41.59"W	20+21.61	436160.14	1657283.33
L19	43.28'	S57° 48' 39.47"W	20+73.41	436140.14	1657235.76
L20	20.22'	S63° 42' 06.90"W	21+32.12	436109.55	1657185.68
L21	35.64'	S58° 40' 58.85"W	21+65.48	436094.26	1657156.04

LINE TABLE					
LINE NO.	LENGTH	DIRECTION	STATION (PT)	START NORTHING	START EASTING
L22	17.14'	S79° 16' 25.00"W	22+55.03	436056.50	1657075.54
L23	94.95'	N89° 10' 23.09"W	23+12.50	436049.84	1657018.59
L24	30.40'	S73° 46' 22.47"W	24+81.86	436041.27	1656850.18
L25	68.45'	N70° 16' 43.67"W	25+87.55	436035.04	1656746.96
L26	29.61'	N85° 15' 38.11"W	27+08.30	436069.18	1656631.56
L27	68.72'	N74° 31' 26.91"W	27+66.02	436076.55	1656574.42
L28	21.64'	N85° 11' 23.72"W	28+71.97	436101.44	1656471.60
L29	10.75'	N38° 28' 27.11"W	29+34.38	436121.97	1656415.08
L30	71.27'	N71° 05' 15.94"W	29+73.59	436146.57	1656385.45
L31	9.85'	S62° 37' 40.66"W	31+25.64	436163.88	1656239.65
L32	3.21'	N74° 09' 08.47"W	32+10.92	436151.95	1656157.61
L33	38.31'	S71° 19' 57.17"W	32+74.37	436151.37	1656095.21
L34	56.40'	N84° 25' 31.47"W	33+97.30	436129.53	1655975.47
L35	40.16'	N88° 17' 26.70"W	34+73.94	436136.29	1655899.15
L36	107.37'	N77° 30' 10.27"W	35+51.75	436142.14	1655821.69
L37	46.16'	N70° 44' 24.35"W	36+82.73	436171.83	1655694.17
L38	10.61'	S70° 04' 15.78"W	37+97.29	436186.67	1655583.52
L39	109.54'	S86° 48' 05.66"W	38+37.10	436177.22	1655545.04
L40	37.07'	N82° 07' 39.95"W	40+04.61	436173.47	1655377.84
L41	10.03'	S59° 18' 56.01"W	40+82.06	436170.71	1655302.28
L42	43.78'	N89° 46' 29.65"W	41+35.25	436154.39	1655252.52

LINE TABLE					
LINE NO.	LENGTH	DIRECTION	STATION (PT)	START NORTHING	START EASTING
L43	201.59'	N56° 17' 21.01"W	42+25.78	436168.01	1655164.65
L44	45.42'	N29° 01' 59.24"W	44+84.46	436321.48	1654958.64
L45	207.30'	N66° 43' 06.31"W	47+92.97	436534.49	1654744.96
L46	170.08'	N85° 50' 29.24"W	50+67.02	436632.19	1654489.99
L47	53.29'	S85° 50' 41.30"W	52+58.86	436644.52	1654298.61
L48	97.45'	N86° 23' 37.77"W	53+39.25	436640.53	1654218.39
L49	34.27'	S80° 10' 17.29"W	54+83.59	436644.12	1654074.42
L50	21.36'	N42° 28' 58.11"W	56+17.95	436669.26	1653949.83
L51	125.66'	N51° 25' 30.85"W	56+70.52	436706.30	1653912.62
L52	59.92'	N37° 59' 10.48"W	58+66.54	436834.55	1653765.00
L53	138.83'	N67° 20' 54.56"W	59+77.71	436912.51	1653687.81
L54	16.00'	N77° 39' 15.77"W	61+43.52	436974.08	1653533.99
L55	108.48'	N68° 57' 34.09"W	61+82.28	436984.03	1653496.58
L56	44.74'	N81° 30' 24.48"W	63+12.67	437028.55	1653374.20
L57	46.87'	N58° 05' 44.65"W	64+18.69	437056.18	1653272.83
L58	150.88'	N12° 42' 54.19"W	65+84.37	437175.27	1653166.00
L59	31.98'	N23° 35' 47.38"E	69+25.37	437508.57	1653150.51

CURVE TABLE						
CURVE NO.	RADIUS	LENGTH	CHORD DIRECTION	STATION (PC)	START NORTHING	START EASTING
C1	400.00	46.24'	S39° 22' 21.70"W	3+43.76	436688.42	1658629.96
C2	200.00	19.78'	S39° 51' 04.31"W	4+98.93	436572.62	1658526.80
C3	100.00	45.37'	S24° 01' 18.53"W	6+28.42	436469.84	1658448.07
C4	100.00	154.07'	S55° 09' 48.64"W	8+28.49	436276.91	1658400.18
C5	300.00	53.41'	N75° 35' 53.59"W	10+09.26	436201.66	1658259.51
C6	300.00	97.13'	N79° 46' 25.47"W	11+42.63	436241.62	1658132.48
C7	75.00	50.58'	S71° 37' 45.89"W	13+45.76	436260.55	1657931.33
C8	100.00	31.46'	S61° 19' 17.68"W	14+42.62	436216.62	1657847.61
C9	300.00	35.37'	S73° 42' 45.60"W	14+97.03	436193.85	1657798.50
C10	300.00	84.18'	S85° 07' 43.51"W	15+75.81	436174.24	1657722.27
C11	300.00	20.75'	N88° 48' 50.43"W	17+09.36	436169.85	1657589.37
C12	100.00	29.20'	N82° 25' 47.08"W	17+74.80	436169.66	1657523.94
C13	150.00	35.73'	N80° 53' 14.87"W	18+07.71	436174.51	1657491.53
C14	150.00	32.41'	N81° 31' 16.82"W	18+49.78	436180.41	1657449.99
C15	80.00	30.25'	N86° 09' 52.38"W	18+87.41	436186.50	1657412.96
C16	200.00	45.95'	S76° 25' 16.93"W	19+26.98	436187.37	1657373.70
C17	200.00	11.42'	S71° 28' 32.33"W	20+10.19	436163.77	1657294.16
C18	150.00	40.06'	S65° 27' 40.53"W	20+33.36	436156.72	1657272.09
C19	150.00	15.42'	S60° 45' 23.19"W	21+16.70	436117.08	1657199.13
C20	150.00	13.14'	S61° 11' 32.88"W	21+52.34	436100.59	1657167.55

CURVE TABLE						
CURVE NO.	RADIUS	LENGTH	CHORD DIRECTION	STATION (PC)	START NORTHING	START EASTING
C21	150.00	53.91'	S68° 58' 41.92"W	22+01.12	436075.73	1657125.59
C22	200.00	40.33'	S85° 03' 00.95"W	22+72.17	436053.31	1657058.70
C23	250.00	74.41'	S82° 17' 59.69"W	24+07.45	436051.21	1656923.65
C24	120.00	75.29'	N88° 15' 10.60"W	25+12.26	436032.78	1656820.99
C25	200.00	52.30'	N77° 46' 10.89"W	26+56.00	436058.13	1656682.53
C26	150.00	28.11'	N79° 53' 32.51"W	27+37.91	436071.63	1656602.06
C27	200.00	37.23'	N79° 51' 25.32"W	28+34.74	436094.89	1656508.19
C28	50.00	40.77'	N61° 49' 55.42"W	28+93.61	436103.25	1656450.03
C29	50.00	28.46'	N54° 46' 51.53"W	29+45.13	436130.38	1656408.39
C30	100.00	80.78'	S85° 46' 12.36"W	30+44.85	436169.67	1656318.03
C31	100.00	75.43'	S84° 14' 16.10"W	31+35.48	436159.35	1656230.90
C32	100.00	60.24'	S88° 35' 24.35"W	32+14.13	436152.83	1656154.53
C33	200.00	84.62'	S83° 27' 12.85"W	33+12.68	436139.11	1656058.91
C34	300.00	20.24'	N86° 21' 29.08"W	34+53.70	436135.01	1655919.34
C35	200.00	37.66'	N82° 53' 48.49"W	35+14.10	436137.49	1655859.00
C36	200.00	23.61'	N74° 07' 17.31"W	36+59.12	436165.38	1655716.86
C37	100.00	68.40'	S89° 39' 55.71"W	37+28.89	436187.06	1655650.59
C38	100.00	29.20'	S78° 26' 10.72"W	38+07.90	436183.05	1655573.55
C39	300.00	57.97'	N87° 39' 47.15"W	39+46.64	436171.11	1655435.67
C40	60.00	40.38'	S78° 35' 38.03"W	40+41.68	436178.54	1655341.12

CURVE TABLE						
CURVE NO.	RADIUS	LENGTH	CHORD DIRECTION	STATION (PC)	START NORTHING	START EASTING
C41	80.00	43.16'	S74° 46' 13.18"W	40+92.09	436165.59	1655293.66
C42	80.00	46.75'	N73° 01' 55.33"W	41+79.03	436154.56	1655208.74
C43	120.00	57.08'	N42° 39' 40.13"W	44+27.37	436279.89	1654996.96
C44	400.00	263.09'	N47° 52' 32.78"W	45+29.87	436361.19	1654936.60
C45	200.00	66.75'	N76° 16' 47.78"W	50+00.27	436616.43	1654554.54
C46	150.00	21.77'	N89° 59' 53.97"W	52+37.10	436644.52	1654320.36
C47	200.00	27.09'	S89° 43' 31.77"W	53+12.16	436640.66	1654245.46
C48	200.00	46.90'	S86° 53' 19.76"W	54+36.70	436646.66	1654121.14
C49	100.00	100.09'	N71° 09' 20.41"W	55+17.86	436638.27	1654040.65
C50	200.00	31.21'	N46° 57' 14.48"W	56+39.31	436685.01	1653935.41
C51	300.00	70.37'	N44° 42' 20.67"W	57+96.18	436784.65	1653814.38
C52	100.00	51.25'	N52° 40' 02.52"W	59+26.46	436881.77	1653728.12
C53	150.00	26.98'	N72° 30' 05.16"W	61+16.54	436965.98	1653559.69
C54	150.00	22.76'	N73° 18' 24.93"W	61+59.52	436977.50	1653518.37
C55	100.00	21.90'	N75° 13' 59.29"W	62+90.77	437022.98	1653395.33
C56	150.00	61.29'	N69° 48' 04.56"W	63+57.40	437035.16	1653329.95
C57	150.00	118.81'	N35° 24' 19.42"W	64+65.56	437080.95	1653233.04
C58	300.00	190.13'	N5° 26' 26.60"E	67+35.25	437322.45	1653132.79

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ISSUE REV					
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- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.
- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA–FSA–APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

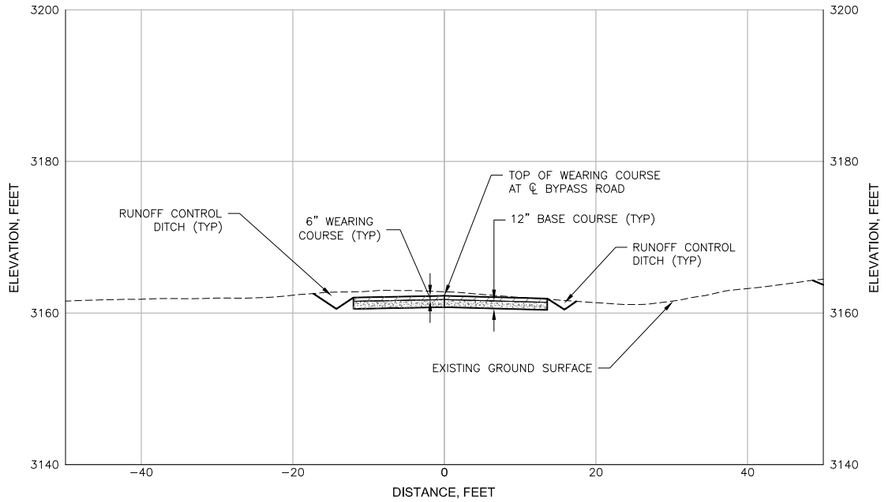
DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BYPASS ROAD LINE AND CURVE TABLES

MWH

SHEET: 10-4-8
REVISION: B
FILE NAME: 1008679D312



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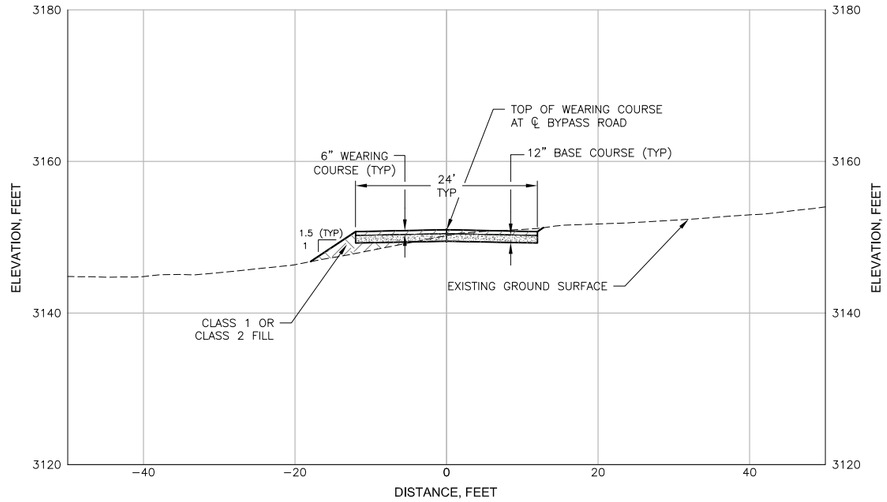

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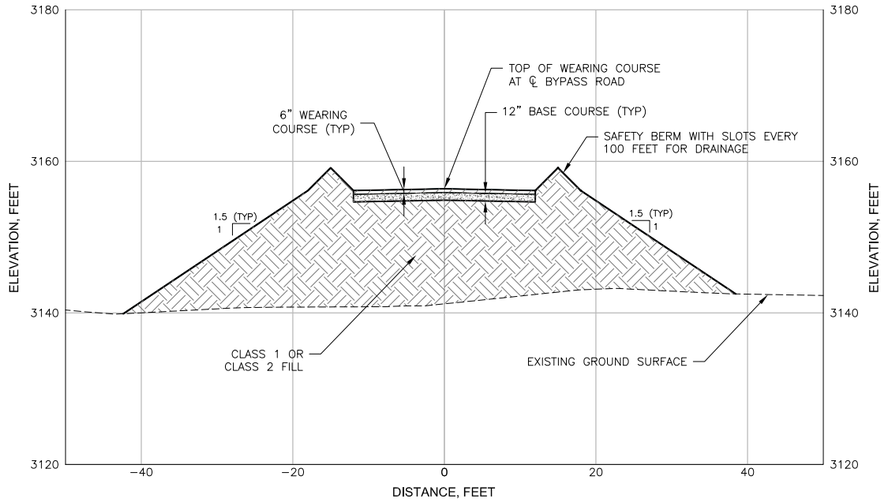

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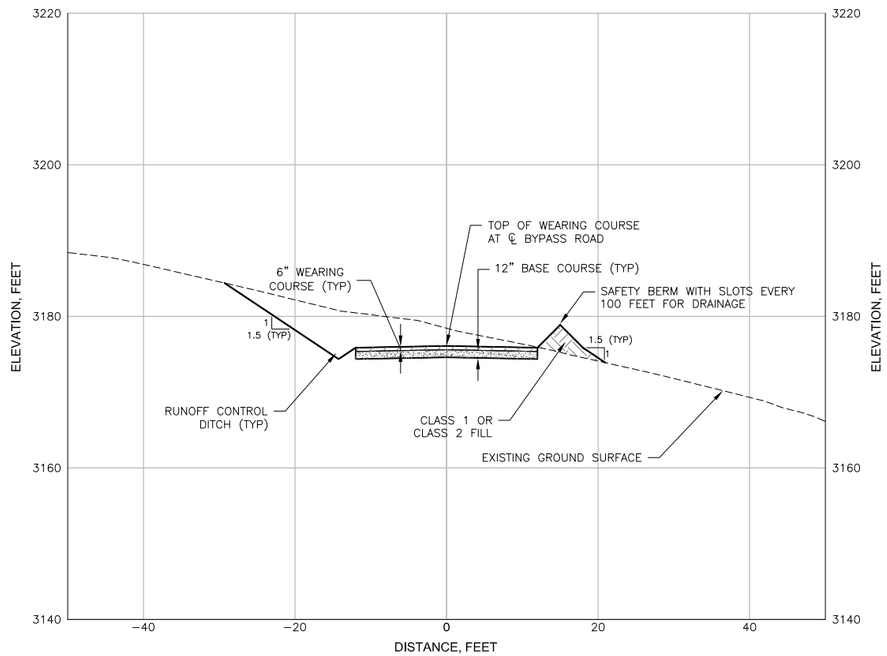

STA 10+00

SCALE
10 0 10 20 FEET

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BYPASS ROAD CROSS SECTIONS

MWH

SHEET: 10-4-9
REVISION: B
FILE NAME: 1008679D292

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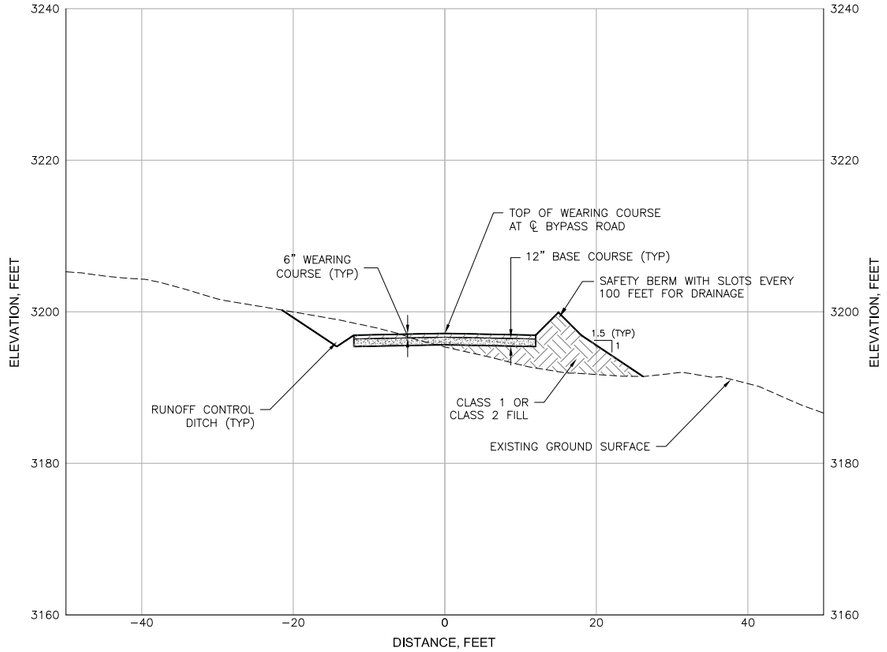

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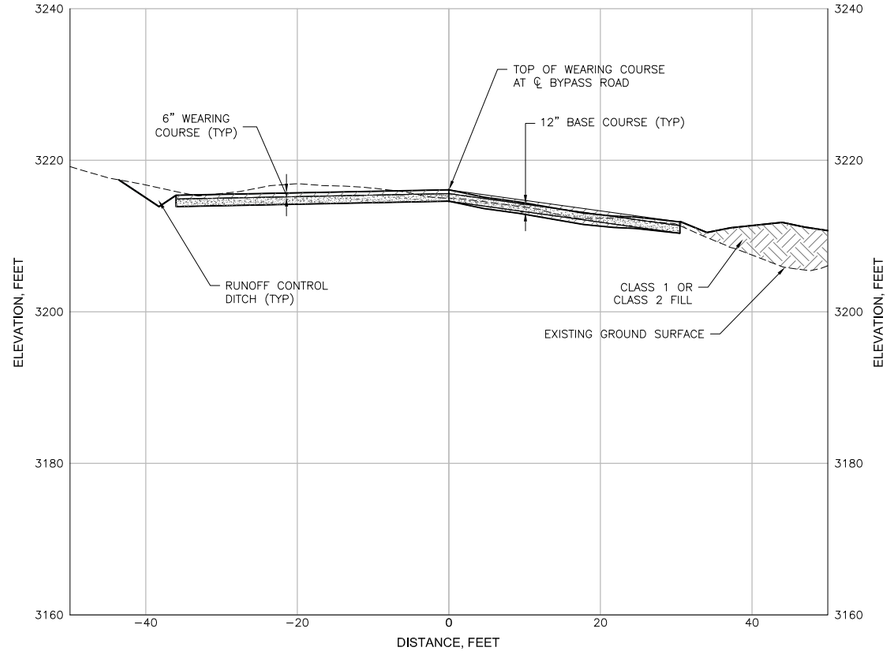

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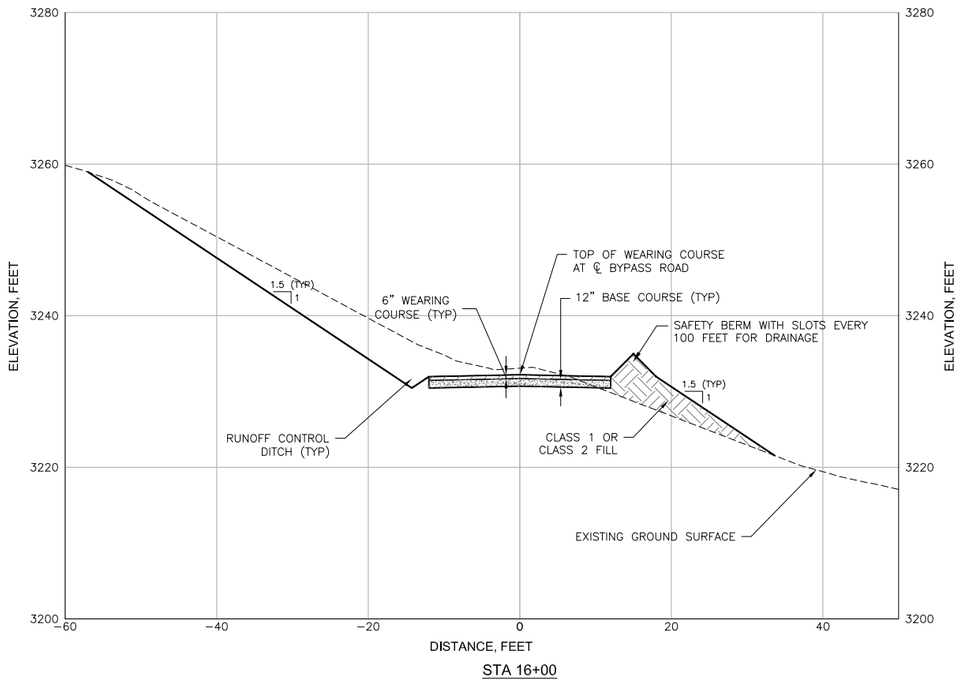

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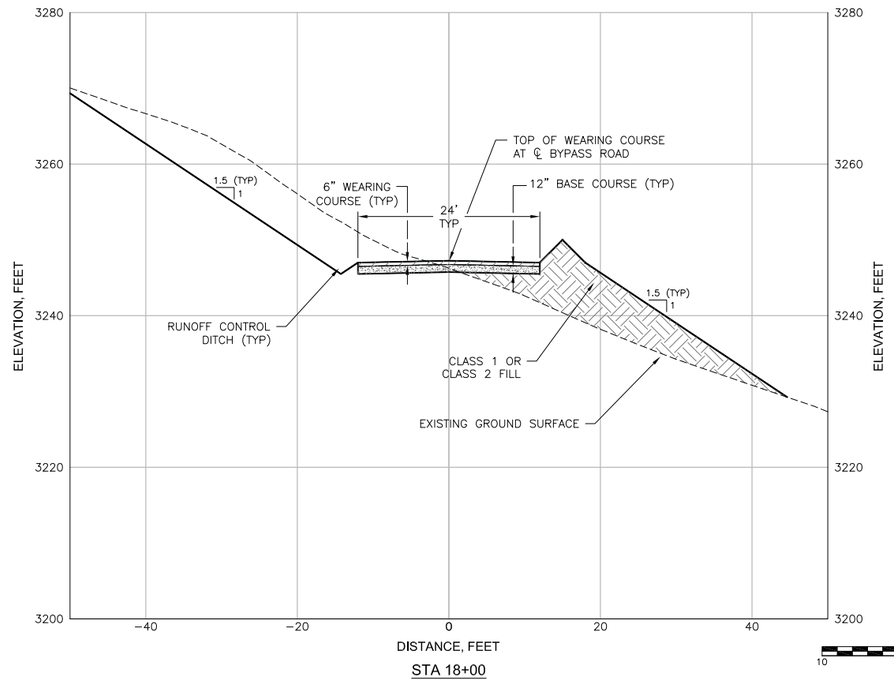

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ISSUE REV	DESCRIPTION	TECH	ENG	DATE
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A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: BYPASS ROAD CROSS SECTIONS

MWH

SHEET: 10-4-10

REVISION: B

FILE NAME: 1008679D293

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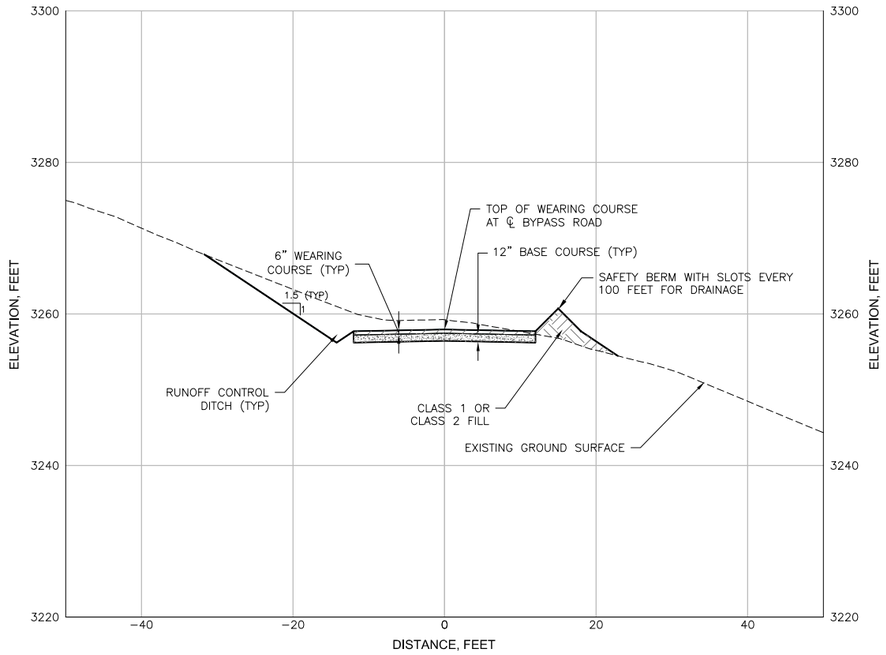

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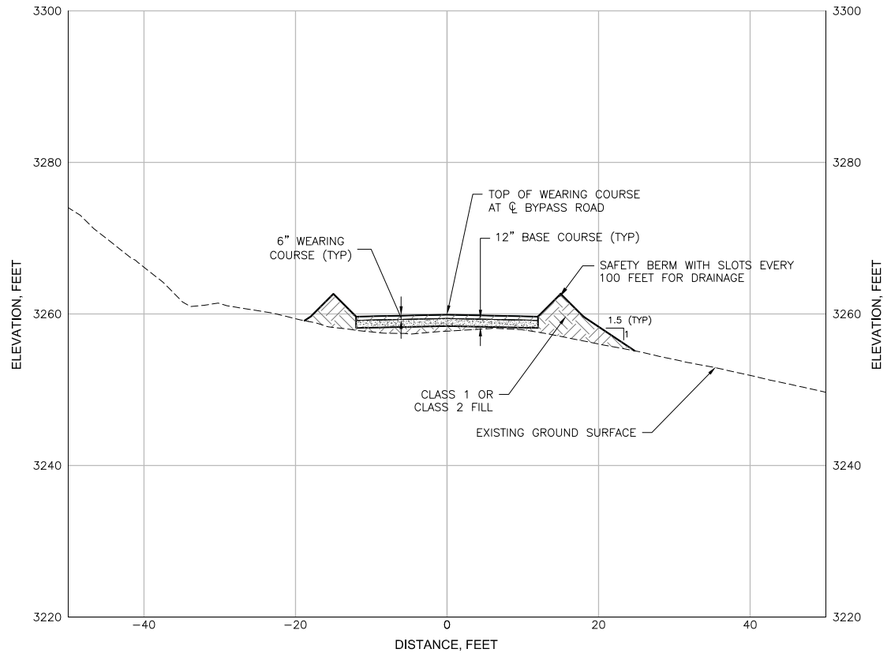

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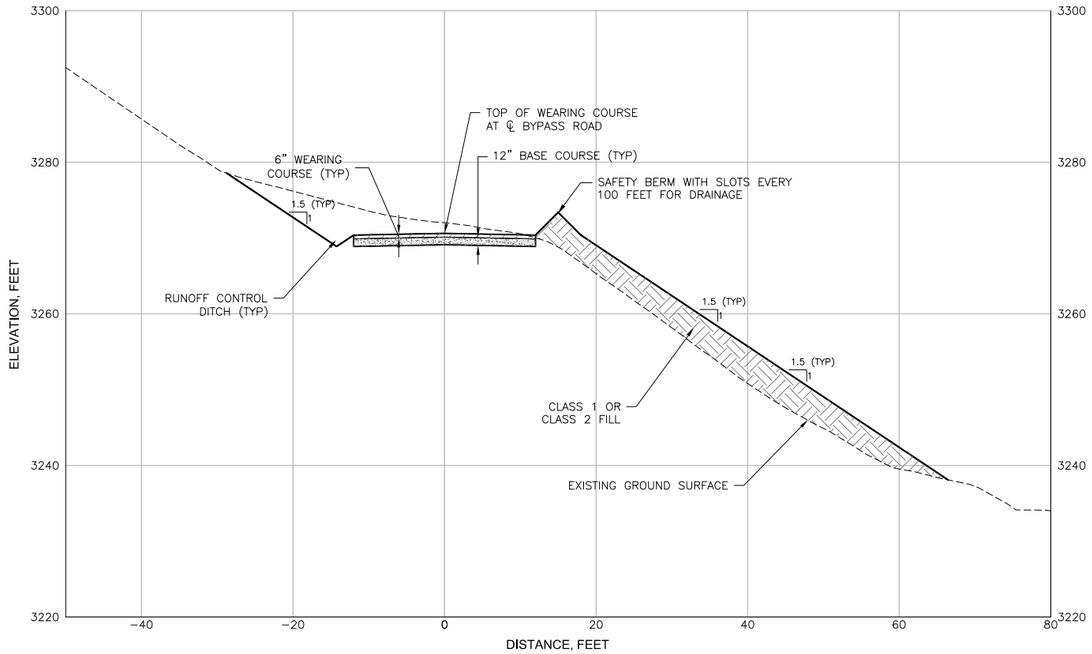

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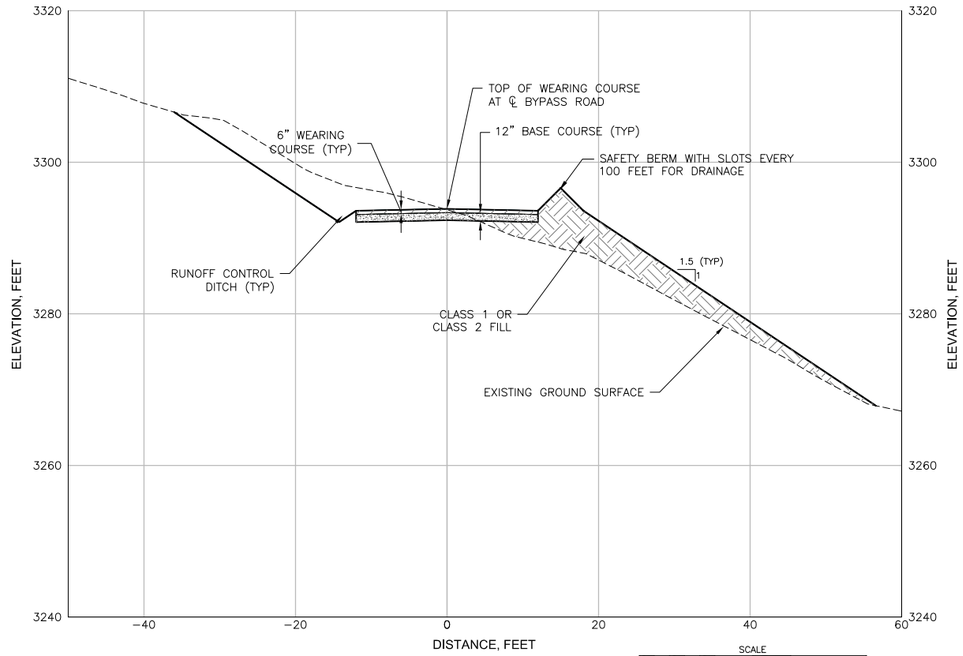

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SCALE
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ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
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A	ISSUED FOR REVIEW AND COMMENT	FA	PC	04/08/11

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CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BYPASS ROAD CROSS SECTIONS

MWH

SHEET: 10-4-11
REVISION: B
FILE NAME: 1008679D381

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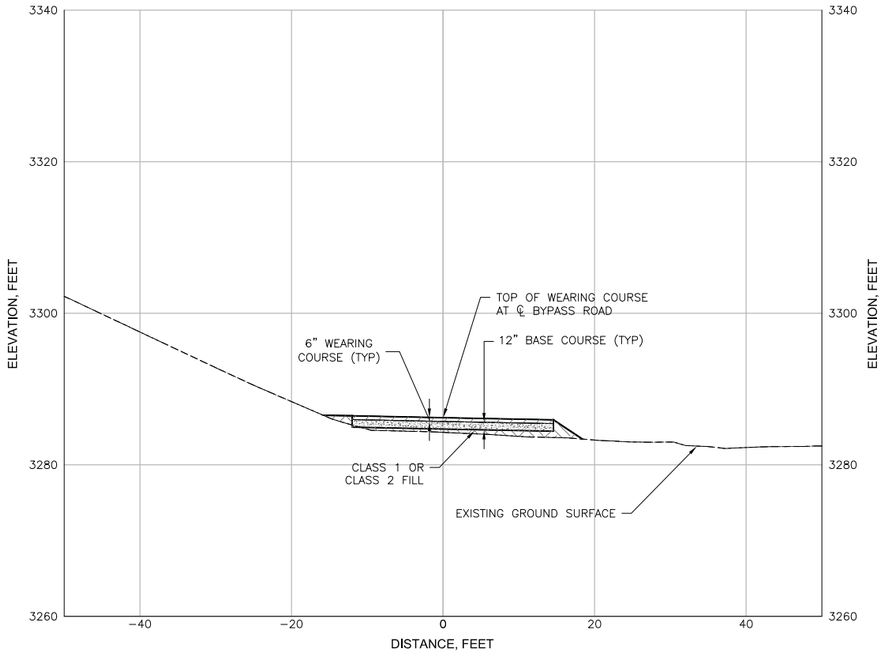

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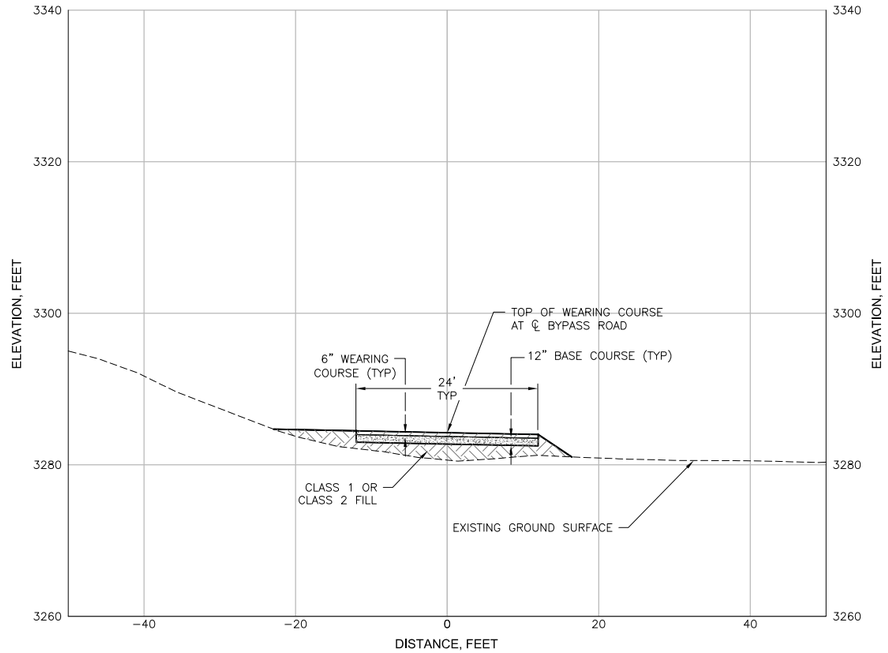

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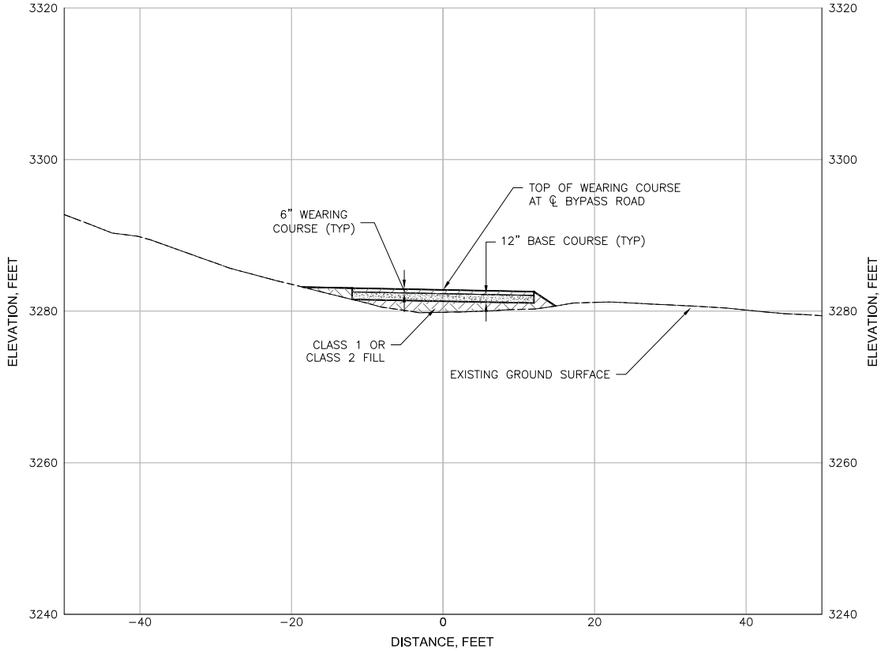

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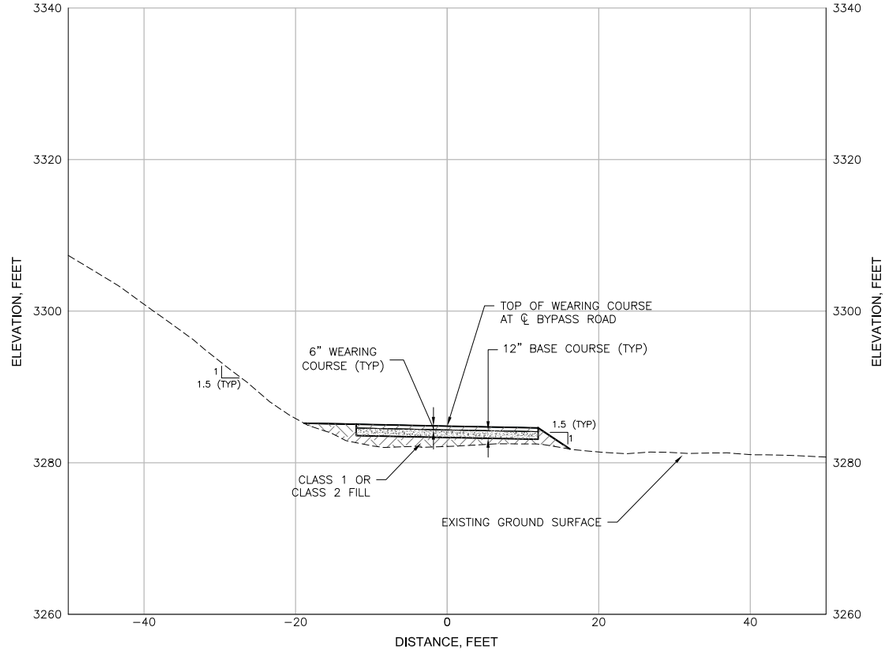

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SCALE
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ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION
HOLDEN VILLAGE, WASHINGTON

PROJECT
REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE
BYPASS ROAD CROSS SECTIONS

MWH

SHEET 10-4-12 | REVISION B

FILE NAME 1008679D303

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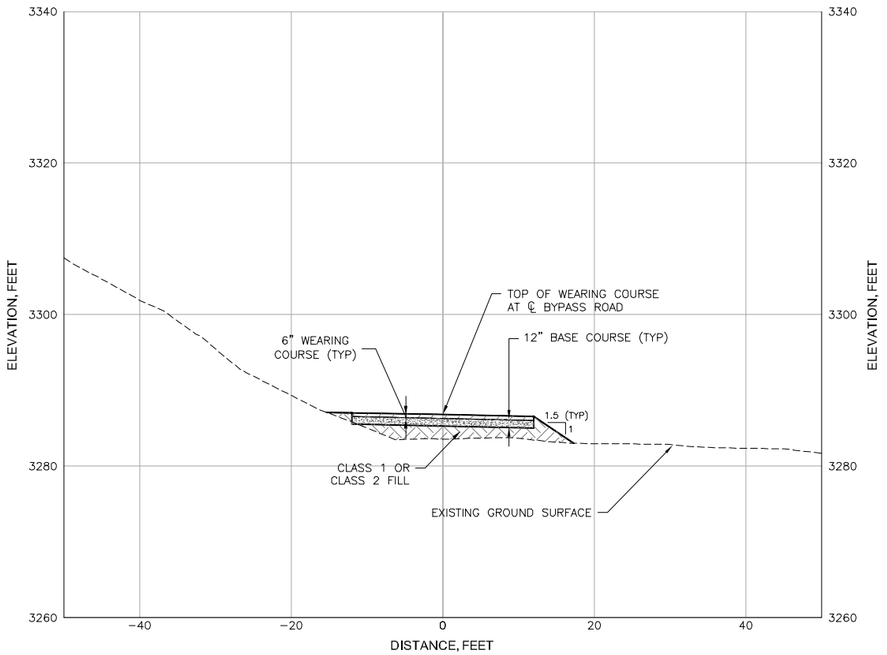

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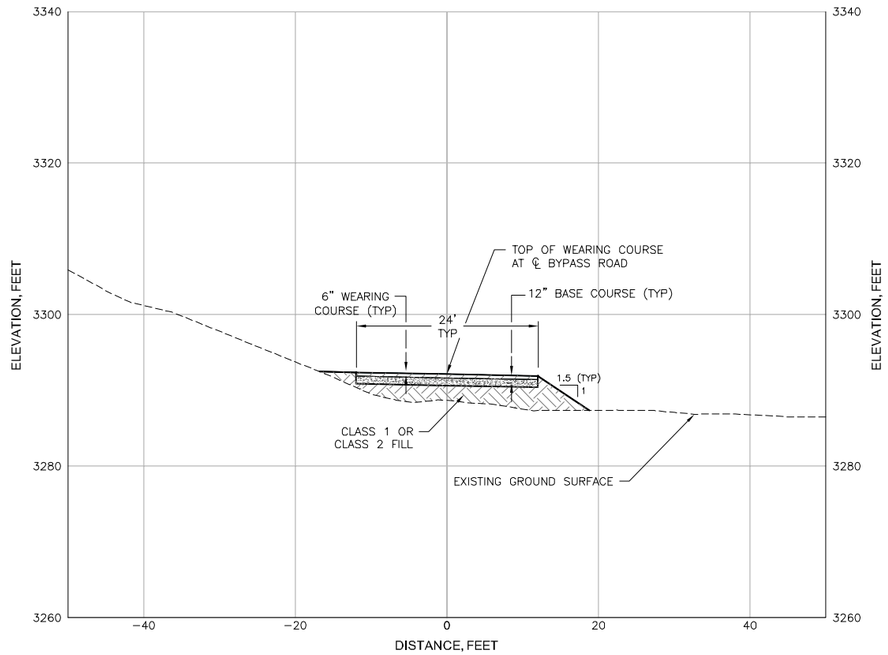

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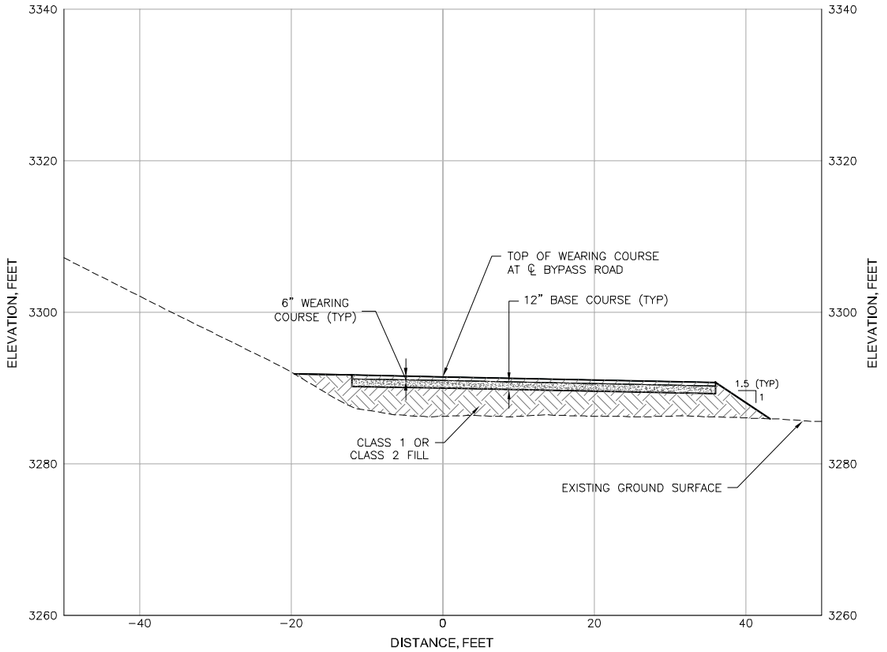

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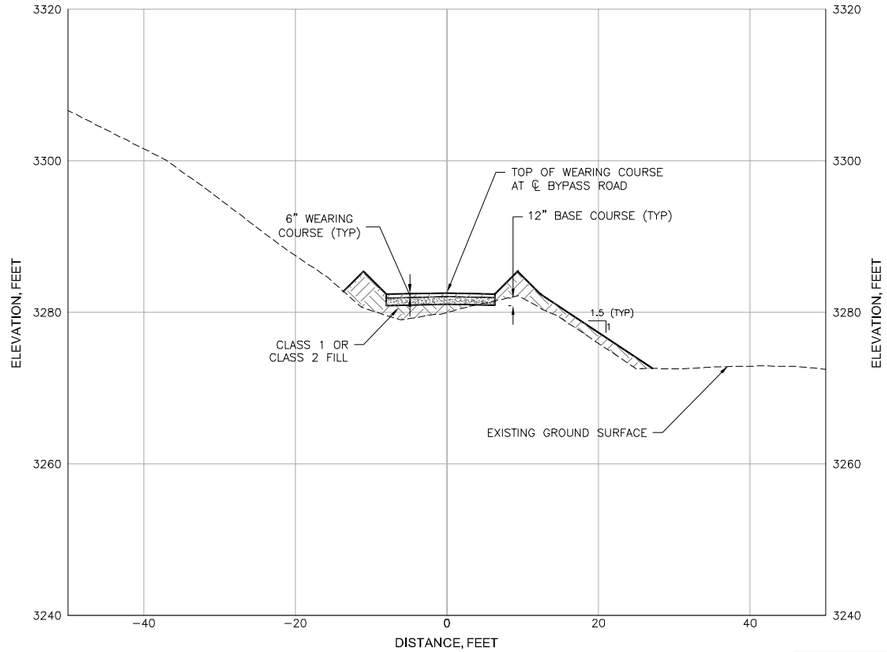

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SCALE
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ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: BYPASS ROAD CROSS SECTIONS

MWH

SHEET: 10-4-13

REVISION: B

FILE NAME: 1008679D377

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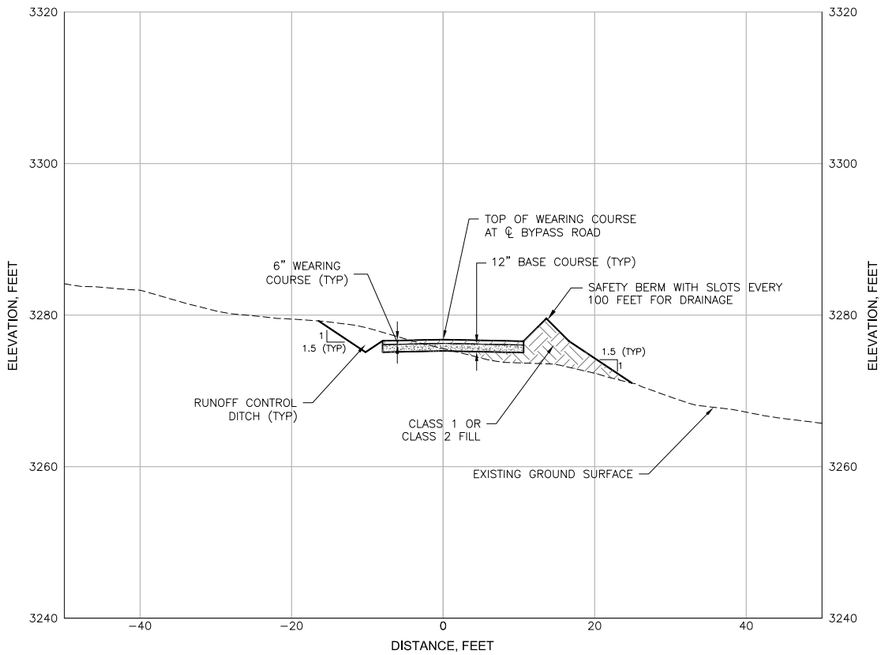

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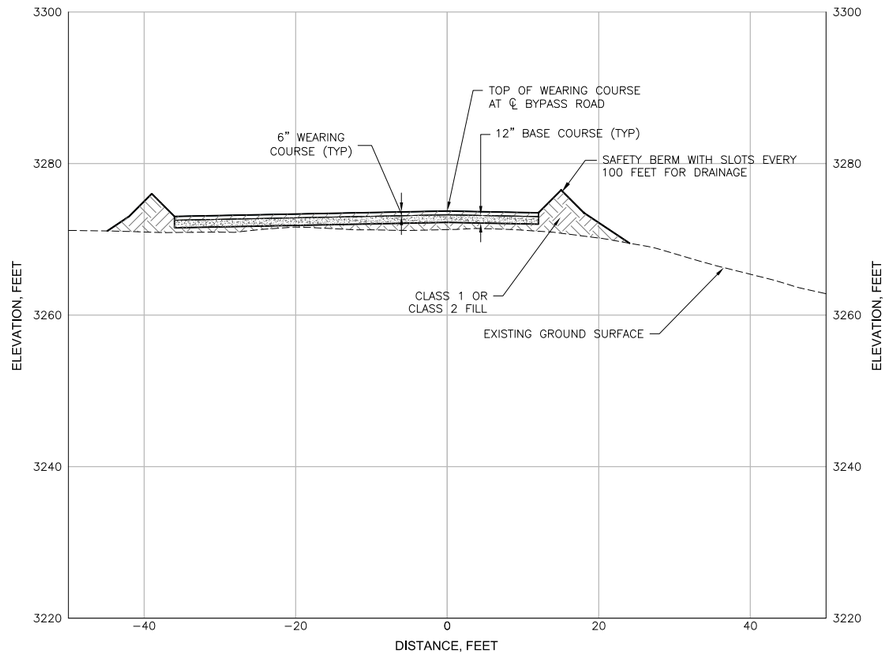

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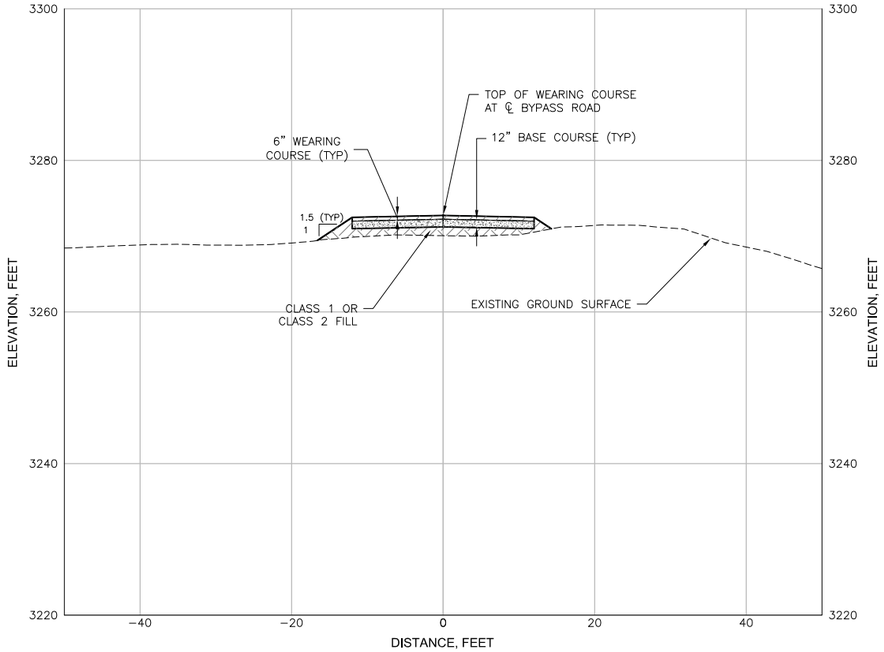

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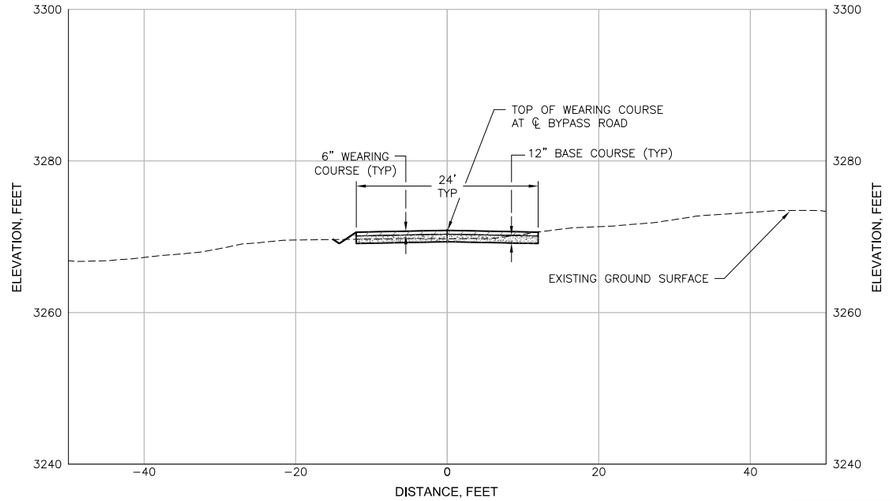

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SCALE
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ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
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Intalco

PROJECT LOCATION
HOLDEN VILLAGE, WASHINGTON

PROJECT
REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE
BYPASS ROAD CROSS SECTIONS

MWH

SHEET 10-4-14
REVISION B
FILE NAME 1008679D378

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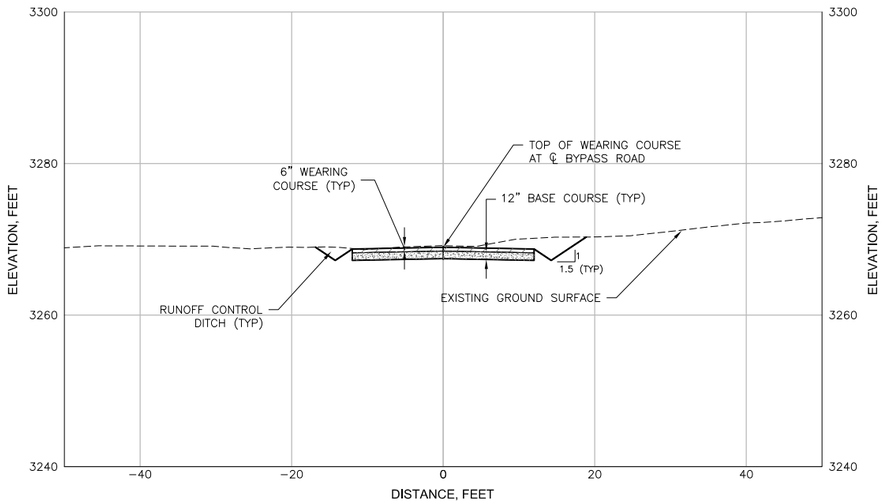

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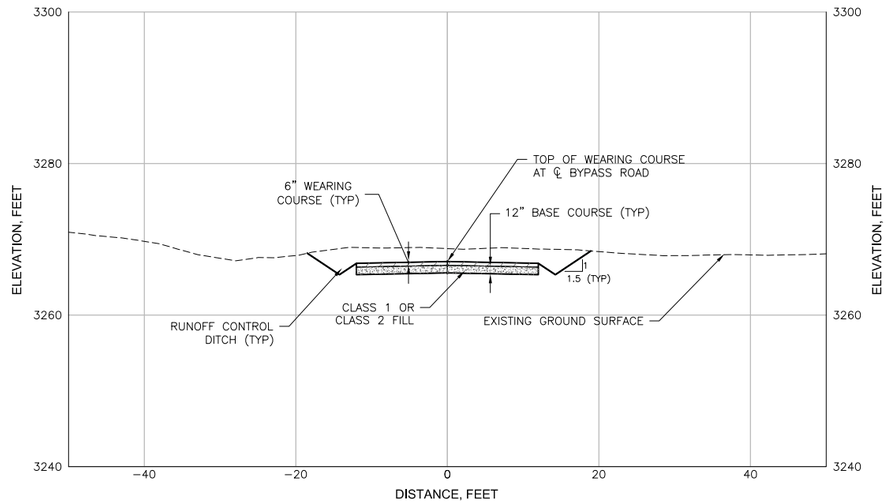

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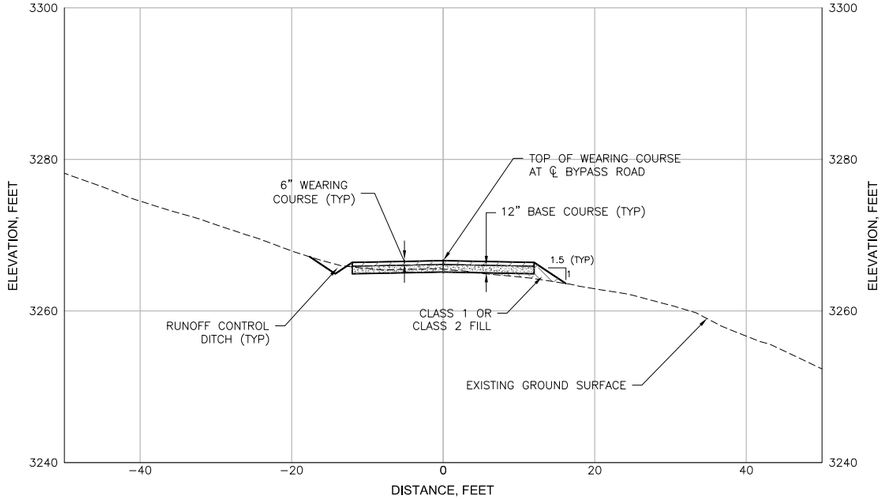

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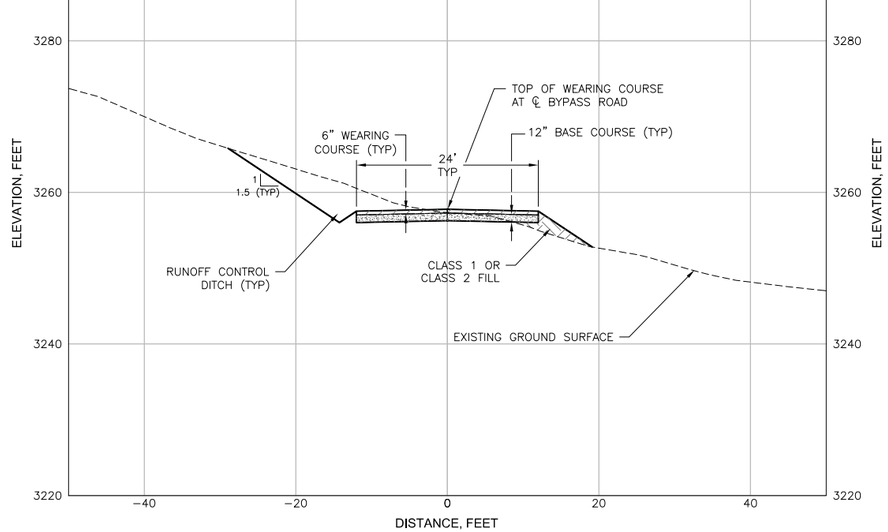

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SCALE
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PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BYPASS ROAD CROSS SECTIONS

MWH

SHEET: 10-4-15
REVISION: B
FILE NAME: 1008679D379

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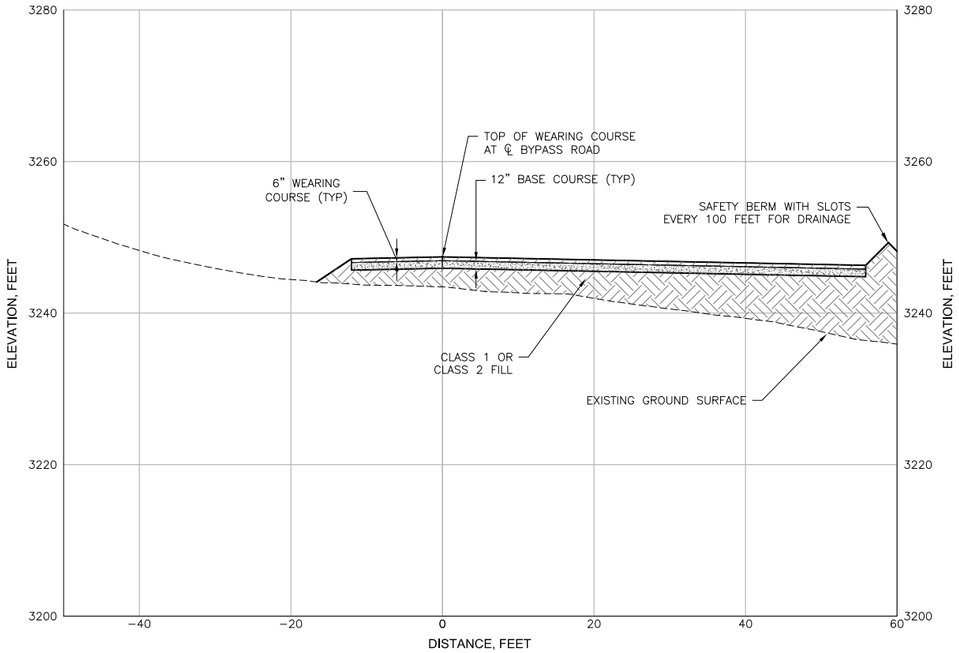
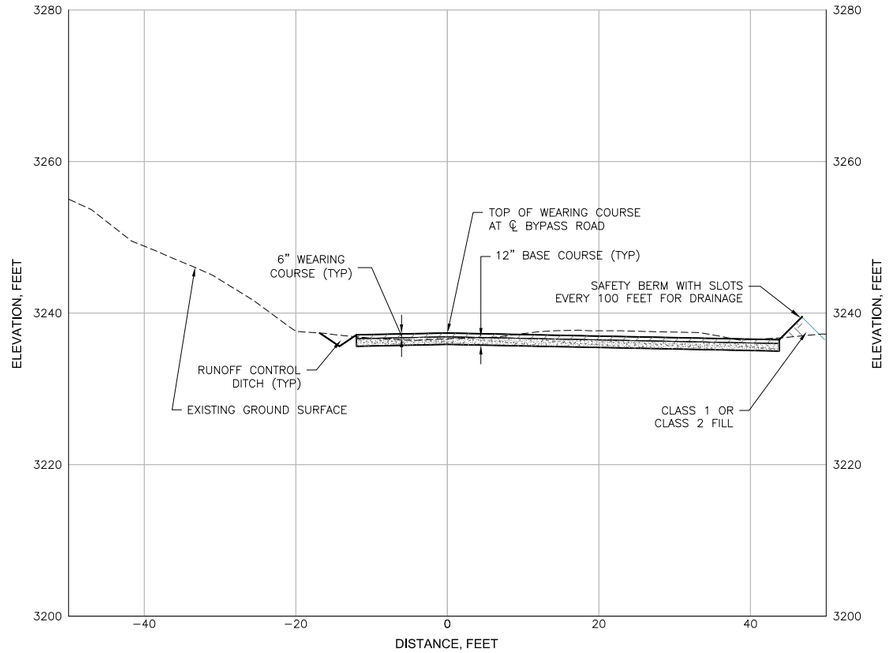


STA 60+00



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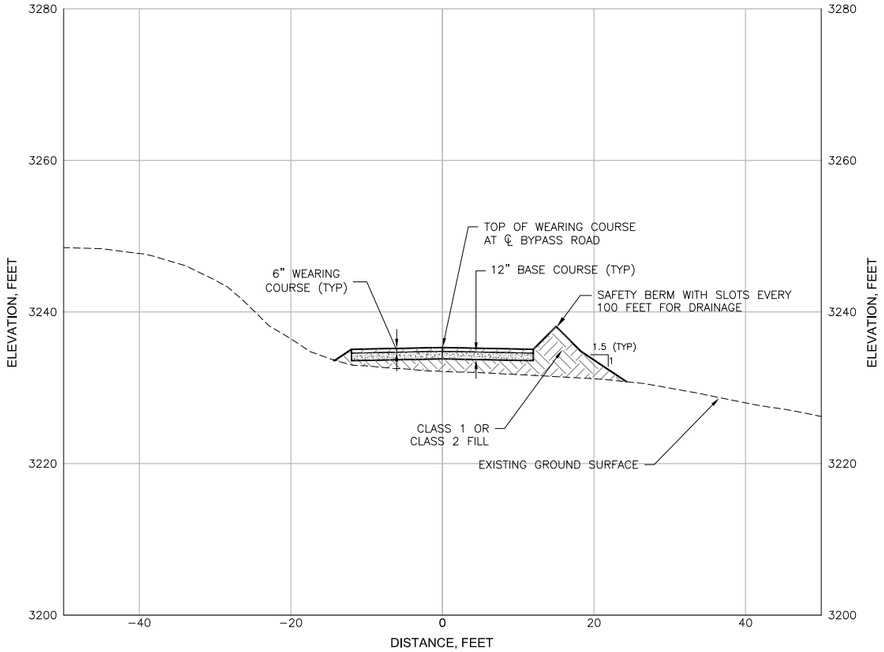

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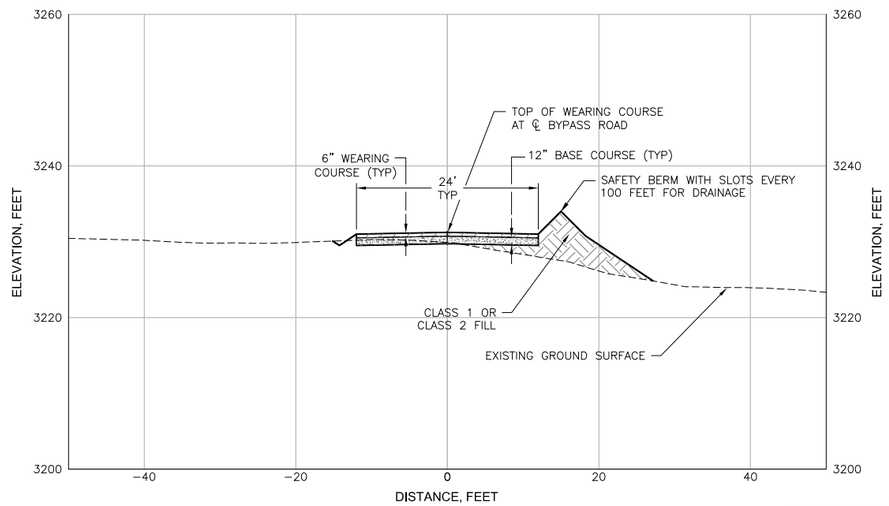

STA 66+00

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: BYPASS ROAD CROSS SECTIONS

MWH

SHEET: 10-4-16

REVISION: B

FILE NAME: 1008679D380

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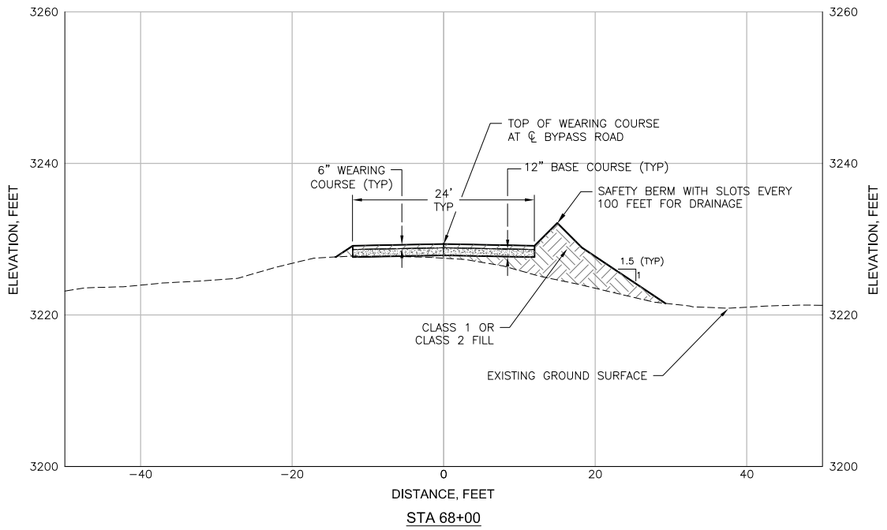

STA 68+00

SCALE
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ISSUE/REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR REVIEW AND COMMENT	FA	PC	04/08/11

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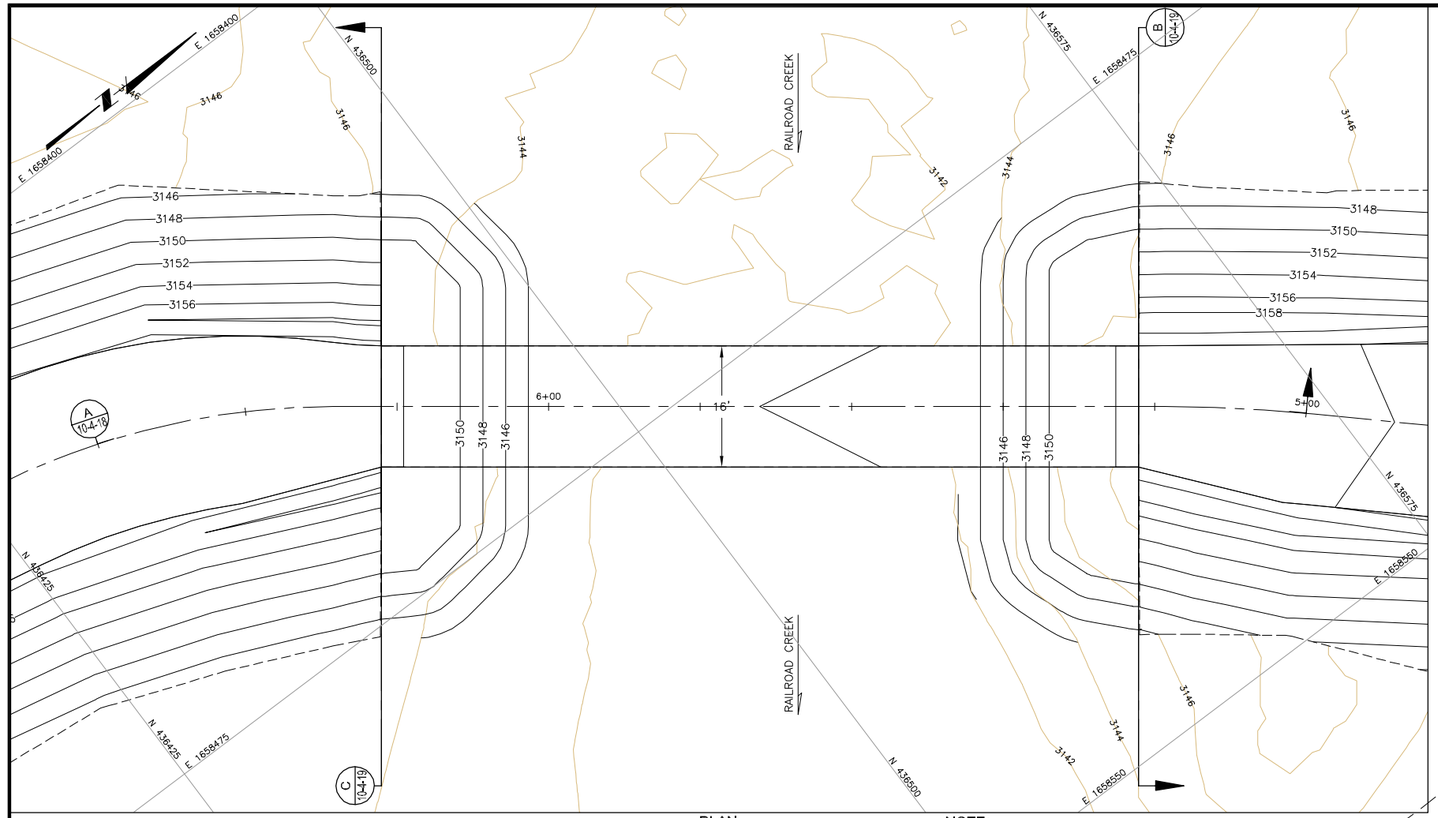
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BYPASS ROAD CROSS SECTIONS

MWH

SHEET: 10-4-17
REVISION: B
FILE NAME: 1008679D382



PLAN

SCALE
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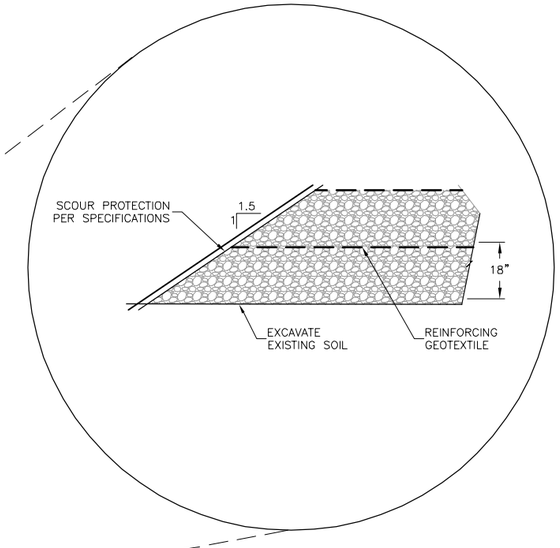
NOTE:

1. FOR PLAN LOCATION SEE SHEET 10-4-1.



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SCALE
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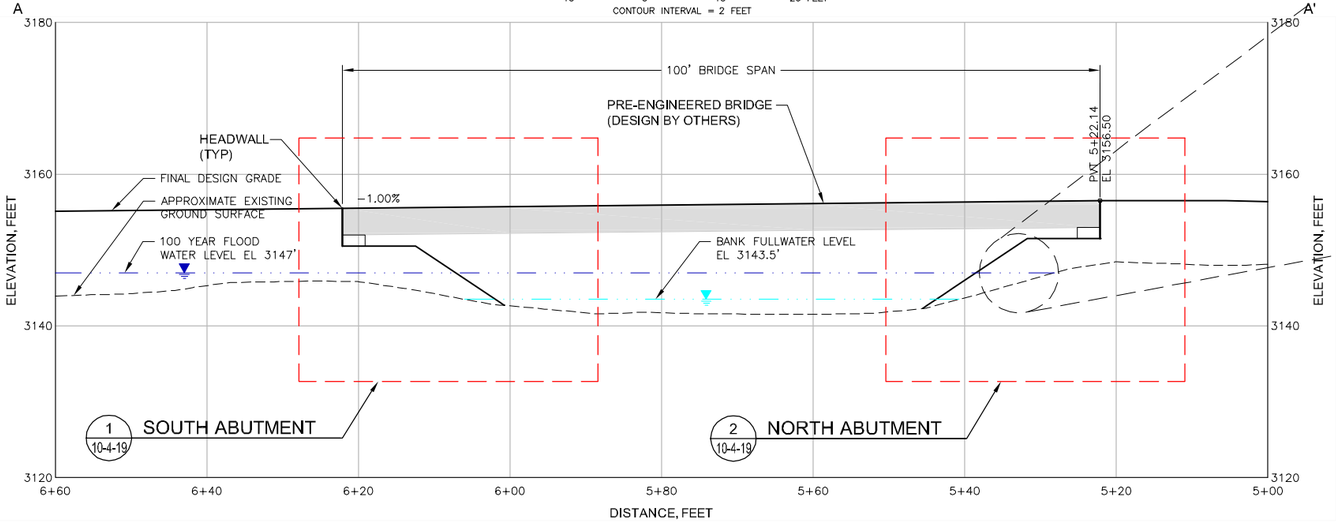

ELEVATION

A 10-4-18 BRIDGE

SCALE
10 0 10 20 FEET

ISSUE REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
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DRAWING REFERENCE(S):
- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BRIDGE PLAN AND SECTION

MWH

SHEET 10-4-18 | REVISION B
FILE NAME 1008679D260

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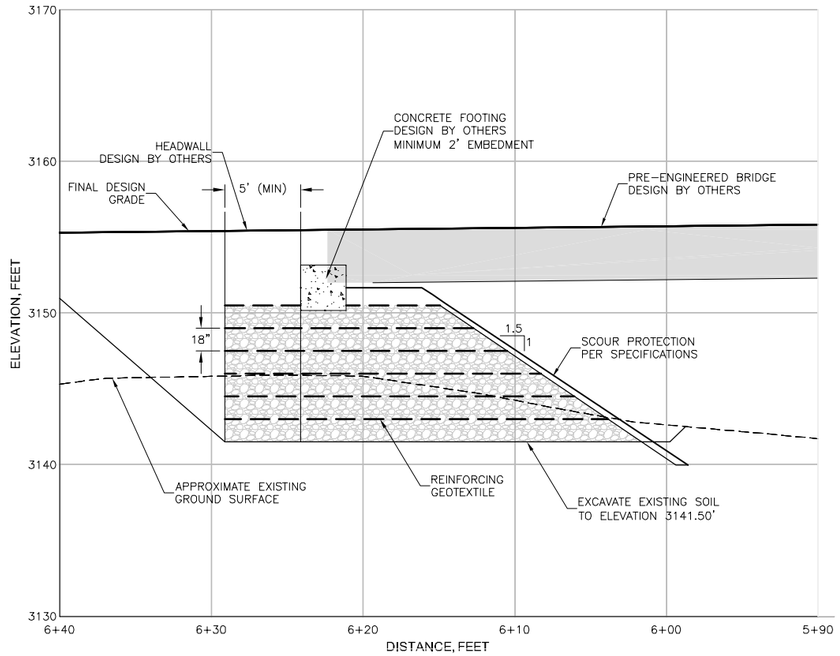

1 10-4-18 BRIDGE SOUTH ABUTMENT

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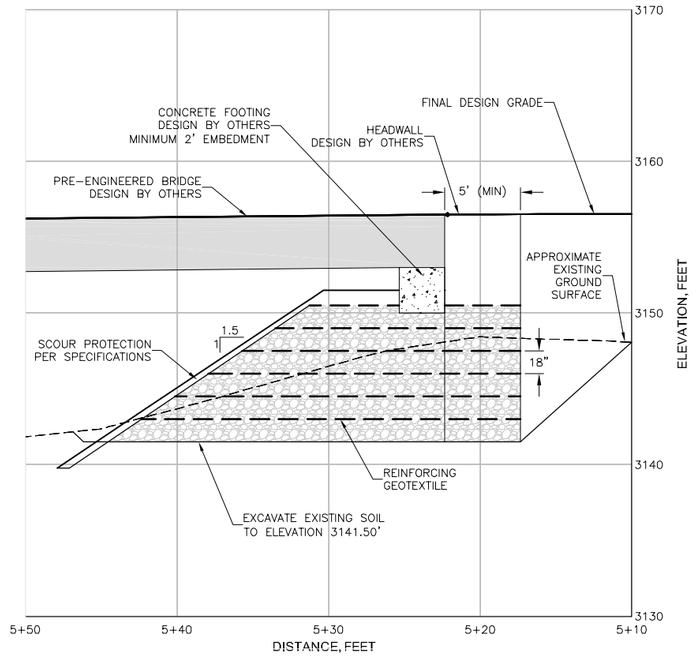

2 10-4-18 BRIDGE NORTH ABUTMENT

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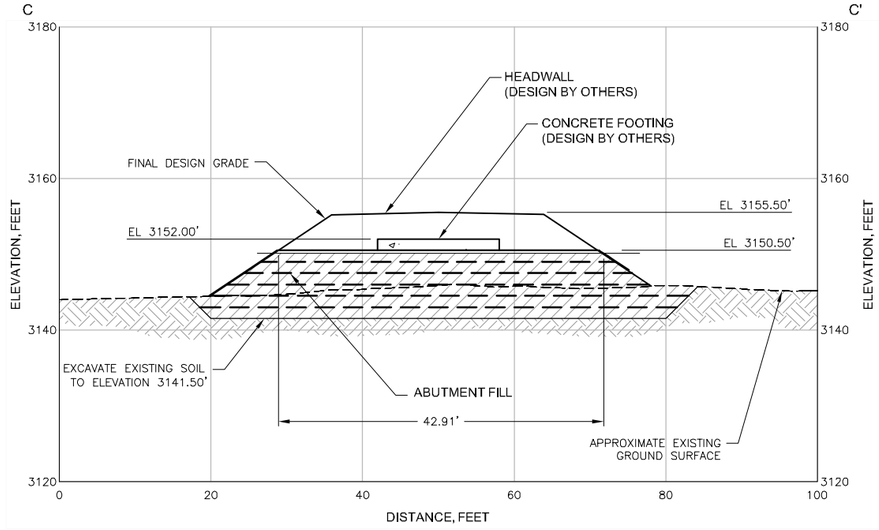

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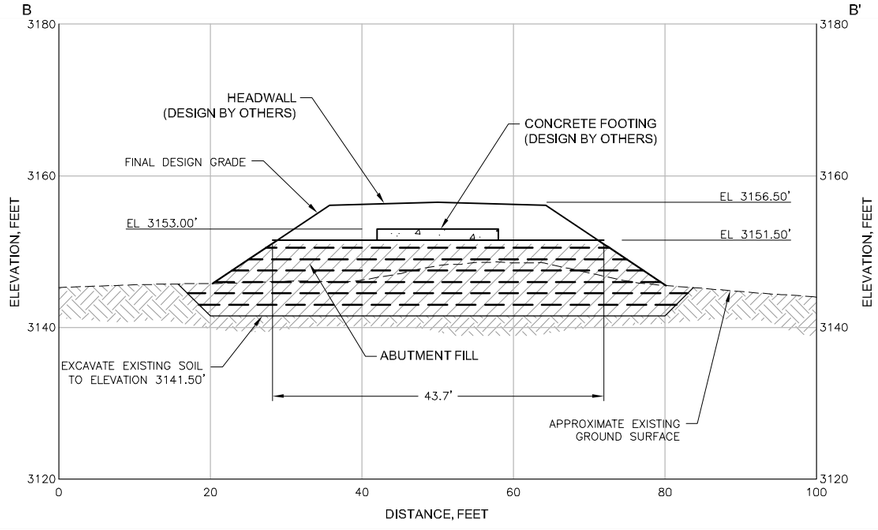
SCALE 10 0 10 20 FEET



B 10-4-18 NORTH ABUTMENT

SCALE 10 0 10 20 FEET

ISSUE / REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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APPROVED BY	P. CROUSE	02/28/11	
PROJECT MANAGER	R. SCHLICHER	02/28/11	
CLIENT APPROVAL			
CLIENT REFERENCE NO.			

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: BRIDGE ABUTMENT DETAILS

MWH

SHEET: 10-4-19 REVISION: B

FILE NAME: 1008679D336

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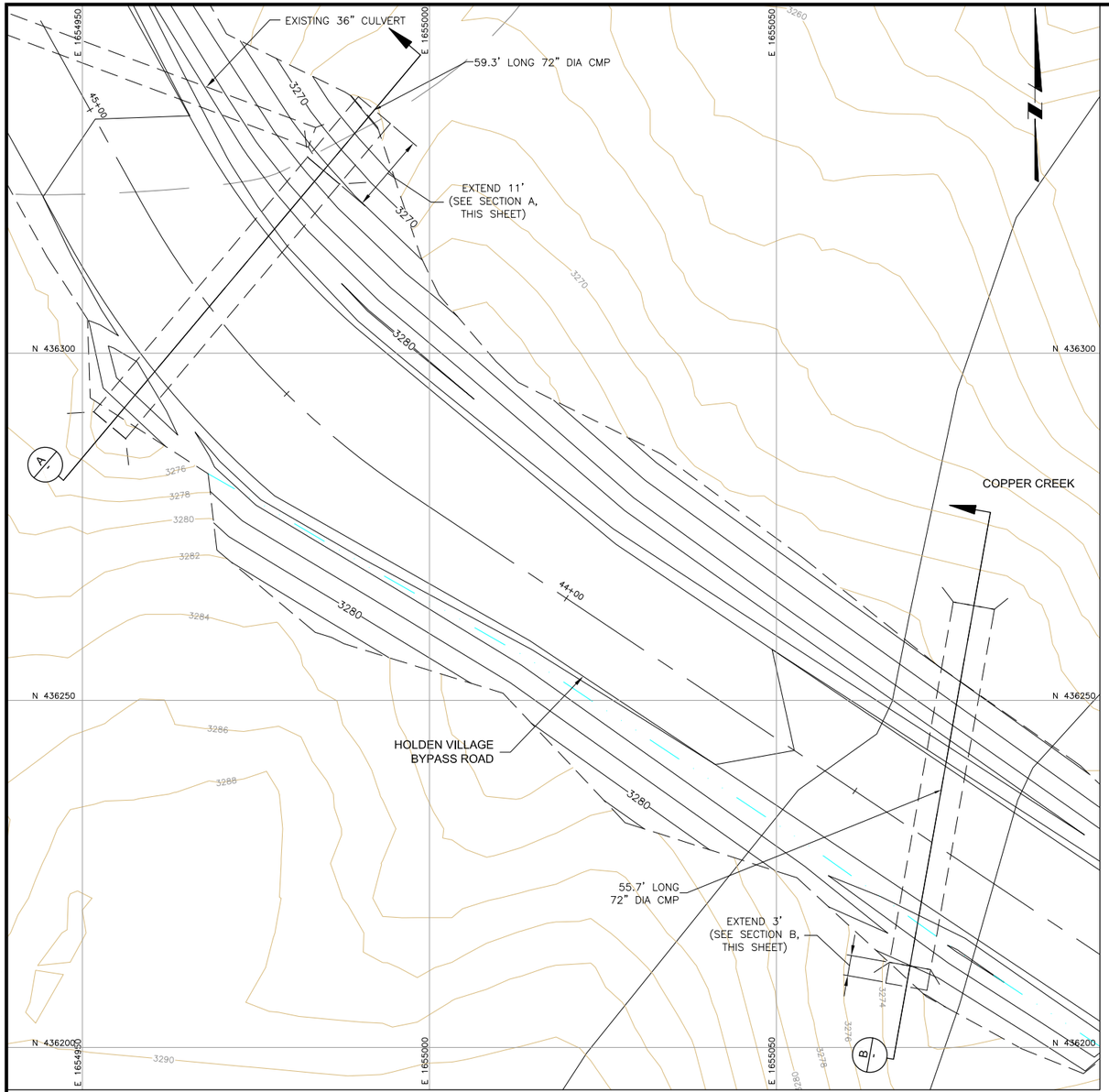

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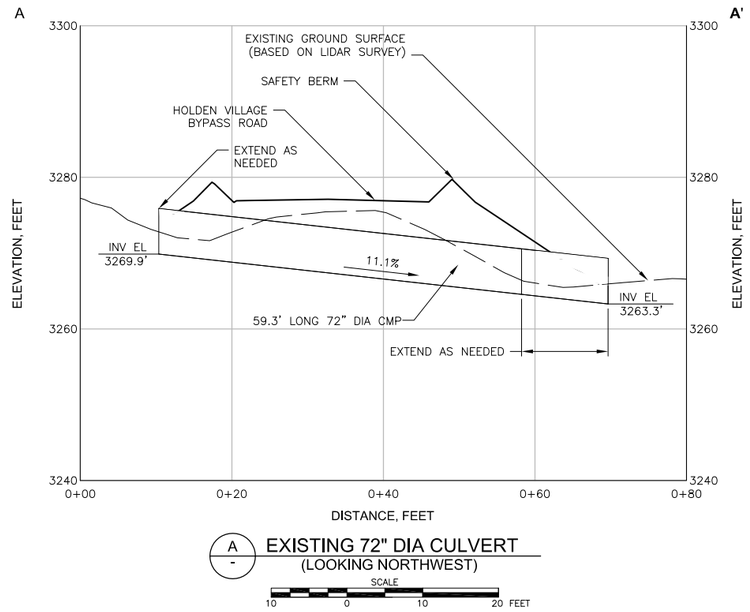

A - EXISTING 72" DIA CULVERT
(LOOKING NORTHWEST)

SCALE
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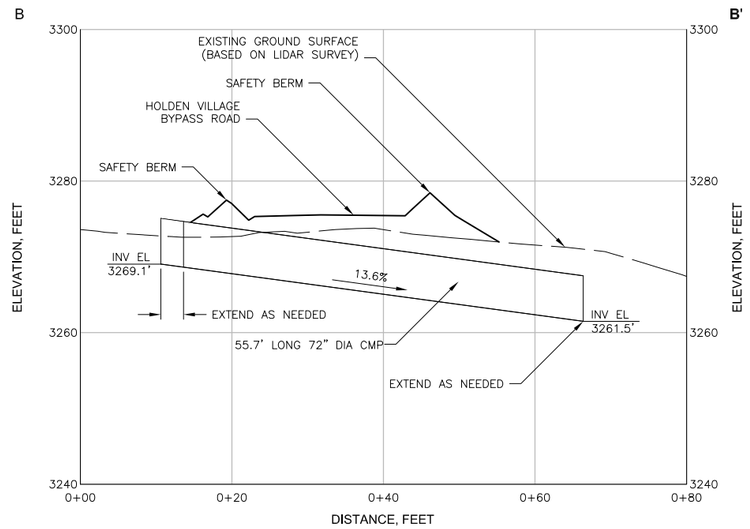

B - COPPER CREEK CULVERT
(LOOKING WEST)

SCALE
10 0 10 20 FEET

NOTES:

1. EXISTING CULVERTS DAYLIGHT BASED ON FIELD OBSERVATION LIDAR SURFACE APPEARS TO BE INACCURATE IN THIS AREA.
2. FILL PLACEMENT CULVERT EXTENSIONS WILL BE FIELD FIT BASED ON ACTUAL CONDITIONS.

ISSUE / REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	G. PHILPOTT	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: COPPER CREEK CULVERT PLAN

MWH

SHEET: 10-4-20
REVISION: B
FILE NAME: 1008679D262

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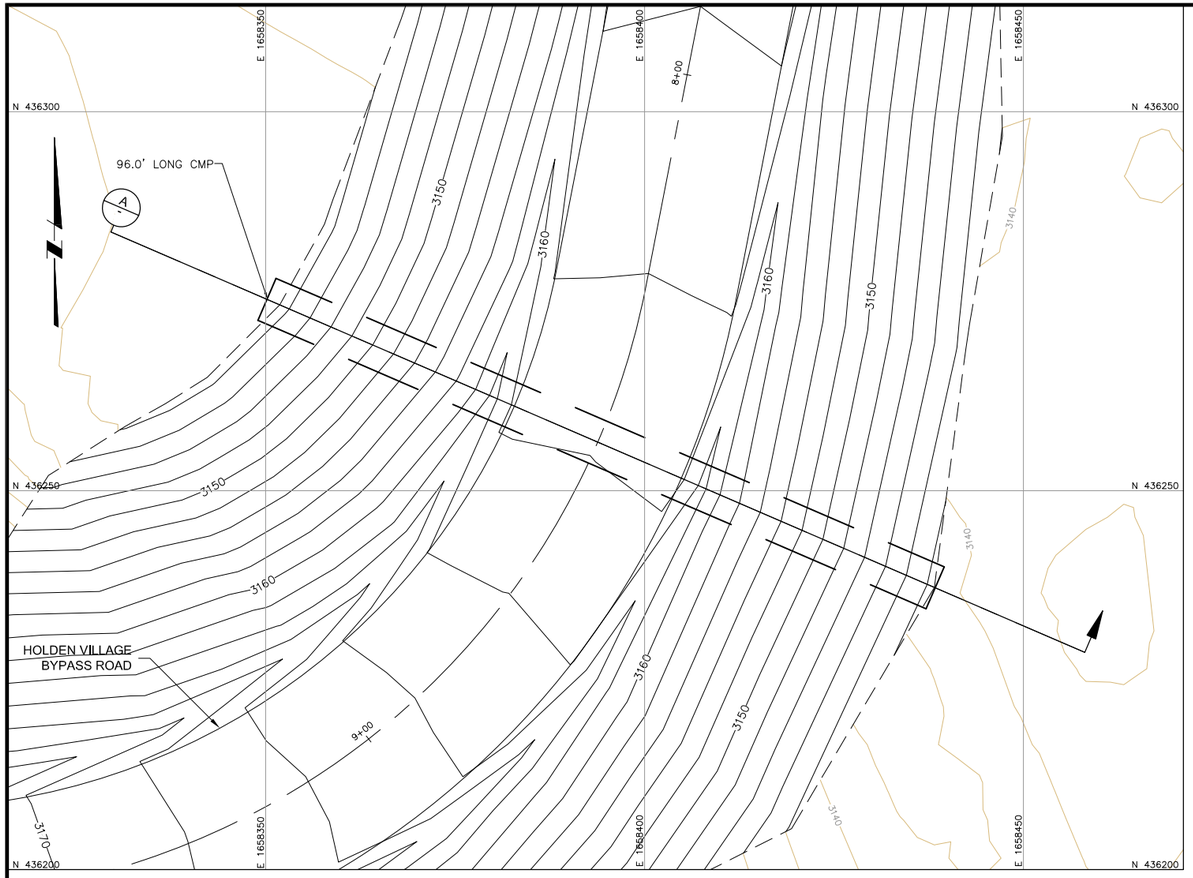

PLAN

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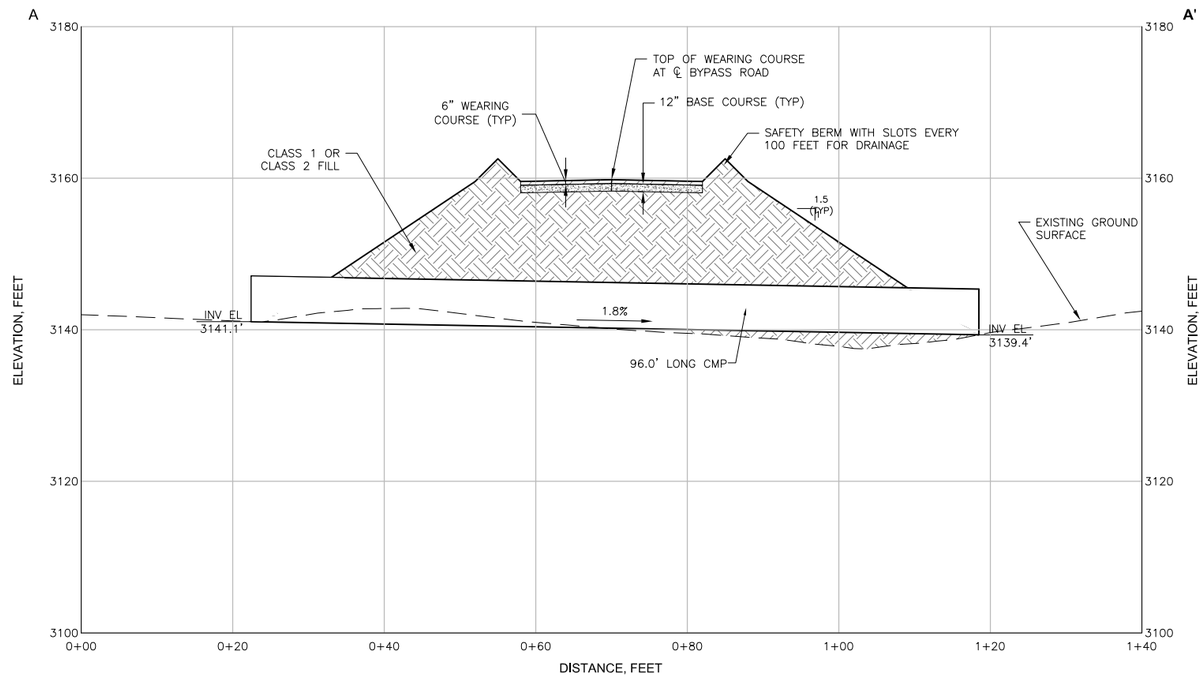
CONTOUR INTERVAL = 2 FEET



SECTION

A / - RAILROAD CREEK CULVERT
(LOOKING NORTH)

SCALE
10 0 10 20 FEET

ISSUE REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	G. PHILPOTT	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: RAILROAD CREEK CULVERT PLAN

MWH

SHEET: 10-4-21
REVISION: B
FILE NAME: 1008679D263

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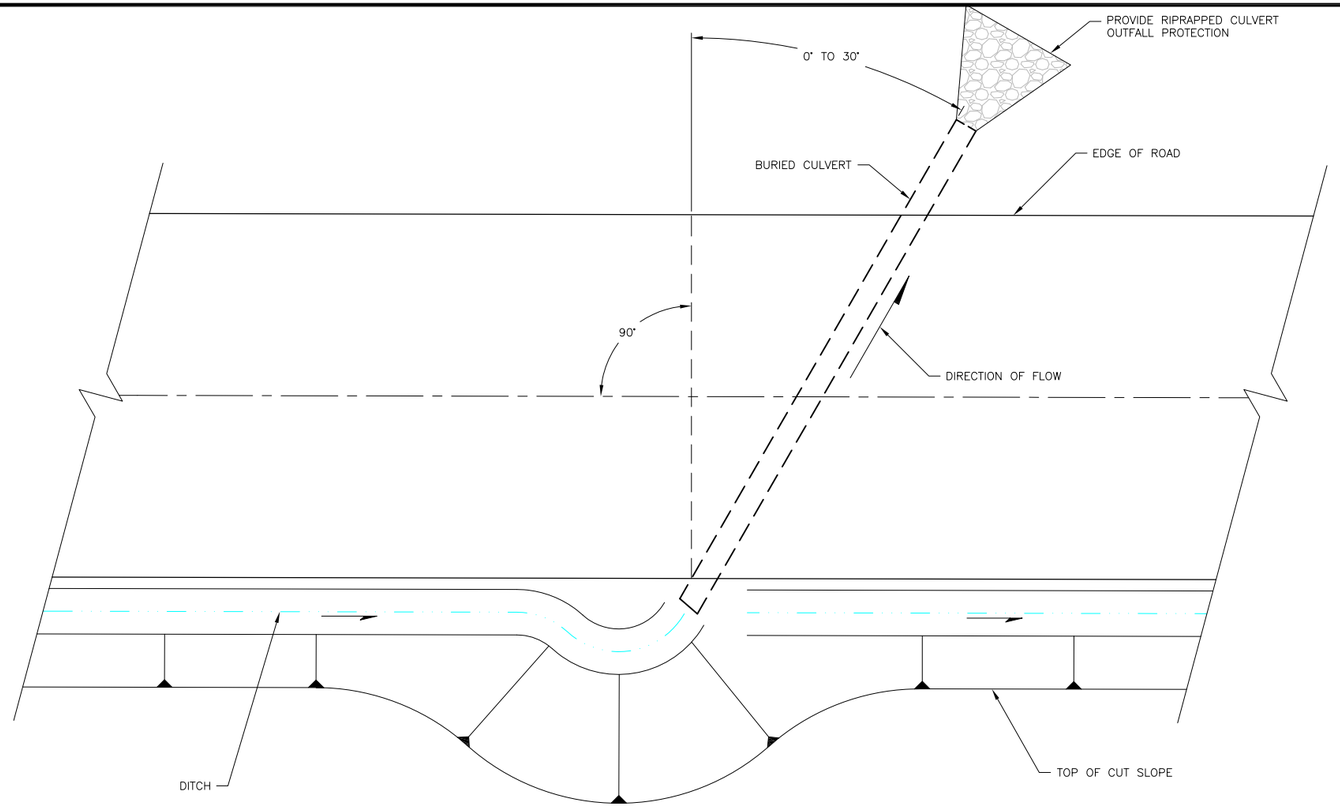

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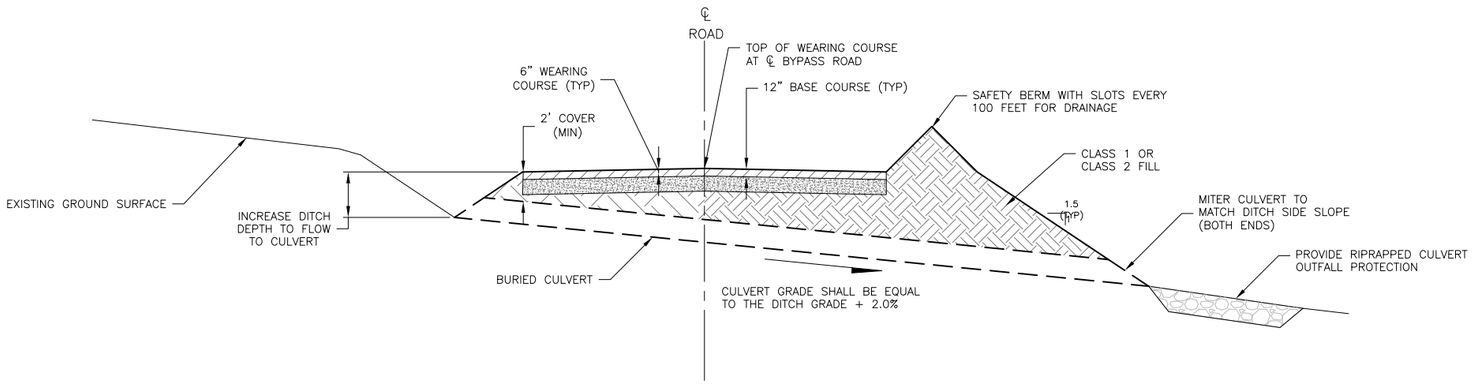

PROFILE

1 / - TYPICAL CULVERT INSTALLATION

SCALE
5 0 5 10 FEET

REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	R. WATT	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: TYPICAL CULVERT INSTALLATION

MWH

SHEET: 10-4-22
REVISION: B
FILE NAME: 1008679D335

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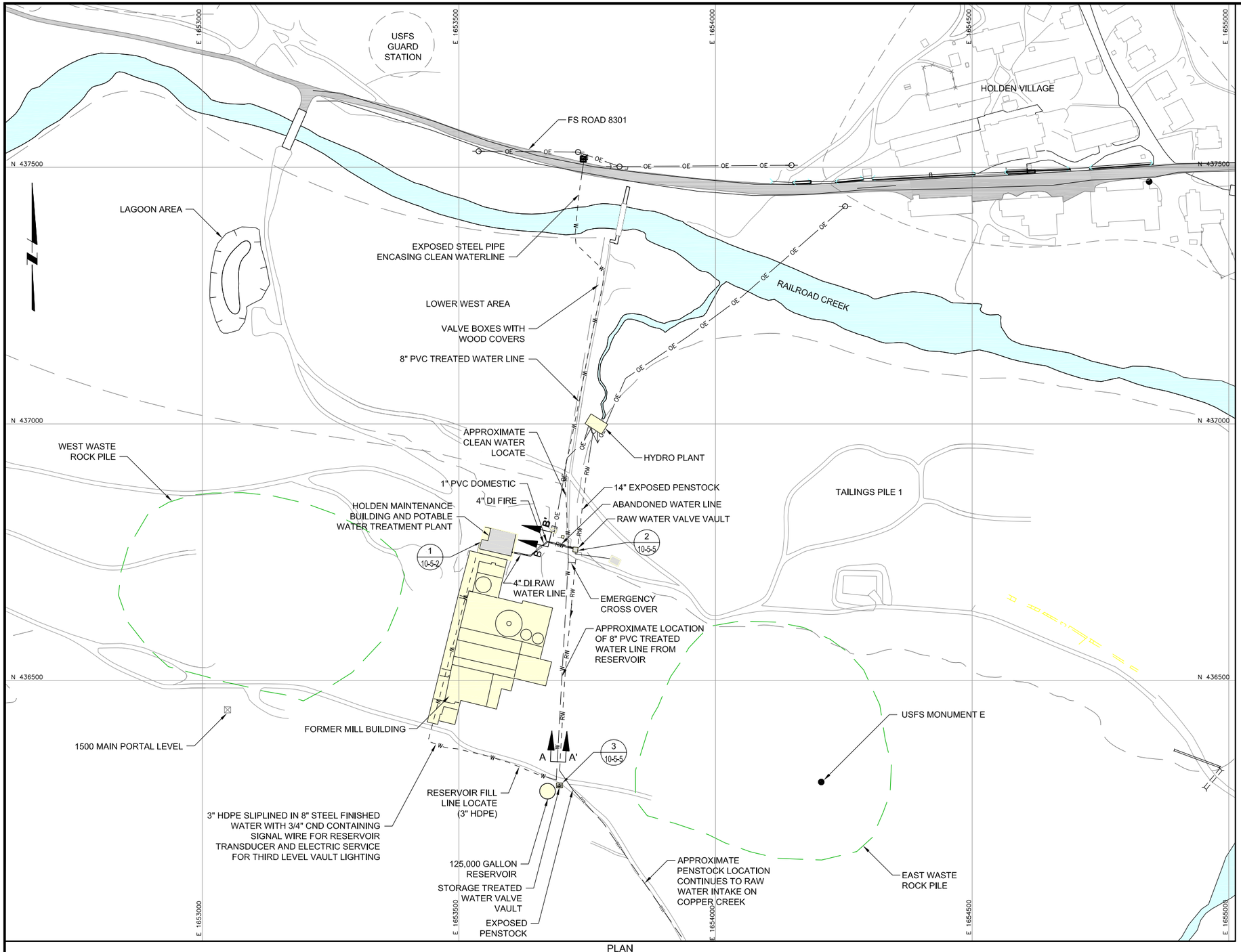

PLAN

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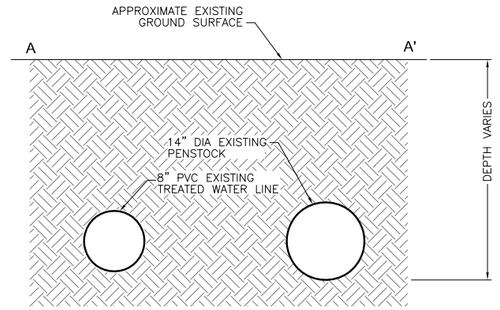
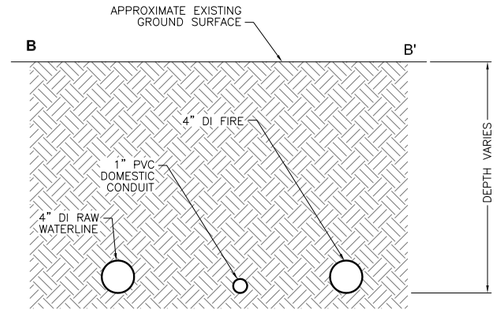
CONTOUR INTERVAL = 10 FEET



A - EXISTING UTILITY LINES
(LOOKING NORTH)
N.T.S.



