Climax Molybdenum
A Freeport-McMoRan Company

Climax Mine
Highway 91 - Fremont Pass
Climax, CO 80429
Phone (719) 486-7718
Fax (719) 486-2251

April 25, 2012

Mr. Eric Scott
Environmental Protection Specialist
Division of Reclamation, Mining and Safety
Department of Natural Resources
1313 Sherman St. Room 215
Denver, Colorado 80203

RE: Climax Mine, Permit No. M-1977-493, Technical Revision 21 – Mayflower Flood Bypass Tunnel and Mayflower TSF Reclaim Water System Modification

Dear Mr. Scott,

The Climax Molybdenum Company - Climax Mine is planning to construct a flood bypass tunnel system that will allow water from a major flood event to pass around the Mayflower Tailing Storage Facility (TSF). The Mayflower Flood Bypass Tunnel will replace the spillway component of the existing decant/flood bypass pipeline system. Climax also is planning a modification to the Mayflower TSF reclaim water system from that shown in the Climax AM-06 application. The modified Mayflower TSF reclaim system includes a new pump barge location and new reclaim pipeline that will utilize portions of Supply Canal No. 2.

Both Mayflower tunnel and Mayflower reclaim system are considered components of Climax Environmental Protection Facilities, and will be included as such in the Climax Environmental Protection Plan. This Technical Revision (TR-21) submittal is intended to provide information regarding the designs of these facilities to satisfy the requirements of Rule 7.3 and to obtain Division approval to initiate construction of the facilities, scheduled to begin in the second quarter of 2012.

Two copies of the TR materials and the $1,060.00 fee applicable to a 112d operation are attached to this letter. We appreciate your review of the TR and look forward to your approval. Please contact me at 719-486-7584 if you need additional information.

Sincerely,

Raymond Lazuk
Environmental Manager

attachments

CLIMAX MINE
RECLAMATION PERMIT NUMBER 1977-493
TECHNICAL REVISION TR-21

MAYFLOWER TUNNEL and RECLAIM WATER SYSTEM

CLIMAX MOLYBDENUM COMPANY

Climax Mine
Highway 91 – Freemont Pass
Climax, CO 80429
(719) 486-7584

Submitted to:

COLORADO DIVISION OF RECLAMATION, MINING & SAFETY

1313 Sherman Street, Room 215
Denver, CO 80203

April 25, 2012

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1.0 INTRODUCTION

The Climax Mine, located on the Continental Divide 12 miles northeast of Leadville Colorado, is a molybdenum mine owned and operated by the Climax Molybdenum Company (Climax). Climax is a wholly-owned subsidiary of Freeport-McMoRan Copper & Gold Inc. (Freeport-McMoRan), a leading international mining company with headquarters in Phoenix, Arizona, the world's largest publicly traded copper company, and one of the principal North American-based mining companies, with long-lived, geographically diverse assets and significant reserves of copper, gold, and molybdenum. The Climax Mine land holdings consist of 14,300 contiguous acres of owned patented mining claims, fee-simple land, and land acquired through exchanges with the United States Forest Service (USFS). The Climax Mine property extends into Eagle, Lake, Park and Summit Counties. Climax is one of the world's largest primary producers of molybdenum.

Operations at the Climax Mine began in 1917 and the existing permit, Mining and Reclamation Permit M-1977-493 as amended, was initially approved by the Colorado Mined Land Reclamation Board (Board) in 1977 after passage of the Colorado Mined Land Reclamation Act (CMLRA). The existing permit remains in effect for the life of the mine as set forth in CMLRA §§34-32-103(6), 34-32-109 and 34-32-116(7)(q). The permit was amended in 1980 (AM-01), 1989 (AM-02), 1997 (AM-03), 2001 (AM-04), 2006 (AM-05), and 2011 (AM-06). In addition, twenty previous Technical Revisions (TR) to the Permit have been approved by the Colorado Division of Reclamation, Mining, and Safety (DRMS).

Climax is planning to construct a flood bypass tunnel system that will allow water from a major flood event to pass around the Mayflower Pond tailings impoundment. The Mayflower Flood Bypass Tunnel (Mayflower Tunnel) will replace the spillway component of the existing decant/flood bypass pipeline system. This TR submittal is intended to provide information regarding the design of the tunnel to satisfy the requirements of Rule 7.3 and to obtain Division approval to initiate construction of the facility.

Also included in this TR is the installation of a new barge pump system (Reclaim Barge) to replace the decant component of the existing decant/flood bypass system and a planned upgrade to Supply Canal No. 2. Supply Canal No. 2, located on the hillside just south and west of the Mayflower TSF, is a makeup water system that allows fresh water to be diverted from Searle Creek into the North Portal of the Tenmile Tunnel. This system is utilized if necessary during drought conditions to provide additional makeup water to Robinson Lake, via the Tenmile Tunnel. In conjunction with the Mill water reclaim system, a pipeline will be buried within a portion of Supply Canal No. 2 to convey process water from the Mayflower Pond to the Tenmile Tunnel for delivery to Robinson Lake. In conjunction with this work, upgrades will also be made to the existing diversion structures on Searle Creek at the West Interceptor and at the head of Supply Canal No. 2.

2.0 MAYFLOWER TUNNEL

2.1 Project Description

The planned Mayflower Tunnel project will consist of a main tunnel which starts below the toe of 5 Dam, near the 5 Dam Seepwater Pump Station at elevation 10,400 feet. The tunnel will be driven through bedrock, around the west abutment of 5 Dam, a distance of approximately 7,750 feet upstream where it will daylight at an elevation of approximately 10,820 feet. Three inlet tunnels will connect to the main tunnel, each averaging approximately 500 feet in length and spaced 70 feet apart vertically to provide for 210 feet of vertical tailing rise. Each inlet tunnel includes a concrete side-hill riser that will serve to regulate the elevation of the flood discharge point as the tailings rise. Initially, during a flood event, water will be decanted from the pond surface into the lowest inlet tunnel's side-hill riser. After 70 feet of tailings rise, the first inlet tunnel will be closed and the second inlet tunnel will become the primary flood decant. This sequence will repeat until the tailing has risen 210 feet and the daylighted tunnel becomes the final flood bypass inlet. A set of preliminary drawings for the project are provided as Appendix A to this TR. A Site Plan drawing is provided as Sheet C-01 and illustrates the primary features of the tunnel project.

The existing Mayflower decant/flood bypass pipeline system consists of twin 42 inch diameter steel pipes encased in reinforced concrete and buried in the left abutment of the Mayflower TSF. The system was designed and installed in the late 1970's. As part of the Climax restart project, it is anticipated that tailing deposition on the Mayflower Tailing Storage Facility (TSF) will begin in 2014. During deposition, the current pipeline system would have marginal capacity to handle the flow of flood waters from Mayflower Pond. Presently, with no active tailing deposition on Mayflower TSF, sufficient surge capacity and hydraulic head are available to adequately pass a Probable Maximum Precipitation (PMP) event. During tailing deposition the operational water pool must be managed to provide reclaim water to the Mill and handle the seasonal influx of snowmelt water while limiting the pond outflow to the capacity of the Property Discharge Water Treatment Plan (PDWTP). With the current decant system, this would result in limited flood routing capacity and the required hydraulic head would no longer be available to drive the flood waters through the existing pipeline. Therefore, a new flood bypass system is required, to operate Mayflower Pond for tailings deposition, provide operational storage, and further protect the dam from potential failure.

The Mayflower Tunnel, as planned, will provide a safe system to pass flood waters in the event of a major PMP event. The tunnel system avoids placing pipelines in or near the structural shell of the tailings dam and will serve the operational needs of Climax.

2.2 Tunnel Capacity and Design Criteria

As described in Exhibit G to Permit Amendment AM-06, a site-wide hydrological assessment of the Climax Mine was completed to evaluate the ability to safely handle the flood generated by the PMP event (Wheeler, 2005).

During mining, the storage capacities of the TSF water pools will be continuously changing as additional tailing is deposited in the facilities. Rather than attempt to model each expected change, a generalized model was established to determine the volume of flood storage that will need to be maintained on the TSFs to accommodate the PMP event with an additional one foot of residual freeboard. The peak flow capacities needed for the decant and spillway structures on each water facility were also determined.

The peak flow rates from the individual subbasins at Climax are relatively high, due primarily to the steep slopes and high-intensity rainfall associated with the PMP event. Runoff from these basins discharges into the water pools on the three TSFs where the peak flows are attenuated to more manageable levels. The flood storage capacity of the TSF water pools is a primary component of the flood routing system at Climax. Several combinations of available flood storage capacity and available hydraulic head could be used to route the PMP event flows through Mayflower TSF. When Climax is depositing tailing into the Mayflower TSF, the new PDWTP will limit the allowable outflow of water from the decant pond. Therefore, it is desirable to dedicate a large volume of the decant pond to operational water storage thereby reducing the volume and available hydraulic head of the portion dedicated to flood routing. Climax has determined that a spillway capacity of about 500 cubic feet per second (cfs) with five feet of hydraulic head would provide an adequate spillway to pass the PMP event while maintaining adequate operational storage capacity.

2.3 Tunnel Design and Construction

The Mayflower Tunnel will have a typical section of approximately 10 feet x 10 feet and will be advanced using drill and blast techniques. It is possible that the cross-sectional dimensions of the tunnel may increase based on ongoing discussions with the tunneling contractor regarding the optimum size based on constructability issues, however, if a larger diameter tunnel is constructed the hydraulic performance of the tunnel will be improved. An initial geotechnical investigation consisting of borings and test pits was completed for Stage 1 of the Main Tunnel alignment and Inlet Tunnel 1. The location of exploratory borings and test pits are indicated on Drawing C-01 and a geologic map with the tunnel profile through inlet portal No. 1 is provided as Drawing C-03. Additional geotechnical investigations are scheduled to be conducted in 2012 for final alignment of Inlets 2 and 3.

The tunnel system will consist of the Main Tunnel Stage 1 (4,950 feet), Inlet Stage 2 (1,000 feet), Inlet Stage 3 (1,000 feet), and Inlet Stage 4 (850 feet) to daylight the tunnel. The purpose for Stage 4 is to maintain two ingress/egress points through the life of the flood bypass system for safety. The tunnel advance rate using drill and blast methods is anticipated to range from 6 to 12-feet per day per shift depending on the rock encountered and stabilization methods. Pre-excavation grouting will be performed through fault zones, or other areas where water inflow is anticipated. To accurately identify areas requiring grouting, probe holes will be drilled in advance of tunnel excavation to lengths of at least 50 feet, with 10 feet of overlap between subsequent probe holes. Where grouting is required, 50 foot long grout holes will be drilled in a full radial pattern, inclined five degrees outward from the tunnel centerline, with 15 foot overlap between successive rows of grout holes along the tunnel alignment.

Depending on rock conditions encountered, the tunnel will require varying degrees of support. Multiple classifications of stabilization have been designed consisting of rock bolt support with wire mesh, rock bolt support with wire mesh and shotcrete, or structural steel rib sets. It is estimated that the majority of the tunnel will require stabilization measures.

Portal stabilization will be required at the inlets to Inlet Stages 1, 2, 3 and 4 as well as at the Main Tunnel's outlet. Portal stabilization has been designed to include a reinforced concrete liner extending 25 feet from the limits of portal excavation. In addition, as indicated on Drawings C-05 and C-06, soil nail retaining walls will be constructed at each portal.

As tailing is deposited in the Mayflower TSF, the flood spillway must rise with the dam elevation. This requires the use of risers which connect to the spillway. At Climax, risers that run up the side of the hill, or "side-hill" risers have been employed successfully. Side-hill risers will be constructed at the inlets to Inlet Stages 1, 2, and 3. Each of the side-hill risers will be connected to the main tunnel via an adit. The configuration of three inlets, and side–hill risers, at 70 foot intervals allows for closure of the lower adits and risers as the tailing surfaces rises. As the tailing surface rises, plates are installed in the openings of the side-hill risers to effectively raise the decant pond elevation. Once a certain number of plates have been placed in the riser, they will be sealed from the inside with structural concrete to minimize seepage.

Identifying historic mine workings is important for the reduction of risk to the Mayflower Tailings Impoundment. Identifying and closing these historic mine working where they intersect the tunnel reduces the potential for seepage of water and tailing through the abutments and around the Mayflower Dam. There is on-going mine claim research and field investigations into the location of the historic mine workings to identify any mine workings prior to construction.

2.4 Seepage Collection and Containment

Based on the initial geotechnical investigation, it is estimated that groundwater inflow into the tunnel may reach approximately 2 cfs (900 gpm). Grouting, as described in the previous section is expected to reduce the amount of seepage into the tunnel to the extent practicable. A seepage collection system will be constructed to contain tunnel seepage and direct it to the existing 5 Dam seepage containment system

(Drawings C-06 and C-07). At the tunnel outlet portal, water will be directed to an enclosed system, consisting of cast-in-place concrete inlet vault, a stormwater vault to trap sediment, and an 18-inch seepage collection pipeline. This pipeline will convey water to the existing concrete lined clear pond associated with the 5 Dam Seepwater Collection and Return system (5 Dam Pump System). As indicated on Drawing C-06, run-on control ditches will prevent unimpacted water from entering the system, and provisions in the piping system have been made to allow the temporary storage of seepage in a lined sediment pond prior to release to the clear pond (Drawing C-07). This sediment pond may be constructed during construction, if necessary, but will be removed following the completion of tunnel construction. Seepage directed to the clear pond will then be pumped back to the Mill process water system using the existing 5 Dam Pump System. The tunnel seepage water will be used for process water or will be treated prior to discharge to the environment. No water would be directly discharged to Tenmile Creek from the Mayflower Tunnel.

The 5 Dam Pump System is classified as an EPF in AM-06 and the Climax Mine Environmental Protection Plan. The function of the existing system is to collect impacted seepage from the toe of 5 Dam and convey this water back into the water treatment system through a 24-inch-diameter HDPE pipeline. The pump system consists of two 150-horspower vertical turbine pumps with a pumping capacity of approximately 2,000 gpm.

As a result of additional water flows into this system from tunnel seepage, modifications to the 5 Dam Pump System will be required. The proposed modifications will involve adding up to two new pumps. The new pumps will either be similar to the existing pumps or have a slightly higher pumping capacity. No changes to the existing discharge pipeline will be necessary, nor will changes be made to the existing seepage collection system. The existing pump station has the space to accommodate the installation of additional pumps. A General Arrangement Drawing (Drawing MPS-G-01) of the 5 Dam pump station, illustrating the location of the new pumps is included in Appendix A.

2.5 Effects of Stability on Blasting

In accordance with DRMS Rule 6.5, Geotechnical Stability, the effects of blasting associated with tunnel construction have been evaluated. Appendix B to this TR includes the results of a blast vibration assessment prepared by URS Corporation and Rock Solid Solutions, and an evaluation of this assessment as it pertains directly to the stability of 5 Dam. In summary, the vibrations from blasting activities within the tunnel will not create the type of ground acceleration that will affect the stability of the tailing dam.

2.6 Roads and Access

The outlet portal of the Mayflower Tunnel will be located below the left (west) abutment of 5 Dam near the 5 Dam pumphouse. The main access to the outlet portal will be provided from the existing site entrance off SH 91 (at its intersection with the old alignment). Access to the inlet portal locations will be provided by new access roads from the West Interceptor road and from the lower perimeter road around the west side of the Mayflower TSF. All work will be within the current Affected Land Boundary, as shown on Drawing C-01.

2.7 Project Schedule

Portal and outlet seepage collection system construction is tentatively scheduled to begin in late May 2012, with initial activities focused on the main tunnel outlet and Inlet 1 construction. Tunnel construction is expected to begin in August 2012. Additional geotechnical investigations will be conducted in 2012 for final alignment of Inlets 2 and 3. Based on the current construction schedule Stage 1 of the tunnel, from the outlet to the connection with Inlet 1, is expected to be completed during the spring of 2013. By the end of 2013 Climax anticipates completing the Stage 1 side-hill riser.

2.8 Construction Quality Control/Quality Assurance

URS is the design engineer for the project. The technical specifications will contain equipment and material specifications, project execution requirements, and quality control requirements, which will be the responsibility of Climax. Third party contractors may be employed to provide specific material testing and inspection services to demonstrate compliance with the project specifications. Quality assurance, consisting of ensuring the completion of all quality control activities, review and approval of quality control results, and independent inspections and testing, will fall under the responsibilities of Climax, who will have overall responsibility for ensuring the facilities are constructed in accordance with the plans and specifications.

2.9 Tunnel System Closure

Closure of the Mayflower Tunnel System will consist of two components; closure of the side-hill risers and adits during operations, and closure of the tunnel itself when it is no longer needed following end of mining and milling operations. As previously described, during operations, as the tailing and pond level rises, steel plates will be installed in the side-hill risers to raise the operating pool. The side-hill risers will be closed by placing structural concrete behind all steel plates to minimize seepage from the tailing pond into the tunnel system. Once the tailing level reaches the maximum elevation for a riser inlet, the riser will be completely grouted and abandoned and a mass concrete plug (MCP) will be constructed within the adit. It is anticipated that each adit MCPs will be approximately 35 feet long, located in the section of each adit with the most competent rock (least amount of fractures).