B - EXISTING UTILITY LINES
(LOOKING WEST)
N.T.S.

NOTES:

1. UTILITY LINE LOCATIONS ARE BASED ON SURVEY PERFORMED BY ERLANDSEN, INC SURVEY UNDERGROUND UTILITY LOCATE SERVICES.
2. THE POTABLE WATER TREATMENT SYSTEM IS IN A 10.5 FT X 25 FT ROOM LOCATED IN THE SOUTHWEST CORNER OF THE HOLDEN VILLAGE MAINTENANCE BUILDING.

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
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APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: EXISTING POTABLE WATER SYSTEM

MWH

SHEET: 10-5-1
REVISION: B
FILE NAME: 1008679D224

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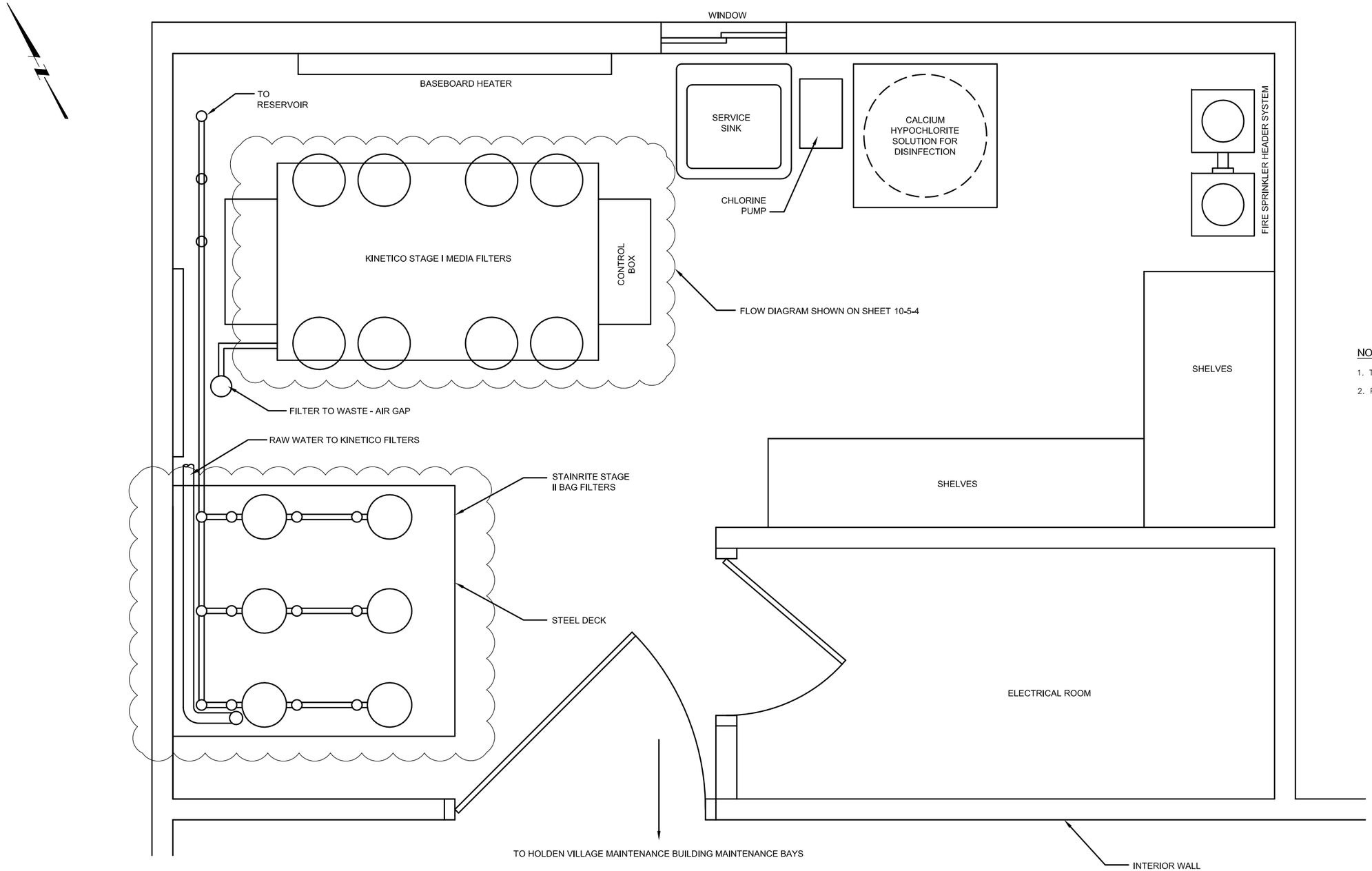

NOTES:

1. THIS DRAWING IS NOT TO SCALE
2. PIPING LAYOUT NOT SHOWN IN DETAIL.

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

- EXHIBIT WT-1 TITLED, "UPGRADE WATER FILTRATION SYSTEM FLOOR PLAN – EXISTING ROOM" PROVIDED TO MWH BY HOLDEN VILLAGE, INC., DATED: MARCH, 2008.

DESIGNED BY		
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: EXISTING POTABLE WATER SYSTEM GENERAL ARRANGEMENT

MWH

SHEET: 10-5-2
REVISION: B
FILE NAME: 1008679D230

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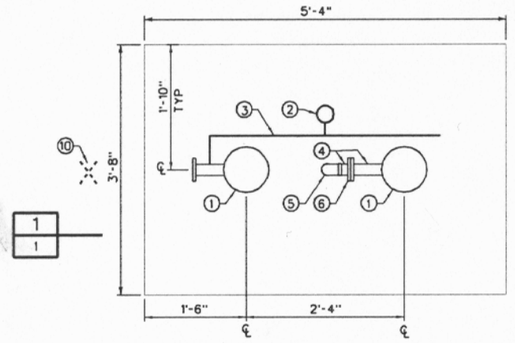
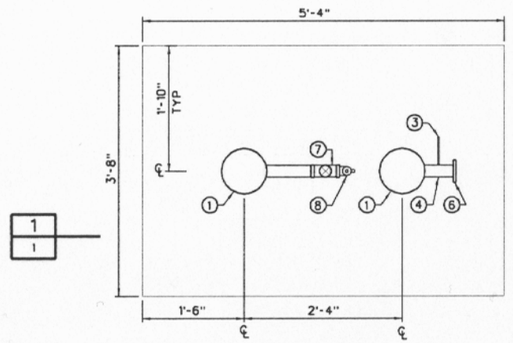
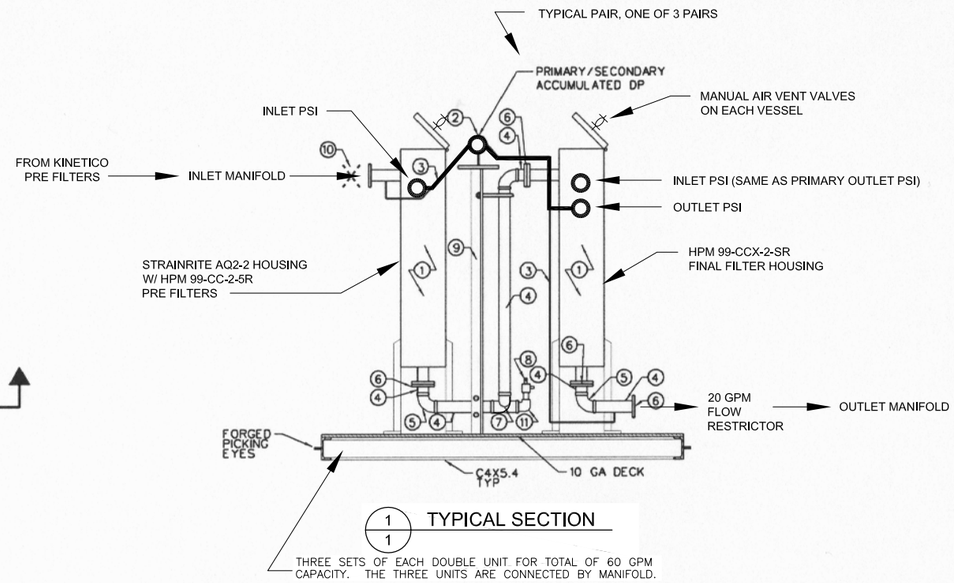


A/1 UPPER PIPING



B/1 LOWER PIPING

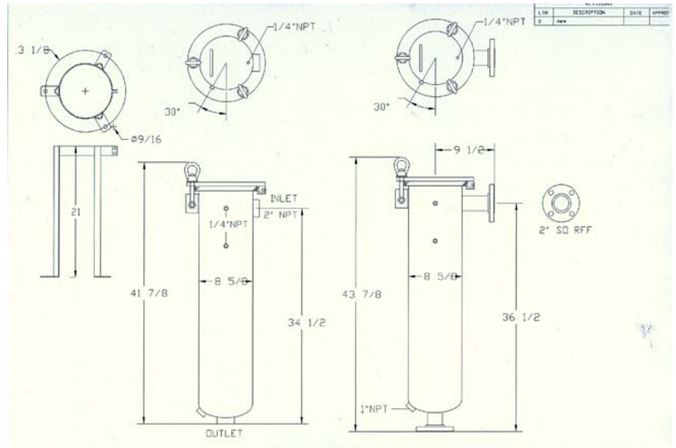


1/1 TYPICAL SECTION

FITTING SCHEDULE				
MARK	SIZE	DESCRIPTION	SCH	MATERIAL
1	NA	FILTER UNIT	NA	NA
2	2½"	PRESSURE GAUGE	NA	NA
3	¼"	PRESSURE LINE	80	POLY
4	2"	PIPE	80	PVC
5	2"	90 DEGREE (SOCKET ENDS)	80	PVC
6	2"	FLANGE (SOCKET END)	80	PVC
7	2"	TEE (SOCKET ENDS)	80	PVC
9	NA	PIPING SUPPORT W/ U BOLTS	NA	304SS
10	1½"	FLOW CONTROL VALVE (BY OTHERS)		

GENERAL NOTES:

1. ALL STEEL PLATE AND CHANNEL SHALL BE A-36 MATERIAL.
2. ALL EXTERIOR SURFACES SHALL BE CLEANED OF DIRT, OIL, GREASE, AND FOREIGN MATERIALS PER MANUFACTURER'S RECOMMENDATION PRIOR TO BEING POWER COATED BLACK.
3. THIS DRAWING IS NOT TO SCALE.
4. SEE PLAN FOR EXACT FITTING DETAIL.



PLAN AND ELEVATION

DISCLAIMER:
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DRAWING REFERENCE(S):

- EXHIBIT WT-3 TITLED, "UPGRADE WATER FILTRATION SYSTEM STRAIN RITE FILTERS" PROVIDED TO MWH BY HOLDEN VILLAGE, INC., DATED: MARCH, 2008.

ISSUE/REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: STRAINRITE FILTER DETAILS

MWH

SHEET: 10-5-3
REVISION: B
FILE NAME: 1008679D231

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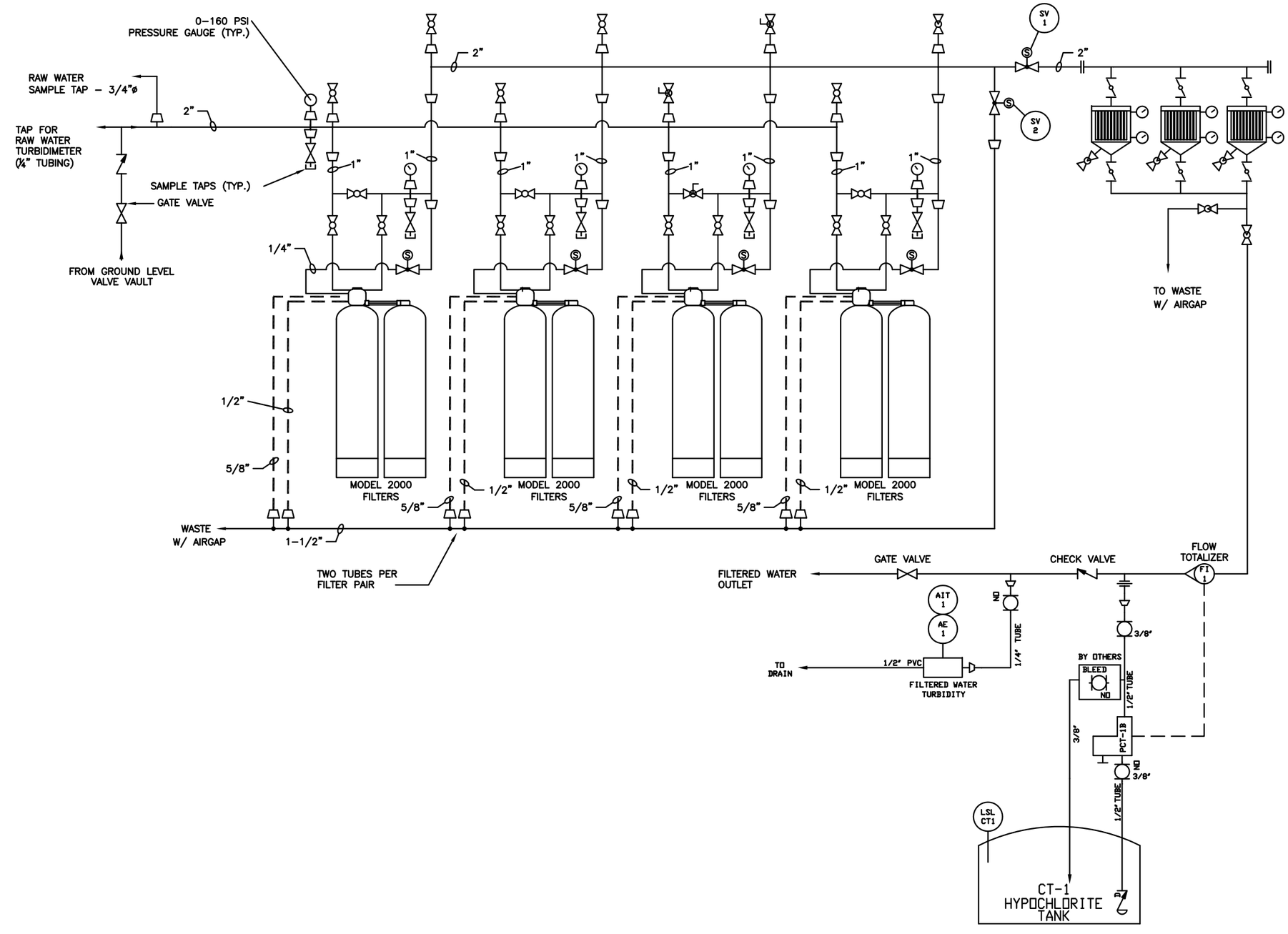

NOTE:

1. THIS DRAWING IS NOT TO SCALE.

LEGEND:

- GATE VALVE
- BALL VALVE
- REDUCER
- PRESSURE GAGE
- PRESSURE RELIEF VALVE
- INCREASER
- REDUCING TEE
- CONTROL VALVE
- CHECK VALVE
- BUTTERFLY VALVE
- SOLENOID VALVE
- PLUG VALVE
- PNUEMATIC CHECK VALVE
- SAMPLE TAPS
- FLANGED CONNECTION
- UNION
- HEAT EXCHANGER

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

- EXHIBIT WT-2 TITLED, "UPGRADE WATER FILTRATION SYSTEM FLOW DIAGRAM" PROVIDED TO MWH BY HOLDEN VILLAGE, INC., DATED: MARCH, 2008.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: KINETICO FILTERS DETAILS

MWH

SHEET: 10-5-4 | REVISION: B

FILE NAME: 1008679D232

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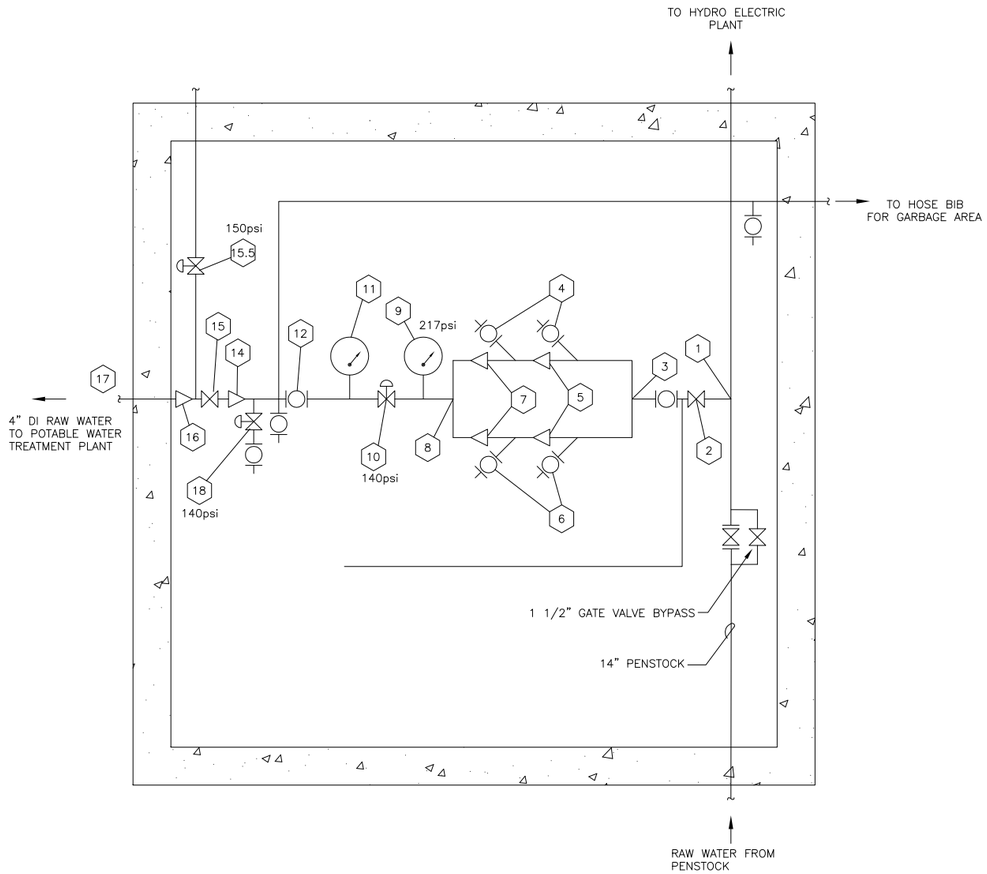
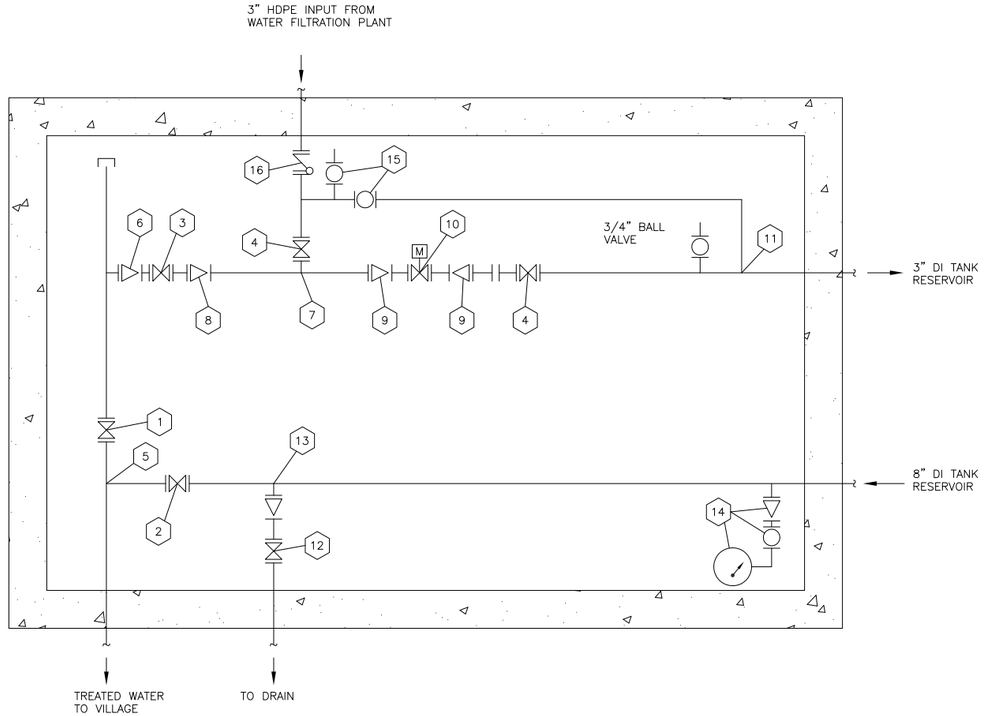


2 RAW WATER LEVEL 2 VALVE VAULT
(LOCATED IN "A-FRAM" NEAR GARAGE)

2nd LEVEL VALVE VAULT

1. 3" TAP ON PENSTOCK
2. 3" GATE VALVE
3. TEE INTO 2-2 1/2" LINES
4. 2-WYE STRAINERS W/ 1" BALL VALVE (TO FLUSH)
5. 3"x2" REDUCER
6. 2-2" WYE STRAINERS
7. 2"x1 1/4" REDUCER W/ UNIONS
8. 2-1 1/4" LINES TEE INTO ONE 1 1/4" LINE
9. PRESSURE GAUGE
10. CLAVAL 990 PRV
11. PRESSURE GAUGE
12. 1 1/4" BALL VALVE
13. SIDESTREAM TEE-1/2" UNTREATED TO GARBAGE AREA
14. 1 1/4"x2" INCREASER
15. 2" GATE VALVE
15.5 PRESSURE RELIEF VALVE
16. 2"x4" INCREASER
17. 4" DI EXIT TO WATER FILTRATION PLANT
18. CLAVAL 990 PRV



3 TREATED WATER LEVEL 3 VALVE VAULT
(LOCATED NEAR STORAGE TANK)

3rd LEVEL VALVE VAULT

1. 8" GATE VALVE, NORMALLY CLOSED
2. 8" GATE VALVE
3. 4" GATE VALVE
4. 3" GATE VALVE
5. 8"x8" TEE
6. 8"x4" REDUCING TEE
7. 3"x3" TEE
8. 4"x3" REDUCER
9. 3"x2 1/2" REDUCER
10. 2 1/2" CLAYTON ALTITUDE CONTROL VALVE MODEL #210-03FORCED OPEN
11. 2" CORP TAP
12. 4" GATE VALVE
13. 8"x4" TEE
14. 3/4" CORP TAP W/ REDUCER, BALL VALVE AND PRESSURE GAUGE
15. 2" BALL VALVE
16. 3" CHECK VALVE

LEGEND:

- GATE VALVE
- BALL VALVE
- REDUCER
- PRESSURE GAGE
- PRESSURE RELIEF VALVE
- INCREASER
- REDUCING TEE
- CONTROL VALVE
- CHECK VALVE

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
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A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

- EXHIBIT W-4 TITLED, "HOLDEN VILLAGE WATER VAULTS" PROVIDED TO MWH BY HOLDEN VILLAGE, INC., DATED: MARCH, 2008.

DESIGNED BY	P. PELLICER	02/28/11	
DRAWN BY	F. ANDRADE	02/28/11	
CHECKED BY	D. RODRIGUEZ	02/28/11	
APPROVED BY	P. CROUSE	02/28/11	
PROJECT MANAGER	R. SCHLICHER	02/28/11	
CLIENT APPROVAL			
CLIENT REFERENCE NO.			

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: POTABLE WATER SYSTEM VAULT DETAIL SHEET

MWH

SHEET: 10-5-5
REVISION: B
FILE NAME: 1008679D242

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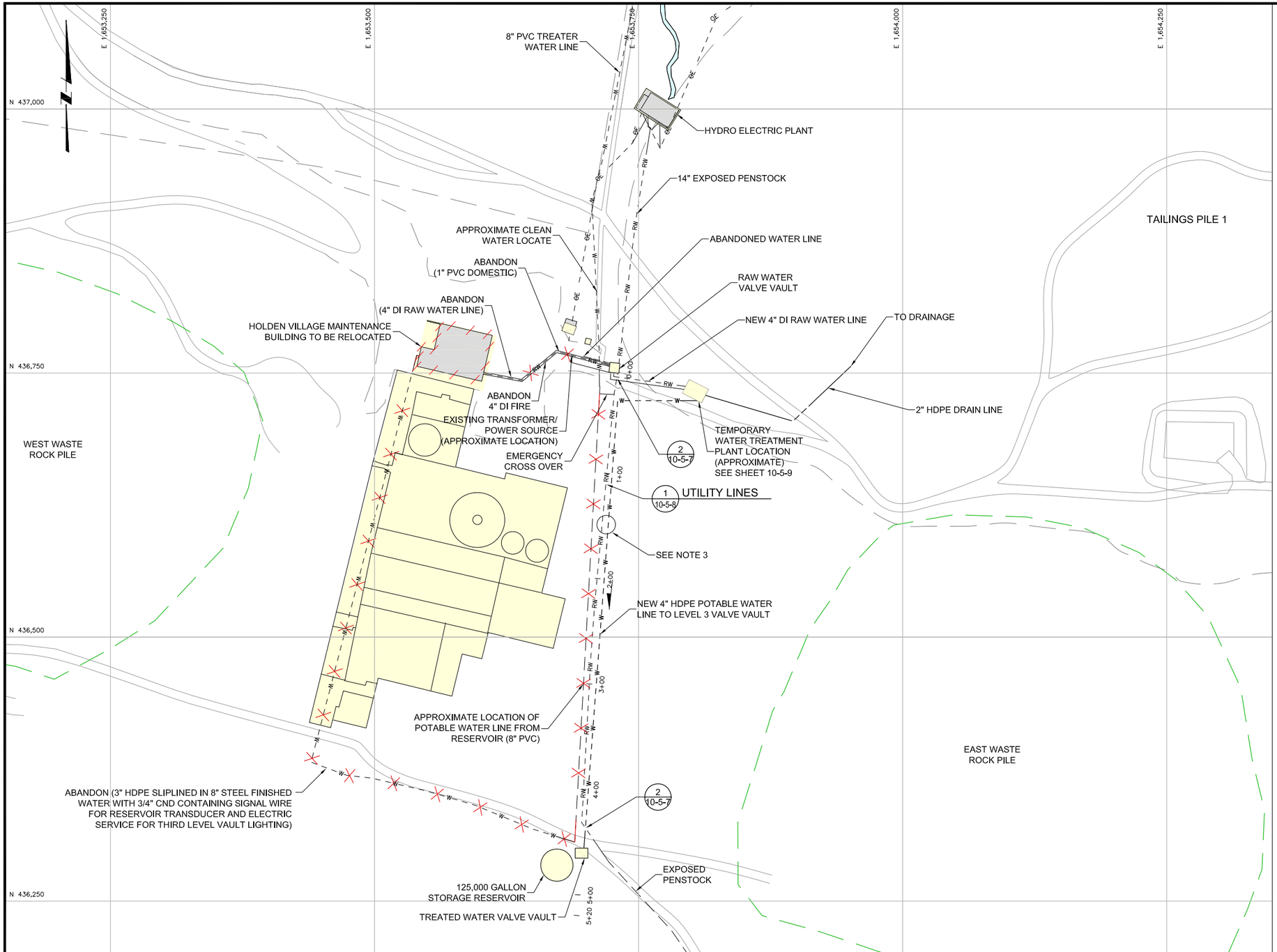

PLAN

SCALE

50 0 50 100 FEET

CONTOUR INTERVAL = 10 FEET

LEGEND:

- 3370 — APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET
- DI — DUCTILE IRON
- INSTRUMENTATION/CONTROL CONDUIT
- ELECTRICAL CONDUIT
- FUTURE DEMOLITION
- ABANDON

NOTES:

1. DISASSEMBLE THE HOLDEN VILLAGE POTABLE WATER PLANT AND REASSEMBLE IN THE TEMPORARY WATER TREATMENT IN NEW BUILDING.
2. CONTRACTOR SHALL FIELD VERIFY THE LOCATION OF RAW ALL EXISTING UTILITIES.
3. MAINTAIN A MINIMUM BUFFER DISTANCE OF 4 FEET BETWEEN TRENCH WALL AND EXISTING PENSTOCK.

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
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A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE

TITLE: RELOCATED POTABLE WATER SYSTEM

MWH

SHEET: 10-5-6 REVISION: B

FILE NAME: 1008679D239

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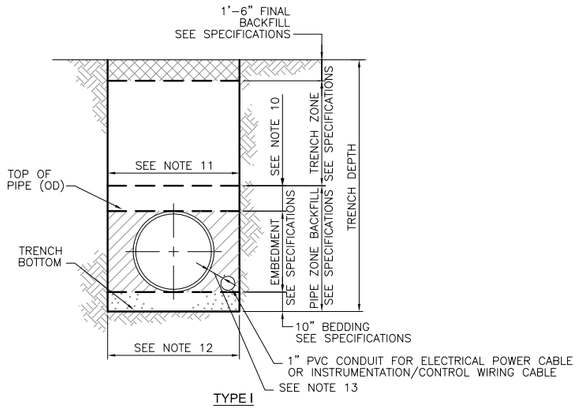
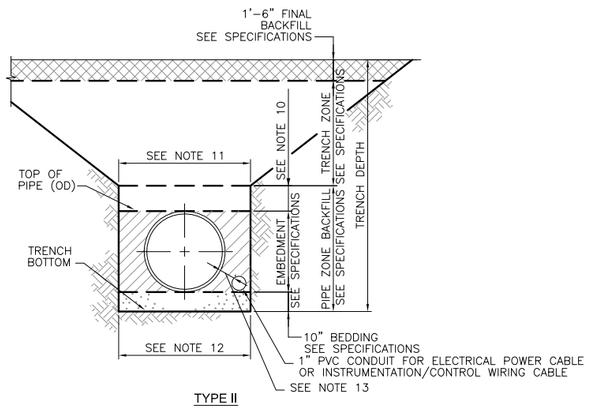


TYPE I

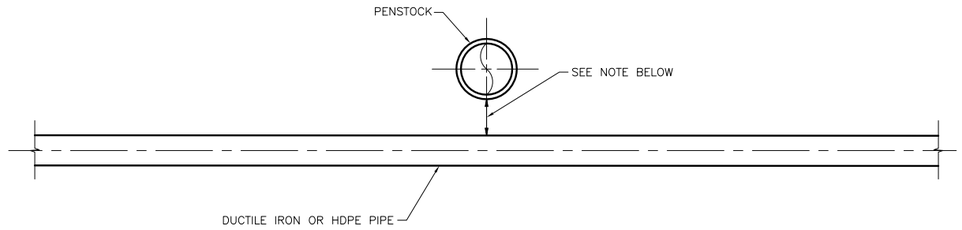


TYPE II

1 / - FLEXIBLE PIPE TRENCH
N.T.S.

NOTES:

1. FLEXIBLE PIPE REFERS TO ALL STEEL, DUCTILE-IRON, AND PLASTIC PIPES.
2. TYPICAL TRENCH SECTIONS (I, II AND III) ARE TO BE USED ONLY WHERE STABLE, COMPACT SOIL CONDITIONS EXIST. IF BOULDERS OR LARGE OBSTRUCTIONS ARE ENCOUNTERED, TRENCH SECTIONS MAY BE DEEPER OR WIDER THAN SHOWN. THE ENGINEER SHALL BE ADVISED SHOULD THIS OCCUR.
3. THE NEED FOR PROTECTIVE SYSTEMS AND EXCAVATION SLOPES SHALL BE DETERMINED CONSIDERING APPLICABLE LOCAL, STATE AND FEDERAL (OSHA) SAFETY STANDARDS AND REGULATIONS.
4. PROTECTIVE SYSTEMS SHALL BE DESIGNED AND BUILT IN ACCORDANCE WITH THE APPLICABLE LOCAL, STATE AND FEDERAL (OSHA) SAFETY STANDARDS AND REGULATIONS.
5. SUPPORTING DOCUMENTATION SHALL BE SUBMITTED TO THE ENGINEER
6. REGARDING PIPE DESIGN AND COMPLIANCE WITH APPLICABLE LOCAL, STATE AND FEDERAL (OSHA) SAFETY STANDARDS.
7. UNSUPPORTED VERTICAL AND/OR SLOPING TRENCH WALL SLOPES SHALL NOT BE STEEPER THAN ALLOWED BY APPLICABLE LOCAL, STATE AND FEDERAL (OSHA) SAFETY STANDARDS AND REGULATIONS, UNLESS SUPPORTING DOCUMENTATION IS SUBMITTED, ACCORDING TO AFOREMENTIONED SAFETY STANDARDS.
8. TRENCH SECTIONS OTHER THAN THE TYPICAL SECTIONS SHOWN MAY BE UTILIZED PROVIDED THEY COMPLY WITH APPLICABLE LOCAL, STATE AND FEDERAL (OSHA) SAFETY STANDARDS AND REGULATIONS. DOCUMENTATION SUPPORTING THIS COMPLIANCE AND PIPE DESIGN CALCULATIONS SHALL BE SUBMITTED TO THE ENGINEER. IF OVER-EXCAVATION DUE TO POOR FOUNDATION MATERIAL IS ORDERED BY THE ENGINEER, THE BACKFILL MATERIAL SHALL BE ACCORDING TO THE EARTHWORK SECTION OF THE SPECIFICATIONS ARTICLE ENTITLED, "FILL AND BACKFILL MATERIAL REQUIREMENTS."
9. IF DURING CONSTRUCTION, THE WATER TABLE IS DISCOVERED TO BE ABOVE THE TRENCH BOTTOM, THE ENGINEER SHALL BE NOTIFIED, AND APPROPRIATE DEWATERING SHALL BE IMPLEMENTED TO LOWER THE WATER LEVEL BELOW THE TRENCH BOTTOM. THE BACKFILL MATERIAL SHALL BE ACCORDING TO THE EARTHWORK SECTIONS OF THE SPECIFICATIONS, OR AS ORDERED BY THE ENGINEER.
10. 6" (MIN) FOR PIPE DIAMETER < 24". 12" (MIN) FOR PIPE DIAMETER > 24".
11. MAX TRENCH WIDTH AT TOP OF PIPE: OD PLUS 36" FOR, 18" AND LARGER PIPE OD. OD PLUS 24" FOR LESS THAN 18".
12. MIN TRENCH BOTTOM WIDTH = OD PLUS 24" FOR MECHANICAL COMPACTION.
13. MIN DISTANCE BETWEEN PIPE AND PVC CONDUIT = 12"
14. MIN SPACING BETWEEN PVC CONDUIT AND SIDE/BOTTOM OF TRENCH = 3"
15. MAINTAIN A MINIMUM BUFFER DISTANCE OF 4 FEET BETWEEN TRENCH WALL AND EXISTING PENSTOCK.



2 / - CROSS OVER PIPING
N.T.S.

NOTE:

1. DUCTILE IRON/HDPE PIPE TO CROSS OVER BELOW THE PENSTOCK WITH 6" MIN CLEARANCE BETWEEN BOTTOM OF PENSTOCK AND TOP OF DUCTILE IRON/HDPE PIPE (WHERE BOTTOM OF PENSTOCK IS AT LEAST 30" BELOW GRADE). IN INSTANCES WHERE PENSTOCK IS ABOVE GRADE OR BOTTOM OF THE PENSTOCK IS NOT AT LEAST 30" BELOW GRADE, LOCATE DUCTILE IRON/HDPE PIPE BOTTOM AT LEAST 30" BELOW GRADE.

LEGEND:

O.D.	OUTSIDE DIAMETER
CLSM	CONTROLLED LOW STRENGTH MATERIAL

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

DISCLAIMER:
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DRAWING REFERENCE(S):

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE
TITLE: DETAIL SHEET

MWH

SHEET: 10-5-7
REVISION: B
FILE NAME: 1008679D240

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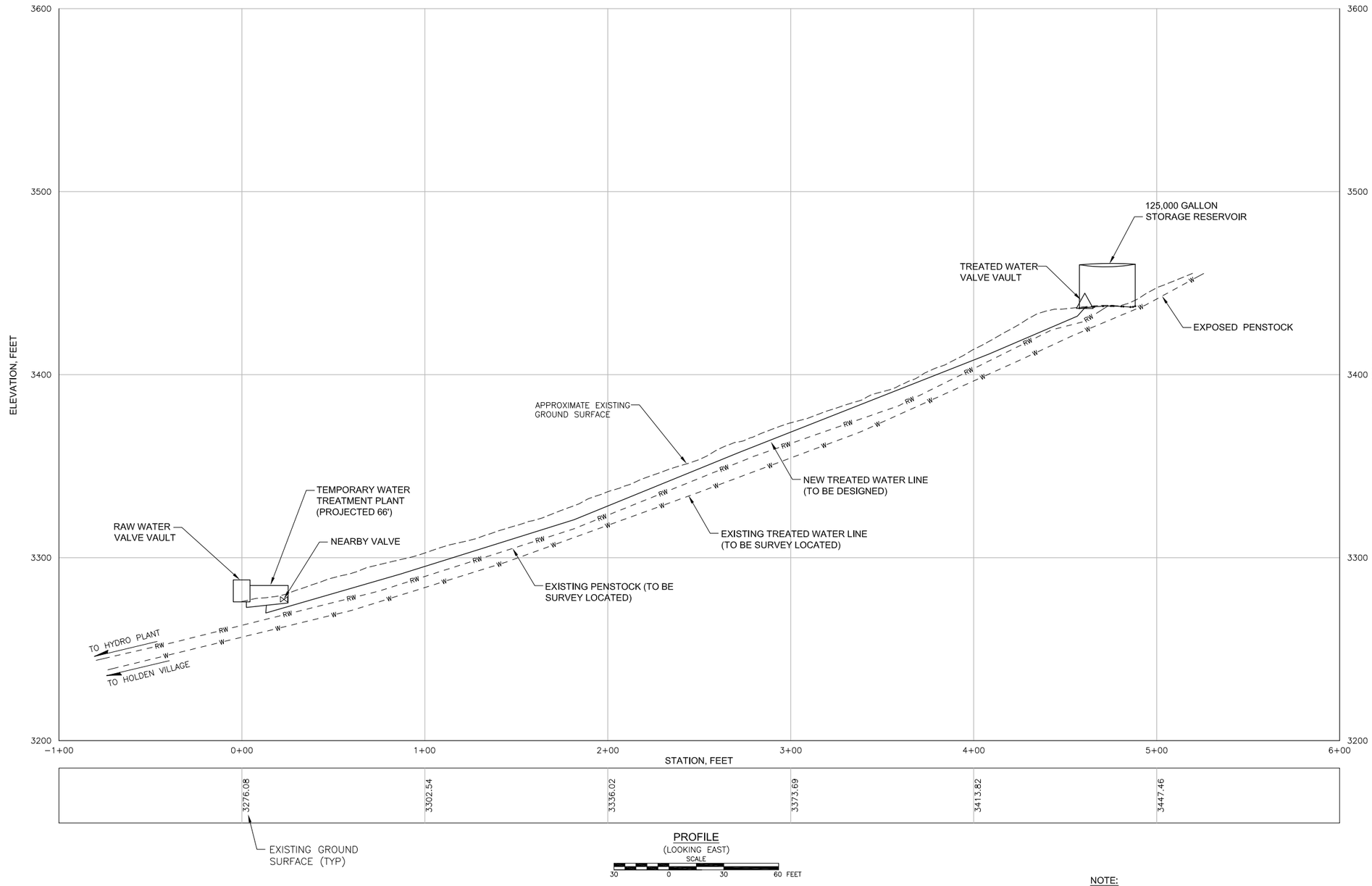

PROFILE
(LOOKING EAST)
SCALE
30 0 30 60 FEET

NOTE:

1. FOR ALIGNMENT LOCATION SEE SHEET 10−5−6.

ISSUE REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DRAWING REFERENCE(S):
- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.
- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA−FSA−APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE
TITLE: UTILITY LINE LOCATIONS

MWH

SHEET: 10-5-8
REVISION: B
FILE NAME: 1008679D241

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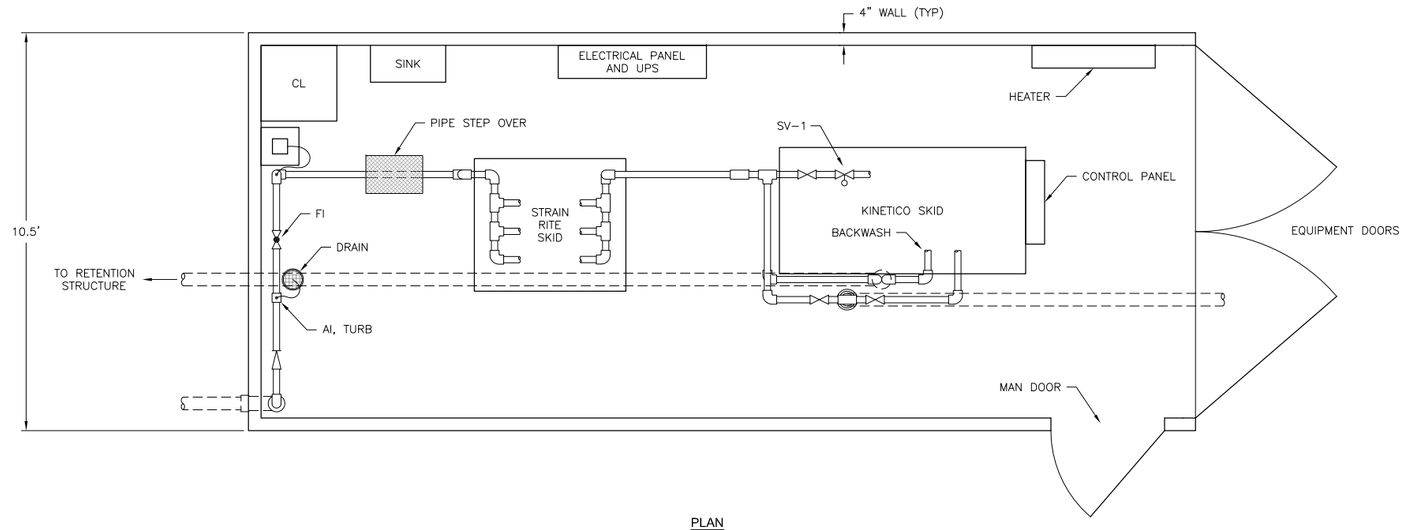
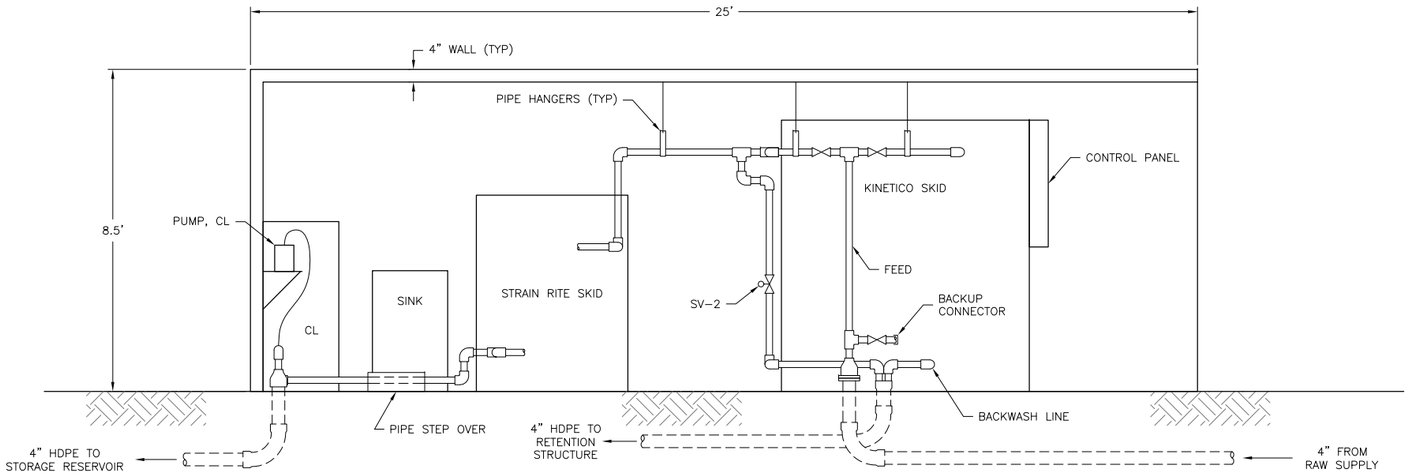


PLAN



ELEVATION

SCALE
2 0 2 4 FEET

NOTE:

1. FOR PLAN LOCATION SEE SHEET 10-5-6.

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	DM	DD	DATE

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DRAWING REFERENCE(S):

DESIGNED BY	D DUPON	3/11/11
DRAWN BY	D MIRANDA	3/11/11
CHECKED BY	D DUPON	3/11/11
APPROVED BY	P. CROUSE	3/11/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

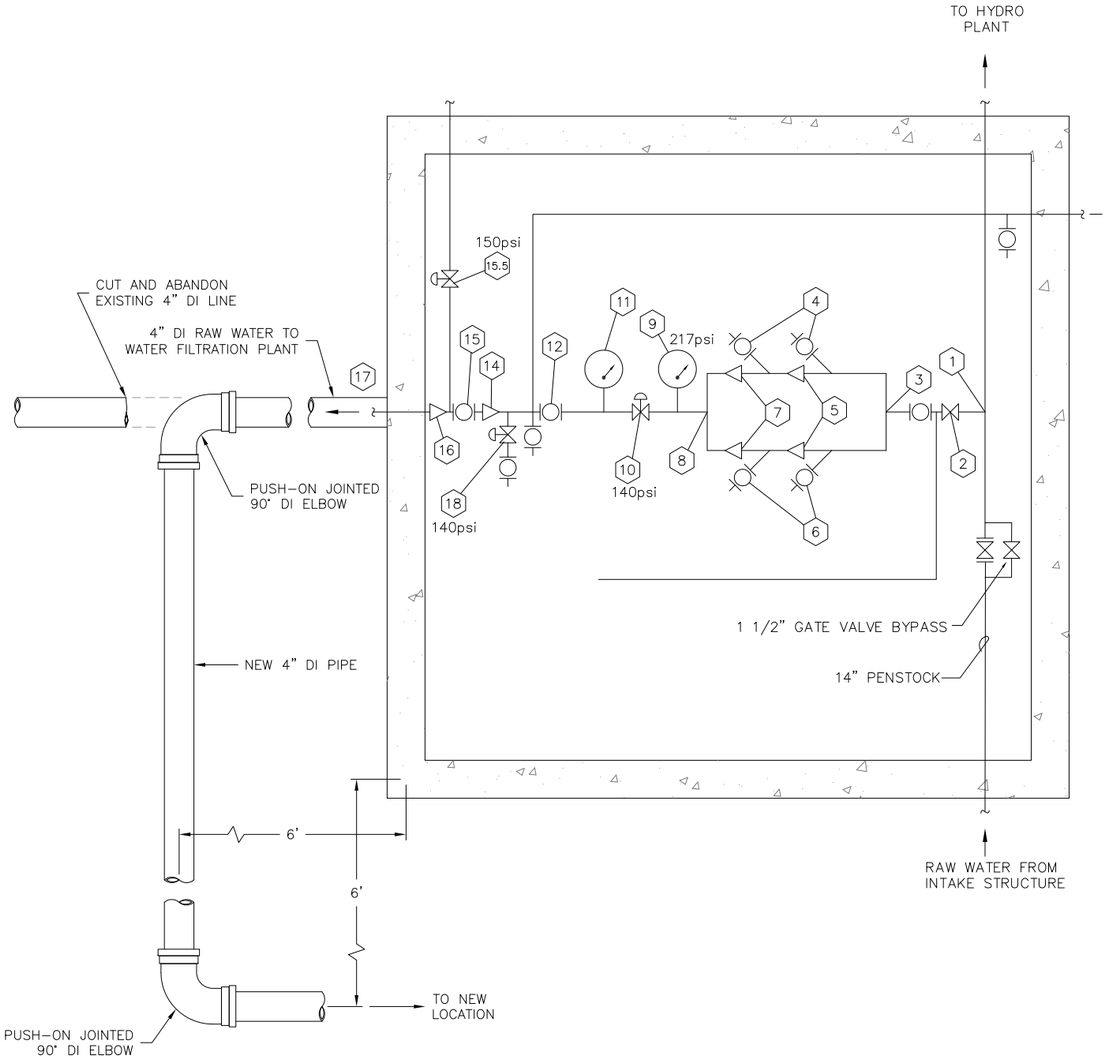
Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: PIPING DIAGRAM TEMPORARY EQUIPMENT ENCLOSURE

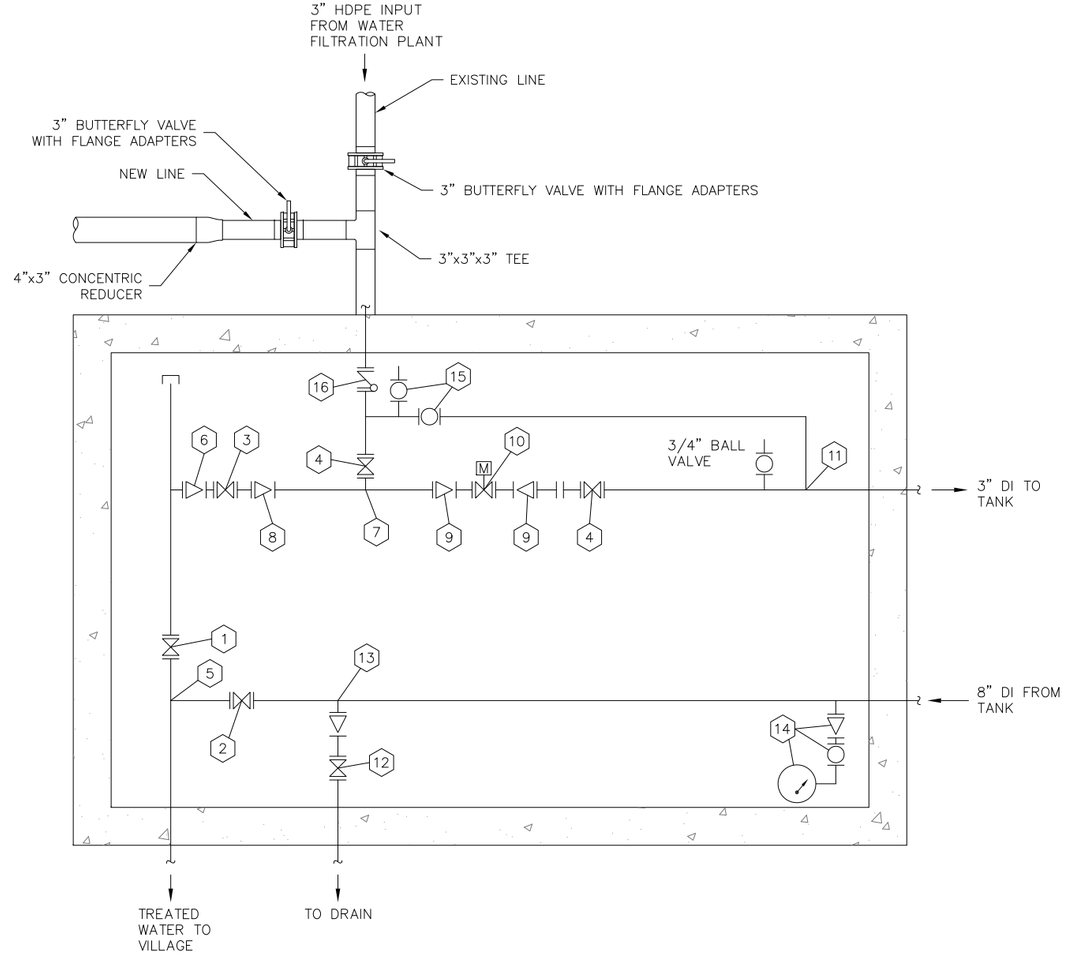
MWH

SHEET: 10-5-9
REVISION: B
FILE NAME: 1008679D348

M:\Clients-G-Z\Rio Tinto\1008679 - Holden Mine\013-Sheet Set\Infrastructure Improvements\Holden Village Facilities\1008790348 4/15/2011 3:46:55 PM



RAW WATER
LEVEL 2 VALVE VAULT DETAIL
2 - (LOCATED IN "A-FRAME" NEAR GARAGE)



TREATED WATER
LEVEL 3 VALVE VAULT
3 - (LOCATED NEAR STORAGE TANK)

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	DM	DD	3/11/11

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DRAWING REFERENCE(S):

- EXHIBIT W-4 TITLED, "HOLDEN VILLAGE WATER VAULTS" PROVIDED TO MWH BY HOLDEN VILLAGE, INC., DATED: MARCH, 2008.

DESIGNED BY	D DUPON	3/11/11
DRAWN BY	D MIRANDA	3/11/11
CHECKED BY	D DUPON	3/11/11
APPROVED BY	P. CROUSE	3/11/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: EXISTING VALVE VAULT MODIFICATIONS

MWH

SHEET: 10-5-10
REVISION: B
FILE NAME: 1008679D356

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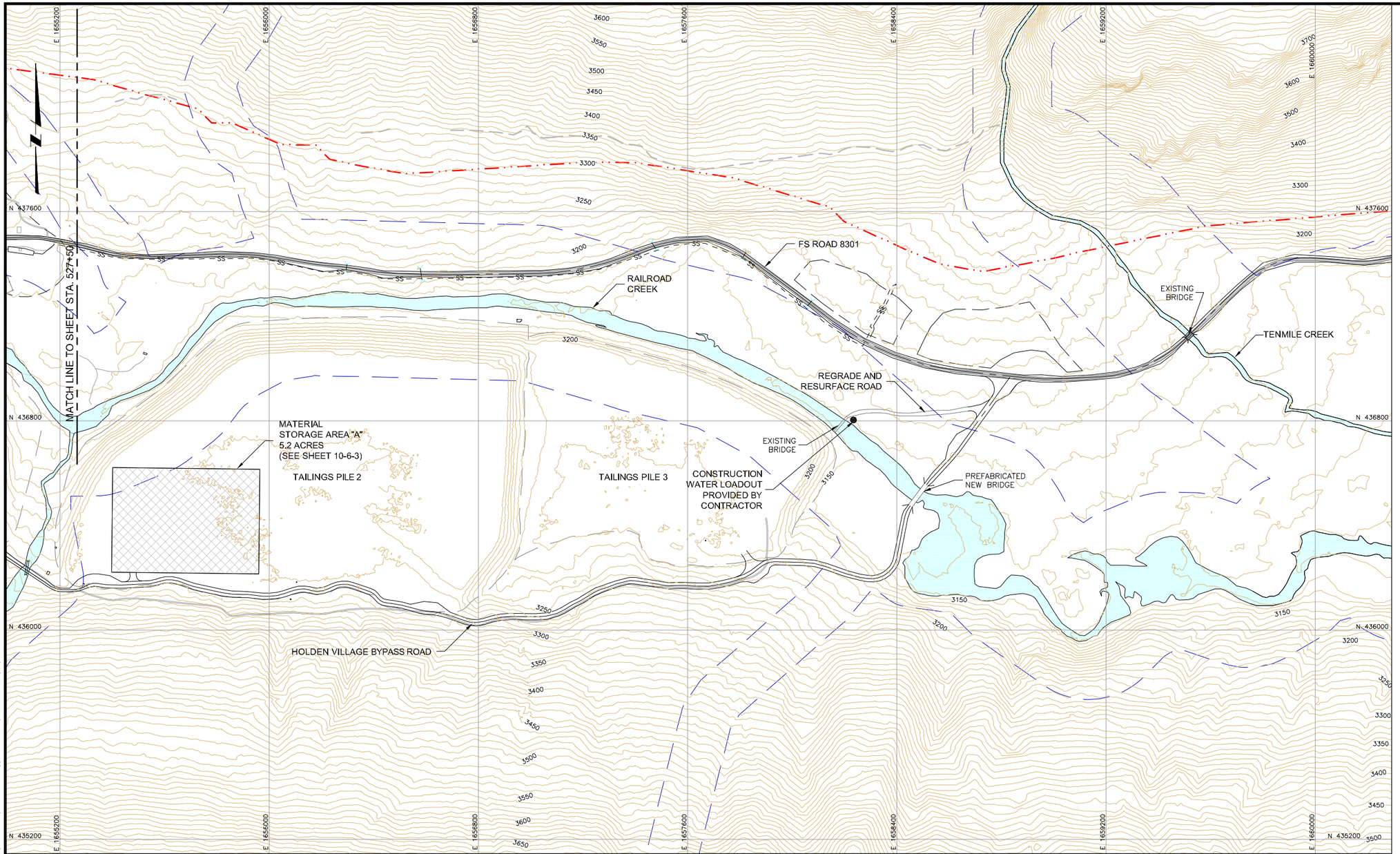

PLAN

SCALE

200 0 200 400 FEET

CONTOUR INTERVAL = 10 FEET

ISSUE REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	R. WATT	02/21/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: CONSTRUCTION SUPPORT FACILITIES (SHEET 1 OF 2)

MWH

SHEET: 10-6-1

REVISION: B

FILE NAME: 1008679D308

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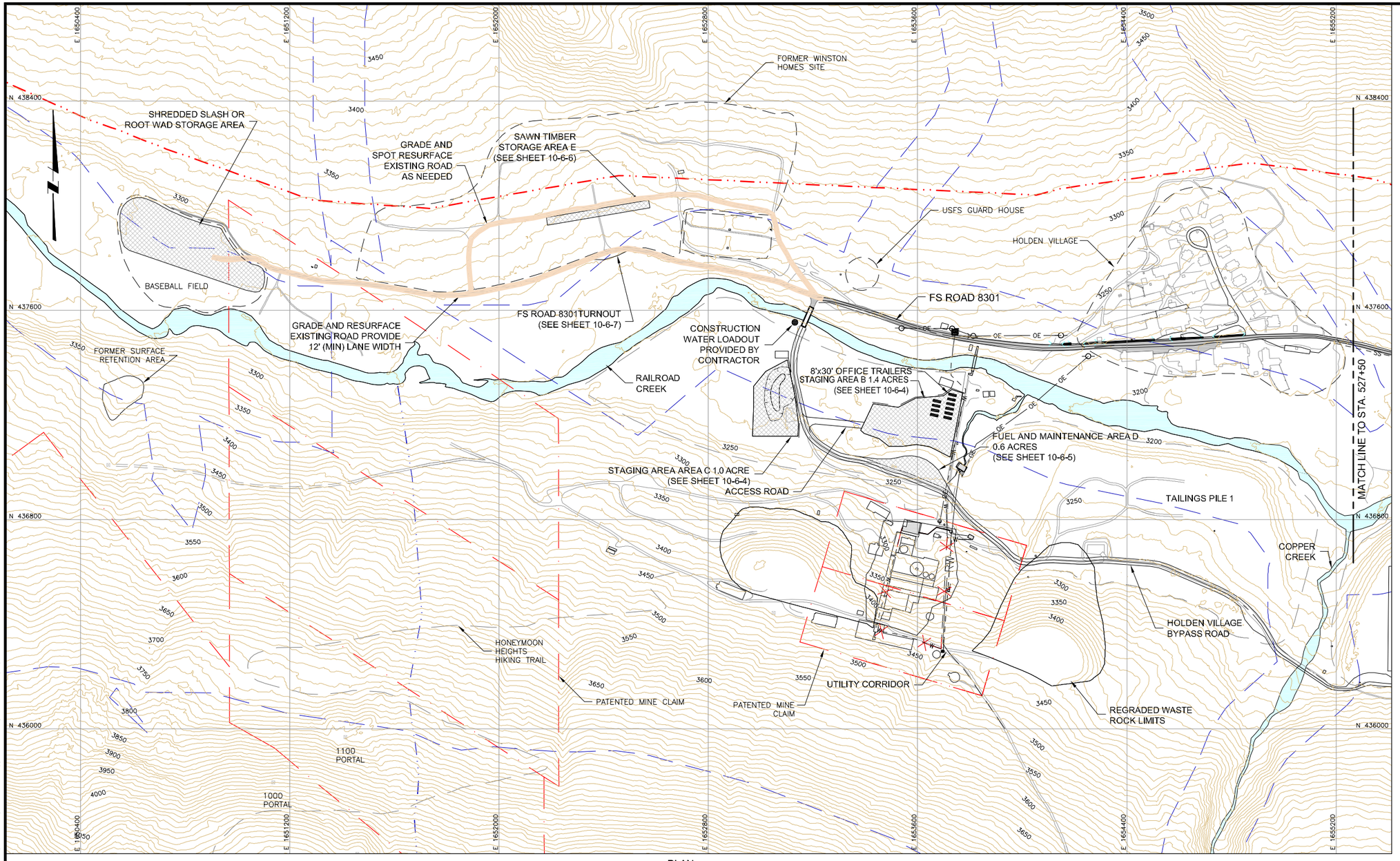

PLAN

SCALE

200 0 200 400 FEET

CONTOUR INTERVAL = 10 FEET

NOTES:

1. SECTIONS OF ROAD THAT WILL BE GRADED AND RESURFACED SHALL BE RESURFACED WITH 6" OF SURFACE COURSE MATERIAL PER SPECIFICATIONS.
2. NOXIOUS WEED CONTROL MEASURES SHALL BE IMPLEMENTED PRIOR TO STOCKPILING SLASH OR ROOT WADS IN THE BALL FIELD AREA.

ISSUE REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	R. WATT	02/21/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: CONSTRUCTION SUPPORT FACILITIES (SHEET 2 OF 2)

MWH

SHEET: 10-6-2 REVISION: B

FILE NAME: 1008679D309

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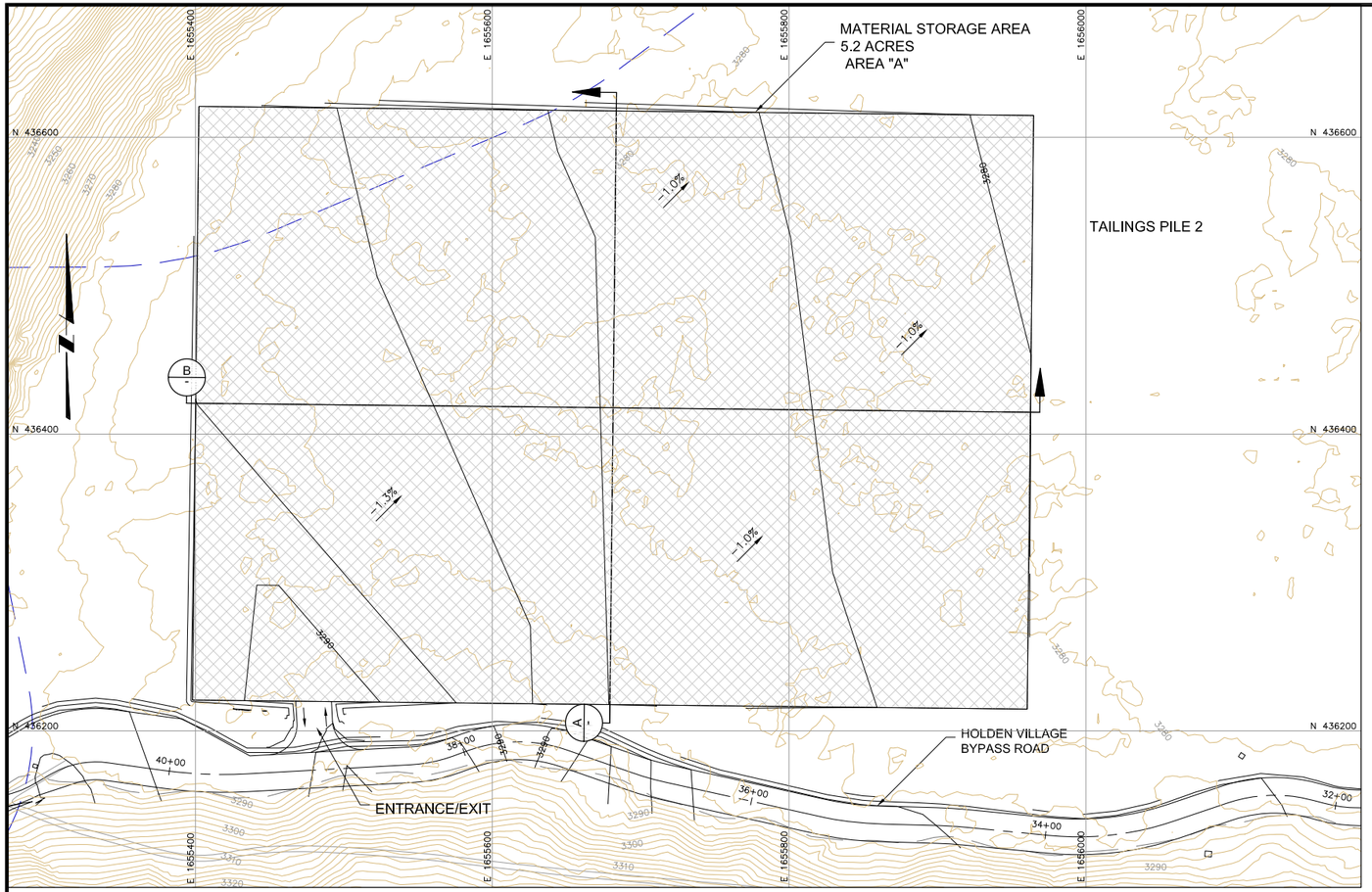
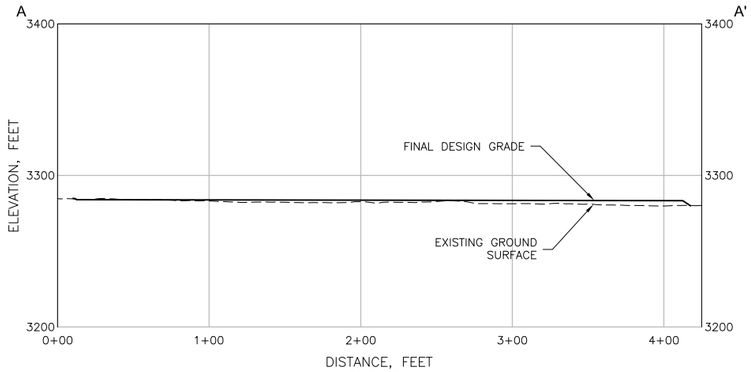


PLAN

SCALE

50 0 50 100 FEET

CONTOUR INTERVAL = 2 FEET



A

SECTION

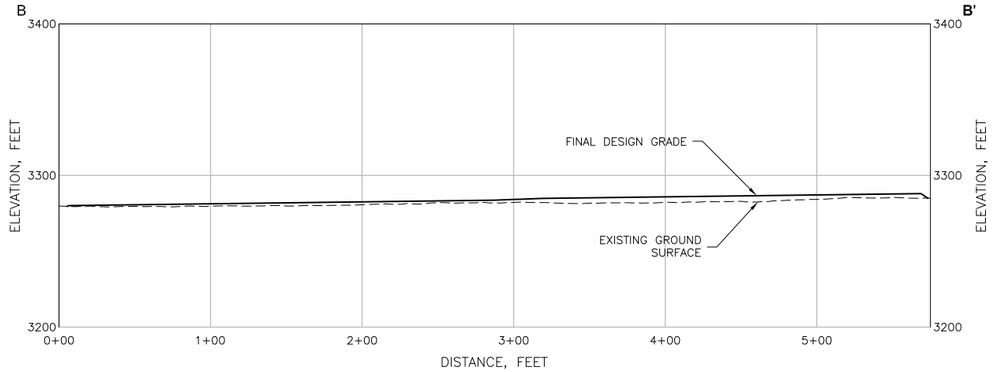
MATERIAL STORAGE AREA "A"

(LOOKING WEST)

SCALE

50 0 50 100 FEET

EARTHWORKS		
CUT, CY	FILL, CY	NET, CY
30	16,974	16,944 (FILL)



B

SECTION

MATERIAL STORAGE AREA "A"

(LOOKING NORTH)

SCALE

50 0 50 100 FEET

NOTES:

1. AREA MAY BE CONSTRUCTED IN PHASES AND ADDITIONAL STAGING AREA IS REQUIRED.
2. NO CUT OF EXISTING TAILINGS PILE SHALL BE PERFORMED.
3. AREA SHALL BE CLEARED AND GRUBBED OF EXISTING VEGETATION AND ROOT SYSTEMS.
4. FOR PLAN LOCATION SEE SHEET 10-6-1.
5. PROVIDE SEDIMENT CONTROL MEASURES AROUND PERIMETER AS NEEDED.

ISSUE / REV				
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	R. WATT	02/28/11
CHECKED BY	D. RODRIGUEZ	----
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: MATERIAL STORAGE AREA A

MWH

SHEET: 10-6-3 REVISION: B

FILE NAME: 1008679D323

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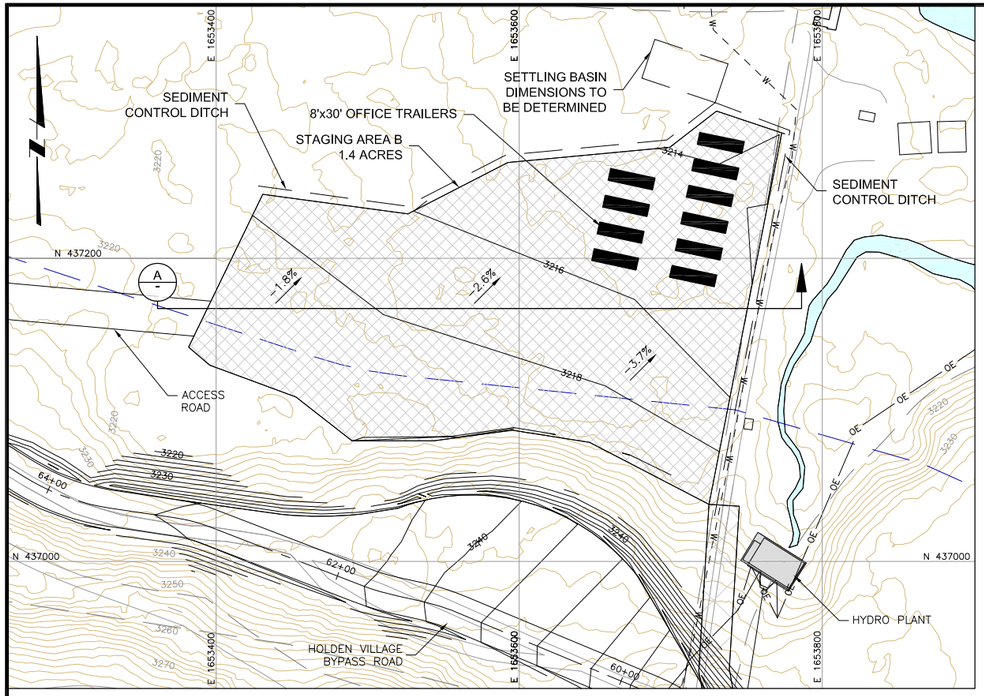


PLAN

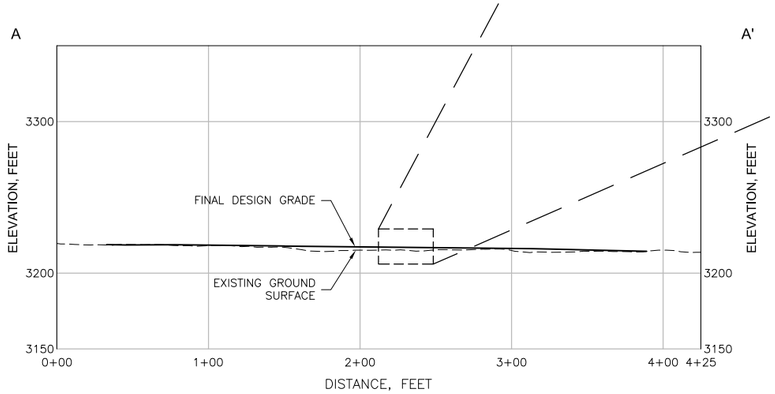
SCALE

50 0 50 100 FEET

CONTOUR INTERVAL = 2 FEET

NOTES:

1. PLAN LOCATION OF STAGING AREAS B AND C ARE SHOWN ON SHEET 10-6-2.
2. FOOTPRINT AREA TO BE CLEARED AND GRUBBED.
3. STRIP TOPSOIL IN STAGING AREAS.
4. A MINIMUM OF 6" OF CONTROLLED FILL SHALL BE PLACED OVER COMPACTED SUBGRADE.
5. GRADING PLAN ASSUMES AT LEAST 6" OF TOPSOIL SHALL BE STRIPPED TO ALLOW PLACEMENT OF CONTROLLED FILL TO MEET GRADES AS SHOWN.
6. PROVIDE SEDIMENT CONTROL MEASURES AROUND PERIMETER AS NEEDED.
7. CONTAMINATED SOIL EXCAVATION MAY BE NEEDED PRIOR TO FILL PLACEMENT.

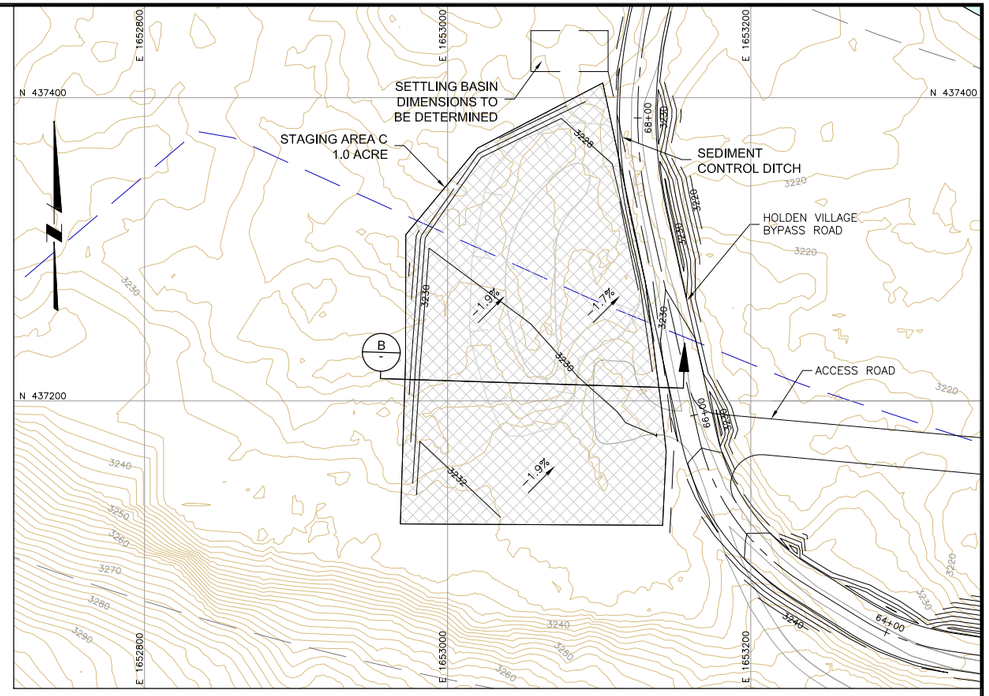


SECTION

A - STAGING AREA B (LOOKING NORTH)

SCALE

50 0 50 100 FEET

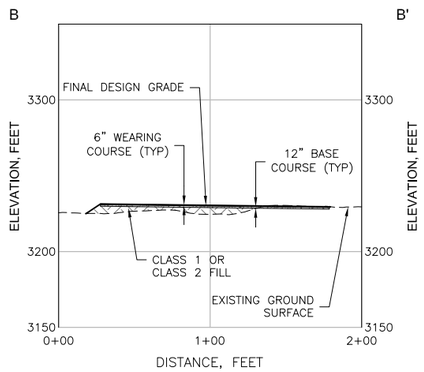


PLAN

SCALE

50 0 50 100 FEET

CONTOUR INTERVAL = 2 FEET



SECTION

B - STAGING AREA C (LOOKING NORTH)

SCALE

50 0 50 100 FEET

ISSUE REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	R. WATT	02/28/11
CHECKED BY	D. RODRIGUEZ	----
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: STAGING AREA B AND STAGING AREA C

MWH

SHEET: 10-6-4

REVISION: B

FILE NAME: 1008679D322

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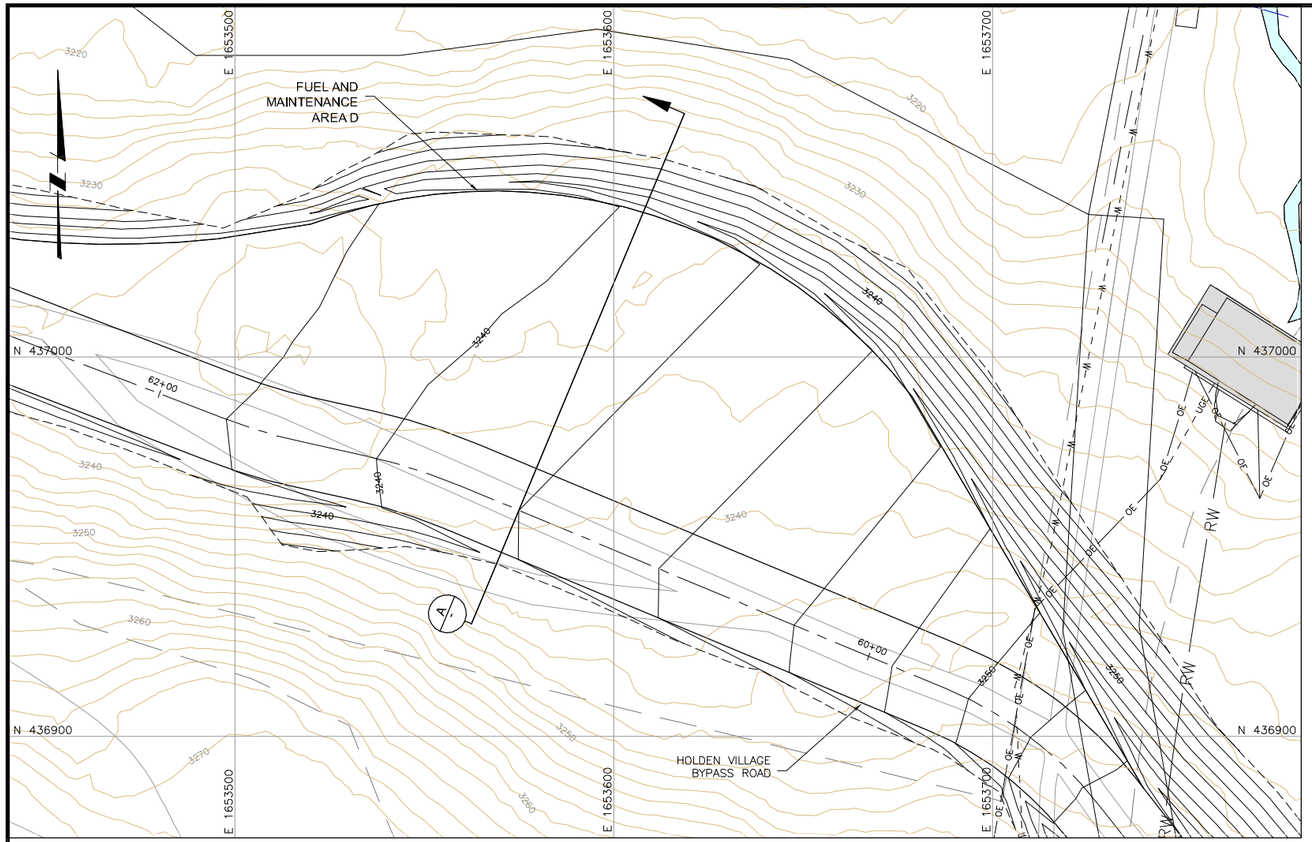
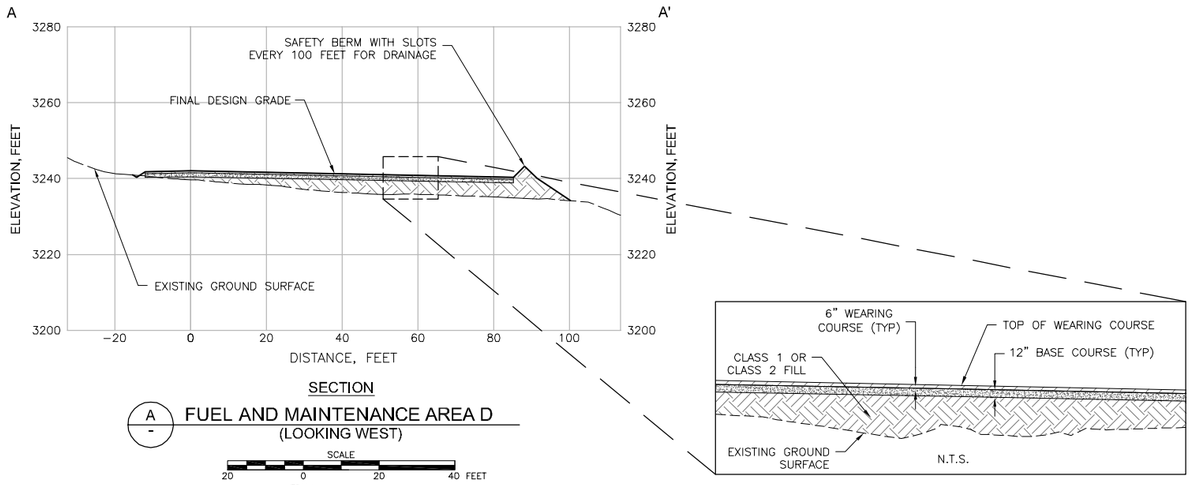


PLAN

SCALE

20 0 20 40 FEET

CONTOUR INTERVAL = 2 FEET



SECTION

A / - FUEL AND MAINTENANCE AREA D

(LOOKING WEST)

SCALE

20 0 20 40 FEET

NOTES:

1. FOR PLAN LOCATION SEE SHEET 10−6−2.
2. CONTRACTOR SHALL PROVIDE SECONDARY CONTAINMENT FOR FUEL STORAGE TANKS, IN ACCORDANCE WITH LOCAL AND STATE REGULATIONS.

ISSUE REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DRAWN BY	R. WATT	02/28/11
CHECKED BY	D. RODRIGUEZ	----
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FUEL AND MAINTENANCE AREA D

MWH

SHEET: 10-6-5 REVISION: B

FILE NAME: 1008679D321

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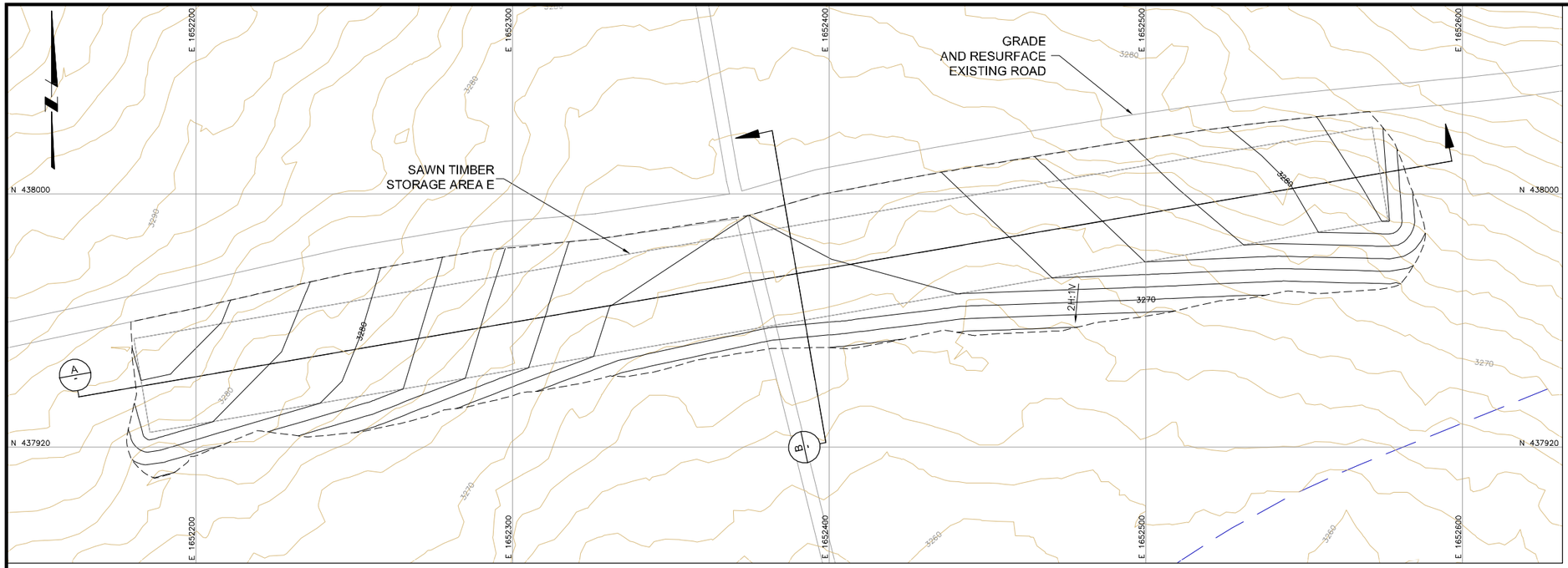
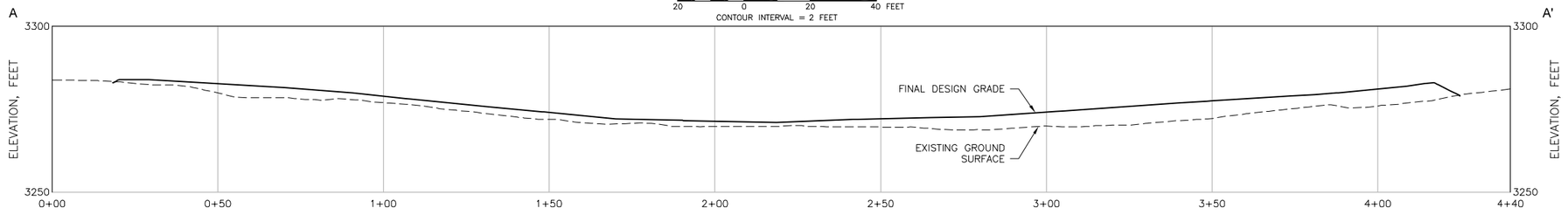


PLAN

SCALE

20 0 20 40 FEET

CONTOUR INTERVAL = 2 FEET



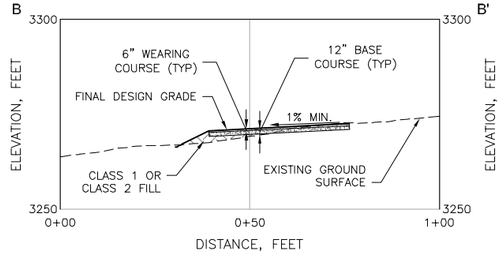
SECTION

A - SAWN TIMBER STORAGE AREA E

(LOOKING NORTH)

SCALE

20 0 20 40 FEET



SECTION

B - SAWN TIMBER STORAGE AREA E

(LOOKING WEST)

SCALE

20 0 20 40 FEET

EARTHWORKS		
CUT, CY[2]	FILL, CY	NET, CY
0	1,594	1,594 (FILL)

NOTES:

1. FOOTPRINT OF LOG DECK SHALL BE CLEARED OF VEGETATION.
2. CUT VEGETATION AS CLOSE AS PRACTICAL TO EXISTING GROUND SURFACE.
3. NO GRUBBING OR EXCAVATION SHALL BE ALLOWED.
4. NO VEHICLE TRAFFIC SHALL BE ALLOWED OUTSIDE OF THE EXISTING ACCESS ROAD UNTIL A MINIMUM OF 2 FT OF FILL IS PLACED.
5. LIMITED TOPOGRAPHIC DETAIL WAS AVAILABLE FOR LAYOUT, GRADE AND FILL VOLUMES ARE APPROXIMATE.
6. LOG PLACEMENT SHALL START AT THE CENTRAL LOW AREA AND CONTINUE TO THE EAST AND WEST OF THE STOCKPILE AREA.
7. PROVIDE SEDIMENT CONTROL AT TOE OF FILL SLOPE.
8. FOR PLAN LOCATION SEE SHEET 10-6-2.

ISSUE / REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	R. WATT	02/28/11
CHECKED BY	D. RODRIGUEZ	----
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: SAWN TIMBER STORAGE AREA E

MWH

SHEET: 10-6-6 REVISION: B

FILE NAME: 1008679D320

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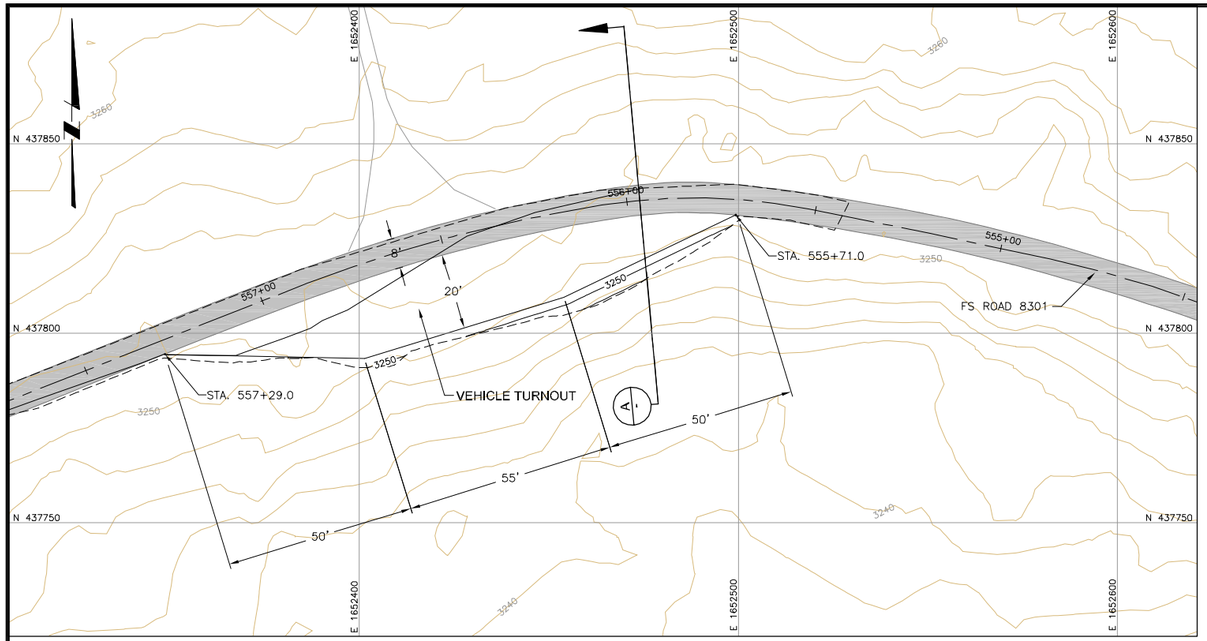

PLAN

SCALE

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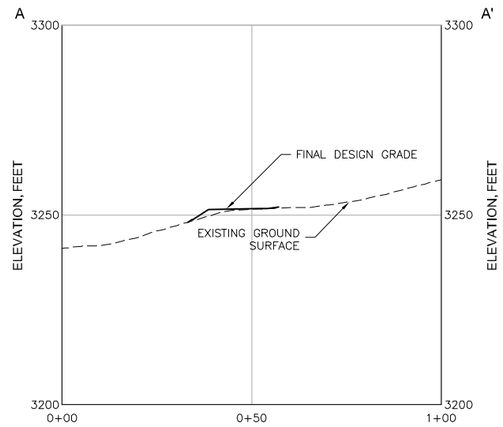
CONTOUR INTERVAL = 2 FEET



SECTION

A – FS ROAD 8301 TURNOUT

(LOOKING WEST)

SCALE

20 0 20 40 FEET

NOTE:

1. FOR PLAN LOCATION SEE SHEET 10-6-2.

EARTHWORKS		
CUT, CY	FILL, CY	NET, CY
11	19	8 (FILL)

ISSUE / REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	----
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: CONSTRUCTION SUPPORT FACILITIES
FS ROAD 8301 TURNOUT STA. 566+50

MWH

SHEET: 10-6-7

REVISION: B

FILE NAME: 1008679D318

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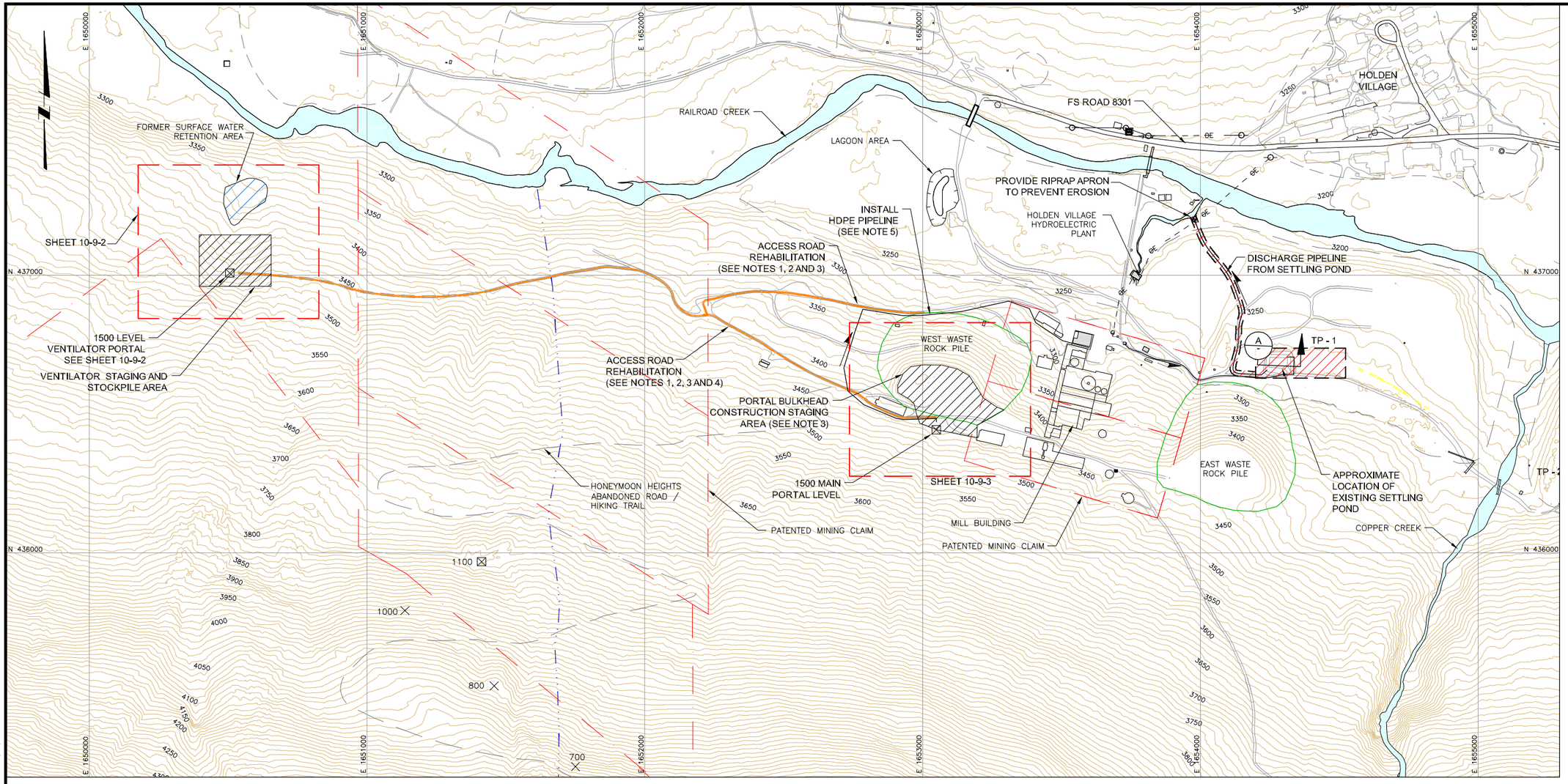

PLAN

SCALE
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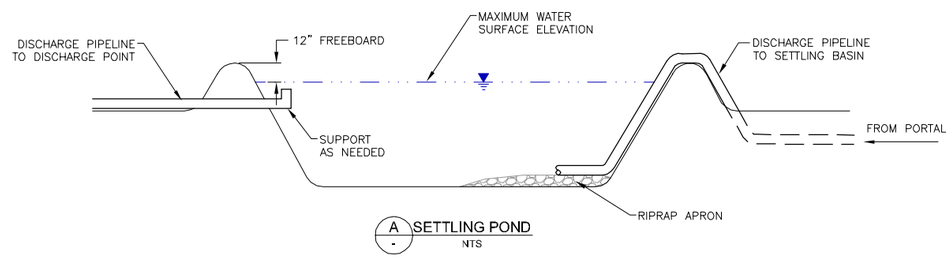
CONTOUR INTERVAL = 10 FEET



A - SETTLING POND
NTS

NOTES:

1. ACCESS ROAD REHABILITATION SHALL CONSIST OF CLEARING AND GRUBBING A CORRIDOR WIDE ENOUGH TO ACCOMMODATE A 12 FOOT WIDE TRAFFIC LANE PLUS ANY CUT/FILL AREAS REQUIRED, STRIPPING OF TOPSOIL AND PLACEMENT OF FILL AND ROAD BASE AS NEEDED.
2. INSTALL CULVERTS AS NEEDED TO PROVIDE DRAINAGE. DRAINAGE PATHS SHALL BE DETERMINED IN THE FIELD.
3. PROVIDE EROSION CONTROL MEASURES AS NEEDED.
4. CLEAN EXISTING DITCHES AND CULVERTS AS NEEDED.
5. EXACT ALIGNMENT OF HDPE PIPELINE SHALL BE DETERMINED IN THE FIELD PRIOR TO INSTALLATION. BURY PIPE WHERE NECESSARY SO AS NOT TO IMPEDE TRAFFIC AND TO ALLOW FOR GRAVITY DRAINAGE.
6. SOIL AND TAILINGS EXCAVATED FOR PIPING PLACEMENT SHALL BE PLACED BACK IN THE EXCAVATION AND COMPACTED. ANY EXCESS MATERIAL SHALL BE STOCKPILED ON TAILINGS PILE 1 IMMEDIATELY ADJACENT TO THE SEDIMENTATION BASIN.
7. SUPPORT THE BASIN OUTLET PIPE AS NECESSARY. RECOMPACT THE SOIL BERM AROUND THE OUTLET PIPE TO PREVENT SEEPAGE. ALSO, IN CASE THE SOIL BERM SEEPS, IT MAY BE NECESSARY TO ELIMINATE THE ELBOW AND RISER SHOWN ON THE OUTLET PIPE. USE SLIP FITTINGS TO ALLOW EASY REMOVAL.
8. PLACE RIPRAP IN THE BASIN BELOW THE INLET PIPE TO PREVENT EROSION OF THE BASIN BOTTOM.