Final designs have not been developed for final closure, however the current preliminary design details are provided below. Construction of each adit MCP will involve installing temporary watertight bulkheads to contain backfill concrete and backfill grout. Concrete will be inserted from the up-station bulkhead through concrete delivery lines. The delivery lines will be inserted through primary and secondary concrete ports and will be retracted as the concrete pour progresses. Once the mass concrete plug is poured and cured, contact grouting will commence along the crown of the tunnel plug to fill any voids created from incomplete filling, shrinkage or consolidation. Contact grouting will be performed through sacrificial grout supply and ventilation/return lines installed along the crown of the tunnel. Grout supply and return lines will be placed into the roof of the tunnel to ensure the entire MCP interval is filled with concrete or grout.

Depending on the geology (orientation, persistence and spacing of discontinuities) at each adit MCP location, a grout curtain may be required at the upstream end of the concrete plug. If required, the curtain would likely consist of drilled grout holes, approximately 30 feet long, equally spaced around the tunnel perimeter, but this design is subject to change based on the conditions at each location. The grout curtain would be constructed within 5 feet of the up-station bulkhead.

After mineral extraction and production at the site have been permanently terminated by Climax the Mayflower Tunnel will be closed as part of the final site reclamation. The timing of the tunnel closure is somewhat uncertain in that it will be linked to other site reclamation elements including the reclamation of the Mayflower TSF and the construction of an alternate surface spillway to manage flood waters, which may ultimately connect to the future extension of the East Side Channel,. As presented in AM-06, the intent of the East Side Channel system will be to eventually convey unimpacted runoff from the reclaimed areas below the fresh water interceptor system to Tenmile Creek. It is anticipated that a fixed crest overflow weir will be constructed at the inlet to the surface spillway from Mayflower Pond, to replace the Mayflower Tunnel to safely pass emergency flood flows.

Closure of the Mayflower Tunnel will be completed similar to the closure of the inlet adits, described above. A Mass Concrete Plug will be constructed, in competent rock, within the main tunnel at a location to be determined based on the geology observed during tunnel construction. MCP construction in the main tunnel will include the same elements as described above for the adit MCPs. Drawing C-8, included in Appendix A, provides preliminary construction details. The cost of tunnel closure is estimated to be approximately $530,000.

Under the current financial assurance required and held by the DRMS, Climax maintains a surety bond in the amount of $78,246,088 (Exhibit L of AM-06). Of this amount $11,967,396 is allocated for water management facilities, including the East Side Channel and East Side Pipeline. The East Side Pipeline, included in the Exhibit L reclamation estimate, accounts for over $7,000,000 of this cost item. This estimate includes costs for over 20,000 feet of new pipe (approximately half of the total pipeline length), identified as the Camp, Robinson, and Tenmile extensions. With the installation of the new HDPE tailing delivery line (TDL) line from the mill to the Tenmile TSF complete, Climax anticipates that all or a large portion of this line can be converted from tailing transport to the conveyance of impacted water and that the construction of a new pipeline in the Camp and Robinson areas would not be necessary. Therefore, the reclamation cost to construct the East Side Pipeline at closure is over-stated by as much as

$3,500,000. This means that there should be sufficient funding currently in the financial assurance for Climax reclamation for the costs of Mayflower Tunnel Closure.

3.0 RECLAIM WATER SYSTEM AND SUPPLY CANAL NO. 2

The current configuration of the reclaim water system, including the new pipeline to be constructed in Supply Canal No. 2 was not specifically identified in the AM-06 application. However, it was shown in the Overall Site Facilities Plan in Technical Revision (TR) 19 for the Property Discharge Water Treatment Plant. This configuration is also represented on a revised Water Management System Map (Figure AM-06-T-02), included with this submittal in the Figures section. As described in the Climax Environmental Protection Plan (EPP), facilities used to transfer process water are considered internal Environmental Protection Facilities (EPFs). As this system is completely within the limits of the Climax Water Management and Treatment System boundaries it is considered an internal control. Drawings referenced within this section are included in Appendix C.

3.1 Reclaim System

A new barge pump system will pump process water from the Mayflower TSF decant pond to Supply Canal No. 2 for delivery to the Tenmile Tunnel and Robinson Lake. The Reclaim Barge will convey approximately 10,000 gpm with two active-duty pumps. A third pump will be installed as a standby pump. This pump station will operate on a continuous basis during active tailing deposition onto the Mayflower TSF.

The final design for this pump system has not yet been finalized. However, the floating barge will be an enclosed structure, with metal siding over a steel structure with a peaked roof. The Reclaim Barge is anticipated to be on the order of 35 to 40-feet-wide by 60 to 80-feet-long.

A new 30-inch-diameter buried carbon steel pipeline will be constructed to convey process water that is pumped by the new Reclaim Barge to Supply Canal No. 2. The alignment for the new pipeline is shown on drawing 542-C-01, included in Appendix C. The pipeline extends from the Reclaim Barge up thru Searle Gulch to the Searle Gulch Valve Vault, and then up the south side of Searle Gulch to Supply Canal No. 2. The carbon steel pipe has a minimum wall thickness of 0.304 inches and design pressure rating of 175 psi. The entire length of this pipeline lies within Climax's process water system so that any failure or leak from the pipeline would be fully contained within the Mayflower TSF decant pond.

3.2 Supply Canal No. 2

Supply Canal No. 2 is located on the northwest side of the Climax property, just south and west of Mayflower TSF. The existing 8,100-foot-long open-channel canal, which is situated below and parallel to the West Interceptor, is used, when needed, to divert fresh water from Searle Gulch and Kokomo Creek and deliver it to the north portal of the Tenmile Tunnel, for make-up process water. The existing canal and diversion structures have not been used in over 20 years and now require rehabilitation prior to being placed back into operation. In addition, a new Mill Water Reclaim Barge will deliver water from the Mayflower TSF decant pond to a pipeline that will be buried in Supply Canal No. 2 as part of the Mill reclaim circuit to Tenmile Tunnel. The alignment of Supply Canal No. 2 and the new pipeline are shown on drawing 542-C-01, included in Appendix C.

The reclaim water flows from Mayflower TSF will occur on a nearly continuous basis throughout the year. With consistent winter-time use, Climax has decided to enclose that portion of the canal that will be used year-round to alleviate snow accumulation and icing concerns and to reduce the risk of winter-time shutdown. The intent of this project is to install approximately 5,800 feet of pipe in the former canal prism for year-round water conveyance and to rehabilitate approximately 2,300 feet of open-channel canal for occasional summer use for make up water from Searle Gulch and Kokomo Creek. A more detailed description of this work is provided below and construction drawings for the project are included in Appendix C.

3.2.1 Open Channel Rehabilitation

The work involved with rehabilitating approximately 2,300 feet of open-channel canal includes removing sediment from the canal prism, reshaping the canal prism, and reconstructing the adjacent access road. The canal is to be reconstructed to have a six-foot-wide bottom width, 2:1 side slopes, and a minimum channel depth of 3.5 feet.

The invert of the canal is to be reconstructed to a nominal slope of 0.40 percent with the goal of utilizing as much of the existing channel and access road as possible without extensive earthwork. Therefore, the channel invert slope can vary from 0.30 percent to 0.50 percent to reduce the overall quantity of excavation.

3.2.2 Pipeline Construction

From Station 0+00 to 58+00, the existing open-channel canal is to be replaced with a buried 60-inch-diameter, corrugated or steel-reinforced HDPE pipeline with bell and spigot joints, watertight per ASTM D3212. This pipeline is to be constructed in the existing channel alignment and buried by borrowing fill material from the immediate vicinity of the channel. It is anticipated that the pipe trench will typically be eight feet wide and about five feet deep. Granular pipe bedding is to be placed beneath the pipe and around the sides up to the springline. Excavated trench material is to be used to backfill over the pipe to a cover depth of two feet. Where sufficient backfill material is not available from the trench excavation, additional, clean material can be borrowed from a nearby source. Drawings 542-C-430 and 542-C-431 provide typical canal and pipeline sections and details.

A new access road is to be constructed adjacent to the pipeline wherever the existing bench width allows or over the pipe in narrower sections. A roadside ditch is to be constructed on the uphill side of the access road to collect and convey surface runoff. Approximately four to six, 18-inch-diameter, corrugated HDPE culverts are to be installed to divert water from the roadside ditch to the downhill side of the pipeline. Where Kokomo Creek crosses the pipeline corridor, two 24-inch corrugated HDPE culverts will be used to convey Kokomo Creek flows across the pipeline.

Perforated drain pipes are to be installed to release water from the pipe bedding to the downhill side of the canal approximately every 300 to 500 feet along the pipeline alignment. These drain pipes will be strategically located based on subsurface water conditions encountered during trench excavation. It is currently anticipated that approximately 15 drain pipes will be needed. These drain pipes are to be six-inch-diameter slotted PVC.

The pipeline alignment crosses an existing mine road at about Station 19+50. In order to protect the pipe from external loads, the pipeline from Station 18+50 to 20+50 is to be fully encased in lean concrete.

3.2.3 West Interceptor Bypass Structure Rehabilitation

Although not considered an EPF, the existing West Interceptor Bypass Structure at Searle Gulch consists of a concrete weir wall across the natural stream channel and a gated 48-inch-diameter corrugated metal pipe (CMP) to direct water into the West Interceptor. The weir wall across Searle Gulch contains a sharp-crested overflow weir plate with a 12-inch-diameter low-level steel outlet pipe, with a stop gate. The majority of the concrete for this structure is in a serviceable condition. Also, the slide gate, trashrack, and CMP appurtenant to the West Interceptor do not require rehabilitation and are currently used to direct water into the West Interceptor. The concrete weir wall across Searle Gulch, however, has deteriorated, the weir plate is rusted, the low-level outlet pipe and stop gate are rusted, and the low-level outlet pipe would not be accessible during high flows. The modifications to the West Interceptor Bypass Structure include adding stop logs in front of the West Interceptor slide gate to allow this gate to remain open when water is being released down Searle Gulch, replacing the concrete weir wall, adding a sharp-crested weir plate to the new weir wall, and replacing the low-level outlet pipe and stop gate with two new aluminum slide gates to facilitate operation and flow regulation.

3.2.4 Searle Gulch Diversion Structure

Also not considered an EPF, the existing diversion structure at Searle Gulch will be completely replaced. The design of the new Searle Gulch Diversion Structure consists of a concrete headwall across Searle Gulch to intercept water released from the West Interceptor Bypass Structure, two 24-inch-square aluminum slide gates to control flows into the Supply Canal, a weir wall to bypass flood flows down Searle Gulch, a low-level 24-inch-square aluminum slide gate on the weir wall to release water into Searle Gulch thru a 60-inch-diameter corrugated HDPE pipe, and a Parshall flume in the canal channel. Riprap with a non-woven geotextile underlay are to be placed as revetment to protect the flow paths around the structure from scour.

3.2.5 Reclaim Pipeline Inlet Structure

At Station 58+00, the open channel transitions into 60-inch-diameter HDPE pipe thru a standard reinforced concrete (RCP) flared end section. Then, at about Station 54+00, a new Pipeline Inlet Structure is required to combine the Supply Canal flows with the piped flows from the new Mill Water

Reclaim Barge. The design for this structure includes a rectangular structure with 60-inch-diameter pipe penetrations on each end and a side inlet to capture and dissipate the pumped barge flows.Riprap with a non-woven geotextile underlay are to be placed as revetment to protect the flow paths around the structure from scour. Drawing number 542-C-45- illustrate the details of this pipeline inlet structure.

3.2.6 Tenmile Tunnel Inlet

Supply Canal No. 2 terminates at the north portal of the Tenmile Tunnel. In order to facilitate equipment entrance into the tunnel for maintenance, the corrugated HDPE pipe will penetrate the right (west) tunnel wall just inside the tunnel entrance. A concrete encasement is to be constructed to support the pipe and seal the annulus between the new corrugated HDPE pipe and tunnel wall. Drawing number 542-C-440 illustrates the details of the Tenmile Tunnel Inlet Structure.

3.3 Leak Detection

The entire Mill reclaim water system is located entirely within the Mayflower TSF basin, below the interceptors. The pipelines are not designed to leak. If leakage were to occur it would be noticed by the daily pipeline inspections performed by Climax personnel during each shift. Any leaks that occur would report to the Mayflower TSF and therefore remain within the Mill reclaim water system. Along the 60-inch pipeline constructed within Supply Canal No. 2, additional leak detection is provided by the perforated drain pipes installed to release water from the pipe bedding to the downhill side of the canal approximately every 300 to 500 feet along the pipeline alignment. These drain pipes are to be six-inch-diameter slotted PVC and unusual flows noticed from the drain pipes may signify pipeline leakage.

4.0 OTHER AGENCY PERMITS AND AUTHORIZATIONS

The Mayflower Tunnel and Reclaim Water System are located within the “affected land” boundary as classified under Climax’s existing Mine Reclamation Permit (Permit # M-77-493), issued by the Colorado Division of Reclamation, Mining and Safety (DRMS). These new facilities also are EPFs to be included in the Climax EPP.

4.1 Required Permits

The federal, state, and local permits and approvals that will be required from agencies other than the DRMS for the Mayflower Tunnel and Reclaim Water System projects are described below.

Colorado Division of Water Resources (Office of the State Engineer) Well Permit

A Water Well permit will be obtained from the State Engineer (Colorado Division of Water Resources, Department of Natural Resources) prior to constructing the Mayflower Tunnel. In addition, Climax has filed a Water Court application for an augmentation plan to cover groundwater diversions associated with the tunnel. The Augmentation Plan and a recently submitted Substitute Water Supply Plan addresses the tunnel, the groundwater diversions associate with new wells associated with the PDWTP, and other minor consumptive uses at the PDWTP.

Summit County Grading and Excavation Permit

A Grading and Excavation permit from Summit County is required for any ground disturbing activities outside of the AM-06 permitted tailing footprint. The grading and excavation permit application will be submitted to Summit County prior to initiating access road construction, and tunnel and pipeline construction.

Summit County Temporary Use Permit

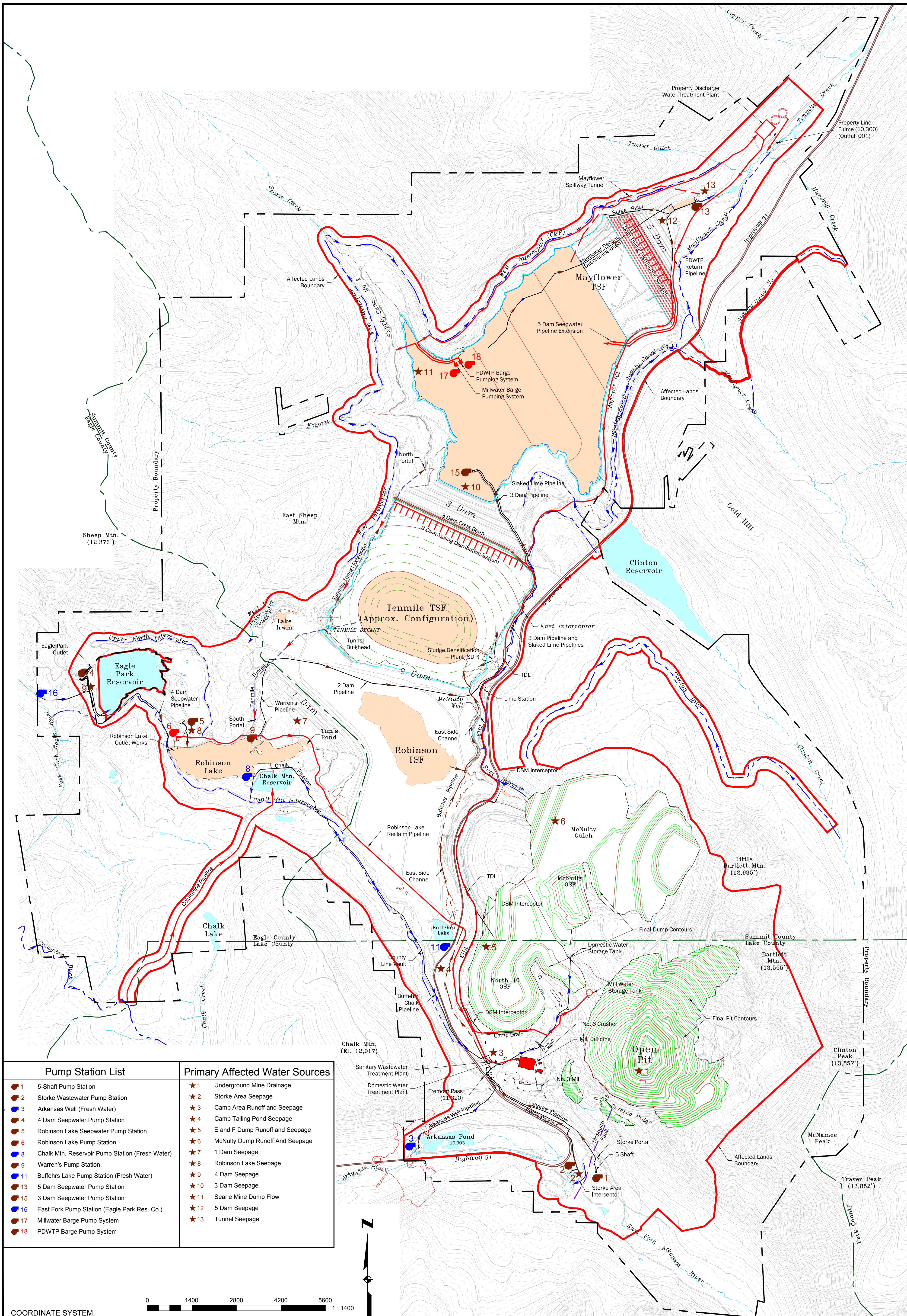
A Temporary Use Permit from Summit County may be required for the establishment of construction trailers in the staging area for Mayflower Tunnel construction.