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA–FSA–APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BULKHEAD CONSTRUCTION SUPPORT WORK ELEMENTS

MWH

SHEET: 10-9-1
REVISION: B
FILE NAME: 1008679D384

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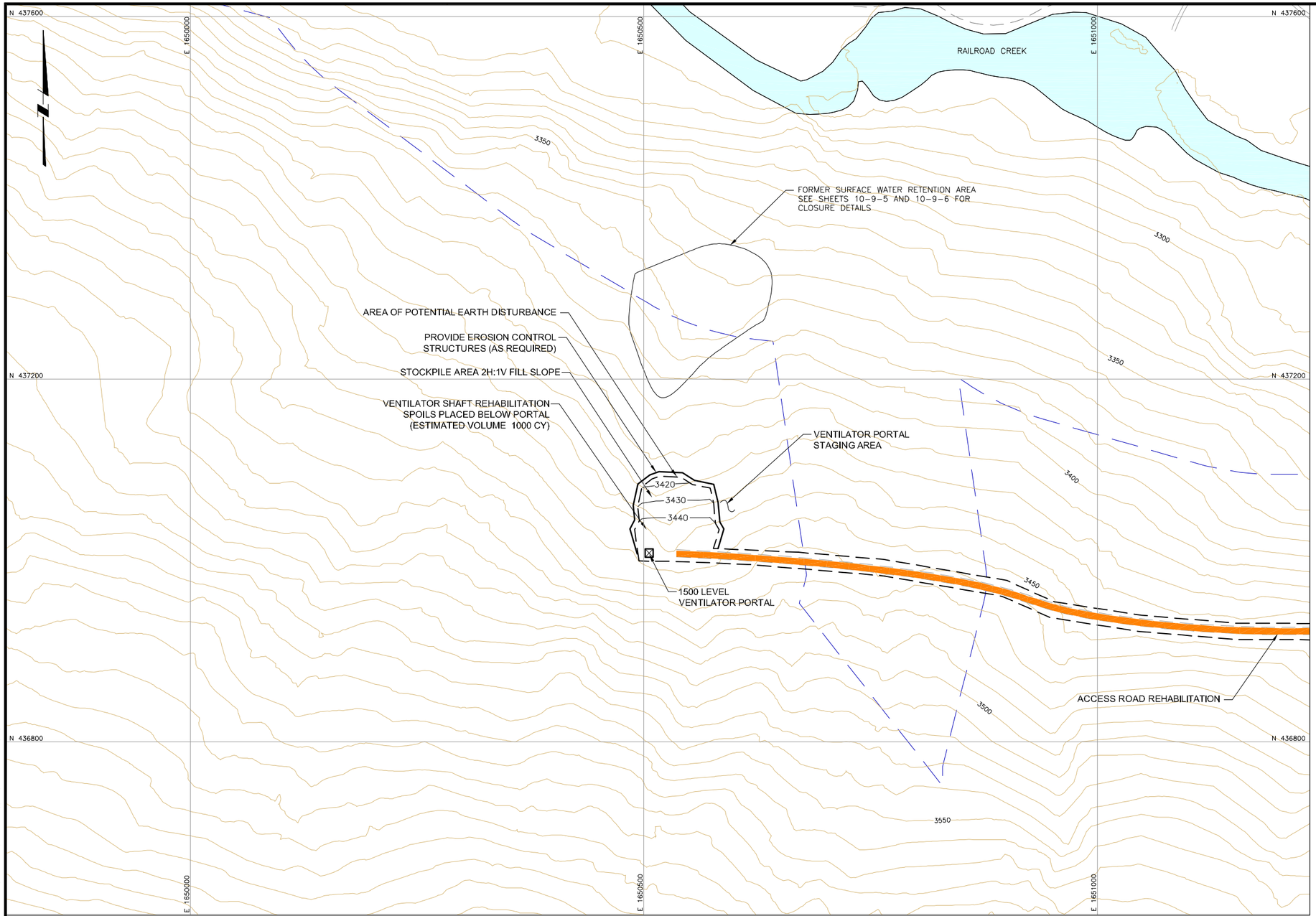

PLAN

SCALE

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CONTOUR INTERVAL = 10 FEET

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ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: BULKHEAD CONSTRUCTION SUPPORT WORK ELEMENTS DETAIL

MWH

SHEET: 10-9-2

REVISION: B

FILE NAME: 1008679D385

PLAN

SCALE
60 0 60 120 FEET
CONTOUR INTERVAL = 10 FEET

NOTE:

1. AVOID STOCKPILED TRASH AREAS OR COORDINATE WITH HOLDEN FOR RELOCATION.

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BULKHEAD CONSTRUCTION SUPPORT WORK ELEMENTS DETAIL

MWH

SHEET: 10-9-3
REVISION: B
FILE NAME: 1008679D386

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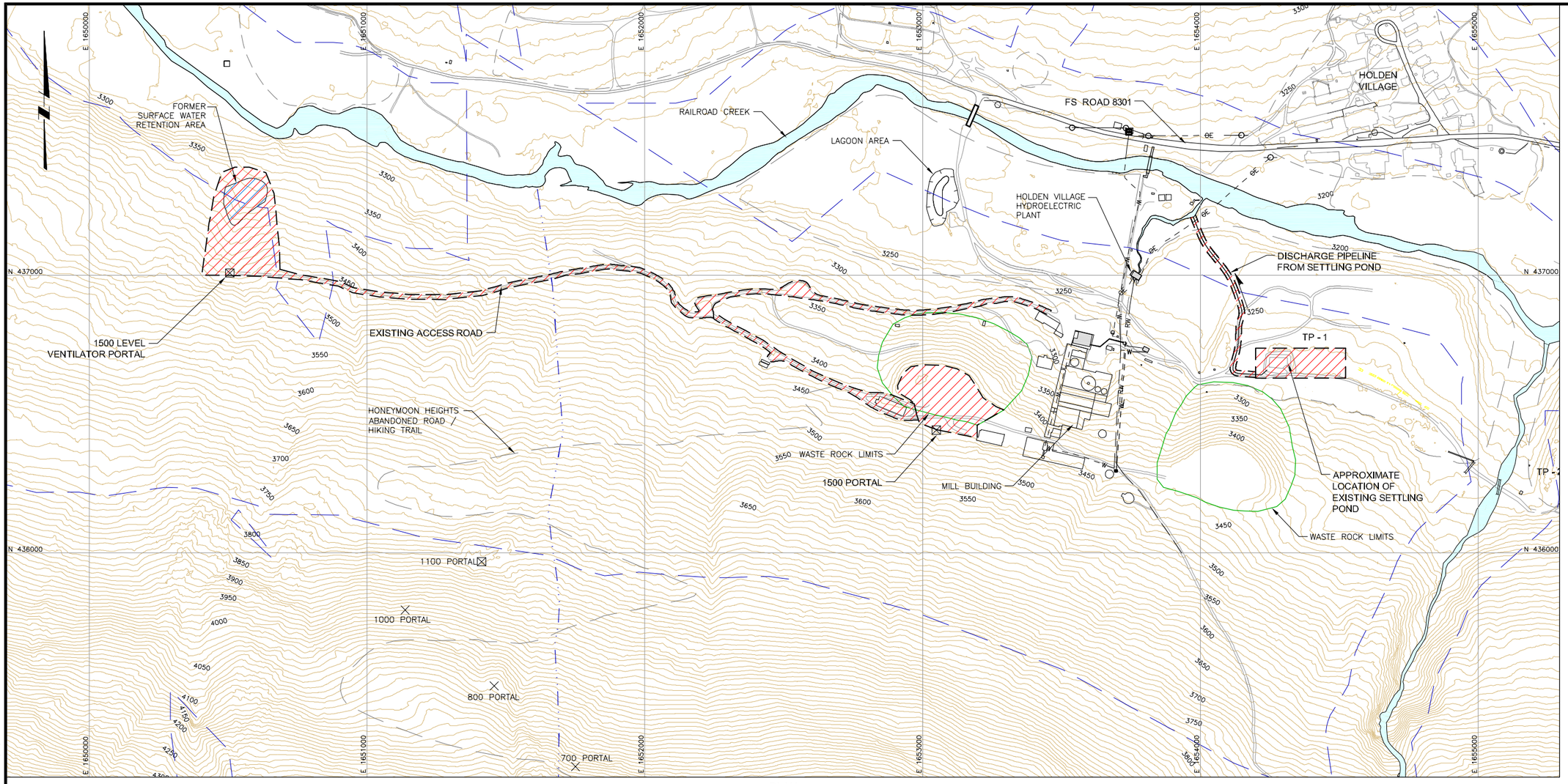

PLAN

SCALE
200 0 200 400 FEET
CONTOUR INTERVAL = 10 FEET

LEGEND:

AREAS OF POTENTIAL EARTH DISTURBANCE

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BULKHEAD CONSTRUCTION SUPPORT AREAS OF DISTURBANCE

MWH

SHEET: 10-9-4
REVISION: B
FILE NAME: 1008679D387

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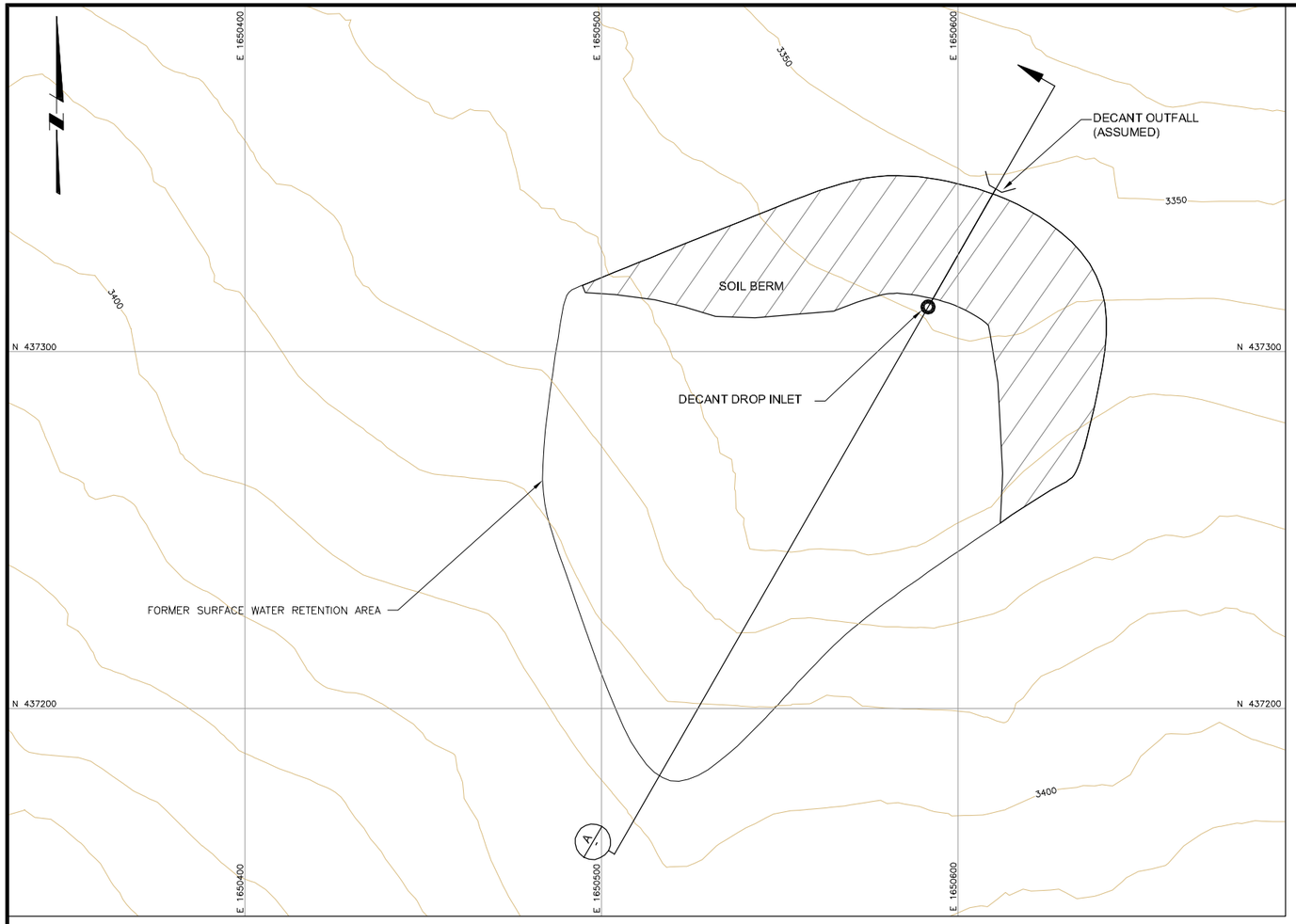

PLAN

SCALE
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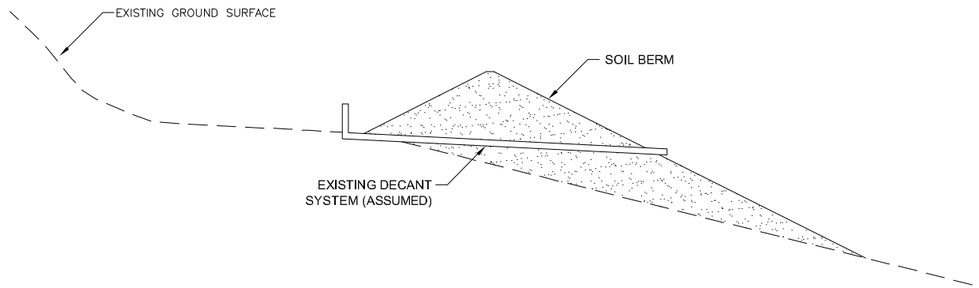
CONTOUR INTERVAL = 10 FEET



A - DECANT SYSTEM
N.T.S.

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
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PROJECT MANAGER	R. SCHLICHER	03/31/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BULKHEAD CONSTRUCTION SUPPORT SURFACE WATER RETENTION AREA

MWH

SHEET: 10-9-5
REVISION: B
FILE NAME: 1008679D389

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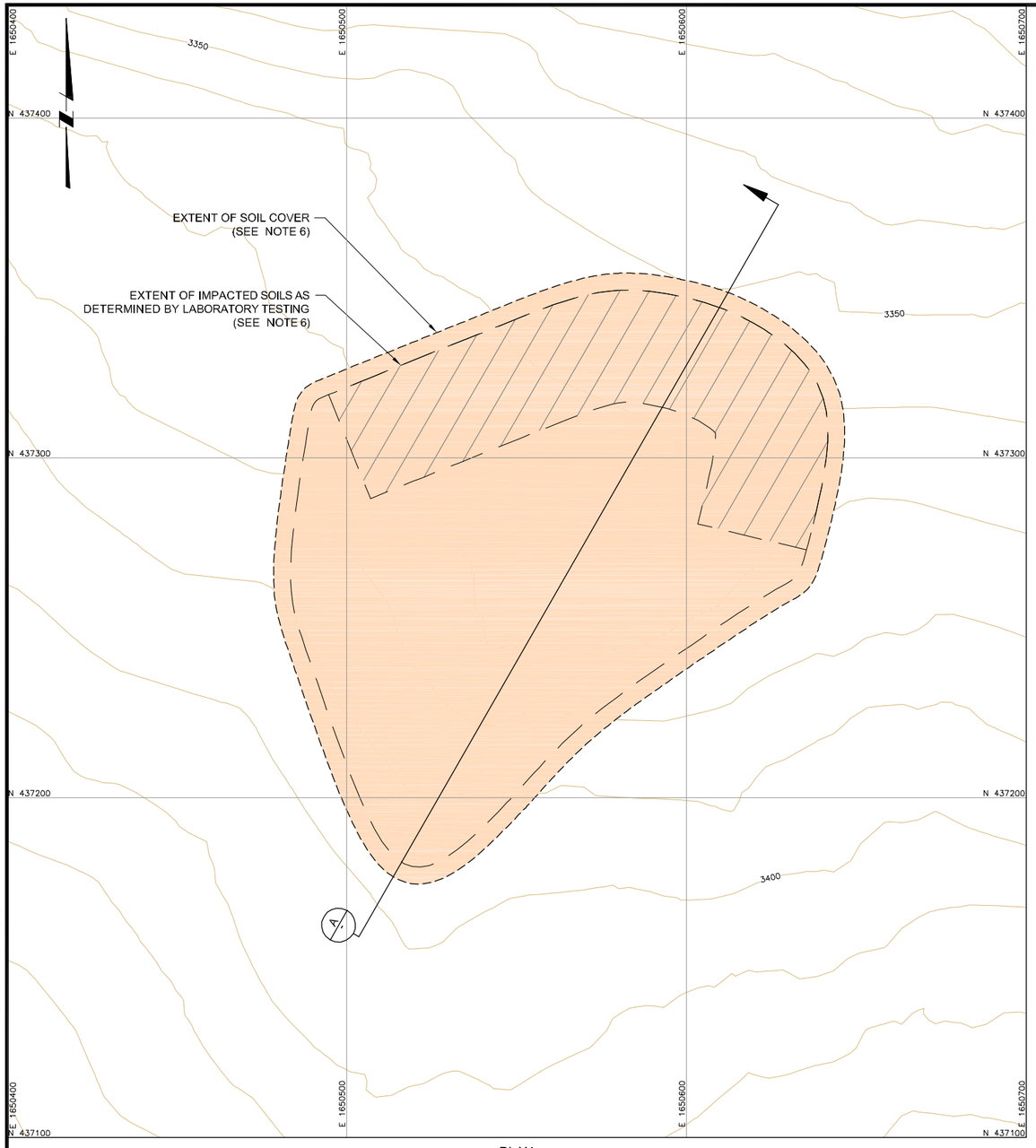
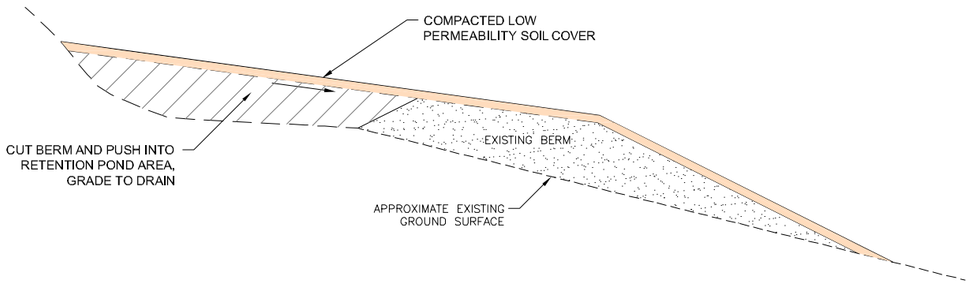


PLAN

SCALE
20 0 20 40 FEET
CONTOUR INTERVAL = 10 FEET



A / - COMPACTED LOW PERMEABILITY SOIL COVER
N.T.S.

NOTES:

1. PERFORM CLEARING AND GRUBBING TO THE EXTENT OF SOIL COVER.
2. EXCAVATE DECANT STRUCTURE AND PIPING. PIPING TO BE REMOVED TO THE EXTENT PRACTICAL. IF PIPING LEFT IN PLACE, THE REMAINING PIPE SHALL BE PLUGGED TO PREVENT WATER FROM ENTERING PIPE. BACKFILL WITH BERM CUT MATERIAL AND/OR SPOILS FROM VENTILATOR PORTAL.
3. SOIL COVER THICKNESS AND GEOTECHNICAL PROPERTIES TO BE DETERMINED.
4. IMPACTED TOPSOIL CAN BE LEFT IN PLACE IN AREA TO BE COVERED.
5. CLEAN TOPSOIL SHALL BE STOCKPILED ADJACENT TO WORK AREA AND WILL BE UTILIZED AS PART OF THE COVER SYSTEM.
6. EXTENT OF IMPACTED SOILS AND SOIL COVER ARE FOR ILLUSTRATIVE PURPOSES ONLY. THEY DO NOT REPRESENT ACTUAL LIMITS FOR CONSTRUCTION.
7. FINAL REMEDY SHALL BE REVIEWED AND APPROVED BY THE AGENCIES.

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
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PROJECT MANAGER	R. SCHLICHER	03/31/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BULKHEAD CONSTRUCTION SUPPORT SURFACE WATER RETENTION AREA

MWH

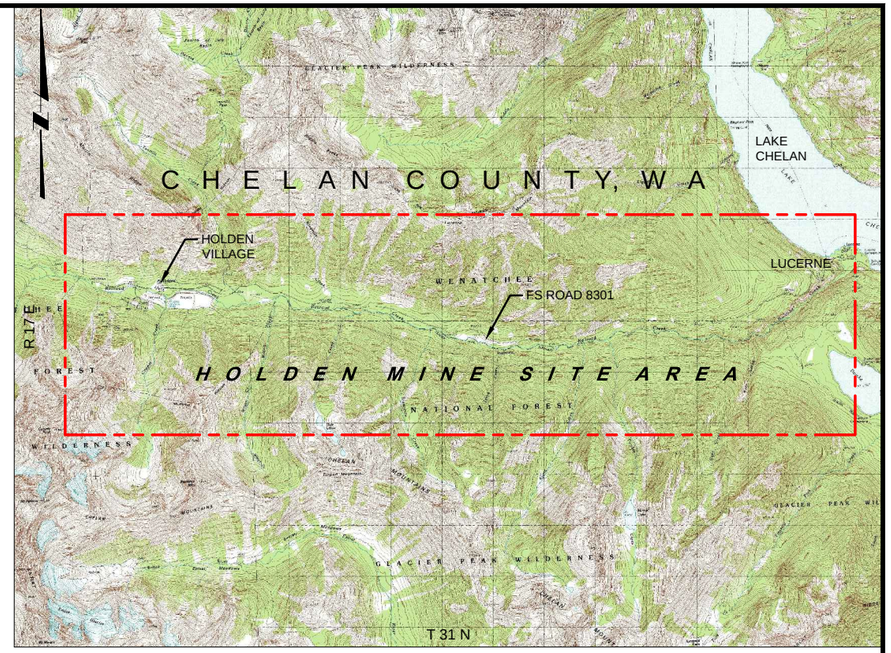
SHEET: 10-9-6
REVISION: B
FILE NAME: 1008679D390

M:\Clients-2-2\Rio Tinto\1008679 - Holden Mine\013-Sheet Set\Infrastructure Improvements\Bulkhead Support\1008679D390 4/15/2011 2:13:20 PM

ATTACHMENT A

2011 EARLY WORKS IMPLEMENTATION DESIGN DRAWINGS

LOCATION MAP
NOT TO SCALE



VICINITY MAP
NOT TO SCALE

REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

prepared for

Intalco

CHELAN COUNTY, WASHINGTON

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

DESIGNED BY	D. RODRIGUEZ	04/04/11
DRAWN BY	F. ANDRADE	04/04/11
CHECKED BY	D. RODRIGUEZ	04/04/11
APPROVED BY	P. CROUSE	04/04/11
PROJECT MANAGER	R. SCHLICHER	04/04/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: COVER SHEET
SHEET: 1-1
REVISION: B
FILE NAME: 1008679D233

MWH

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REMEDIAL DESIGN FOR HOLDEN MINE				DRAWING ISSUE DATE						
REMEDIAL COMPONENT	SHEET NUMBER	DESCRIPTION	FILENAME	04-08-11	04-15-11	'	'	'	'	'
SECTION 1 GENERAL	1–1	COVER SHEET – 30% REMEDIAL DESIGN FOR HOLDEN	1008679D050	–	–					
	1–1	COVER SHEET – INFRASTRUCTURE	1008679D233	●	●					
	1–1	COVER SHEET – POTABLE WATER SYSTEM RELOCATION	1008679D225	–	–					
	1–2	INDEX OF DRAWINGS (1 OF 3)	1008679D002	●	●					
	1–3	INDEX OF DRAWINGS (2 OF 3)	1008679D044	●	●					
	1–4	INDEX OF DRAWINGS (3 OF 3)	1008679D334	●	●					
	1–5	MASTER LEGEND	1008679D037	●	●					
	1–6	GENERAL NOTES AND ACRONYMS	1008679D051	●	●					
	1–7	SITE LOCATION MAP	1008679D337	●	●					
	1–8	LOCAL GEOLOGIC MAP	1008679D374	●	●					
	1–9	EXISTING CONDITIONS	1008679D375	●	●					
	1–10	HOLDEN VILLAGE EXISTING CONDITIONS	1008679D269	●	●					
	1–11	EXISTING UTILITIES	1008679D364	●	●					
	1–12	REMEDIAL COMPONENTS	1008679DXXX	–	–					
	1–13	RECLAIMED SITE PLAN	1008679DXXX	–	–					
	1–14	RECLAIMED SITE PLAN	1008679DXXX	–	–					
	1–15	INVESTIGATION LOCATIONS (SHEET 1 OF 8)	1008679D366	●	●					
	1–16	INVESTIGATION LOCATIONS (SHEET 2 OF 8)	1008679D367	●	●					
	1–17	INVESTIGATION LOCATIONS (SHEET 3 OF 8)	1008679D368	●	●					
	1–18	INVESTIGATION LOCATIONS (SHEET 4 OF 8)	1008679D369	●	●					
	1–19	INVESTIGATION LOCATIONS (SHEET 5 OF 8)	1008679D370	●	●					
	1–20	INVESTIGATION LOCATIONS (SHEET 6 OF 8)	1008679D371	●	●					
	1–21	INVESTIGATION LOCATIONS (SHEET 7 OF 8)	1008679D372	●	●					
	1–22	INVESTIGATION LOCATIONS (SHEET 8 OF 8)	1008679D373	●	●					
	1–23	SITE BOUNDARIES MAP	1008679D376	●	●					
SECTION 2 SITE DEVEL-OPMENT	2–1	YEAR 1 SITE DEVELOPMENT	1008679D388	●	●					
	2–2	XX	1008679DXXX	–	–					
	2–3	XX	1008679DXXX	–	–					
SECTION 3 DEMOLITION	3–1	MILL DEMOLITION AND REGRADING PLAN	1008679DXXX	–	–					
	3–2	SRA AND LAGOON EXCAVATION AND REGRADING PLAN	1008679DXXX	–	–					
	3–3	DECANT DEMOLITION PLAN	1008679DXXX	–	–					
	3–4	CROSS SECTIONS	1008679DXXX	–	–					
	3–5	CROSS SECTIONS	1008679DXXX	–	–					
	3–6	HOLDEN VILLAGE WATER LINE RELOCATION PLAN	1008679DXXX	–	–					
	3–7	MILL DEMOLITION AND REGRADING PLAN	1008679DXXX	–	–					
	3–8	MILL DEMOLITION AND REGRADING PLAN	1008679DXXX	–	–					
	3–9	DETAILS	1008679DXXX	–	–					
SECTION 4 SURFACE WATER AND SEDIMENT CONTROL	4–1	DRAINAGE BASIN PLAN	1008679DXXX	–	–					
	4–2	SURFACE WATER AND SEDIMENT CONTROL LAYOUT	1008679DXXX	–	–					
	4–3	EAST SURFACE WATER DIVERSION CHANNEL PLAN AND PROFILE	1008679DXXX	–	–					
	4–4	EAST SURFACE WATER DIVERSION CHANNEL PLAN AND PROFILE	1008679DXXX	–	–					
	4–5	EAST SEDIMENT CONTROL STRUCTURE	1008679DXXX	–	–					
	4–6	WEST SURFACE WATER DIVERSION CHANNEL PLAN AND PROFILE	1008679DXXX	–	–					
	4–7	WEST SURFACE WATER DIVERSION CHANNEL PLAN AND PROFILE	1008679DXXX	–	–					
	4–8	WEST SEDIMENT CONTROL STRUCTURE	1008679DXXX	–	–					

REMEDIAL DESIGN FOR HOLDEN MINE				DRAWING ISSUE DATE						
REMEDIAL COMPONENT	SHEET NUMBER	DESCRIPTION	FILENAME	04-08-11	04-15-11	'	'	'	'	'
SECTION 4 SURFACE WATER AND SEDIMENT CONTROL	4–9	BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 1 OF 8)	1008679D297	●	●					
	4–10	BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 2 OF 8)	1008679D298	●	●					
	4–11	BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 3 OF 8)	1008679D299	●	●					
	4–12	BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 4 OF 8)	1008679D300	●	●					
	4–13	BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 5 OF 8)	1008679D301	●	●					
	4–14	BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 6 OF 8)	1008679D325	●	●					
	4–15	BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 7 OF 8)	1008679D326	●	●					
	4–16	BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 8 OF 8)	1008679D327	●	●					
SECTION 5 GRADING	5–1	GENERAL REGRADING PLAN	1008679DXXX	–	–					
	5–2	EAST REGRADING PLAN	1008679DXXX	–	–					
	5–3	WEST REGRADING PLAN	1008679DXXX	–	–					
	5–4	GENERAL REGRADING PLAN	1008679DXXX	–	–					
	5–5	CROSS SECTIONS	1008679DXXX	–	–					
	5–6	DETAILS	1008679DXXX	–	–					
	5–7	DETAILS	1008679DXXX	–	–					
SECTION 6 STREAM RESTORATION	6–1	STREAM REALIGNMENT PLAN	1008679DXXX	–	–					
	6–2	RAILROAD CREEK PLAN AND PROFILE	1008679DXXX	–	–					
	6–3	RAILROAD CREEK PLAN AND PROFILE	1008679DXXX	–	–					
	6–4	RAILROAD CREEK PLAN AND PROFILE	1008679DXXX	–	–					
	6–5	RAILROAD CREEK PLAN AND PROFILE	1008679DXXX	–	–					
	6–6	RAILROAD CREEK PLAN AND PROFILE	1008679DXXX	–	–					
	6–7	RAILROAD CREEK CROSS SECTIONS	1008679DXXX	–	–					
	6–8	RAILROAD CREEK CROSS SECTIONS	1008679DXXX	–	–					
	6–9	RAILROAD CREEK CROSS SECTIONS	1008679DXXX	–	–					
	6–10	RAILROAD CREEK CROSS SECTIONS	1008679DXXX	–	–					
	6–11	RAILROAD CREEK CROSS SECTIONS	1008679DXXX	–	–					
	6–12	COPPER CREEK PLAN AND PROFILE	1008679DXXX	–	–					
	6–13	COPPER CREEK PLAN AND PROFILE	1008679DXXX	–	–					
	6–14	COPPER CREEK CROSS SECTIONS	1008679DXXX	–	–					
	6–15	COPPER CREEK CROSS SECTIONS	1008679DXXX	–	–					
	6–16	DETAILS	1008679DXXX	–	–					
	6–17	DETAILS	1008679DXXX	–	–					
	6–18	DETAILS	1008679DXXX	–	–					
SECTION 7 BARRIER WALL	7–1	BARRIER WALL ALIGNMENT PLAN	1008679DXXX	–	–					
	7–2	PLAN AND PROFILE	1008679DXXX	–	–					
	7–3	PLAN AND PROFILE	1008679DXXX	–	–					
	7–4	PLAN AND PROFILE	1008679DXXX	–	–					
	7–5	PLAN AND PROFILE	1008679DXXX	–	–					
	7–6	PLAN AND PROFILE	1008679DXXX	–	–					
	7–7	CROSS SECTION	1008679DXXX	–	–					
	7–8	CROSS SECTION	1008679DXXX	–	–					
	7–9	DETAILS	1008679DXXX	–	–					
	7–10	DETAILS	1008679DXXX	–	–					

LEGEND:

● SHEETS INCLUDED IN ISSUANCE

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ISSUE REV	DESCRIPTION	TECH	ENG	DATE
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PROJECT MANAGER	R. SCHLICHER	
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CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE GENERAL

TITLE: INDEX OF DRAWINGS (1 OF 3)

MWH

SHEET: 1-2 | REVISION: B

FILE NAME: 1008679D002

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REMEDIAL DESIGN FOR HOLDEN MINE				DRAWING ISSUE DATE						
REMEDIAL COMPONENT	SHEET NUMBER	DRAWING TITLE	FILENAME	04-08-11	04-15-11	'	'	'	'	'
SECTION 8 SHALLOW GROUNDWATER COLLECTION SYSTEM	8-1	GROUNDWATER ELEVATION CONTOUR MAP	1008679DXXX	–	–					
	8-2	GROUNDWATER COLLECTION SYSTEM PLAN	1008679DXXX	–	–					
	8-3	EAST GROUNDWATER COLLECTION SYSTEM PLAN AND PROFILE	1008679DXXX	–	–					
	8-4	EAST GROUNDWATER COLLECTION SYSTEM PLAN AND PROFILE	1008679DXXX	–	–					
	8-5	WEST GROUNDWATER COLLECTION SYSTEM PLAN AND PROFILE	1008679DXXX	–	–					
	8-6	WEST GROUNDWATER COLLECTION SYSTEM PLAN AND PROFILE	1008679DXXX	–	–					
	8-7	CROSS SECTION	1008679DXXX	–	–					
	8-8	CROSS SECTION	1008679DXXX	–	–					
	8-9	DETAILS	1008679DXXX	–	–					
	8-10	DETAILS	1008679DXXX	–	–					
SECTION 9 QUARRY	9-1	POTENTIAL BORROW SOURCE LOCATION MAP	1008679D383	●	●					
	9-2	QUARRY MINE PLAN	1008679DXXX	–	–					
	9-3	COVER MATERIAL MINE PLAN	1008679DXXX	–	–					
	9-4	CROSS SECTIONS	1008679DXXX	–	–					
	9-5	CROSS SECTIONS	1008679DXXX	–	–					
	9-6	DETAILS	1008679DXXX	–	–					
	9-7	DETAILS	1008679DXXX	–	–					
SECTION 10 INFRASTRUCTURE / SHORELINE FACILITIES	10-2-1	XXX	1008679DXXX	–	–					
	10-2-2	XXX	1008679DXXX	–	–					
	10-2-3	XXX	1008679DXXX	–	–					
	10-2-4	XXX	1008679DXXX	–	–					
	10-2-5	XXX	1008679DXXX	–	–					
	10-2-6	XXX	1008679DXXX	–	–					
	10-2-7	XXX	1008679DXXX	–	–					
	10-2-8	XXX	1008679DXXX	–	–					
	10-2-9	XXX	1008679DXXX	–	–					
	10-2-10	XXX	1008679DXXX	–	–					
SECTION 10 INFRASTRUCTURE / FS ROAD 8301	10-3-1	FS ROAD 8301 KEY MAP	1008679D237	●	●					
	10-3-2	FS ROAD 8301 (STA 0+00 TO STA 58+00) PLAN AND PROFILE	1008679D246	●	●					
	10-3-3	FS ROAD 8301 (STA 58+00 TO STA 114+00) PLAN AND PROFILE	1008679D247	●	●					
	10-3-4	FS ROAD 8301 (STA 114+00 TO STA 172+50) PLAN AND PROFILE	1008679D248	●	●					
	10-3-5	FS ROAD 8301 (STA 172+50 TO STA 231+00) PLAN AND PROFILE	1008679D249	●	●					
	10-3-6	FS ROAD 8301 (STA 231+00 TO STA 289+50) PLAN AND PROFILE	1008679D250	●	●					
	10-3-7	FS ROAD 8301 (STA 289+50 TO STA 348+00) PLAN AND PROFILE	1008679D251	●	●					
	10-3-8	FS ROAD 8301 (STA 348+00 TO STA 406+50) PLAN AND PROFILE	1008679D252	●	●					
	10-3-9	FS ROAD 8301 (STA 406+50 TO STA 465+00) PLAN AND PROFILE	1008679D253	●	●					
	10-3-10	FS ROAD 8301 (STA 465+00 TO STA 523+50) PLAN AND PROFILE	1008679D254	●	●					
	10-3-11	FS ROAD 8301 (STA 523+50 TO STA 548+00) PLAN AND PROFILE	1008679D255	●	●					
	10-3-12	FS ROAD 8301 TURNOUTS 1 AND 2 GRADING PLAN	1008679D270	●	●					
	10-3-13	FS ROAD 8301 TURNOUTS 3 AND 4 GRADING PLAN	1008679D271	●	●					
	10-3-14	FS ROAD 8301 TURNOUTS 5 AND 6 GRADING PLAN	1008679D272	●	●					
	10-3-15	FS ROAD 8301 TURNOUTS 7 AND 8 GRADING PLAN	1008679D273	●	●					
	10-3-16	FS ROAD 8301 TURNOUTS 9 AND 10 GRADING PLAN	1008679D274	●	●					
	10-3-17	FS ROAD 8301 TURNOUTS 11 AND 12 GRADING PLAN	1008679D275	●	●					
	10-3-18	FS ROAD 8301 TURNOUTS 13 AND 14 GRADING PLAN	1008679D276	●	●					
	10-3-19	FS ROAD 8301 TURNOUTS 15 AND 16 GRADING PLAN	1008679D277	●	●					
	10-3-20	FS ROAD 8301 TURNOUTS 17 AND 18 GRADING PLAN	1008679D278	●	●					
	10-3-21	FS ROAD 8301 TURNOUTS 19 AND 20 GRADING PLAN	1008679D279	●	●					
	10-3-22	FS ROAD 8301 TURNOUTS 21 AND 22 GRADING PLAN	1008679D280	●	●					
	10-3-23	FS ROAD 8301 TURNOUTS 23 AND 24 GRADING PLAN	1008679D281	●	●					
	10-3-24	FS ROAD 8301 TURNOUTS 25 AND 26 GRADING PLAN	1008679D282	●	●					
	10-3-25	FS ROAD 8301 TURNOUTS 27 AND 28 GRADING PLAN	1008679D283	●	●					
	10-3-26	FS ROAD 8301 – DETAIL SHEET	1008679D236	●	●					
	10-3-27	EXISTING CULVERTS ALONG FS ROAD 8301 (SHEET 1 OF 2)	1008679D313	●	●					
	10-3-28	EXISTING CULVERTS ALONG FS ROAD 8301 (SHEET 2 OF 2)	1008679D314	●	●					
	10-3-29	EXISTING CULVERT PROFILES C1 THROUGH C20	1008679D330	●	●					
	10-3-30	EXISTING CULVERT PROFILES C21 THROUGH C40	1008679D331	●	●					
	10-3-31	EXISTING CULVERT PROFILES C41 THROUGH C55	1008679D332	●	●					
SECTION 10 INFRASTRUCTURE / HOLDEN VILLAGE BYPASS ROAD	10-4-1	BYPASS ROAD KEY MAP	1008679D238	●	●					
	10-4-2	BYPASS ROAD STA 0+00 TO STA 13+50 PLAN AND PROFILE	1008679D264	●	●					
	10-4-3	BYPASS ROAD STA 13+50 TO STA 28+00 PLAN AND PROFILE	1008679D265	●	●					
	10-4-4	BYPASS ROAD STA 28+00 TO STA 42+50 PLAN AND PROFILE	1008679D266	●	●					
	10-4-5	BYPASS ROAD STA 42+50 TO STA 57+00 PLAN AND PROFILE	1008679D267	●	●					
	10-4-6	BYPASS ROAD STA 57+00 TO STA 69+69 PLAN AND PROFILE	1008679D268	●	●					
	10-4-7	BYPASS ROAD DETAILS	1008679D311	●	●					
	10-4-8	BYPASS ROAD LINE AND CURVE TABLES	1008679D312	●	●					
	10-4-9	BYPASS ROAD CROSS SECTIONS	1008679D292	●	●					
	10-4-10	BYPASS ROAD CROSS SECTIONS	1008679D293	●	●					
	10-4-11	BYPASS ROAD CROSS SECTIONS	1008679D381	●	●					
	10-4-12	BYPASS ROAD CROSS SECTIONS	1008679D303	●	●					
	10-4-13	BYPASS ROAD CROSS SECTIONS	1008679D377	●	●					
	10-4-14	BYPASS ROAD CROSS SECTIONS	1008679D378	●	●					
	10-4-15	BYPASS ROAD CROSS SECTIONS	1008679D379	●	●					
	10-4-16	BYPASS ROAD CROSS SECTIONS	1008679D380	●	●					
	10-4-17	BYPASS ROAD CROSS SECTIONS	1008679D382	●	●					
	10-4-18	BRIDGE PLAN AND SECTION	1008679D260	●	●					
	10-4-19	BRIDGE ABUTMENT DETAILS	1008679D336	●	●					
	10-4-20	COPPER CREEK CULVERT PLAN	1008679D262	●	●					
	10-4-21	RAILROAD CREEK CULVERT PLAN	1008679D263	●	●					
	10-4-22	TYPICAL CULVERT INSTALLATION	1008679D335	●	●					
SECTION 10 INFRASTRUCTURE / HOLDEN VILLAGE FACILITIES	10-5-1	EXISTING POTABLE WATER SYSTEM	1008679D224	●	●					
	10-5-2	EXISTING POTABLE WATER SYSTEM GENERAL ARRANGEMENT	1008679D230	●	●					
	10-5-3	STRAINRITE FILTER DETAILS	1008679D231	●	●					
	10-5-4	KINETICO FILTERS DETAILS	1008679D232	●	●					
	10-5-5	POTABLE WATER SYSTEM VAULT DETAIL SHEET	1008679D242	●	●					
	10-5-6	RELOCATED POTABLE WATER SYSTEM	1008679D239	●	●					
	10-5-7	DETAIL SHEET	1008679D240	●	●					
	10-5-8	UTILITY LINE LOCATIONS	1008679D241	●	●					
	10-5-9	PIPING DIAGRAM TEMPORARY EQUIPMENT ENCLOSURE	1008679D348	●	●					
	10-5-10	EXISTING VALVE VAULT MODIFICATIONS	1008679D356	●	●					
	10-5-11	HOLDEN VILLAGE TEMPORARY MAINTENANCE FACILITY (PLAN)	1008679DXXX	–	–					
	10-5-12	HOLDEN VILLAGE TEMPORARY MAINTENANCE FACILITY (DETAILS)	1008679DXXX	–	–					

LEGEND:

● SHEETS INCLUDED IN ISSUANCE

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CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE GENERAL

TITLE: INDEX OF DRAWINGS (2 OF 3)

MWH

SHEET: 1-3

REVISION: B

FILE NAME: 1008679D044

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REMEDIAL DESIGN FOR HOLDEN MINE					DRAWING ISSUE DATE						
REMEDIAL COMPONENT	SHEET NUMBER	DRAWING TITLE	FILENAME		04-08-11	04-15-11	'	'	'	'	'
SECTION 10 INFRASTRUCTURE DESIGN REPORT / CONSTRUCTION SUPPORT FACILITIES	10-6-1	CONSTRUCTION SUPPORT FACILITIES (SHEET 1 OF 2)	1008679D308		●	●					
	10-6-2	CONSTRUCTION SUPPORT FACILITIES (SHEET 2 OF 2)	1008679D309		●	●					
	10-6-3	MATERIAL STORAGE AREA A	1008679D323		●	●					
	10-6-4	STAGING AREA B AND STAGING AREA C	1008679D322		●	●					
	10-6-5	FUEL AND MAINTENANCE AREA D	1008679D321		●	●					
	10-6-6	SAWN TIMBER STORAGE AREA E	1008679D320		●	●					
	10-6-7	CONSTRUCTION SUPPORT FACILITIES FS ROAD 8301 TURNOUT STA. 566+50	1008679D318		●	●					
SECTION 10-7 NOT USED	10-7-1	XXX	1008679DXXX		–	–					
	10-7-2	XXX	1008679DXXX		–	–					
	10-7-3	XXX	1008679DXXX		–	–					
	10-7-4	XXX	1008679DXXX		–	–					
	10-7-5	XXX	1008679DXXX		–	–					
	10-7-6	XXX	1008679DXXX		–	–					
	10-7-7	XXX	1008679DXXX		–	–					
	10-7-8	XXX	1008679DXXX		–	–					
SECTION 10-8 CAMP FACILITIES	10-8-1	XXX	1008679DXXX		–	–					
	10-8-2	XXX	1008679DXXX		–	–					
	10-8-3	XXX	1008679DXXX		–	–					
	10-8-4	XXX	1008679DXXX		–	–					
	10-8-5	XXX	1008679DXXX		–	–					
	10-8-6	XXX	1008679DXXX		–	–					
	10-8-7	XXX	1008679DXXX		–	–					
	10-8-8	XXX	1008679DXXX		–	–					
	10-8-9	XXX	1008679DXXX		–	–					
	10-8-10	XXX	1008679DXXX		–	–					
SECTION 10-9 BULKHEAD SUPPORT	10-9-1	BULKHEAD CONSTRUCTION SUPPORT WORK ELEMENTS	1008679D384		●	●					
	10-9-2	BULKHEAD CONSTRUCTION SUPPORT WORK ELEMENTS DETAIL	1008679D385		●	●					
	10-9-3	BULKHEAD CONSTRUCTION SUPPORT WORK ELEMENTS DETAIL	1008679D386		●	●					
	10-9-4	BULKHEAD CONSTRUCTION SUPPORT AREAS OF DISTURBANCE	1008679D387		●	●					
	10-9-5	BULKHEAD CONSTRUCTION SUPPORT SURFACE WATER RETENTION AREA	1008679D389		●	●					
	10-9-6	BULKHEAD CONSTRUCTION SUPPORT SURFACE WATER RETENTION AREA	1008679D390		●	●					

LEGEND:

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A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

DESIGNED BY	D. RODRIGUEZ	07/15/10
DRAWN BY	F. ANDRADE	07/15/10
CHECKED BY	D. RODRIGUEZ	07/15/10
APPROVED BY	P. CROUSE	----
PROJECT MANAGER	R. SCHLICHER	
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE GENERAL

TITLE: INDEX OF DRAWINGS (3 OF 3)

MWH

SHEET: 1-4 | REVISION: B

FILE NAME: 1008679D334

M:\Clients-Q-Z\Rio Tinto\1008679 - Holden Mine\013-Sheet Set\General\1008679D334 4/15/2011 3:49:47 PM

LEGEND:

- 5280 — APPROXIMATE EXISTING GROUND SURFACE CONTOURS AND ELEVATION, FEET
- 5275 — DESIGN CONTOUR AND ELEVATION, FEET
- PRIMARY HIGHWAY
- PAVED ROAD
- DIRT ROAD
- TRAIL
- CONTROL LINE AND/OR ROAD CENTERLINE
- WATERSHED BOUNDARY
- CREEK
- NATURAL DRAINAGE
- USFS RIPARIAN AND WETLAND DELINEATION
- SURFACE WATER FLOW DIRECTION
- GLACIER PEAK WILDERNESS BOUNDARY
- INVENTORIED ROADLESS AREA
- LATE SUCCESSIONAL RESERVE (LSR)
- APPROXIMATE LIMITS OF CLEARING AND GRUBBING
- COUNTY OR EQUIVALENT BOUNDARY
- CIVIL TOWNSHIP OR EQUIVALENT BOUNDARY
- INCORPORATED CITY OR EQUIVALENT BOUNDARY
- SECTION LINE
- PATENTED MINE CLAIM BOUNDARY
- NEW PIPELINE
- W — EXISTING POTABLE WATER PIPELINE
- RW — EXISTING RAW WATER PIPELINE
- X — FENCE
- E — ELECTRIC
- UGE — UNDERGROUND ELECTRIC
- OHP — OVERHEAD POWER
- SS — SANITARY SEWER
- ST — STORM SEWER
- W — POTABLE WATER PIPELINE

- AREAS OF POTENTIAL EARTH DISTURBANCE
- EXISTING VEGETATION
- 1% — PERCENT SLOPE
- 2 / 1 — SLOPE RATIO
- 3:1 — FILL SLOPE, H:V (HORIZONTAL TO VERTICAL)
- 3:1 — CUT SLOPE, H:V (HORIZONTAL TO VERTICAL)
- FINAL DESIGN ELEVATION 3156.43 / 3148.1 APPROXIMATE EXISTING GROUND SURFACE ELEVATION
- 50 — U.S. HIGHWAY
- 119 — STATE HIGHWAY
- 141 — COUNTY HIGHWAY
- Mi 2 — MILE MARKER
- A / 1 — PROFILE OR CROSS SECTION IDENTIFICATION; DRAWING NO. WHERE PROFILE/SECTION IS SHOWN
- 1 / 1 — DETAIL IDENTIFICATION; DRAWING No. WHERE DETAIL IS SHOWN
- 1 / - — DETAIL IDENTIFICATION; DETAIL SHOWN ON SAME SHEET AS ORIGINALLY IDENTIFIED

MISCELLANEOUS SYMBOLS:

- SECTION CORNER/CONTROL MONUMENT
- ALIQUOT SECTION CORNER
- 22 — SECTION NUMBER
- 5332.785 — HORIZONTAL AND VERTICAL SURVEY CONTROL POINT AND ELEVATION
- BENCH MARK
- CORNER MARKER POST
- MINE ADIT
- ARTESIAN WELL
- POWER POLE
- LIGHT POLE
- MANHOLE
- HORIZONTAL TANK
- VERTICAL TANK
- CULVERT
- STRUCTURE
- BRIDGE

INVESTIGATION LOCATION SYMBOLS:

- TP1-1BB — BATT TIP
- CPT-1 — CONE PENETROMETER TEST PROBE
- SG-1-WP — DRIVEN WELL POINT
- SB-1 — GEOTECHNICAL BORING EXPLORATION
- HB-1 — HAND AUGER
- TP2-9L — LYSIMETER
- P-1 (HC-1975) — PERMEABILITY TEST
- SP-3 — SEEP
- SG-1 — STAFF GAUGE
- P-1 — PORTAL DRAINAGE
- CH-3 — CORE HOLE
- RC-6-PW-12 — PORE WATER SAMPLER
- RC-7 — SURFACE WATER
- TP-5 — TEST PIT
- 1S/1I/1D — WELL (S = SHALLOW, I= INTERMEDIATE D = DEEP)
- 2010 MWH INVESTIGATION LOCATIONS
- 2009 URS INVESTIGATION LOCATIONS
- 2008 URS INVESTIGATION LOCATIONS
- HISTORICAL INVESTIGATION LOCATIONS (BY OTHERS)

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	C. LEE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: MASTER LEGEND

MWH

SHEET: 1-5 | REVISION: B

FILE NAME: 1008679D037

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GENERAL:

1. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING IMPROVEMENTS WHICH ARE TO REMAIN IN PLACE FROM DAMAGE. ALL IMPROVEMENTS DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE EXPEDITIOUSLY REPAIRED OR RECONSTRUCTED AT THE CONTRACTOR'S EXPENSE WITHOUT ADDITIONAL COMPENSATION.
2. ALL BUILDING COORDINATES ARE TO OUTSIDE CORNER OF COLUMN OR BUILDING.
3. CONTRACTOR SHALL RESTORE ALL SURVEY MONUMENTS THAT ARE DAMAGED OR DESTROYED DURING CONSTRUCTION.

UTILITIES:

1. PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR SHALL LOCATE ALL EXISTING UTILITIES IN AND AROUND THE AREAS OF NEW CONSTRUCTION. THE CONTRACTOR SHALL POTHOLE FOR EXISTING UTILITIES PRIOR TO SUBMITTAL OF SHOP DRAWINGS, FOR POINTS OF CONNECTIONS.
2. THE CONTRACTOR SHALL PROTECT ALL REMAINING EXISTING UTILITIES.
3. LOCATIONS OF UNDERGROUND UTILITIES SHOWN ON THE DRAWINGS WERE OBTAINED FROM AVAILABLE RECORDS. THE CONTRACTOR SHALL VERIFY ALL LOCATIONS AND ELEVATIONS AND SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT UTILITY LINES WHETHER SHOWN OR NOT SHOWN.
4. PRIOR TO ANY CONNECTION TO AN EXISTING UTILITY, THE CONTRACTOR SHALL COORDINATE WITH THE UTILITY OWNER.
5. PRIOR TO ANY EXCAVATION IN THE VICINITY OF ANY EXISTING UNDERGROUND FACILITIES, INCLUDING ALL WATER, SEWER, STORM DRAIN, GAS, PETROLEUM PRODUCTS, OR OTHER PIPELINES; ALL BURIED ELECTRIC POWER, COMMUNICATIONS, OR TELEVISION CABLES; ALL TRAFFIC SIGNAL AND STREET LIGHTING FACILITIES; AND ALL ROADWAY, STATE HIGHWAY, AND RAILROAD RIGHTS–OF–WAY, THE CONTRACTOR. SHALL NOTIFY THE RESPECTIVE AUTHORITIES REPRESENTING THE OWNERS OR AGENCIES RESPONSIBLE FOR SUCH FACILITIES NOT LESS THAN 3 DAYS NOR MORE THAN 7 DAYS PRIOR TO EXCAVATION SO THAT A REPRESENTATIVE OF SAID OWNERS OR AGENCIES CAN BE PRESENT DURING SUCH WORK IF THEY SO DESIRE. IN THE CASE OF THE UNDERGROUND UTILITY SERVICE ALERT CENTER, THIS NOTICE WILL GIVE THEM TIME TO MARK THE LOCATION OF THE UTILITIES. THE CONTRACTOR SHALL ALSO NOTIFY THE REGIONAL OR LOCAL UNDERGROUND SERVICE ALERT COMPANY AT LEAST 3 DAYS, BUT NO MORE THAN 7 DAYS, PRIOR TO SUCH EXCAVATION.

PIPING:

1. THE CONTRACTOR SHALL COMPLY WITH THE STATE DEPARTMENT OF HEALTH SERVICES CRITERIA FOR THE SEPARATION OF WATER MAINS AND SANITARY SEWERS.
2. THE CONTRACTOR SHALL PROVIDE A MINIMUM OF 36 INCHES OF COVER ON ALL PIPELINES UNLESS OTHERWISE SHOWN OR DIRECTED.
3. STRAIGHT SLOPES SHALL BE MAINTAINED BETWEEN INVERT ELEVATIONS SHOWN OR SPECIFIED.
4. THE CONTRACTOR SHALL ADJUST ALL VALVE BOXES, PULL BOXES AND MANHOLES TO FINISHED GRADE UNLESS OTHERWISE SHOWN OR SPECIFIED. MANHOLES IN OPEN FIELDS SHALL BE SET ONE FOOT ABOVE GRADE. APPROXIMATE RIM ELEVATIONS ARE SHOWN ON DRAWINGS.

EROSION CONTROL:

1. THE CONTRACTOR SHALL SUBMIT AN EROSION CONTROL PLAN FOR WORK PRIOR TO THE START OF CONSTRUCTION.
   a. ALL SLOPES SHALL BE PROTECTED FROM EROSION DURING ROUGH GRADING OPERATIONS AND THEREAFTER, UNTIL INSTALLATION OF FINAL GROUNDCOVER.
   b. ALL SLOPE PROTECTION SWALES SHALL BE CONSTRUCTED AT THE SAME TIME AS BANKS ARE GRADED.
   c. THE CONTRACTOR IS RESPONSIBLE FOR IMPLEMENTATION AND MAINTENANCE OF EROSION CONTROL MEASURES CONTAINED WITHIN THE CONTRACT SPECIFICATIONS OR AS REQUIRED BY THE CITY, DISTRICT, OR OTHER REGULATORY AUTHORITY. THE CONTRACTOR SHALL ALSO PROVIDE ANY ADDITIONAL EROSION CONTROL MEASURES (E.G. HYDROSEEDING, MULCHING OF STRAW, SAND BAGGING, DIVERSION DITCHES, ETC.) DICTATED BY FIELD CONDITIONS TO PREVENT EROSION OR THE INTRODUCTION OF DIRT, MUD, OR DEBRIS INTO EXISTING PUBLIC STREETS, WATERWAYS, OR ONTO ADJACENT PROPERTIES DURING ANY PHASE OF CONSTRUCTION OPERATIONS.

ACRONYMS:

AMSL	ABOVE MEAN SEA LEVEL
BH	BORE HOLE
CH	CORE HOLE
CGS	CLEARING, GRUBBING, STRIPPING
CMP	CORRUGATED METAL PIPE
CND	CONDUIT
CONT	CONTINUOUS
CPT	CORRUGATED POLYETHYLENE TUBING
℄	CENTER LINE
CY	CUBIC YARD
DI	DUCTILE IRON
DIA	DIAMETER
DS	DOWNSTREAM
EL	ELEVATION
ENV	ENVIRONMENTAL
EOP	EDGE OF PAVEMENT
EQUIV	EQUIVALENT
HOR	HORIZONTAL
HDPE	HIGH DENSITY POLYETHYLENE
ID	INSIDE DIAMETER
INV	INVERT
LCRS	LEACHATE COLLECTION AND RECOVERY SYSTEM
LLDPE	LINEAR LOW DENSITY POLYETHYLENE
LF	LINEAL FOOT
MAX	MAXIMUM
mil	1/1000TH OF AN INCH
MIN	MINIMUM
MW	MONITORING WELL
MH	MANHOLE
MSL	MEAN SEA LEVEL
NFWE	NO FREE WATER ENCOUNTERED
NO	NUMBER
NOM	NOMINAL
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
PC	POINT OF CURVE
PCC	POINT OF COMPOUND CURVE
PI	POINT OF INTERSECTION
PRC	POINT OF RETURN CURVE
PT	POINT OF TANGENCY
PVC	POINT OF VERTICAL TANGENT
PVC	POLYVINYL CHLORIDE
PSI	POUNDS PER SQUARE INCH
PVC	POINT OF VERTICAL CURVE
PVC	POLYVINYL CHLORIDE
RCP	REINFORCED CONCRETE PIPE
REQ'D	REQUIRED
R.O.W.	RIGHT OF WAY
SCH	SCHEDULE
SDR	STANDARD DIMENSIONAL RATIO
SDR	STANDARD DIMENSION RATIO
SPECS	SPECIFICATIONS
STA	STATION

ACRONYMS (CONT'D):

TOC	TOP OF CONCRETE
TP	TAILINGS PILE
TYP	TYPICAL
US	UPSTREAM
FS	UNITED STATES DEPARTMENT OF THE INTERIOR FOREST SERVICE
VERT	VERTICAL
VLDPE	VERY LOW DENSITY POLYETHYLENE

IMPERIAL UNITS:

" OR IN	INCHES
OZ	OUNCES
F	FAHRENHEIT
' OR FT	FEET
MI	MILES
YD	YARD
SQ MI	SQUARE MILES
AC	ACRE
AC–FT	ACRE–FEET
° OR DEGREES	DEGREES
4.9%	SLOPE GRADE

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

DESIGNED BY	D. RODRIGUEZ	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: GENERAL NOTES AND ACRONYMS

MWH

SHEET: 1-6
REVISION: B
FILE NAME: 1008679D051

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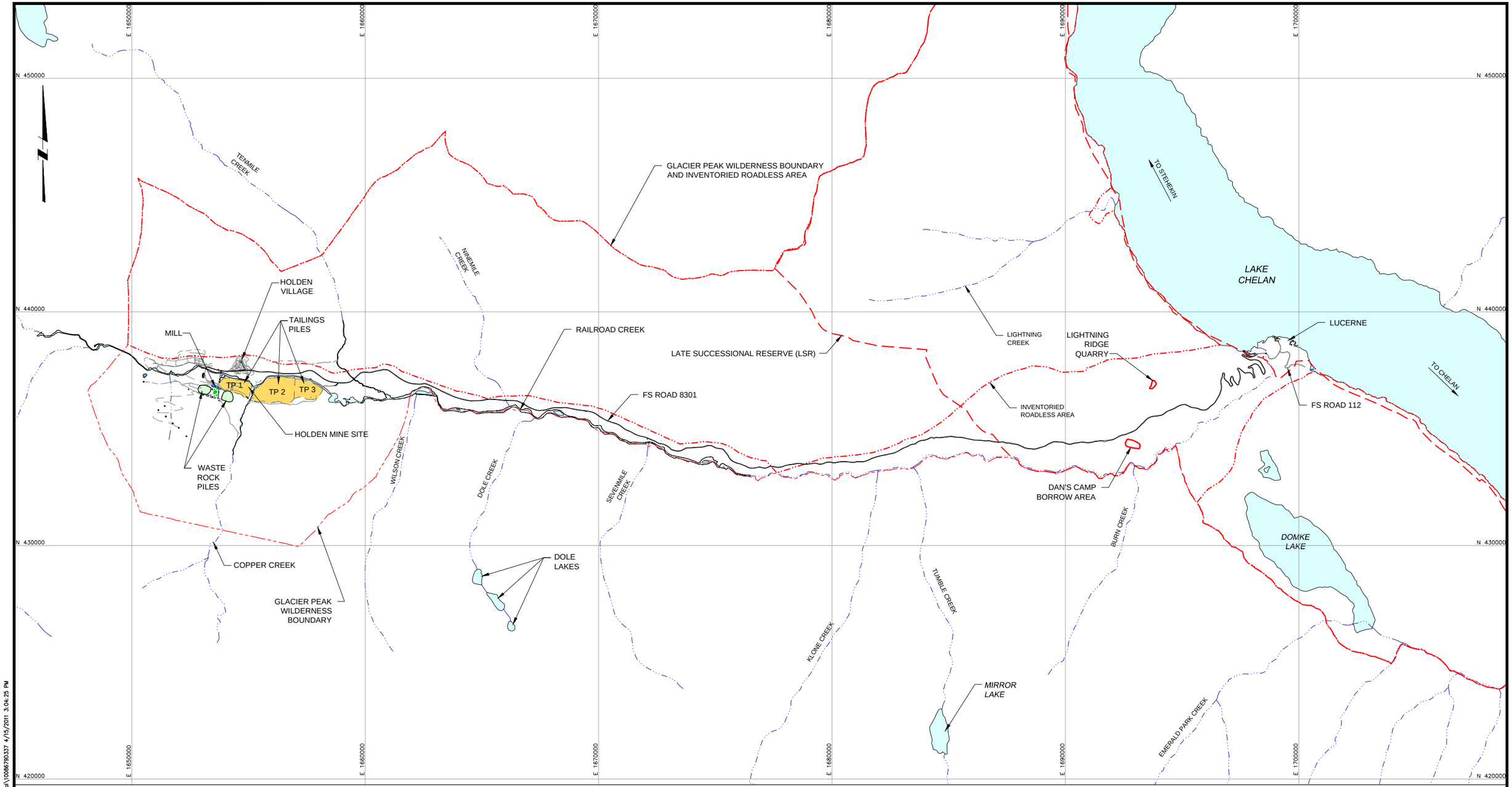

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ISSUE / REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT COMMENT AND REVIEW	FA	PC	04/08/11	

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DRAWING REFERENCE(S):
- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

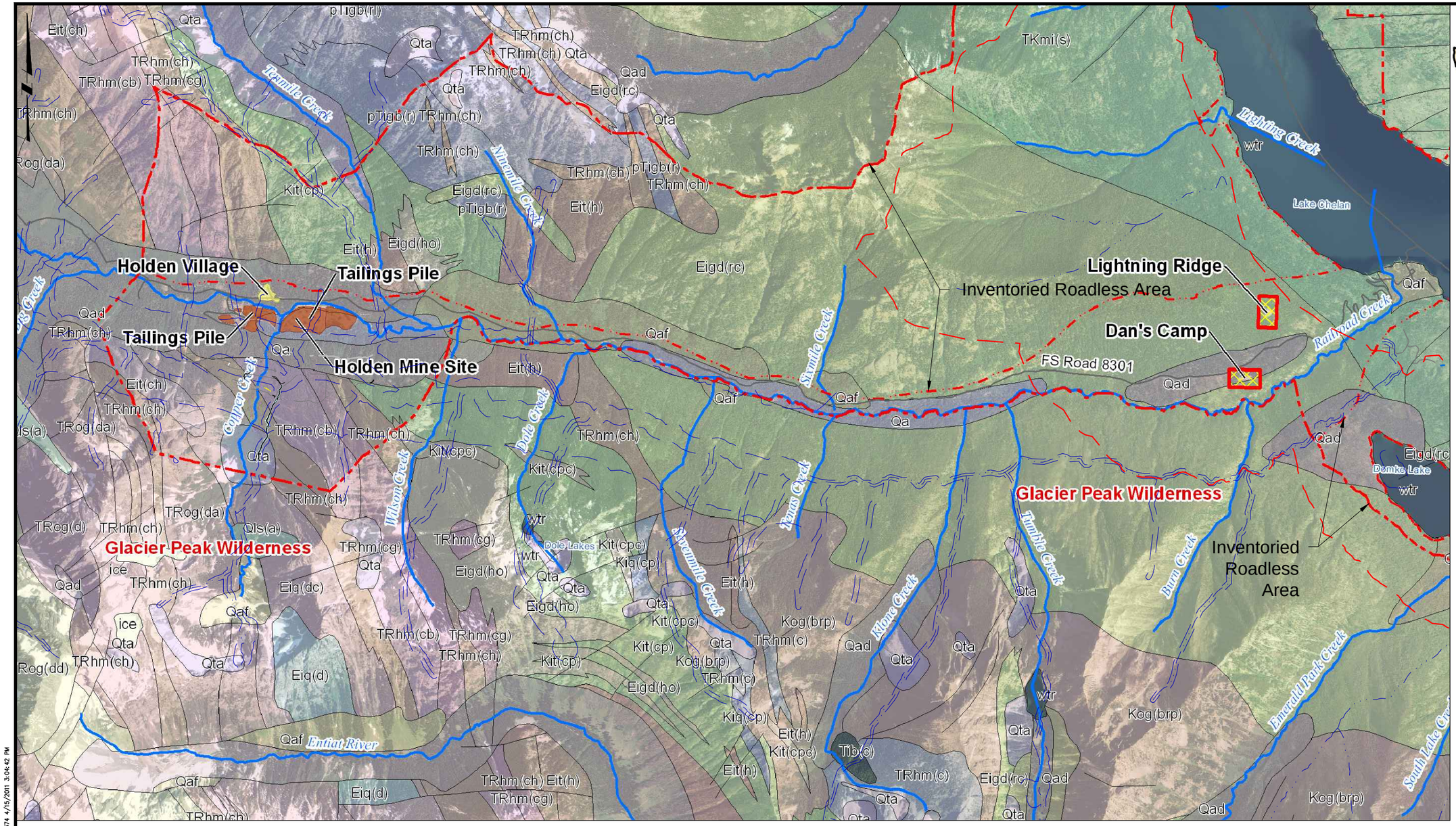
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: SITE LOCATION MAP

MWH

SHEET 1-7 | REVISION B

FILE NAME 1008679D337



KEY MAP
NTS

NOTE:

1. GLACIER PEAK WILDERNESS BOUNDARY LOCATION CONSIDERED APPROXIMATE AT THIS TIME (SOURCE U.S. FOREST SERVICE).

DATA REFERENCE(S):

1. IMAGERY SOURCE: NAIP 2009
2. SPATIAL REFERENCE: NAD 1983 STATE PLANE WASHINGTON NORTH FIPS 4601 FEET
3. DIGITAL DATA PROVIDED BY WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES, SCALE OF 1:100,000, DATED: OCTOBER 2008.

SCALE
2000 0 2000 4000 FEET

LEGEND:

- Potential Quarry and Borrow Sites Visited during the Reconnaissance
- Holden Village
- Tailings Pile
- Rivers/Streams
- Inventoried Roadless Area
- Glacier Peak Wilderness Boundary

- Eigd(ho), Holden, biotite granodiorite & granite
- Eigd(rc), Railroad Creek pluton
- Eiq(d), Duncan Hill pluton
- Eiq(dc), Duncan Hill pluton, contact complex
- Eit(ch), Copper Peak and Holden Lake plutons
- Eit(h), Holden, hornblende biotite tonalite
- Kiq(cp), Cardinal Peak pluton
- Kit(cp), Cardinal Peak pluton
- Kit(cpc), Cardinal Peak pluton, contact complex
- Kit(s), Seven Fingered Jack pluton
- Kog(brp), Bearcat Ridge pluton
- Kog(ef), Eldorado Orthogneiss, flaser gneiss
- Qa, Alluvium
- Qad, Alpine glacial deposits
- Qaf, Alluvial fan deposits
- Qls(a), rock avalanche deposits
- Qls, Landslide deposits
- Qta, Talus deposits
- TKmi(s), Skagit Gneiss
- TRhm(c), Cascade River unit, Chelan Mountains terrane
- TRhm(cb), Cascade River unit, Chelan Mountains terrane
- TRhm(cc), Cas. Riv. unit, Chelan Mtns. terr., Cas. Riv. Schist
- TRhm(cg), Cascade River unit, Chelan Mountains terrane
- TRhm(ch), Cas. Riv. unit, hornblende-bearing,Chelan Mtns. terr.
- TRog(d), Dumbell Mountain plutons
- TRog(da), Dumbell Mountain plutons, augen orthogneiss
- TRog(dd), Dumbell Mountain plutons, qtz diorite to tonalite orthogneiss
- i, ice
- pTigb(r), Riddle Peaks pluton
- pTigb(rl), Riddle Peaks pluton, layered

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):
- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.
- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA–FSA–APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	J. THOMPSON	04/04/11
DRAWN BY	R. WATT	04/04/11
CHECKED BY	D. RODRIGUEZ	04/04/11
APPROVED BY	P. CROUSE	04/04/11
PROJECT MANAGER	R. SCHLICHER	04/04/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

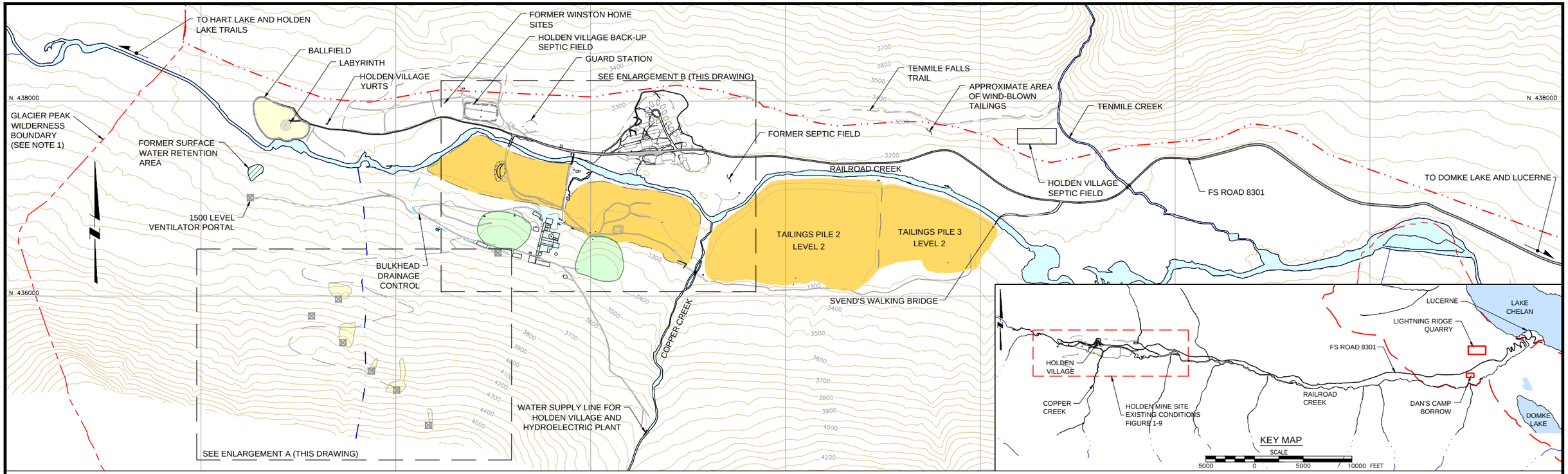
Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: LOCAL GEOLOGIC MAP

MWH

1-8 | REVISION B
FILE NAME 1008679D374

M:\Clients–Q–Z\Rio Tinto\1008679 – Holden Mine\013–Sheet Set\General\1008679D374 4/15/2011 3:04:42 PM

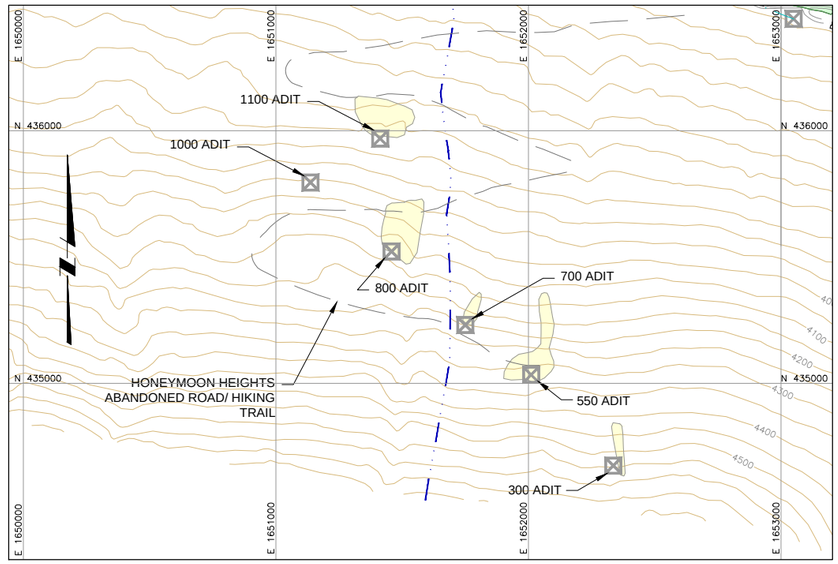


PLAN

SCALE

500 0 500 1000 FEET

CONTOUR INTERVAL = 50 FEET



ENLARGEMENT A

SCALE

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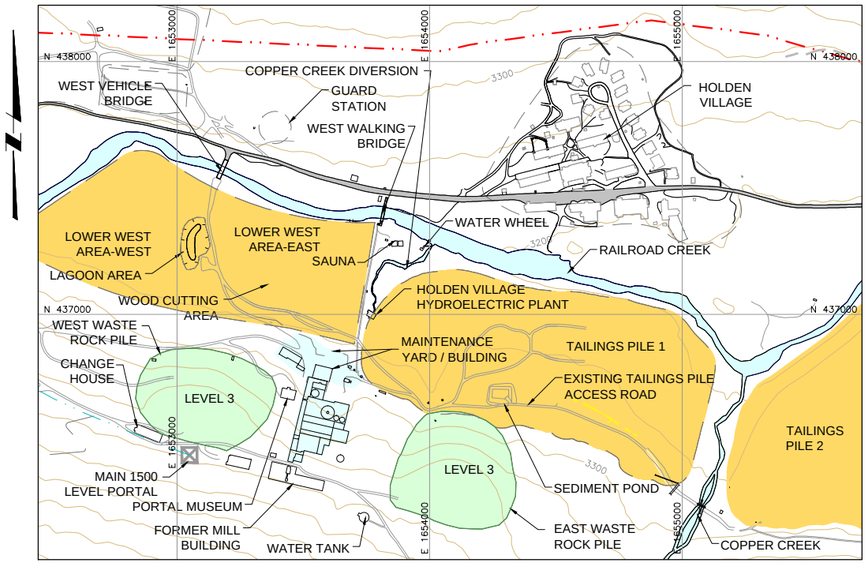
CONTOUR INTERVAL = 50 FEET



ENLARGEMENT B

SCALE

300 0 300 600 FEET

CONTOUR INTERVAL = 50 FEET

NOTE:

1. GLACIER PEAK WILDERNESS BOUNDARY LOCATION CONSIDERED APPROXIMATE AT THIS TIME (SOURCE: WILDERNESS.NET).

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
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- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.
- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA–FSA–APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	DJR/RTL	06/11/10
DRAWN BY	F. ANDRADE	06/11/10
CHECKED BY	D. RODRIGUEZ	06/11/10
APPROVED BY	R. LEESON	06/11/10
PROJECT MANAGER	R. SCHLICHER	06/11/10
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: EXISTING CONDITIONS

MWH

SHEET 1-9 | REVISION B

FILE NAME 1008679D375

M:\Clients~0~Z\Rio Tinto\1008679 - Holden Mine\013~Sheet Set\General\1008679D375 4/15/2011 3:05:03 PM

NOTE:

1. CHALET 2 WAS CONSTRUCTED AFTER AERIAL PHOTOGRAPH WAS TAKEN.

PLAN

SCALE

50 0 50 100 FEET

CONTOUR INTERVAL = 10 FEET

ISSUE/REV				
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DESIGNED BY	P. PELLICER
DRAWN BY	G. PHILPOTT
CHECKED BY	D. RODRIGUEZ
APPROVED BY	P. CROUSE
PROJECT MANAGER	R. SCHLICHER
CLIENT APPROVAL	
CLIENT REFERENCE NO.	

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: HOLDEN VILLAGE EXISTING CONDITIONS

MWH

SHEET: 1-10

REVISION: A

FILE NAME: 1008679D269

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E 1655000

N 437000

HOLDEN VILLAGE BACK-UP SEPTIC FIELD

USFS GUARD STATION

FS ROAD 8301

RETAINING WALL (TYP)

CULVERT (TYP)

HOLDEN VILLAGE

5150
3209.51'
FND-MON (3.5INBC)

SEPTIC LIFT STATION

SANITARY SEWER LINE

TO SEPTIC FIELD
(SEE DETAIL THIS SHEET)

LAGOON AREA

EXPOSED STEEL PIPE ENCASING CLEAN WATERLINE

LOWER WEST AREA

VALVE BOXES WITH WOOD COVERS

RAILROAD CREEK

RAILROAD CREEK

FORMER SEPTIC FIELD

CLEAN WATER LOCATE (8" PVC)

HYDROPLANT

APPROXIMATE CLEAN WATER LOCATE

1" PVC DOMESTIC

4" DI FIRE

14" EXPOSED PENSTOCK

ABANDONED WATER LINE

LEVEL 2 8 'X 8' CONCRETE VALVE VAULT

EMERGENCY CROSS OVER

SHOP/ TREATMENT PLANT

TAILINGS PILE 1

APPROXIMATE LOCATION OF POTABLE WATER LINE FROM RESERVOIR (8" PVC)

1500 MAIN PORTAL

3" HDPE SLIPLINED IN 8" STEEL FINISHED WATER WITH 3/4" CND CONTAINING SIGNAL WIRE FOR RESERVOIR TRANSDUCER AND ELECTRIC SERVICE FOR THIRD LEVEL VAULT LIGHTING

RESERVOIR FILL LINE LOCATE (3" HDPE)

125,000 GALLON RESERVOIR

LEVEL 3 VALVE VAULT

EXPOSED PENSTOCK

APPROXIMATE PENSTOCK LOCATION CONTINUES TO RAW WATER INTAKE ON COPPER CREEK

USFS MONUMENT E

TAILINGS PILE 2

COPPER CREEK

HOLDEN VILLAGE SEPTIC FIELD

HOLDEN VILLAGE SEPTIC FIELD

SEWER LINE

FS ROAD 8301

SCALE
200 0 200 400 FEET
CONTOUR INTERVAL = 10 FEET

PLAN

SCALE
100 0 100 200 FEET
CONTOUR INTERVAL = 10 FEET

NOTE:

1. UTILITY LINE LOCATIONS ARE BASED ON SURVEY PERFORMED BY ERLANDSEN, INC SURVEY UNDERGROUND UTILITY LOCATE SERVICES.

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
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DRAWN BY	R. WATT	03/28/11
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PROJECT MANAGER	R. SCHLICER	03/28/11
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CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: EXISTING UTILITIES

MWH

SHEET: 1-11

REVISION: B

FILE NAME: 1008679D364

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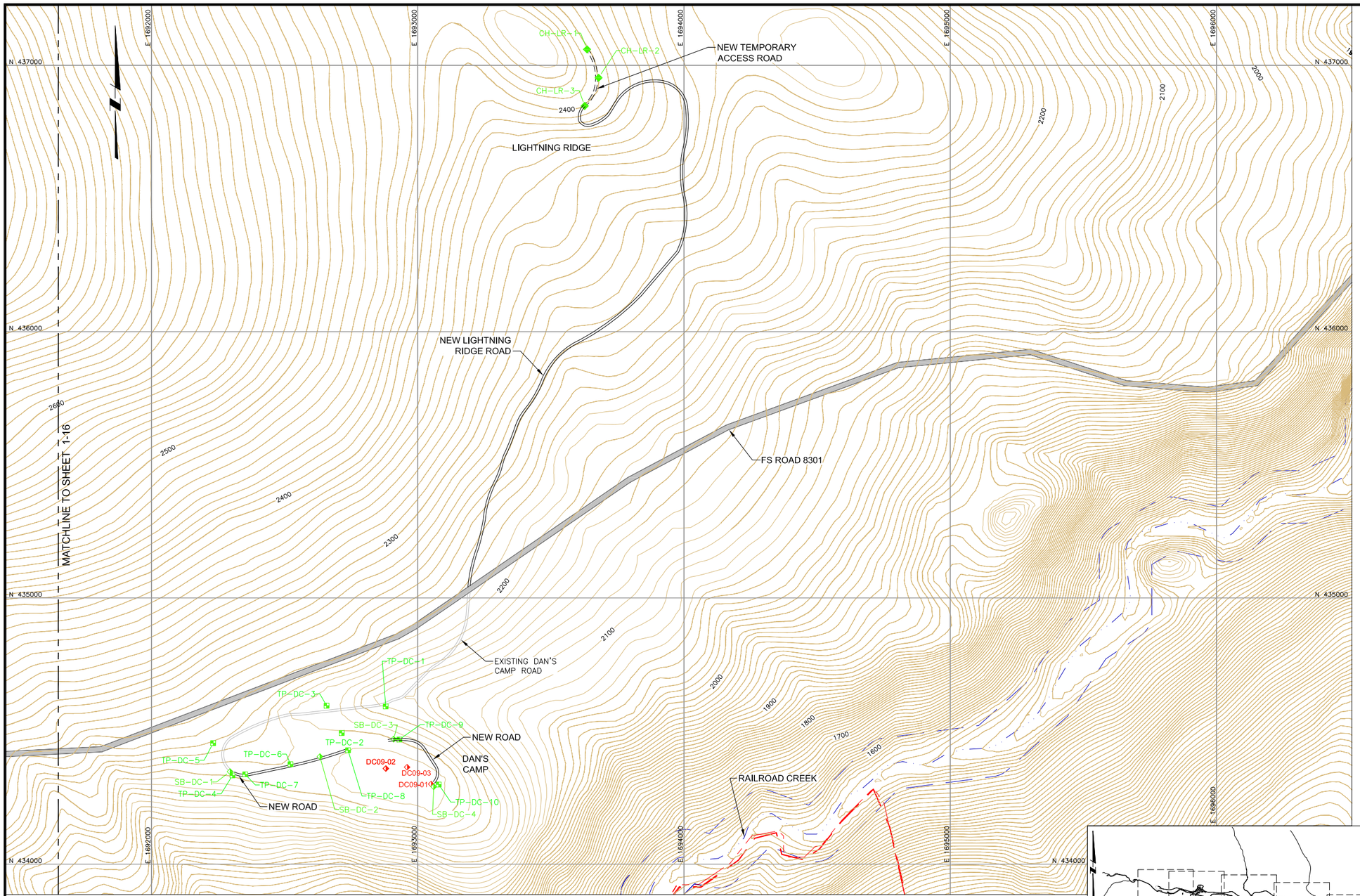

PLAN

SCALE
200 0 200 400 FEET
CONTOUR INTERVAL = 10 FEET

LEGEND:

TP1-1BB	BATT TIP
CPT-1	CONE PENETROMETER TEST PROBE
SG-1-WP	DRIVEN WELL POINT
SB-1	GEOTECHNICAL BORING EXPLORATION
HB-1	HAND AUGER
TP2-9L	LYSIMETER
P-1 (HC-1975)	PERMEABILITY TEST
SP-3	SEEP
SG-1	STAFF GAUGE
P-1	PORTAL DRAINAGE
CH-3	CORE HOLE
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RC-7	SURFACE WATER
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UWTM	UPPER WEST TENMILE
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RC	RAILROAD CREEK
DC	DAN'S CAMP
	CREEK FLOW DIRECTION
	INVENTORIED ROADLESS AREA
	GLACIER PEAK WILDERNESS BOUNDARY
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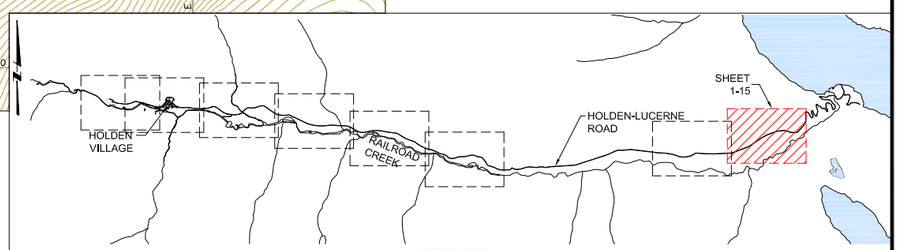
	2009 URS INVESTIGATION LOCATIONS
	2008 URS INVESTIGATION LOCATIONS
	HISTORICAL INVESTIGATION LOCATIONS (BY OTHERS)



KEY MAP

SCALE
5000 0 5000 10000 FEET

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- MWH 2010 FIELD DATA SURVEY PROVIDED BY EHRLANDSEN SURVEYING DATED DECEMBER 27, 2010

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DRAWN BY	R. WATT	03/28/11
CHECKED BY	D. RODRIGUEZ	03/28/11
APPROVED BY	P. CROUSE	03/28/11
PROJECT MANAGER	R. SCHLICHER	03/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: INVESTIGATION LOCATIONS (SHEET 1 OF 8)

MWH

SHEET 1-15 | REVISION B

FILE NAME 1008679D366

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N 434000
N 433000
3100
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2900
2800
2700
2600
2500
2400
2300
2200
2100
2000
THREE AND ONE-HALF MILE
NEW THREE AND ONE-HALF MILE TEMPORARY ROAD
FS ROAD 8301
RAILROAD CREEK
CH-THM-1
CH-THM-2
CH-THM-3
TP-THM-1
TP-THM-2
TP-THM-3
TP-THM-4
TP-THM-5
TP-THM-6
MATCHLINE TO SHEET 1-16

PLAN

SCALE
200 0 200 400 FEET
CONTOUR INTERVAL = 10 FEET

LEGEND:

- TP1-1BB — BATT TIP
- CPT-1 — CONE PENETROMETER TEST PROBE
- SG-1-WP — DRIVEN WELL POINT
- SB-1 — GEOTECHNICAL BORING EXPLORATION
- HB-1 — HAND AUGER
- TP2-9L — LYSIMETER
- P-1 (HC-1975) — PERMEABILITY TEST
- SP-3 — SEEP
- SG-1 — STAFF GAUGE
- P-1 — PORTAL DRAINAGE
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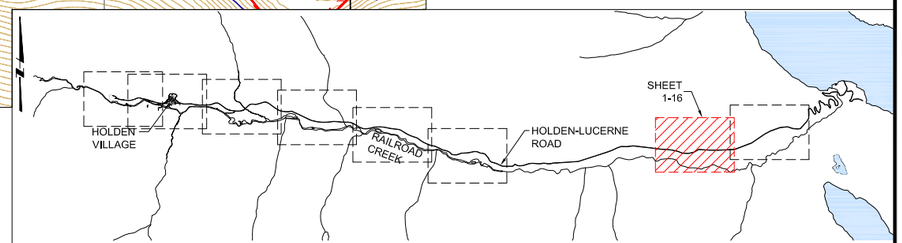

KEY MAP
SCALE
5000 0 5000 10000 FEET

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
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Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: INVESTIGATION LOCATIONS (SHEET 2 OF 8)

MWH

SHEET 1-16 | REVISION B
FILE NAME 1008679D367

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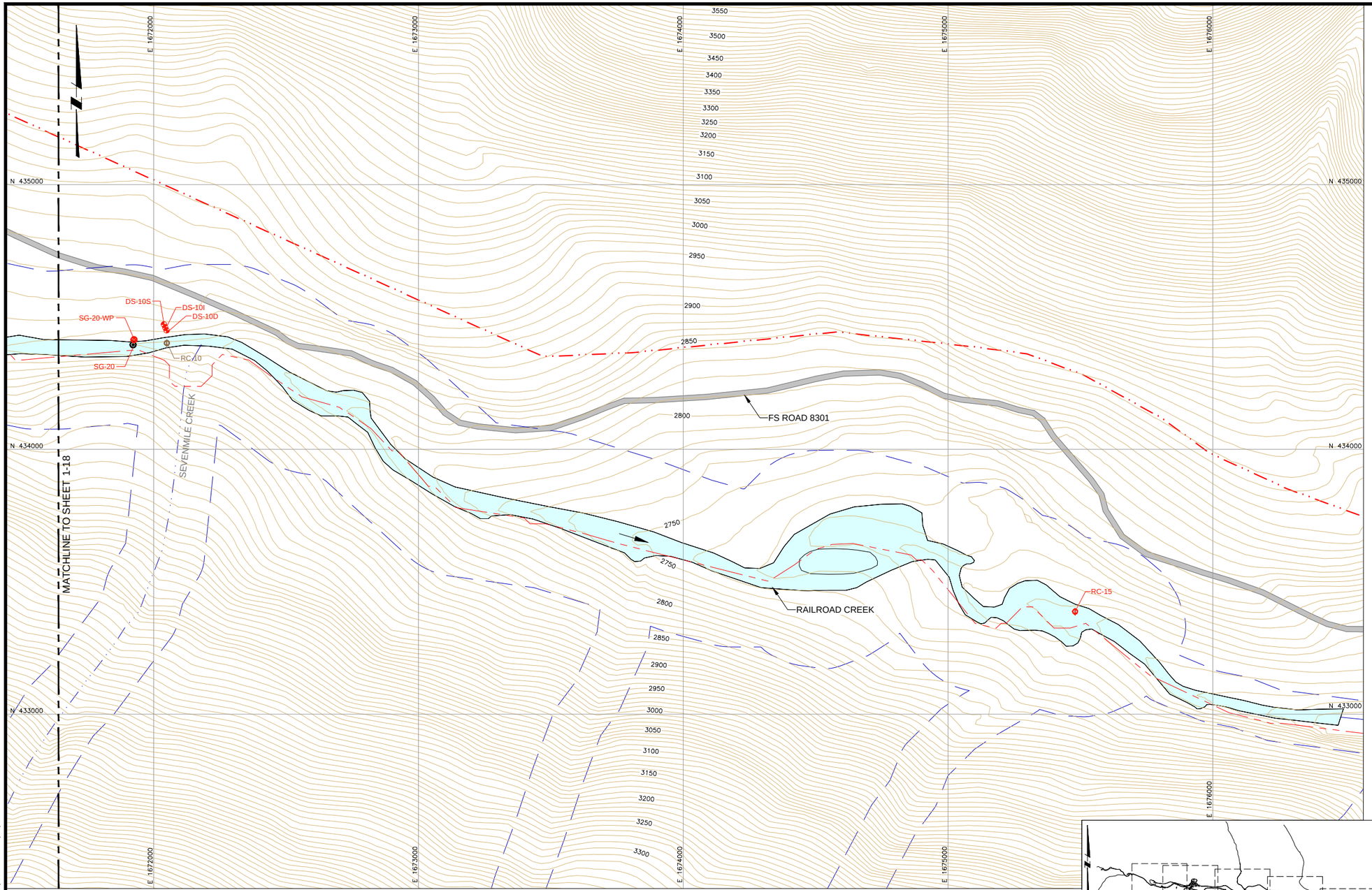

PLAN

SCALE

200 0 200 400 FEET

CONTOUR INTERVAL = 10 FEET

LEGEND:

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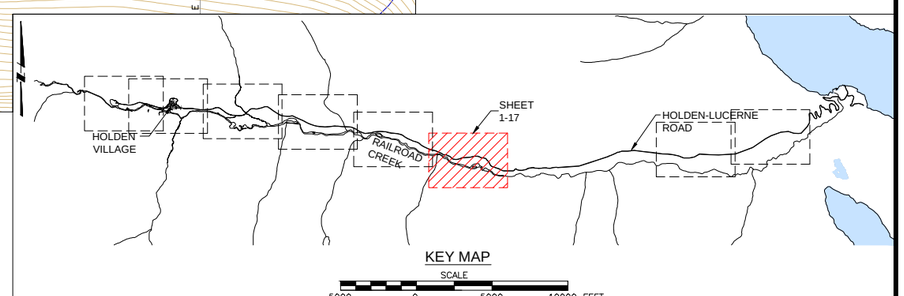

KEY MAP

SCALE

5000 0 5000 10000 FEET

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Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: INVESTIGATION LOCATIONS (SHEET 3 OF 8)

MWH

SHEET 1-17 | REVISION B

FILE NAME 1008679D368

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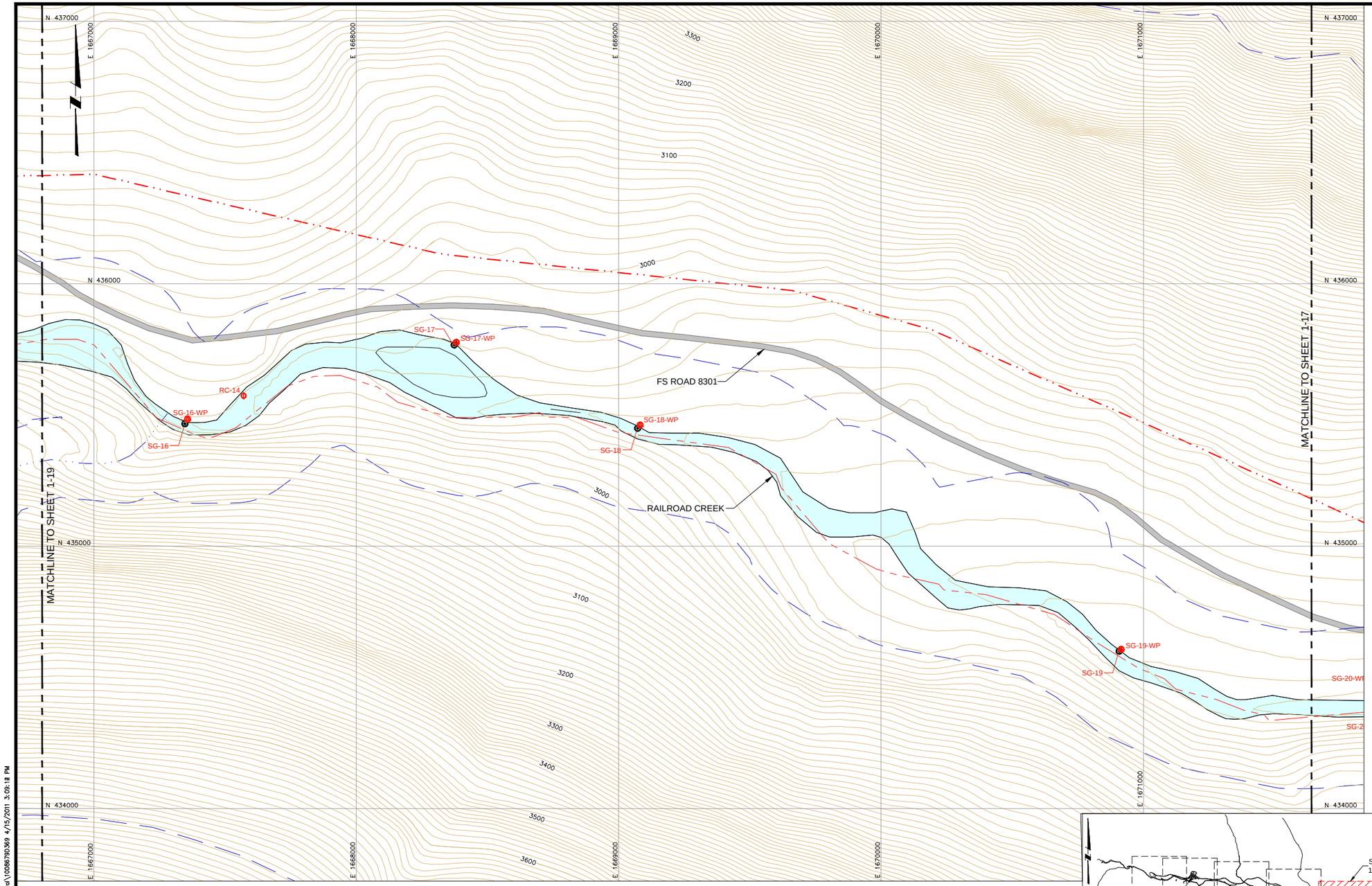

PLAN

SCALE
200 0 200 400 FEET
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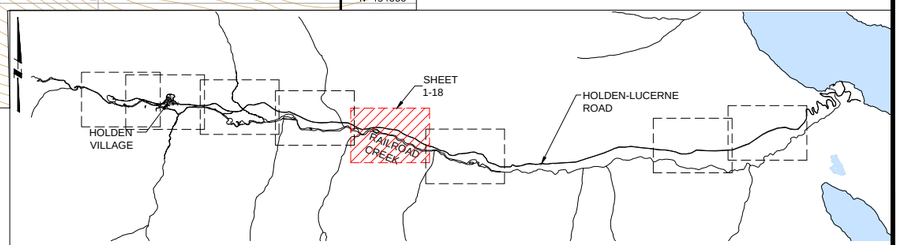

KEY MAP

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5000 0 5000 10000 FEET

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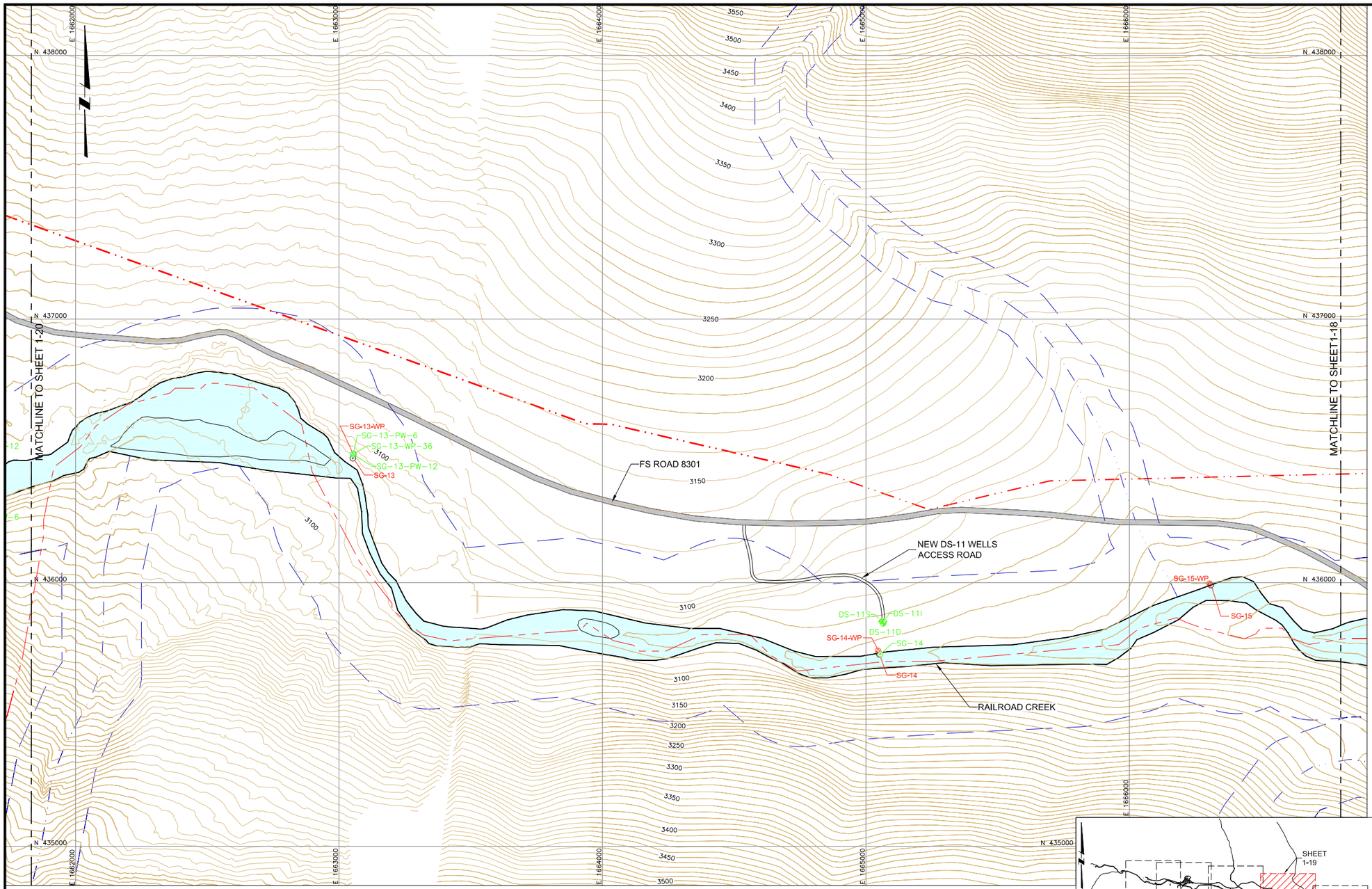
PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: INVESTIGATION LOCATIONS (SHEET 4 OF 8)