Storm Water Permit

The EPA requires that storm water discharges be regulated under the National Pollutant Discharge Elimination System (NPDES) program. The Colorado program is referred to as the Colorado Discharge Permit System (CDPS), and is administered by the Water Quality Control Division (WQCD) of CDPHE.
Since all construction activities will be conducted within the boundaries of the Climax Water Management and Treatment System and covered by the existing CDPS Permit No. CO-0000248, a separate storm water permit is not needed. However, as a Climax best management practice, a supplement to the site-wide Storm Water Management Plan (SWMP) will be prepared prior to the start of construction and will include BMPs specific to the planned tunnel and pipeline construction activities.

FIGURES

R:\1000\1051\1051.27 DRMS\Permit Amendment AM-06\DRAWINGS\AM-06-T_Rev1.dwg 2/28/2012 5:48 PM



Pump Station List

No.	Pump Station
1	5-Shaft Pump Station
2	Storke Wastewater Pump Station
3	Arkansas Well (Fresh Water)
4	4 Dam Seepwater Pump Station
5	Robinson Lake Seepwater Pump Station
6	Robinson Lake Pump Station
7	Chalk Mtn. Reservoir Pump Station (Fresh Water)
9	Warren's Pump Station
11	Buffehrs Lake Pump Station (Fresh Water)
13	5 Dam Seepwater Pump Station
15	3 Dam Seepwater Pump Station
16	East Fork Pump Station (Eagle Park Res. Co.)
17	Millwater Barge Pump System
18	PDWTP Barge Pump System

Primary Affected Water Sources

No.	Source
1	Underground Mine Drainage
2	Storke Area Seepage
3	Camp Area Runoff and Seepage
4	Camp Tailing Pond Seepage
5	E and F Dump Runoff and Seepage
6	McNulty Dump Runoff And Seepage
7	1 Dam Seepage
8	Robinson Lake Seepage
9	4 Dam Seepage
10	3 Dam Seepage
11	Searle Mine Dump Flow
12	5 Dam Seepage
13	Tunnel Seepage

COORDINATE SYSTEM:
Climax Mine Coordinate System, Feet.

W. W. Wheeler and Associates, Inc.
Water Resources Engineers
3700 S. Inca Street, Englewood, CO 80110
Phone: 303-761-4130 Fax: 303-761-2802

FOR PERMITTING ONLY
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Drawing Scale:	As Noted
Drawn By:	SMM
Checked By:	MDS
Approved By:	BR
Date:	March 2010