MWH

SHEET 1-18 | REVISION B
FILE NAME 1008679D369

M:\Clients–Q–Z\Rio Tinto\1008679 – Holden Mine\013–Sheet Set\General\1008679D369 4/15/2011 3:09:18 PM

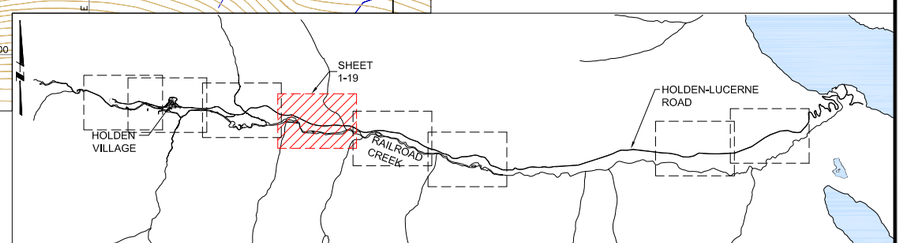


PLAN

SCALE
200 0 200 400 FEET
CONTOUR INTERVAL = 10 FEET

LEGEND:

TP1-1BB	BATT TIP
CPT-1	CONE PENETROMETER TEST PROBE
SG-1-WP	DRIVEN WELL POINT
SB-1	GEOTECHNICAL BORING EXPLORATION
HB-1	HAND AUGER
TP2-9L	LYSIMETER
P-1 (HC-1975)	PERMEABILITY TEST
SP-3	SEEP
SG-1	STAFF GAUGE
P-1	PORTAL DRAINAGE
CH-3	CORE HOLE
RC-6-PW-12	PORE WATER SAMPLER
RC-7	SURFACE WATER
TP-5	TEST PIT
1S/1I/1D	WELL (S = SHALLOW, I= INTERMEDIATE D = DEEP)
DS	DOWNSTREAM WELL
US	UPSTREAM WELL
NRC	NORTH OF RAILROAD CREEK WELL
PW	PUMPING WELL
TP1	TAILINGS PILE 1
TP2	TAILINGS PILE 2
TP3	TAILINGS PILE 3
THM	THREE AND ONE-HALF MILE
TM	TENMILE
UWTM	UPPER WEST TENMILE
LWTM	LOWER WEST TENMILE
RC	RAILROAD CREEK
DC	DAN'S CAMP
	CREEK FLOW DIRECTION
	INVENTORIED ROADLESS AREA
	GLACIER PEAK WILDERNESS BOUNDARY
	LATE SUCCESSIONAL RESERVE (LSR)
	APPROXIMATE LIMITS OF PRINCIPAL SITE FEATURES
	2010 MWH INVESTIGATION LOCATIONS
	2009 URS INVESTIGATION LOCATIONS
	2008 URS INVESTIGATION LOCATIONS
	HISTORICAL INVESTIGATION LOCATIONS (BY OTHERS)



KEY MAP

SCALE
5000 0 5000 10000 FEET

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA--FSA--APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.
- AFTER URS DRAWING HOLDEN SAMPLING LOCATIONS (NO OBJECT DATA).
- MWH 2010 FIELD DATA SURVEY PROVIDED BY EHRLANDSEN SURVEYING DATED DECEMBER 27, 2010

DESIGNED BY	J. THOMPSON	03/28/11
DRAWN BY	R. WATT	03/28/11
CHECKED BY	D. RODRIGUEZ	03/28/11
APPROVED BY	P. CROUSE	03/28/11
PROJECT MANAGER	R. SCHLICHER	03/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: INVESTIGATION LOCATIONS (SHEET 5 OF 8)

MWH

SHEET 1-19 | REVISION B
FILE NAME 1008679D370

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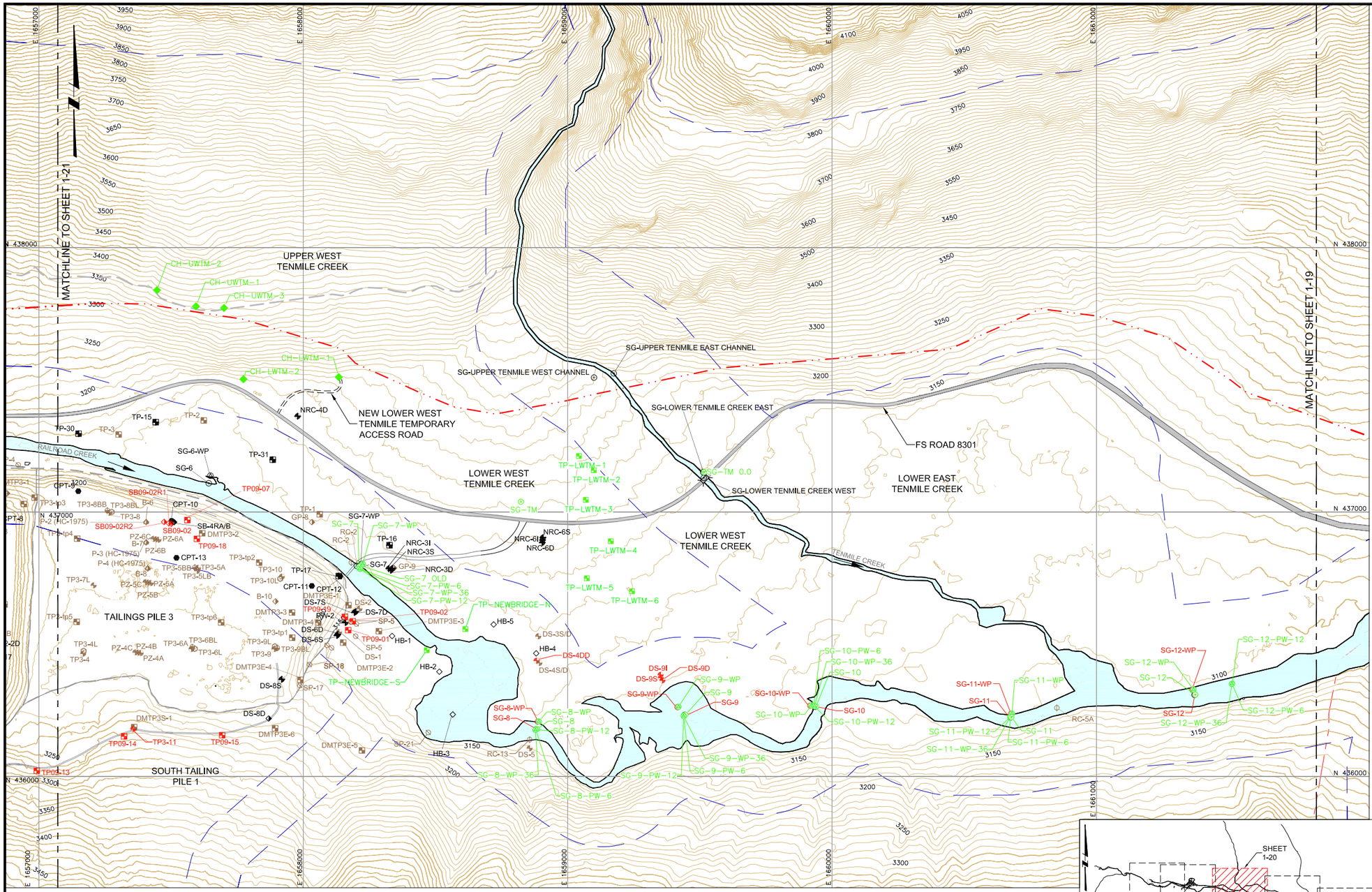
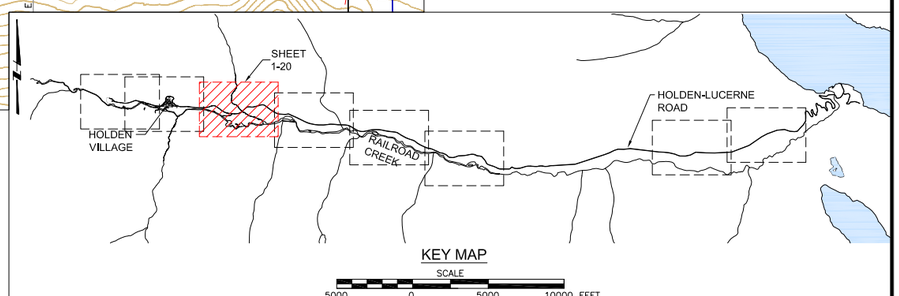


PLAN

SCALE
200 0 200 400 FEET
CONTOUR INTERVAL = 10 FEET



KEY MAP

SCALE
5000 0 5000 10000 FEET

LEGEND:

- TP1-1BB — BATT TIP
- CPT-1 — CONE PENETROMETER TEST PROBE
- SG-1-WP — DRIVEN WELL POINT
- SB-1 — GEOTECHNICAL BORING EXPLORATION
- HB-1 — HAND AUGER
- TP2-9L — LYSIMETER
- P-1 (HC-1975) — PERMEABILITY TEST
- SP-3 — SEEP
- SG-1 — STAFF GAUGE
- P-1 — PORTAL DRAINAGE
- CH-3 — CORE HOLE
- RC-6-PW-12 — PORE WATER SAMPLER
- RC-7 — SURFACE WATER
- TP-5 — TEST PIT
- 1S/1I/1D — WELL (S = SHALLOW, I= INTERMEDIATE D = DEEP)
- DS — DOWNSTREAM WELL
- US — UPSTREAM WELL
- NRC — NORTH OF RAILROAD CREEK WELL
- PW — PUMPING WELL
- TP1 — TAILINGS PILE 1
- TP2 — TAILINGS PILE 2
- TP3 — TAILINGS PILE 3
- THM — THREE AND ONE–HALF MILE
- TM — TENMILE
- UWTM — UPPER WEST TENMILE
- LWTM — LOWER WEST TENMILE
- RC — RAILROAD CREEK
- DC — DAN'S CAMP
- CREEK FLOW DIRECTION
- INVENTORIED ROADLESS AREA
- GLACIER PEAK WILDERNESS BOUNDARY
- LATE SUCCESSIONAL RESERVE (LSR)
- APPROXIMATE LIMITS OF PRINCIPAL SITE FEATURES
- 2010 MWH INVESTIGATION LOCATIONS
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- 2008 URS INVESTIGATION LOCATIONS
- HISTORICAL INVESTIGATION LOCATIONS (BY OTHERS)

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.
- AFTER URS DRAWING HOLDEN SAMPLING LOCATIONS (NO OBJECT DATA).
- MWH 2010 FIELD DATA SURVEY PROVIDED BY EHRLANDSEN SURVEYING DATED DECEMBER 27, 2010

DESIGNED BY	J. THOMPSON	03/28/11
DRAWN BY	R. WATT	03/28/11
CHECKED BY	D. RODRIGUEZ	03/28/11
APPROVED BY	P. CROUSE	03/28/11
PROJECT MANAGER	R. SCHLICHER	03/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: INVESTIGATION LOCATIONS (SHEET 6 OF 8)

MWH

SHEET 1-20 | REVISION A
FILE NAME 1008679D371

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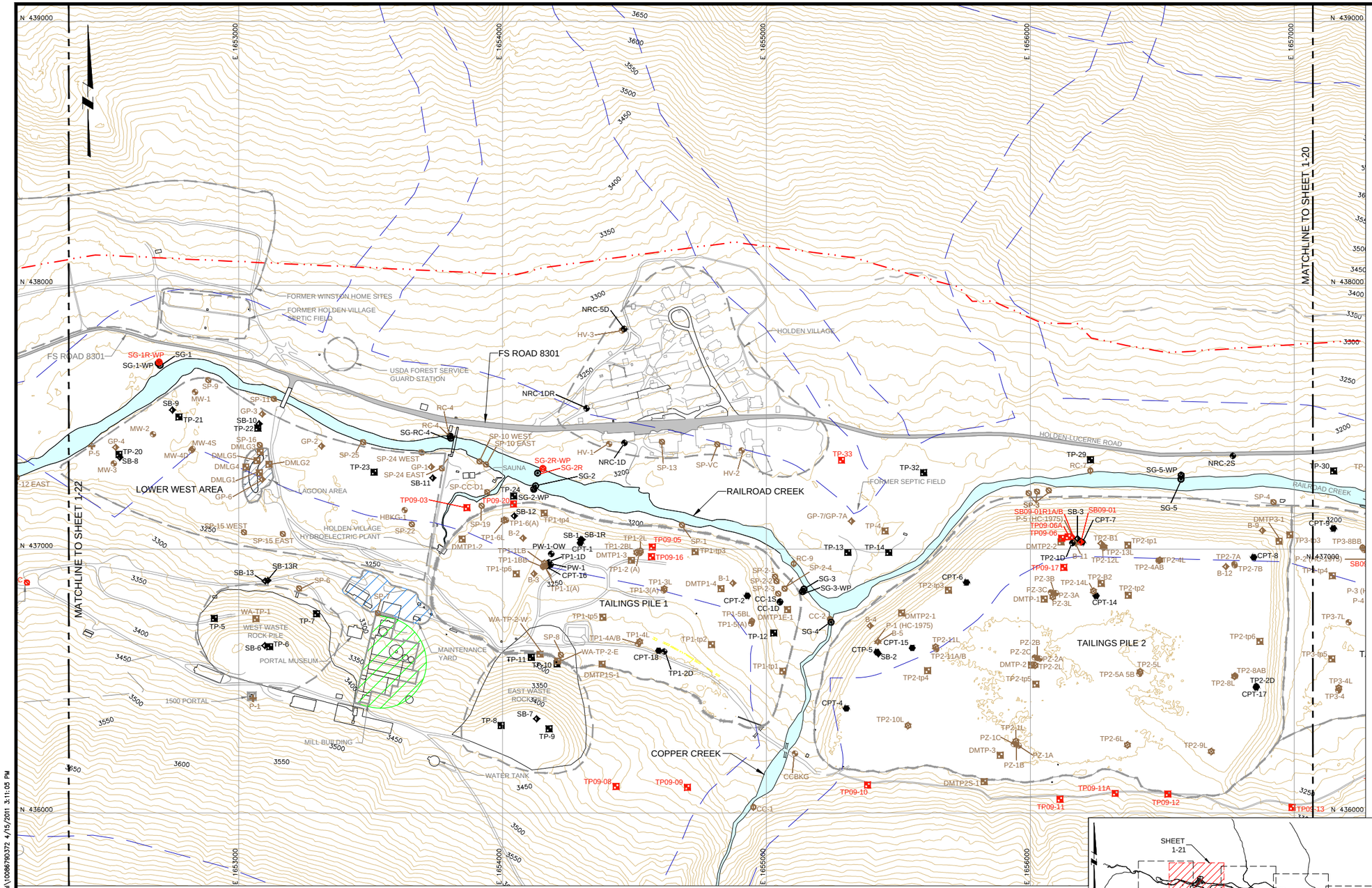

LEGEND:

TP1-1BB	BATT TIP
CPT-1	CONE PENETROMETER TEST PROBE
SG-1-WP	DRIVEN WELL POINT
SB-1	GEOTECHNICAL BORING EXPLORATION
HB-1	HAND AUGER
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SP-3	SEEP
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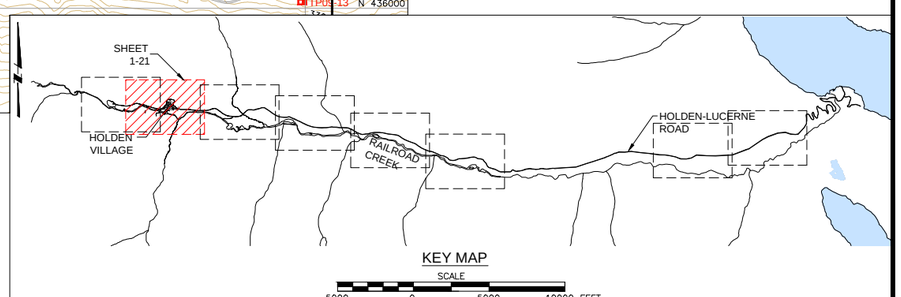
- 2008 URS INVESTIGATION LOCATIONS
- HISTORICAL INVESTIGATION LOCATIONS (BY OTHERS)

PLAN

SCALE
200 0 200 400 FEET
CONTOUR INTERVAL = 10 FEET



KEY MAP

SCALE
5000 0 5000 10000 FEET

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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- MWH 2010 FIELD DATA SURVEY PROVIDED BY EHRLANDSEN SURVEYING DATED DECEMBER 27, 2010

DESIGNED BY	J. THOMPSON	03/28/11
DRAWN BY	R. WATT	03/28/11
CHECKED BY	D. RODRIGUEZ	03/28/11
APPROVED BY	P. CROUSE	03/28/11
PROJECT MANAGER	R. SCHLICHER	03/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: INVESTIGATION LOCATIONS (SHEET 7 OF 8)

MWH

SHEET 1-21 | REVISION B
FILE NAME 1008679D372

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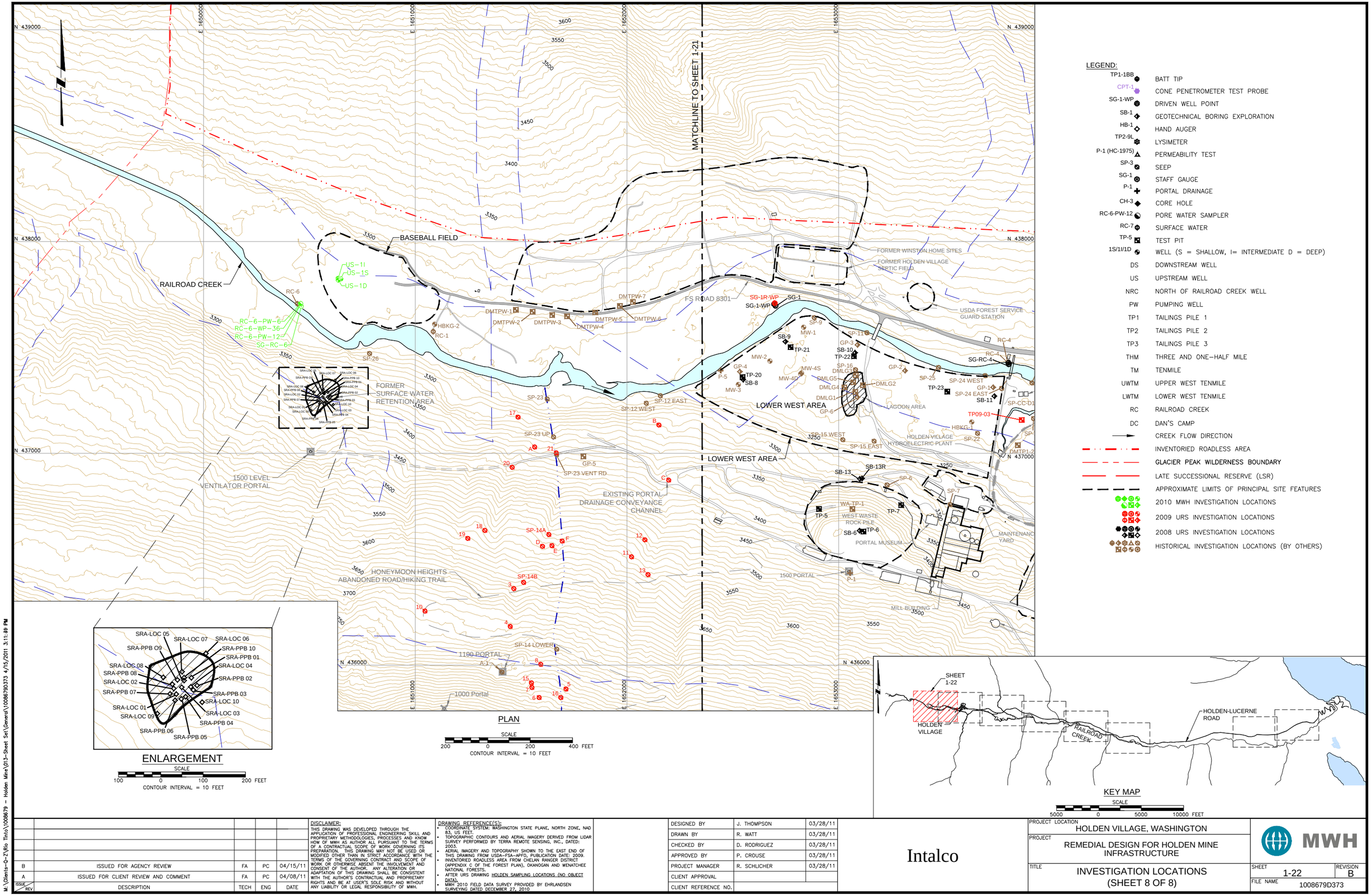

ENLARGEMENT

SCALE
100 0 100 200 FEET
CONTOUR INTERVAL = 10 FEET

PLAN

SCALE
200 0 200 400 FEET
CONTOUR INTERVAL = 10 FEET

KEY MAP

SCALE
5000 0 5000 10000 FEET

LEGEND:

- TP1-1BB — BATT TIP
- CPT-1 — CONE PENETROMETER TEST PROBE
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A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DESIGNED BY	J. THOMPSON	03/28/11
DRAWN BY	R. WATT	03/28/11
CHECKED BY	D. RODRIGUEZ	03/28/11
APPROVED BY	P. CROUSE	03/28/11
PROJECT MANAGER	R. SCHLICHER	03/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

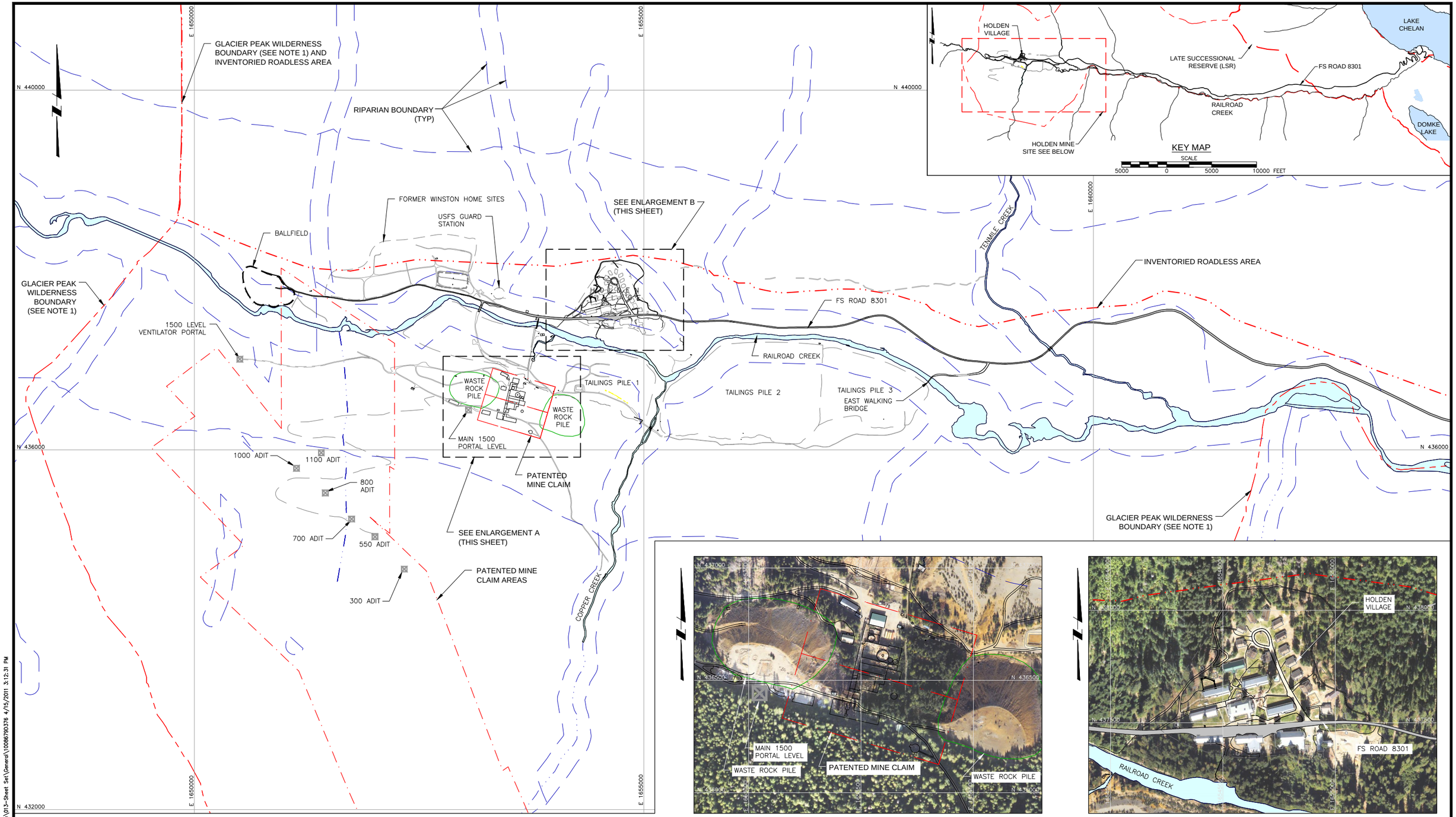
TITLE: INVESTIGATION LOCATIONS (SHEET 8 OF 8)

MWH

SHEET 1-22 | REVISION B

FILE NAME 1008679D373

M:\Clients—O—Z\Rio Tinto\1008679 – Holden Mine\013–Sheet Set\General\1008679D373 4/15/2011 3:11:49 PM



NOTE:

1. GLACIER PEAK WILDERNESS BOUNDARY LOCATION CONSIDERED APPROXIMATE AT THIS TIME (SOURCE: WILDERNESS.NET).

PLAN
SCALE
500 0 500 1000 FEET

ENLARGEMENT A
MILL FACILITIES
SCALE
200 0 200 400 FEET

ENLARGEMENT B
HOLDEN VILLAGE
SCALE
200 0 200 400 FEET

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DESIGNED BY	D. RODRIGUEZ	04/04/11
DRAWN BY	R. WATT	04/04/11
CHECKED BY	D. RODRIGUEZ	04/04/11
APPROVED BY	P. CROUSE	04/04/11
PROJECT MANAGER	R. SCHLICHER	04/04/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

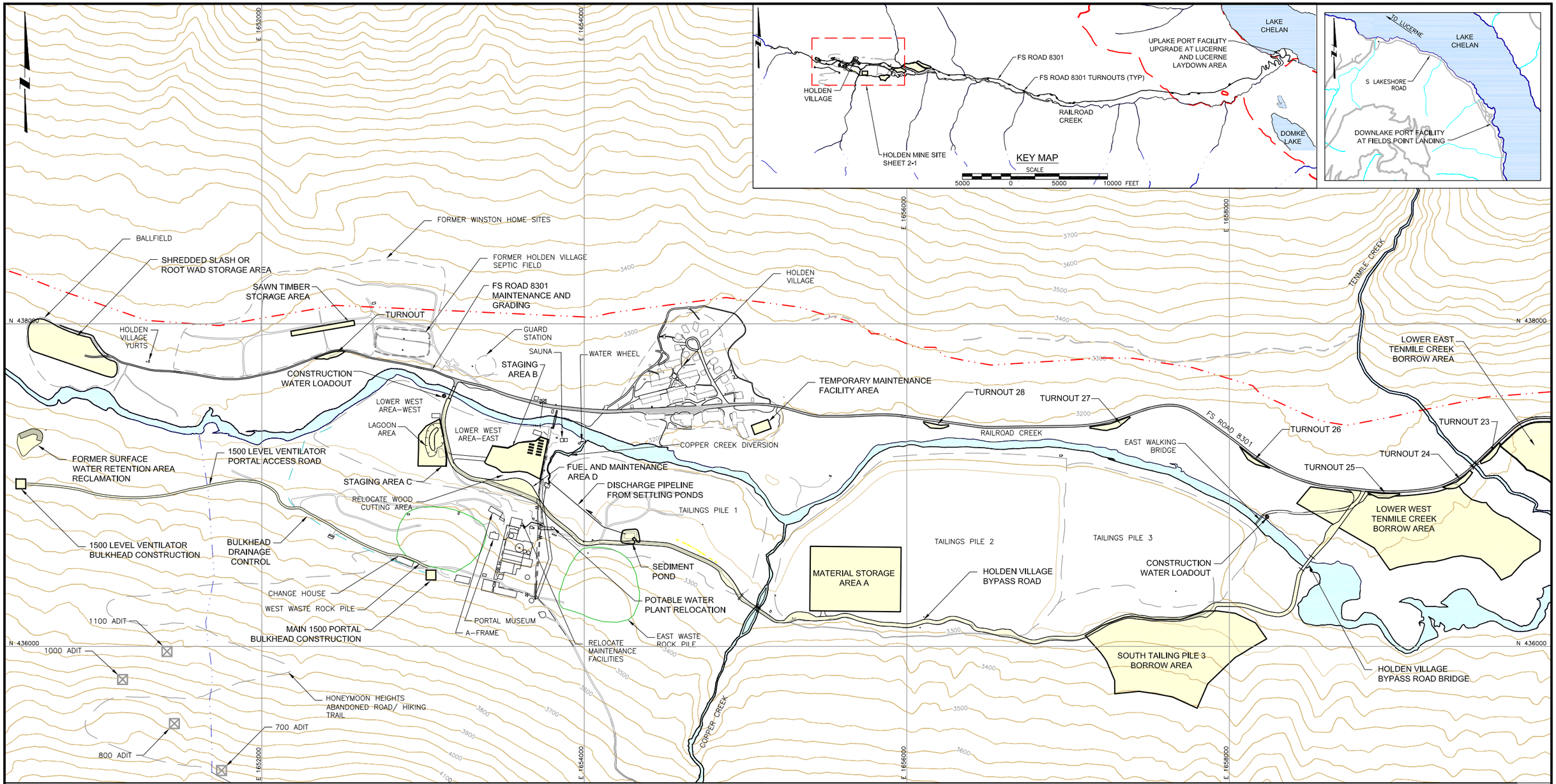
Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: SITE BOUNDARIES MAP

MWH

SHEET: 1-23
REVISION: B
FILE NAME: 1008679D376

M:\Clients-Q-Z\Rio Tinto\1008679 - Holden Mine\013-Sheet Set\General\1008679D376 4/15/2011 3:12:31 PM



LEGEND:

YEAR 1 SITE DEVELOPMENT FEATURE

PLAN
SCALE
300 0 300 600 FEET
CONTOUR INTERVAL = 50 FEET

NOTES:

1. TURNOUTS SHOWN ON SHEETS 10–3–12 THROUGH 10–3–25, SHALL BE INCLUDED IN YEAR 1 SITE DEVELOPMENT.
2. THE WOOD CUTTING AREA SHALL BE RELOCATED TO THE SAWN TIMBER STORAGE AREA OR THE BALLFIELD.
3. THE MAINTENANCE FACILITIES SHALL BE RELOCATED.

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	F.A	P.G.C.	04/15/11
A	ISSUED FOR CLIENT COMMENT AND REVIEW	F.A.	P.G.C.	04/08/11

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DESIGNED BY	DJR/RTL	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: YEAR 1 SITE DEVELOPMENT
SHEET: 2-1
REVISION: B
FILE NAME: 1008679D388

MWH

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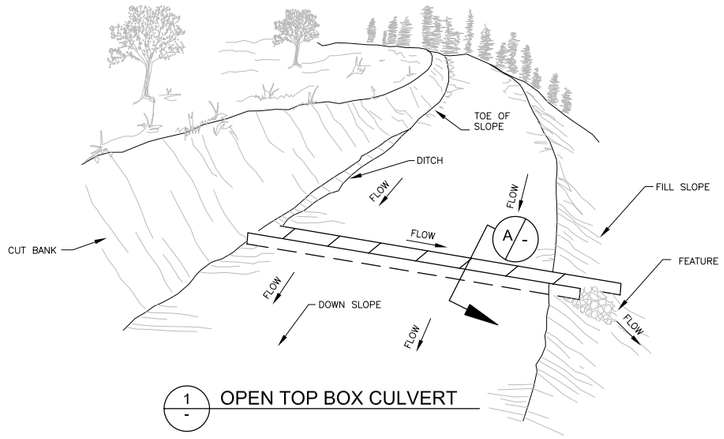
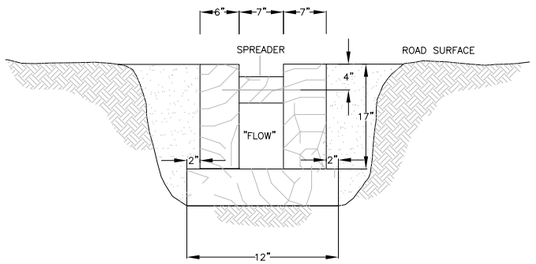
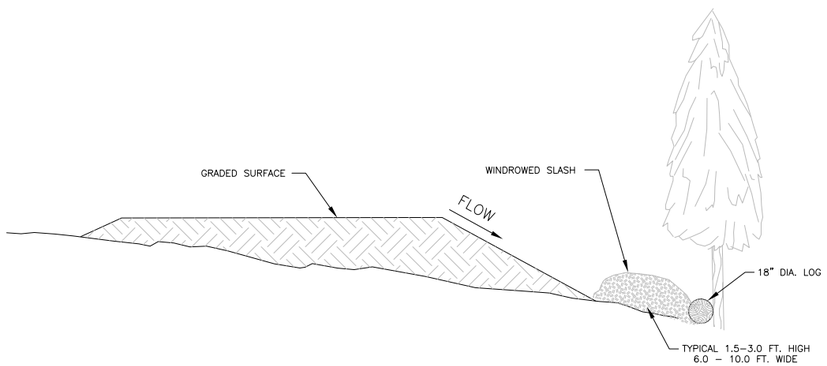


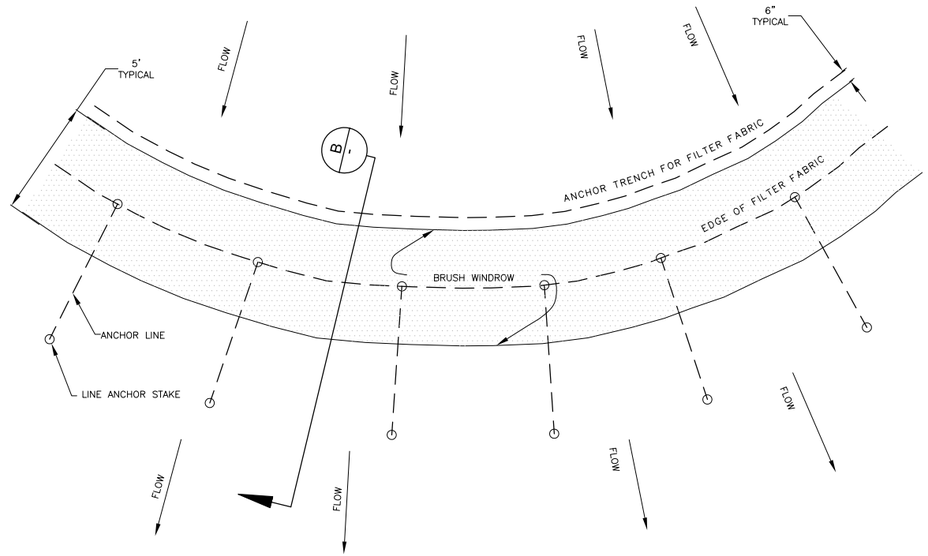
1 / - OPEN TOP BOX CULVERT



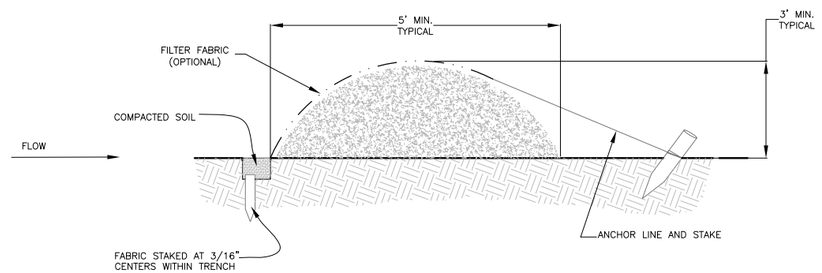
A / 1 OPEN TOP BOX CULVERT SECTION A-A'



2 / - SLASH FILTER WINDROW



3 / - BRUSH SEDIMENT BARRIER



B / - BRUSH SEDIMENT BARRIER B-B'

NOTES:

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3. THIS DRAWING IS NOT TO SCALE

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
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A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):
- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.
- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA–FSA–APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 1 OF 8)

MWH

SHEET: 4-9
REVISION: B
FILE NAME: 1008679D297

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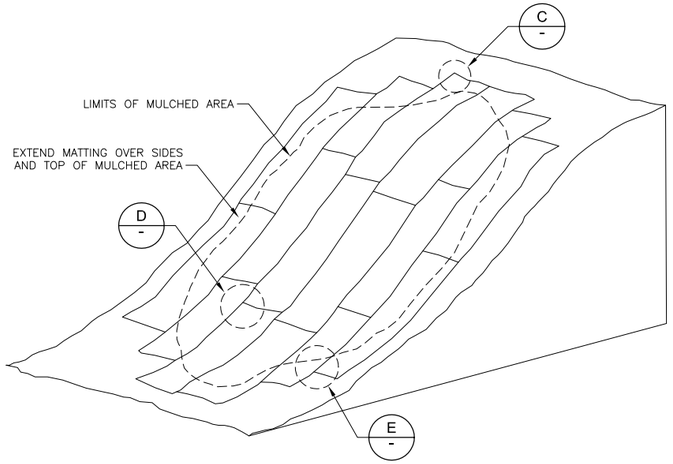
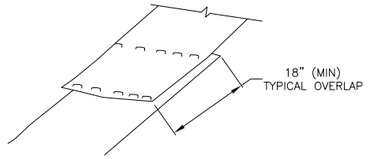


4 - EROSION CONTROL BLANKET



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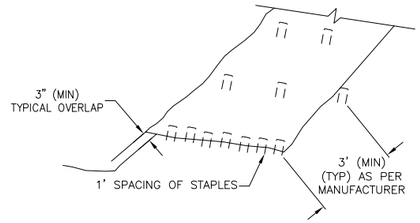

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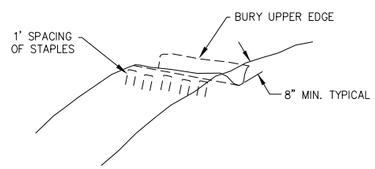

E - EROSION CONTROL BLANKET

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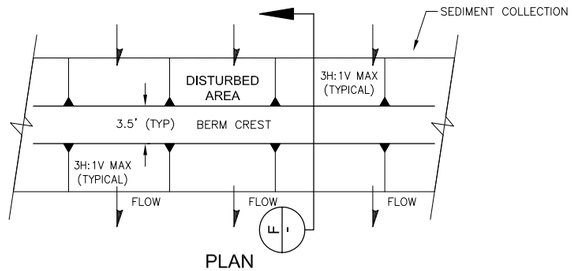
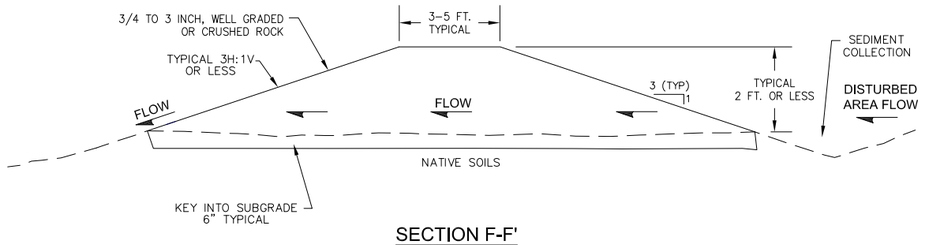
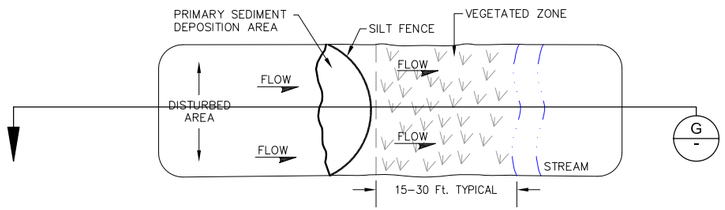


PLAN

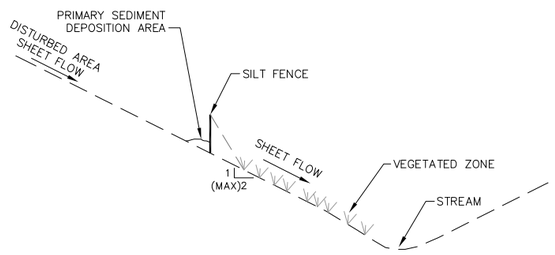


SECTION F-F'

5 - GRAVEL FILTER BERM



6 - VEGETATED BUFFER ZONE



G - VEGETATED BUFFER ZONE'

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DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

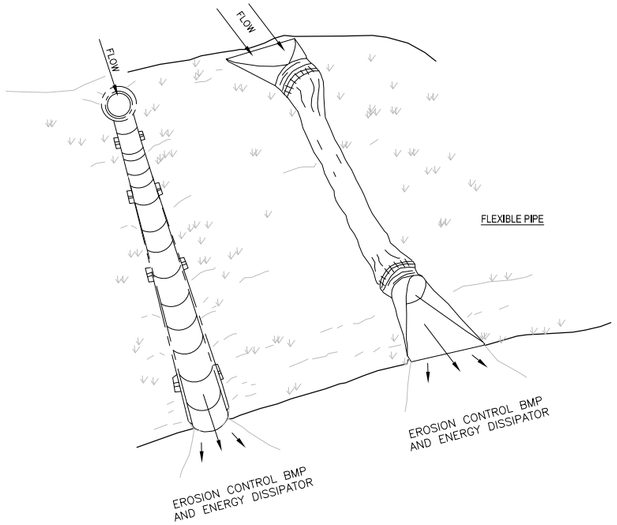
Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 2 OF 8)

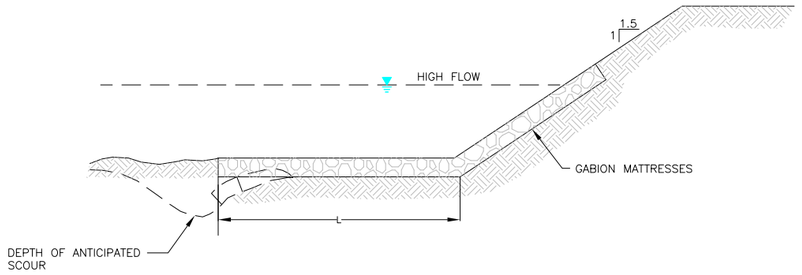
MWH

SHEET: 4-10
REVISION: B
FILE NAME: 1008679D298

M:\Clients-0-Z\Rio Tinto\1008679 - Holden Mine\013-Sheet Set\Surface Water And Sediment Control\1008679D298 4/15/2011 3:09:43 PM

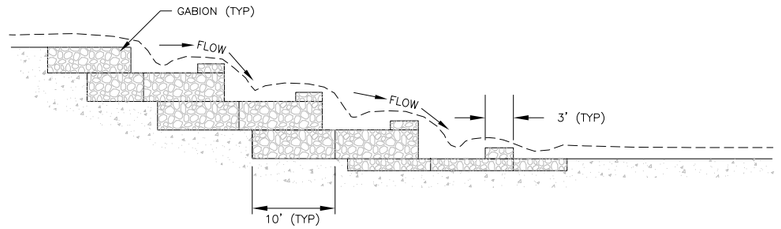


7 - NON-ROCK DROP STRUCTURES



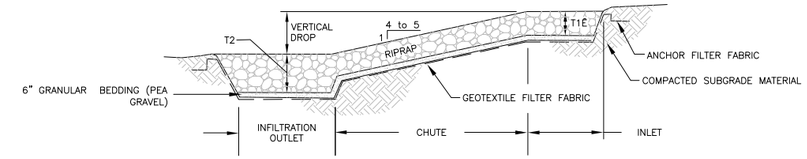
SECTION

9 - SLOPE STABILIZATION



SECTION

10 - EROSION CONTROL



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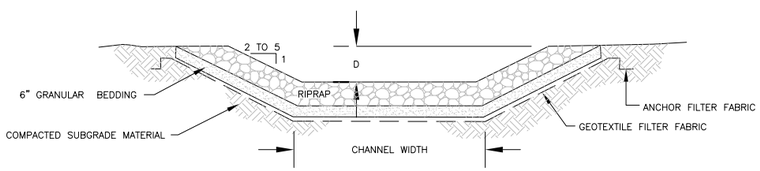
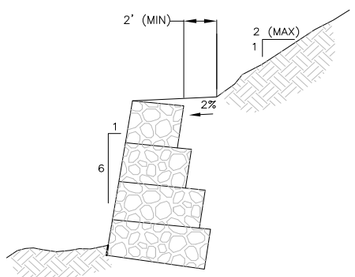


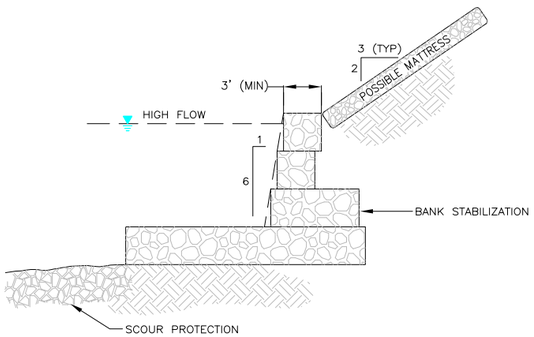
END VIEW

8 - TYPICAL RIPRAP DROP STRUCTURE



SECTION

RETAINING WALL



SECTION

BANK STABILIZATION

11 - GABIONS

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ISSUE REV	DESCRIPTION	TECH	ENG	DATE
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A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

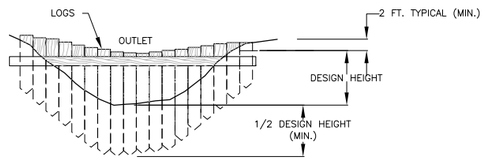
TITLE: BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 3 OF 8)

MWH

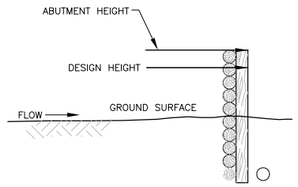
SHEET: 4-11

REVISION: B

FILE NAME: 1008679D299

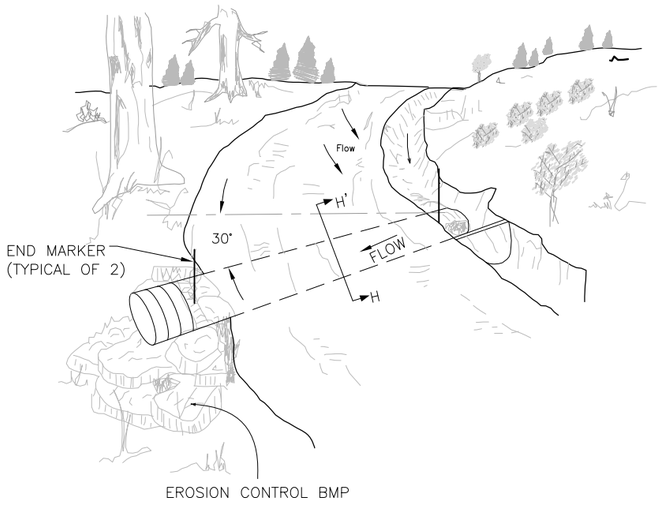


FRONT VIEW



SIDE VIEW

12 — LOG CHECK DAM



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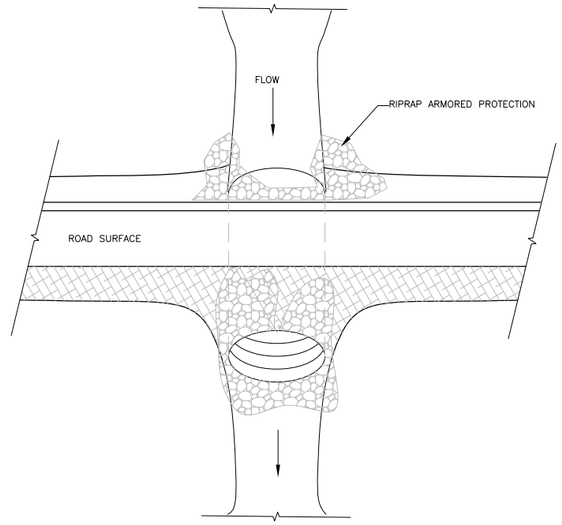
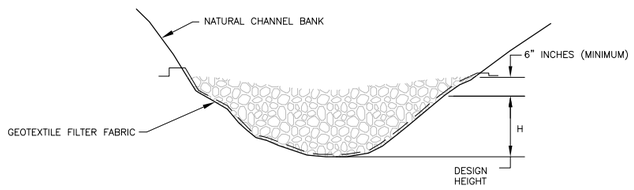


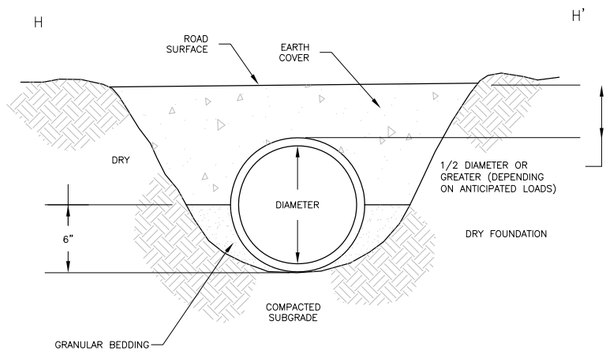
ISOMETRIC VIEW

SIDE VIEW



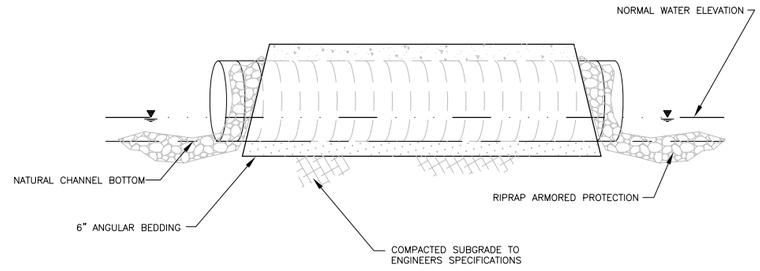
FRONT VIEW

13 — ROCK CHECK DAM



SECTION H-H'

14 — CULVERT CROSSING



ELEVATION

15 — CULVERT UNDER ROAD

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APPROVED BY	P. CROUSE	02/28/11
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CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 4 OF 8)

MWH

SHEET: 4-12
REVISION: B
FILE NAME: 1008679D300

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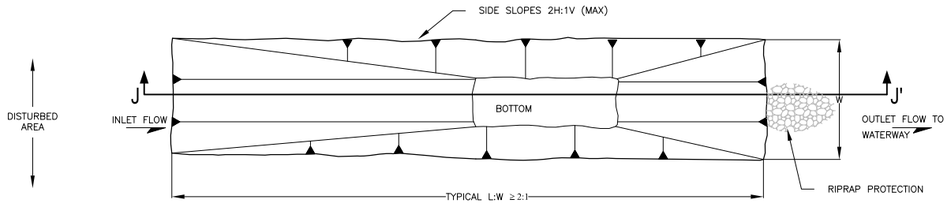
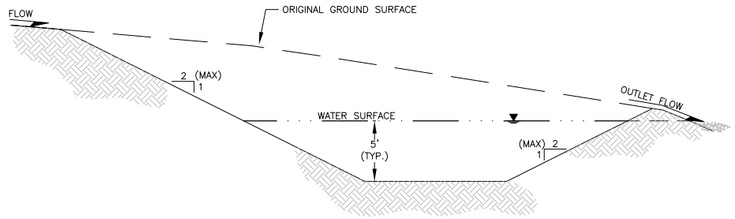
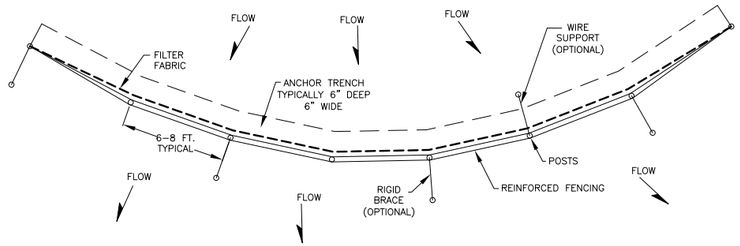


PLAN

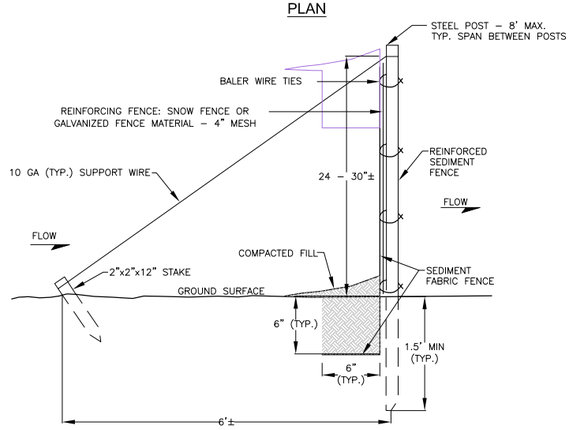


SECTION J-J'

16 -- SEDIMENT TRAP OR CATCH BASIN

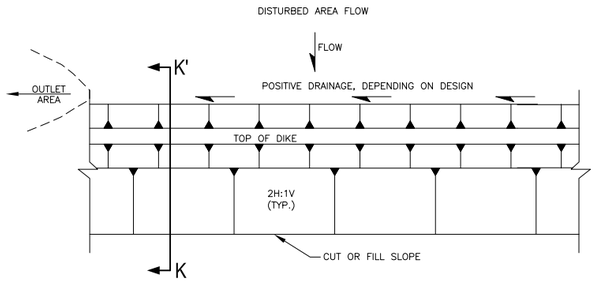


PLAN

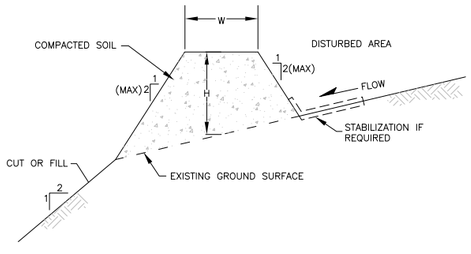


ELEVATION

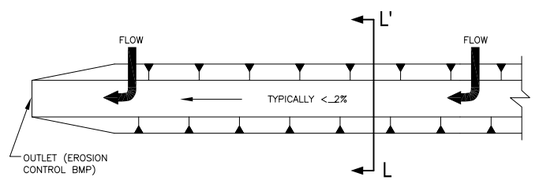
18 -- TYPICAL FILTER FENCE INSTALLATION



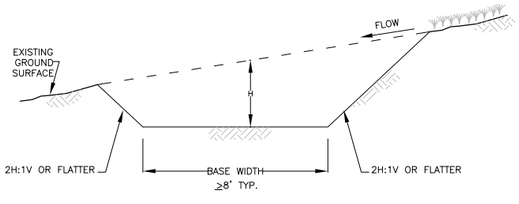
PLAN



SECTION K-K'



PLAN



SECTION L-L'

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17 -- DIVERSION DIKE

19 -- DIVERSION DITCH

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DRAWING REFERENCE(S):

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 5 OF 8)

MWH

SHEET: 4-13
REVISION: B
FILE NAME: 1008679D301

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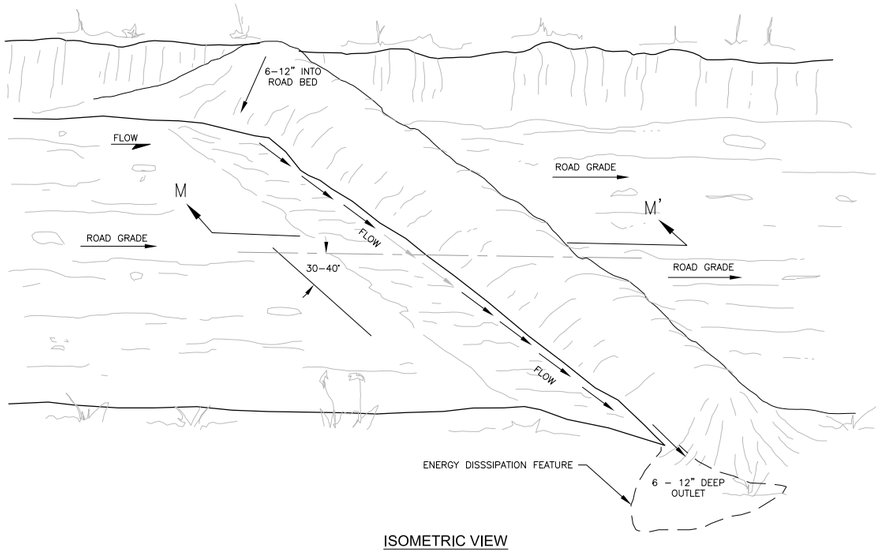
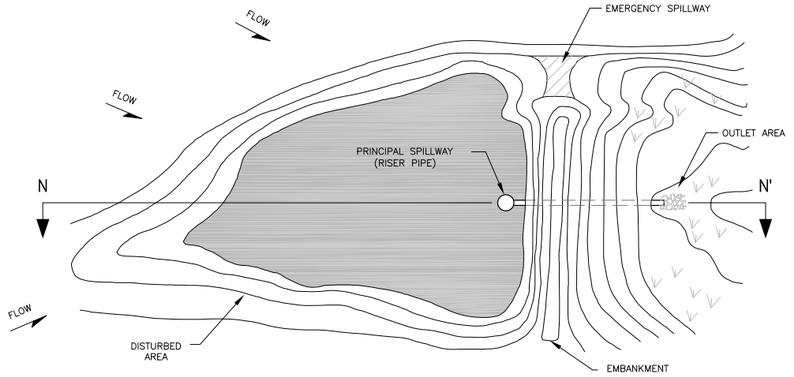
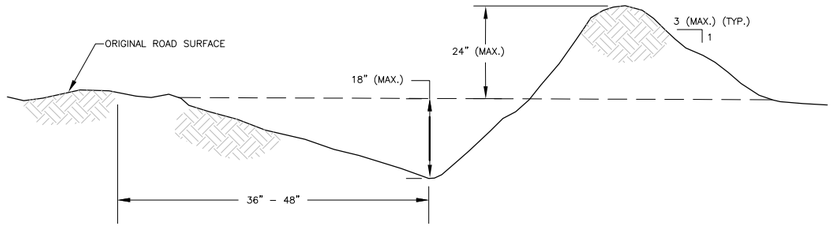


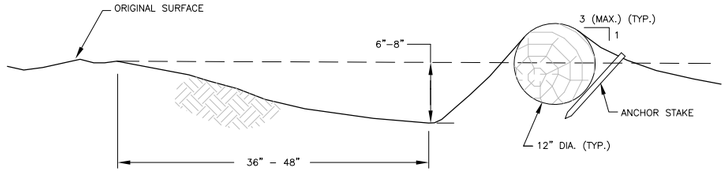
ISOMETRIC VIEW



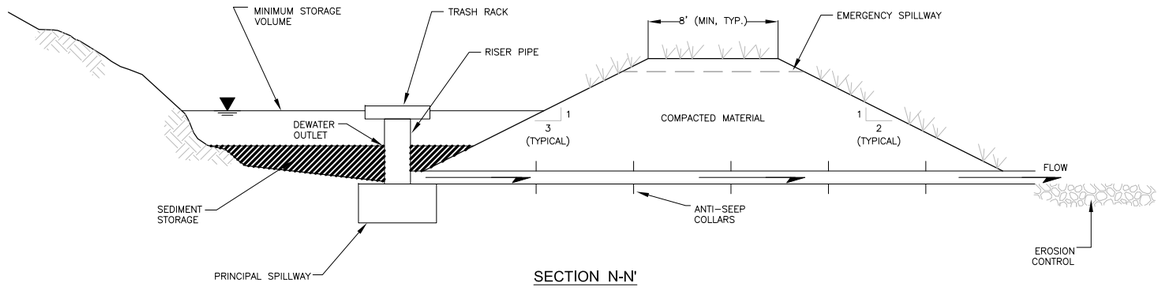
PLAN



M -- EARTHEN WATERBAR



20 -- EARTHEN AND LOG WATERBAR



SECTION N-N'

21 -- SEDIMENT DETENTION POND

NOTES:

1. ALL BMPs ARE TYPICAL. SELECTION OF BMPs AND FINAL DESIGN DETAILS SHALL BE DETERMINED BY ENGINEER PRIOR TO CONSTRUCTION.
2. FIELD PLACEMENT SHALL BE DETERMINED BY ENGINEER DURING CONSTRUCTION.
3. THIS DRAWING IS NOT TO SCALE

ISSUE/REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 6 OF 8)

MWH

SHEET: 4-14
REVISION: B
FILE NAME: 1008679D325

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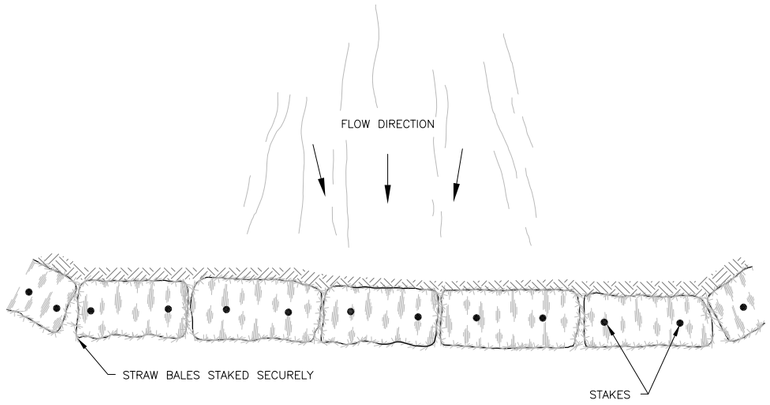

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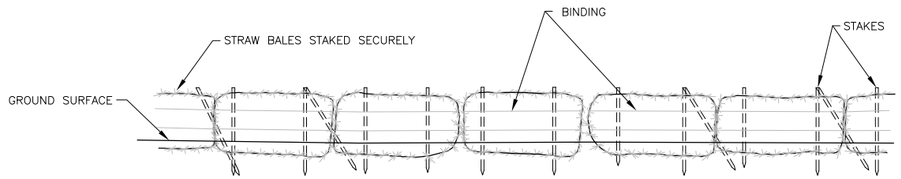

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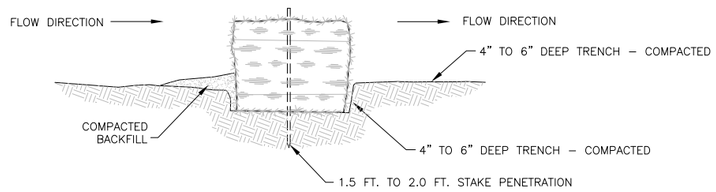
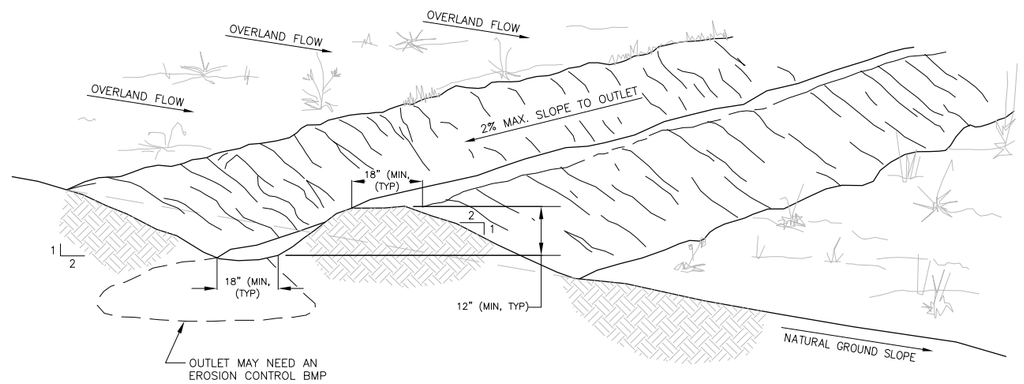
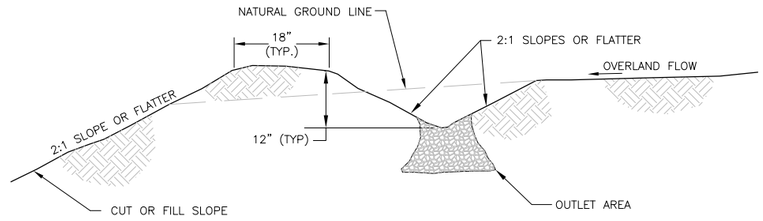


EMBEDDING DETAIL

22 - STRAW BALE BARRIER



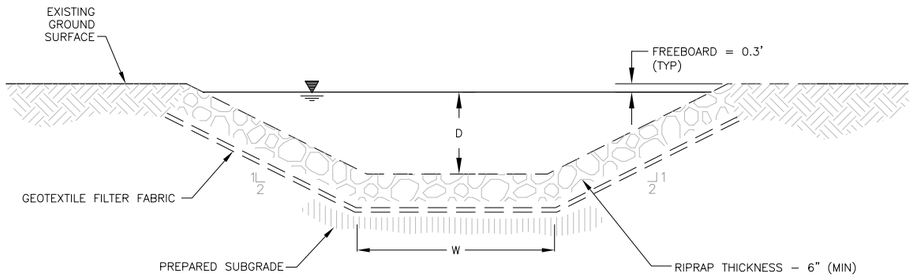
INTERCEPTOR TRENCH



END VIEW

NOTE:

1. BED OF TRENCH MAY BE RIP.RAPPED



D = DESIGN FLOW DEPTH
W = DESIGN WIDTH

NOTE:

1. A GEOTEXTILE FILTER FABRIC OR GRANULAR BEDDING MAY NOT ALWAYS BE NECESSARY.

23 - TYPICAL RIPRAP LINED DITCH

NOTES:

1. ALL BMPs ARE TYPICAL. SELECTION OF BMPs AND FINAL DESIGN DETAILS SHALL BE DETERMINED BY ENGINEER PRIOR TO CONSTRUCTION.
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3. THIS DRAWING IS NOT TO SCALE

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
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DRAWING REFERENCE(S):

DESIGNED BY	P. PELLICER	02/28/11	
DRAWN BY	F. ANDRADE	02/28/11	
CHECKED BY	D. RODRIGUEZ	02/28/11	
APPROVED BY	P. CROUSE	02/28/11	
PROJECT MANAGER	R. SCHLICHER	02/28/11	
CLIENT APPROVAL			
CLIENT REFERENCE NO.			

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 7 OF 8)

MWH

SHEET: 4-15
REVISION: B
FILE NAME: 1008679D326

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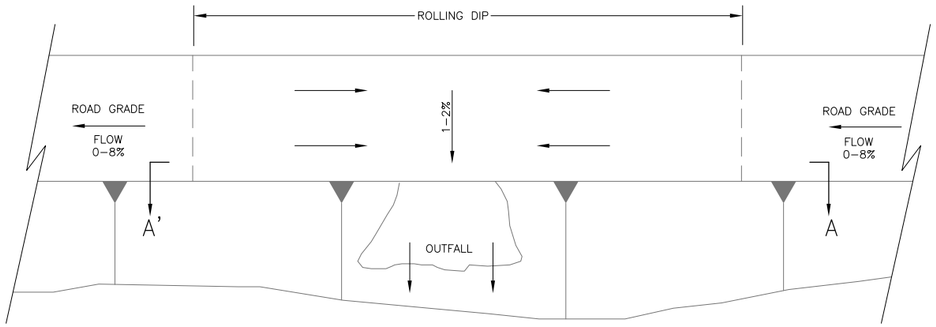

PLAN

A A'

SECTION A-A'

24 - ROLLING DIP

NOTE:

1. OUTFALL AREA MAY NEED AN EROSION CONTROL BMP.

NOTES:

1. ALL BMPs ARE TYPICAL. SELECTION OF BMPs AND FINAL DESIGN DETAILS TO BE DETERMINED BY ENGINEER PRIOR TO CONSTRUCTION.
2. FIELD PLACEMENT TO BE DETERMINED BY ENGINEER DURING CONSTRUCTION.
3. ALL DRAWINGS NOT TO SCALE.

ISSUE/REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWN BY	F. ANDRADE	02/28/11	
CHECKED BY	D. RODRIGUEZ	02/28/11	
APPROVED BY	P. CROUSE	02/28/11	
PROJECT MANAGER	R. SCHLICHER	02/28/11	
CLIENT APPROVAL			
CLIENT REFERENCE NO.			

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BEST MANAGEMENT PRACTICES (BMP'S) (SHEET 8 OF 8)

MWH

SHEET: 4-16
REVISION: B
FILE NAME: 1008679D327

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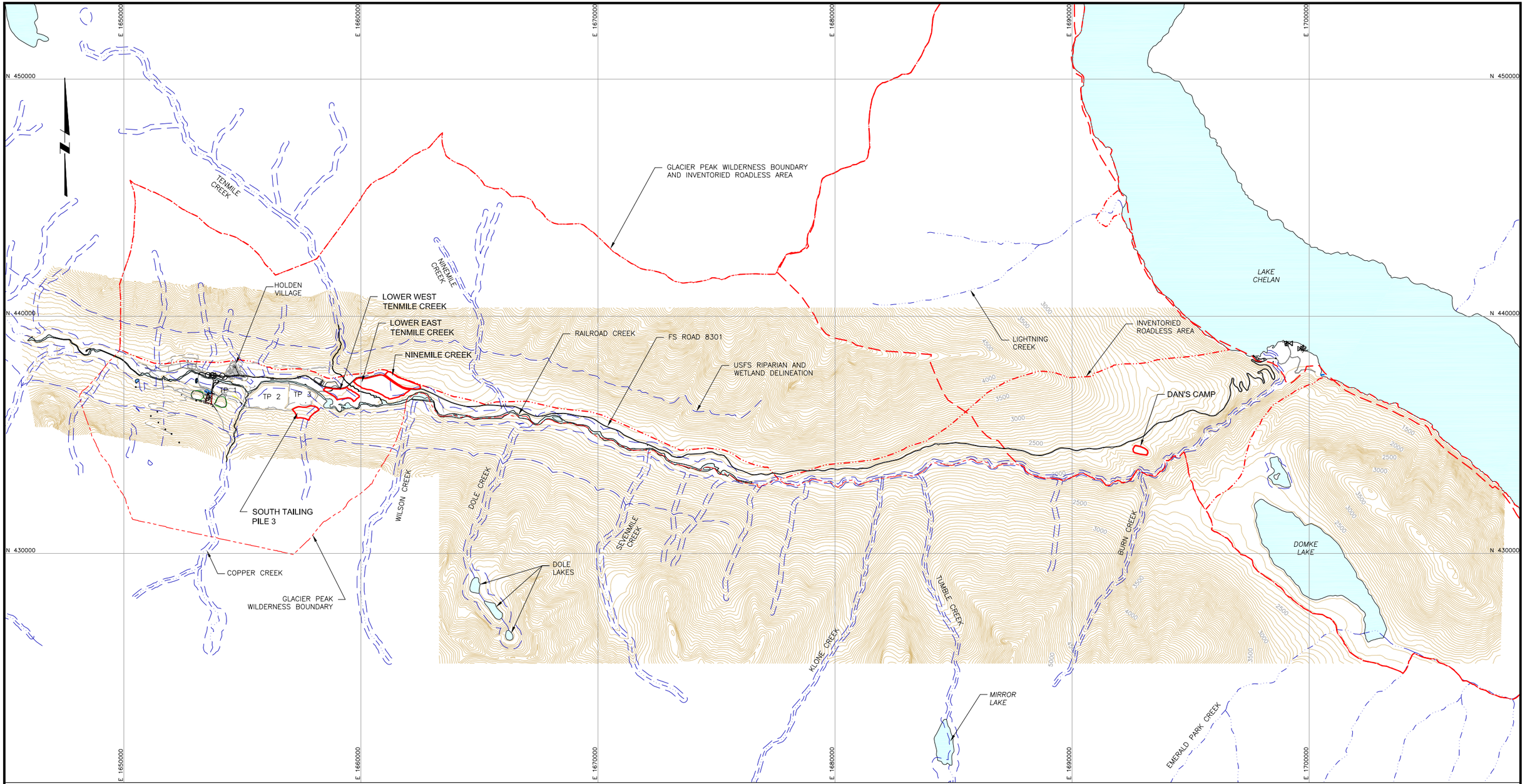

PLAN

SCALE

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CONTOUR INTERVAL = 50 FEET

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ISSUE / REV					
B	ISSUED FOR AGENCY REVIEW	F.A.	P.G.C.	04/15/11	
A	ISSUED FOR CLIENT COMMENT AND REVIEW	F.A.	P.G.C.	03/07/11	

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DRAWING REFERENCE(S):

- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.
- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA–FSA–APFO, PUBLICATION DATE: 2009.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

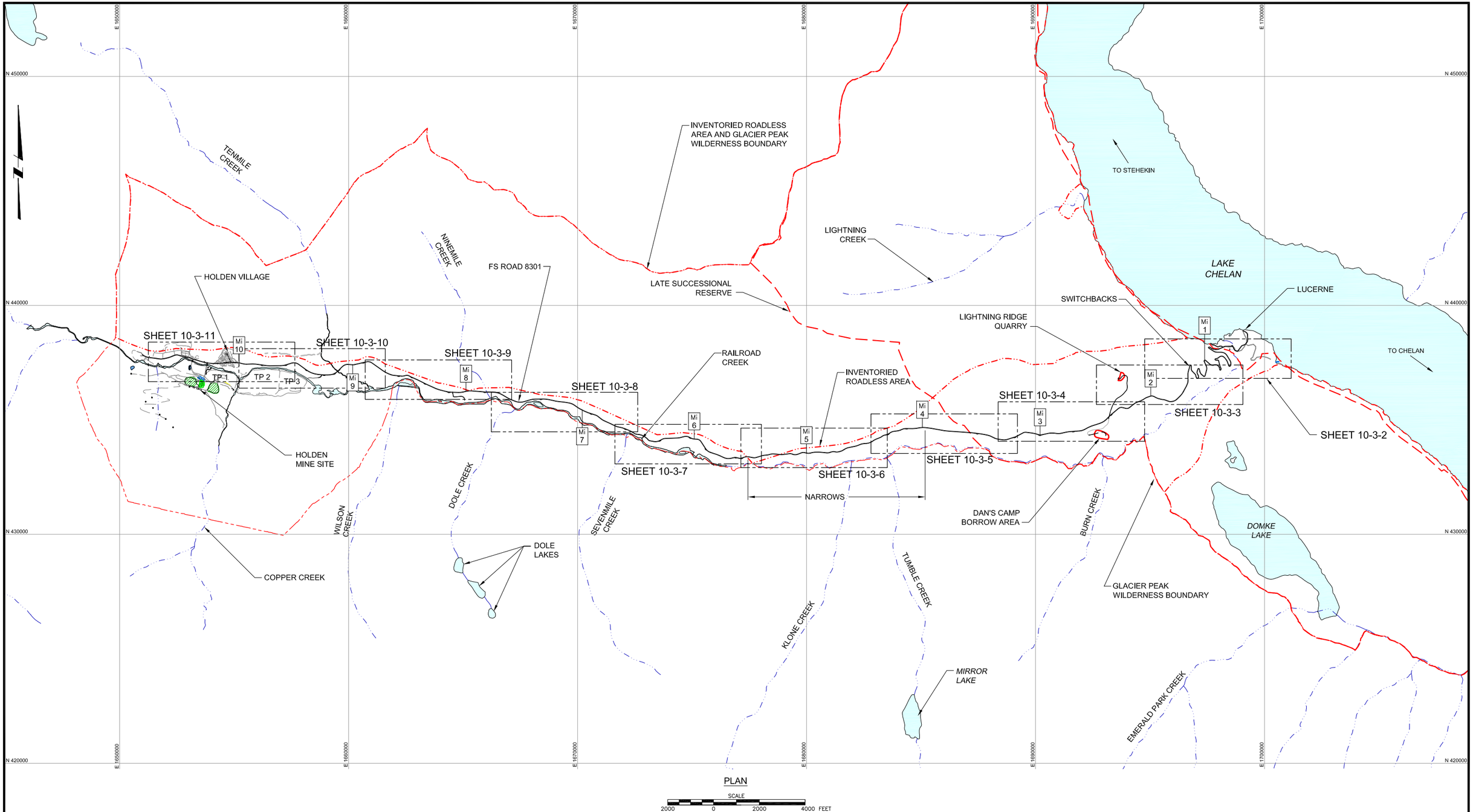
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: POTENTIAL BORROW SOURCE LOCATION MAP

MWH

SHEET 9-1 REVISION B

FILE NAME 1008679D383



PLAN

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ISSUE REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
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- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.
- FS ROAD 8301 TOPOGRPAHY RECEIVED FROM ERLANDSEN DATED; JANUARY 18, 2011.

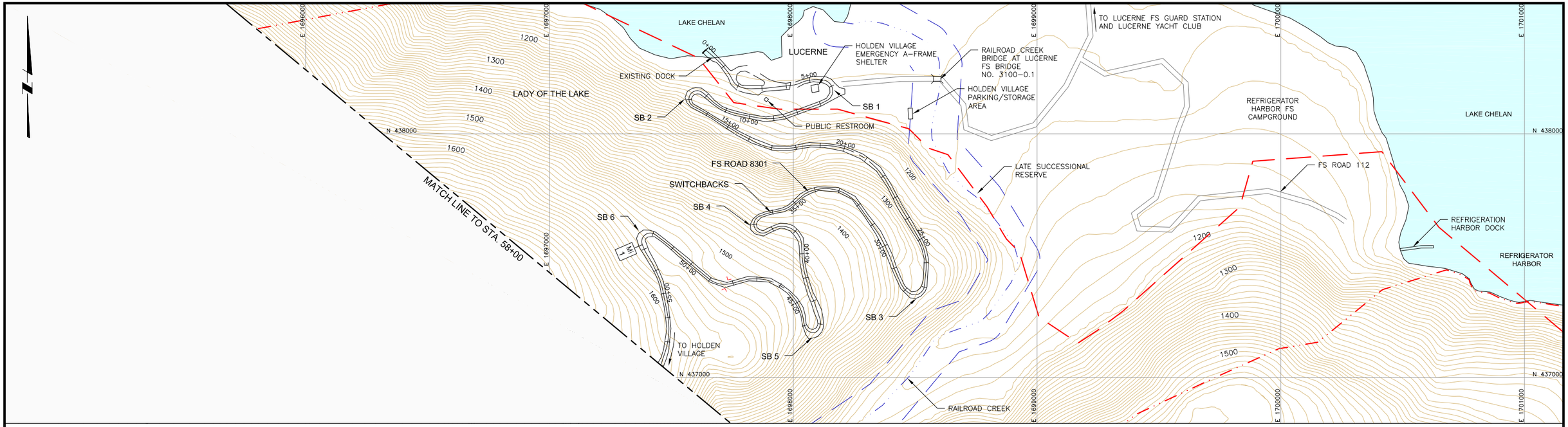
DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 KEY MAP

MWH

SHEET: 10-3-1
REVISION: B
FILE NAME: 1008679D237



PLAN

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NOTE:

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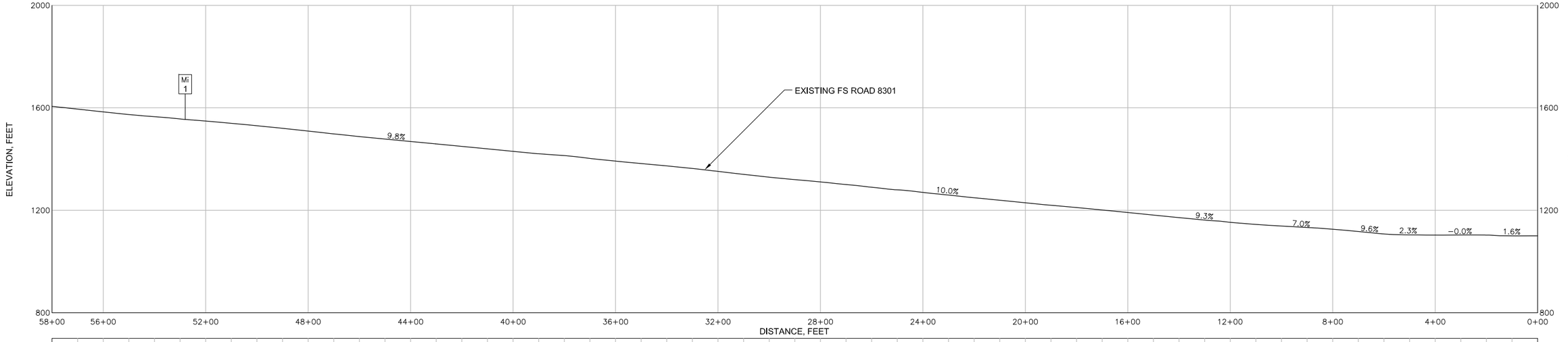

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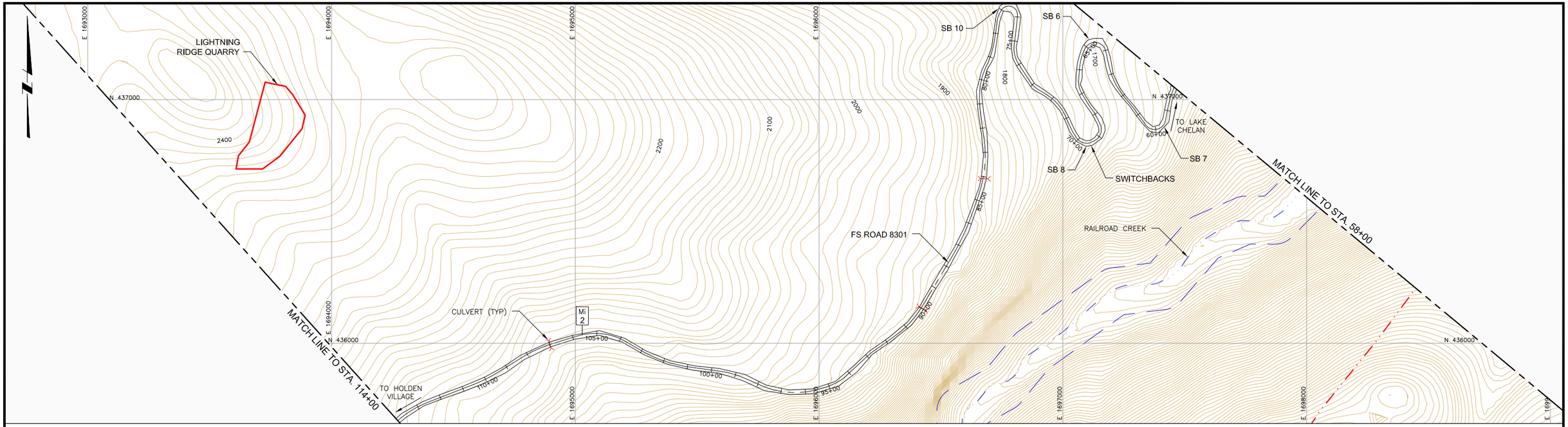

NOTE:

1. PLAN LOCATION SHOWN ON SHEET 10-3-1.

PLAN

SCALE

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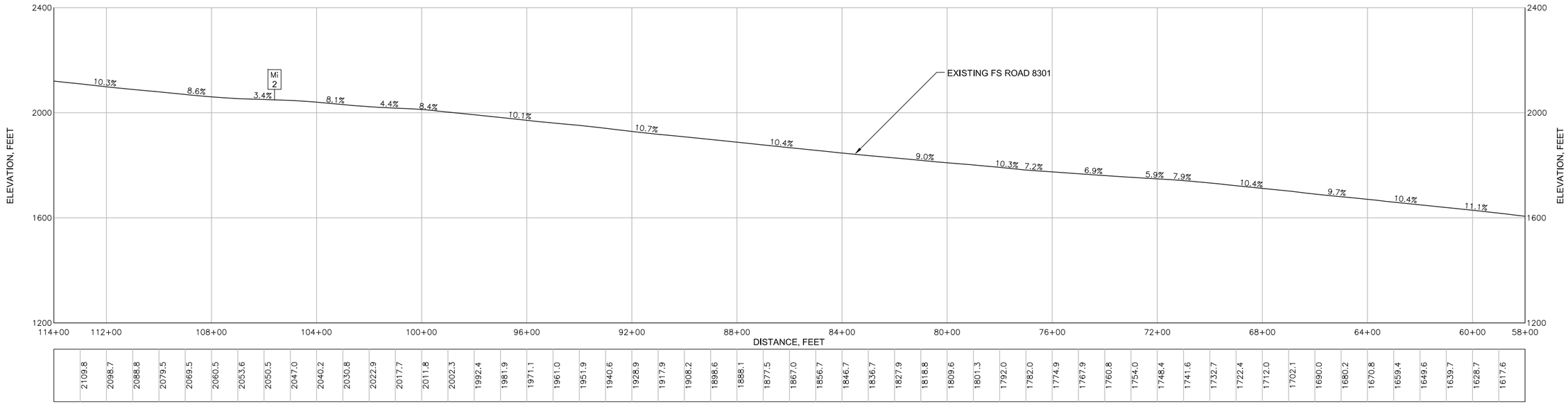
CONTOUR INTERVAL = 10 FEET



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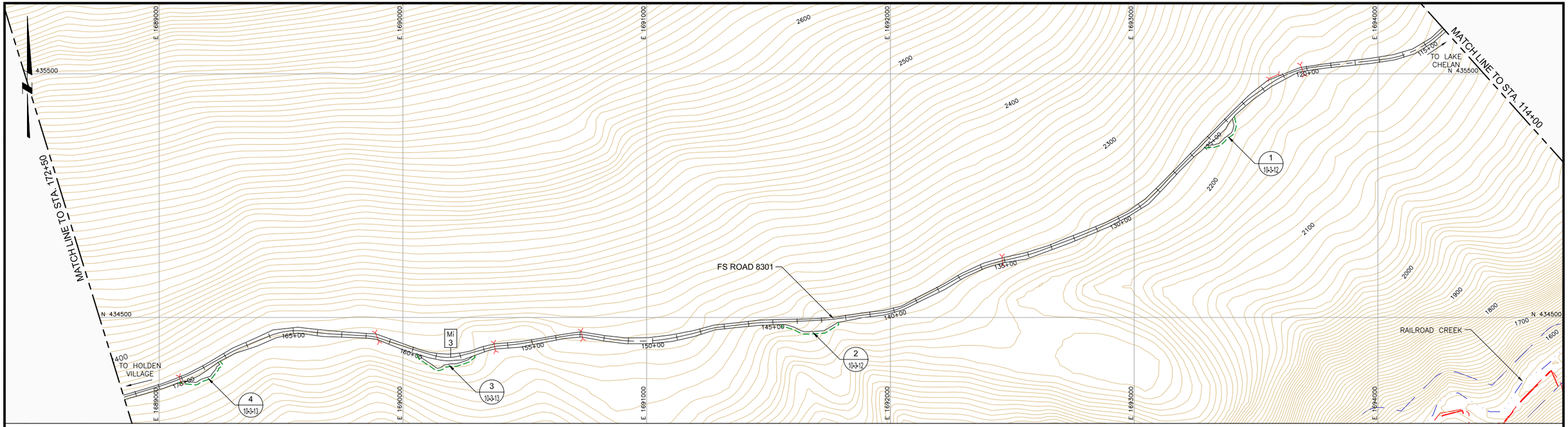
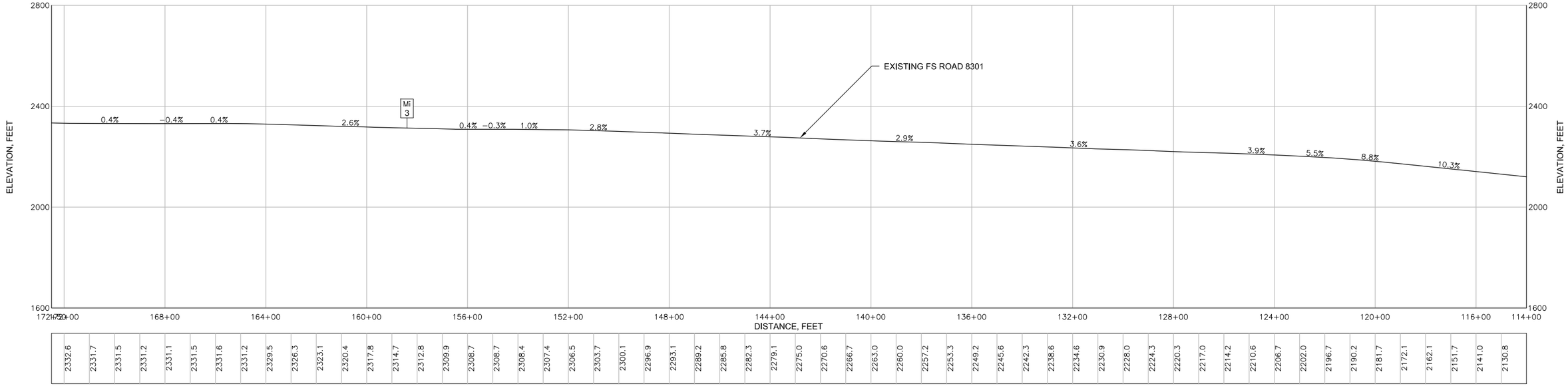


NOTE:

1. PLAN LOCATION SHOWN ON SHEET 10-3-1.

PLAN
SCALE
200 0 200 400 FEET
CONTOUR INTERVAL = 10 FEET



PROFILE
SCALE
200 0 200 400 FEET

NOTE:

1. GRADES SHOWN IN SECTION ARE AVERAGES, LOCALIZED STEEPER GRADES MAY EXIST.

ISSUE / REV					
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DRAWING REFERENCE(S):
- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.
- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA-FSA-APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/07/11	
DRAWN BY	F. ANDRADE	02/07/11	
CHECKED BY	D. RODRIGUEZ	02/08/11	
APPROVED BY	P. CROUSE	02/28/11	
PROJECT MANAGER	R. SCHLICHER	02/28/11	
CLIENT APPROVAL			
CLIENT REFERENCE NO.			

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 (STA 114+00 TO STA 172+50) PLAN AND PROFILE
SHEET: 10-3-4
REVISION: B
FILE NAME: 1008679D248

MWH

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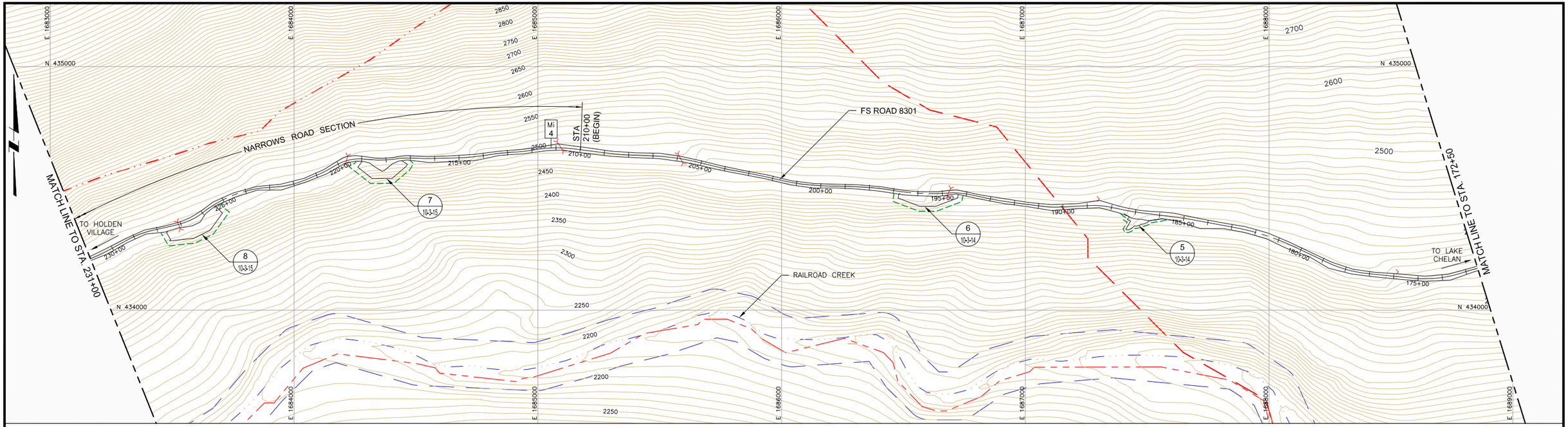
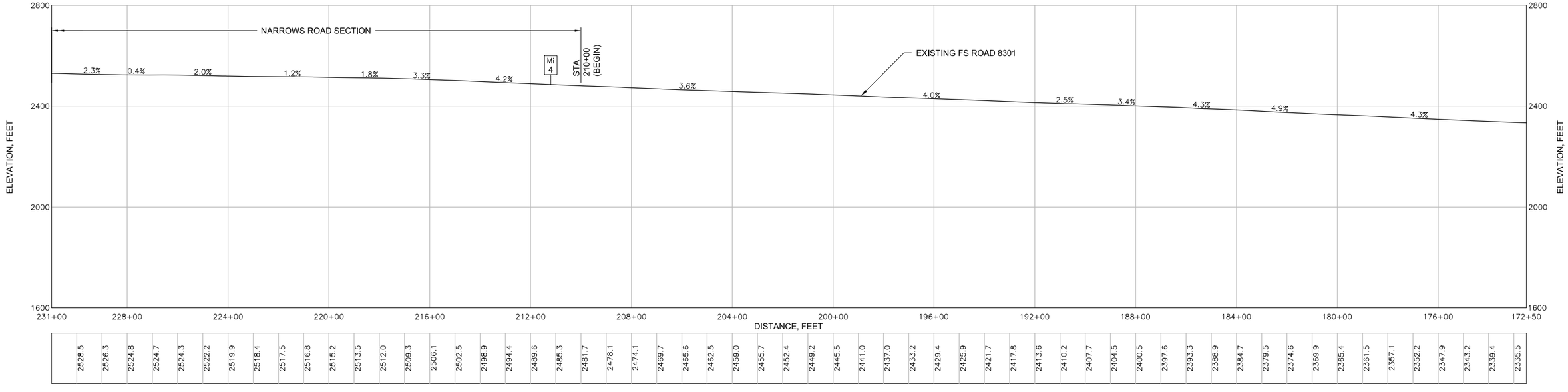


NOTE:

1. PLAN LOCATION SHOWN ON SHEET 10–3–1.

PLAN

SCALE
200 0 200 400 FEET
CONTOUR INTERVAL = 10 FEET



NOTE:

1. GRADES SHOWN ARE AVERAGES. LOCALIZED STEEPER GRADES MAY EXIST.

PROFILE

SCALE
200 0 200 400 FEET

ISSUE / REV					
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DRAWING REFERENCE(S):

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- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.
- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA–FSA–APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/07/11
DRAWN BY	F. ANDRADE	02/07/11
CHECKED BY	D. RODRIGUEZ	02/08/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 (STA 172+50 TO STA 231+00) PLAN AND PROFILE

MWH

SHEET: 10-3-5
REVISION: B
FILE NAME: 1008679D249

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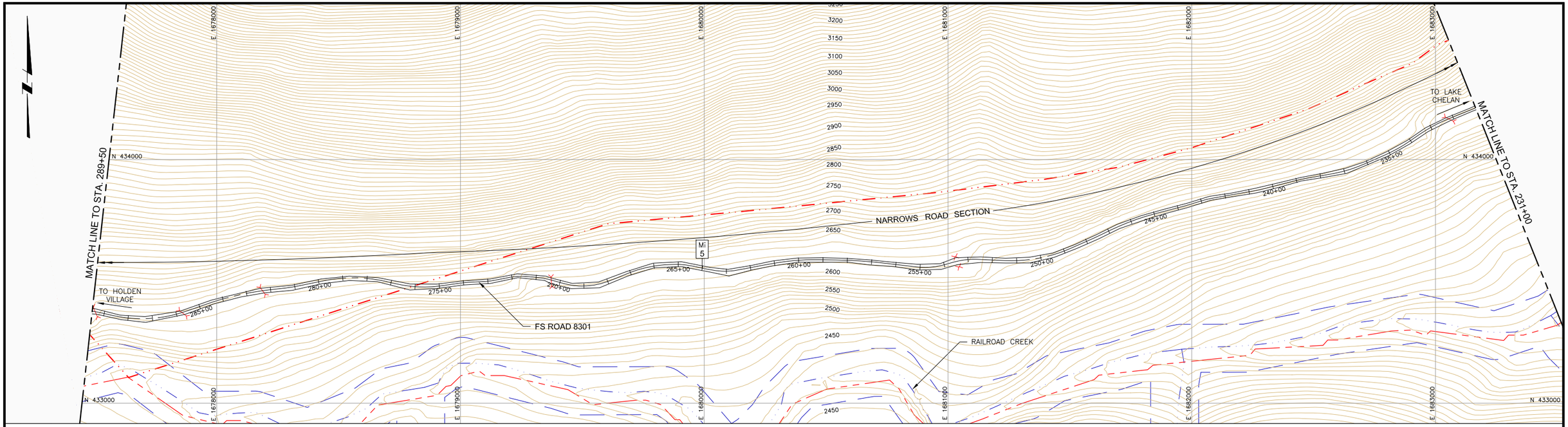


NOTE:

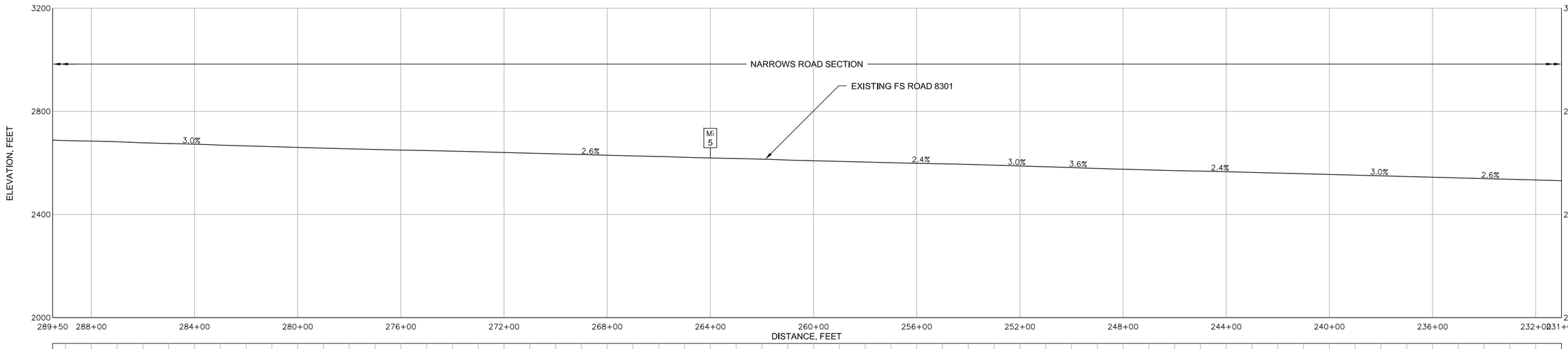
1. PLAN LOCATION SHOWN ON SHEET 10-3-1.