Climax Molybdenum
A Freeport-McMoRan Company

REVISIONS

DATE	BY	DATE	BY
2-28-2012	SMM		

CLIMAX MINE

FIGURE AM-06-T-02
WATER MANAGEMENT SYSTEM MAP
SITEWIDE PHASE I AND II DEPOSITION
WATER SYSTEM

APPENDIX A

MAYFLOWER TUNNEL DRAWINGS

MAYFLOWER FLOOD BYPASS TUNNEL SYSTEM
DRMS PERMIT SET

CLIMAX, COLORADO

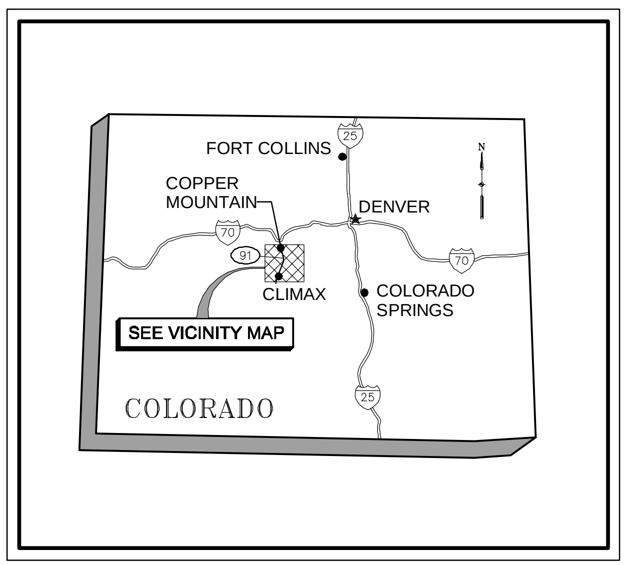
PREPARED FOR

CLIMAX MOLYBDENUM COMPANY

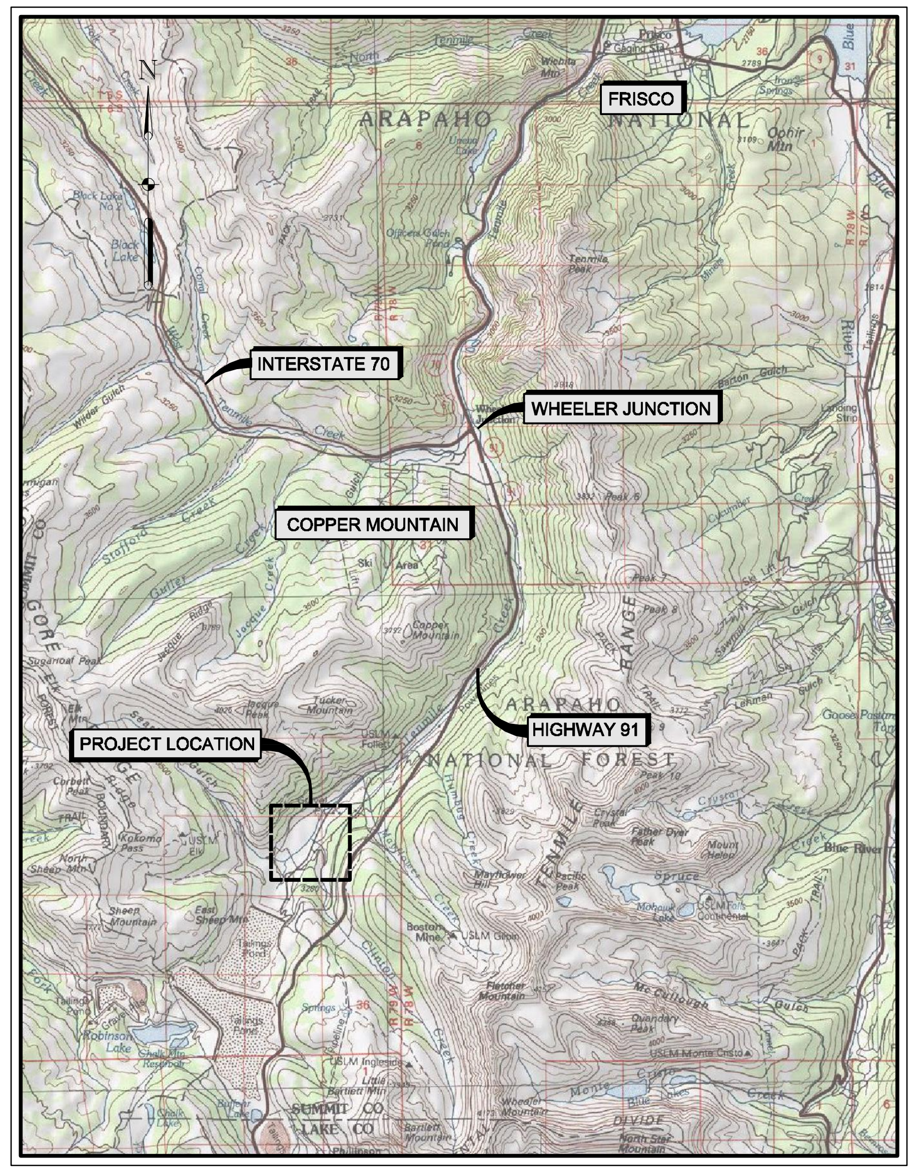
PREPARED BY

URS

APRIL 2012



STATE MAP
NOT TO SCALE



VICINITY MAP
NOT TO SCALE

SHEET INDEX

DRAWING NO.	DESCRIPTION
G-01	COVER SHEET WITH VICINITY MAP, PROJECT LOCATION AND DRAWING INDEX
G-02	GENERAL NOTES, LEGEND AND ABBREVIATIONS
C-01	SITE PLAN AND EXISTING IMPROVEMENTS
C-02	PROPOSED TUNNEL ALIGNMENTS AND STAGING AREAS
C-03	STAGE 1 PROFILE
C-04	CONCEPTUAL STAGES 2, 3, AND 4 PROFILE
C-05	INLET PORTAL NO. 1 PLAN
C-06	OUTLET PORTAL PLAN
C-07	SEEPAGE COLLECTION SYSTEM
C-08	CONCRETE PLUG CLOSUE DETAILS

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CLIMAX MOLYBDENUM COMPANY

MAYFLOWER FLOOD BYPASS TUNNEL SYSTEM DRMS PERMIT SET

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ISSUED FOR CONSTRUCTION ____ DATE BY

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NO.	DESCRIPTION	DATE
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URS PROJECT NO:	22242752.00100
DRAWN BY:	WDH
DESIGNED BY:	DL
CHECKED BY:	-
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PLOT DATE:	3/2012
SCALE:	AS SHOWN
ACAD VER:	2011

SHEET TITLE

COVER SHEET WITH VICINITY MAP, PROJECT LOCATION AND DRAWING INDEX

G-01

SHEET 1 OF 10

ABBREVIATIONS

APPROX.	APPROXIMATE	N	NORTHING
AC-FT	ACRE - FEET	NA	NOT APPLICABLE
CFS	CUBIC FEET PER SECOND	O.C.	ON CENTER
℄	CENTERLINE	O.W.	OUTLET WORKS
DIA.	DIAMETER	PC	POINT OF CURVATURE
D/S	DOWNSTREAM	Pm	MINTURN FORMATION
E	EASTING	PT	POINT OF TANGENCY
EA.	EACH	PVI	POINT OF VERTICAL INTERSECTION
ELEV, EL.	ELEVATION	Qal	ALLUVIUM
EOC	EDGE OF CONCRETE	Qm	MORAINE
EST.	ESTIMATED	R	RADIUS
EX.	EXAMPLE	S	SLOPE, FT./FT.
EXIST.	EXISTING	STA.	STATION
FT.	FEET	STD	STANDARD
FTG.	FOOTING	Ti	INTRUSIVE COMPLEX
H, HORIZ	HORIZONTAL	TH	TEST HOLE
IN.	INCHES	TOW	TOP OF WALL
INV.	INVERT	TP	TEST PIT
L_d	DEVELOPMENT LENGTH	TYP.	TYPICAL
MAX.	MAXIMUM	U/S	UPSTREAM
MIN.	MINIMUM	V, VERT	VERTICAL
M.E.	MATCH EXISTING	WL	WATER LEVEL
		WSE	WATER SERVICE ELEVATION

LEGEND

EXISTING UTILITY POLE

TEST HOLE (SEE GBR BY URS, 2012)

B / C-02 — INDICATES CROSS SECTION LOCATION. B REFERS TO THE CROSS SECTION DESIGNATION. C-02 REFERS TO THE DRAWING NUMBER WHERE THE SECTION IS SHOWN. WHEN SHOWN ON THE SECTION LABEL, THIS NUMBER REFERS TO THE DRAWING NUMBER WHERE THE SECTION IS CUT.

SEE DETAIL 1 / C-04 — INDICATES DETAIL LOCATION. 1 REFERS TO THE DETAIL DESIGNATION. C-04 REFERS TO THE DRAWING NUMBER WHERE THE DETAIL IS SHOWN. WHEN SHOWN ON THE DETAIL, THIS NUMBER REFERS TO THE DRAWING NUMBER WHERE THE DETAIL IS TAKEN.

10600 — INDEX CONTOURS (10' INTERVAL)

10602 — INTERMEDIATE CONTOURS (2' INTERVAL)

10610 — FINAL GRADING CONTOURS (10' INTERVAL)

10612 — FINAL GRADING CONTOURS (2' INTERVAL)

FLOW — INDICATES DIRECTION OF FLOW

EXISTING FENCE

WATER SURFACE

WATER SURFACE

PROPOSED SURVEY BENCHMARK

CULVERT

FILL SLOPE

CUT SLOPE

EXISTING HOUSE OR STRUCTURE

TREE LINE/SHRUB

GM — GAS METER

GW — GUY WIRE

PP — POWER POLE

UMKR — UTILITY MARKER

TRB — TELEPHONE RISER BOX

UE — UNDERGROUND ELECTRIC LINE

FO — UNDERGROUND FIBER OPTIC LINE

OT — UNDERGROUND TELEPHONE LINE

OE — OVERHEAD ELECTRIC LINE

EXISTING SOIL OR GRADE

LIMIT OF SOIL EXCAVATION

ESTIMATED BEDROCK SURFACE

CONCRETE

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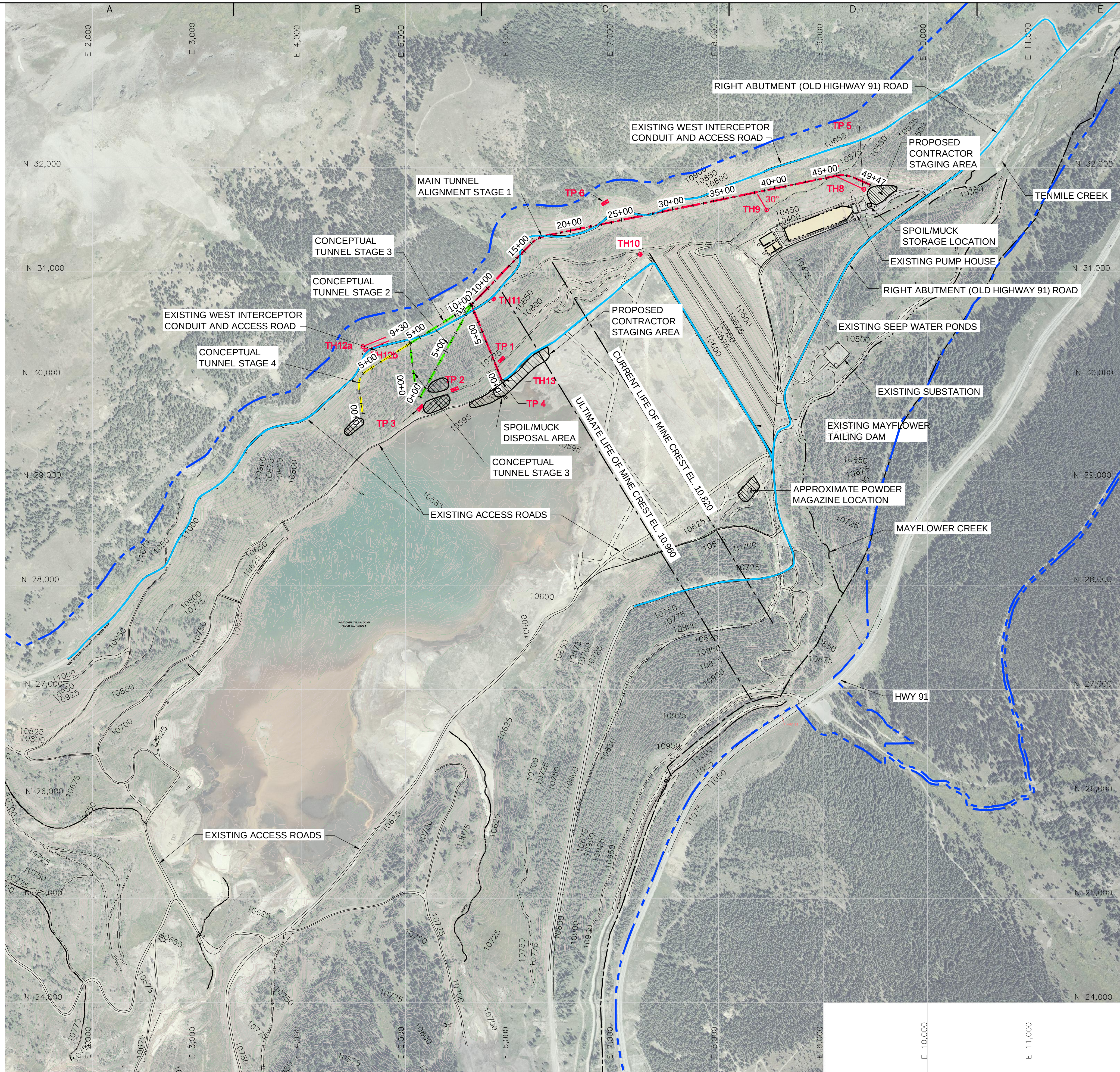
SHEET TITLE