PLAN

SCALE

200 0 200 400 FEET

CONTOUR INTERVAL = 10 FEET



NOTE:

1. GRADES SHOWN ARE AVERAGES. LOCALIZED STEEPER GRADES MAY EXIST.

PROFILE

SCALE

200 0 200 400 FEET

ISSUE REV					
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DRAWN BY	F. ANDRADE	02/07/11
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APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 (STA 231+00 TO STA 289+50) PLAN AND PROFILE

MWH

SHEET: 10-3-6

REVISION: A

FILE NAME: 1008679D250

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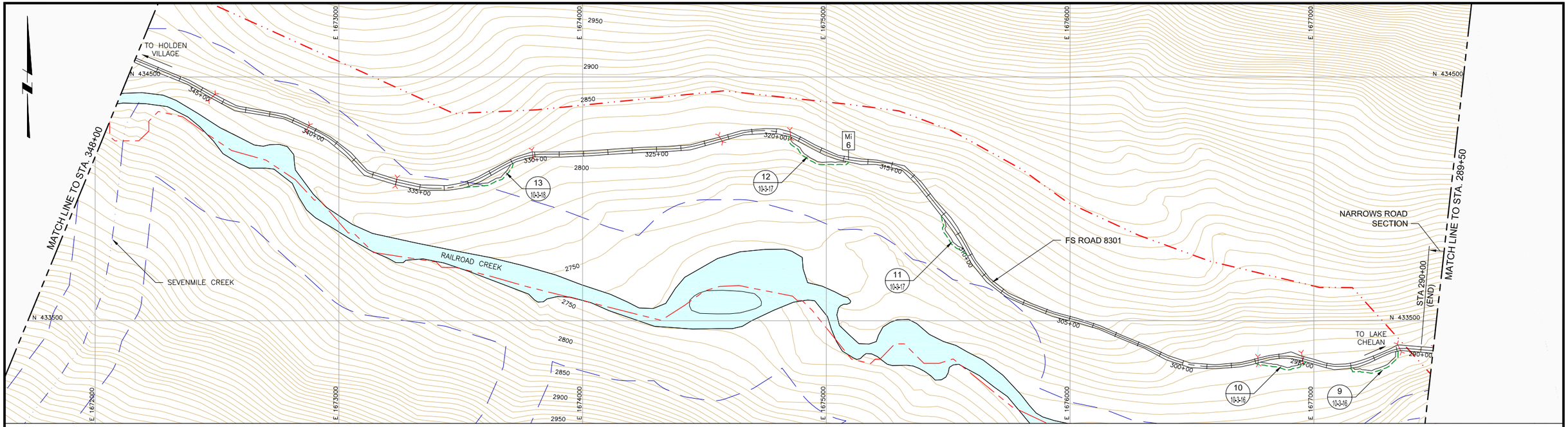


NOTE:

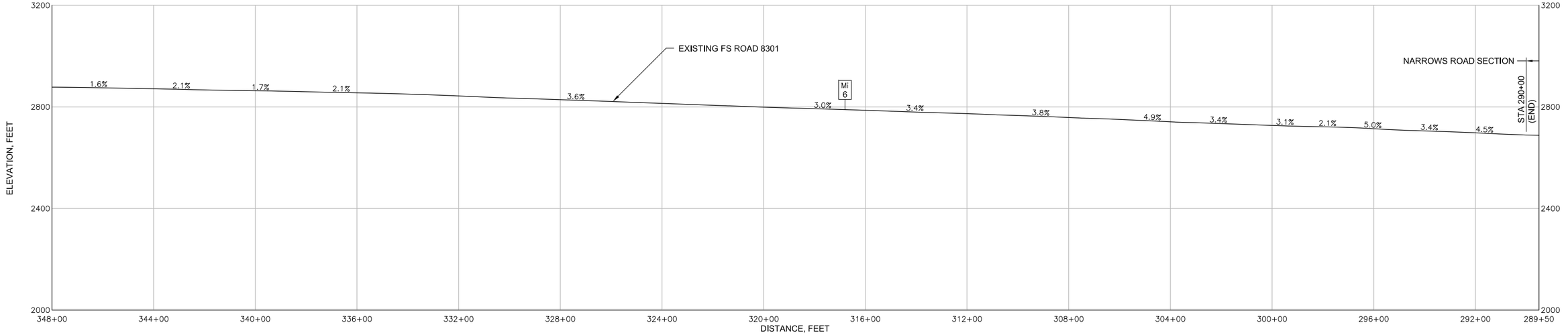
1. PLAN LOCATION SHOWN ON SHEET 10–3–1.

PLAN

SCALE

200 0 200 400 FEET

CONTOUR INTERVAL = 10 FEET



NOTE:

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PROFILE

SCALE

200 0 200 400 FEET

ISSUE / REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DRAWN BY	F. ANDRADE	02/07/11
CHECKED BY	D. RODRIGUEZ	02/08/11
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PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 (STA 289+50 TO STA 348+00) PLAN AND PROFILE

MWH

SHEET: 10-3-7

REVISION: B

FILE NAME: 1008679D251

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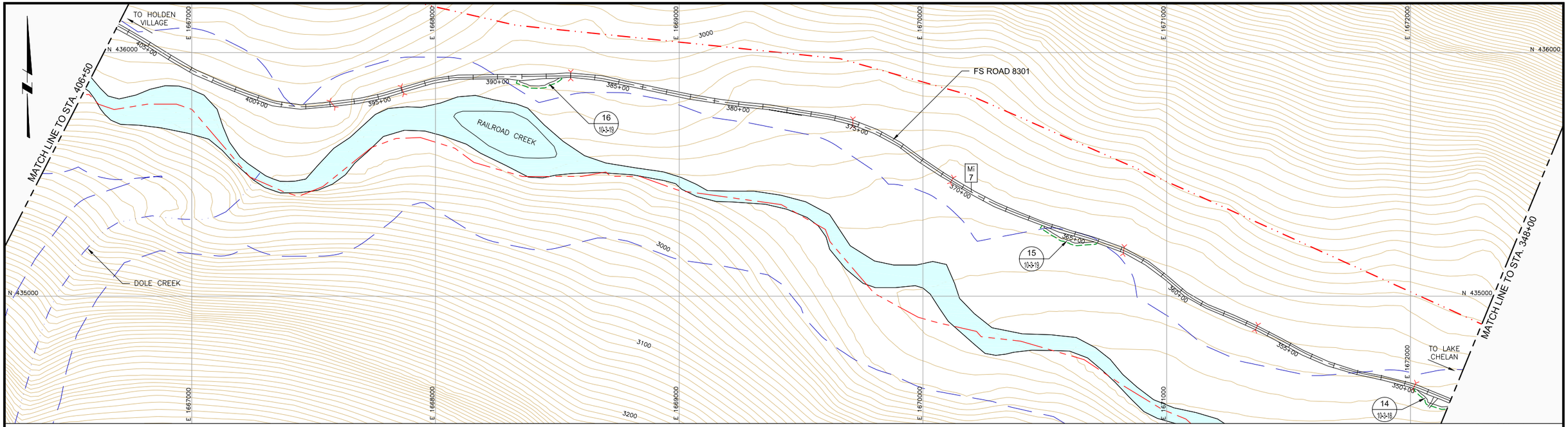


NOTE:

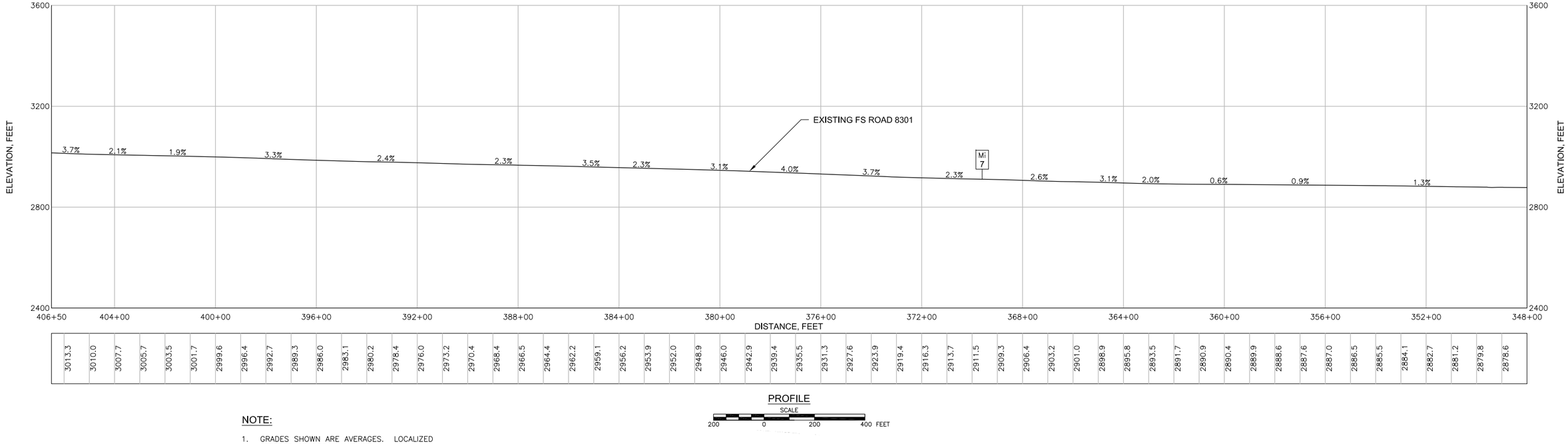
1. PLAN LOCATION SHOWN ON SHEET 10-3-1.

PLAN

SCALE

200 0 200 400 FEET

CONTOUR INTERVAL = 10 FEET



PROFILE

SCALE

200 0 200 400 FEET

NOTE:

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ISSUE / REV				
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWN BY	F. ANDRADE	02/07/11
CHECKED BY	D. RODRIGUEZ	02/08/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 (STA 348+00 TO STA 406+50) PLAN AND PROFILE

MWH

SHEET: 10-3-8

REVISION: A

FILE NAME: 1008679D252

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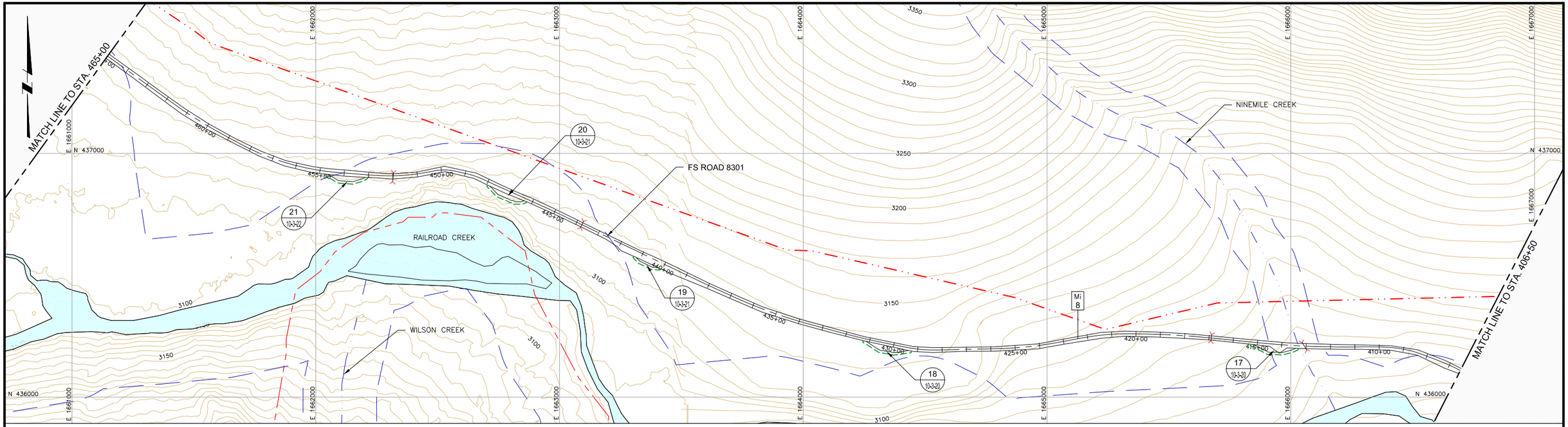


NOTE:

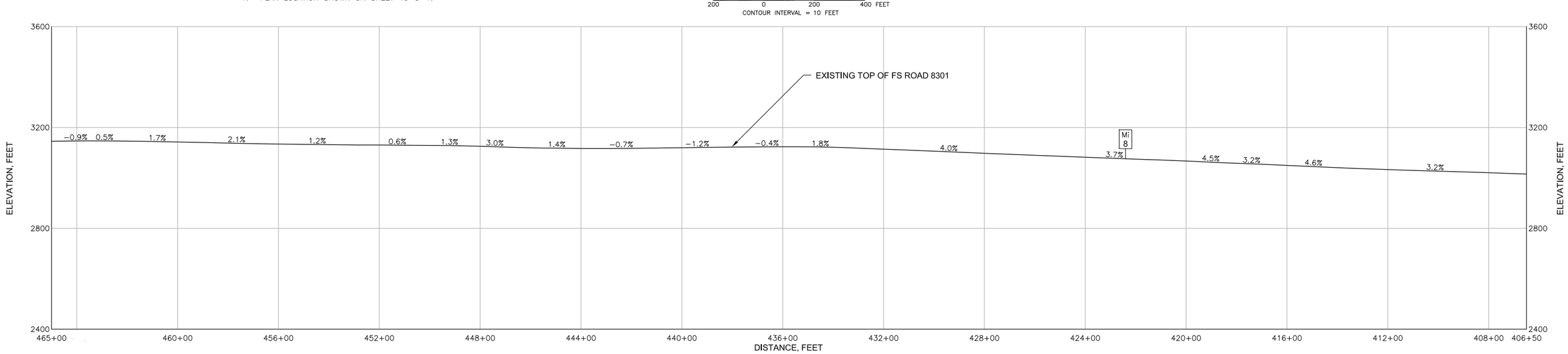
1. PLAN LOCATION SHOWN ON SHEET 10–3–1.

PLAN

SCALE

200 0 200 400 FEET

CONTOUR INTERVAL = 10 FEET



NOTE:

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PROFILE

SCALE

200 0 200 400 FEET

ISSUE REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DESIGNED BY	P. PELLICER	02/07/11	
DRAWN BY	F. ANDRADE	02/07/11	
CHECKED BY	D. RODRIGUEZ	02/08/11	
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PROJECT MANAGER	R. SCHLICHER	02/28/11	
CLIENT APPROVAL			
CLIENT REFERENCE NO.			

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 (STA 406+50 TO STA 465+00) PLAN AND PROFILE

MWH

SHEET: 10-3-9

REVISION: B

FILE NAME: 1008679D253

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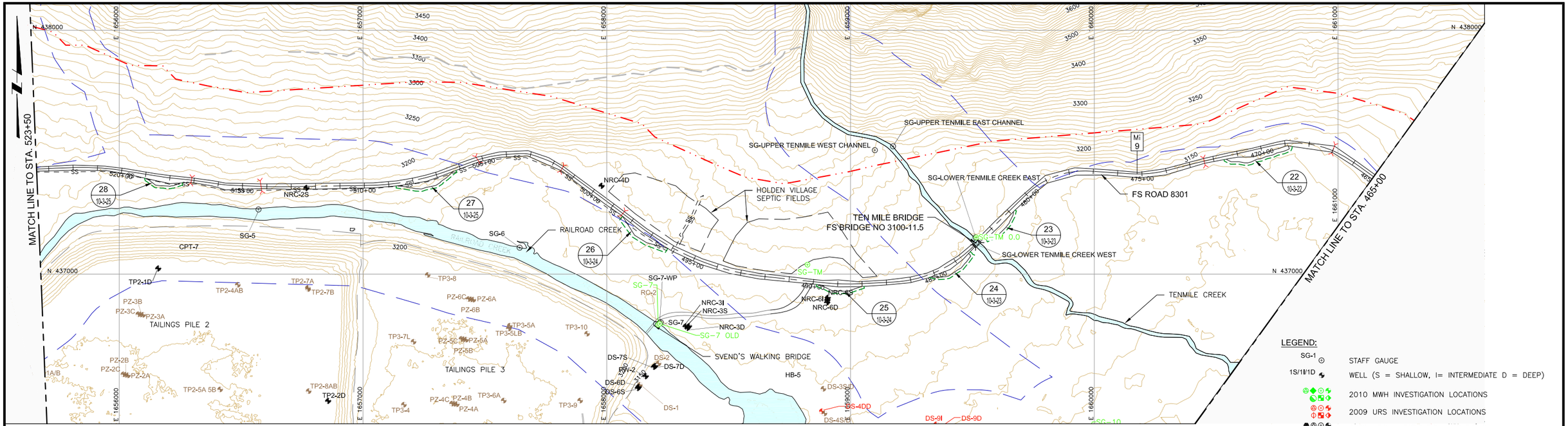


NOTE:

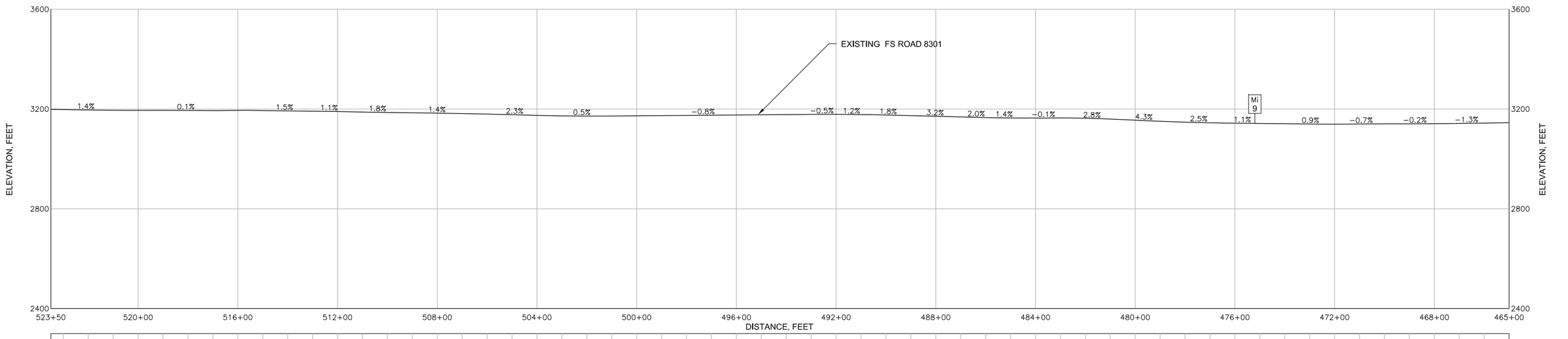
1. PLAN LOCATION SHOWN ON SHEET 10-3-1.

PLAN

SCALE

200 0 200 400 FEET

CONTOUR INTERVAL = 10 FEET



NOTE:

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PROFILE

SCALE

200 0 200 400 FEET

ISSUE / REV				
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWN BY	F. ANDRADE	02/07/11
CHECKED BY	D. RODRIGUEZ	02/08/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 (STA 465+00 TO STA 523+50) PLAN AND PROFILE

MWH

SHEET: 10-3-10

REVISION: A

FILE NAME: 1008679D254

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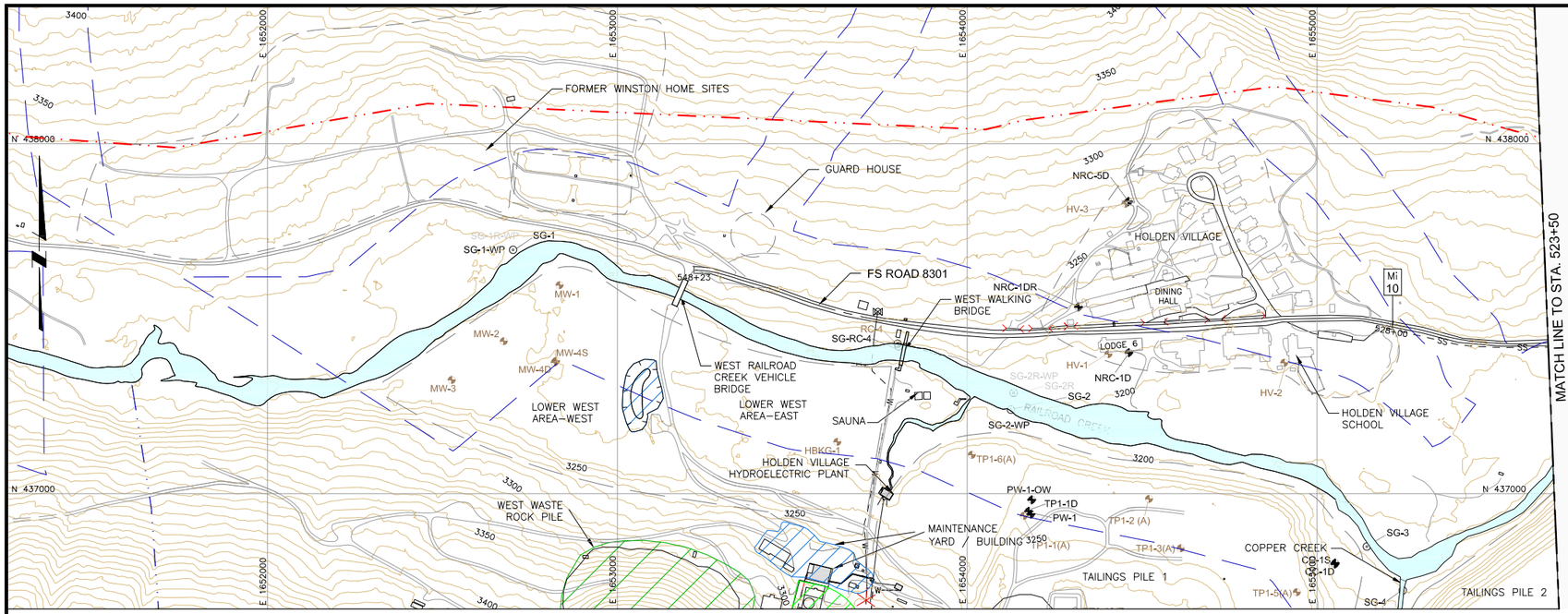
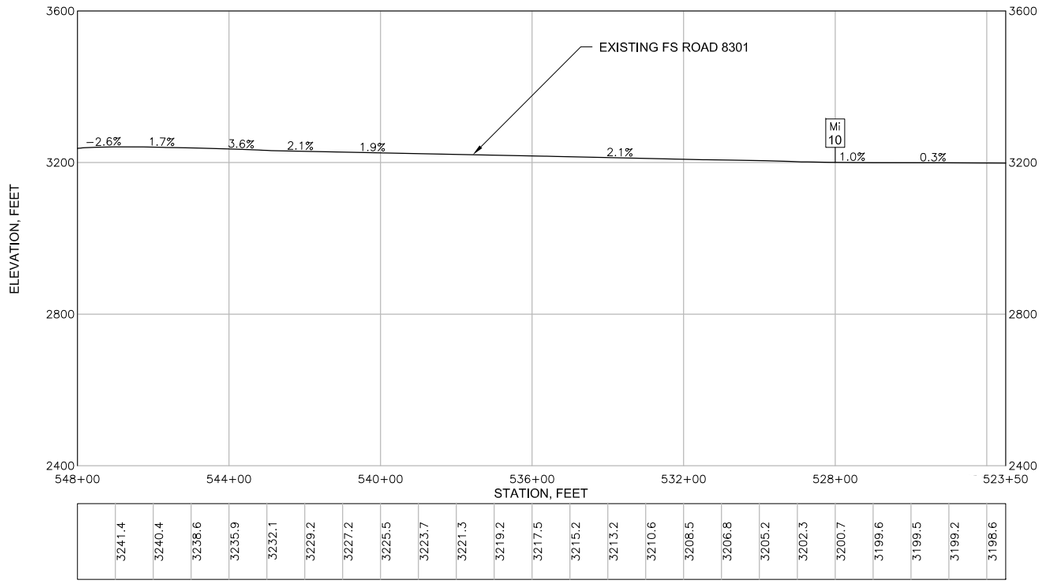


PLAN

SCALE

200 0 200 400 FEET

CONTOUR INTERVAL = 10 FEET



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PROFILE

SCALE

200 0 200 400 FEET

NOTE:

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LEGEND:

- SG-1 — STAFF GAUGE
- 1S/1I/1D — WELL (S = SHALLOW, I= INTERMEDIATE D = DEEP)
- 2010 MWH INVESTIGATION LOCATIONS
- 2009 URS INVESTIGATION LOCATIONS
- 2008 URS INVESTIGATION LOCATIONS
- HISTORICAL INVESTIGATION LOCATIONS (BY OTHERS)

ISSUE / REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
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APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 (STA 523+50 TO STA 548+00) PLAN AND PROFILE

MWH

SHEET: 10-3-11

REVISION: B

FILE NAME: 1008679D255

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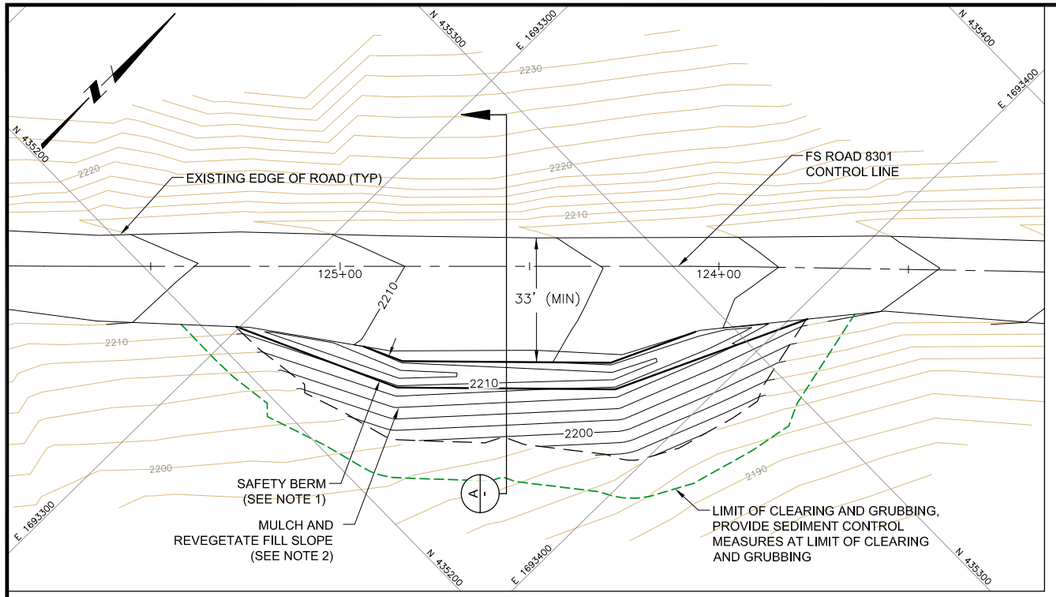
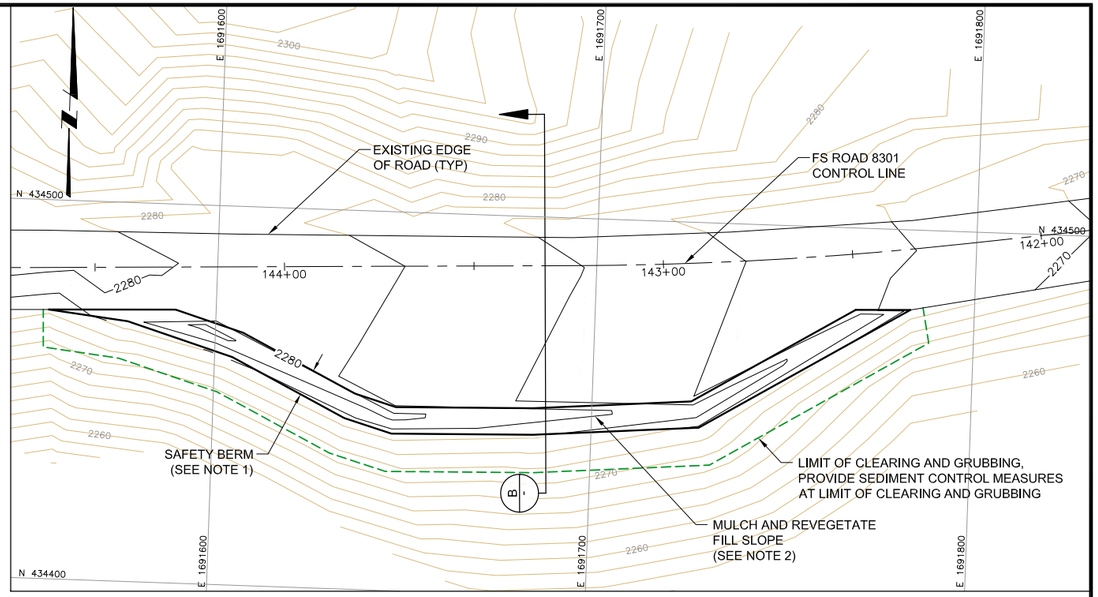
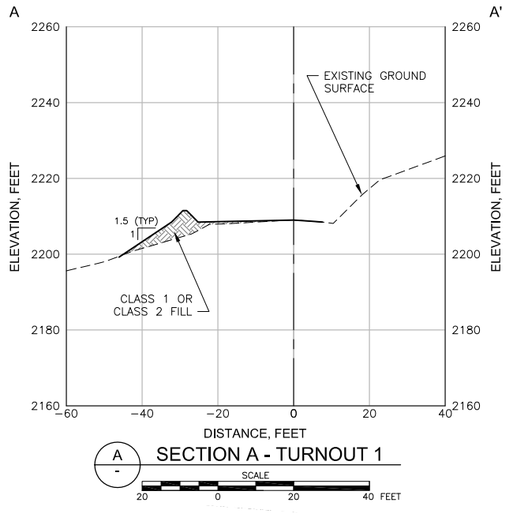
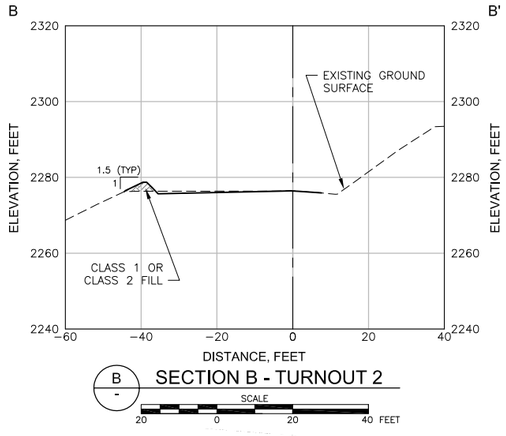


PLAN



PLAN





NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.

TURNOUT 1 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
613	2	307

TURNOUT 2 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
0	32	44

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

- FS ROAD 8301 TOPOGRPAHY RECEIVED FROM ERLANDSEN DATED; JANUARY 18, 2011.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 TURNOUTS 1 AND 2 GRADING PLAN

MWH

SHEET: 10-3-12

REVISION: B

FILE NAME: 1008679D270

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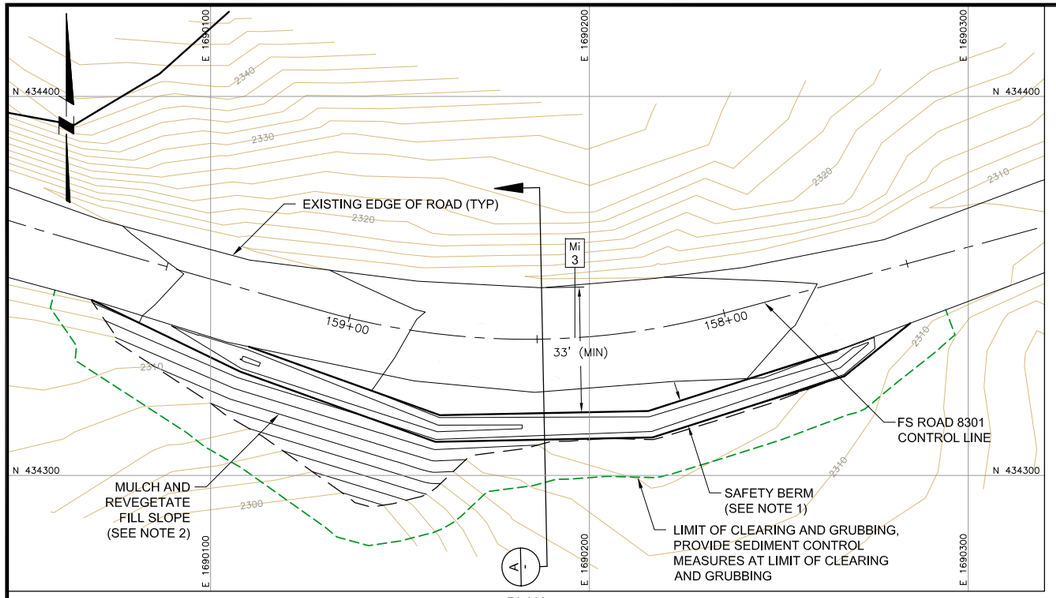

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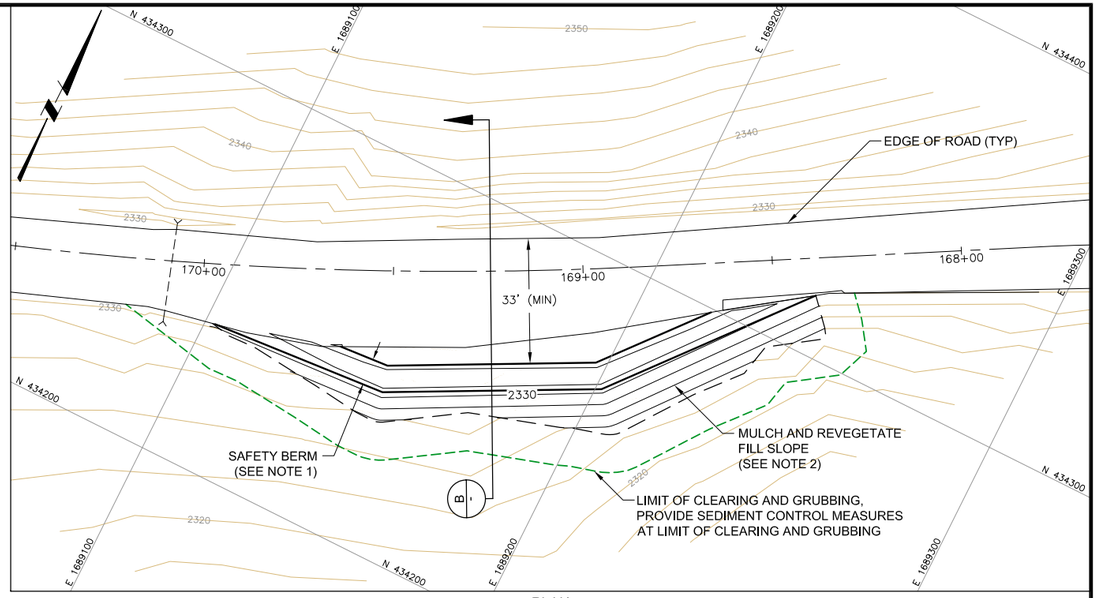

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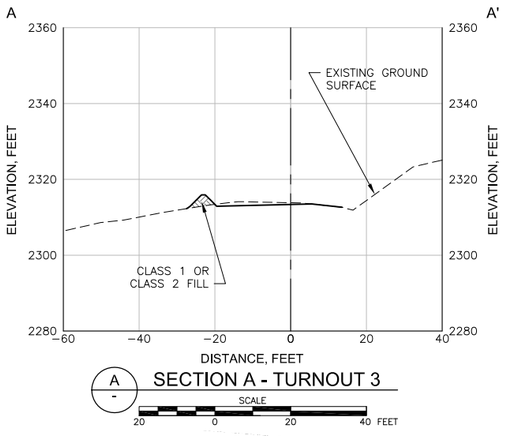
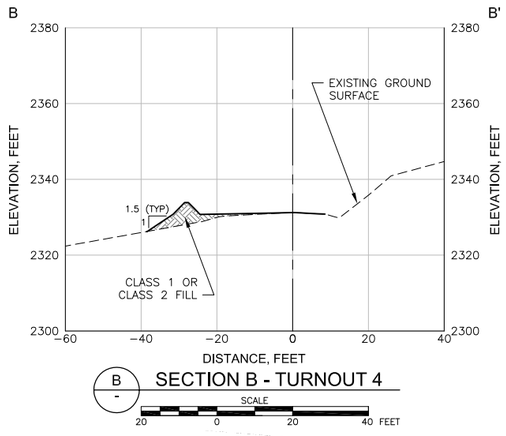


A - SECTION A - TURNOUT 3

SCALE 20 0 20 40 FEET



B - SECTION B - TURNOUT 4

SCALE 20 0 20 40 FEET

TURNOUT 3 - GRADING PLAN AND SECTION

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
724	51	217

TURNOUT 4 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
562	5	201

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

DISCLAIMER:
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DRAWING REFERENCE(S):

- FS ROAD 8301 TOPOGRPAHY RECEIVED FROM ERLANDSEN DATED; JANUARY 18, 2011.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 TURNOUTS 3 AND 4 GRADING PLAN

MWH

SHEET: 10-3-13

REVISION: B

FILE NAME: 1008679D271

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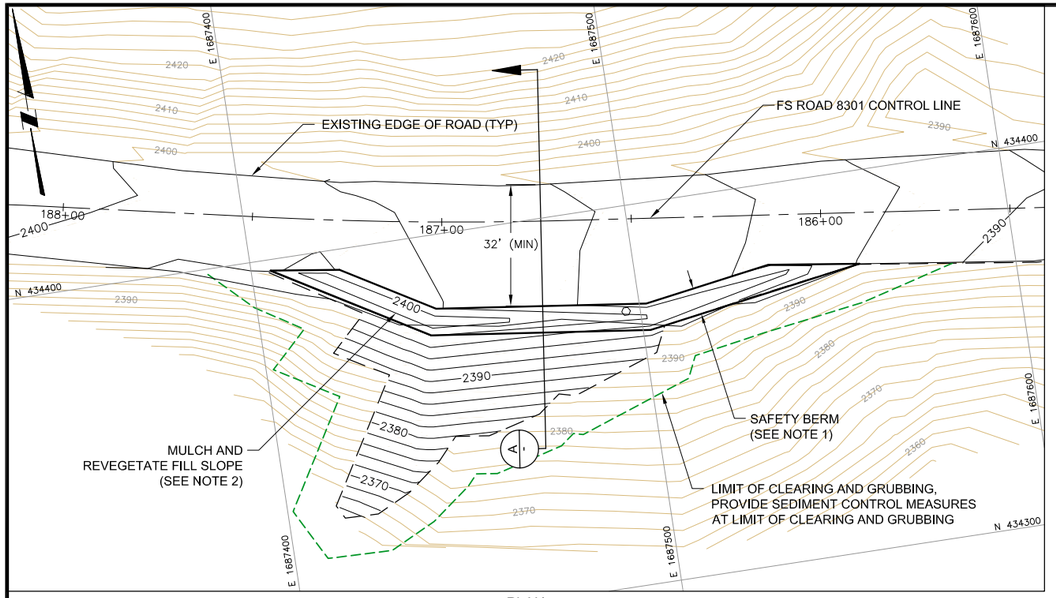

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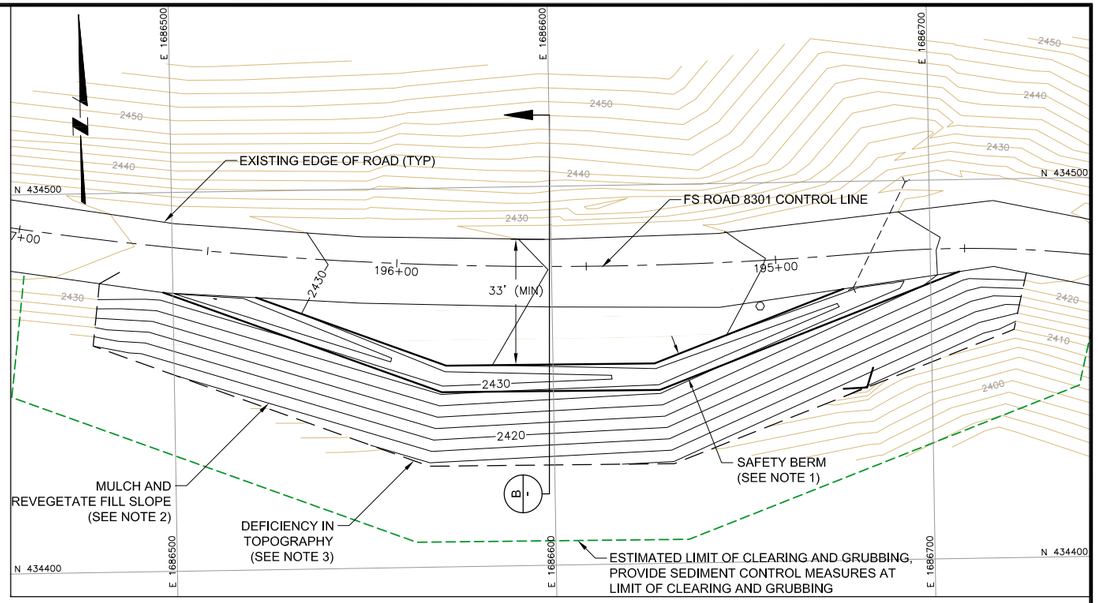

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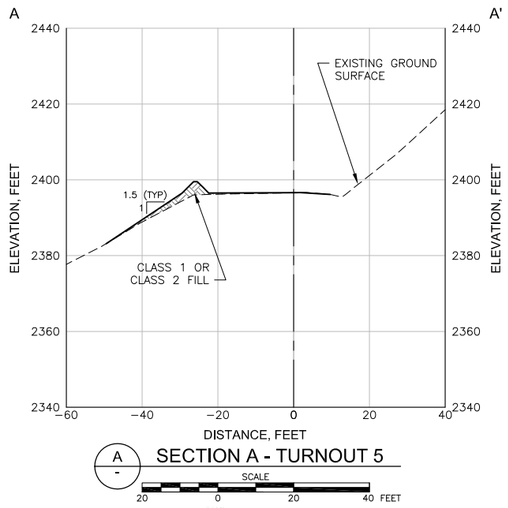

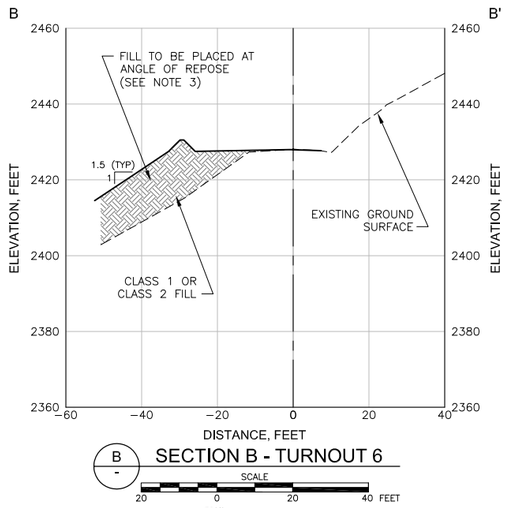

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.
3. THE FINAL CONFIGURATION WILL BE BASED ON ADDITIONAL FIELD DATA AT THE TIME OF CONSTRUCTION.

TURNOUT 5 - GRADING PLAN AND SECTION

TURNOUT 6 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
643	30	127

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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- FS ROAD 8301 TOPOGRPAHY RECEIVED FROM ERLANDSEN DATED; JANUARY 18, 2011.

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DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 TURNOUTS 5 AND 6 GRADING PLAN
SHEET: 10-3-14
REVISION: B
FILE NAME: 1008679D272

MWH

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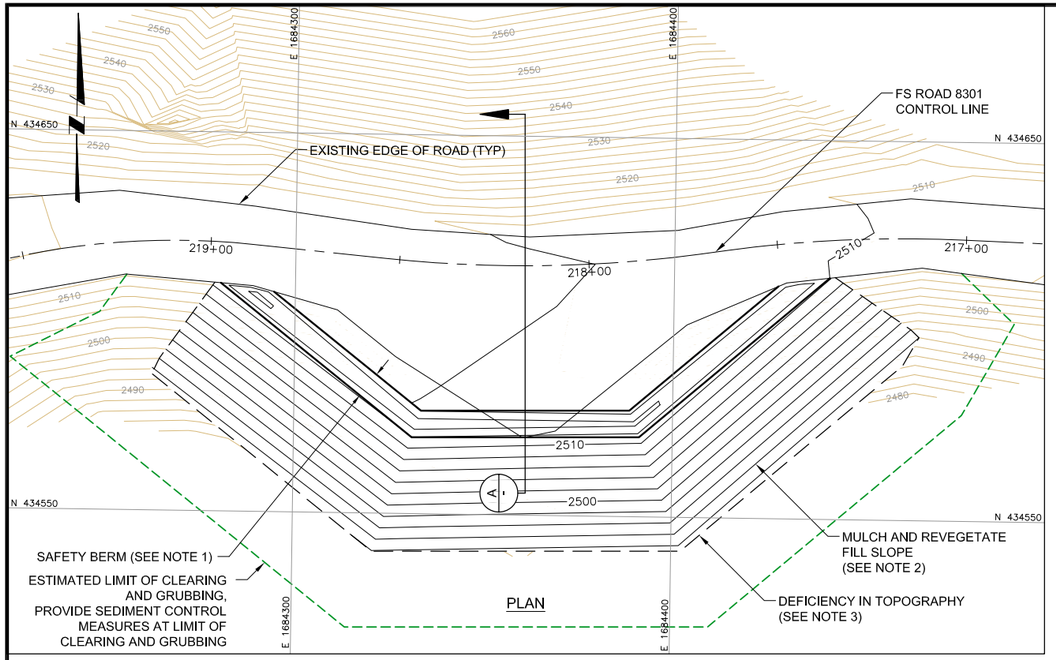
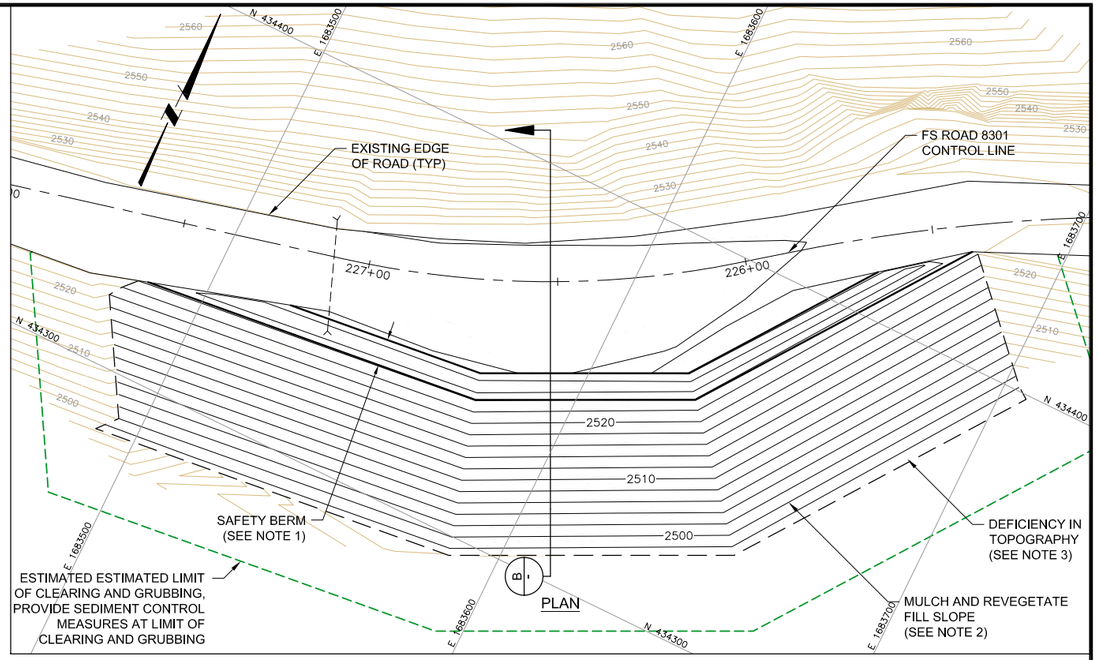
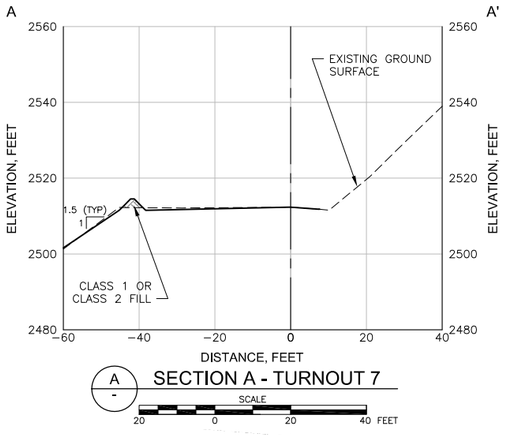


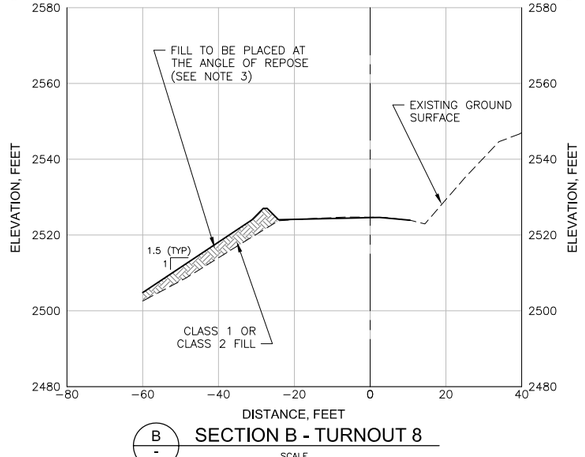




TURNOUT 7 - GRADING PLAN AND SECTION

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.
3. THE FINAL CONFIGURATION WILL BE BASED ON ADDITIONAL FIELD DATA AT THE TIME OF CONSTRUCTION.



TURNOUT 8 - GRADING PLAN AND SECTION

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 TURNOUTS 7 AND 8 GRADING PLAN

MWH

SHEET: 10-3-15
REVISION: B
FILE NAME: 1008679D273

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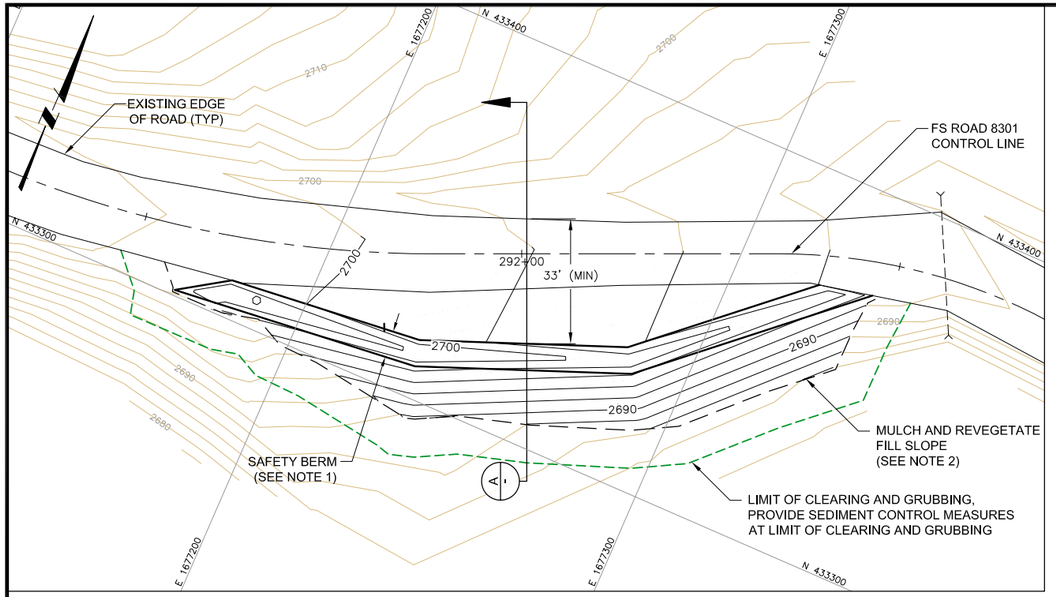
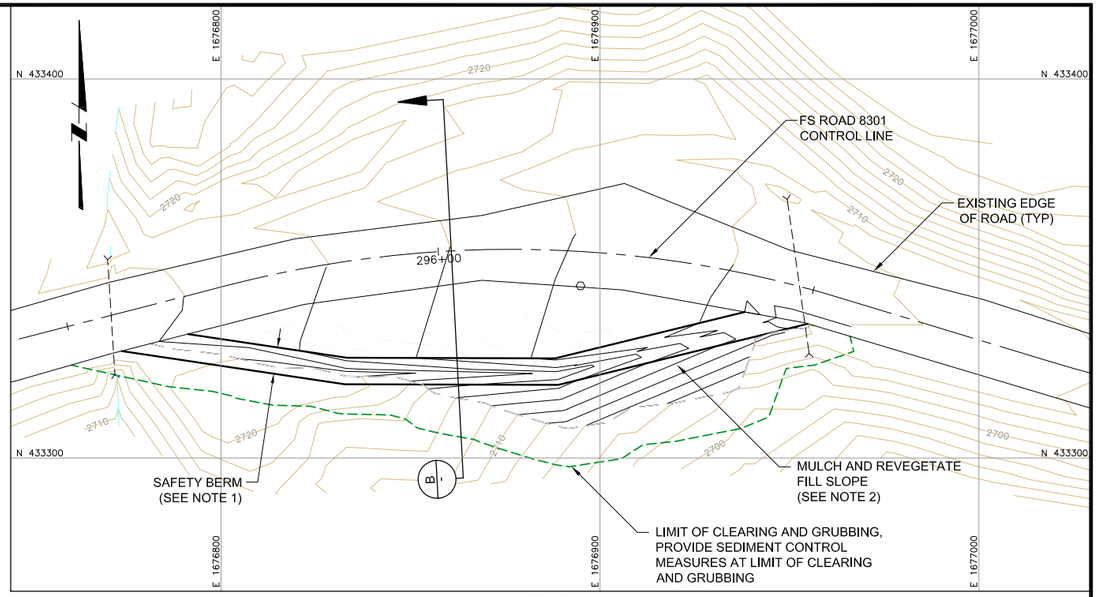


PLAN



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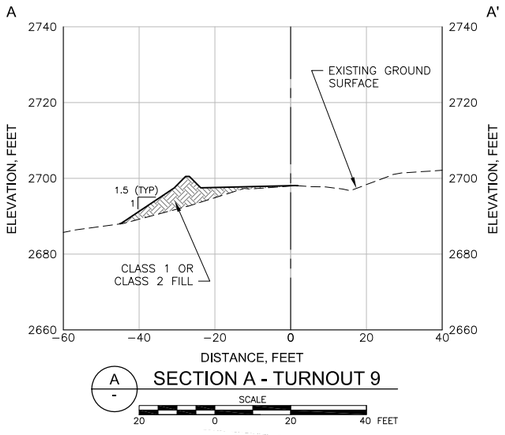

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.

TURNOUT 9 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
855	0	460

TURNOUT 10 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
679	32	83

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 TURNOUTS 9 AND 10 GRADING PLAN
SHEET: 10-3-16
REVISION: B
FILE NAME: 1008679D274

MWH

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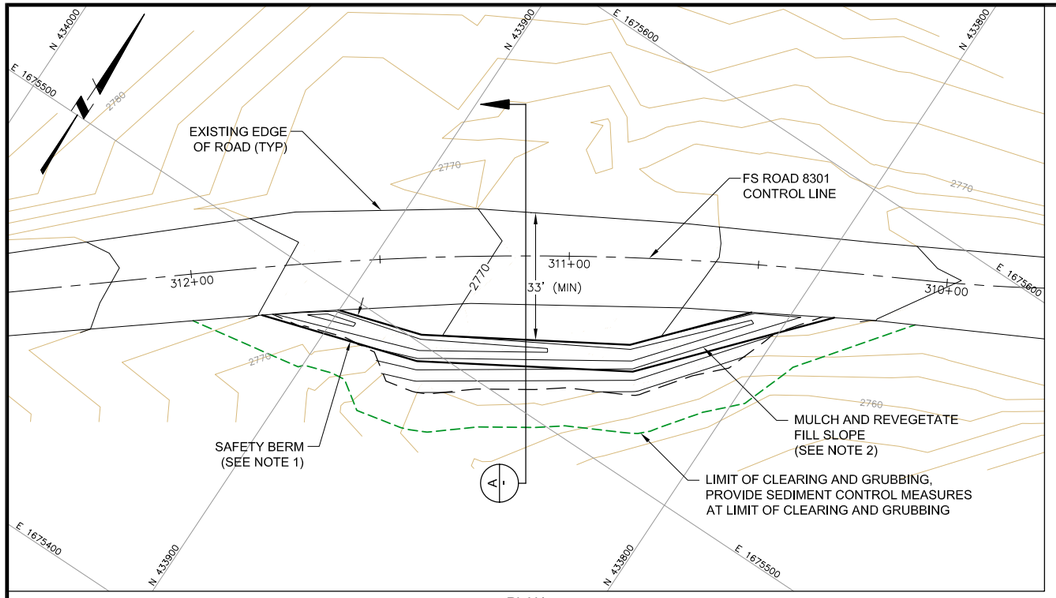

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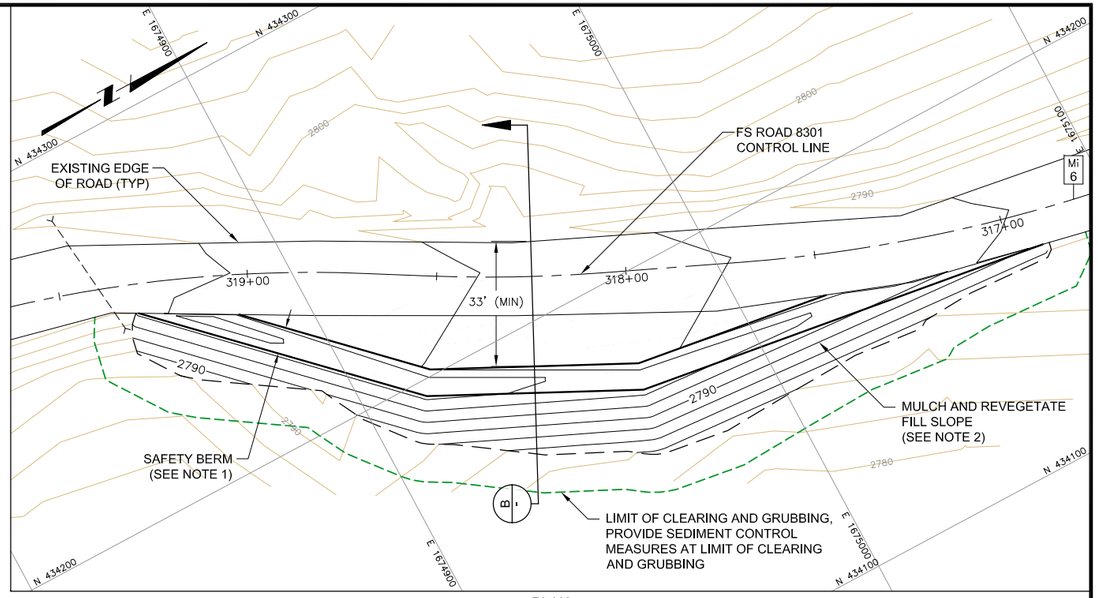

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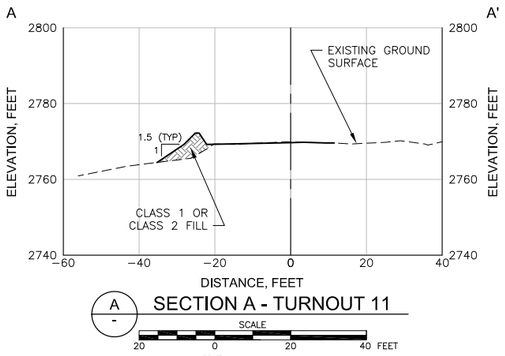
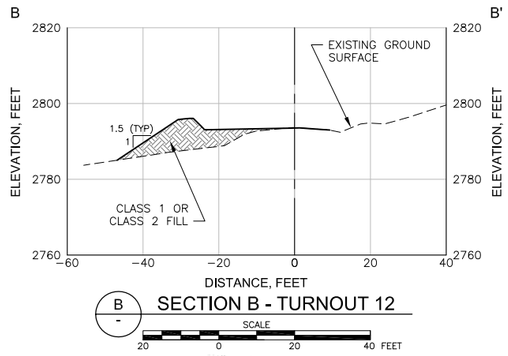


A - SECTION A - TURNOUT 11

SCALE
20 0 20 40 FEET

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.



B - SECTION B - TURNOUT 12

SCALE
20 0 20 40 FEET

TURNOUT 11 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
477	16	82

TURNOUT 12 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
1007	1	612

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

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DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 TURNOUTS 11 AND 12 GRADING PLAN

MWH

SHEET: 10-3-17
REVISION: B
FILE NAME: 1008679D275

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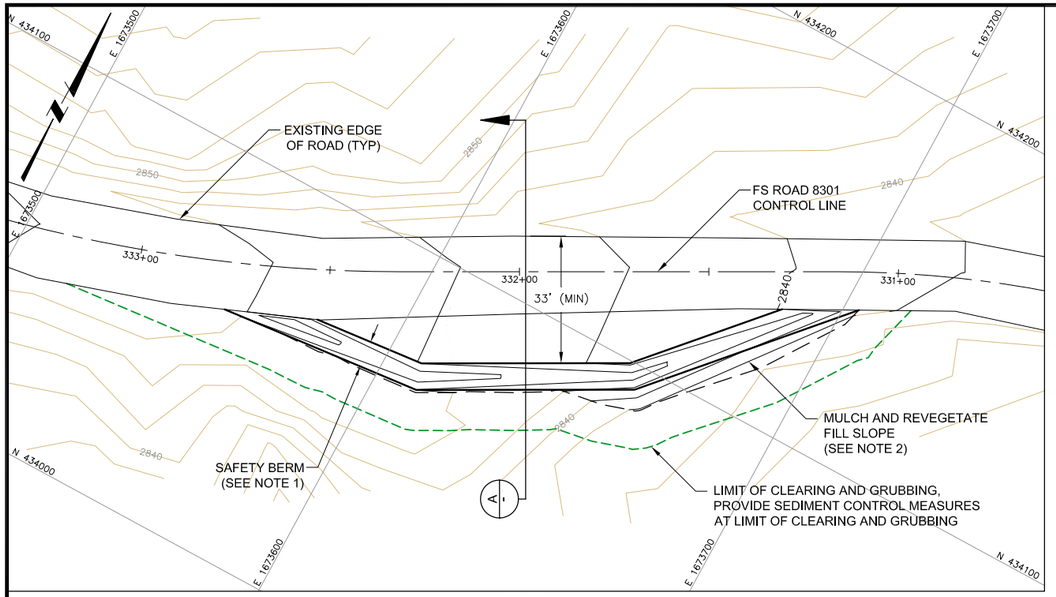

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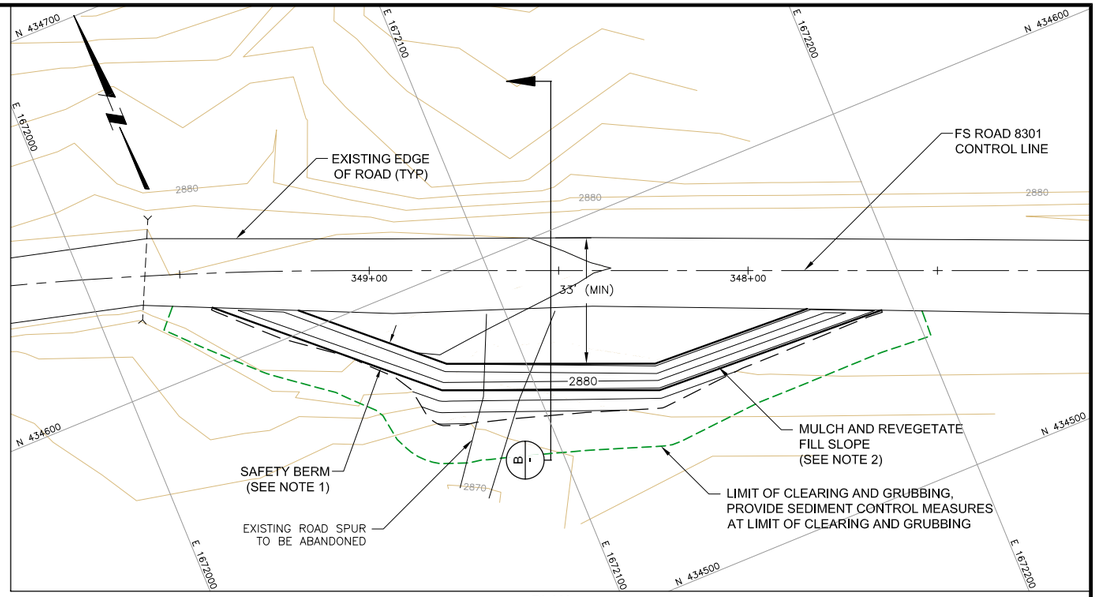

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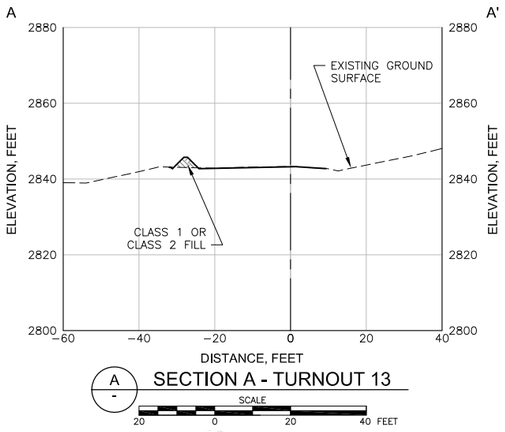
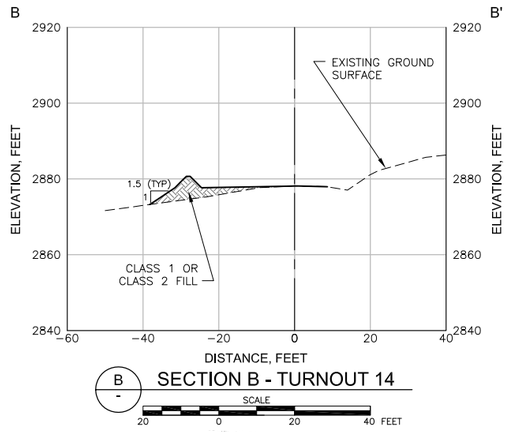


A — SECTION A - TURNOUT 13

SCALE 20 0 20 40 FEET

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.



B — SECTION B - TURNOUT 14

SCALE 20 0 20 40 FEET

TURNOUT 13 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
531	6	64

TURNOUT 14 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
593	2	133

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DESIGNED BY	P. PELLICER	02/28/11
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APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 TURNOUTS 13 AND 14 GRADING PLAN

MWH

SHEET 10-3-18 | REVISION B

FILE NAME 1008679D276

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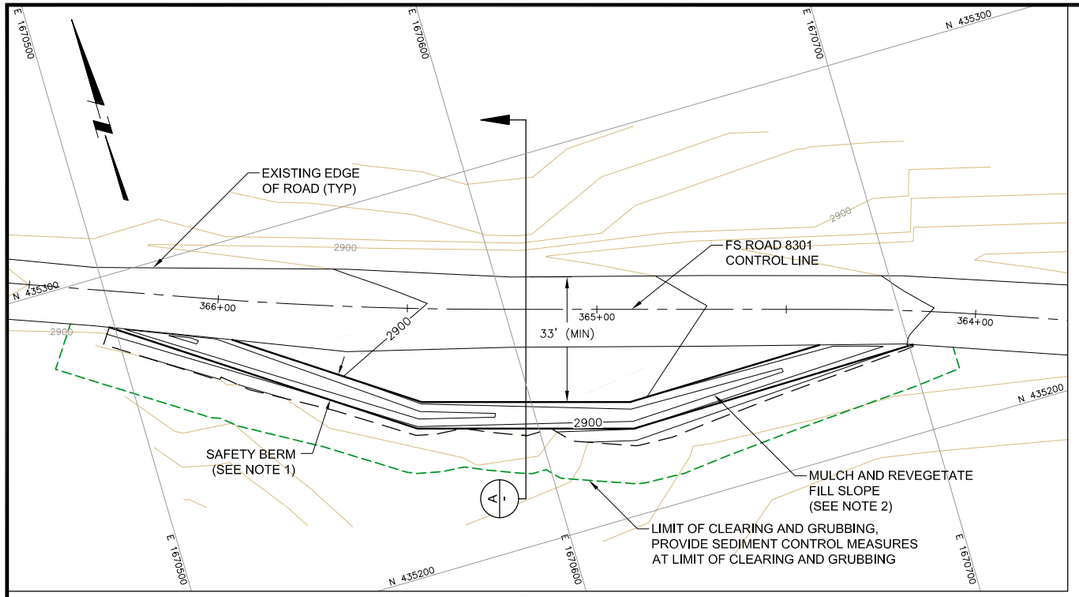
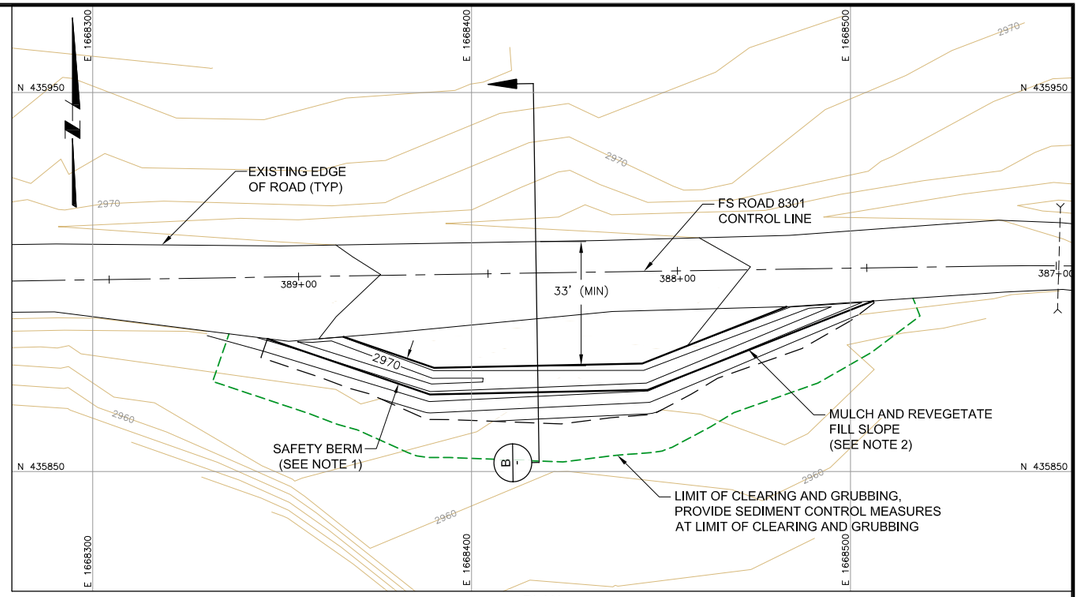
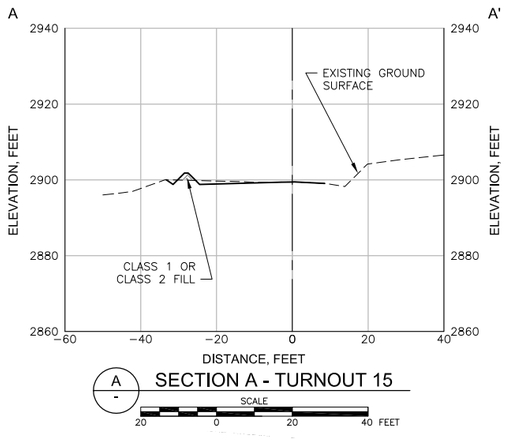


PLAN



PLAN

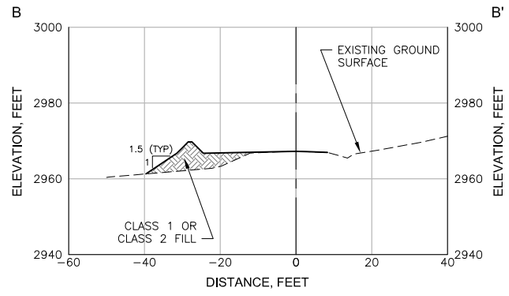


A - SECTION A - TURNOUT 15

SCALE
20 0 20 40 FEET

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.



B - SECTION B - TURNOUT 16

SCALE
20 0 20 40 FEET

TURNOUT 15 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
667	9	75

TURNOUT 16 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
571	0	195

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

DISCLAIMER:
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DRAWING REFERENCE(S):

- FS ROAD 8301 TOPOGRPAHY RECEIVED FROM ERLANDSEN DATED; JANUARY 18, 2011.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 TURNOUTS 15 AND 16 GRADING PLAN

MWH

SHEET: 10-3-19
REVISION: B
FILE NAME: 1008679D277

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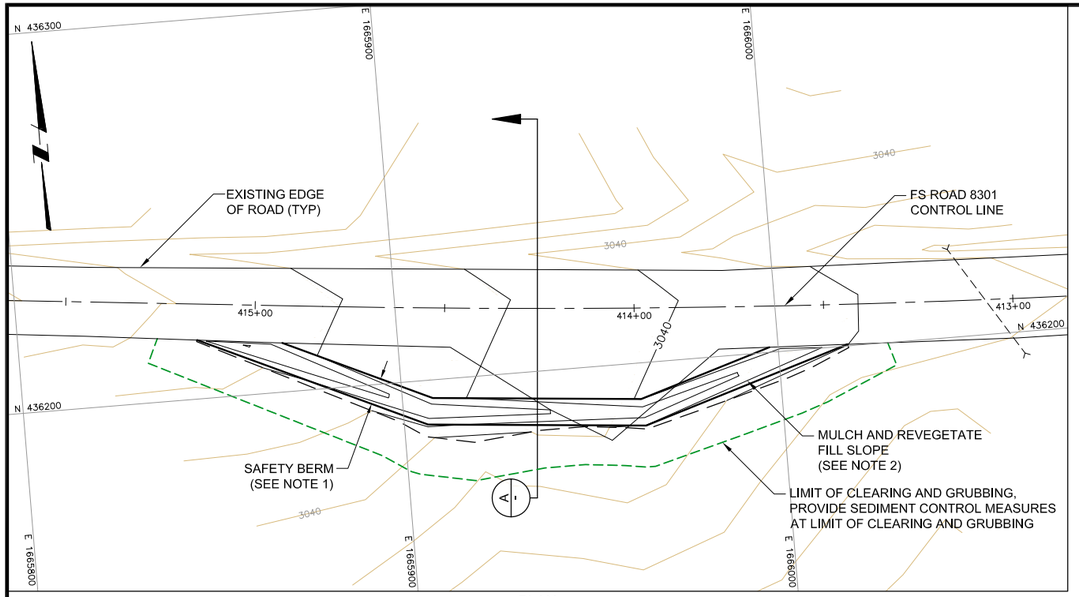

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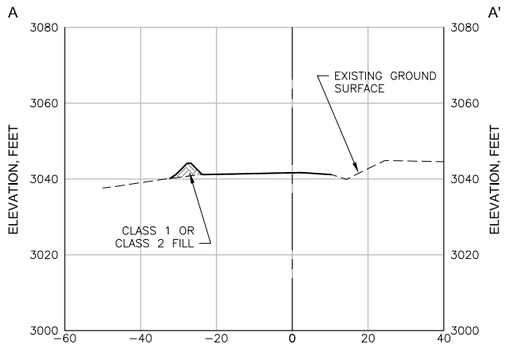


A - SECTION A - TURNOUT 17

SCALE

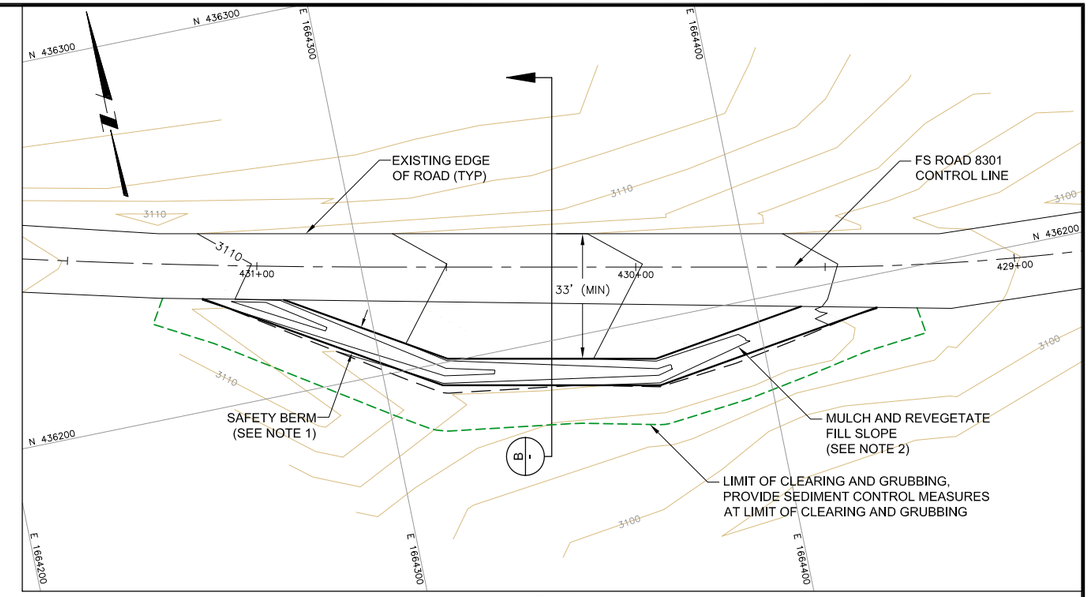
20 0 20 40 FEET

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.

TURNOUT 17 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
422	1	76



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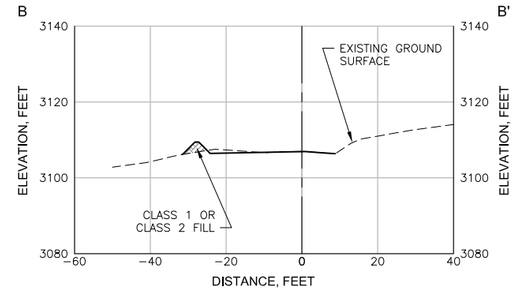

B - SECTION B - TURNOUT 18

SCALE

20 0 20 40 FEET

TURNOUT 18 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
536	115	117

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

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DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 TURNOUTS 17 AND 18 GRADING PLAN

MWH

SHEET: 10-3-20

REVISION: B

FILE NAME: 1008679D278

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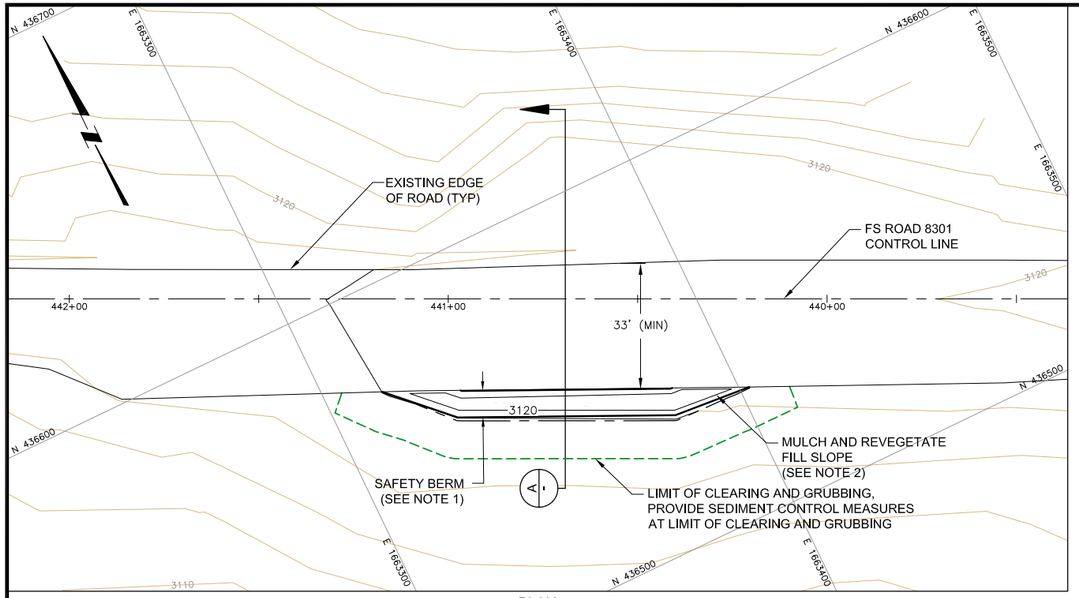

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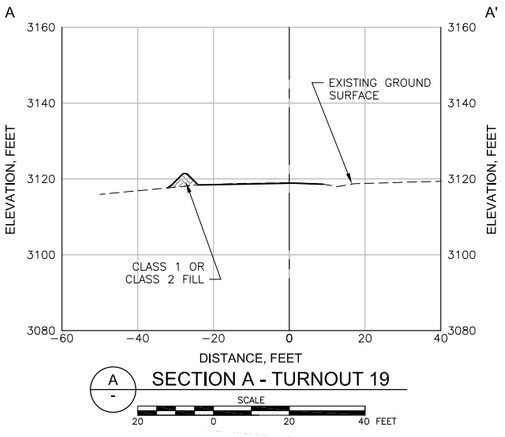
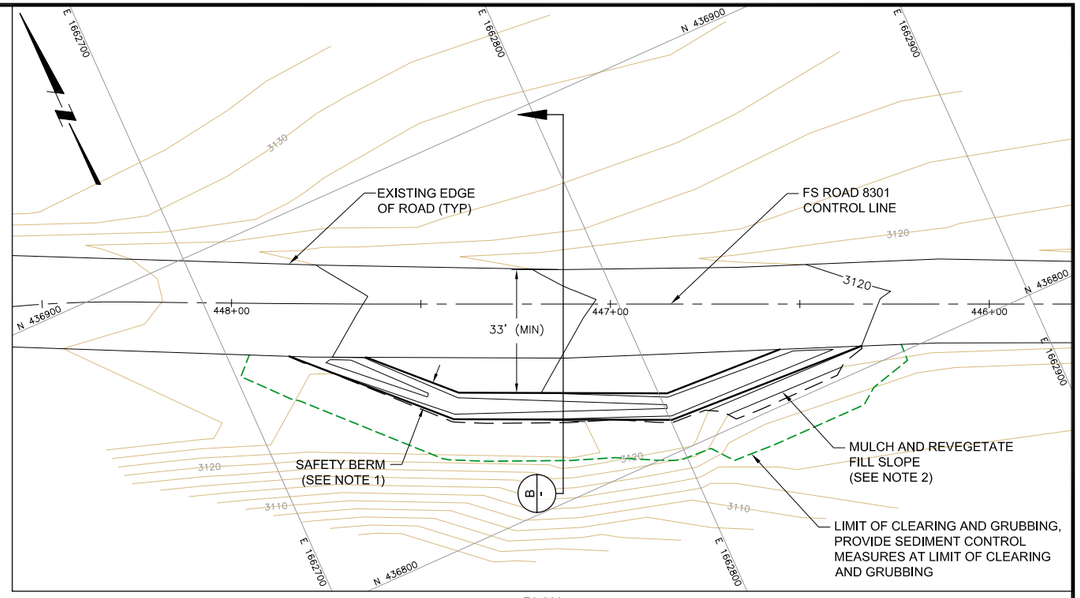


A
-
SECTION A - TURNOUT 19

SCALE
20 0 20 40 FEET

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.



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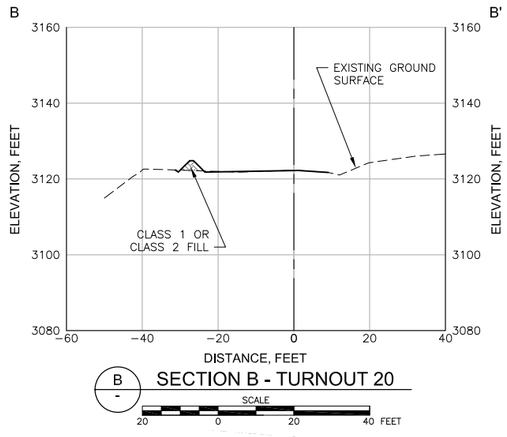

B
-
SECTION B - TURNOUT 20

SCALE
20 0 20 40 FEET

TURNOUT 19 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
206	5	15

TURNOUT 20 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
434	79	112

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):
- FS ROAD 8301 TOPOGRPAHY RECEIVED FROM ERLANDSEN DATED; JANUARY 18, 2011.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 TURNOUTS 19 AND 20 GRADING PLAN

MWH

SHEET: 10-3-21
REVISION: B
FILE NAME: 1008679D279

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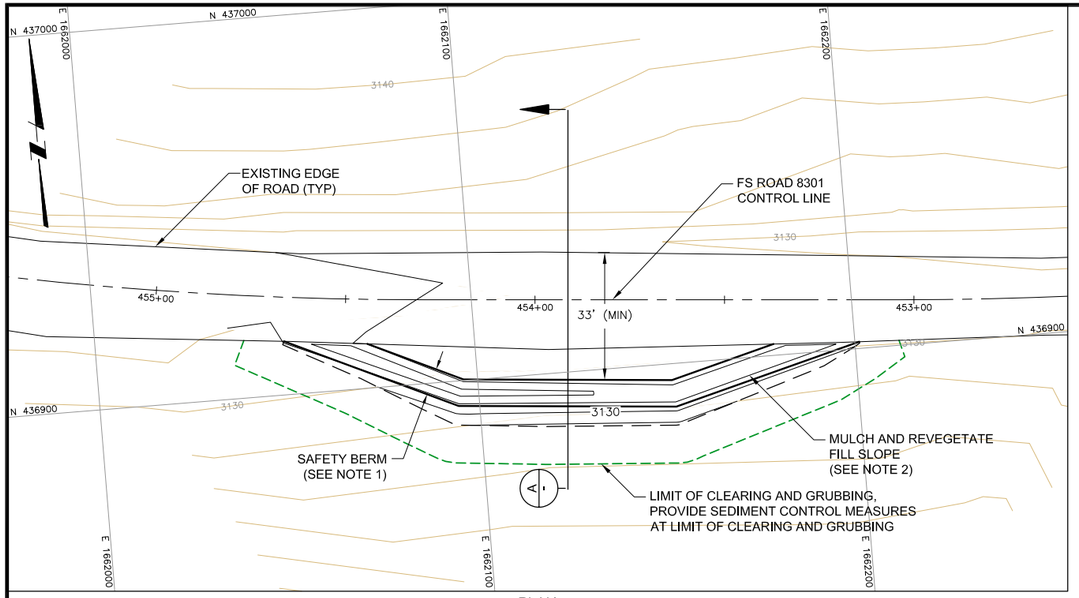

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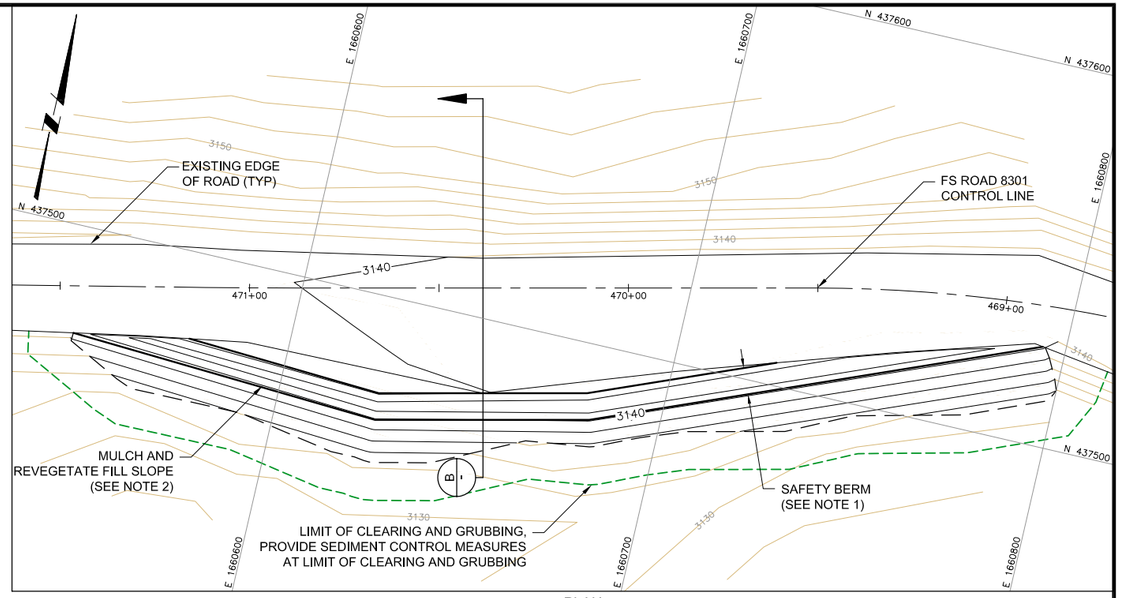

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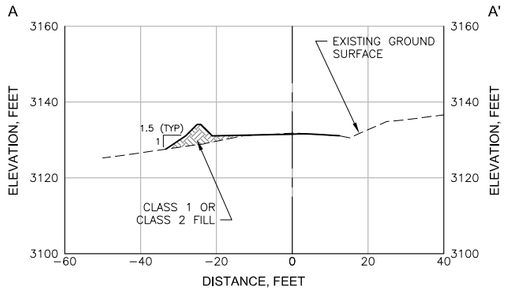
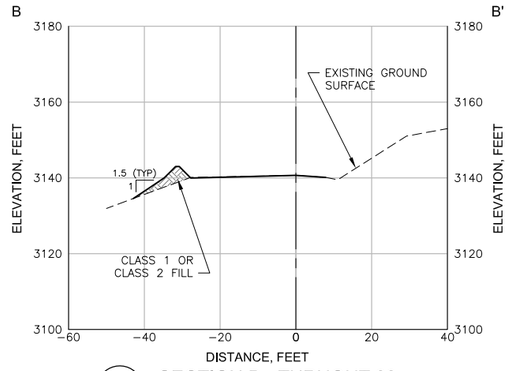


A - SECTION A - TURNOUT 21

SCALE 20 0 20 40 FEET

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.



B - SECTION B - TURNOUT 22

SCALE 20 0 20 40 FEET

TURNOUT 21 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
457	7	92

TURNOUT 22 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
882	1	285

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 TURNOUTS 21 AND 22 GRADING PLAN

MWH

SHEET: 10-3-22 | REVISION: B

FILE NAME: 1008679D280

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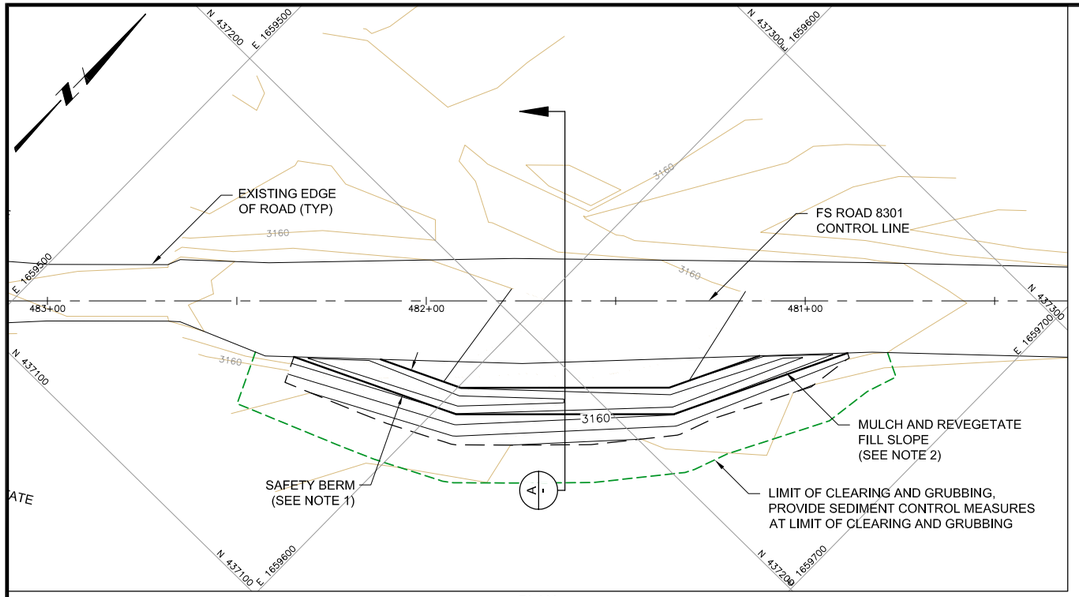

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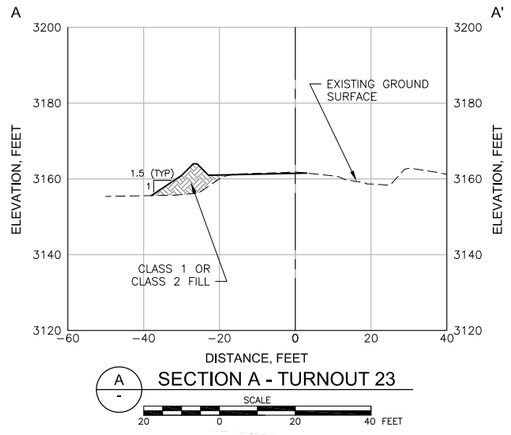


A — SECTION A - TURNOUT 23

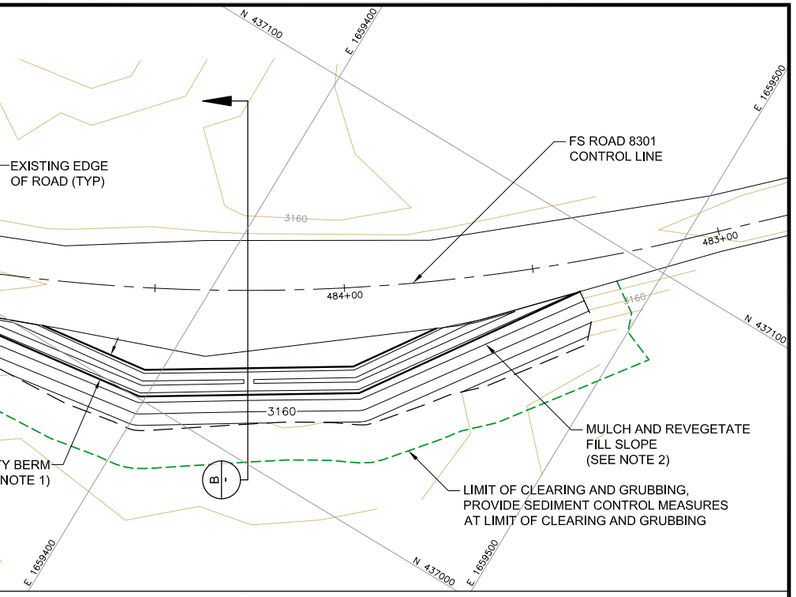
SCALE 20 0 20 40 FEET

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.

TURNOUT 23 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
500	4	178



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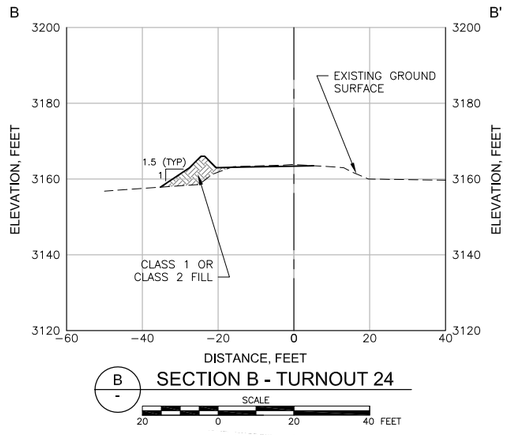

B — SECTION B - TURNOUT 24

SCALE 20 0 20 40 FEET

TURNOUT 24 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
634	122	337

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	PC		FA	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

DISCLAIMER:
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DRAWING REFERENCE(S):

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DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FS ROAD 8301 TURNOUTS 23 AND 24 GRADING PLAN

MWH

SHEET: 10-3-23

REVISION: B

FILE NAME: 1008679D281

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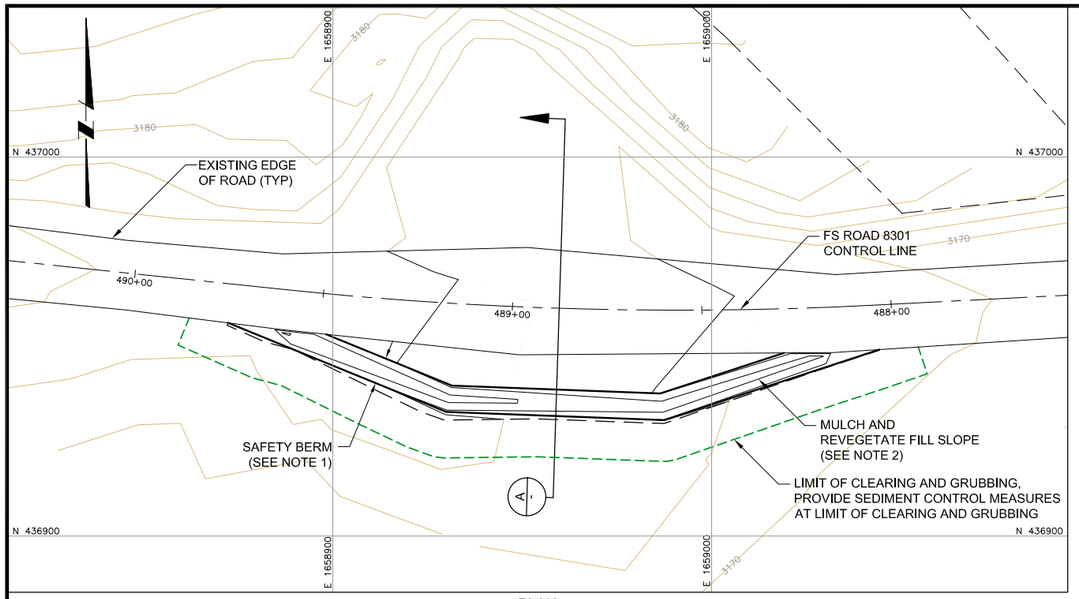

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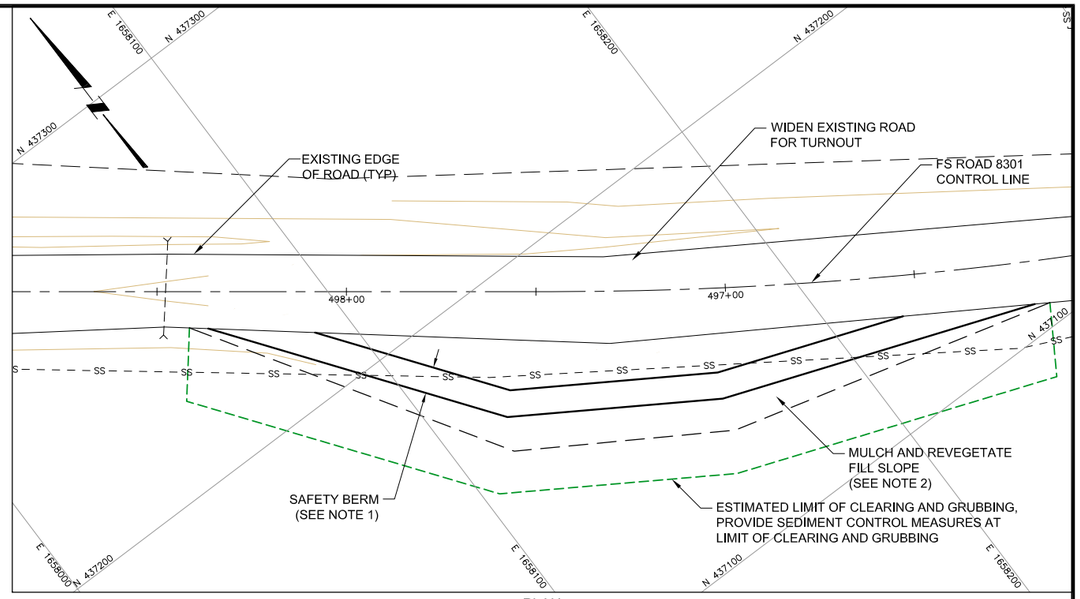
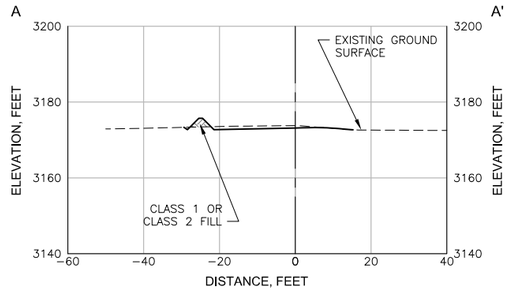


PLAN

TURNOUT 26 - GRADING PLAN

SCALE
20 0 20 40 FEET



A
-
SECTION A - TURNOUT 25

SCALE
20 0 20 40 FEET

TURNOUT 25 - GRADING PLAN AND SECTION

NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.
3. CONTRACTOR TO LOCATE SANITARY SEWER PRIOR TO CONSTRUCTION. CONTRACTOR TO PROTECT SEWER LINE PER SPECIFICATIONS.
4. SEE SHEET 1-6, GENERAL NOTES.

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
458	52	9

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 TURNOUTS 25 AND 26 GRADING PLAN

MWH

SHEET: 10-3-24
REVISION: B
FILE NAME: 1008679D282

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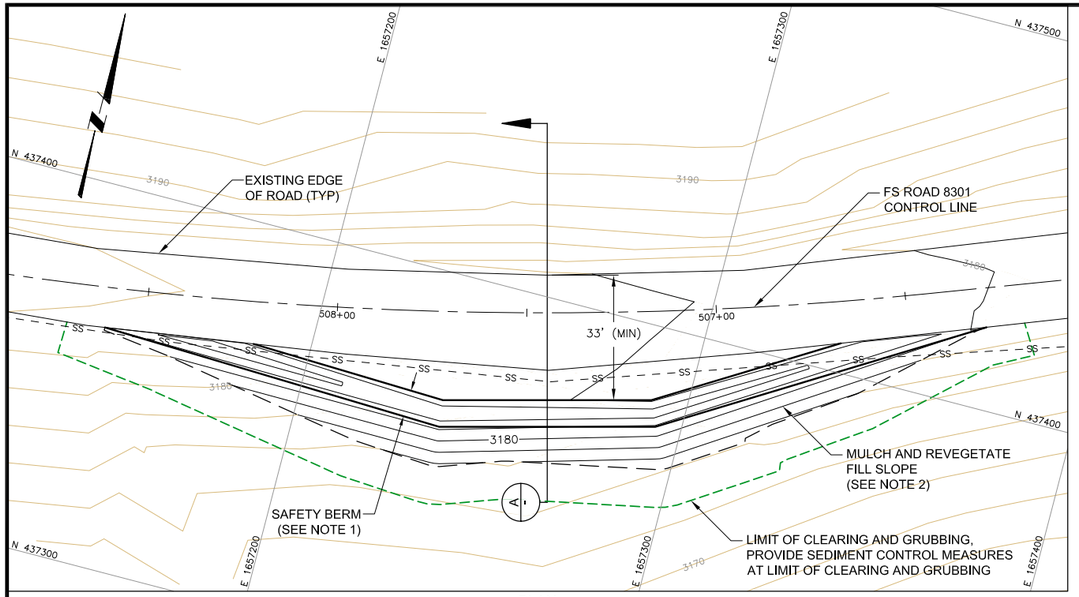

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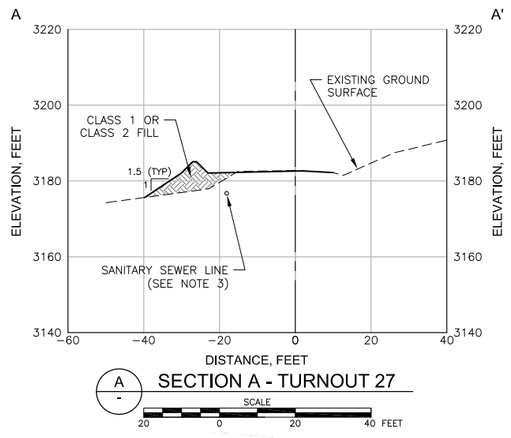


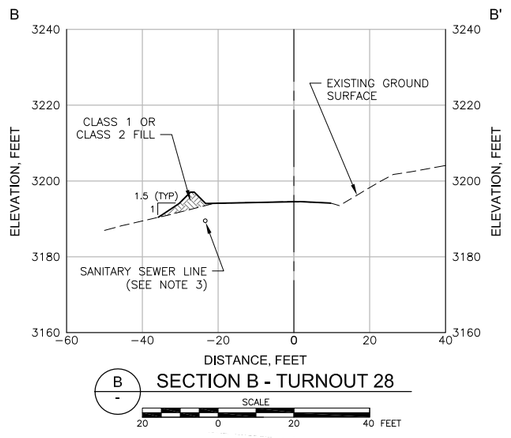
NOTES:

1. CONTRACTOR SHALL CONSTRUCT BREAK IN SAFETY BERM AT LOW POINT TO ALLOW FOR SURFACE WATER DRAINAGE BASED ON FINAL GRADE IN THE FIELD.
2. ALL CUT AND FILL SLOPES SHALL BE MULCHED AND SEEDED.
3. CONTRACTOR TO LOCATE SANITARY SEWER PRIOR TO CONSTRUCTION. CONTRACTOR TO PROTECT SEWER LINE PER SPECIFICATIONS.
4. SEE SHEET 1−6, GENERAL NOTES.

TURNOUT 27 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
797	4	294

PLAN



TURNOUT 28 - GRADING PLAN AND SECTION

EARTHWORKS		
CLEARING AND GRUBBING AREA, SY	CUT, CY	FILL, CY
362	3	61

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

DISCLAIMER:
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DRAWING REFERENCE(S):
- FS ROAD 8301 TOPOGRPAHY RECEIVED FROM ERLANDSEN DATED; JANUARY 18, 2011.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 TURNOUTS 27 AND 28 GRADING PLAN

MWH

SHEET: 10-3-25
REVISION: B
FILE NAME: 1008679D283

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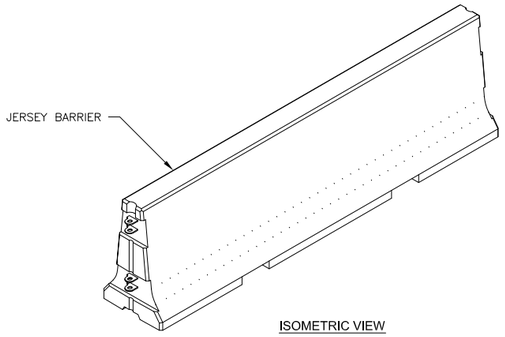
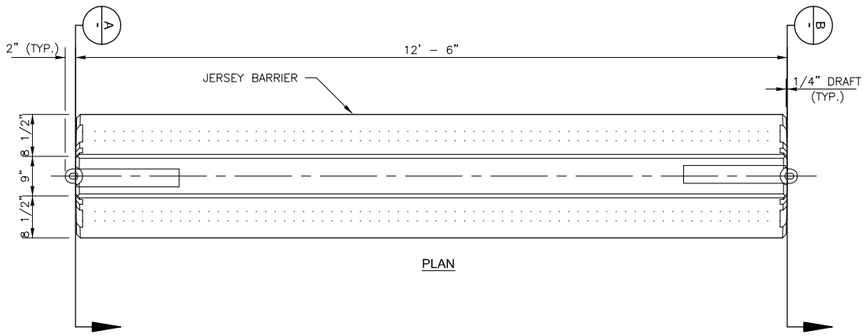
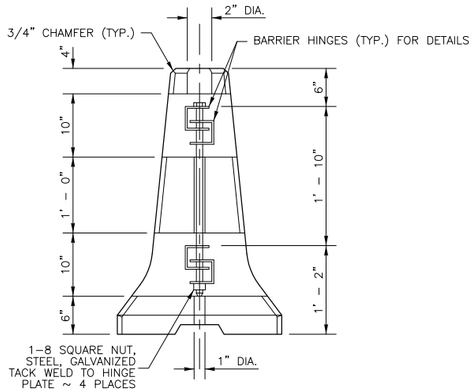


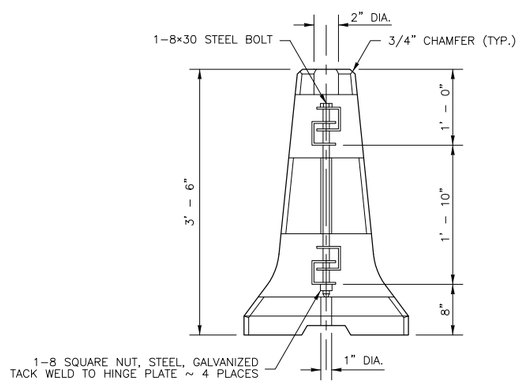
ISOMETRIC VIEW



PLAN

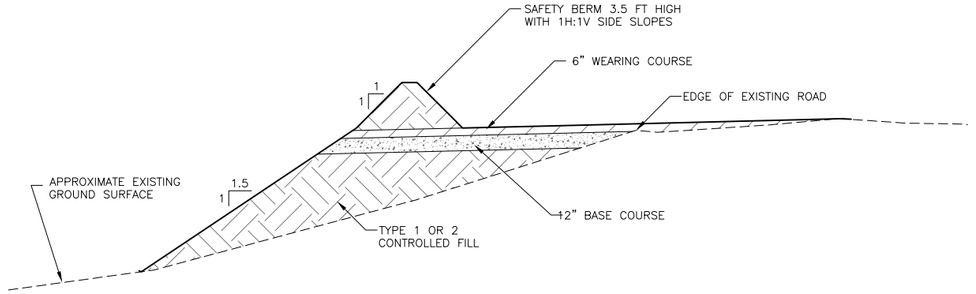


A SECTION A
N.T.S.

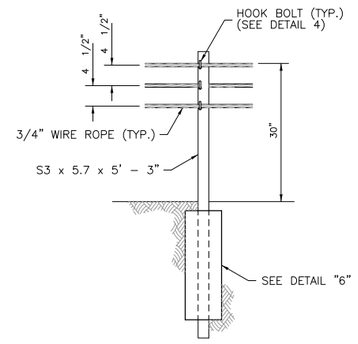


B SECTION B
N.T.S.

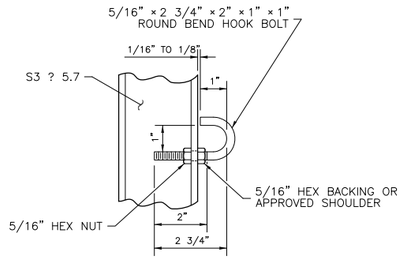
1 10-3-26 JERSEY BARRIER



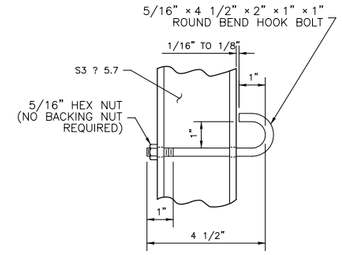
2 10-3-26 FS ROAD 8301 TURNOUT EXPANSION (TYP)



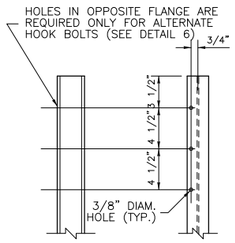
3 - CABLE BARRIER TYPE 2 OR 3



4 - HOOK BOLT



5 - ALTERNATE HOOK BOLT



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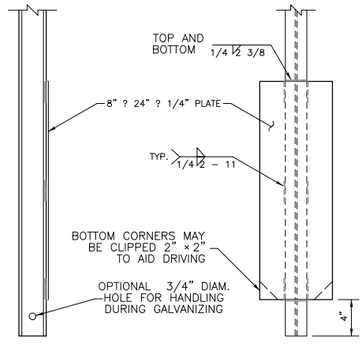

6 -

NOTES:

1. JERSEY BARRIERS MAY BE USED ON TANGENTS AND HORIZONTAL CURVES WITH RADII GREATER THAN 770'.
2. JERSEY BARRIER HINGES SHALL BE PLACED IN LOCATIONS SHOWN TO A TOLERANCE OF 3/32".
3. THIS DRAWING IS NOT TO SCALE.

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: FS ROAD 8301 - DETAIL SHEET

MWH

SHEET: 10-3-26
REVISION: B
FILE NAME: 1008679D236

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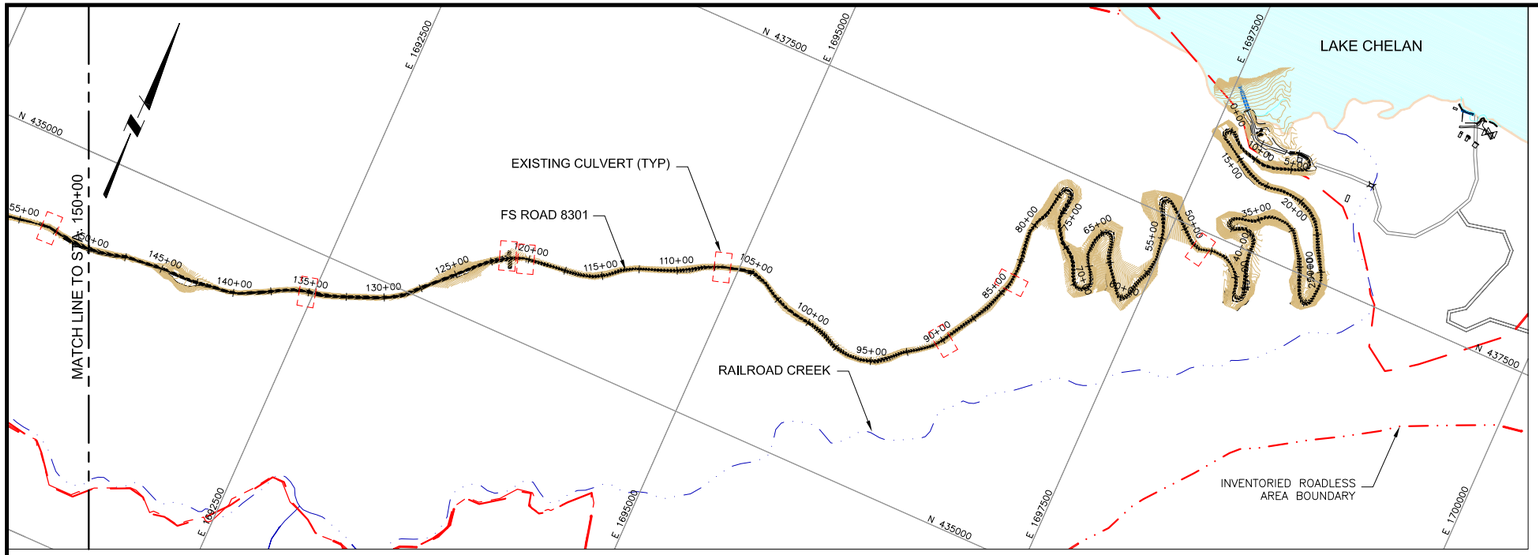

PLAN

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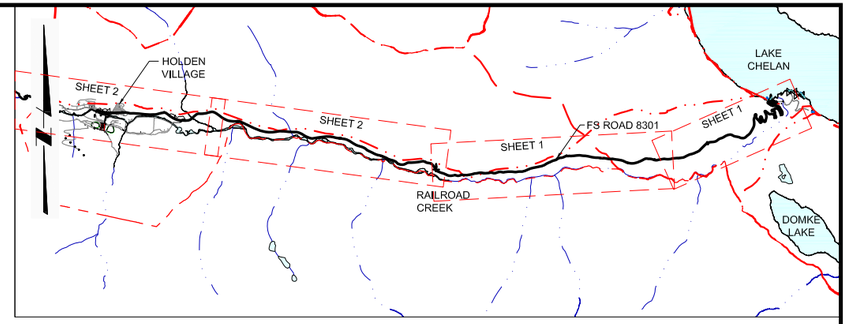
CONTOUR INTERVAL = 10 FEET



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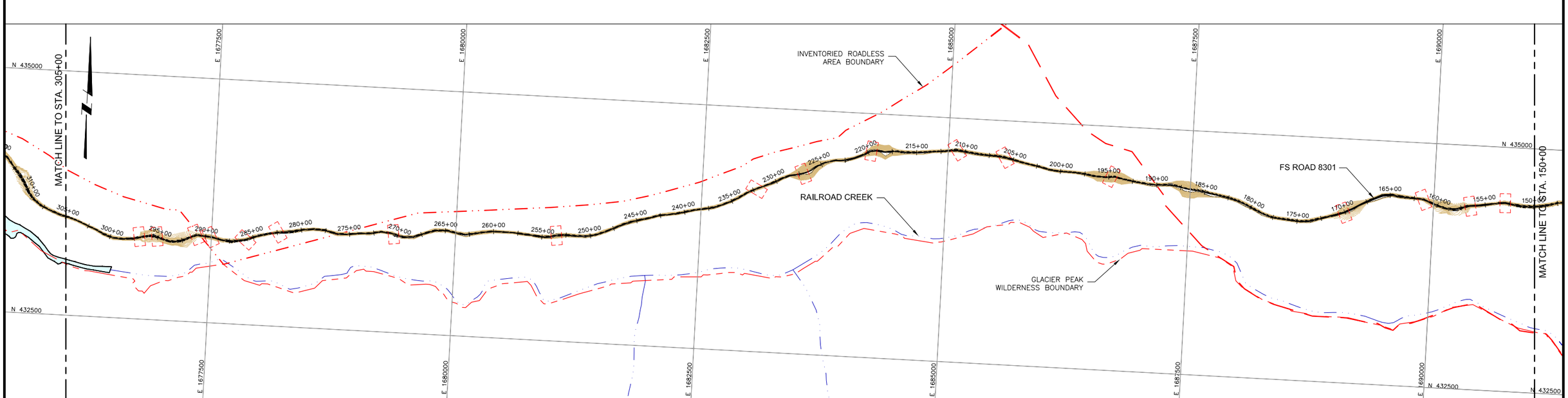

PLAN

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REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):
- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- FS ROAD 8301 TOPOGRPAHY RECEIVED FROM ERLANDSEN DATED: JANUARY 18, 2011.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	R. WATT	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: EXISTING CULVERTS ALONG FS ROAD 8301 (SHEET 1 OF 2)

MWH

SHEET: 10-3-27
REVISION: B
FILE NAME: 1008679D313

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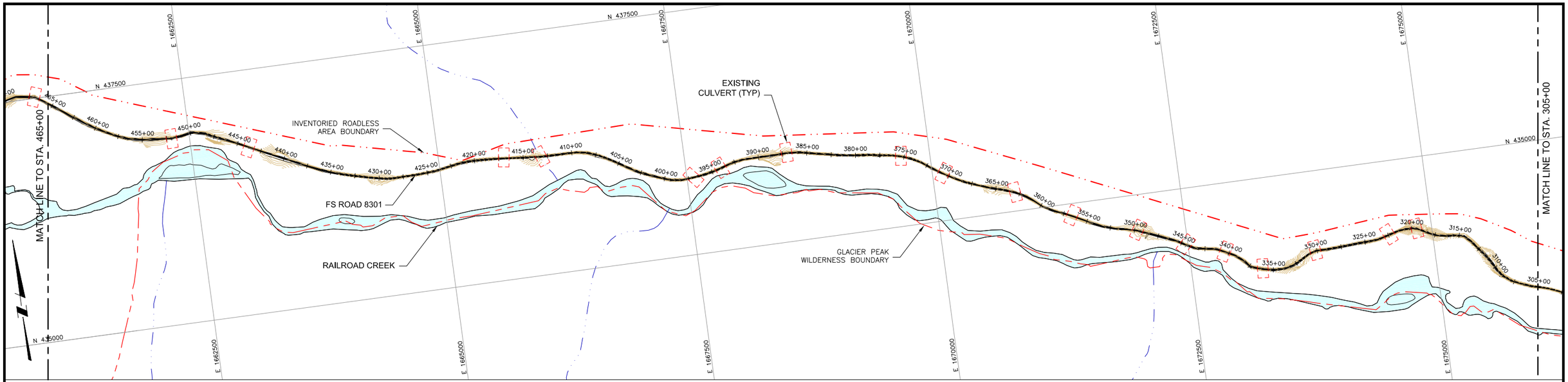

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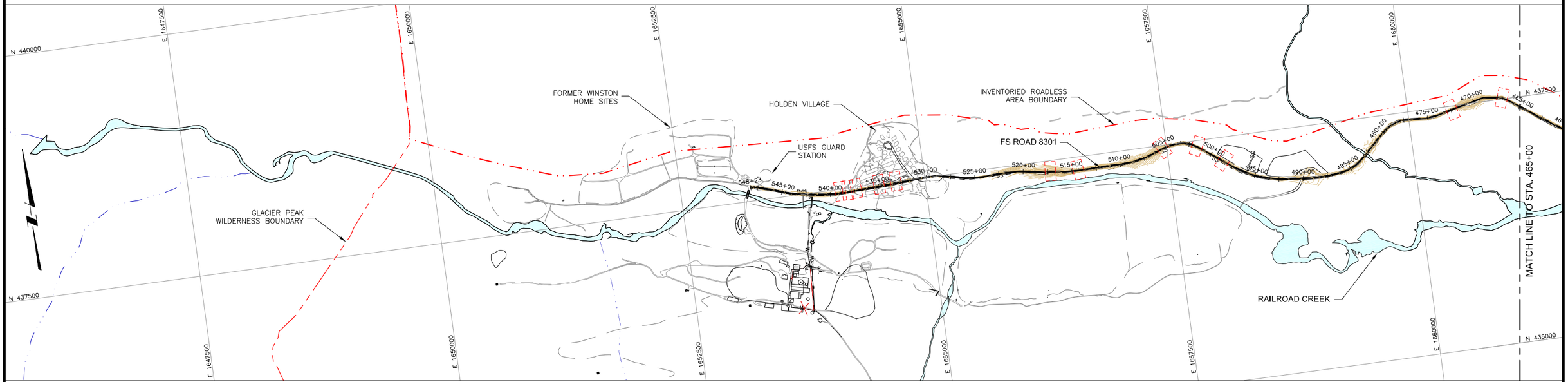

PLAN

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CONTOUR INTERVAL = 10 FEET

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
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- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	R. WATT	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: EXISTING CULVERTS ALONG FS ROAD 8301 (SHEET 2 OF 2)

MWH

SHEET: 10-3-28
REVISION: B
FILE NAME: 1008679D314

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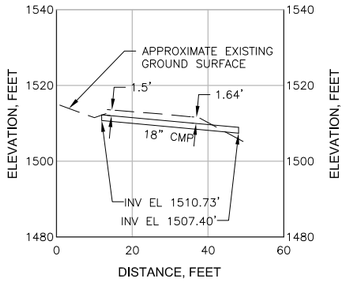
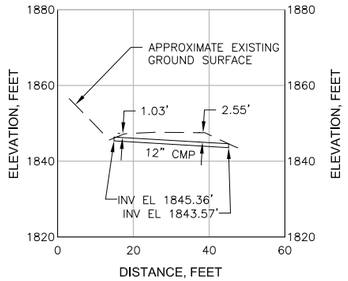
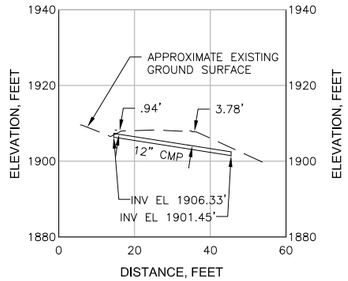


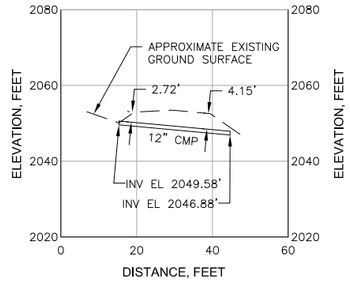
C1 - STA 48+28



C2 - STA 84+09



C3 - STA 90+00



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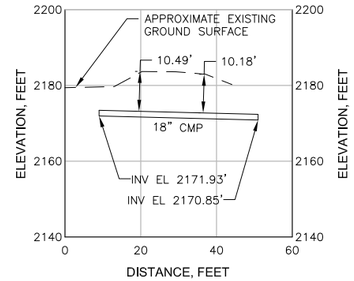
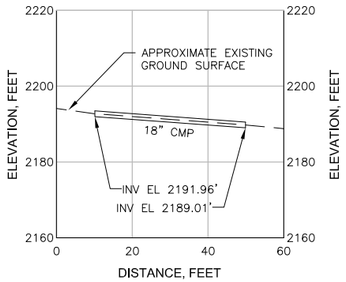


C5 - STA 120+19



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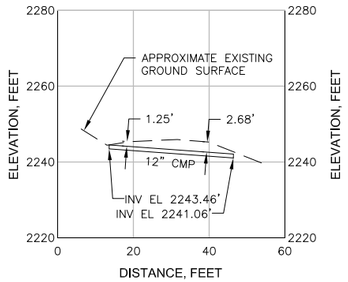

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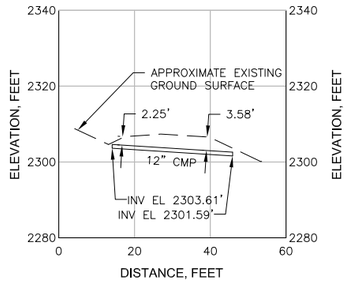
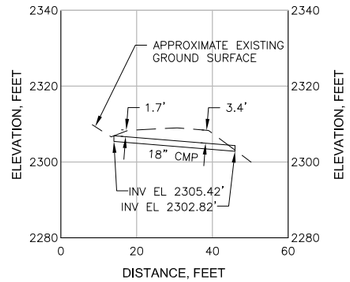


C8 - STA 152+93



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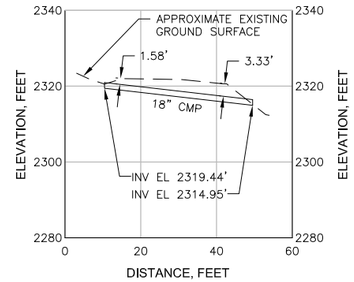

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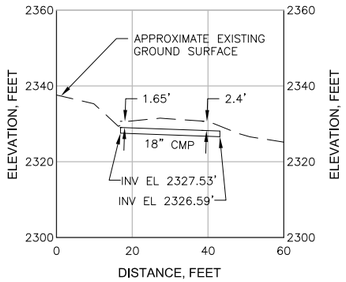
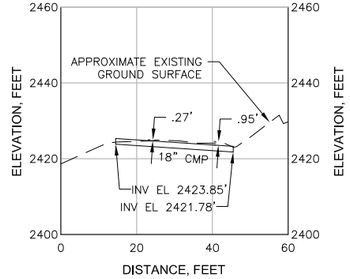


C11 - STA 170+09

C12 - STA 175+83

C13 - STA 188+52



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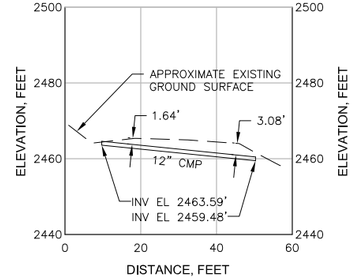
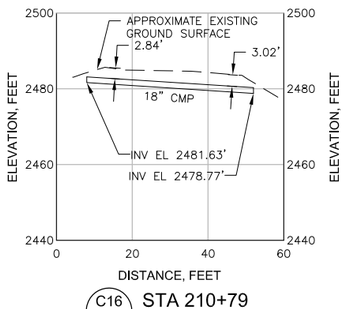
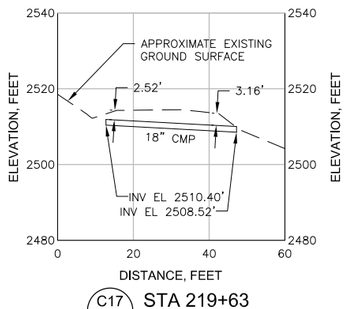


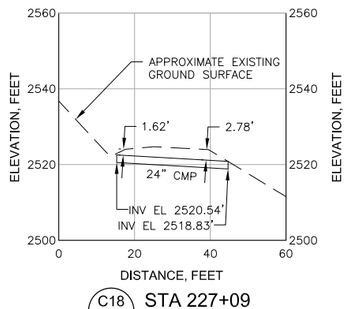
C15 - STA 205+86



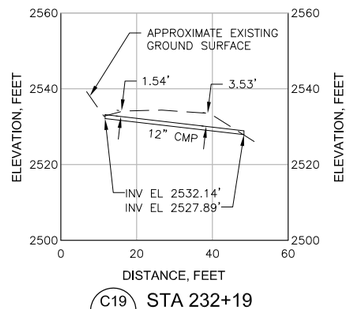
C16 - STA 210+79



C17 - STA 219+63



C18 - STA 227+09



C19 - STA 232+19

C20 - STA 249+81

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
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APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: EXISTING CULVERT PROFILES C1 THROUGH C20

MWH

SHEET: 10-3-29
REVISION: B
FILE NAME: 1008679D330

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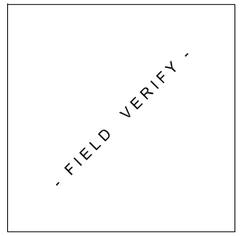
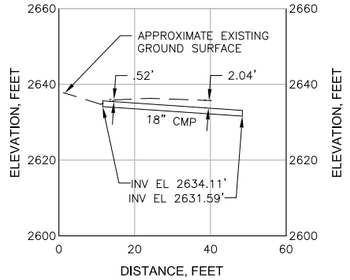
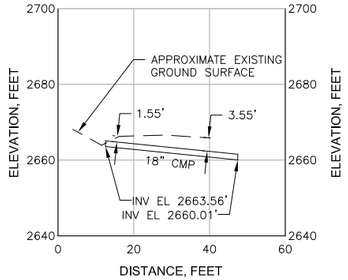


C21 - STA 253+46

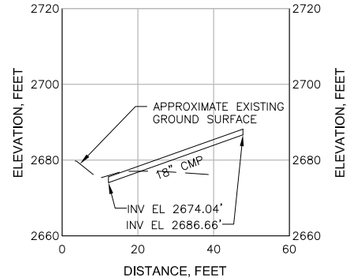
C22 - STA 253+46



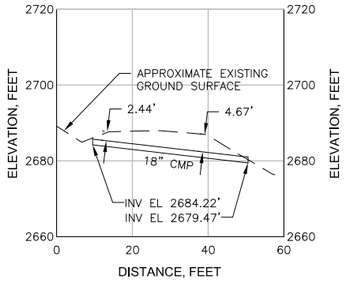
C23 - STA 270+37



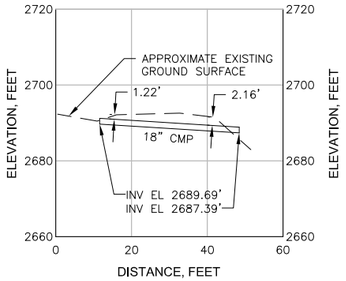
C24 - STA 282+33



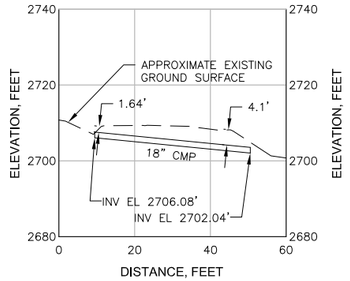
C25 - STA 285+76



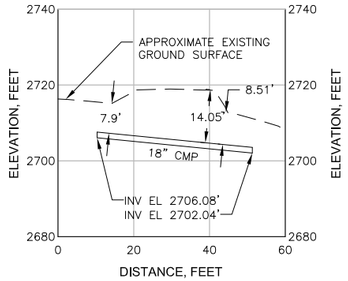
C26 - STA 289+38



C27 - STA 290+88



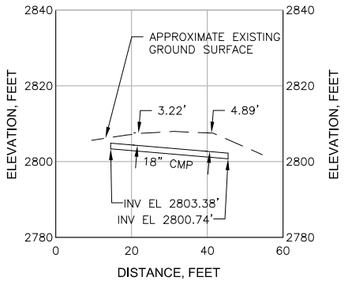
C28 - STA 295+04



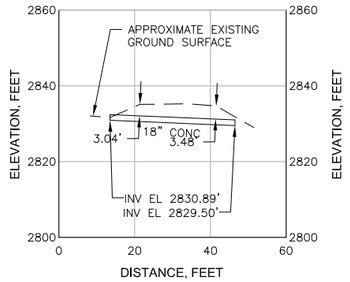
C29 - STA 296+88

C30 - STA 310+25

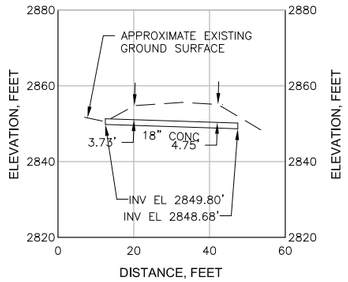
C31 - STA 319+39



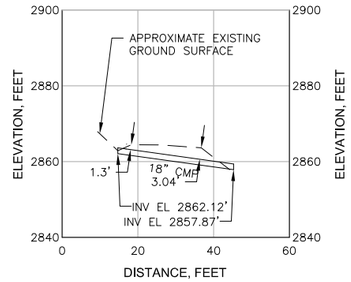
C32 - STA 322+32



C33 - STA 330+09



C34 - STA 335+99



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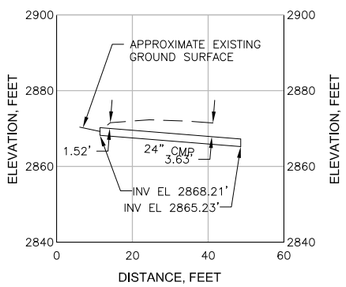

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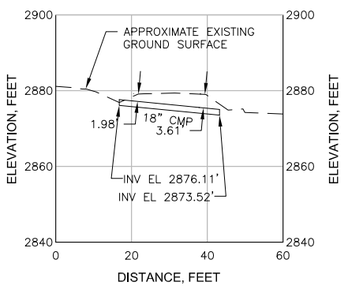
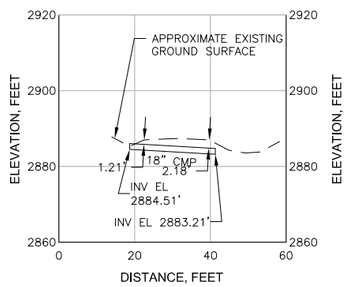
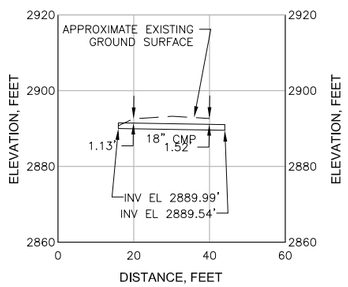


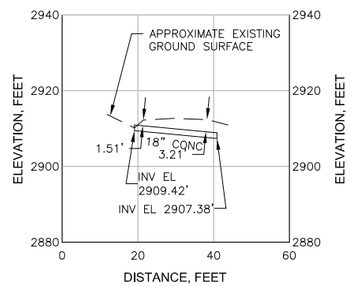
C37 - STA 349+59



C38 - STA 356+54



C39 - STA 366+89



C40 - STA 370+53

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: EXISTING CULVERT PROFILES C21 THROUGH C40

MWH

SHEET: 10-3-30
REVISION: B
FILE NAME: 1008679D331

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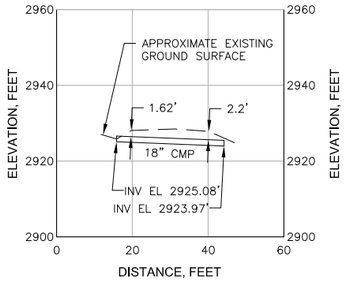
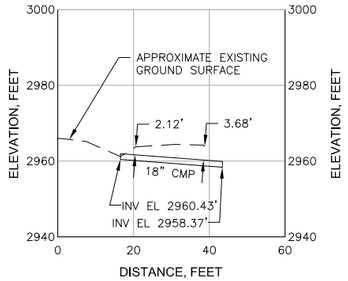
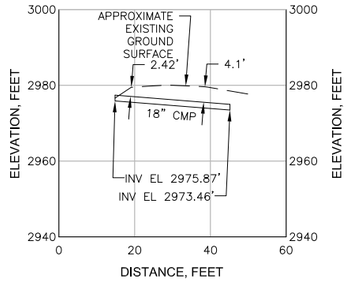


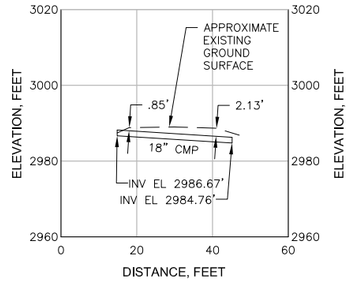
C41 - STA 375+24



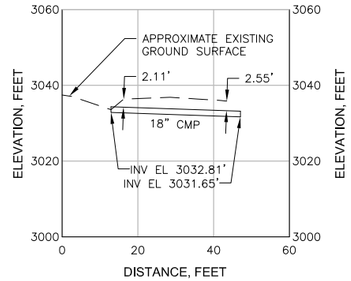
C42 - STA 386+99



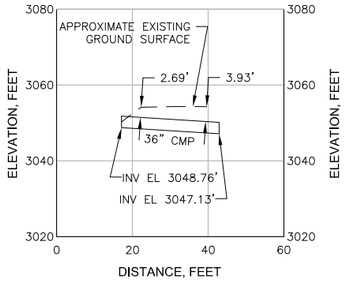
C43 - STA 393+96



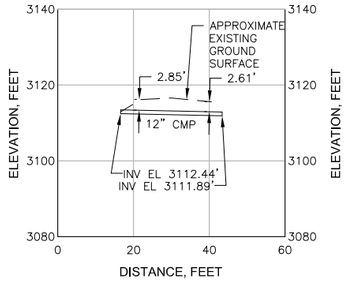
C44 - STA 396+90



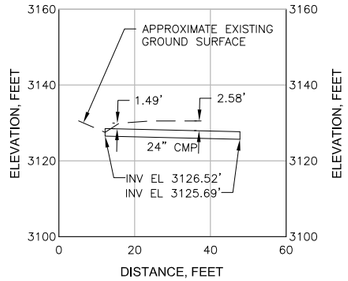
C45 - STA 413+07



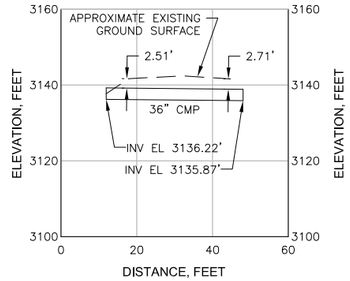
C46 - STA 416+91



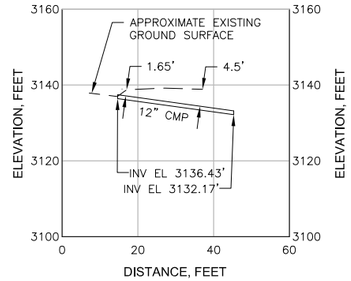
C47 - STA 443+77



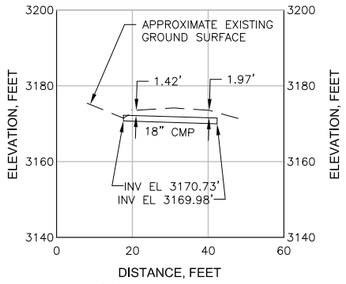
C48 - STA 451+99



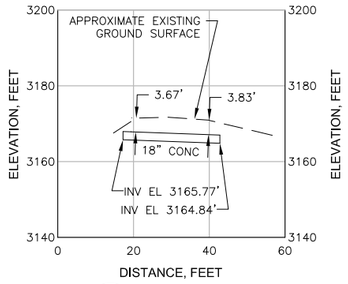
C49 - STA 467+00



C50 - STA 472+39



C51 - STA 498+48



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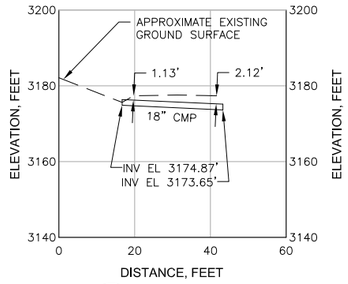
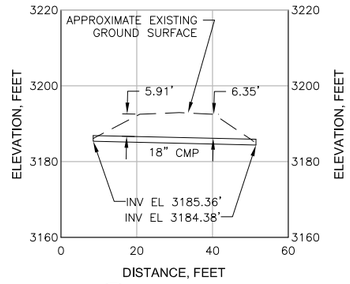
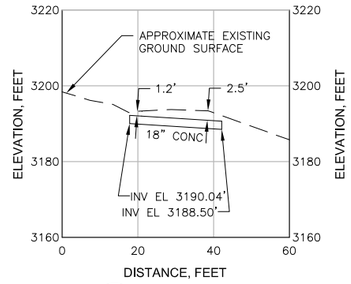


C53 - STA 505+20



C54 - STA 514+24



C55 - STA 517+11

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: EXISTING CULVERT PROFILES C41 THROUGH C55

MWH

SHEET: 10-3-31

REVISION: B

FILE NAME: 1008679D332

M:\Clients-G-Z\Rio Tinto\1008679 - Holden Mine\013-Sheet Set\Infrastructure Improvements\FS Road 830\1008679D332 4/15/2011 3:26:36 PM

FORMER WINSTON HOME SITES
USFS GUARD STATION
HOLDEN VILLAGE
EXISTING BRIDGE
LAGOON AREA
LOWER WEST AREA
SHEET 10-4-6
HOLDEN VILLAGE HYDROELECTRIC PLANT
TAILINGS PILE 1
SEDIMENT POND TO REMAIN
WEST WASTE ROCK PILE
EAST WASTE ROCK PILE
SHEET 10-4-5
INVENTORIED ROADLESS AREA BOUNDARY
RAILROAD CREEK
TAILINGS PILE 2
TAILINGS PILE 3
EXISTING ACCESS ROAD
FS ROAD 8301
TENMILE CREEK
TO LUCERNE 9.5 MILES
SHEET 10-4-2
SHEET 10-4-4
SHEET 10-4-3
EXISTING ROAD
COPPER CREEK
HOLDEN VILLAGE BY-PASS ROAD
N 438000
N 437000
N 436000
E 1654000
E 1655000
E 1656000
E 1657000
E 1658000
E 1659000
69+41
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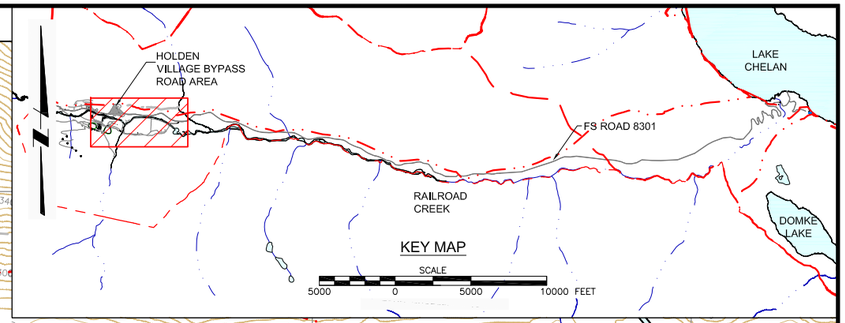
KEY MAP



SCALE
5000 0 5000 10000 FEET

PLAN

SCALE
200 0 200 400 FEET
CONTOUR INTERVAL = 10 FEET

REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):
- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.
- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA–FSA–APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BYPASS ROAD KEY MAP

MWH

SHEET: 10-4-1
REVISION: B
FILE NAME: 1008679D238

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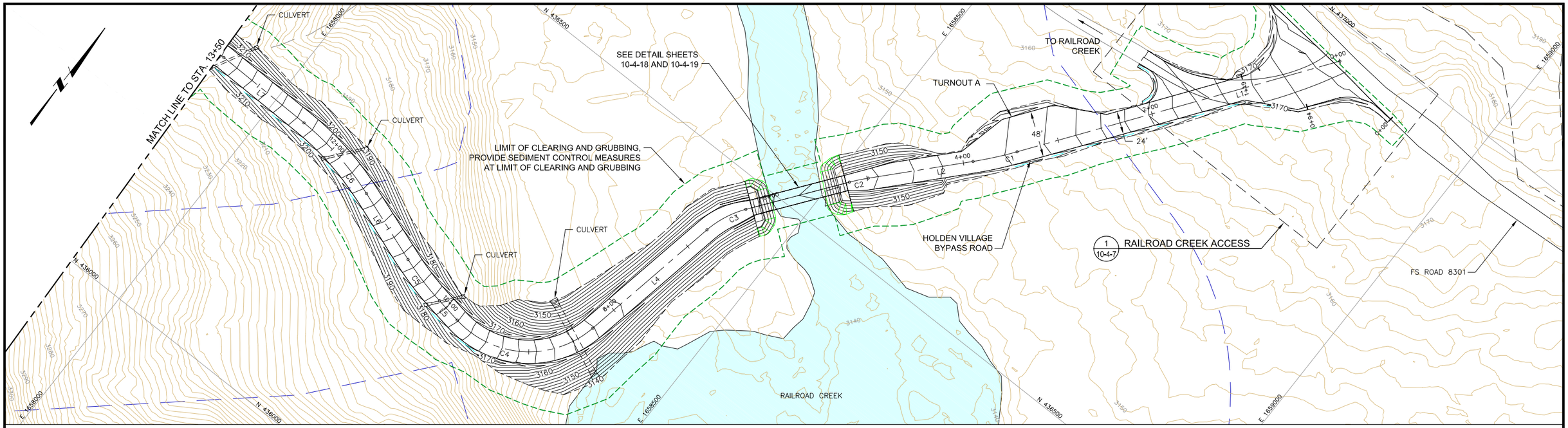

PLAN

SCALE

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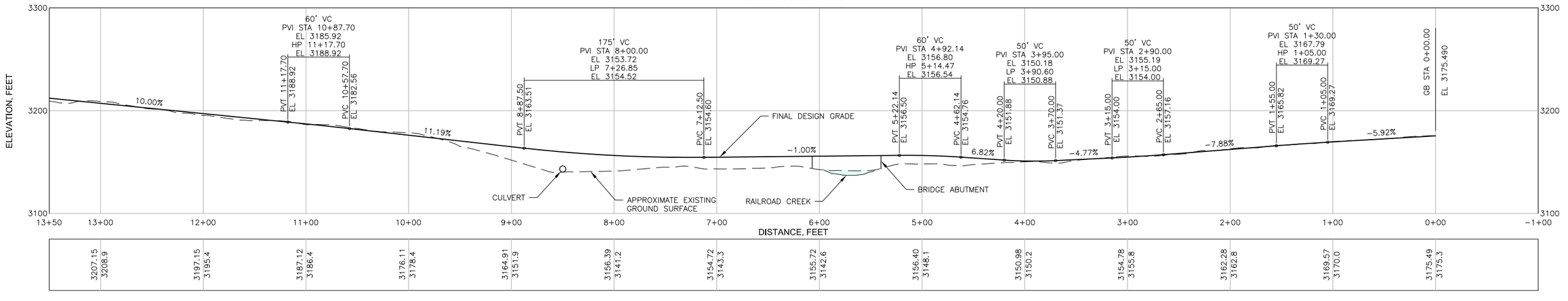
CONTOUR INTERVAL = 2 FEET

LEGEND:

L44 LINE AND CURVE DESIGNATIONS
C47 SEE SHEET 10-4-8 FOR LINE AND CURVE TABLES



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3208.9	3195.4	3186.4	3178.4	3151.9
3156.39	3154.72	3155.72	3156.40	3150.98
3141.2	3143.3	3142.6	3148.1	3150.2
3154.78	3162.28	3169.57	3175.49	
3155.8	3162.8	3170.0	3175.3	

PROFILE

SCALE

50 0 50 100 FEET

NOTE:

1. LIMITS OF CLEARING AND GRUBBING BASED ON DESIGN CUT/FILL DAYLIGHT LIMITS PLUS 20 FEET HORIZONTALLY.

ISSUE / REV				
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: BYPASS ROAD STA 0+00 TO STA 13+50 PLAN AND PROFILE

MWH

SHEET: 10-4-2 REVISION: B

FILE NAME: 1008679D264

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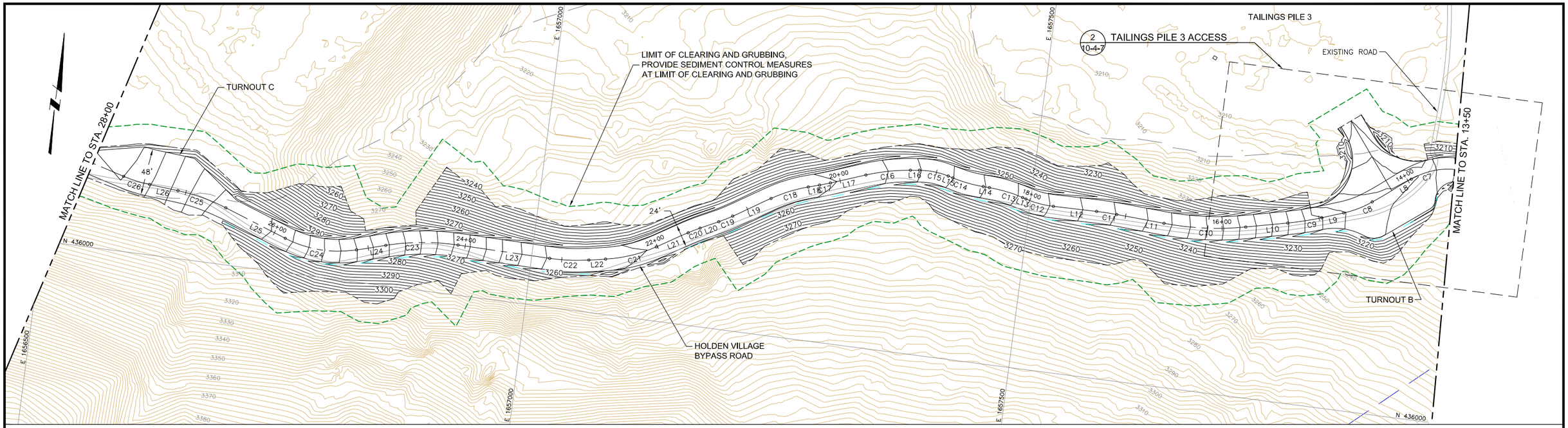


PLAN

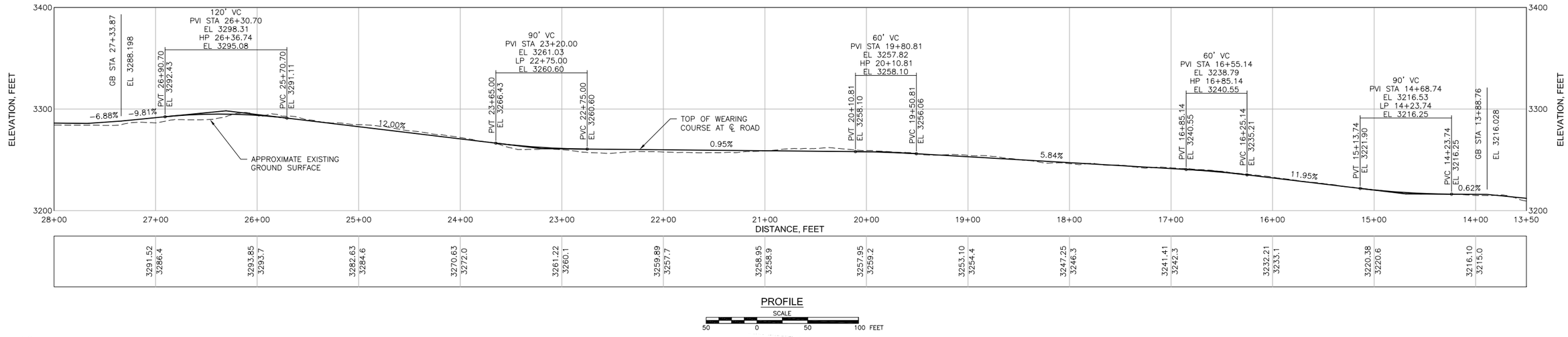
SCALE

50 0 50 100 FEET

CONTOUR INTERVAL = 2 FEET

LEGEND:

L44 LINE AND CURVE DESIGNATIONS
C47 SEE SHEET 10-4-8 FOR LINE AND CURVE TABLES



PROFILE

SCALE

50 0 50 100 FEET

NOTE:

1. LIMITS OF CLEARING AND GRUBBING BASED ON DESIGN CUT/FILL DAYLIGHT LIMITS PLUS 20 FEET HORIZONTALLY.

ISSUE/REV				
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.
- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA–FSA–APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

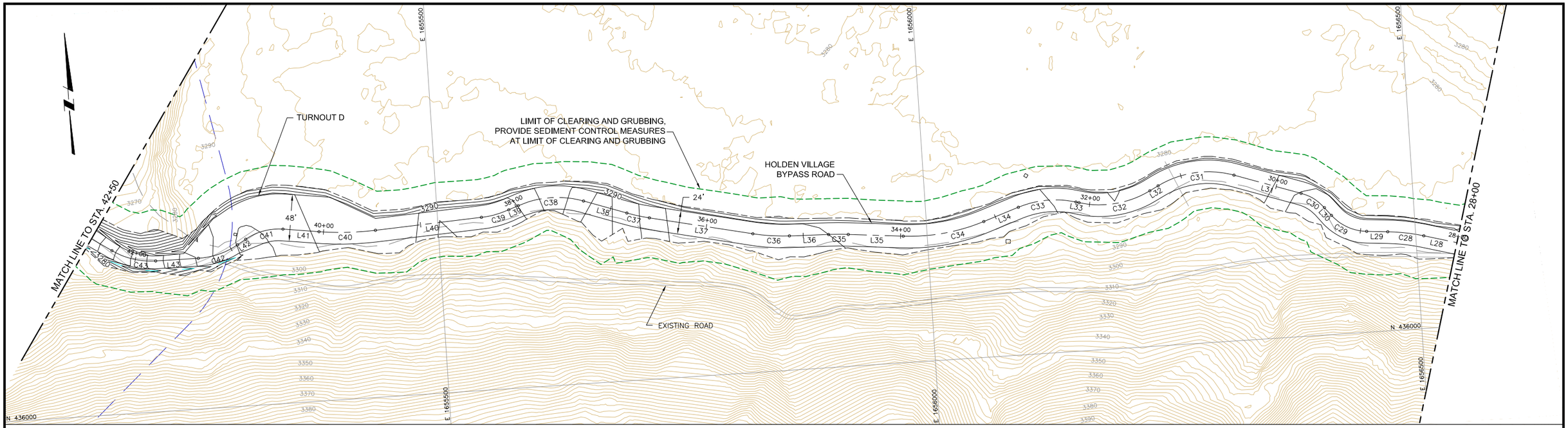
Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BYPASS ROAD STA 13+50 TO STA 28+00 PLAN AND PROFILE

MWH

SHEET 10-4-3
REVISION B
FILE NAME 1008679D265

M:\clients-q-z\rio tinto\1008679 - holden mine\013-sheet set\infrastructure improvements\Holden Village Bypass Road\1008679D265 4/15/2011 3:05:18 PM



PLAN

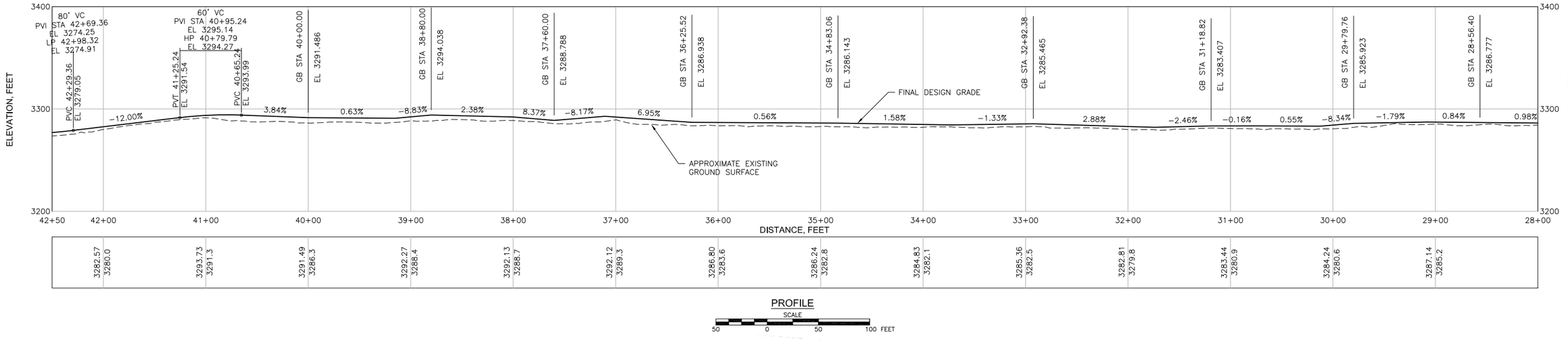
SCALE

50 0 50 100 FEET

CONTOUR INTERVAL = 2 FEET

LEGEND:

L44 LINE AND CURVE DESIGNATIONS
C47 SEE SHEET 10-4-8 FOR LINE AND CURVE TABLES



PROFILE

SCALE

50 0 50 100 FEET

NOTE:

1. LIMITS OF CLEARING AND GRUBBING BASED ON DESIGN CUT/FILL DAYLIGHT LIMITS PLUS 20 FEET HORIZONTALLY.

ISSUE / REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: BYPASS ROAD STA 28+00 TO STA 42+50 PLAN AND PROFILE

MWH

SHEET 10-4-4 REVISION B

FILE NAME 1008679D266

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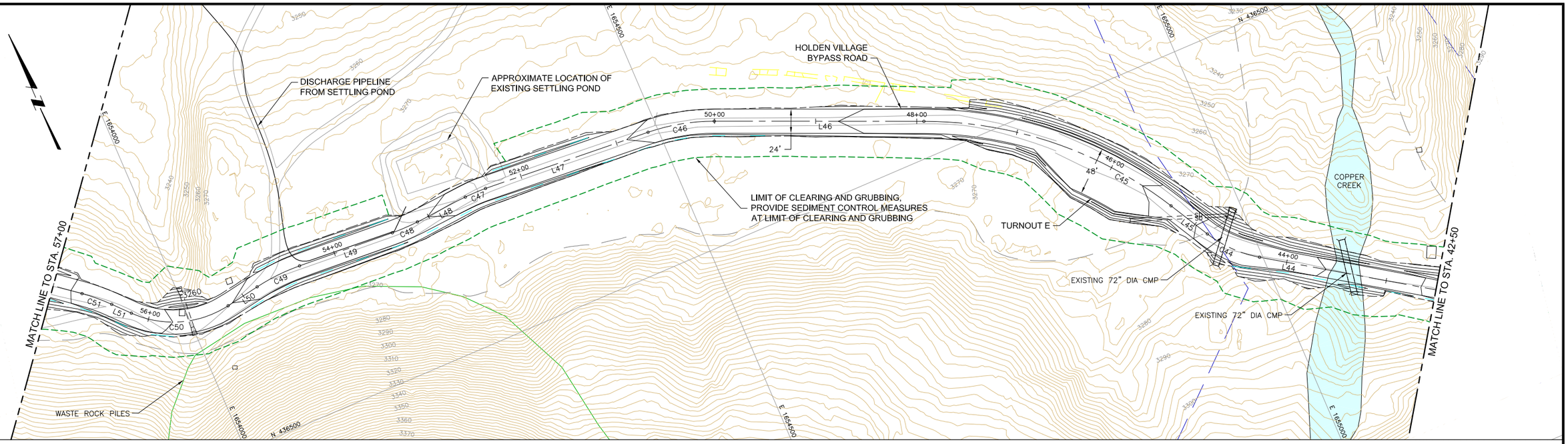


PLAN

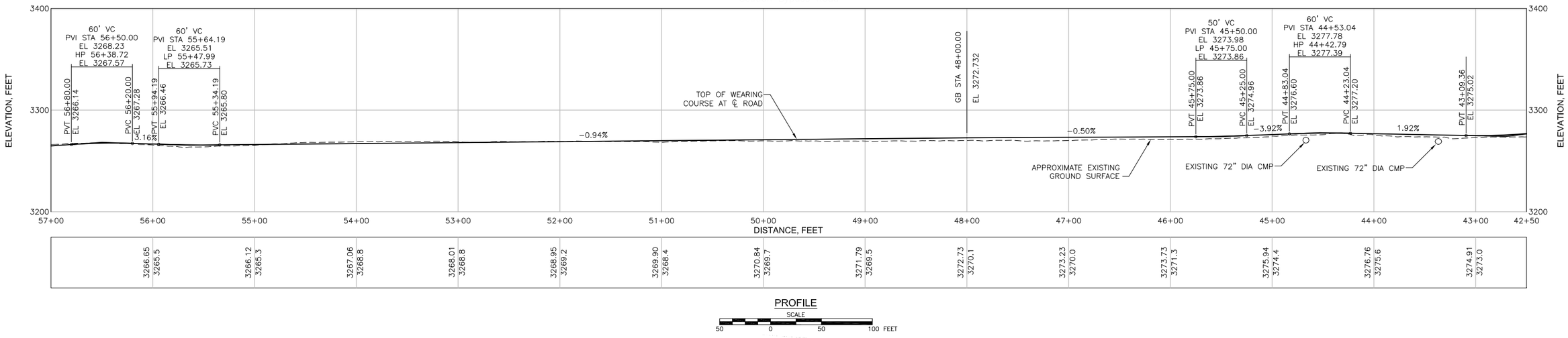
SCALE
50 0 50 100 FEET
CONTOUR INTERVAL = 2 FEET

LEGEND:

L44 LINE AND CURVE DESIGNATIONS
C47 SEE SHEET 10-4-8 FOR LINE AND CURVE TABLES

NOTE:

1. VERIFY DEPTH OF COVER OVER RAW WATER AND WATER LINES BY POTHOLING PRIOR TO STRIPPING AND GRUBBING FOR ROAD CONSTRUCTION.



PROFILE

SCALE
50 0 50 100 FEET

NOTE:

1. LIMITS OF CLEARING AND GRUBBING BASED ON DESIGN CUT/FILL DAYLIGHT LIMITS PLUS 20 FEET HORIZONTALLY.

ISSUE / REV				
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BYPASS ROAD STA 42+50 TO STA 57+00 PLAN AND PROFILE

MWH

SHEET: 10-4-5
REVISION: B
FILE NAME: 1008679D267

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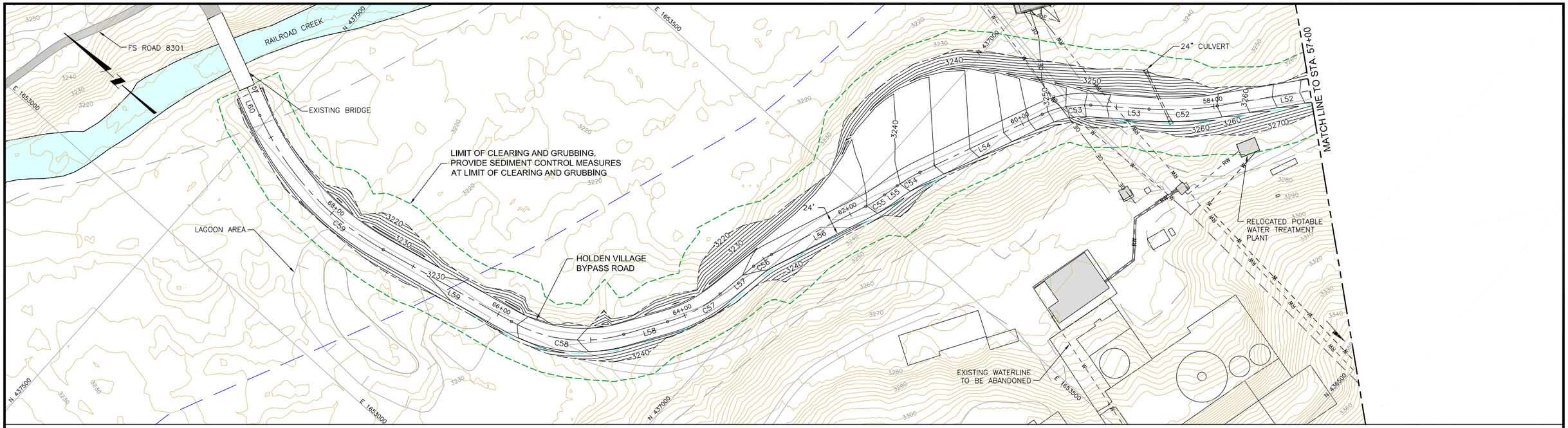
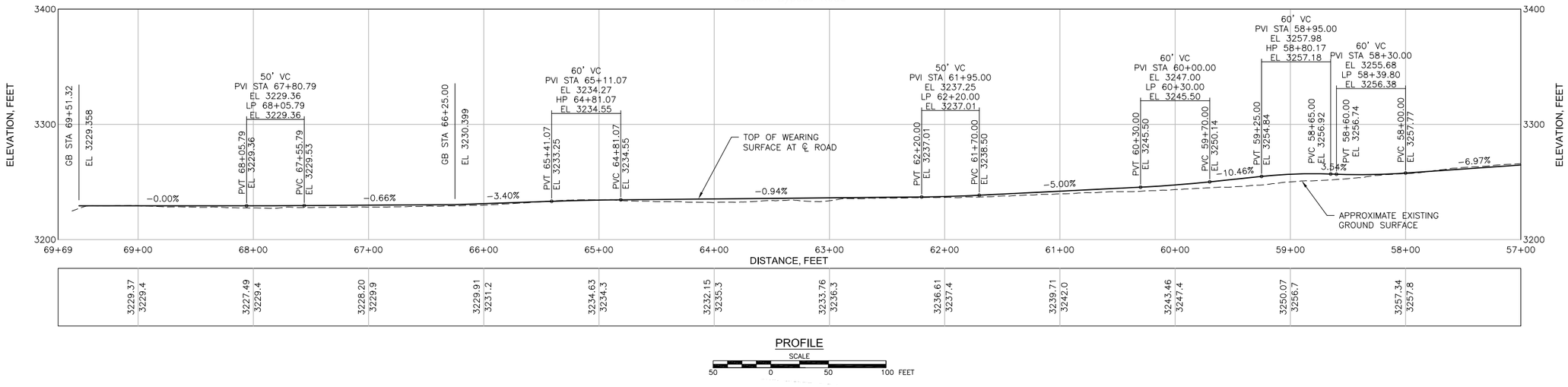


PLAN
SCALE
50 0 50 100 FEET
CONTOUR INTERVAL = 2 FEET

LEGEND:

L44 LINE AND CURVE DESIGNATIONS
C47 SEE SHEET 10-4-8 FOR LINE AND CURVE TABLES



PROFILE
SCALE
50 0 50 100 FEET

NOTE:

1. LIMITS OF CLEARING AND GRUBBING BASED ON DESIGN CUT/FILL DAYLIGHT LIMITS PLUS 20 FEET HORIZONTALLY.

ISSUE/REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	03/01/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BYPASS ROAD STA 57+00 TO STA 69+69 PLAN AND PROFILE

MWH

SHEET 10-4-6
REVISION B
FILE NAME 1008679D268

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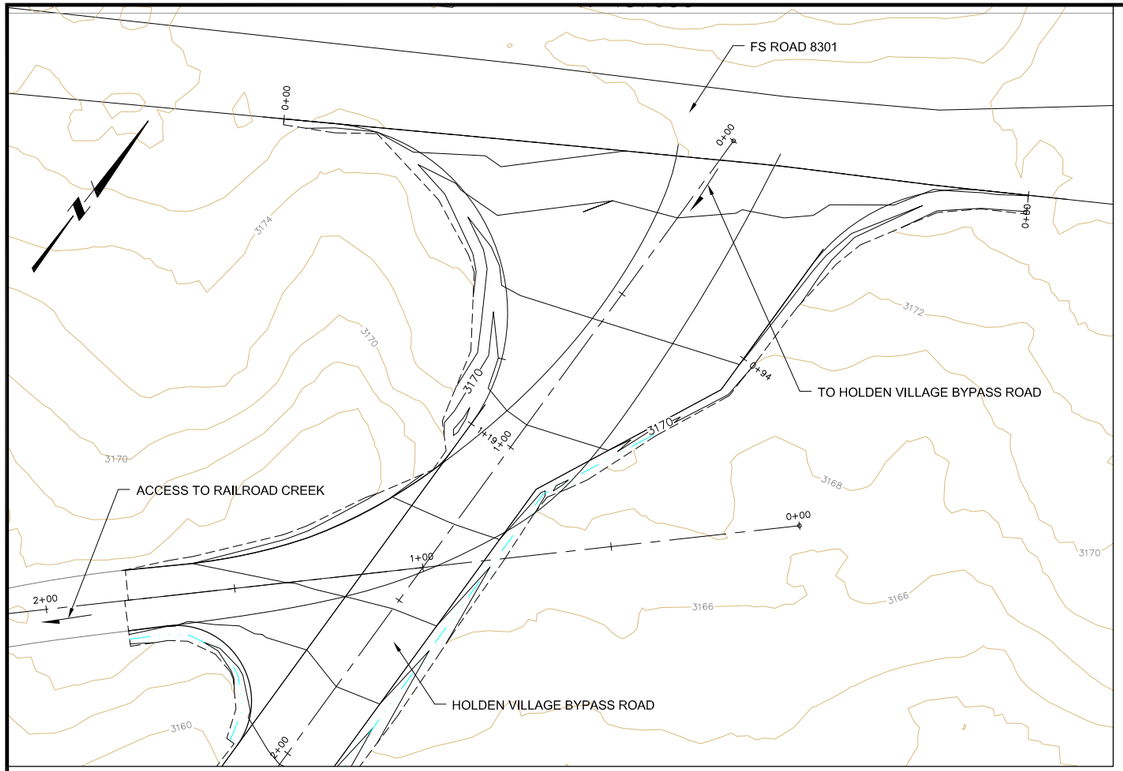
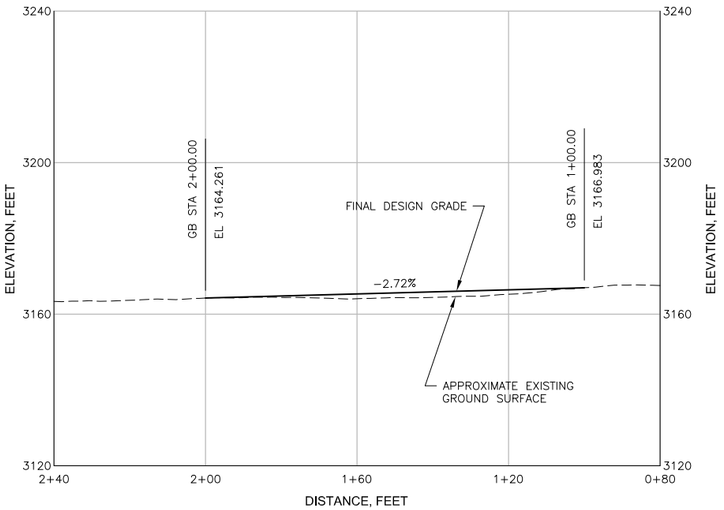
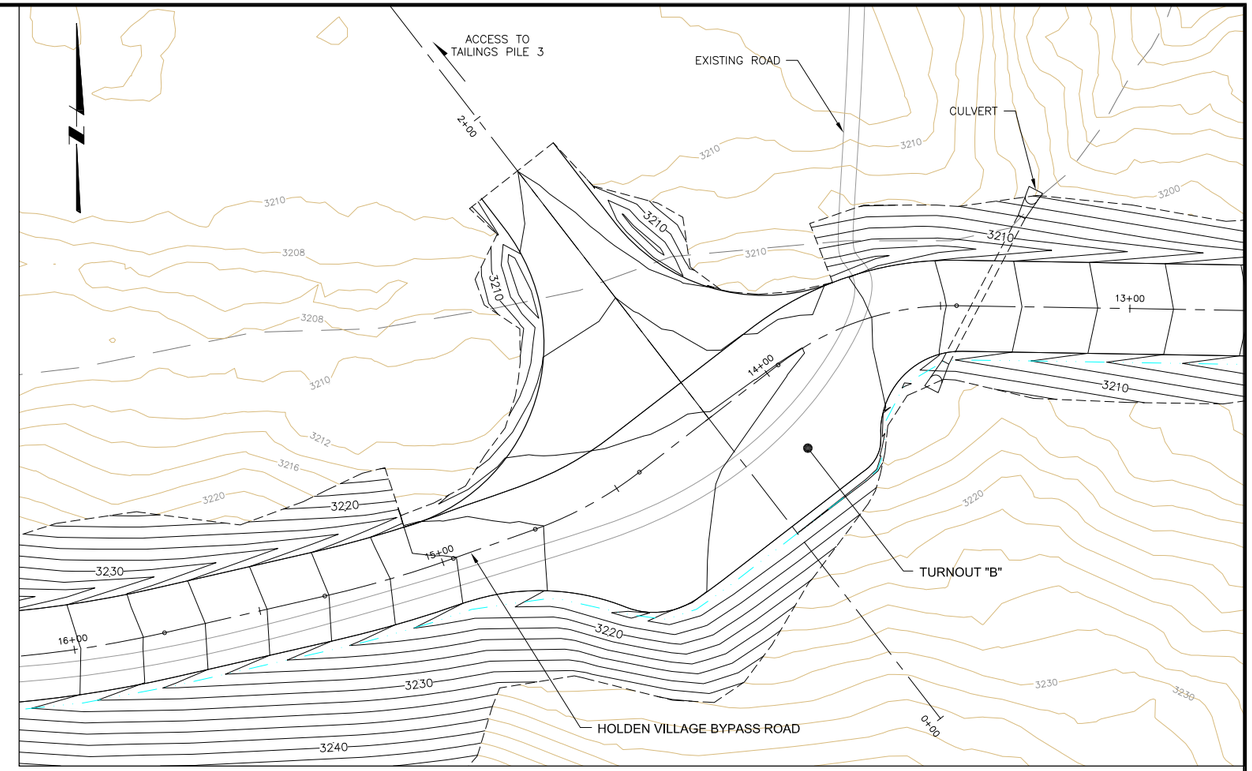


PLAN
SCALE
20 0 20 40 FEET
CONTOUR INTERVAL = 2 FEET

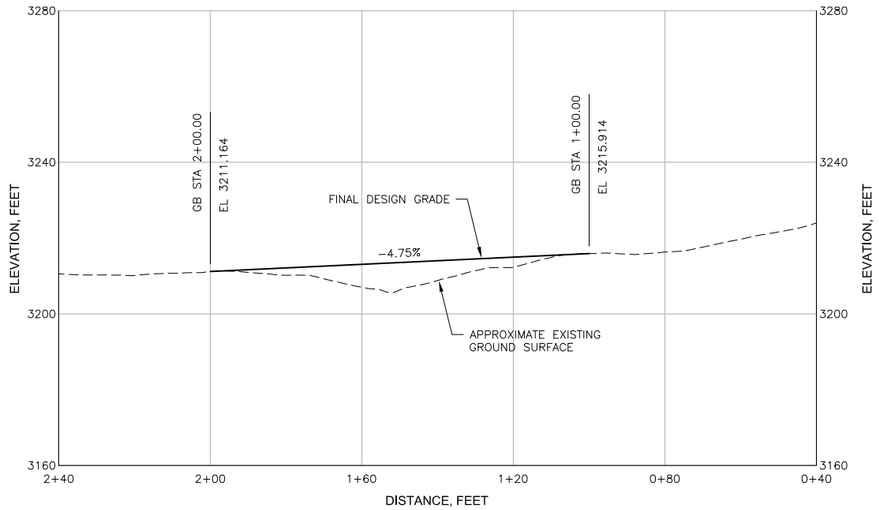


PROFILE

1 / 10-4-2 RAILROAD CREEK ACCESS
SCALE
20 0 20 40 FEET



PLAN
SCALE
20 0 20 40 FEET
CONTOUR INTERVAL = 2 FEET



PROFILE

2 / 10-4-3 TAILINGS PILE 3 ACCESS
SCALE
20 0 20 40 FEET

ISSUE / REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BYPASS ROAD DETAILS
MWH
SHEET: 10-4-7
REVISION: B
FILE NAME: 1008679D311

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LINE TABLE					
LINE NO.	LENGTH	DIRECTION	STATION (PT)	START NORTHING	START EASTING
L1	343.76'	S36° 03' 40.55"W	0+00.00	436966.31	1658832.32
L2	108.93'	S42° 41' 02.85"W	3+90.00	436652.70	1658600.64
L3	109.72'	S37° 01' 05.78"W	5+18.70	436557.45	1658514.13
L4	154.71'	S11° 01' 31.29"W	6+73.79	436428.76	1658429.76
L5	26.69'	N80° 41' 54.00"W	9+82.57	436197.35	1658285.86
L6	79.96'	N70° 29' 53.18"W	10+62.67	436214.93	1658207.85
L7	105.99'	N89° 02' 57.76"W	12+39.76	436258.79	1658037.31
L8	46.28'	S52° 18' 29.55"W	13+96.34	436244.91	1657884.23
L9	22.95'	S70° 20' 05.82"W	14+74.08	436201.58	1657820.12
L10	43.40'	S77° 05' 25.37"W	15+32.40	436183.94	1657764.57
L11	49.37'	N86° 49' 58.35"W	16+59.98	436167.12	1657638.67
L12	44.70'	S89° 12' 17.48"W	17+30.10	436170.28	1657568.63
L13	3.71'	N74° 03' 51.65"W	18+04.00	436173.49	1657495.09
L14	6.35'	N87° 42' 38.09"W	18+43.44	436180.15	1657456.34
L15	5.22'	N75° 19' 55.55"W	18+82.19	436185.17	1657418.00
L16	9.32'	S83° 00' 10.79"W	19+17.66	436188.51	1657382.95
L17	37.26'	S69° 50' 23.07"W	19+72.92	436176.61	1657329.14
L18	11.75'	S73° 06' 41.59"W	20+21.61	436160.14	1657283.33
L19	43.28'	S57° 48' 39.47"W	20+73.41	436140.14	1657235.76
L20	20.22'	S63° 42' 06.90"W	21+32.12	436109.55	1657185.68
L21	35.64'	S58° 40' 58.85"W	21+65.48	436094.26	1657156.04

LINE TABLE					
LINE NO.	LENGTH	DIRECTION	STATION (PT)	START NORTHING	START EASTING
L22	17.14'	S79° 16' 25.00"W	22+55.03	436056.50	1657075.54
L23	94.95'	N89° 10' 23.09"W	23+12.50	436049.84	1657018.59
L24	30.40'	S73° 46' 22.47"W	24+81.86	436041.27	1656850.18
L25	68.45'	N70° 16' 43.67"W	25+87.55	436035.04	1656746.96
L26	29.61'	N85° 15' 38.11"W	27+08.30	436069.18	1656631.56
L27	68.72'	N74° 31' 26.91"W	27+66.02	436076.55	1656574.42
L28	21.64'	N85° 11' 23.72"W	28+71.97	436101.44	1656471.60
L29	10.75'	N38° 28' 27.11"W	29+34.38	436121.97	1656415.08
L30	71.27'	N71° 05' 15.94"W	29+73.59	436146.57	1656385.45
L31	9.85'	S62° 37' 40.66"W	31+25.64	436163.88	1656239.65
L32	3.21'	N74° 09' 08.47"W	32+10.92	436151.95	1656157.61
L33	38.31'	S71° 19' 57.17"W	32+74.37	436151.37	1656095.21
L34	56.40'	N84° 25' 31.47"W	33+97.30	436129.53	1655975.47
L35	40.16'	N88° 17' 26.70"W	34+73.94	436136.29	1655899.15
L36	107.37'	N77° 30' 10.27"W	35+51.75	436142.14	1655821.69
L37	46.16'	N70° 44' 24.35"W	36+82.73	436171.83	1655694.17
L38	10.61'	S70° 04' 15.78"W	37+97.29	436186.67	1655583.52
L39	109.54'	S86° 48' 05.66"W	38+37.10	436177.22	1655545.04
L40	37.07'	N82° 07' 39.95"W	40+04.61	436173.47	1655377.84
L41	10.03'	S59° 18' 56.01"W	40+82.06	436170.71	1655302.28
L42	43.78'	N89° 46' 29.65"W	41+35.25	436154.39	1655252.52

LINE TABLE					
LINE NO.	LENGTH	DIRECTION	STATION (PT)	START NORTHING	START EASTING
L43	201.59'	N56° 17' 21.01"W	42+25.78	436168.01	1655164.65
L44	45.42'	N29° 01' 59.24"W	44+84.46	436321.48	1654958.64
L45	207.30'	N66° 43' 06.31"W	47+92.97	436534.49	1654744.96
L46	170.08'	N85° 50' 29.24"W	50+67.02	436632.19	1654489.99
L47	53.29'	S85° 50' 41.30"W	52+58.86	436644.52	1654298.61
L48	97.45'	N86° 23' 37.77"W	53+39.25	436640.53	1654218.39
L49	34.27'	S80° 10' 17.29"W	54+83.59	436644.12	1654074.42
L50	21.36'	N42° 28' 58.11"W	56+17.95	436669.26	1653949.83
L51	125.66'	N51° 25' 30.85"W	56+70.52	436706.30	1653912.62
L52	59.92'	N37° 59' 10.48"W	58+66.54	436834.55	1653765.00
L53	138.83'	N67° 20' 54.56"W	59+77.71	436912.51	1653687.81
L54	16.00'	N77° 39' 15.77"W	61+43.52	436974.08	1653533.99
L55	108.48'	N68° 57' 34.09"W	61+82.28	436984.03	1653496.58
L56	44.74'	N81° 30' 24.48"W	63+12.67	437028.55	1653374.20
L57	46.87'	N58° 05' 44.65"W	64+18.69	437056.18	1653272.83
L58	150.88'	N12° 42' 54.19"W	65+84.37	437175.27	1653166.00
L59	31.98'	N23° 35' 47.38"E	69+25.37	437508.57	1653150.51

CURVE TABLE						
CURVE NO.	RADIUS	LENGTH	CHORD DIRECTION	STATION (PC)	START NORTHING	START EASTING
C1	400.00	46.24'	S39° 22' 21.70"W	3+43.76	436688.42	1658629.96
C2	200.00	19.78'	S39° 51' 04.31"W	4+98.93	436572.62	1658526.80
C3	100.00	45.37'	S24° 01' 18.53"W	6+28.42	436469.84	1658448.07
C4	100.00	154.07'	S55° 09' 48.64"W	8+28.49	436276.91	1658400.18
C5	300.00	53.41'	N75° 35' 53.59"W	10+09.26	436201.66	1658259.51
C6	300.00	97.13'	N79° 46' 25.47"W	11+42.63	436241.62	1658132.48
C7	75.00	50.58'	S71° 37' 45.89"W	13+45.76	436260.55	1657931.33
C8	100.00	31.46'	S61° 19' 17.68"W	14+42.62	436216.62	1657847.61
C9	300.00	35.37'	S73° 42' 45.60"W	14+97.03	436193.85	1657798.50
C10	300.00	84.18'	S85° 07' 43.51"W	15+75.81	436174.24	1657722.27
C11	300.00	20.75'	N88° 48' 50.43"W	17+09.36	436169.85	1657589.37
C12	100.00	29.20'	N82° 25' 47.08"W	17+74.80	436169.66	1657523.94
C13	150.00	35.73'	N80° 53' 14.87"W	18+07.71	436174.51	1657491.53
C14	150.00	32.41'	N81° 31' 16.82"W	18+49.78	436180.41	1657449.99
C15	80.00	30.25'	N86° 09' 52.38"W	18+87.41	436186.50	1657412.96
C16	200.00	45.95'	S76° 25' 16.93"W	19+26.98	436187.37	1657373.70
C17	200.00	11.42'	S71° 28' 32.33"W	20+10.19	436163.77	1657294.16
C18	150.00	40.06'	S65° 27' 40.53"W	20+33.36	436156.72	1657272.09
C19	150.00	15.42'	S60° 45' 23.19"W	21+16.70	436117.08	1657199.13
C20	150.00	13.14'	S61° 11' 32.88"W	21+52.34	436100.59	1657167.55

CURVE TABLE						
CURVE NO.	RADIUS	LENGTH	CHORD DIRECTION	STATION (PC)	START NORTHING	START EASTING
C21	150.00	53.91'	S68° 58' 41.92"W	22+01.12	436075.73	1657125.59
C22	200.00	40.33'	S85° 03' 00.95"W	22+72.17	436053.31	1657058.70
C23	250.00	74.41'	S82° 17' 59.69"W	24+07.45	436051.21	1656923.65
C24	120.00	75.29'	N88° 15' 10.60"W	25+12.26	436032.78	1656820.99
C25	200.00	52.30'	N77° 46' 10.89"W	26+56.00	436058.13	1656682.53
C26	150.00	28.11'	N79° 53' 32.51"W	27+37.91	436071.63	1656602.06
C27	200.00	37.23'	N79° 51' 25.32"W	28+34.74	436094.89	1656508.19
C28	50.00	40.77'	N61° 49' 55.42"W	28+93.61	436103.25	1656450.03
C29	50.00	28.46'	N54° 46' 51.53"W	29+45.13	436130.38	1656408.39
C30	100.00	80.78'	S85° 46' 12.36"W	30+44.85	436169.67	1656318.03
C31	100.00	75.43'	S84° 14' 16.10"W	31+35.48	436159.35	1656230.90
C32	100.00	60.24'	S88° 35' 24.35"W	32+14.13	436152.83	1656154.53
C33	200.00	84.62'	S83° 27' 12.85"W	33+12.68	436139.11	1656058.91
C34	300.00	20.24'	N86° 21' 29.08"W	34+53.70	436135.01	1655919.34
C35	200.00	37.66'	N82° 53' 48.49"W	35+14.10	436137.49	1655859.00
C36	200.00	23.61'	N74° 07' 17.31"W	36+59.12	436165.38	1655716.86
C37	100.00	68.40'	S89° 39' 55.71"W	37+28.89	436187.06	1655650.59
C38	100.00	29.20'	S78° 26' 10.72"W	38+07.90	436183.05	1655573.55
C39	300.00	57.97'	N87° 39' 47.15"W	39+46.64	436171.11	1655435.67
C40	60.00	40.38'	S78° 35' 38.03"W	40+41.68	436178.54	1655341.12

CURVE TABLE						
CURVE NO.	RADIUS	LENGTH	CHORD DIRECTION	STATION (PC)	START NORTHING	START EASTING
C41	80.00	43.16'	S74° 46' 13.18"W	40+92.09	436165.59	1655293.66
C42	80.00	46.75'	N73° 01' 55.33"W	41+79.03	436154.56	1655208.74
C43	120.00	57.08'	N42° 39' 40.13"W	44+27.37	436279.89	1654996.96
C44	400.00	263.09'	N47° 52' 32.78"W	45+29.87	436361.19	1654936.60
C45	200.00	66.75'	N76° 16' 47.78"W	50+00.27	436616.43	1654554.54
C46	150.00	21.77'	N89° 59' 53.97"W	52+37.10	436644.52	1654320.36
C47	200.00	27.09'	S89° 43' 31.77"W	53+12.16	436640.66	1654245.46
C48	200.00	46.90'	S86° 53' 19.76"W	54+36.70	436646.66	1654121.14
C49	100.00	100.09'	N71° 09' 20.41"W	55+17.86	436638.27	1654040.65
C50	200.00	31.21'	N46° 57' 14.48"W	56+39.31	436685.01	1653935.41
C51	300.00	70.37'	N44° 42' 20.67"W	57+96.18	436784.65	1653814.38
C52	100.00	51.25'	N52° 40' 02.52"W	59+26.46	436881.77	1653728.12
C53	150.00	26.98'	N72° 30' 05.16"W	61+16.54	436965.98	1653559.69
C54	150.00	22.76'	N73° 18' 24.93"W	61+59.52	436977.50	1653518.37
C55	100.00	21.90'	N75° 13' 59.29"W	62+90.77	437022.98	1653395.33
C56	150.00	61.29'	N69° 48' 04.56"W	63+57.40	437035.16	1653329.95
C57	150.00	118.81'	N35° 24' 19.42"W	64+65.56	437080.95	1653233.04
C58	300.00	190.13'	N5° 26' 26.60"E	67+35.25	437322.45	1653132.79

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ISSUE REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DRAWING REFERENCE(S):
- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.
- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA–FSA–APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

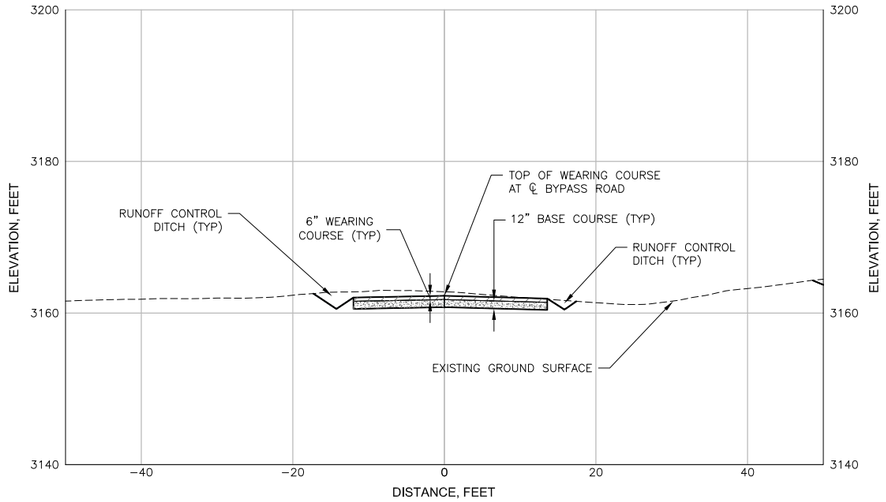
DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BYPASS ROAD LINE AND CURVE TABLES

MWH

SHEET: 10-4-8
REVISION: B
FILE NAME: 1008679D312



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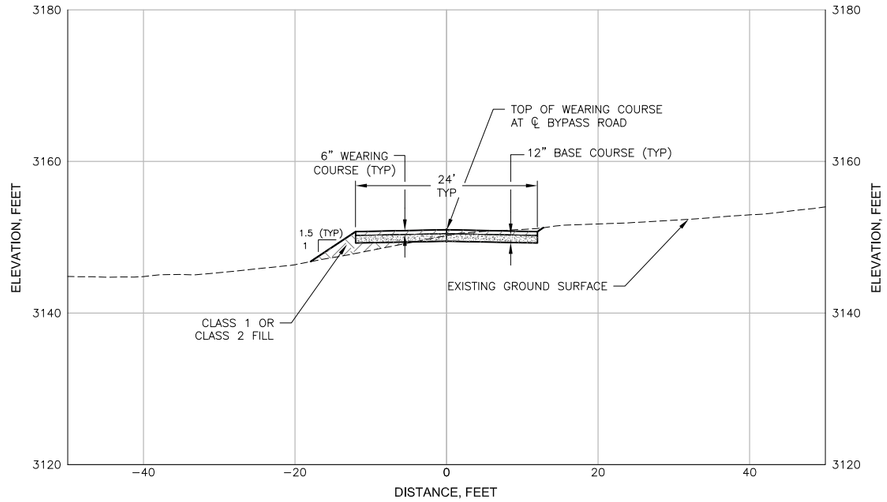

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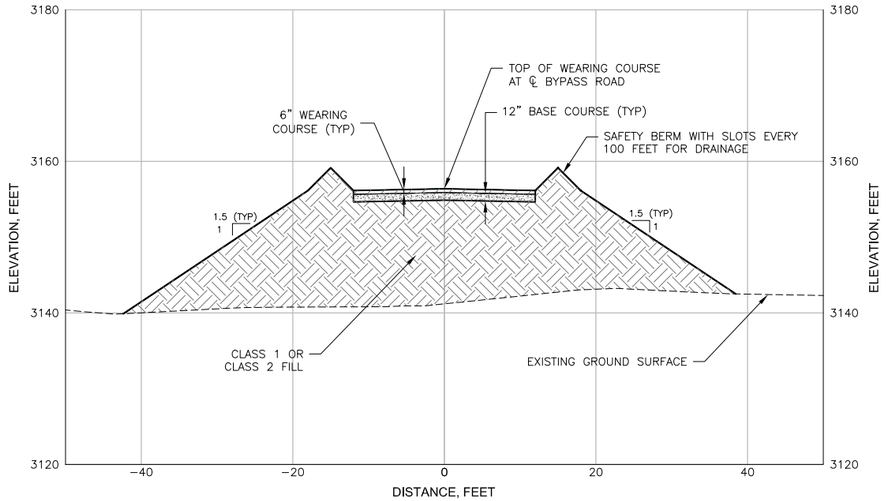

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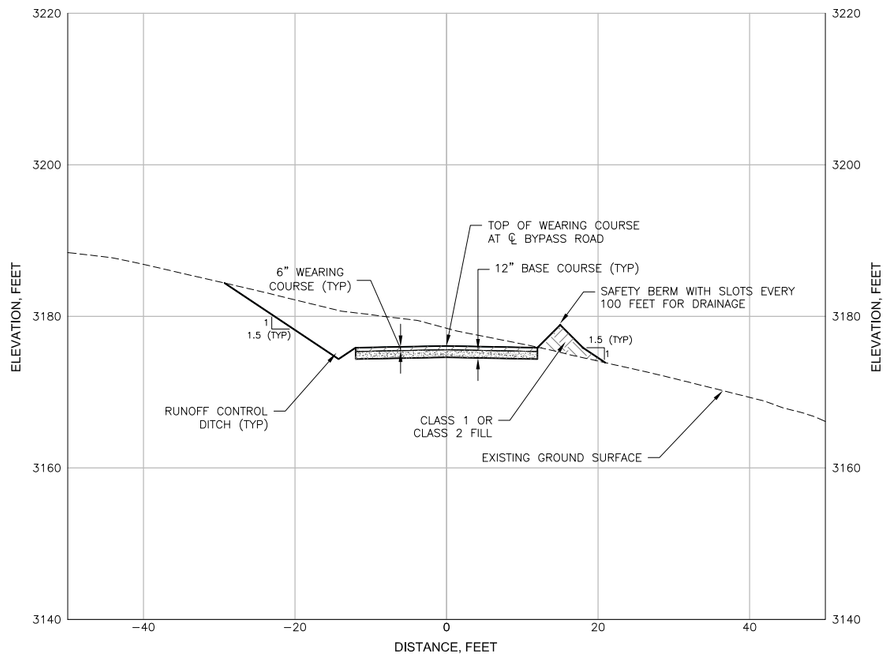

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ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BYPASS ROAD CROSS SECTIONS

MWH

SHEET: 10-4-9
REVISION: B
FILE NAME: 1008679D292

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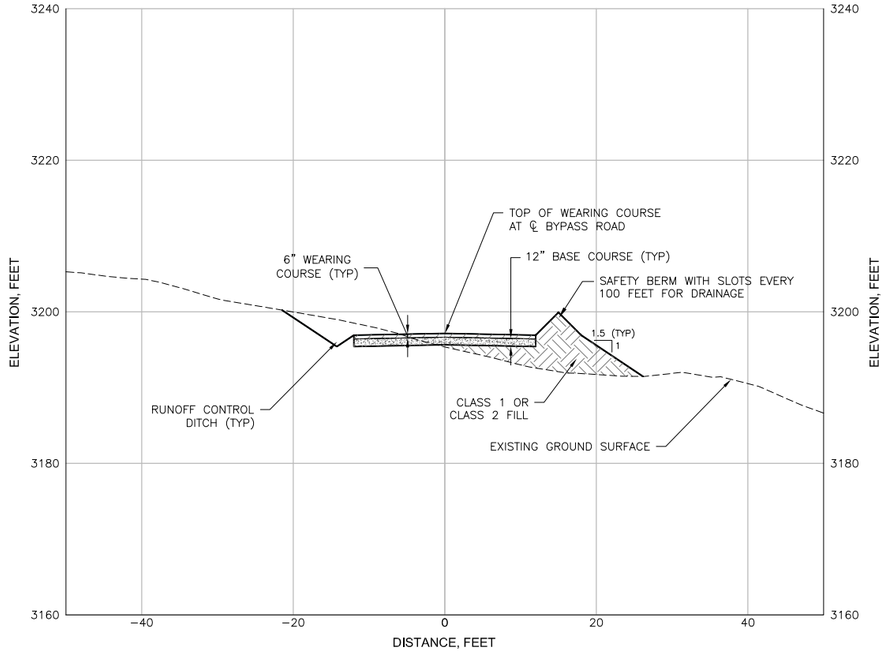

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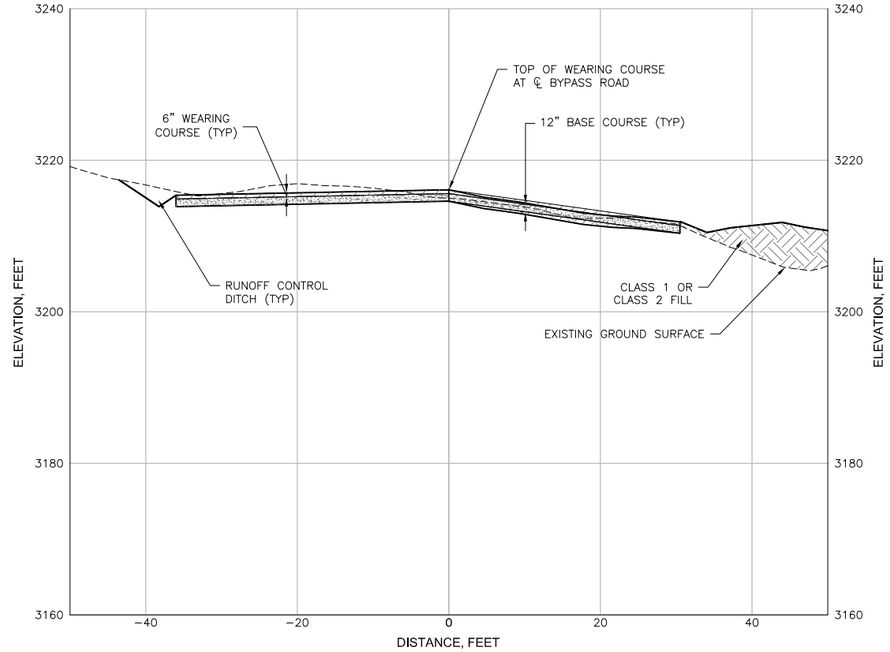

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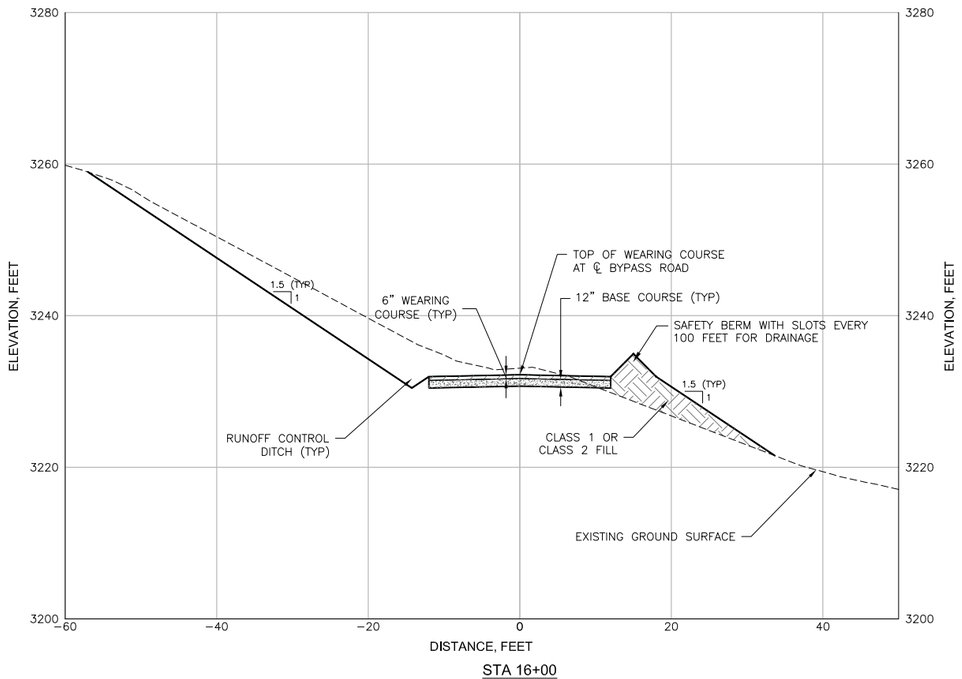

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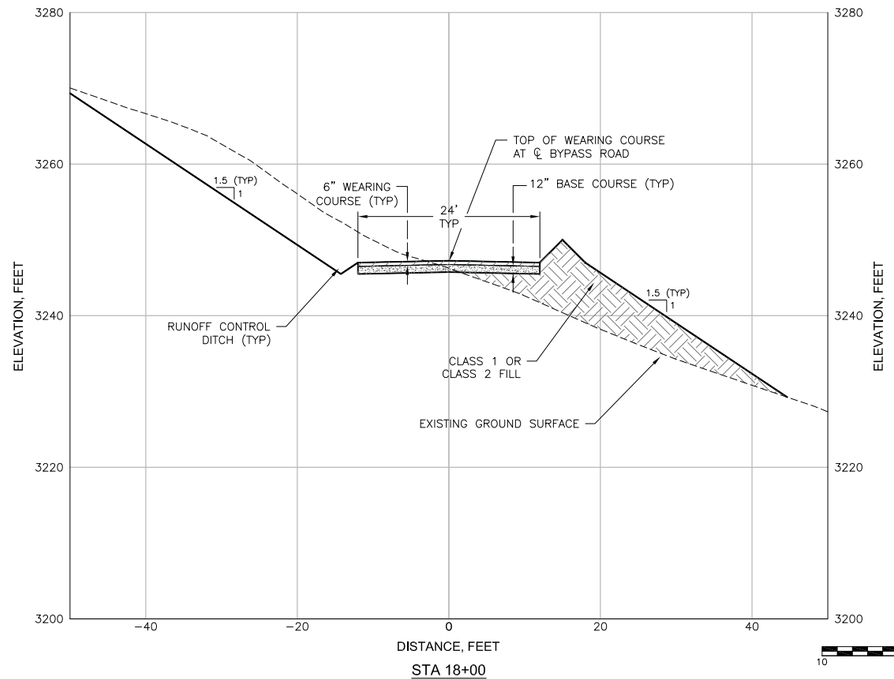

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ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: BYPASS ROAD CROSS SECTIONS

MWH

SHEET: 10-4-10

REVISION: B

FILE NAME: 1008679D293

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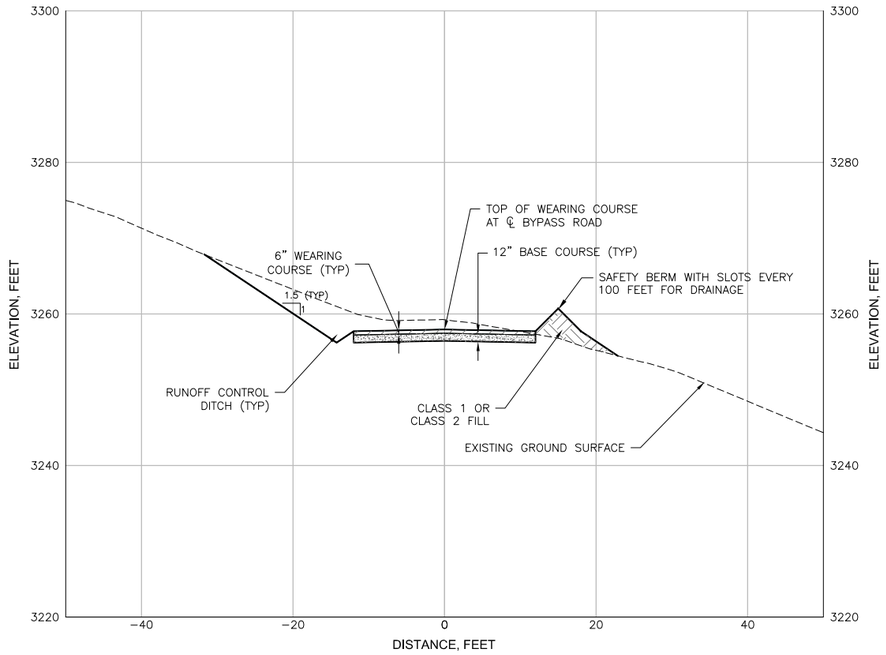