GENERAL NOTES, LEGEND AND ABBREVIATIONS

G-02

SHEET 2 OF 8



PLAN VIEW

0 500 1000 1500
SCALE IN FEET

LEGEND:

- TUNNEL ALIGNMENT STAGE 1
- CONCEPTUAL TUNNEL ALIGNMENT STAGES 2 AND 3
- CONCEPTUAL TUNNEL STAGE 4
- ANTICIPATED ACCESS ROADS DURING CONSTRUCTION
- AFFECTED LANDS BOUNDARY
- STAGING AREA
- SPOIL/MUCK DISPOSAL AREA

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SHEET TITLE

SITE PLAN AND EXISTING IMPROVEMENTS

C-01

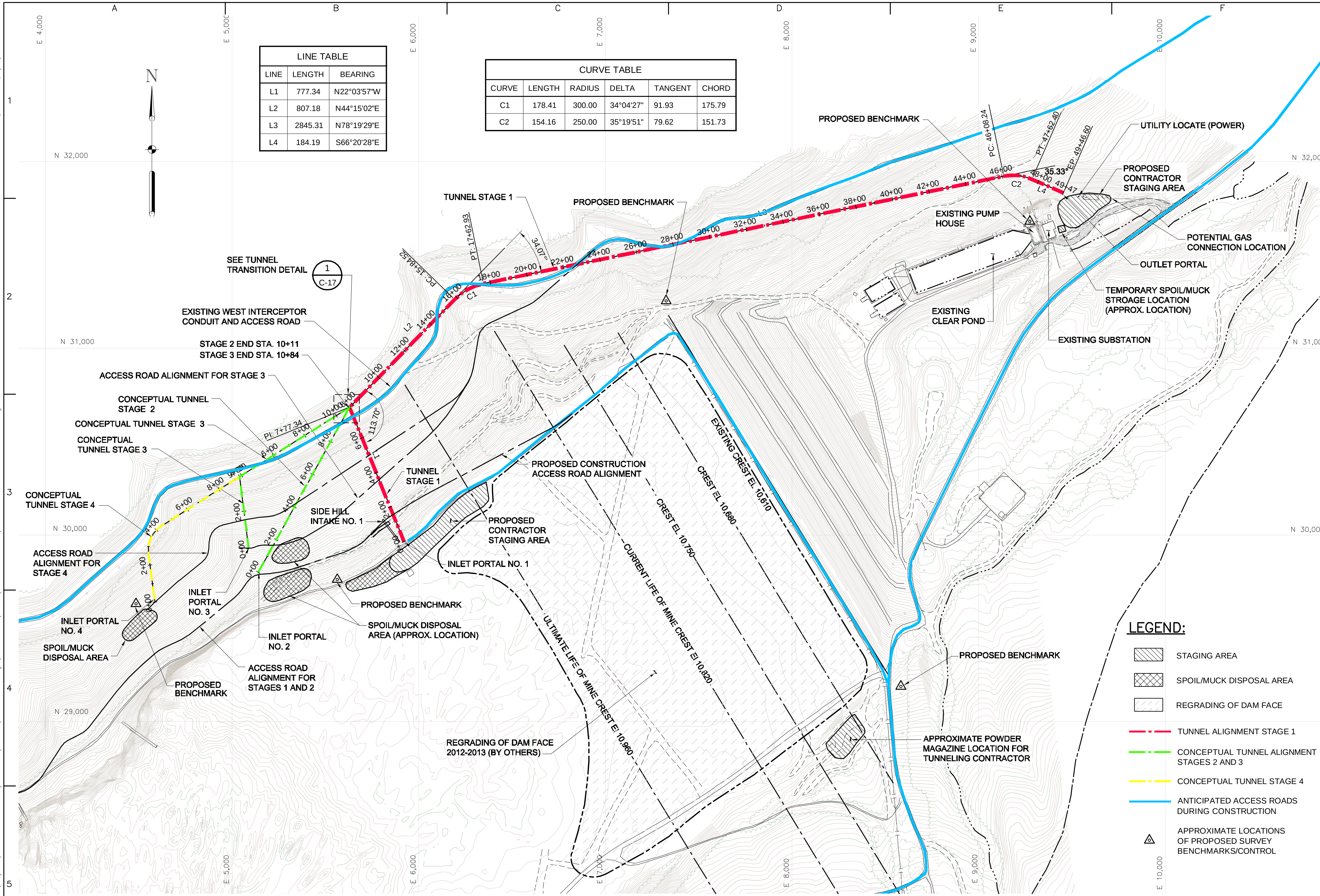
SHEET 3 OF 9

HOFER, WARREN D., 3/12/2012 1:53 PM

DRAWING PATH: N:\Projects\22242143_Climax_Mayflower_De\Sub_00\9.0_Constr_Design\Plan_Sheets\Tunnel\DRMS PERMIT SET\DRMS PERMIT STAGE 1 PLAN C-2.dwg

LINE TABLE		
LINE	LENGTH	BEARING
L1	777.34	N22°03'57"W
L2	807.18	N44°15'02"E
L3	2845.31	N78°19'29"E
L4	184.19	S66°20'28"E

CURVE TABLE					
CURVE	LENGTH	RADIUS	DELTA	TANGENT	CHORD
C1	178.41	300.00	34°04'27"	91.93	175.79
C2	154.16	250.00	35°19'51"	79.62	151.73



PLAN VIEW

0 250 500 750

SCALE IN FEET

LEGEND:

- STAGING AREA
- SPOIL/MUCK DISPOSAL AREA
- REGRADING OF DAM FACE
- TUNNEL ALIGNMENT STAGE 1
- CONCEPTUAL TUNNEL ALIGNMENT STAGES 2 AND 3
- CONCEPTUAL TUNNEL STAGE 4
- ANTICIPATED ACCESS ROADS DURING CONSTRUCTION
- APPROXIMATE LOCATIONS OF PROPOSED SURVEY BENCHMARKS/CONTROL

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REVISIONS		
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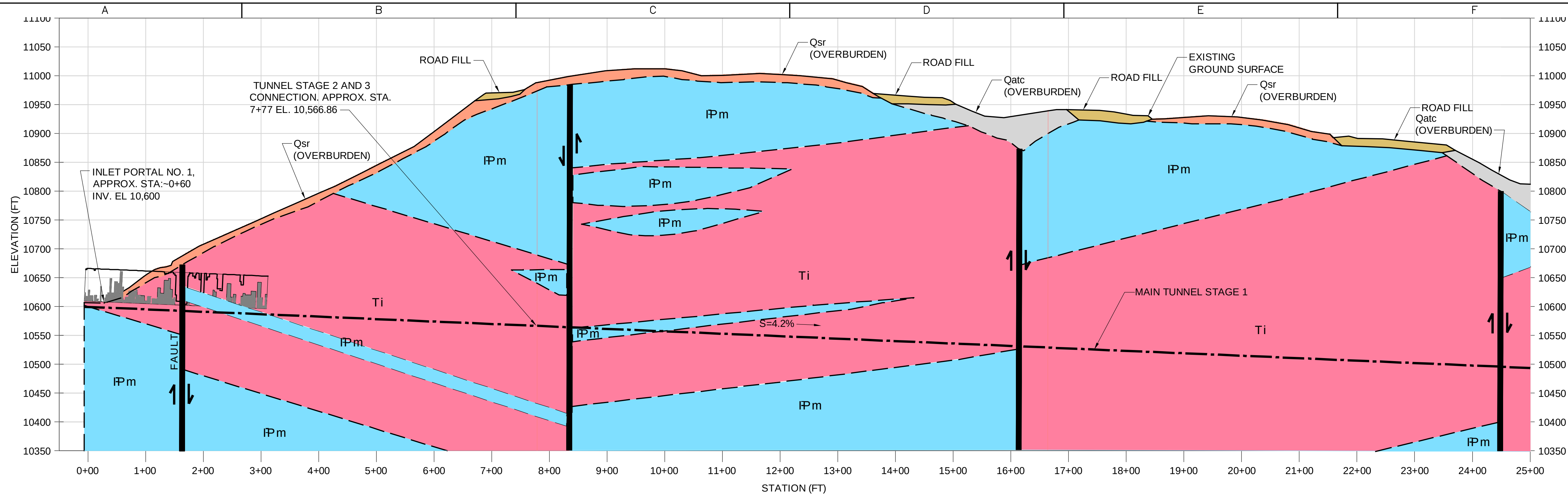
ACAD VER:	2011