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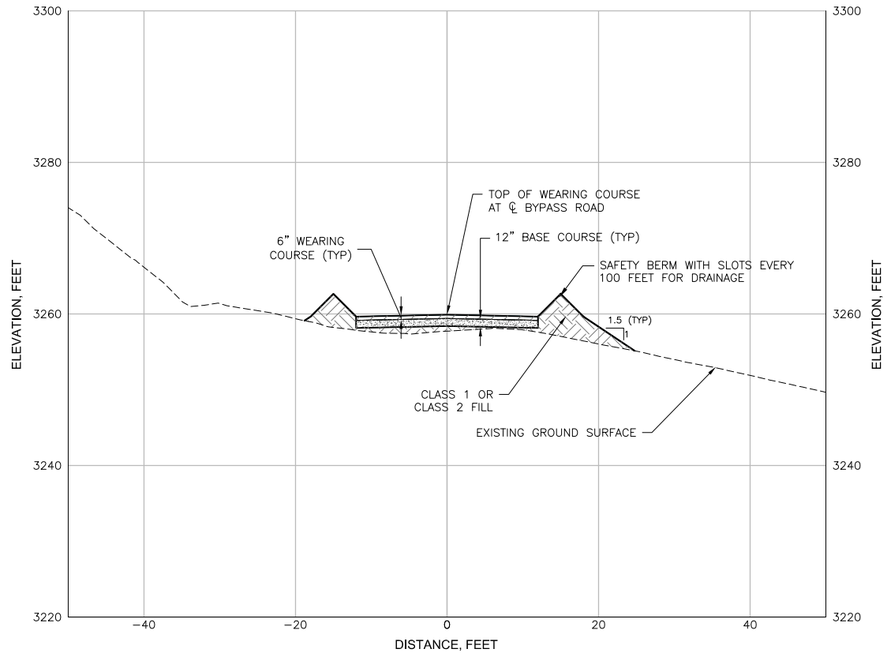

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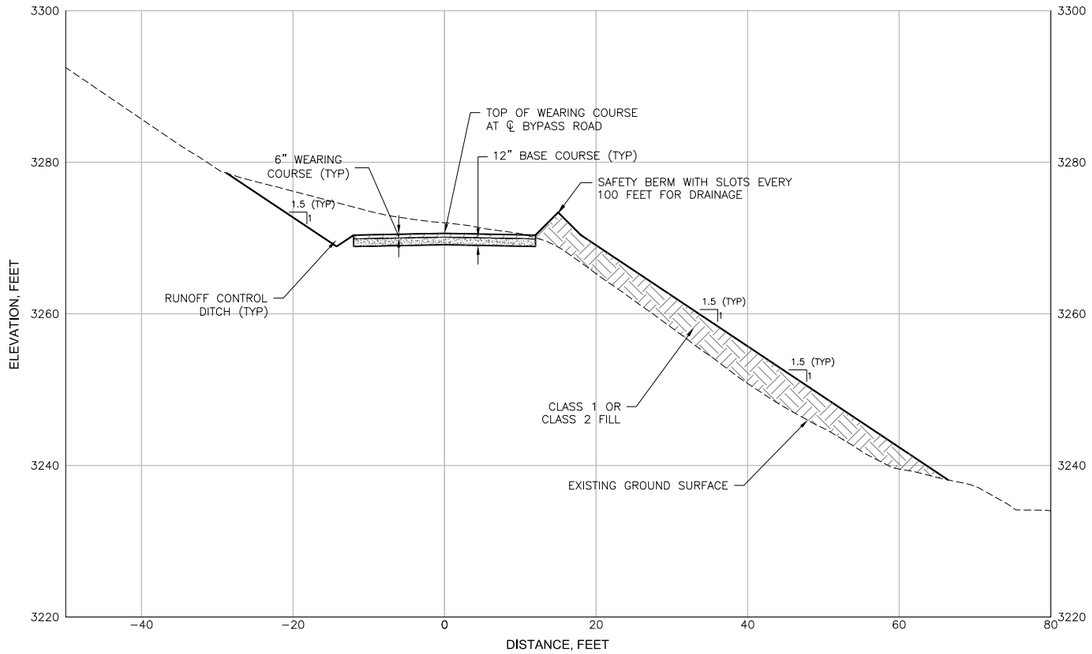

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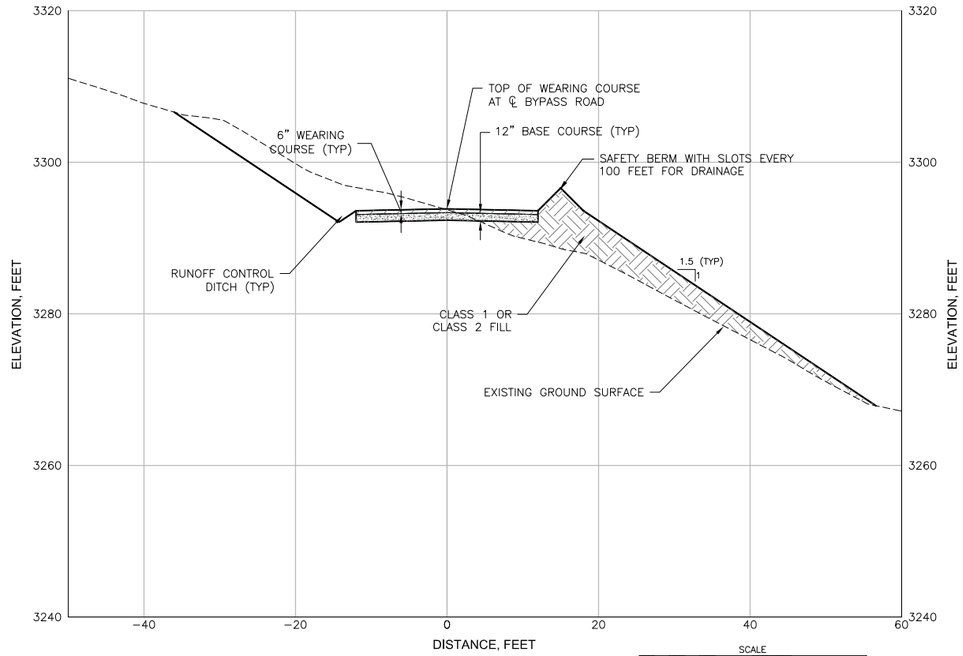

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ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR REVIEW AND COMMENT	FA	PC	04/08/11

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PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BYPASS ROAD CROSS SECTIONS

MWH

SHEET: 10-4-11
REVISION: B
FILE NAME: 1008679D381

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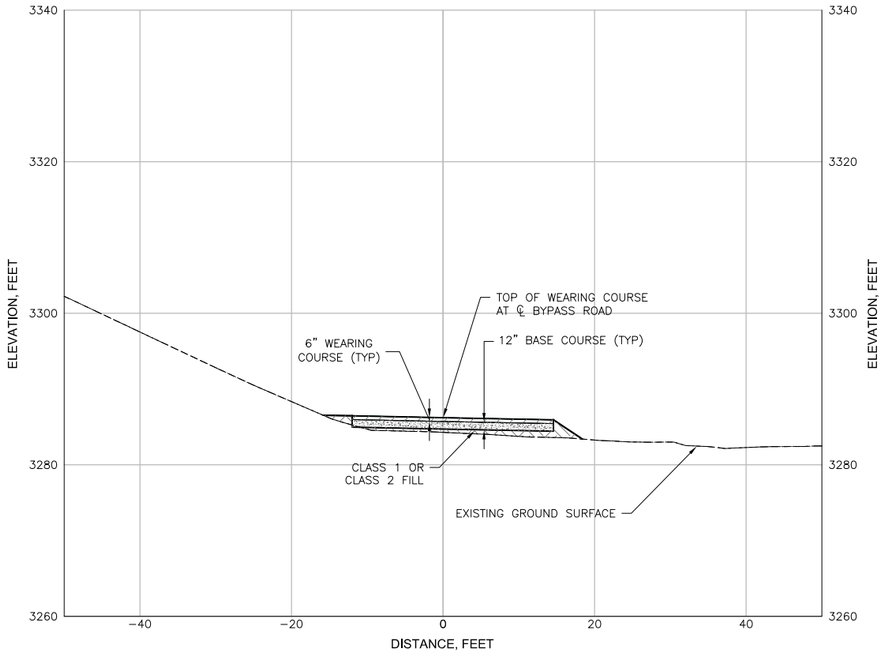

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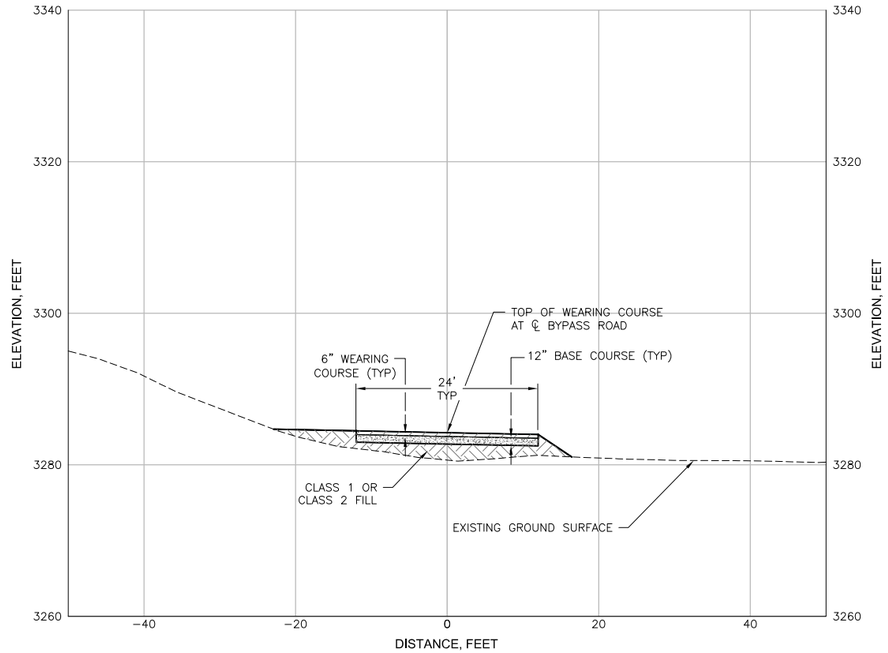

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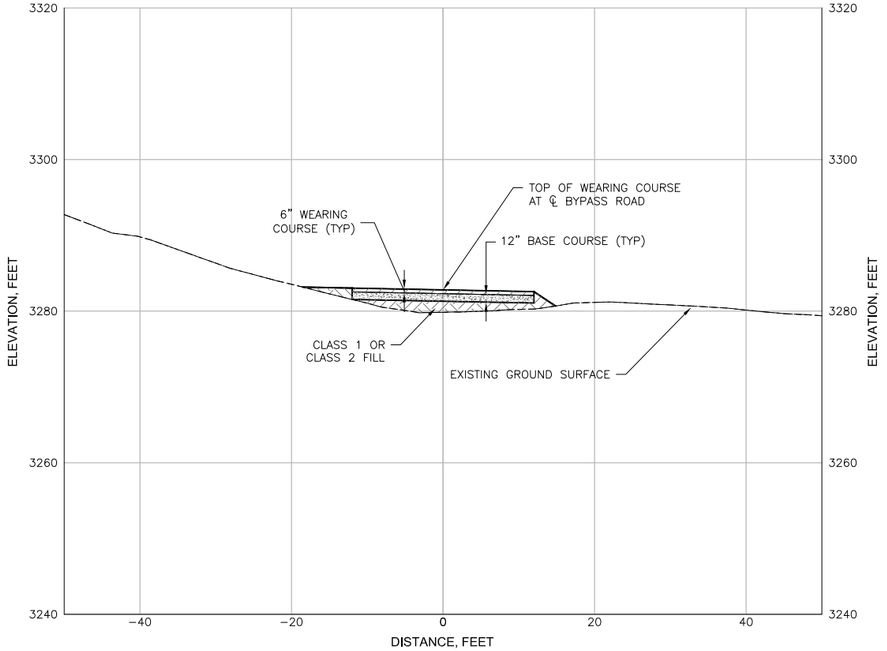

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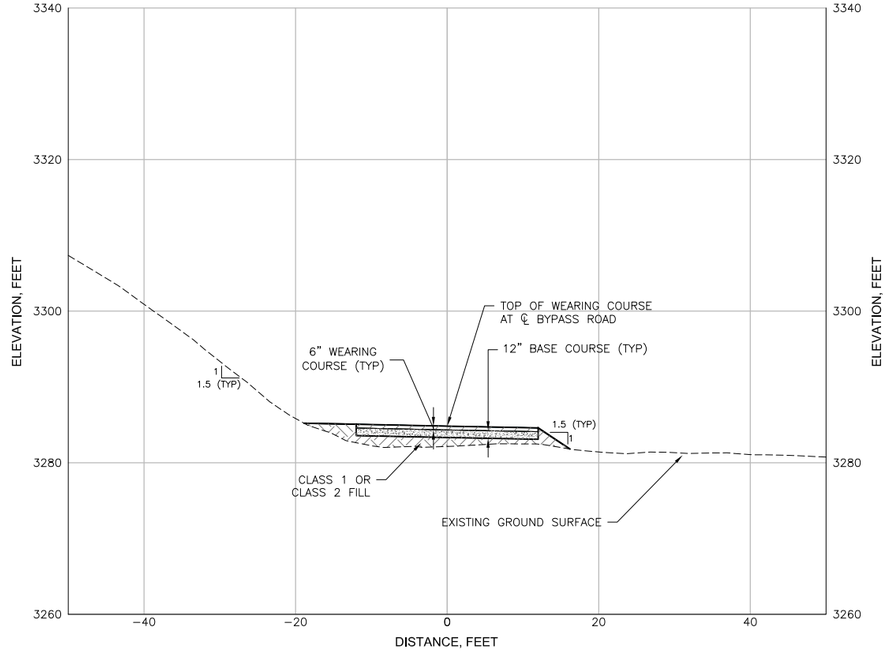

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ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION
HOLDEN VILLAGE, WASHINGTON

PROJECT
REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE
BYPASS ROAD CROSS SECTIONS

MWH

SHEET 10-4-12 | REVISION B

FILE NAME 1008679D303

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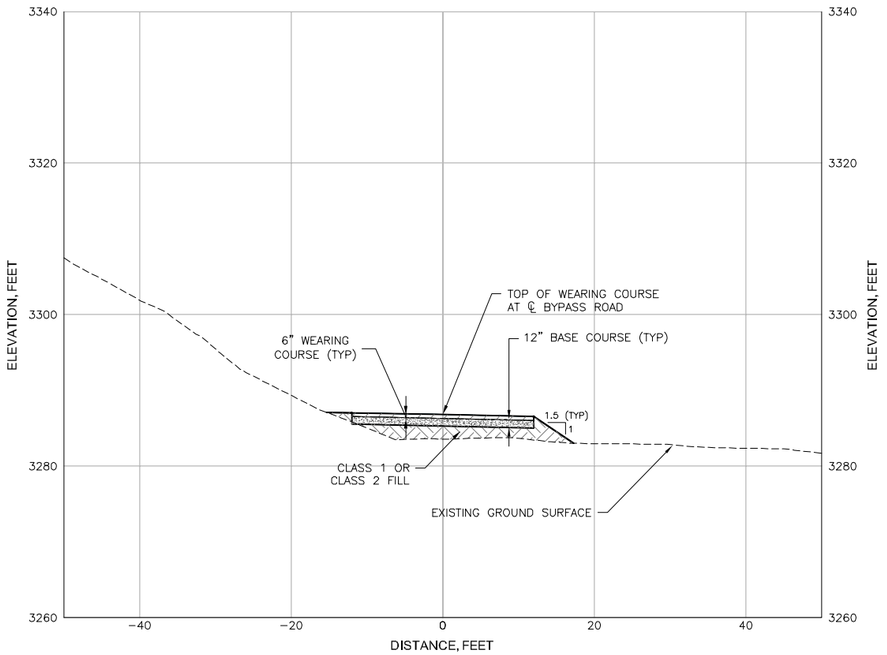

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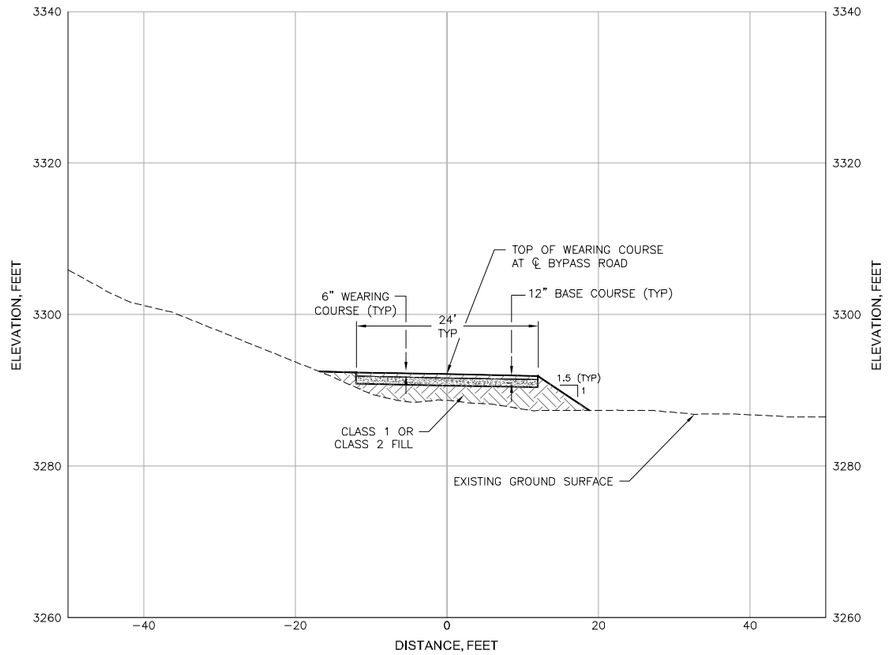

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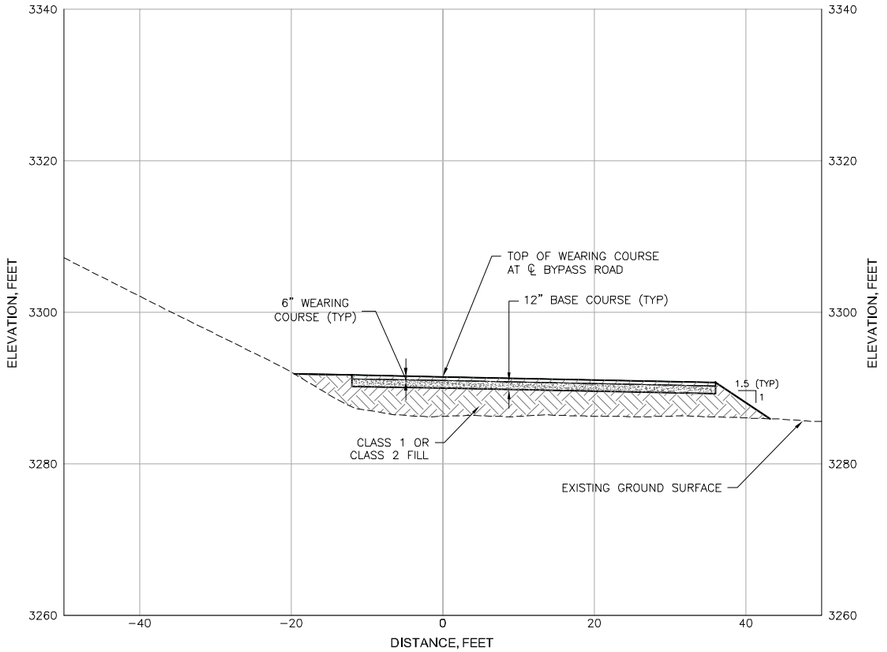

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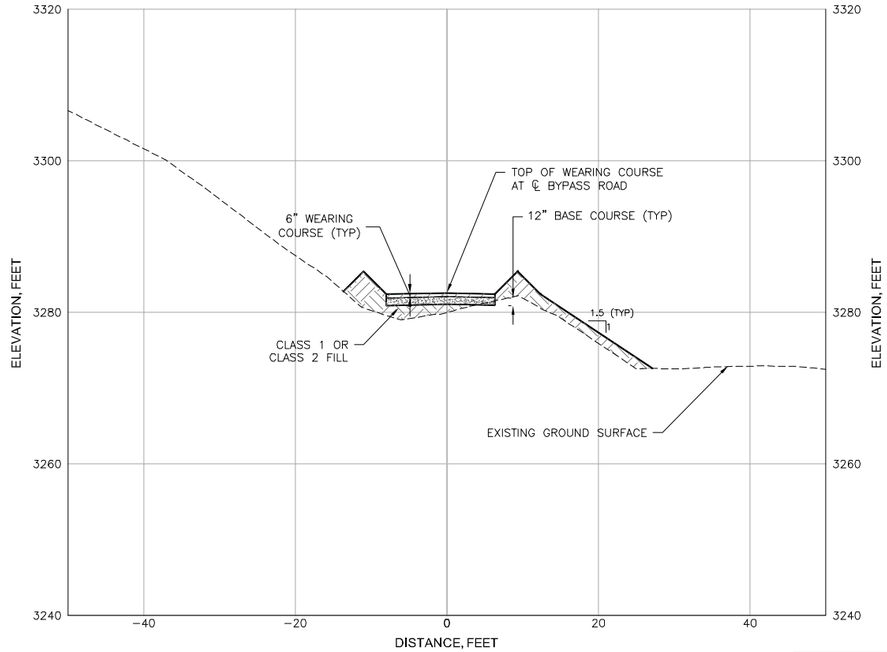

STA 42+00

SCALE
10 0 10 20 FEET

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: BYPASS ROAD CROSS SECTIONS

MWH

SHEET: 10-4-13

REVISION: B

FILE NAME: 1008679D377

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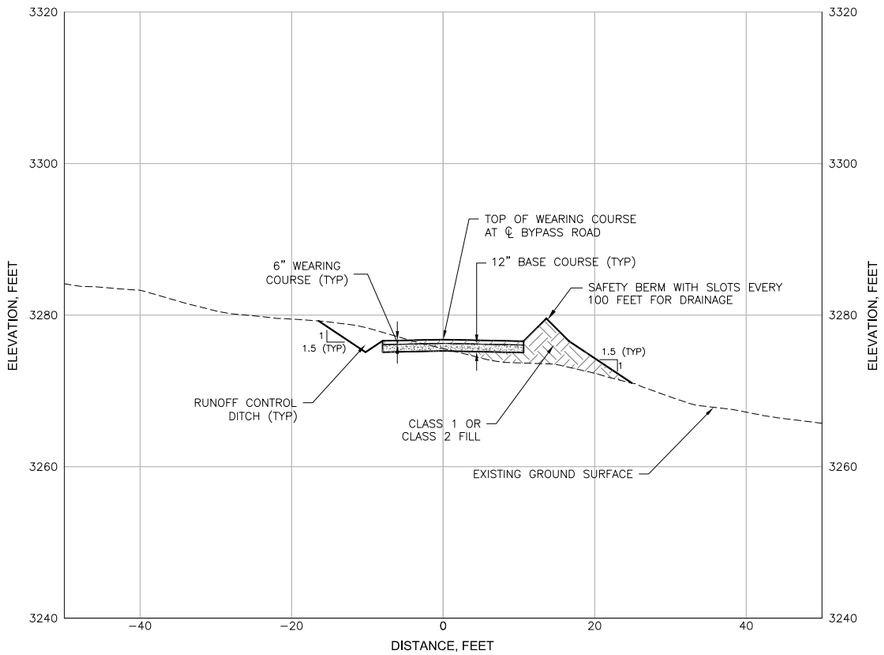

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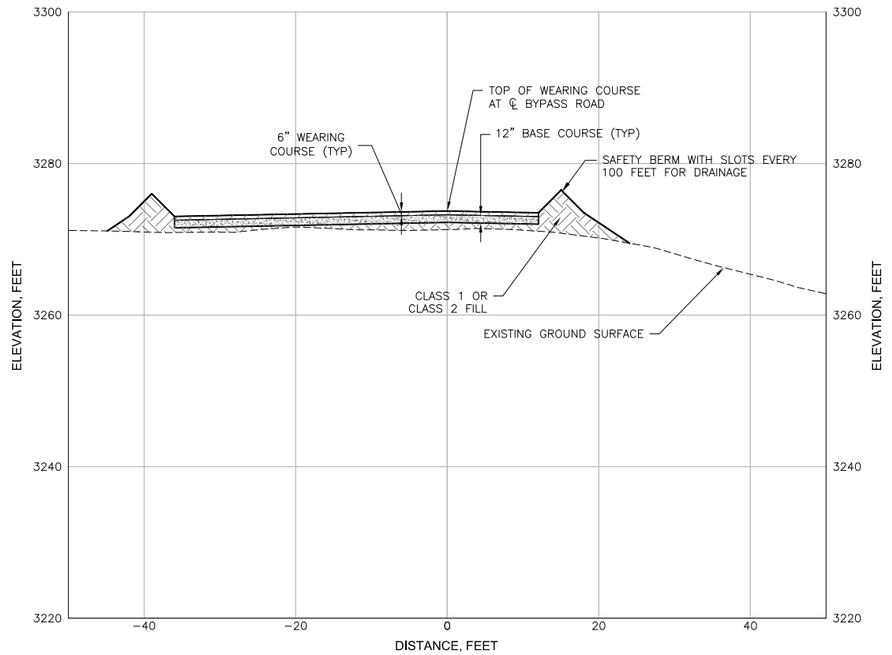

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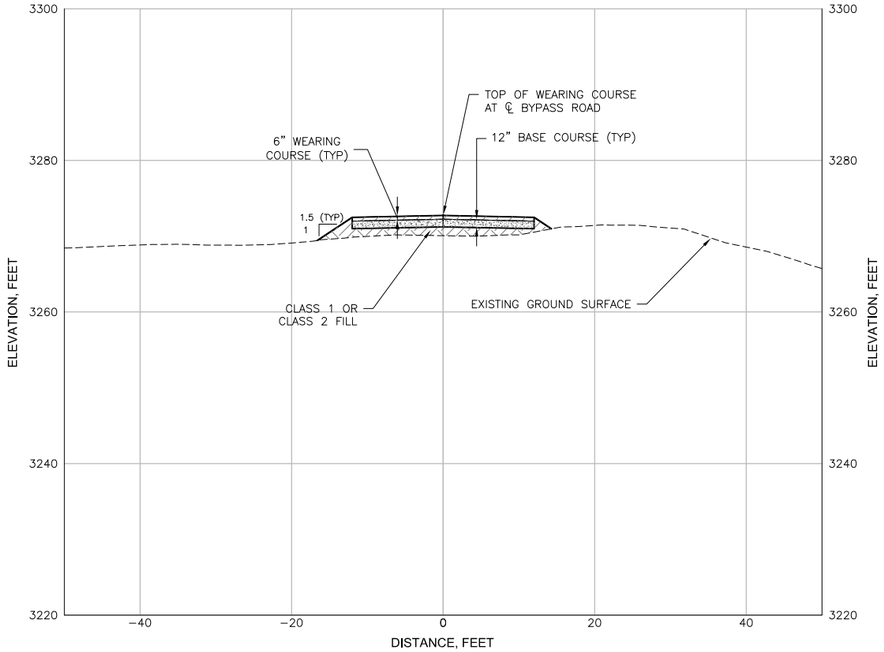

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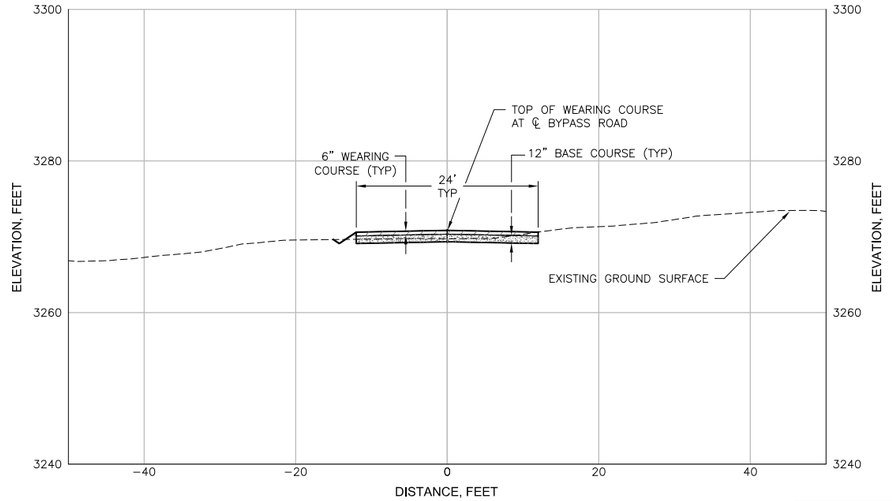

STA 50+00

SCALE
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ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
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A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION
HOLDEN VILLAGE, WASHINGTON

PROJECT
REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE
BYPASS ROAD CROSS SECTIONS

MWH

SHEET 10-4-14
REVISION B
FILE NAME 1008679D378

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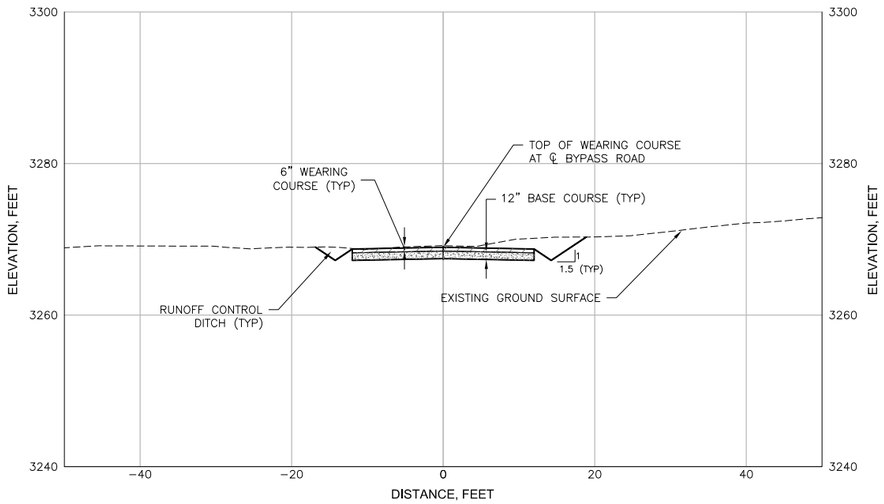

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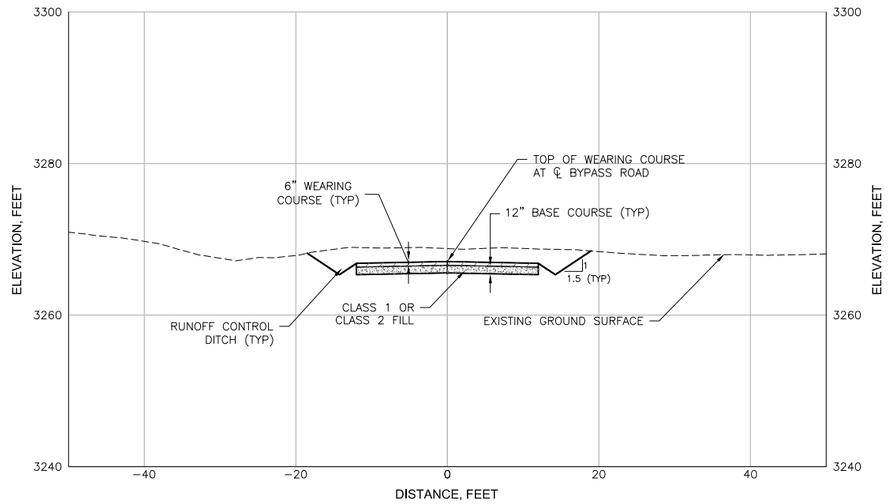

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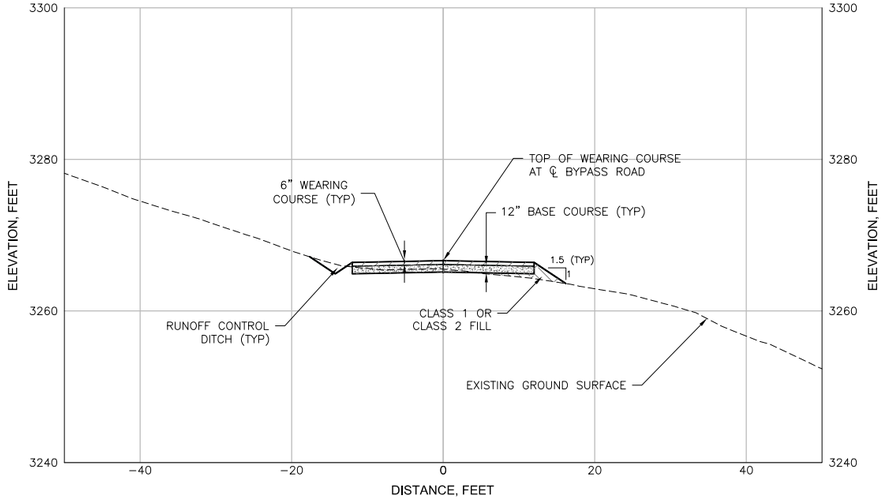

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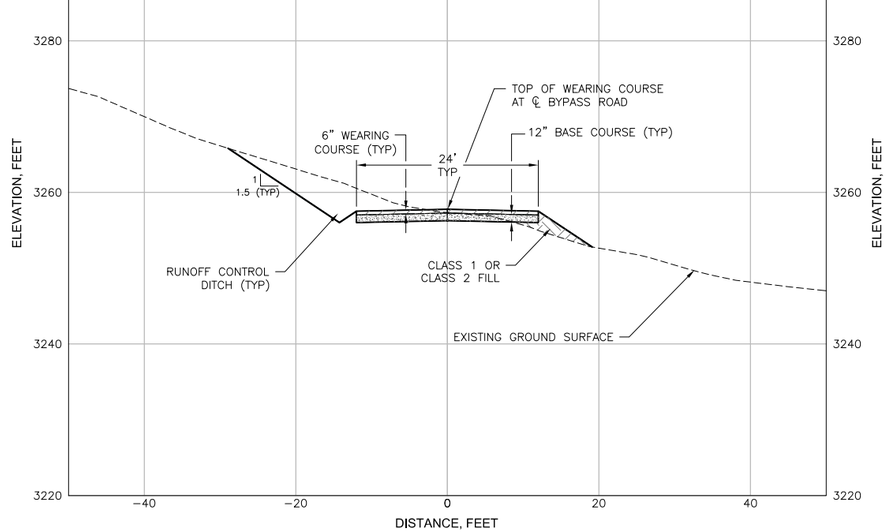

STA 58+00

SCALE
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ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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APPROVED BY	P. CROUSE	02/28/11	
PROJECT MANAGER	R. SCHLICHER	02/28/11	
CLIENT APPROVAL			
CLIENT REFERENCE NO.			

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BYPASS ROAD CROSS SECTIONS

MWH

SHEET: 10-4-15
REVISION: B
FILE NAME: 1008679D379

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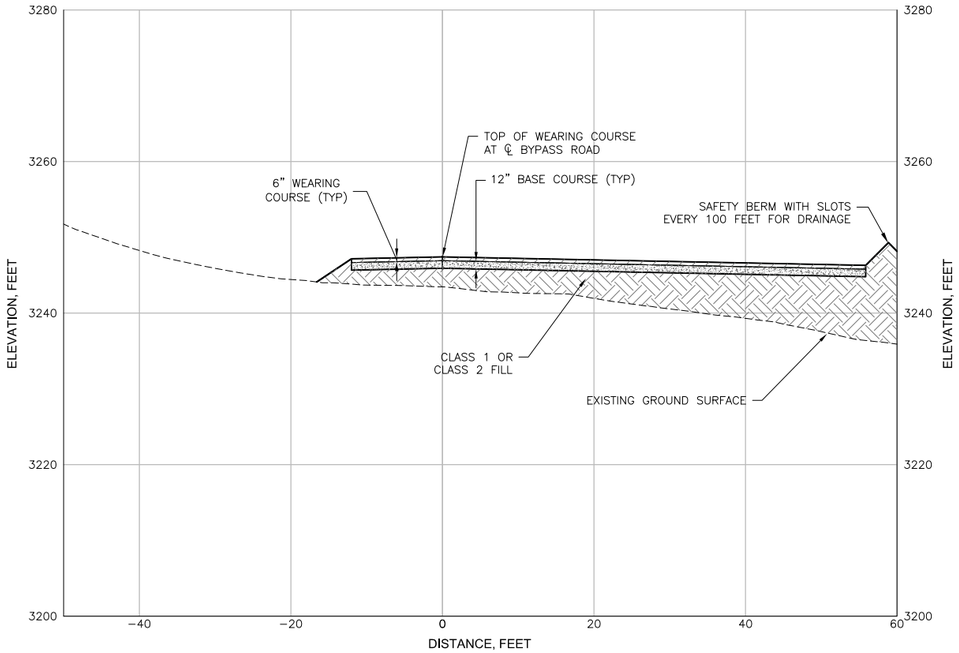

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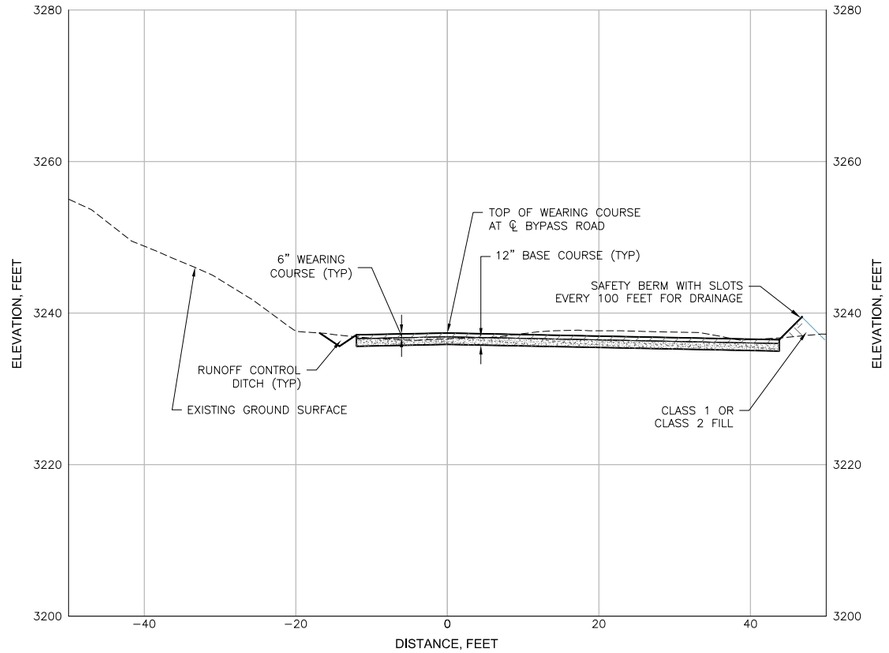

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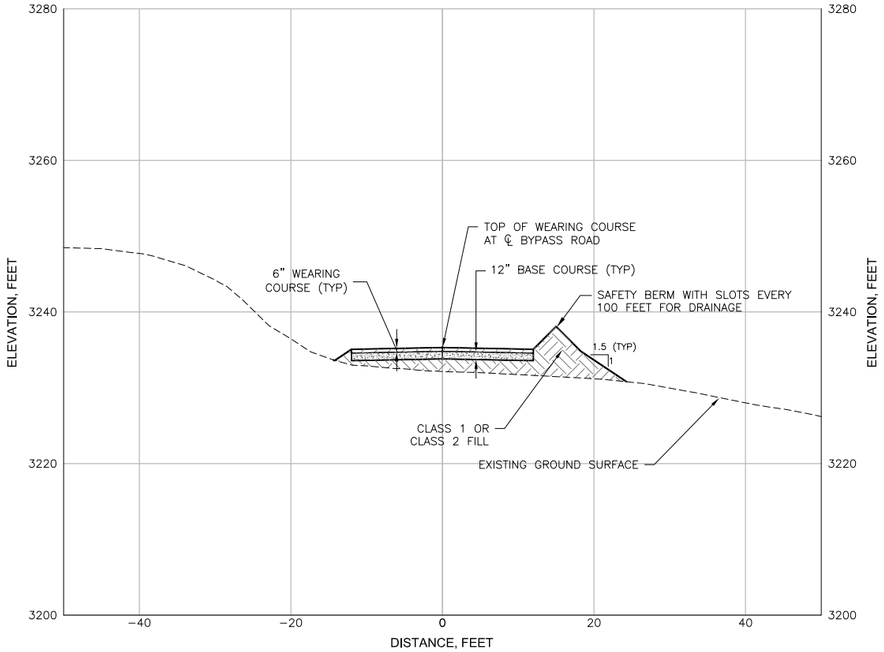

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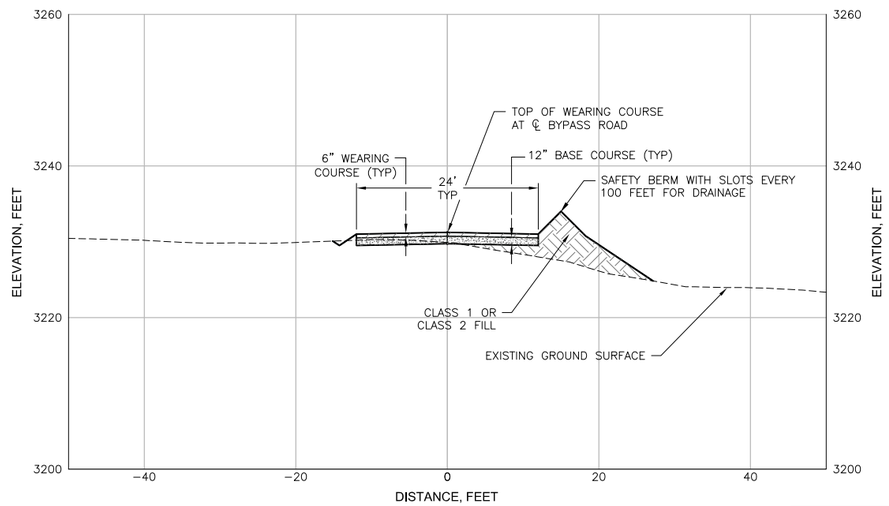

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ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
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PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: BYPASS ROAD CROSS SECTIONS

MWH

SHEET: 10-4-16

REVISION: B

FILE NAME: 1008679D380

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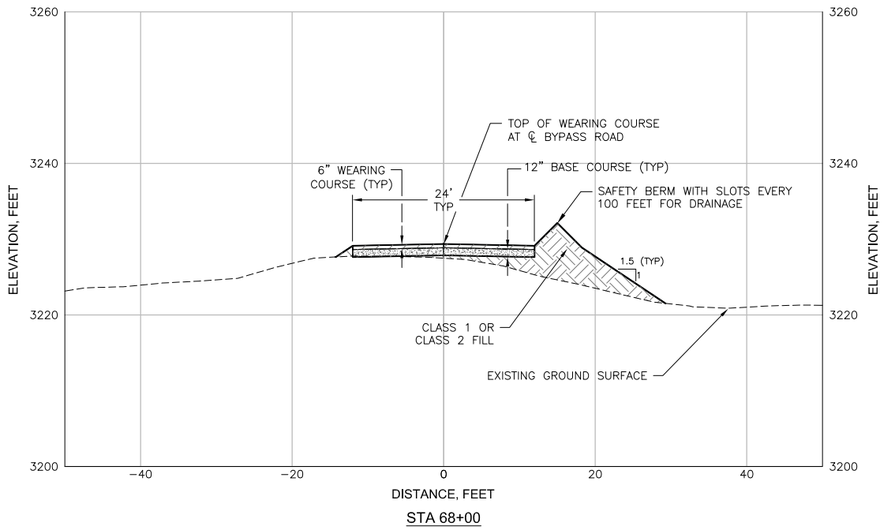

STA 68+00

SCALE
10 0 10 20 FEET

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ISSUE/REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR REVIEW AND COMMENT	FA	PC	04/08/11

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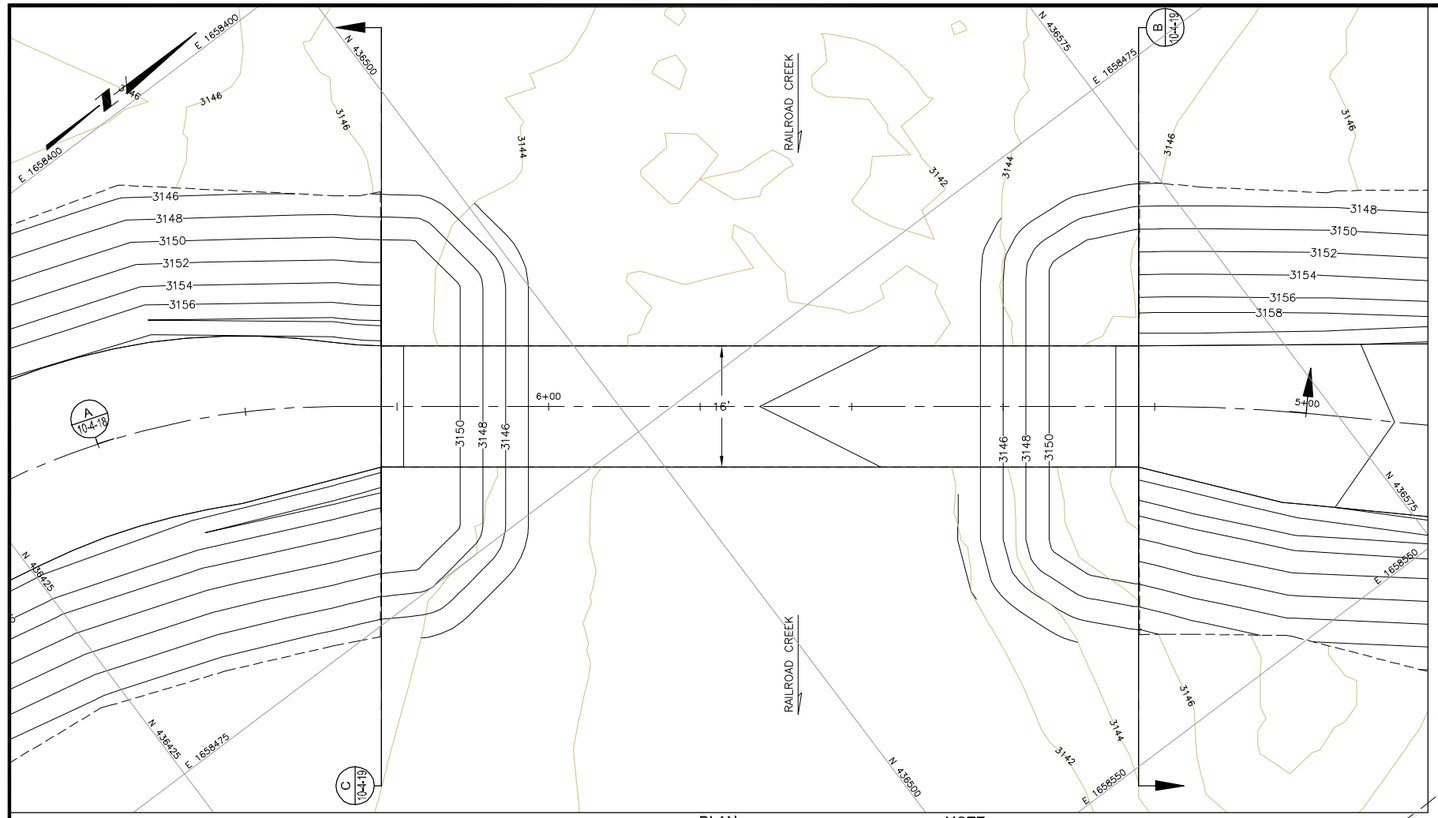
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BYPASS ROAD CROSS SECTIONS

MWH

SHEET: 10-4-17
REVISION: B
FILE NAME: 1008679D382



PLAN

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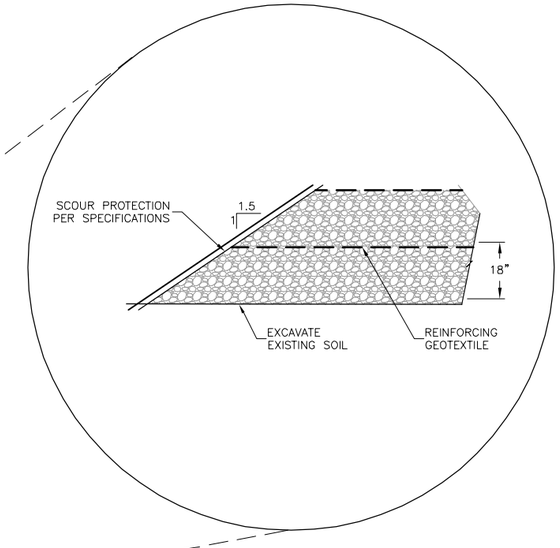
CONTOUR INTERVAL = 2 FEET

NOTE:

1. FOR PLAN LOCATION SEE SHEET 10-4-1.



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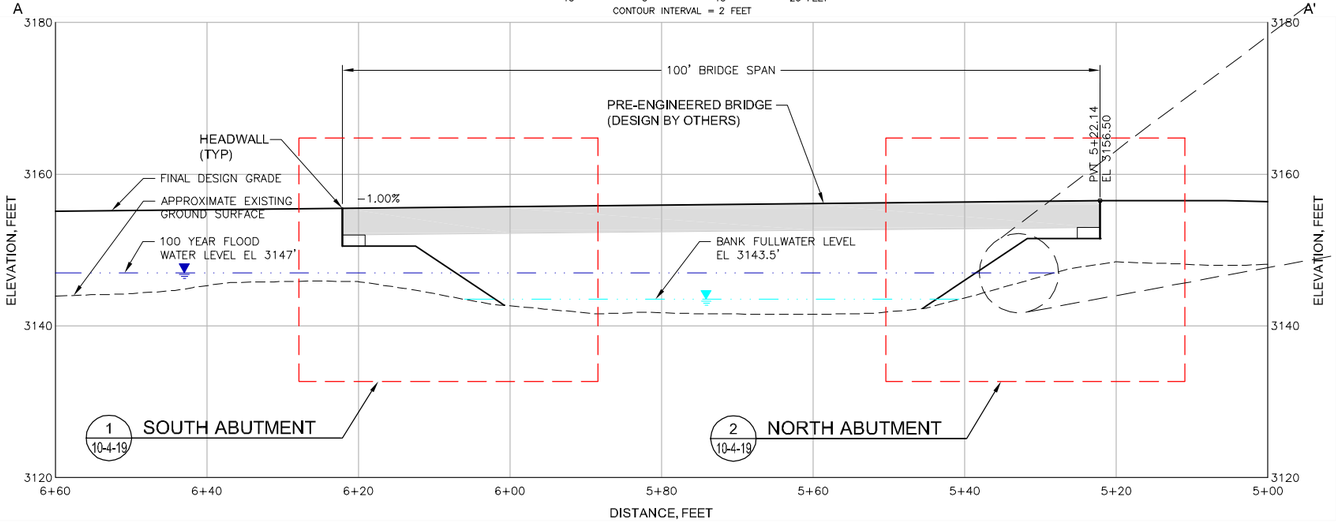

ELEVATION

A 10-4-18 BRIDGE

SCALE
10 0 10 20 FEET

ISSUE REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DRAWING REFERENCE(S):
- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BRIDGE PLAN AND SECTION

MWH

SHEET 10-4-18 | REVISION B
FILE NAME 1008679D260

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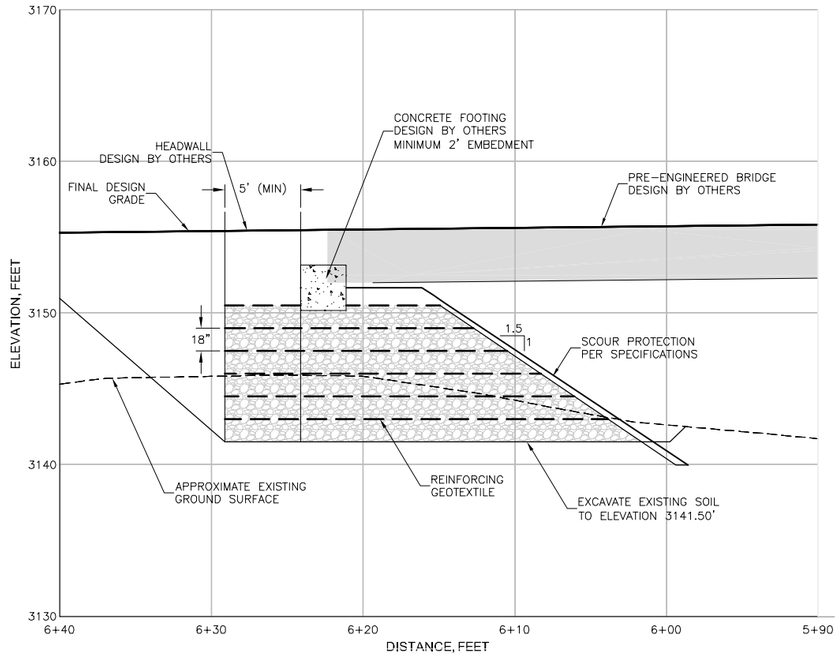
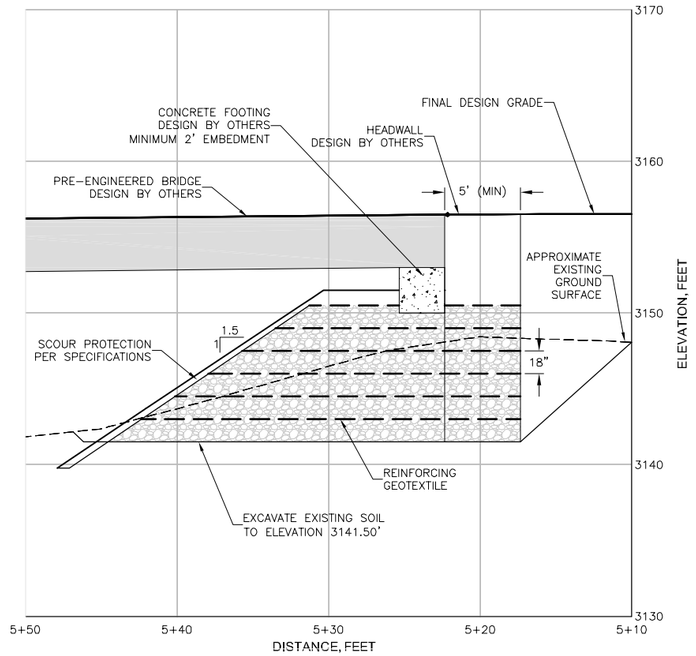


1 10-4-18 BRIDGE SOUTH ABUTMENT

SCALE 5 0 5 10 FEET



2 10-4-18 BRIDGE NORTH ABUTMENT

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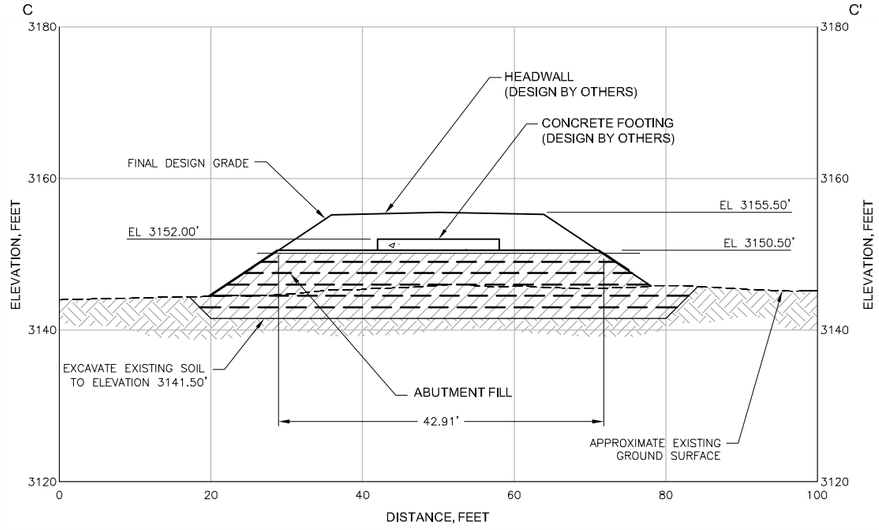
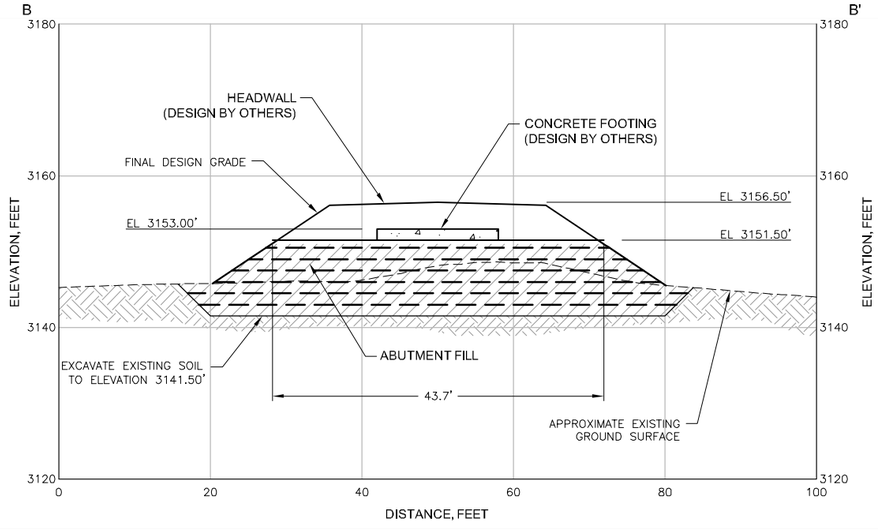


C 10-4-18 SOUTH ABUTMENT

SCALE 10 0 10 20 FEET



B 10-4-18 NORTH ABUTMENT

SCALE 10 0 10 20 FEET

ISSUE / REV					
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CHECKED BY	D. RODRIGUEZ	02/28/11	
APPROVED BY	P. CROUSE	02/28/11	
PROJECT MANAGER	R. SCHLICHER	02/28/11	
CLIENT APPROVAL			
CLIENT REFERENCE NO.			

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: BRIDGE ABUTMENT DETAILS

MWH

SHEET: 10-4-19 REVISION: B

FILE NAME: 1008679D336

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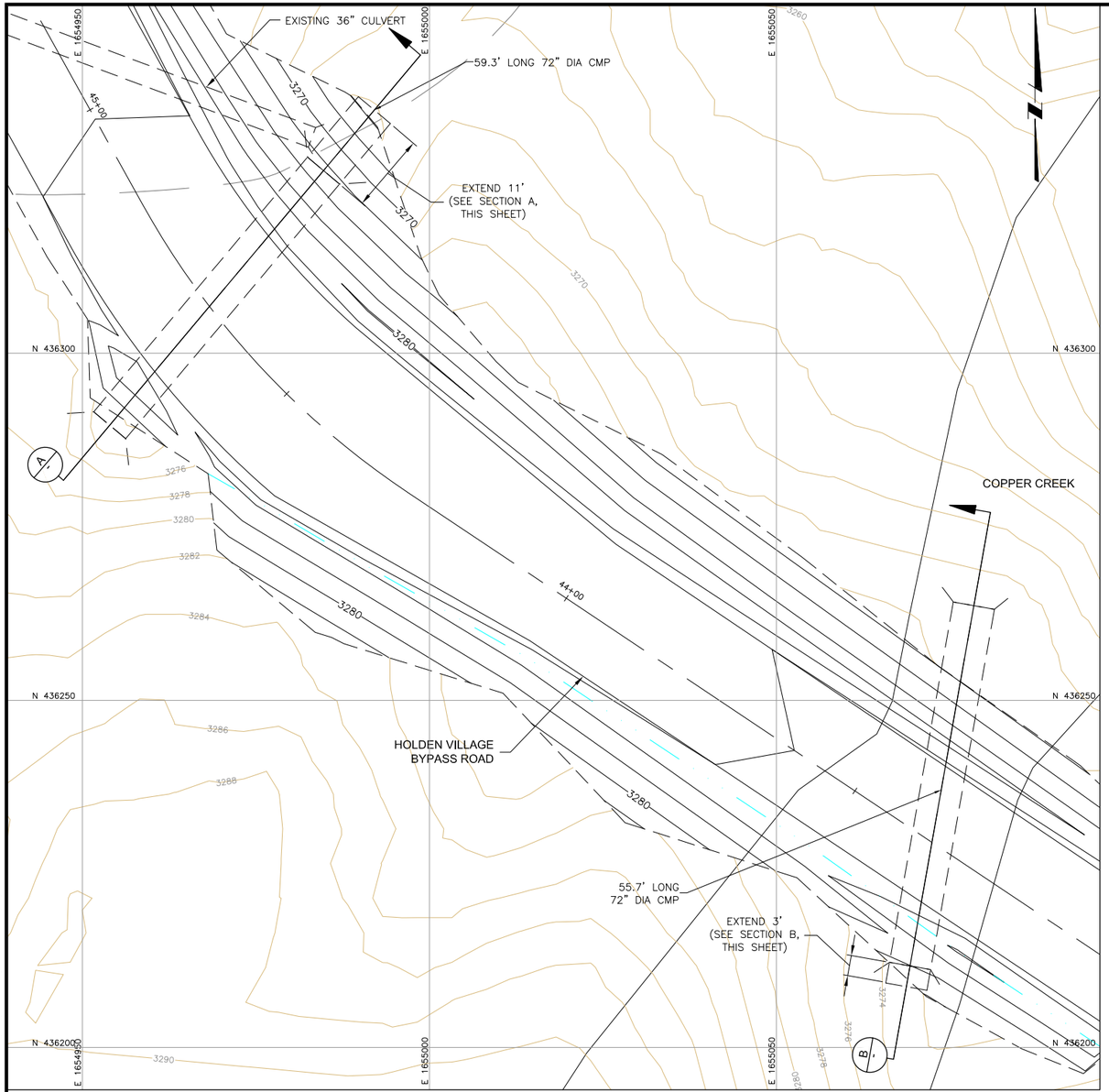

PLAN

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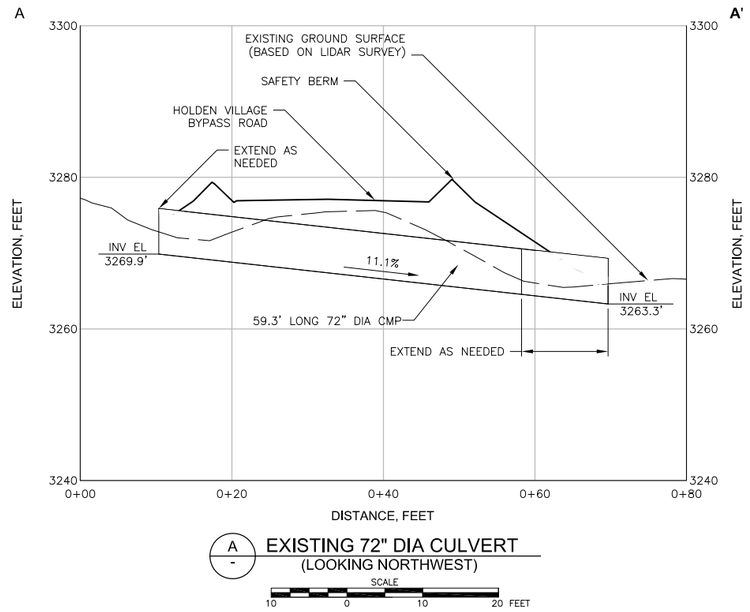
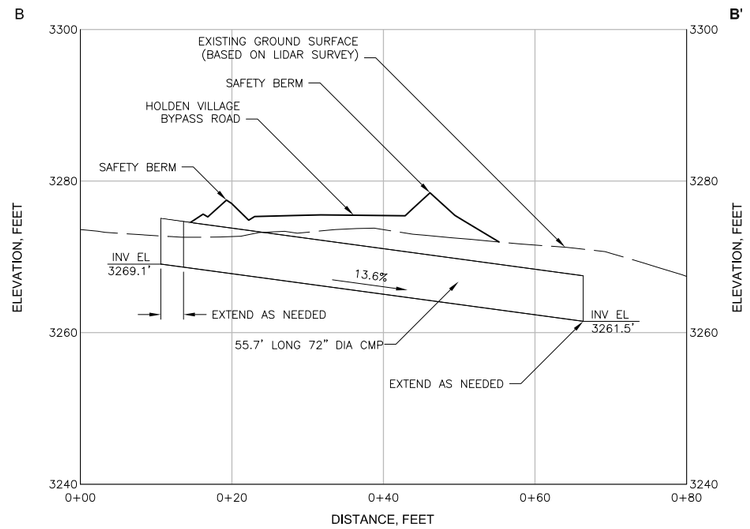
CONTOUR INTERVAL = 2 FEET



A - EXISTING 72" DIA CULVERT
(LOOKING NORTHWEST)

SCALE
10 0 10 20 FEET



B - COPPER CREEK CULVERT
(LOOKING WEST)

SCALE
10 0 10 20 FEET

NOTES:

1. EXISTING CULVERTS DAYLIGHT BASED ON FIELD OBSERVATION LIDAR SURFACE APPEARS TO BE INACCURATE IN THIS AREA.
2. FILL PLACEMENT CULVERT EXTENSIONS WILL BE FIELD FIT BASED ON ACTUAL CONDITIONS.

ISSUE / REV					
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A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.

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CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: COPPER CREEK CULVERT PLAN

MWH

SHEET: 10-4-20
REVISION: B
FILE NAME: 1008679D262

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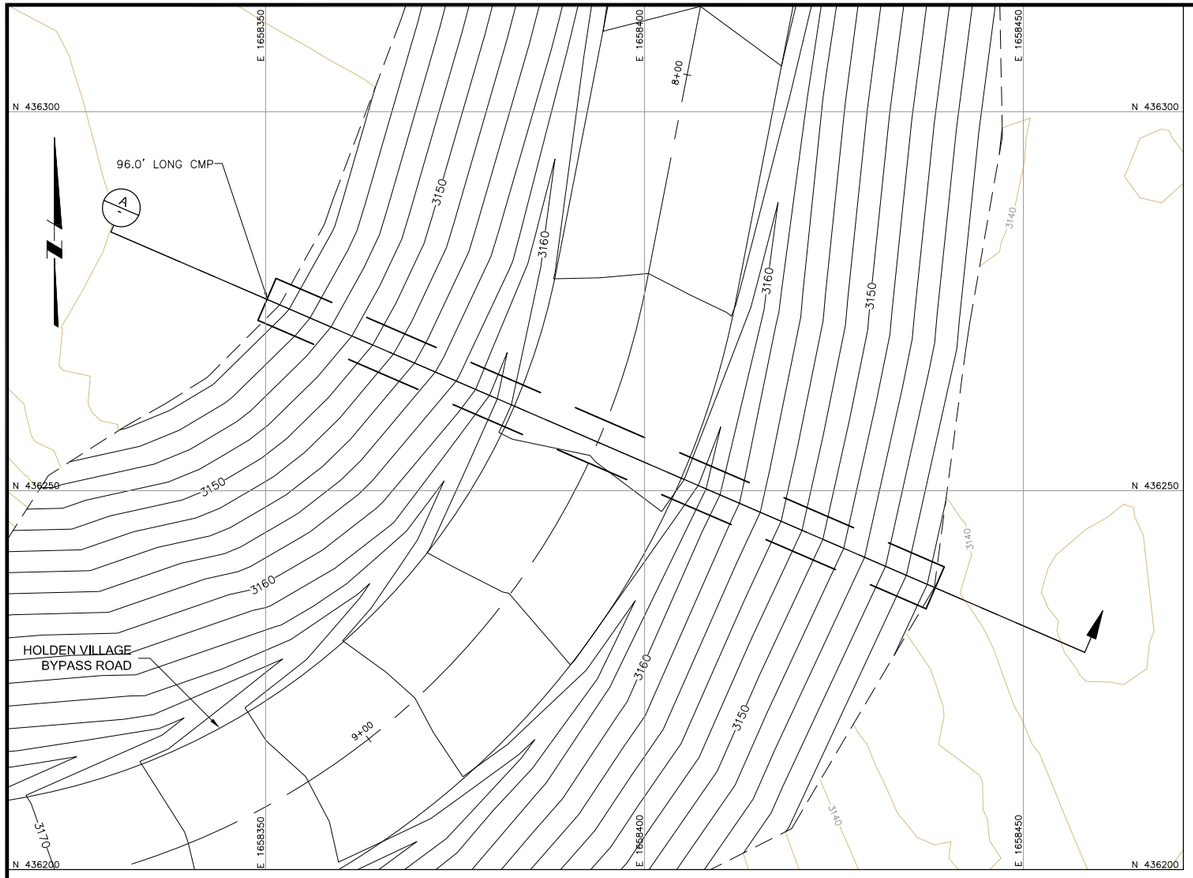
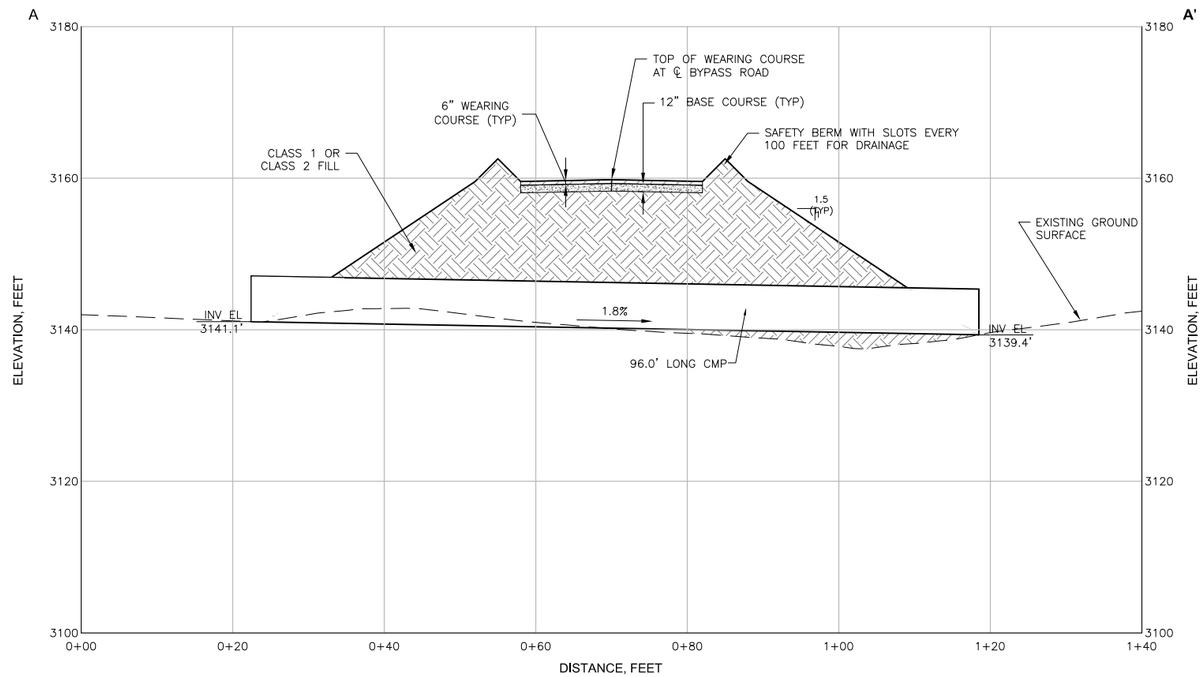


PLAN

SCALE
10 0 10 20 FEET
CONTOUR INTERVAL = 2 FEET



SECTION

A / - RAILROAD CREEK CULVERT
(LOOKING NORTH)

SCALE
10 0 10 20 FEET

ISSUE REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DRAWING REFERENCE(S):
- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	G. PHILPOTT	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: RAILROAD CREEK CULVERT PLAN

MWH

SHEET: 10-4-21
REVISION: B
FILE NAME: 1008679D263

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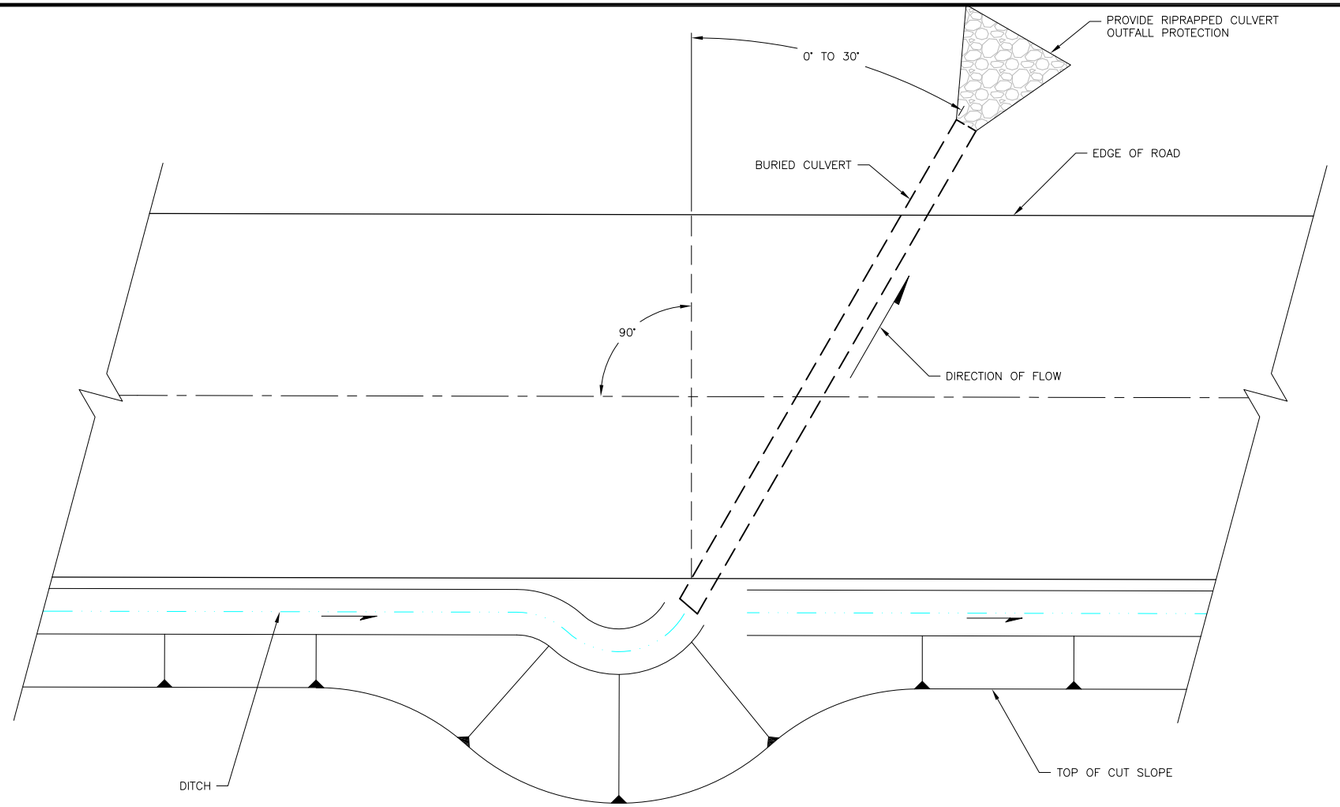
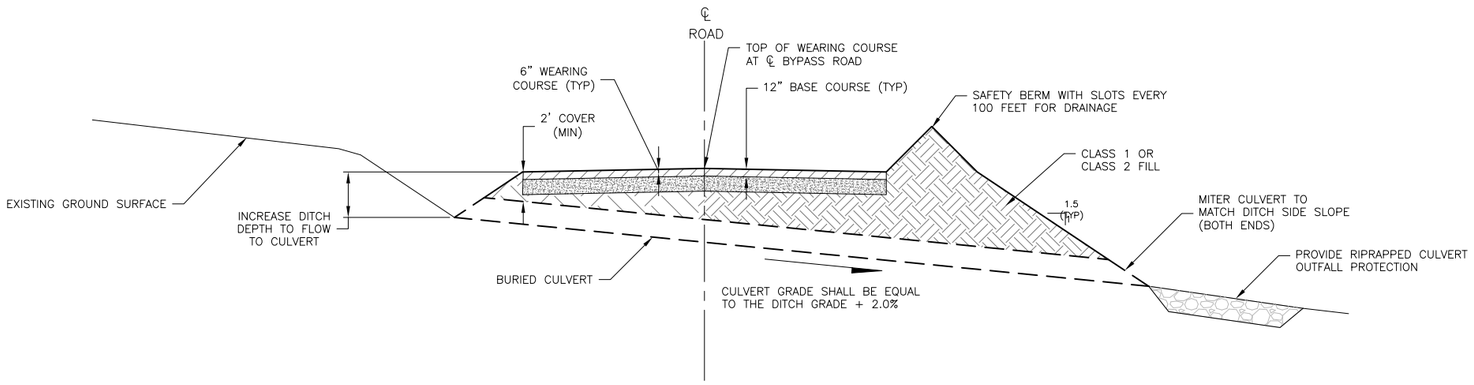


PLAN



PROFILE

1 / - TYPICAL CULVERT INSTALLATION

SCALE
5 0 5 10 FEET

REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DRAWING REFERENCE(S):

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	R. WATT	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: TYPICAL CULVERT INSTALLATION

MWH

SHEET: 10-4-22
REVISION: B
FILE NAME: 1008679D335

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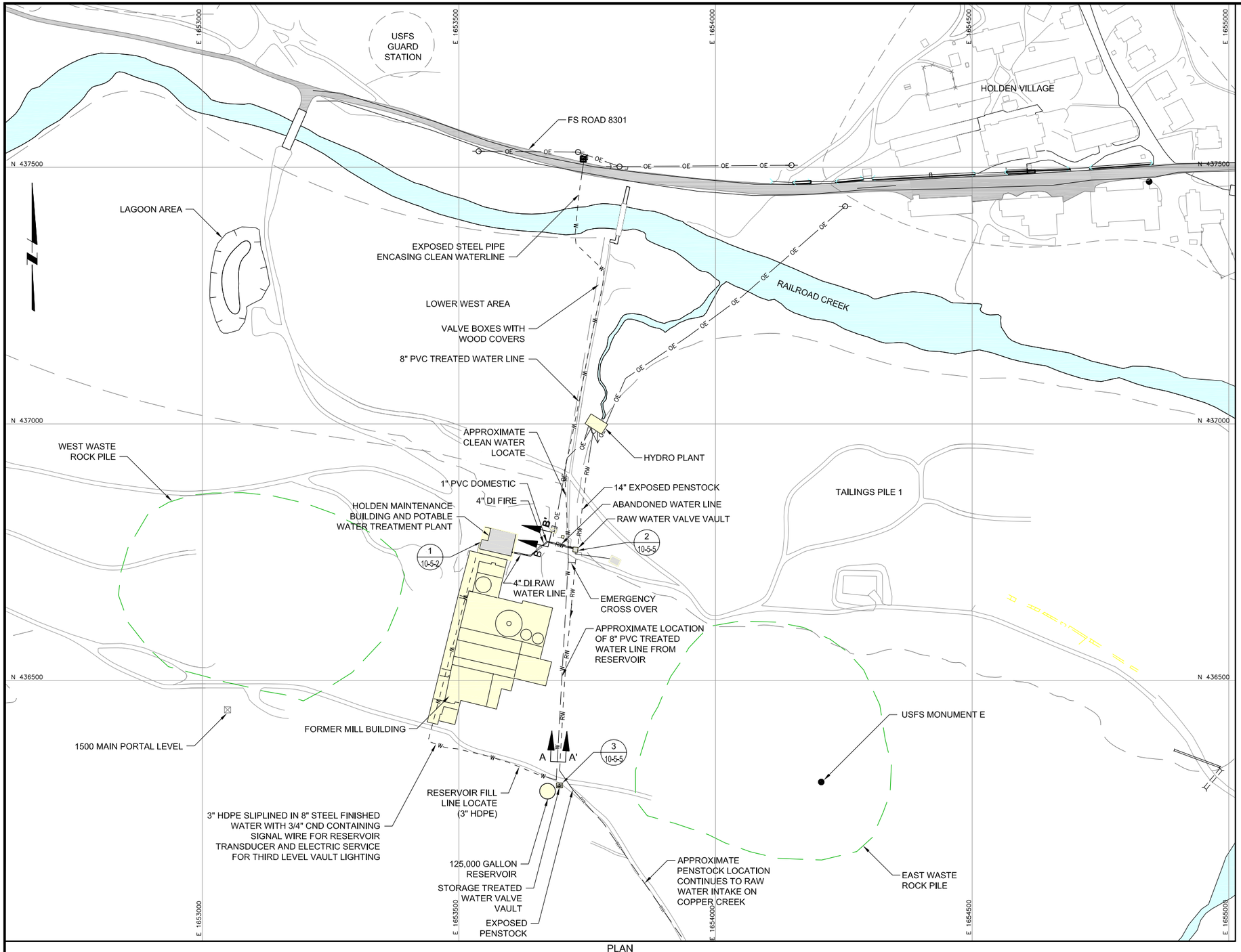
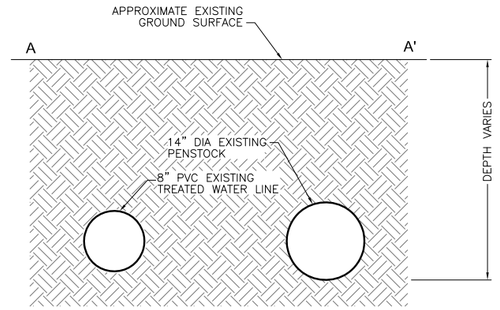
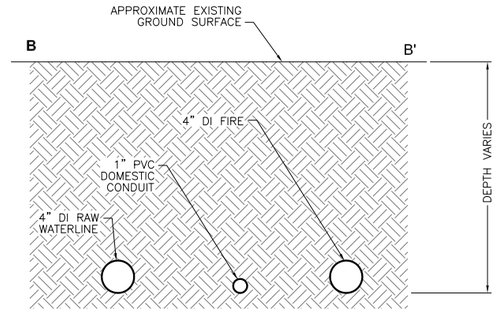


PLAN

SCALE
100 0 100 200 FEET
CONTOUR INTERVAL = 10 FEET



A - EXISTING UTILITY LINES
(LOOKING NORTH)
N.T.S.



B - EXISTING UTILITY LINES
(LOOKING WEST)
N.T.S.

NOTES:

1. UTILITY LINE LOCATIONS ARE BASED ON SURVEY PERFORMED BY ERLANDSEN, INC SURVEY UNDERGROUND UTILITY LOCATE SERVICES.
2. THE POTABLE WATER TREATMENT SYSTEM IS IN A 10.5 FT X 25 FT ROOM LOCATED IN THE SOUTHWEST CORNER OF THE HOLDEN VILLAGE MAINTENANCE BUILDING.

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):
- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: EXISTING POTABLE WATER SYSTEM

MWH

SHEET: 10-5-1
REVISION: B
FILE NAME: 1008679D224

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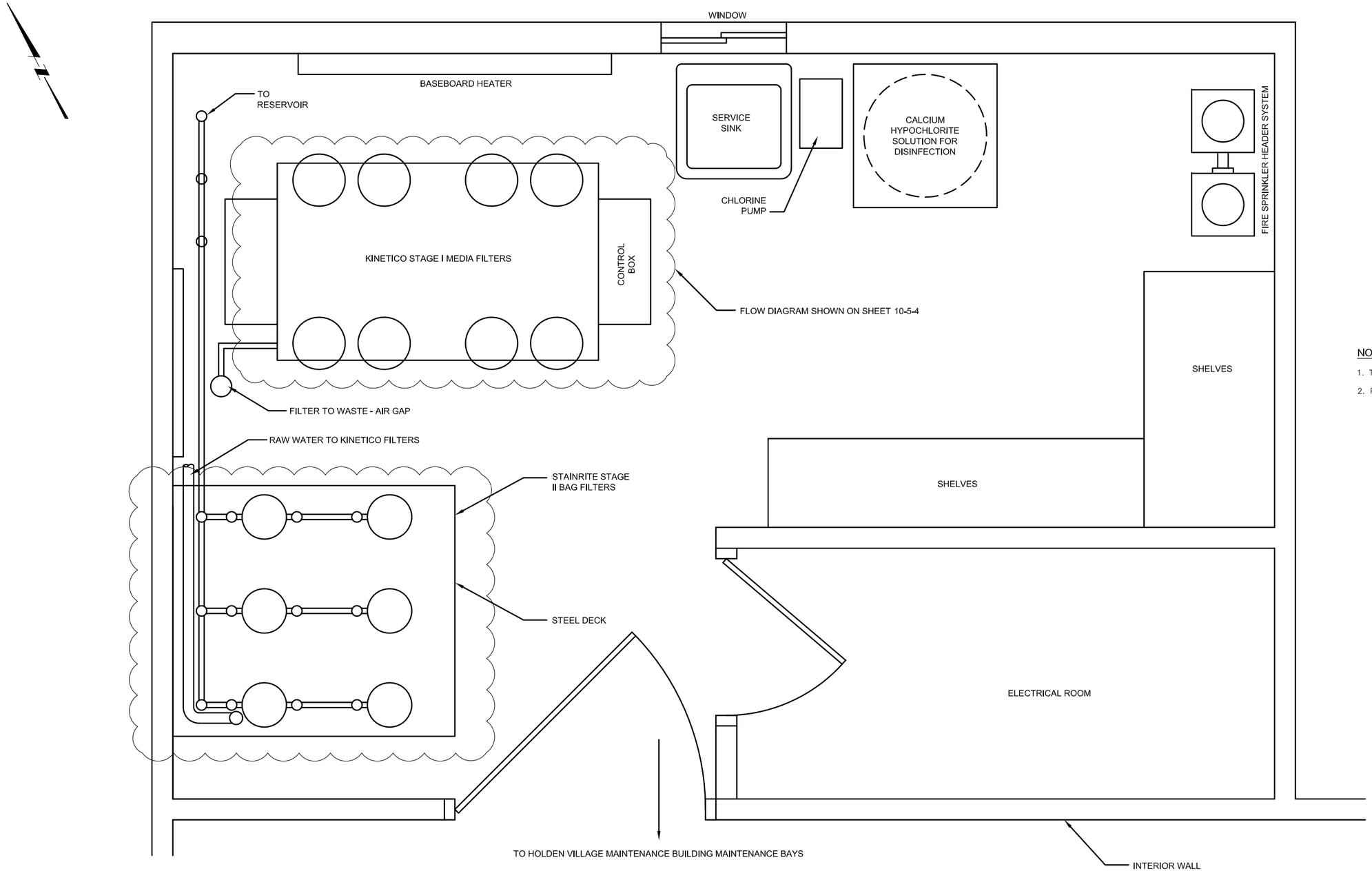

NOTES:

1. THIS DRAWING IS NOT TO SCALE
2. PIPING LAYOUT NOT SHOWN IN DETAIL.

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

- EXHIBIT WT-1 TITLED, "UPGRADE WATER FILTRATION SYSTEM FLOOR PLAN – EXISTING ROOM" PROVIDED TO MWH BY HOLDEN VILLAGE, INC., DATED: MARCH, 2008.

DESIGNED BY		
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: EXISTING POTABLE WATER SYSTEM GENERAL ARRANGEMENT

MWH

SHEET: 10-5-2
REVISION: B
FILE NAME: 1008679D230

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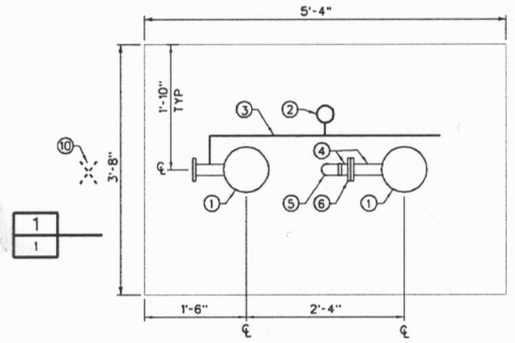
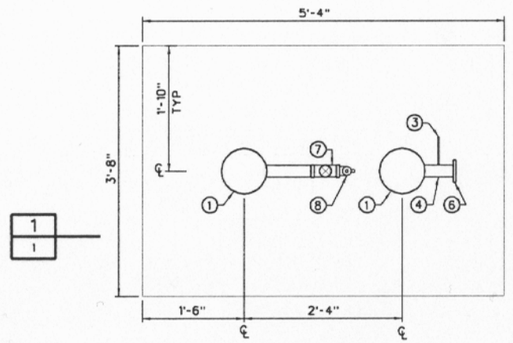
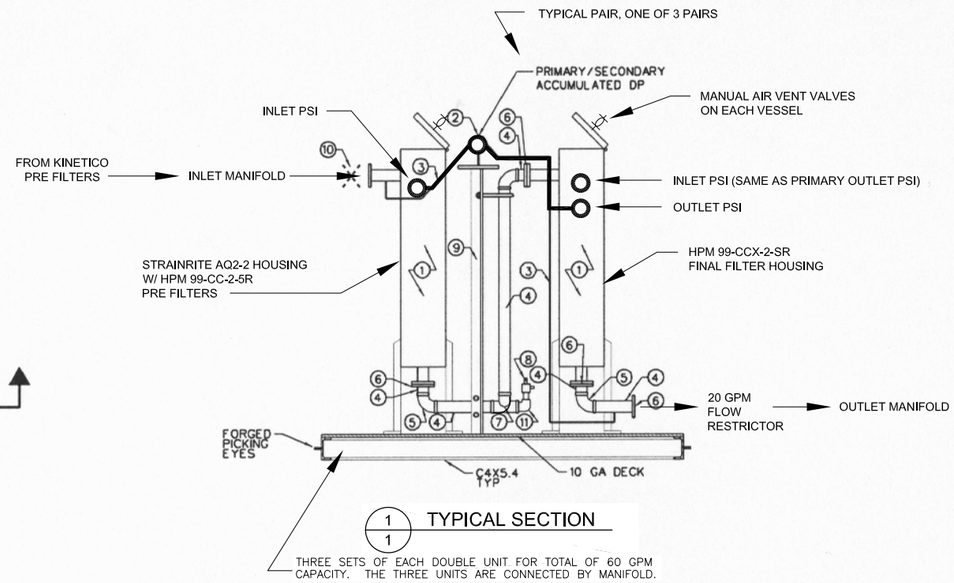


A/1 UPPER PIPING



B/1 LOWER PIPING

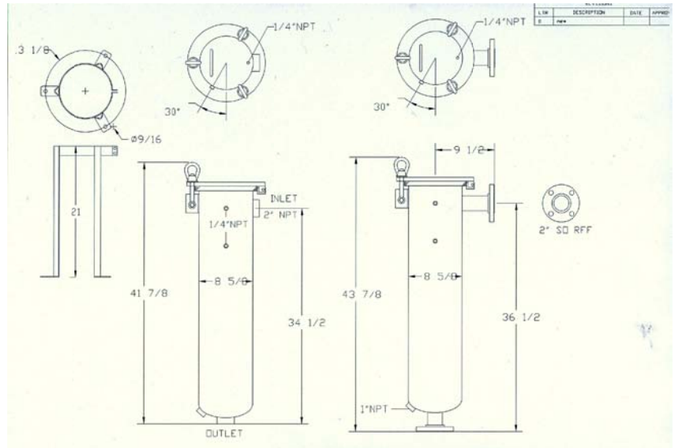


1/1 TYPICAL SECTION

FITTING SCHEDULE				
MARK	SIZE	DESCRIPTION	SCH	MATERIAL
1	NA	FILTER UNIT	NA	NA
2	2½"	PRESSURE GAUGE	NA	NA
3	¼"	PRESSURE LINE	80	POLY
4	2"	PIPE	80	PVC
5	2"	90 DEGREE (SOCKET ENDS)	80	PVC
6	2"	FLANGE (SOCKET END)	80	PVC
7	2"	TEE (SOCKET ENDS)	80	PVC
9	NA	PIPING SUPPORT W/ U BOLTS	NA	304SS
10	1½"	FLOW CONTROL VALVE (BY OTHERS)		

GENERAL NOTES:

1. ALL STEEL PLATE AND CHANNEL SHALL BE A-36 MATERIAL.
2. ALL EXTERIOR SURFACES SHALL BE CLEANED OF DIRT, OIL, GREASE, AND FOREIGN MATERIALS PER MANUFACTURER'S RECOMMENDATION PRIOR TO BEING POWER COATED BLACK.
3. THIS DRAWING IS NOT TO SCALE.
4. SEE PLAN FOR EXACT FITTING DETAIL.



PLAN AND ELEVATION

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DRAWING REFERENCE(S):

- EXHIBIT WT-3 TITLED, "UPGRADE WATER FILTRATION SYSTEM STRAIN RITE FILTERS" PROVIDED TO MWH BY HOLDEN VILLAGE, INC., DATED: MARCH, 2008.

ISSUE/REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: STRAINRITE FILTER DETAILS

MWH

SHEET: 10-5-3
REVISION: B
FILE NAME: 1008679D231

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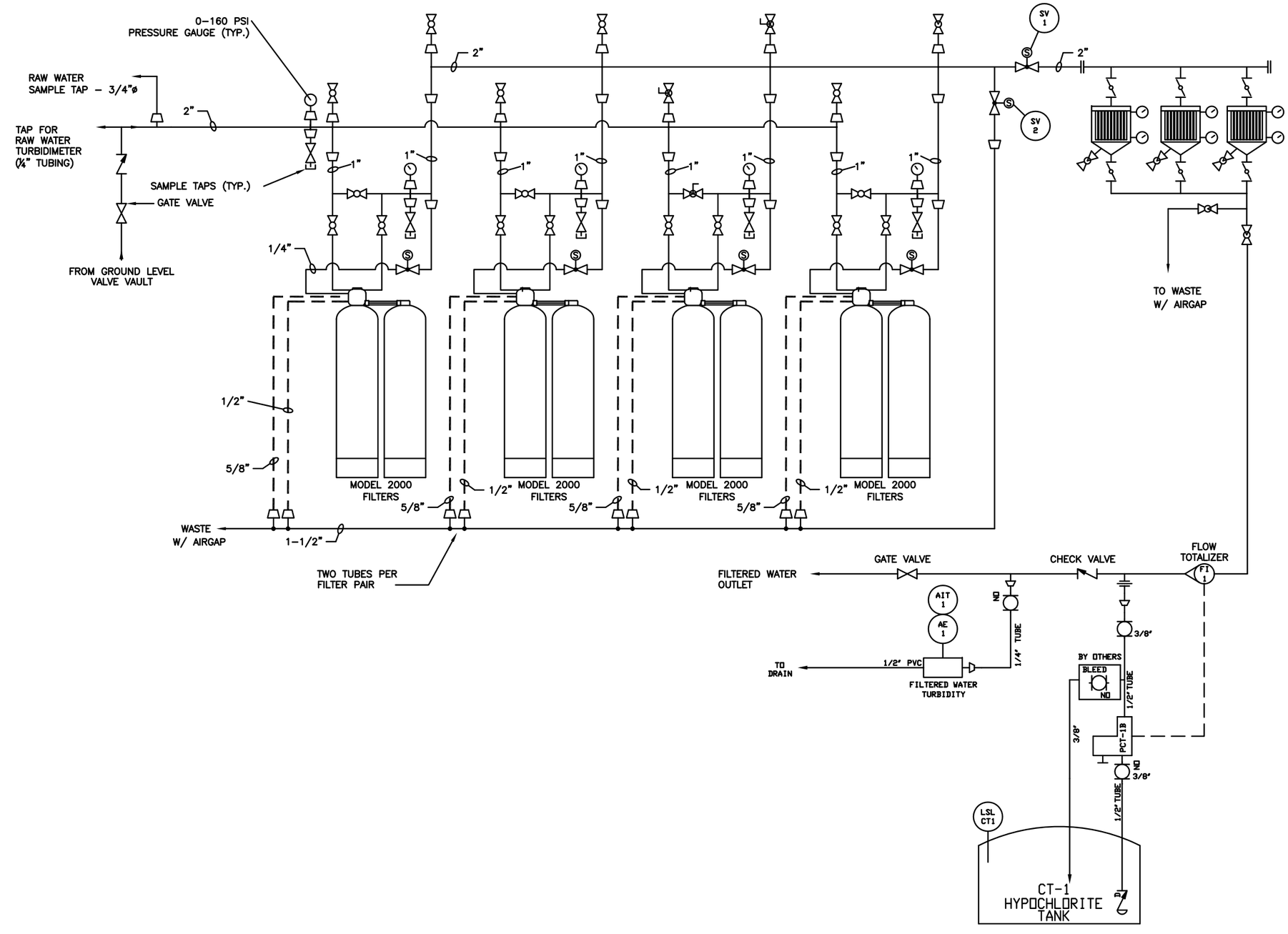

NOTE:

1. THIS DRAWING IS NOT TO SCALE.

LEGEND:

- GATE VALVE
- BALL VALVE
- REDUCER
- PRESSURE GAGE
- PRESSURE RELIEF VALVE
- INCREASER
- REDUCING TEE
- CONTROL VALVE
- CHECK VALVE
- BUTTERFLY VALVE
- SOLENOID VALVE
- PLUG VALVE
- PNUEMATIC CHECK VALVE
- SAMPLE TAPS
- FLANGED CONNECTION
- UNION
- HEAT EXCHANGER

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
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DRAWING REFERENCE(S):

- EXHIBIT WT-2 TITLED, "UPGRADE WATER FILTRATION SYSTEM FLOW DIAGRAM" PROVIDED TO MWH BY HOLDEN VILLAGE, INC., DATED: MARCH, 2008.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

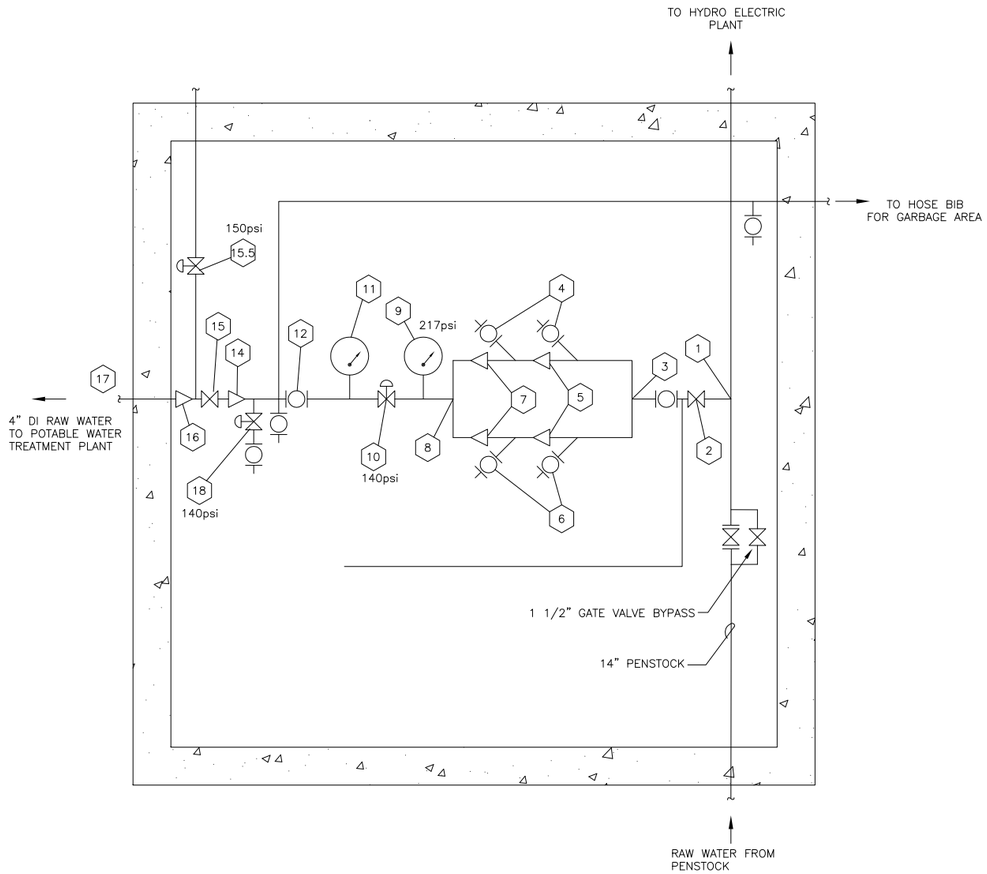
TITLE: KINETICO FILTERS DETAILS

MWH

SHEET: 10-5-4 | REVISION: B

FILE NAME: 1008679D232

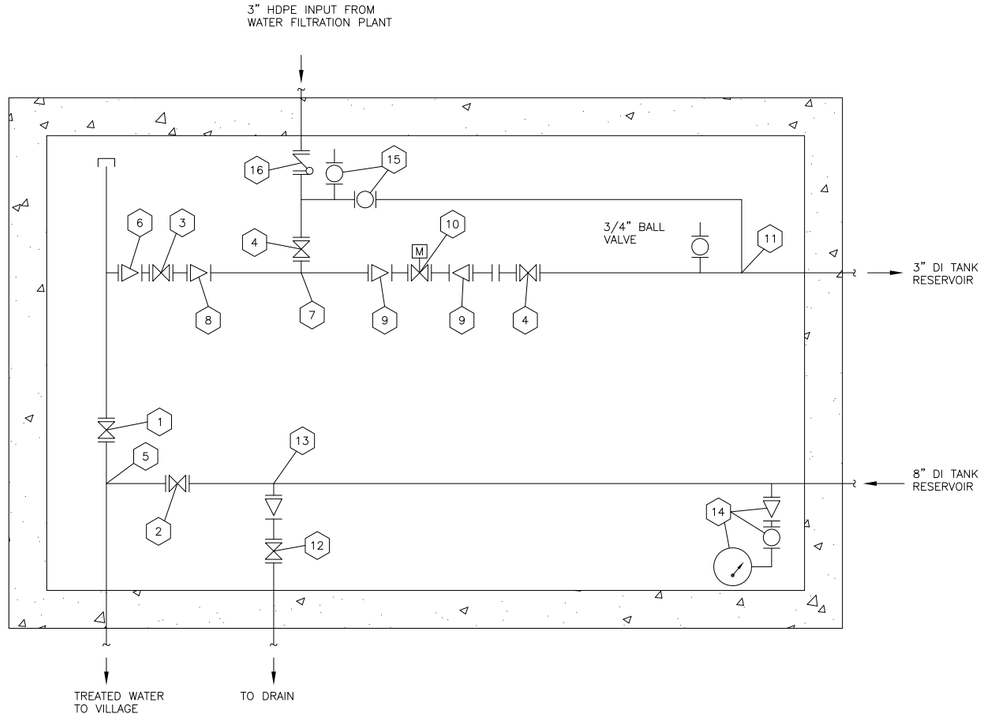
M:\Clients-G-Z\Rio Tinto\1008679 - Holden Mine\013-Sheet Set\Infrastructure Improvements\Holden Village Facilities\10086790232 4/15/2011 3:45:47 PM



2 RAW WATER LEVEL 2 VALVE VAULT
(LOCATED IN "A-FRAM" NEAR GARAGE)

2nd LEVEL VALVE VAULT

1. 3" TAP ON PENSTOCK
2. 3" GATE VALVE
3. TEE INTO 2-2 1/2" LINES
4. 2-WYE STRAINERS W/ 1" BALL VALVE (TO FLUSH)
5. 3"x2" REDUCER
6. 2-2" WYE STRAINERS
7. 2"x1 1/4" REDUCER W/ UNIONS
8. 2-1 1/4" LINES TEE INTO ONE 1 1/4" LINE
9. PRESSURE GAUGE
10. CLAVAL 990 PRV
11. PRESSURE GAUGE
12. 1 1/4" BALL VALVE
13. SIDESTREAM TEE-1/2" UNTREATED TO GARBAGE AREA
14. 1 1/4"x2" INCREASER
15. 2" GATE VALVE
15.5 PRESSURE RELIEF VALVE
16. 2"x4" INCREASER
17. 4" DI EXIT TO WATER FILTRATION PLANT
18. CLAVAL 990 PRV



3 TREATED WATER LEVEL 3 VALVE VAULT
(LOCATED NEAR STORAGE TANK)

3rd LEVEL VALVE VAULT

1. 8" GATE VALVE, NORMALLY CLOSED
2. 8" GATE VALVE
3. 4" GATE VALVE
4. 3" GATE VALVE
5. 8"x8" TEE
6. 8"x4" REDUCING TEE
7. 3"x3" TEE
8. 4"x3" REDUCER
9. 3"x2 1/2" REDUCER
10. 2 1/2" CLAYTON ALTITUDE CONTROL VALVE MODEL #210-03FORCED OPEN
11. 2" CORP TAP
12. 4" GATE VALVE
13. 8"x4" TEE
14. 3/4" CORP TAP W/ REDUCER, BALL VALVE AND PRESSURE GAUGE
15. 2" BALL VALVE
16. 3" CHECK VALVE

LEGEND:

- GATE VALVE
- BALL VALVE
- REDUCER
- PRESSURE GAGE
- PRESSURE RELIEF VALVE
- INCREASER
- REDUCING TEE
- CONTROL VALVE
- CHECK VALVE

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
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DRAWING REFERENCE(S):

- EXHIBIT W-4 TITLED, "HOLDEN VILLAGE WATER VAULTS" PROVIDED TO MWH BY HOLDEN VILLAGE, INC., DATED: MARCH, 2008.

DESIGNED BY	P. PELLICER	02/28/11	
DRAWN BY	F. ANDRADE	02/28/11	
CHECKED BY	D. RODRIGUEZ	02/28/11	
APPROVED BY	P. CROUSE	02/28/11	
PROJECT MANAGER	R. SCHLICHER	02/28/11	
CLIENT APPROVAL			
CLIENT REFERENCE NO.			

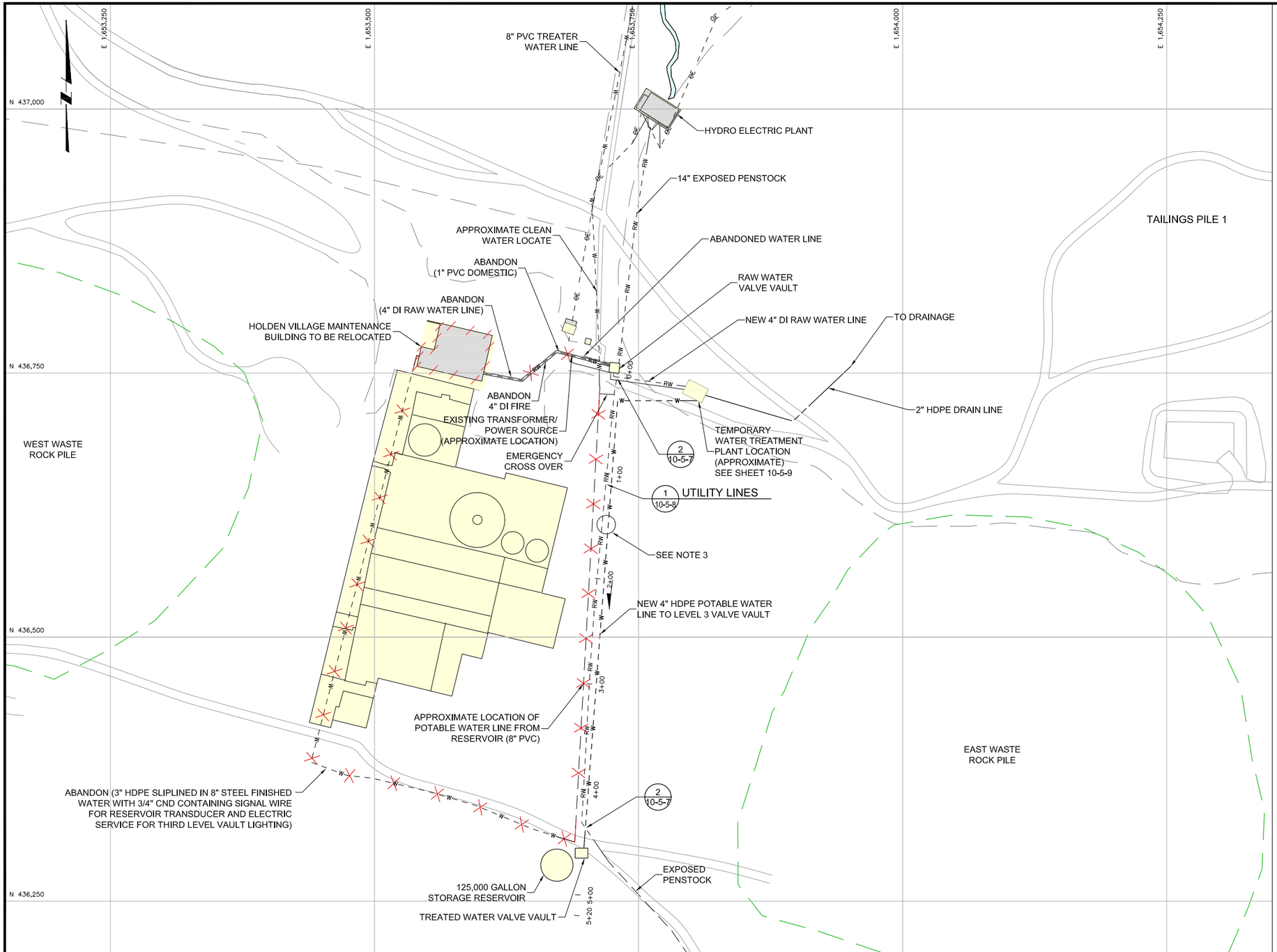
Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: POTABLE WATER SYSTEM VAULT DETAIL SHEET

MWH

SHEET: 10-5-5
REVISION: B
FILE NAME: 1008679D242

M:\Clients-Q-Z\Rio Tinto\1008679 - Holden Mine\013-Sheet Set\Infrastructure Improvements\Holden Village Facilities\1008679D242 4/15/2011 3:45:57 PM



PLAN

SCALE

50 0 50 100 FEET

CONTOUR INTERVAL = 10 FEET

LEGEND:

- 3370 — APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, FEET
- DI — DUCTILE IRON
- INSTRUMENTATION/CONTROL CONDUIT
- ELECTRICAL CONDUIT
- FUTURE DEMOLITION
- ABANDON

NOTES:

1. DISASSEMBLE THE HOLDEN VILLAGE POTABLE WATER PLANT AND REASSEMBLE IN THE TEMPORARY WATER TREATMENT IN NEW BUILDING.
2. CONTRACTOR SHALL FIELD VERIFY THE LOCATION OF RAW ALL EXISTING UTILITIES.
3. MAINTAIN A MINIMUM BUFFER DISTANCE OF 4 FEET BETWEEN TRENCH WALL AND EXISTING PENSTOCK.

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
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A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE

TITLE: RELOCATED POTABLE WATER SYSTEM

MWH

SHEET: 10-5-6 REVISION: B

FILE NAME: 1008679D239

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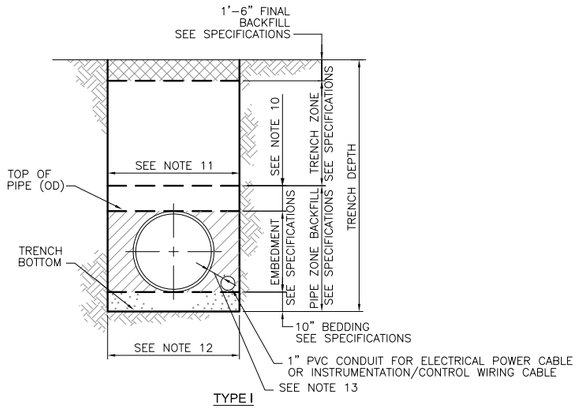
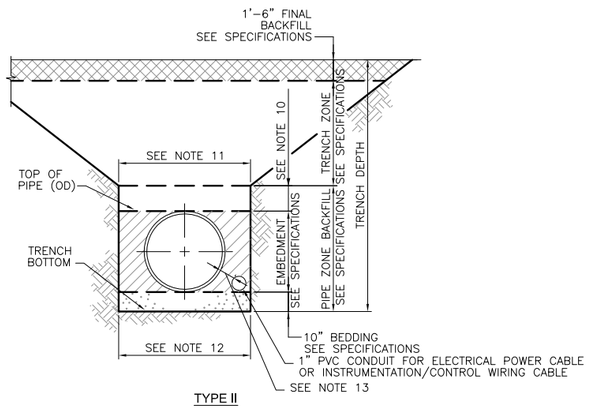


TYPE I

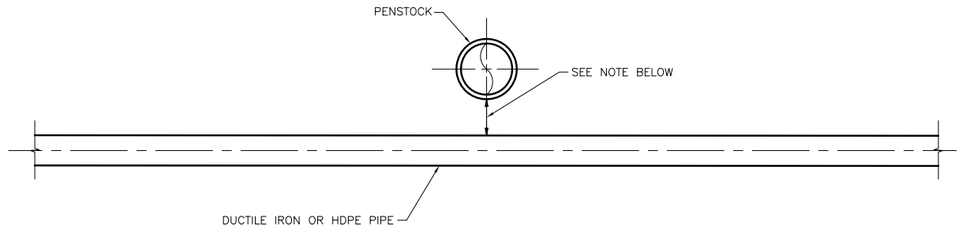


TYPE II

1 / - FLEXIBLE PIPE TRENCH
N.T.S.

NOTES:

1. FLEXIBLE PIPE REFERS TO ALL STEEL, DUCTILE-IRON, AND PLASTIC PIPES.
2. TYPICAL TRENCH SECTIONS (I, II AND III) ARE TO BE USED ONLY WHERE STABLE, COMPACT SOIL CONDITIONS EXIST. IF BOULDERS OR LARGE OBSTRUCTIONS ARE ENCOUNTERED, TRENCH SECTIONS MAY BE DEEPER OR WIDER THAN SHOWN. THE ENGINEER SHALL BE ADVISED SHOULD THIS OCCUR.
3. THE NEED FOR PROTECTIVE SYSTEMS AND EXCAVATION SLOPES SHALL BE DETERMINED CONSIDERING APPLICABLE LOCAL, STATE AND FEDERAL (OSHA) SAFETY STANDARDS AND REGULATIONS.
4. PROTECTIVE SYSTEMS SHALL BE DESIGNED AND BUILT IN ACCORDANCE WITH THE APPLICABLE LOCAL, STATE AND FEDERAL (OSHA) SAFETY STANDARDS AND REGULATIONS.
5. SUPPORTING DOCUMENTATION SHALL BE SUBMITTED TO THE ENGINEER
6. REGARDING PIPE DESIGN AND COMPLIANCE WITH APPLICABLE LOCAL, STATE AND FEDERAL (OSHA) SAFETY STANDARDS.
7. UNSUPPORTED VERTICAL AND/OR SLOPING TRENCH WALL SLOPES SHALL NOT BE STEEPER THAN ALLOWED BY APPLICABLE LOCAL, STATE AND FEDERAL (OSHA) SAFETY STANDARDS AND REGULATIONS, UNLESS SUPPORTING DOCUMENTATION IS SUBMITTED, ACCORDING TO AFOREMENTIONED SAFETY STANDARDS.
8. TRENCH SECTIONS OTHER THAN THE TYPICAL SECTIONS SHOWN MAY BE UTILIZED PROVIDED THEY COMPLY WITH APPLICABLE LOCAL, STATE AND FEDERAL (OSHA) SAFETY STANDARDS AND REGULATIONS. DOCUMENTATION SUPPORTING THIS COMPLIANCE AND PIPE DESIGN CALCULATIONS SHALL BE SUBMITTED TO THE ENGINEER. IF OVER-EXCAVATION DUE TO POOR FOUNDATION MATERIAL IS ORDERED BY THE ENGINEER, THE BACKFILL MATERIAL SHALL BE ACCORDING TO THE EARTHWORK SECTION OF THE SPECIFICATIONS ARTICLE ENTITLED, "FILL AND BACKFILL MATERIAL REQUIREMENTS."
9. IF DURING CONSTRUCTION, THE WATER TABLE IS DISCOVERED TO BE ABOVE THE TRENCH BOTTOM, THE ENGINEER SHALL BE NOTIFIED, AND APPROPRIATE DEWATERING SHALL BE IMPLEMENTED TO LOWER THE WATER LEVEL BELOW THE TRENCH BOTTOM. THE BACKFILL MATERIAL SHALL BE ACCORDING TO THE EARTHWORK SECTIONS OF THE SPECIFICATIONS, OR AS ORDERED BY THE ENGINEER.
10. 6" (MIN) FOR PIPE DIAMETER < 24". 12" (MIN) FOR PIPE DIAMETER > 24".
11. MAX TRENCH WIDTH AT TOP OF PIPE: OD PLUS 36" FOR, 18" AND LARGER PIPE OD. OD PLUS 24" FOR LESS THAN 18".
12. MIN TRENCH BOTTOM WIDTH = OD PLUS 24" FOR MECHANICAL COMPACTION.
13. MIN DISTANCE BETWEEN PIPE AND PVC CONDUIT = 12"
14. MIN SPACING BETWEEN PVC CONDUIT AND SIDE/BOTTOM OF TRENCH = 3"
15. MAINTAIN A MINIMUM BUFFER DISTANCE OF 4 FEET BETWEEN TRENCH WALL AND EXISTING PENSTOCK.



2 / - CROSS OVER PIPING
N.T.S.

NOTE:

1. DUCTILE IRON/HDPE PIPE TO CROSS OVER BELOW THE PENSTOCK WITH 6" MIN CLEARANCE BETWEEN BOTTOM OF PENSTOCK AND TOP OF DUCTILE IRON/HDPE PIPE (WHERE BOTTOM OF PENSTOCK IS AT LEAST 30" BELOW GRADE). IN INSTANCES WHERE PENSTOCK IS ABOVE GRADE OR BOTTOM OF THE PENSTOCK IS NOT AT LEAST 30" BELOW GRADE, LOCATE DUCTILE IRON/HDPE PIPE BOTTOM AT LEAST 30" BELOW GRADE.

LEGEND:

O.D.	OUTSIDE DIAMETER
CLSM	CONTROLLED LOW STRENGTH MATERIAL

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE
TITLE: DETAIL SHEET

MWH

SHEET: 10-5-7
REVISION: B
FILE NAME: 1008679D240

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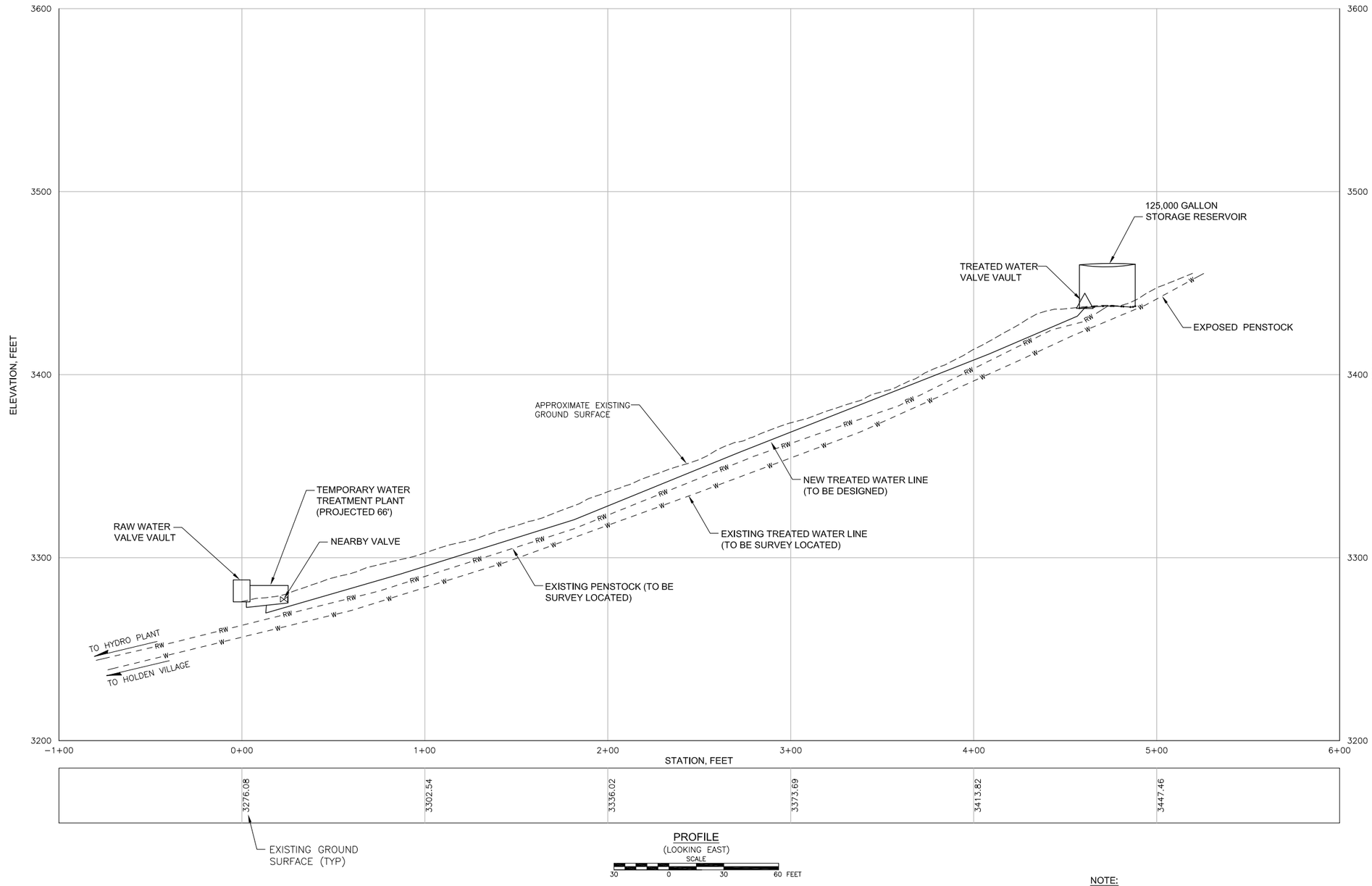

PROFILE
(LOOKING EAST)
SCALE
30 0 30 60 FEET

NOTE:

1. FOR ALIGNMENT LOCATION SEE SHEET 10−5−6.

ISSUE REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DRAWING REFERENCE(S):
- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.
- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA−FSA−APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE
TITLE: UTILITY LINE LOCATIONS

MWH

SHEET: 10-5-8
REVISION: B
FILE NAME: 1008679D241

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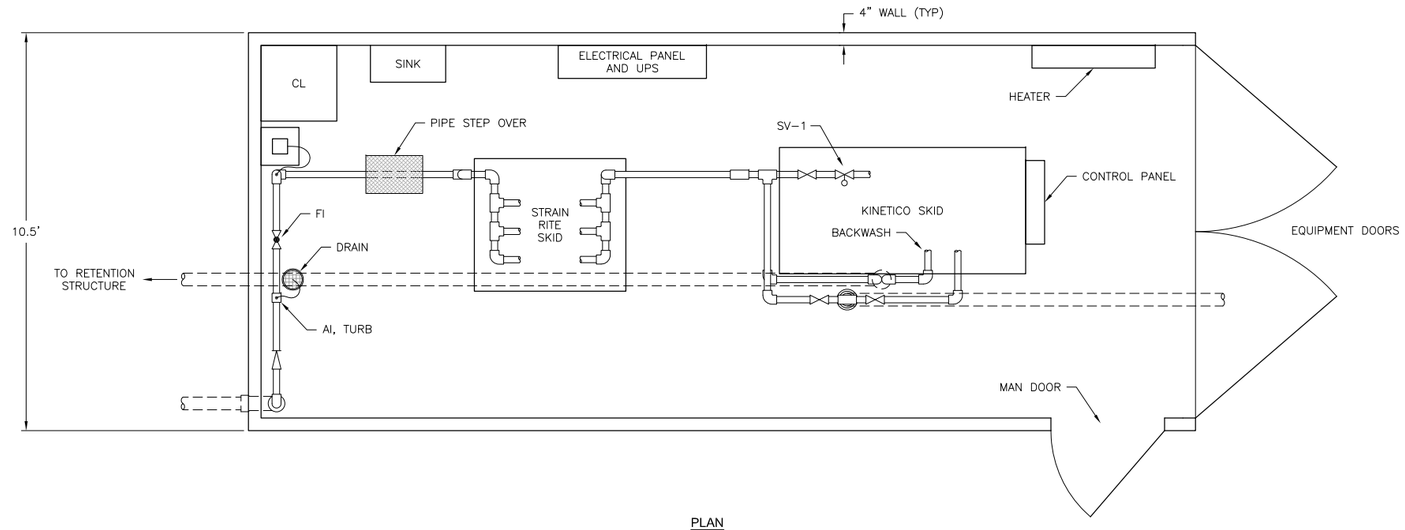
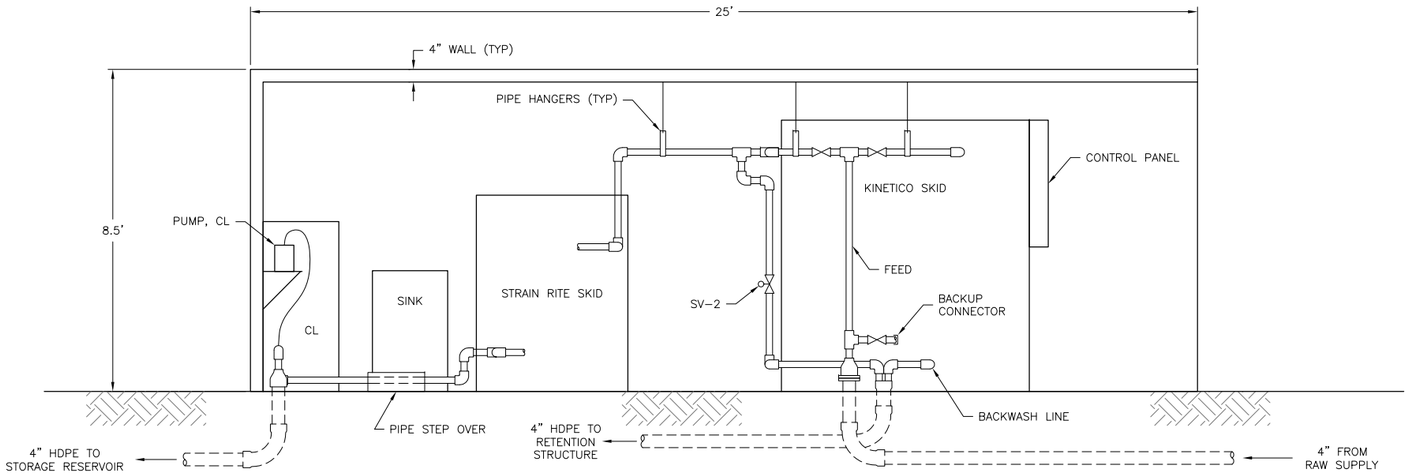


PLAN



ELEVATION

SCALE
2 0 2 4 FEET

NOTE:

1. FOR PLAN LOCATION SEE SHEET 10-5-6.

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	DM	DD	DATE

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DRAWING REFERENCE(S):

DESIGNED BY	D DUPON	3/11/11
DRAWN BY	D MIRANDA	3/11/11
CHECKED BY	D DUPON	3/11/11
APPROVED BY	P. CROUSE	3/11/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: PIPING DIAGRAM TEMPORARY EQUIPMENT ENCLOSURE

MWH

SHEET: 10-5-9
REVISION: B
FILE NAME: 1008679D348

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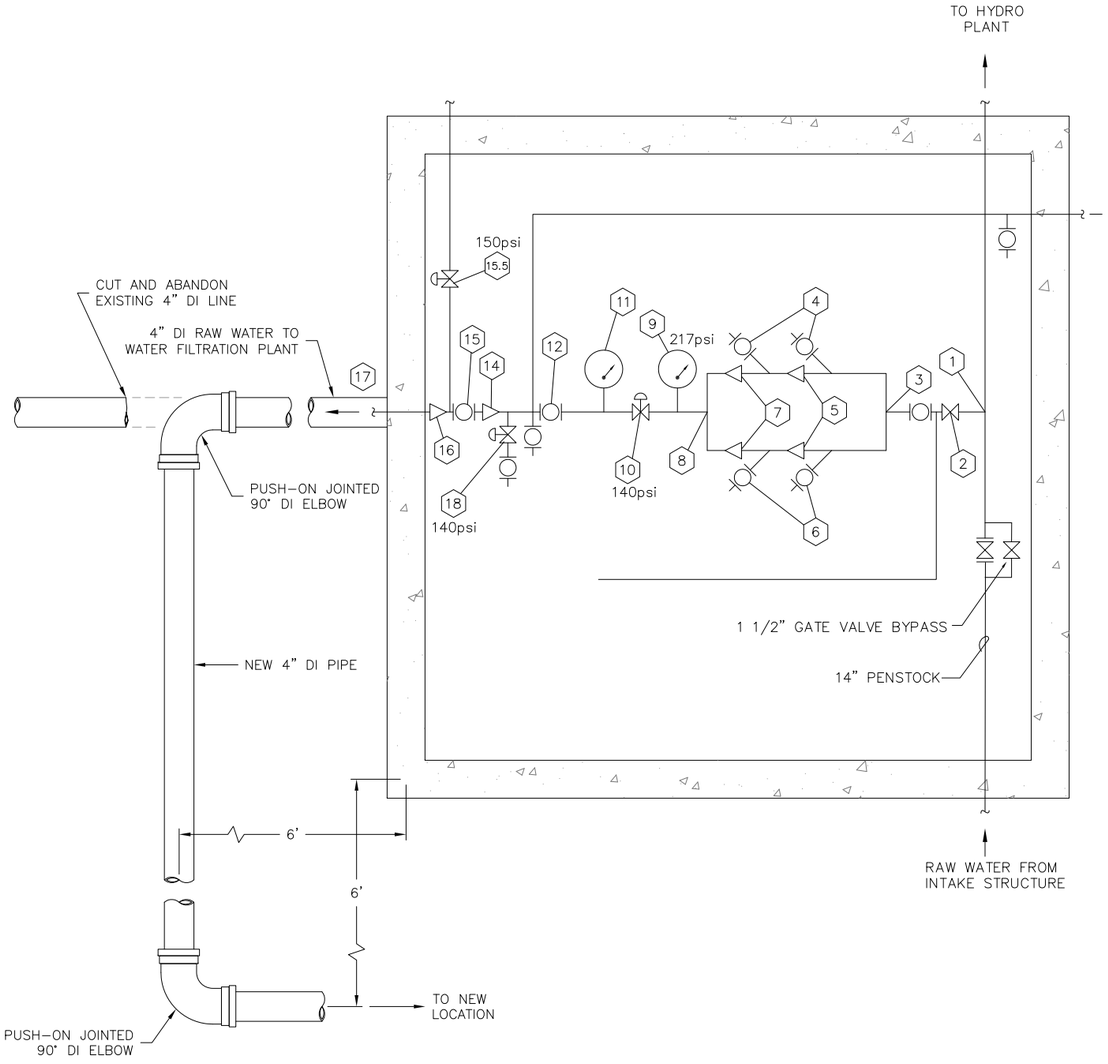
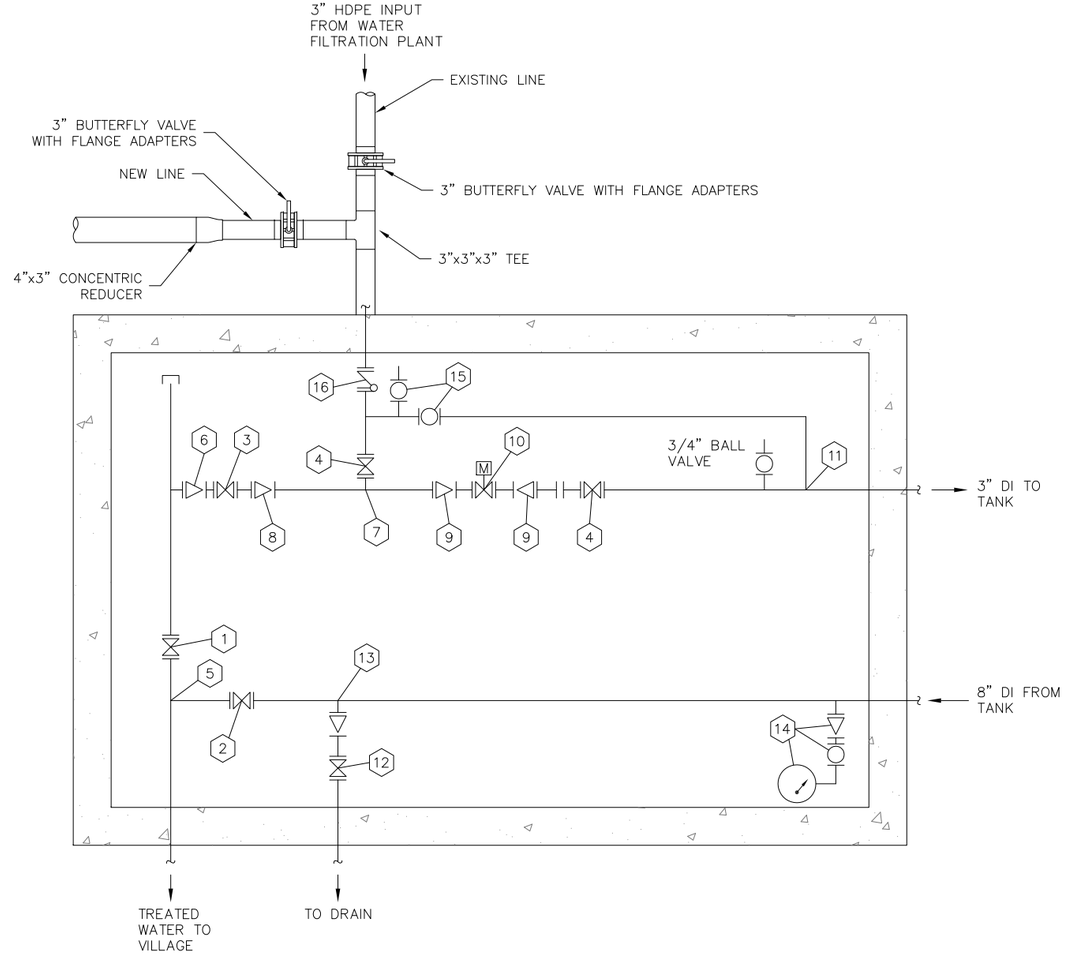


RAW WATER
LEVEL 2 VALVE VAULT DETAIL
2 - (LOCATED IN "A-FRAME" NEAR GARAGE)



TREATED WATER
LEVEL 3 VALVE VAULT
3 - (LOCATED NEAR STORAGE TANK)

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	DM	DD	3/11/11

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DRAWING REFERENCE(S):

- EXHIBIT W-4 TITLED, "HOLDEN VILLAGE WATER VAULTS" PROVIDED TO MWH BY HOLDEN VILLAGE, INC., DATED: MARCH, 2008.

DESIGNED BY	D DUPON	3/11/11
DRAWN BY	D MIRANDA	3/11/11
CHECKED BY	D DUPON	3/11/11
APPROVED BY	P. CROUSE	3/11/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: EXISTING VALVE VAULT MODIFICATIONS

MWH

SHEET: 10-5-10
REVISION: B
FILE NAME: 1008679D356

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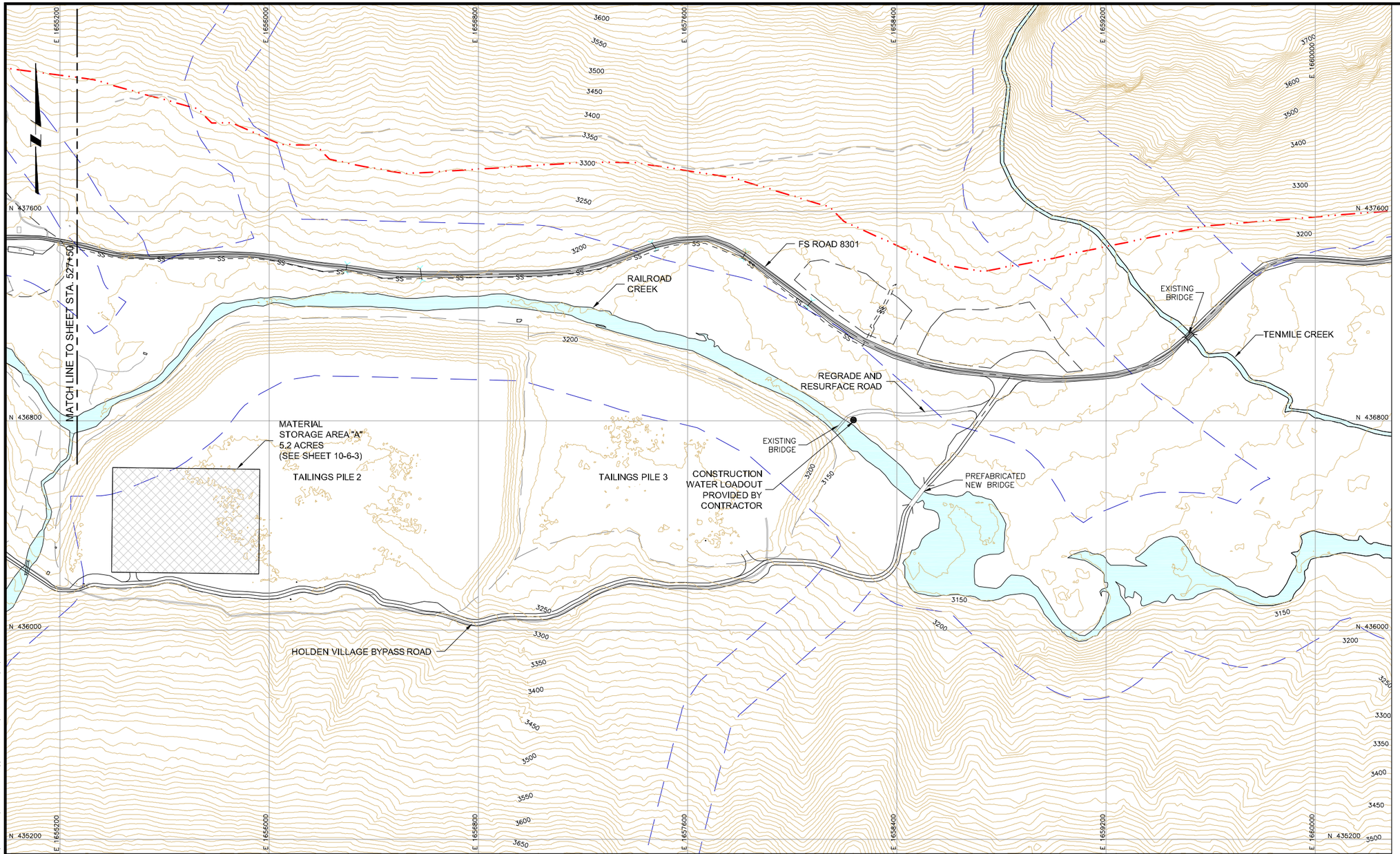

PLAN

SCALE

200 0 200 400 FEET

CONTOUR INTERVAL = 10 FEET

ISSUE REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA–FSA–APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	R. WATT	02/21/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: CONSTRUCTION SUPPORT FACILITIES (SHEET 1 OF 2)

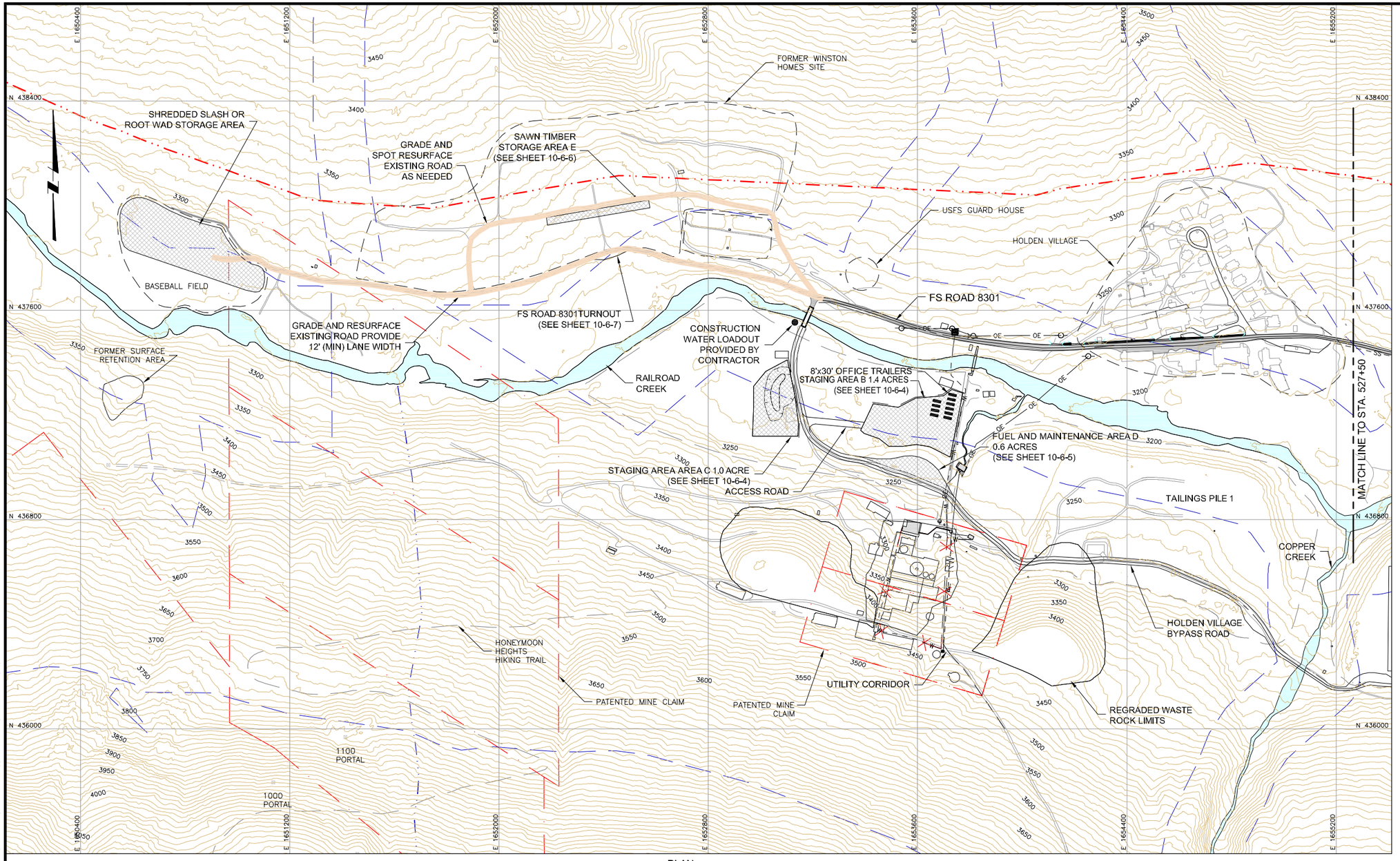
MWH

SHEET: 10-6-1

REVISION: B

FILE NAME: 1008679D308

M:\Clients–O–Z\Rio Tinto\1008679 – Holden Mine\01\3–Sheet Set\Infrastructure Improvements\Construction Support Facilities\1008679D308 4/15/2011 2:05:17 PM



PLAN

SCALE

200 0 200 400 FEET

CONTOUR INTERVAL = 10 FEET

NOTES:

1. SECTIONS OF ROAD THAT WILL BE GRADED AND RESURFACED SHALL BE RESURFACED WITH 6" OF SURFACE COURSE MATERIAL PER SPECIFICATIONS.
2. NOXIOUS WEED CONTROL MEASURES SHALL BE IMPLEMENTED PRIOR TO STOCKPILING SLASH OR ROOT WADS IN THE BALL FIELD AREA.

ISSUE REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.
- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA–FSA–APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	R. WATT	02/21/11
CHECKED BY	D. RODRIGUEZ	
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: CONSTRUCTION SUPPORT FACILITIES (SHEET 2 OF 2)

MWH

SHEET: 10-6-2 REVISION: B

FILE NAME: 1008679D309

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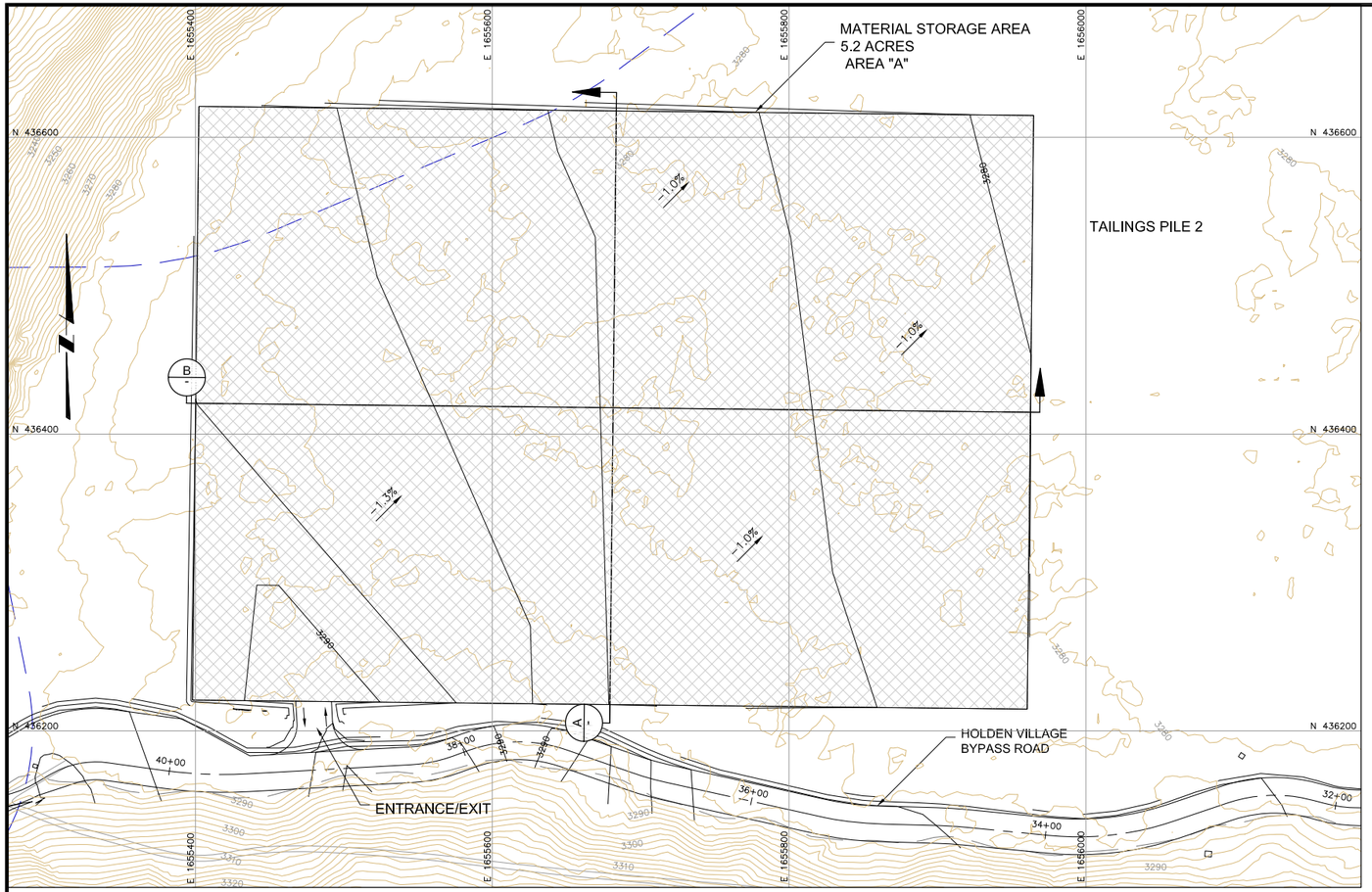
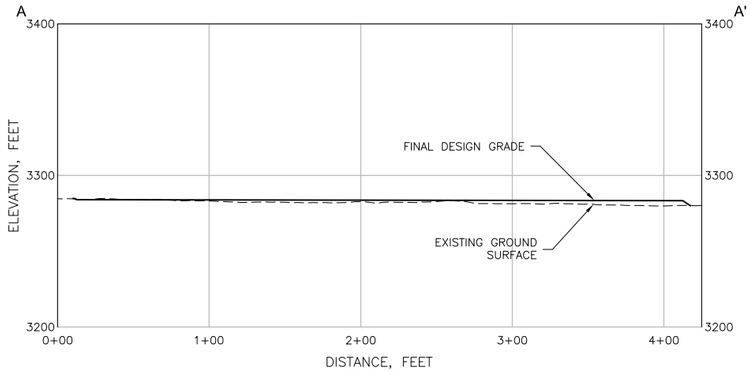


PLAN

SCALE

50 0 50 100 FEET

CONTOUR INTERVAL = 2 FEET



A

SECTION

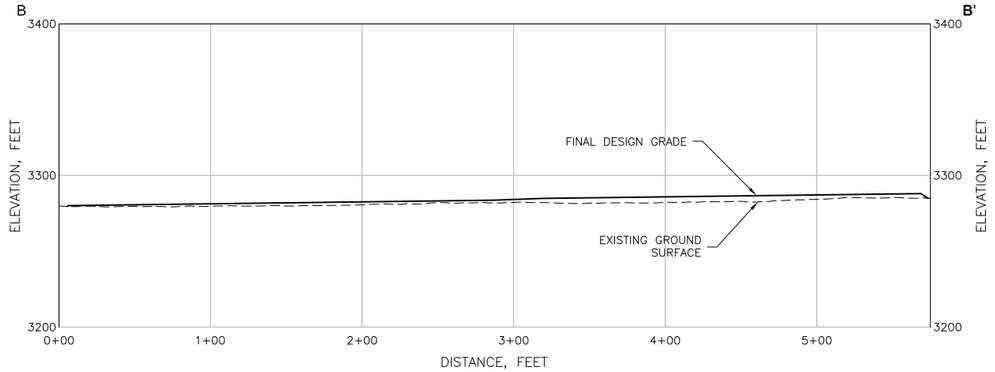
MATERIAL STORAGE AREA "A"

(LOOKING WEST)

SCALE

50 0 50 100 FEET

EARTHWORKS		
CUT, CY	FILL, CY	NET, CY
30	16,974	16,944 (FILL)



B

SECTION

MATERIAL STORAGE AREA "A"

(LOOKING NORTH)

SCALE

50 0 50 100 FEET

NOTES:

1. AREA MAY BE CONSTRUCTED IN PHASES AND ADDITIONAL STAGING AREA IS REQUIRED.
2. NO CUT OF EXISTING TAILINGS PILE SHALL BE PERFORMED.
3. AREA SHALL BE CLEARED AND GRUBBED OF EXISTING VEGETATION AND ROOT SYSTEMS.
4. FOR PLAN LOCATION SEE SHEET 10-6-1.
5. PROVIDE SEDIMENT CONTROL MEASURES AROUND PERIMETER AS NEEDED.

ISSUE / REV				
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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DRAWING REFERENCE(S):

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- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	R. WATT	02/28/11
CHECKED BY	D. RODRIGUEZ	----
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

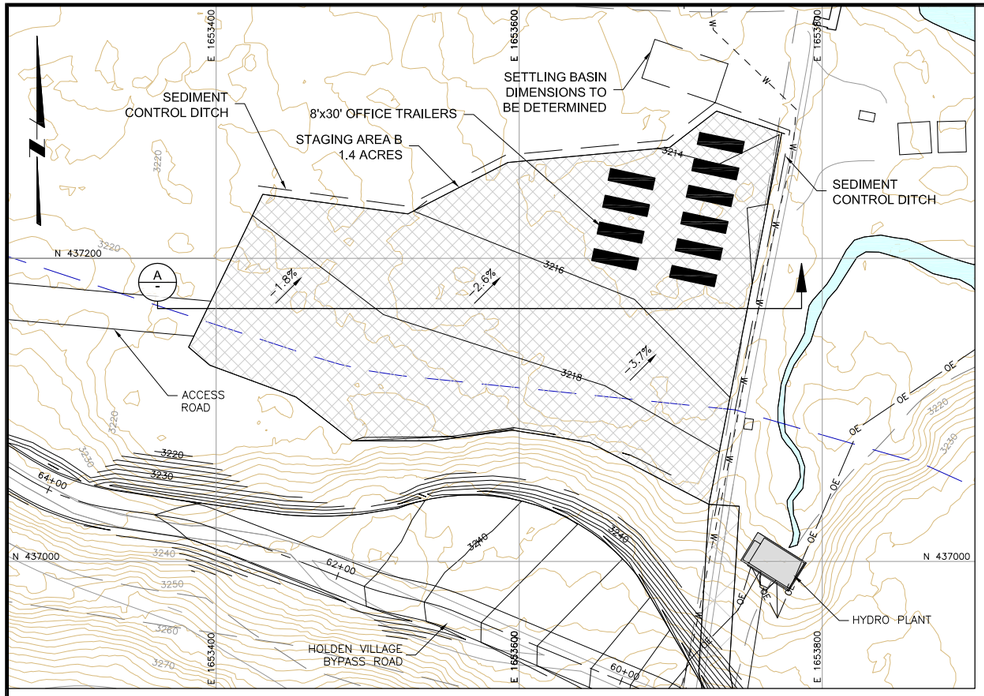
TITLE: MATERIAL STORAGE AREA A

MWH

SHEET: 10-6-3 REVISION: B

FILE NAME: 1008679D323

M:\Clients-0-Z\Rio Tinto\1008679 - Holden Mine\01.3-Sheet Set\Infrastructure Improvements\Construction Support Facilities\1008679D323 4/15/2011 4:24:48 PM



PLAN

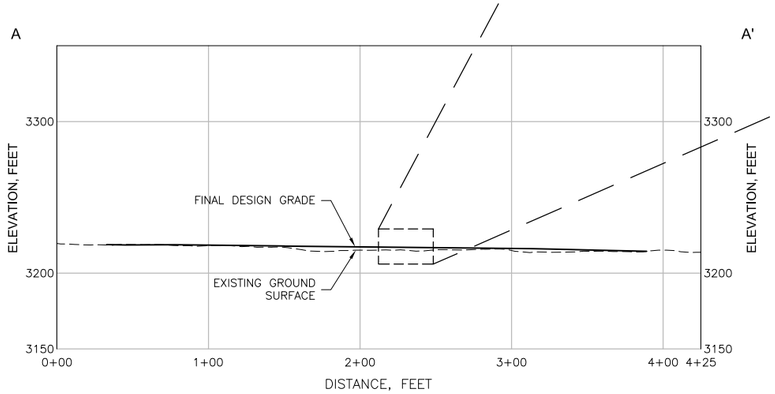
SCALE

50 0 50 100 FEET

CONTOUR INTERVAL = 2 FEET

NOTES:

1. PLAN LOCATION OF STAGING AREAS B AND C ARE SHOWN ON SHEET 10-6-2.
2. FOOTPRINT AREA TO BE CLEARED AND GRUBBED.
3. STRIP TOPSOIL IN STAGING AREAS.
4. A MINIMUM OF 6" OF CONTROLLED FILL SHALL BE PLACED OVER COMPACTED SUBGRADE.
5. GRADING PLAN ASSUMES AT LEAST 6" OF TOPSOIL SHALL BE STRIPPED TO ALLOW PLACEMENT OF CONTROLLED FILL TO MEET GRADES AS SHOWN.
6. PROVIDE SEDIMENT CONTROL MEASURES AROUND PERIMETER AS NEEDED.
7. CONTAMINATED SOIL EXCAVATION MAY BE NEEDED PRIOR TO FILL PLACEMENT.

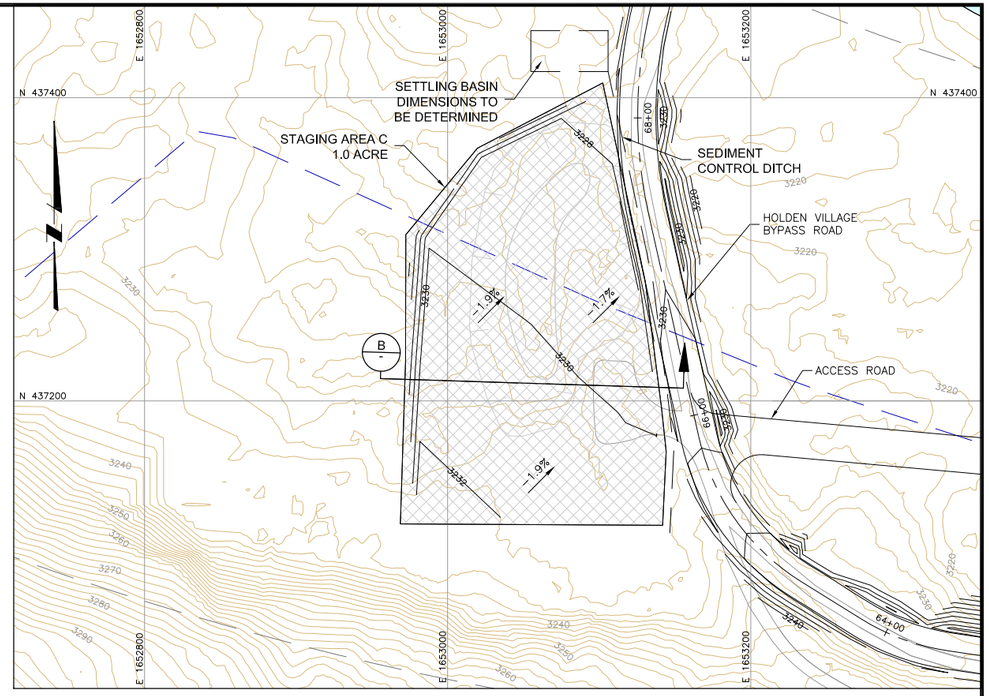


SECTION

A - STAGING AREA B (LOOKING NORTH)

SCALE

50 0 50 100 FEET

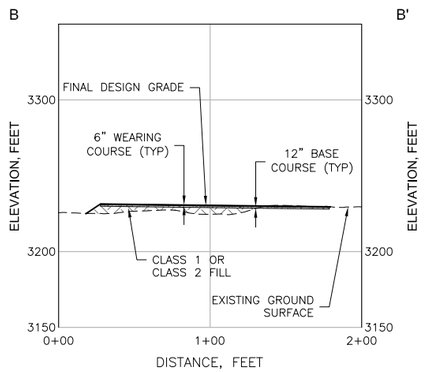


PLAN

SCALE

50 0 50 100 FEET

CONTOUR INTERVAL = 2 FEET



SECTION

B - STAGING AREA C (LOOKING NORTH)

SCALE

50 0 50 100 FEET

ISSUE REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	R. WATT	02/28/11
CHECKED BY	D. RODRIGUEZ	----
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: STAGING AREA B AND STAGING AREA C

MWH

SHEET: 10-6-4

REVISION: B

FILE NAME: 1008679D322

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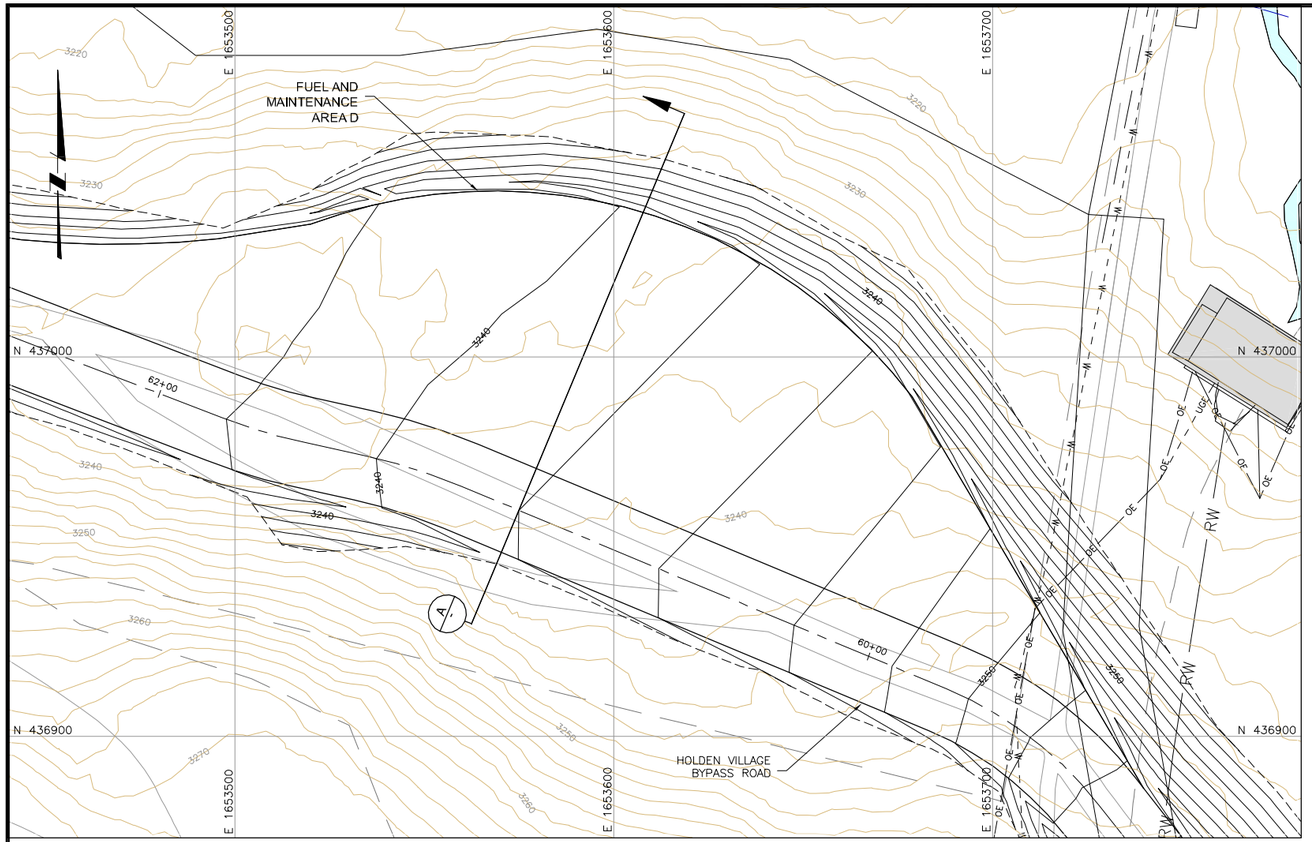

PLAN

SCALE

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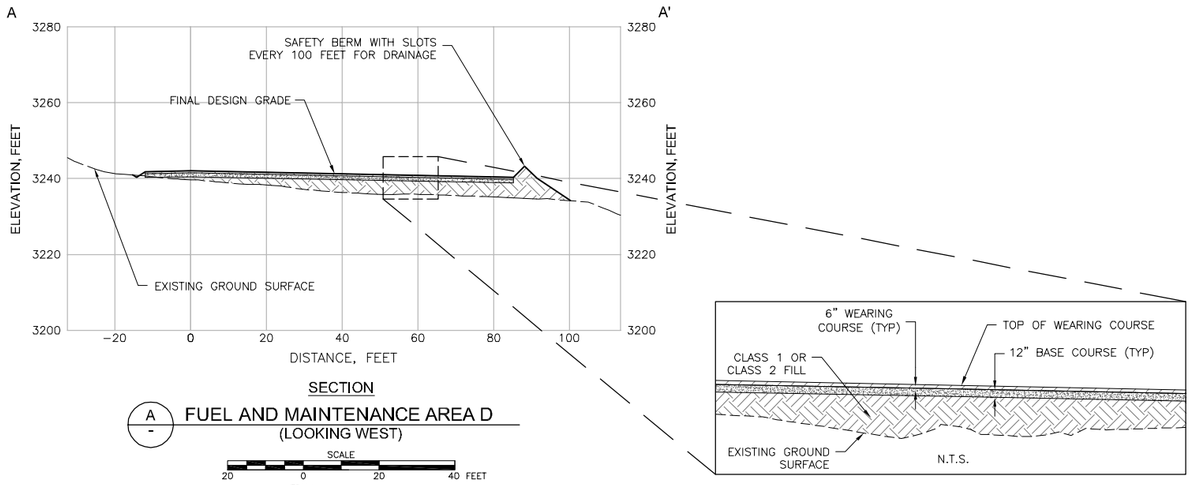
CONTOUR INTERVAL = 2 FEET



SECTION

A / - FUEL AND MAINTENANCE AREA D

(LOOKING WEST)

SCALE

20 0 20 40 FEET

NOTES:

1. FOR PLAN LOCATION SEE SHEET 10−6−2.
2. CONTRACTOR SHALL PROVIDE SECONDARY CONTAINMENT FOR FUEL STORAGE TANKS, IN ACCORDANCE WITH LOCAL AND STATE REGULATIONS.

ISSUE REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	R. WATT	02/28/11
CHECKED BY	D. RODRIGUEZ	----
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: FUEL AND MAINTENANCE AREA D

MWH

SHEET: 10-6-5 REVISION: B

FILE NAME: 1008679D321

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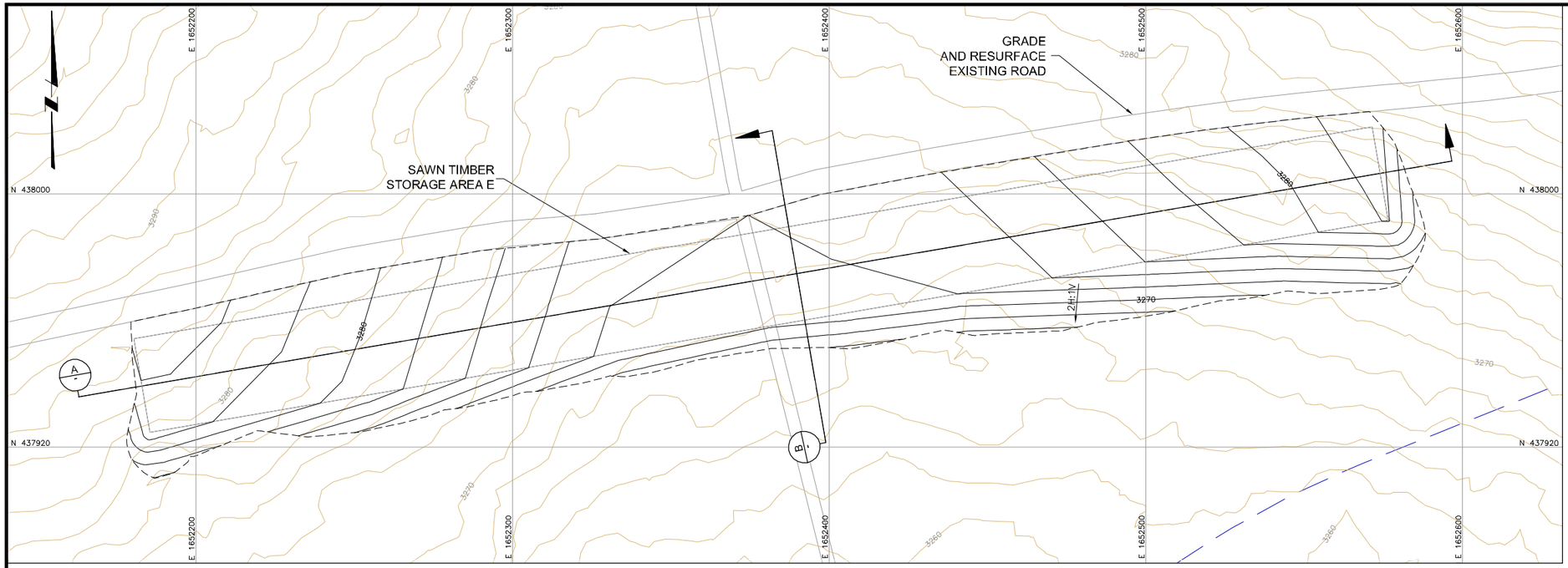

PLAN

SCALE

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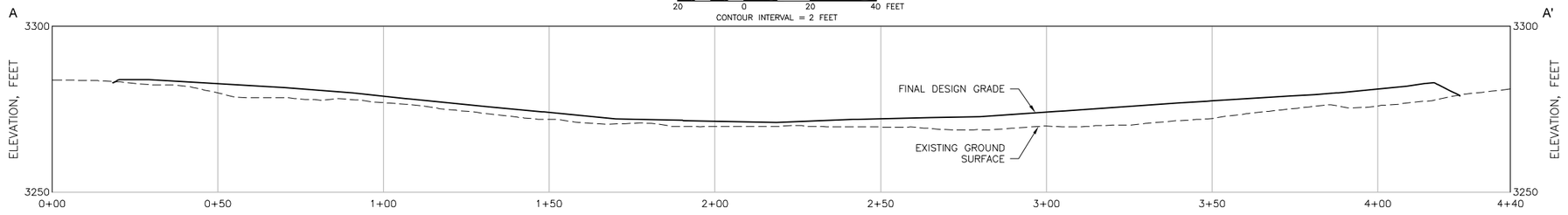
CONTOUR INTERVAL = 2 FEET



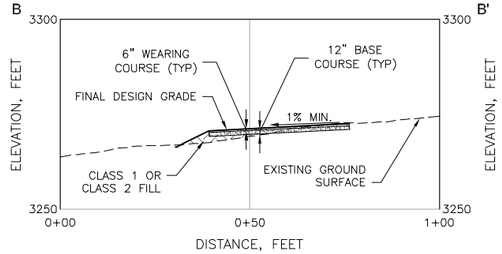
SECTION

A - SAWN TIMBER STORAGE AREA E

(LOOKING NORTH)

SCALE

20 0 20 40 FEET



SECTION

B - SAWN TIMBER STORAGE AREA E

(LOOKING WEST)

SCALE

20 0 20 40 FEET

EARTHWORKS		
CUT, CY[2]	FILL, CY	NET, CY
0	1,594	1,594 (FILL)

NOTES:

1. FOOTPRINT OF LOG DECK SHALL BE CLEARED OF VEGETATION.
2. CUT VEGETATION AS CLOSE AS PRACTICAL TO EXISTING GROUND SURFACE.
3. NO GRUBBING OR EXCAVATION SHALL BE ALLOWED.
4. NO VEHICLE TRAFFIC SHALL BE ALLOWED OUTSIDE OF THE EXISTING ACCESS ROAD UNTIL A MINIMUM OF 2 FT OF FILL IS PLACED.
5. LIMITED TOPOGRAPHIC DETAIL WAS AVAILABLE FOR LAYOUT, GRADE AND FILL VOLUMES ARE APPROXIMATE.
6. LOG PLACEMENT SHALL START AT THE CENTRAL LOW AREA AND CONTINUE TO THE EAST AND WEST OF THE STOCKPILE AREA.
7. PROVIDE SEDIMENT CONTROL AT TOE OF FILL SLOPE.
8. FOR PLAN LOCATION SEE SHEET 10-6-2.

ISSUE / REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DRAWN BY	R. WATT	02/28/11
CHECKED BY	D. RODRIGUEZ	----
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: SAWN TIMBER STORAGE AREA E

MWH

SHEET: 10-6-6 REVISION: B

FILE NAME: 1008679D320

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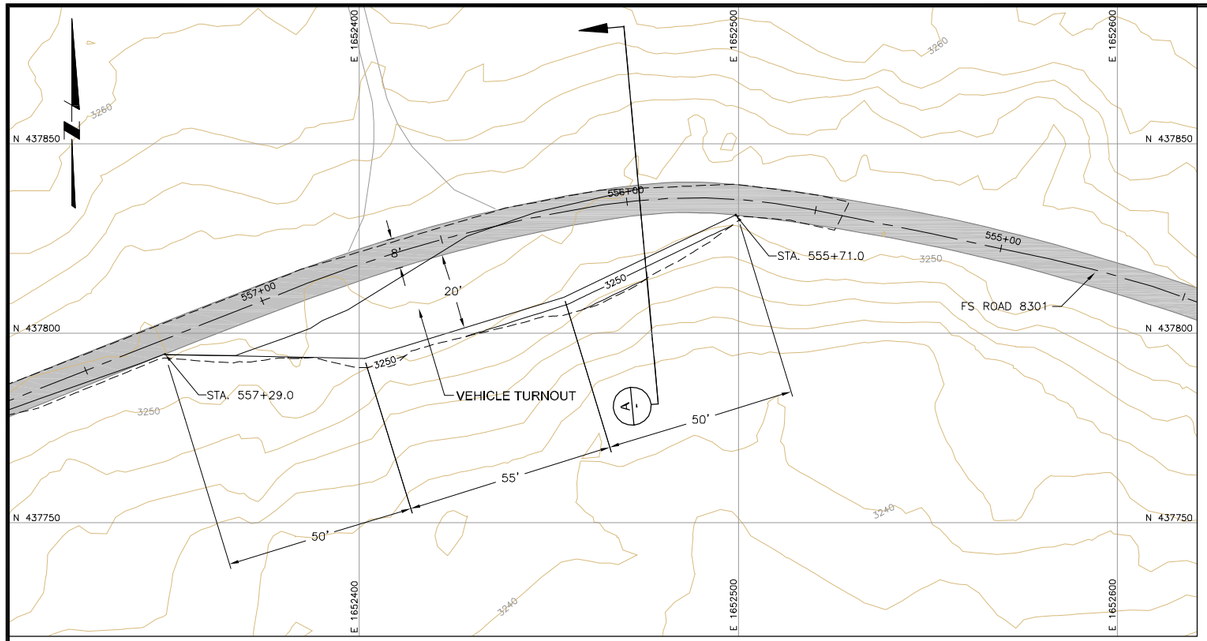
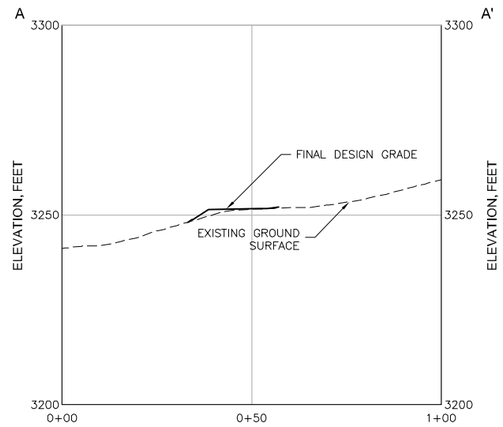


PLAN

SCALE

20 0 20 40 FEET

CONTOUR INTERVAL = 2 FEET



SECTION

A – FS ROAD 8301 TURNOUT

(LOOKING WEST)

SCALE

20 0 20 40 FEET

NOTE:

1. FOR PLAN LOCATION SEE SHEET 10-6-2.

EARTHWORKS		
CUT, CY	FILL, CY	NET, CY
11	19	8 (FILL)

ISSUE / REV					
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11	
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11	

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DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	----
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: CONSTRUCTION SUPPORT FACILITIES
FS ROAD 8301 TURNOUT STA. 566+50

MWH

SHEET: 10-6-7

REVISION: B

FILE NAME: 1008679D318

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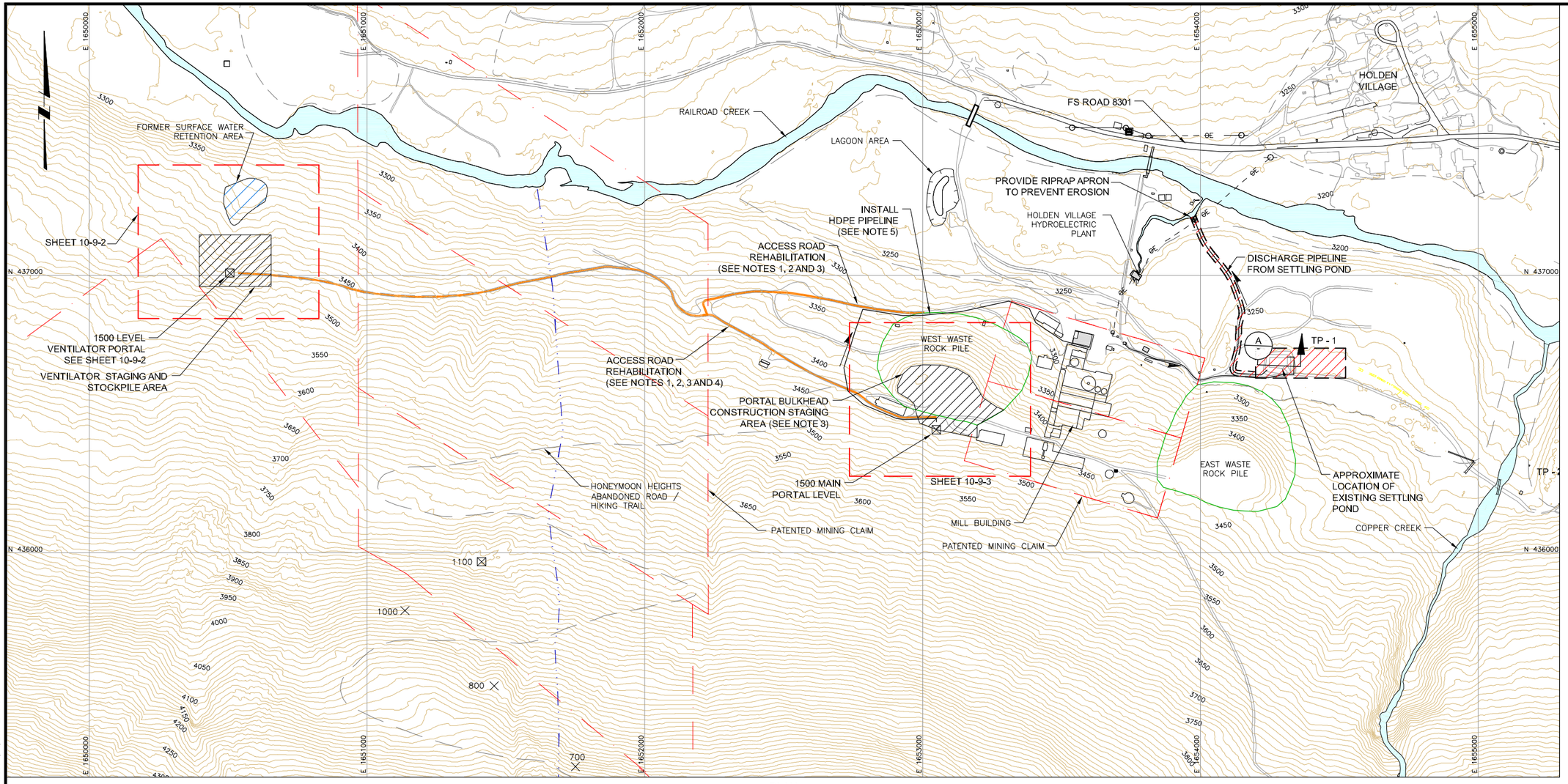
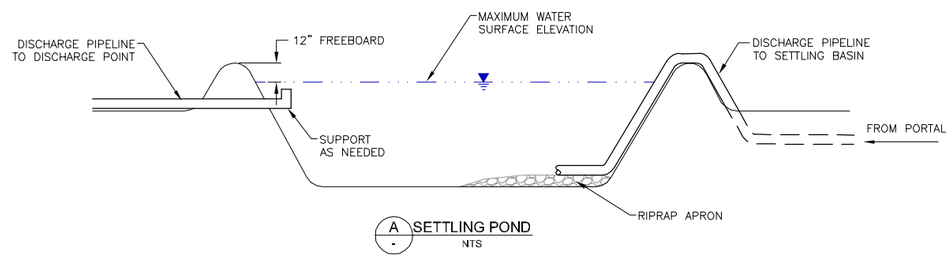


PLAN

SCALE
200 0 200 400 FEET
CONTOUR INTERVAL = 10 FEET



A - SETTLING POND
NTS

NOTES:

1. ACCESS ROAD REHABILITATION SHALL CONSIST OF CLEARING AND GRUBBING A CORRIDOR WIDE ENOUGH TO ACCOMMODATE A 12 FOOT WIDE TRAFFIC LANE PLUS ANY CUT/FILL AREAS REQUIRED, STRIPPING OF TOPSOIL AND PLACEMENT OF FILL AND ROAD BASE AS NEEDED.
2. INSTALL CULVERTS AS NEEDED TO PROVIDE DRAINAGE. DRAINAGE PATHS SHALL BE DETERMINED IN THE FIELD.
3. PROVIDE EROSION CONTROL MEASURES AS NEEDED.
4. CLEAN EXISTING DITCHES AND CULVERTS AS NEEDED.
5. EXACT ALIGNMENT OF HDPE PIPELINE SHALL BE DETERMINED IN THE FIELD PRIOR TO INSTALLATION. BURY PIPE WHERE NECESSARY SO AS NOT TO IMPEDE TRAFFIC AND TO ALLOW FOR GRAVITY DRAINAGE.
6. SOIL AND TAILINGS EXCAVATED FOR PIPING PLACEMENT SHALL BE PLACED BACK IN THE EXCAVATION AND COMPACTED. ANY EXCESS MATERIAL SHALL BE STOCKPILED ON TAILINGS PILE 1 IMMEDIATELY ADJACENT TO THE SEDIMENTATION BASIN.
7. SUPPORT THE BASIN OUTLET PIPE AS NECESSARY. RECOMPACT THE SOIL BERM AROUND THE OUTLET PIPE TO PREVENT SEEPAGE. ALSO, IN CASE THE SOIL BERM SEEPS, IT MAY BE NECESSARY TO ELIMINATE THE ELBOW AND RISER SHOWN ON THE OUTLET PIPE. USE SLIP FITTINGS TO ALLOW EASY REMOVAL.
8. PLACE RIPRAP IN THE BASIN BELOW THE INLET PIPE TO PREVENT EROSION OF THE BASIN BOTTOM.

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	02/28/11
DRAWN BY	F. ANDRADE	02/28/11
CHECKED BY	D. RODRIGUEZ	02/28/11
APPROVED BY	P. CROUSE	02/28/11
PROJECT MANAGER	R. SCHLICHER	02/28/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BULKHEAD CONSTRUCTION SUPPORT WORK ELEMENTS

MWH

SHEET: 10-9-1
REVISION: B
FILE NAME: 1008679D384

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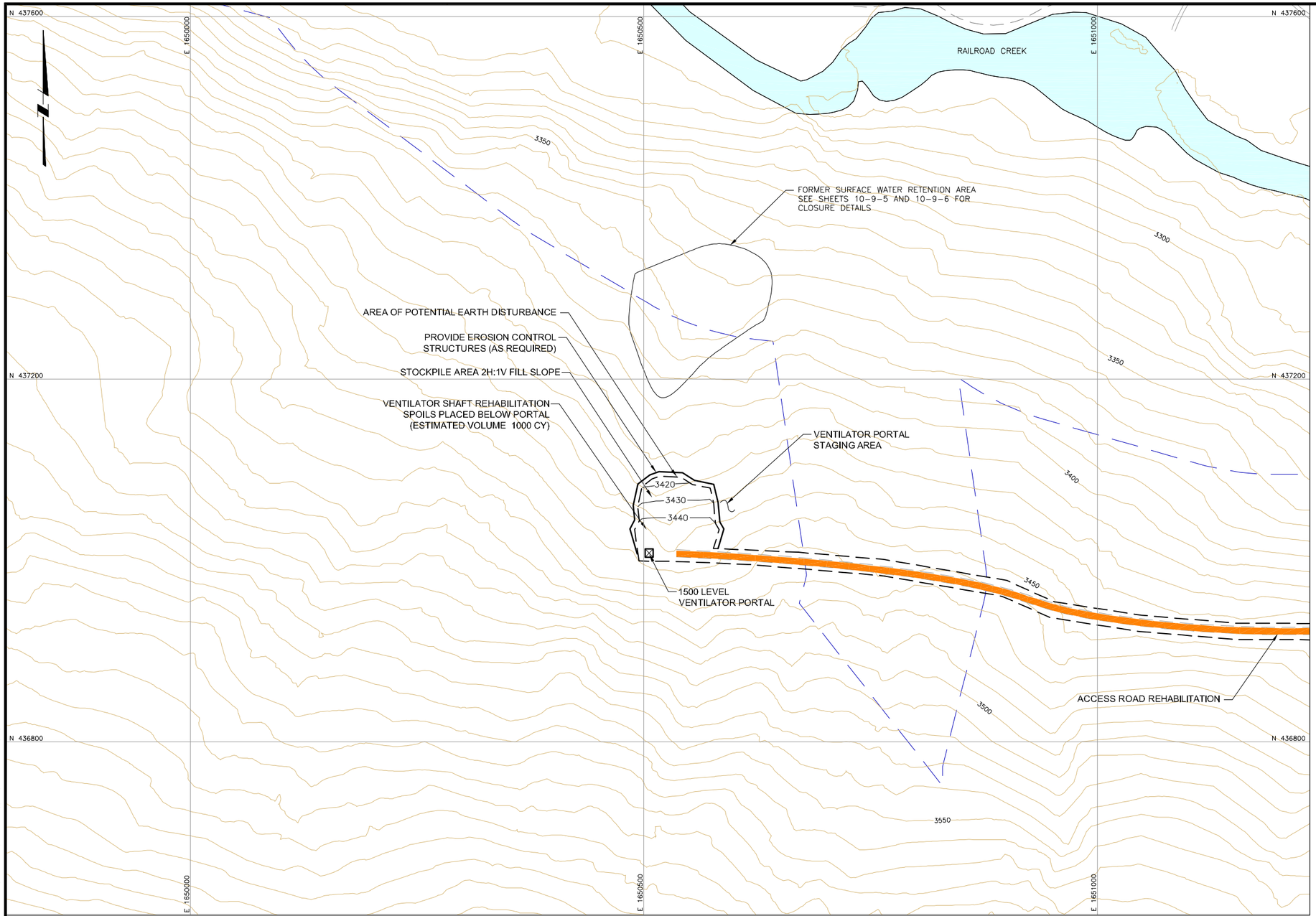

PLAN

SCALE

60 0 60 120 FEET

CONTOUR INTERVAL = 10 FEET

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ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON

PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE

TITLE: BULKHEAD CONSTRUCTION SUPPORT WORK ELEMENTS DETAIL

MWH

SHEET: 10-9-2

REVISION: B

FILE NAME: 1008679D385

PLAN

SCALE
60 0 60 120 FEET
CONTOUR INTERVAL = 10 FEET

NOTE:

1. AVOID STOCKPILED TRASH AREAS OR COORDINATE WITH HOLDEN FOR RELOCATION.

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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CLIENT APPROVAL		
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Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BULKHEAD CONSTRUCTION SUPPORT WORK ELEMENTS DETAIL

MWH

SHEET: 10-9-3
REVISION: B
FILE NAME: 1008679D386

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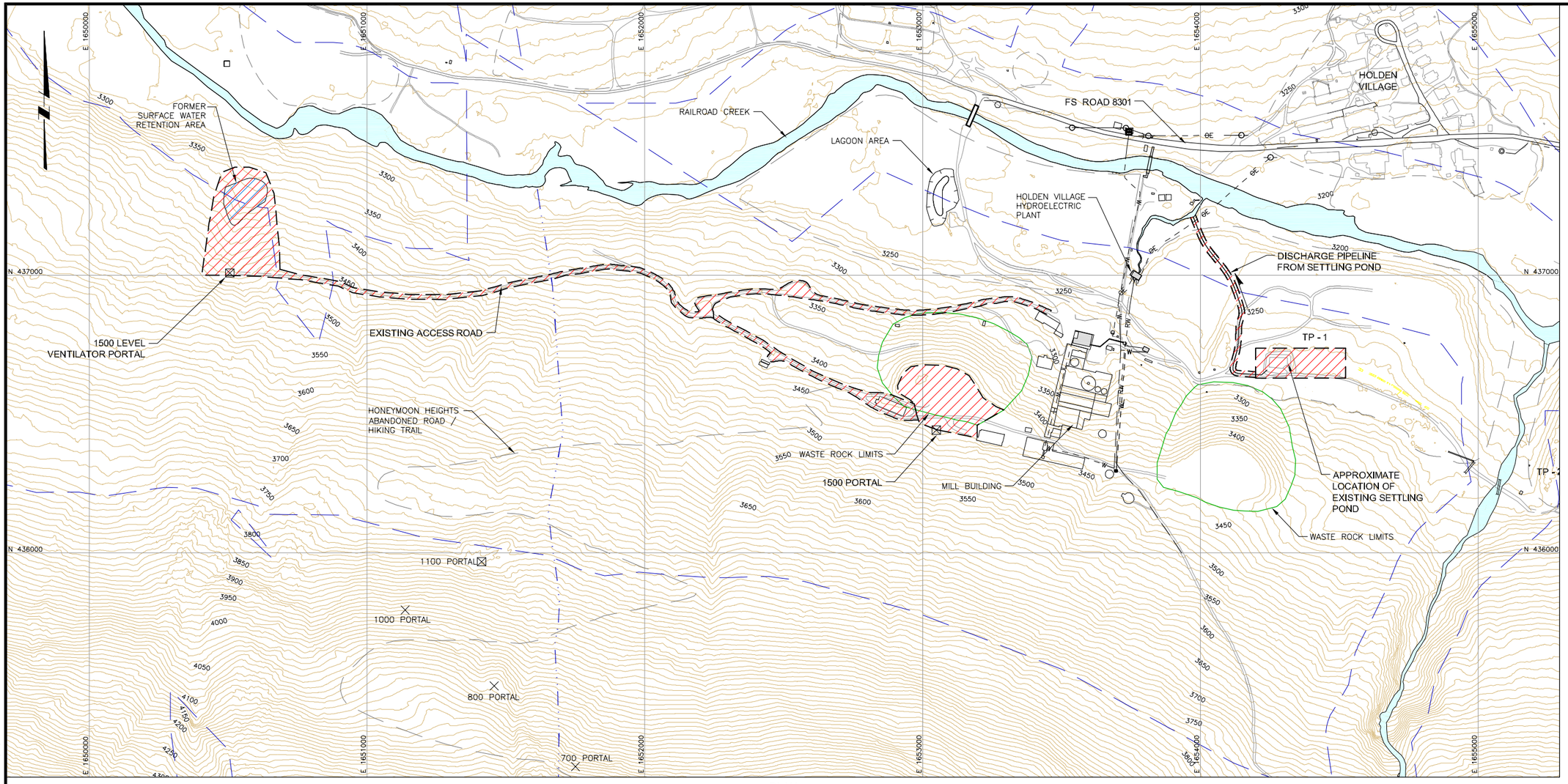

PLAN

SCALE
200 0 200 400 FEET
CONTOUR INTERVAL = 10 FEET

LEGEND:

AREAS OF POTENTIAL EARTH DISTURBANCE

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
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Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BULKHEAD CONSTRUCTION SUPPORT AREAS OF DISTURBANCE

MWH

SHEET: 10-9-4
REVISION: B
FILE NAME: 1008679D387

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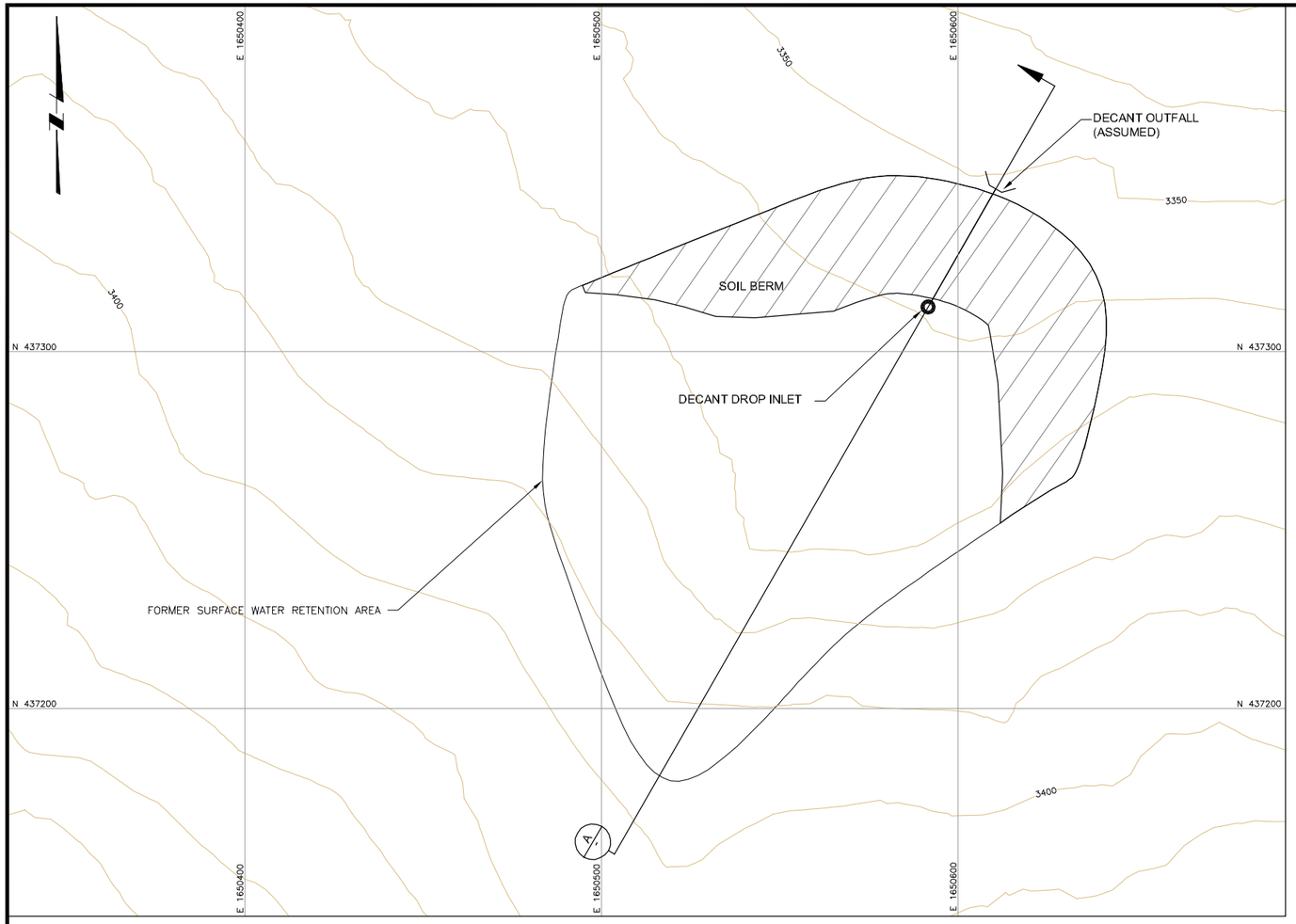

PLAN

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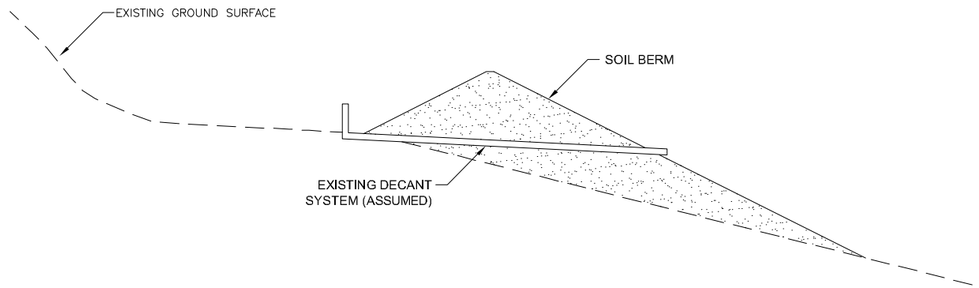
CONTOUR INTERVAL = 10 FEET



A - DECANT SYSTEM
N.T.S.

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW	FA	PC	04/15/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

DISCLAIMER:
THIS DRAWING WAS DEVELOPED THROUGH THE APPLICATION OF PROFESSIONAL ENGINEERING SKILL AND PROPRIETARY METHODOLOGIES, PROCESSES AND KNOW HOW OF MWH AS AUTHOR ALL PURSUANT TO THE TERMS OF A CONTRACTUAL SCOPE OF WORK GOVERNING ITS PREPARATION. THIS DRAWING MAY NOT BE USED OR MODIFIED OTHER THAN IN STRICT ACCORDANCE WITH THE TERMS OF THE GOVERNING CONTRACT AND SCOPE OF WORK OR OTHERWISE ABSENT THE INVOLVEMENT AND CONSENT OF THE AUTHOR. ANY ALTERATION OR ADAPTATION OF THIS DRAWING SHALL BE CONSISTENT WITH THE AUTHOR'S CONTRACTUAL AND PROPRIETARY RIGHTS AND BE AT USER'S SOLE RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY OF MWH.

DRAWING REFERENCE(S):
- COORDINATE SYSTEM: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, US FEET.
- TOPOGRAPHIC CONTOURS AND AERIAL IMAGERY DERIVED FROM LIDAR SURVEY PERFORMED BY TERRA REMOTE SENSING, INC., DATED: 2003.
- AERIAL IMAGERY AND TOPOGRAPHY SHOWN TO THE EAST END OF THIS DRAWING FROM USDA–FSA–APFO, PUBLICATION DATE: 2009.
- INVENTORIED ROADLESS AREA FROM CHELAN RANGER DISTRICT (APPENDIX C OF THE FOREST PLAN), OKANOGAN AND WENATCHEE NATIONAL FORESTS.

DESIGNED BY	P. PELLICER	03/31/11
DRAWN BY	F. ANDRADE	03/31/11
CHECKED BY	D. RODRIGUEZ	03/31/11
APPROVED BY	P. CROUSE	03/31/11
PROJECT MANAGER	R. SCHLICHER	03/31/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

Intalco

PROJECT LOCATION: HOLDEN VILLAGE, WASHINGTON
PROJECT: REMEDIAL DESIGN FOR HOLDEN MINE INFRASTRUCTURE
TITLE: BULKHEAD CONSTRUCTION SUPPORT SURFACE WATER RETENTION AREA

MWH

SHEET: 10-9-5
REVISION: B
FILE NAME: 1008679D389

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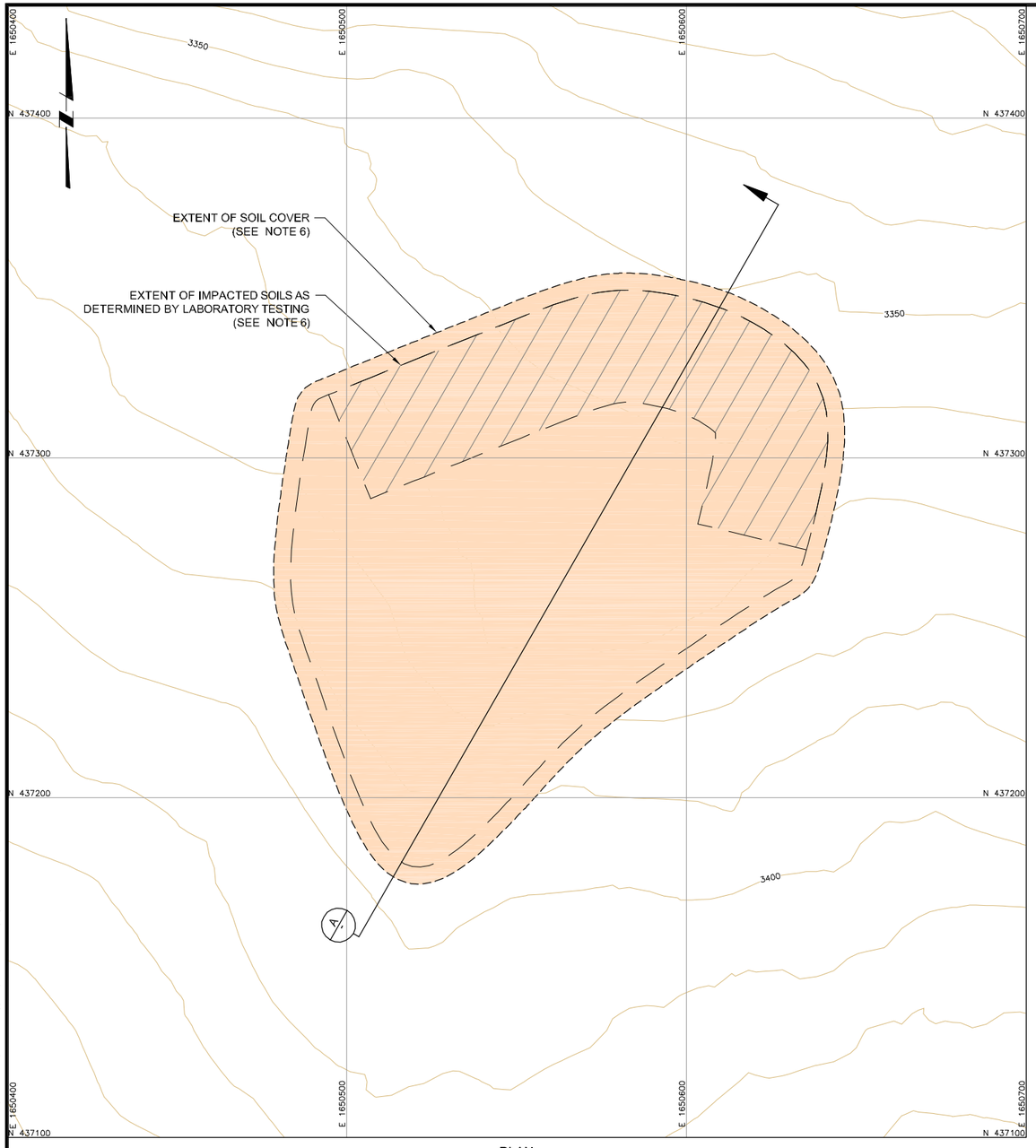

PLAN

SCALE
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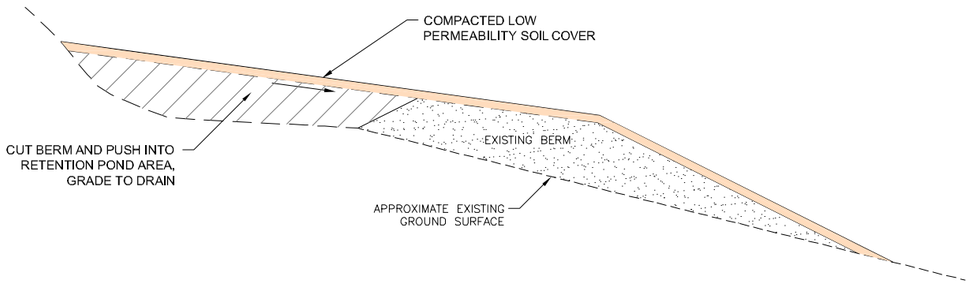
CONTOUR INTERVAL = 10 FEET



A / - COMPACTED LOW PERMEABILITY SOIL COVER
N.T.S.

NOTES:

1. PERFORM CLEARING AND GRUBBING TO THE EXTENT OF SOIL COVER.
2. EXCAVATE DECANT STRUCTURE AND PIPING. PIPING TO BE REMOVED TO THE EXTENT PRACTICAL. IF PIPING LEFT IN PLACE, THE REMAINING PIPE SHALL BE PLUGGED TO PREVENT WATER FROM ENTERING PIPE. BACKFILL WITH BERM CUT MATERIAL AND/OR SPOILS FROM VENTILATOR PORTAL.
3. SOIL COVER THICKNESS AND GEOTECHNICAL PROPERTIES TO BE DETERMINED.
4. IMPACTED TOPSOIL CAN BE LEFT IN PLACE IN AREA TO BE COVERED.
5. CLEAN TOPSOIL SHALL BE STOCKPILED ADJACENT TO WORK AREA AND WILL BE UTILIZED AS PART OF THE COVER SYSTEM.
6. EXTENT OF IMPACTED SOILS AND SOIL COVER ARE FOR ILLUSTRATIVE PURPOSES ONLY. THEY DO NOT REPRESENT ACTUAL LIMITS FOR CONSTRUCTION.
7. FINAL REMEDY SHALL BE REVIEWED AND APPROVED BY THE AGENCIES.

ISSUE / REV	DESCRIPTION	TECH	ENG	DATE
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A	ISSUED FOR CLIENT REVIEW AND COMMENT	FA	PC	04/08/11

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TITLE: BULKHEAD CONSTRUCTION SUPPORT SURFACE WATER RETENTION AREA

MWH

SHEET: 10-9-6
REVISION: B
FILE NAME: 1008679D390

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