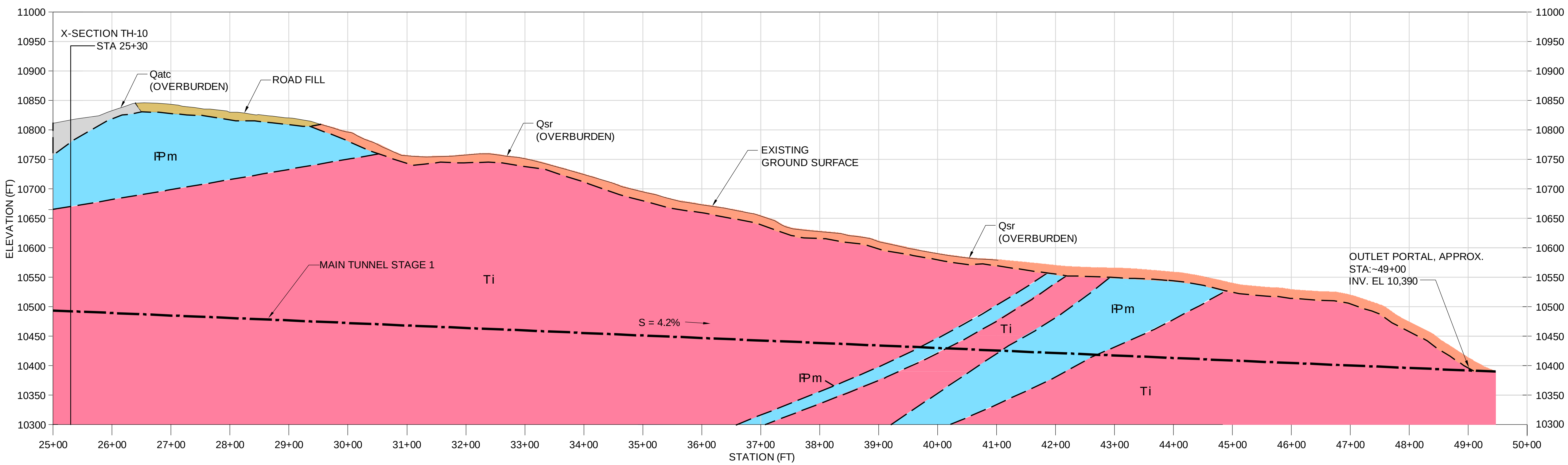
SHEET TITLE

PROPOSED ALIGNMENTS AND STAGING AREAS

C-02

SHEET 4 OF 8





TUNNEL STAGE 1 PROFILE

0 100 200 300
SCALE IN FEET

LEGEND

- **Ti** — INTRUSIVE QUARTZ MONZONITE PORPHYRY OR SIMILAR ROCK: SILLS INTRUDED INTO PALEOZOIC SEDIMENTS ARE THE MOST COMMON FORM OF OCCURRENCE.
- **PPm** — MINTURN FORMATION: PREDOMINANTLY THICK SEQUENCES OF ARKOSIC SANDSTONE LOCALLY METAMORPHOSED TO QUARTZITE NEAR INTRUSIVE QUARTZ MONZONITE PORPHYRY.
- **Qatc** — UNDIFFERENTIATED QUATERNARY ALLUVIUM, TILL, AND COLLUVIUM.
- **Qsr** — SLOPEWASH AND RESIDUAL SOILS: PRIMARILY SAND SILTS AND CLAYS WITH SCATTERED BOULDERS DERIVED FROM UNDERLYING BEDROCK, GRAVELLY IN PART.

Pre-Excavation Grouting Locations

Reach**	Approximate* Grouting Interval		Grout Hole Length (ft)	Grouted Length of Tunnel (ft)
5	14+75	16+65	50	190
7	23+90	25+80	50	190

* Actual grouting interval based upon groundwater inflows from verification probing
** Reach 1 through Reach 8 described in GBR

Verification Probing Locations

Reach**	Probing Interval		Probe Length	Estimated Fault or Contact Zone Location	Type*
1 & 2	1+50	3+45	195	1+75, 2+00, 2+95	F, C, C
3 & 4	7+30	11+00	370	8+30, 9+00, 10+50	F, C, C
5	14+00	17+10	310	15+00 to 16+10	F
7	23+50	26+00	250	24+50 to 25+25	F
8	39+25	43+75	450	39+75, 40+10, 41+00 & 42+75	C, C, C & C

* F=Fault, C=Contact
** Reach 1 through Reach 8 described in GBR

NOTES:

1. GEOLOGY HAS BEEN INTERPRETED. BEDROCK AND SURFACE GEOLOGY MAY VARY DURING CONSTRUCTION. SEE MAYFLOWER TUNNEL GDR AND GBR BY URS (2012) FOR MORE INFORMATION.
2. PROBE HOLE INTERVALS DRILLED IN MINIMUM 50' LENGTHS WITH 10' OVERLAP.
3. VERIFICATION PROBING INTERVALS WILL CONSIST OF 1 DRILLED PROBE HOLE WITHIN THE TUNNEL HEADING.

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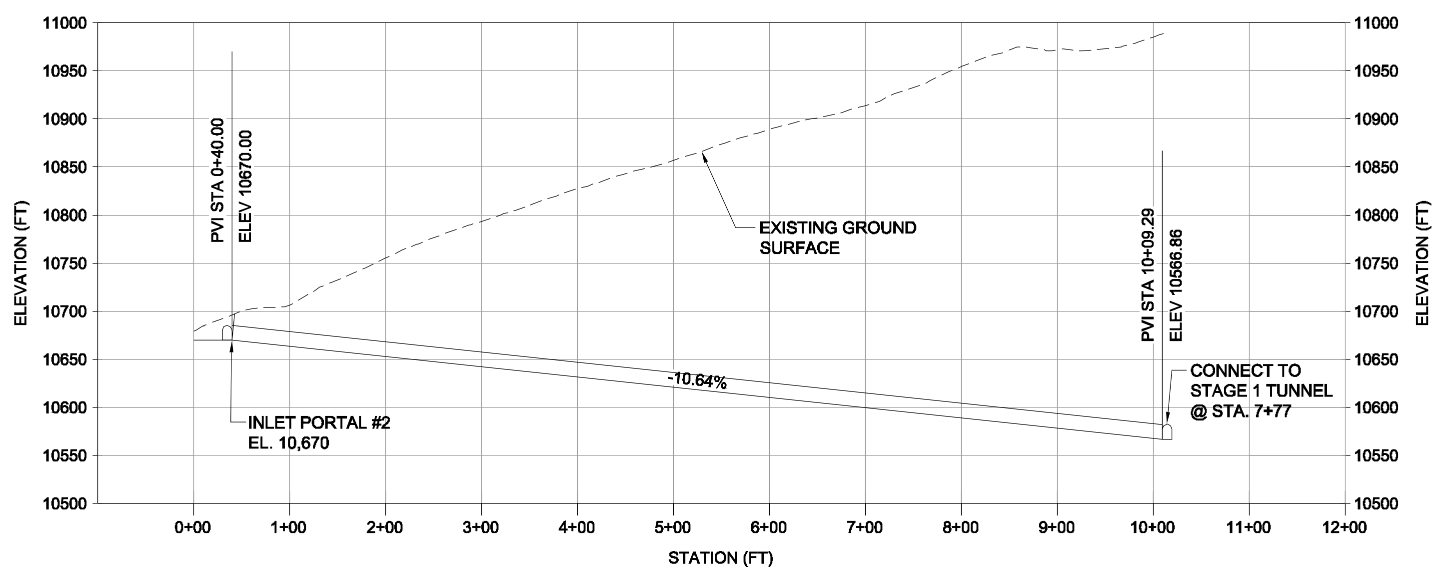
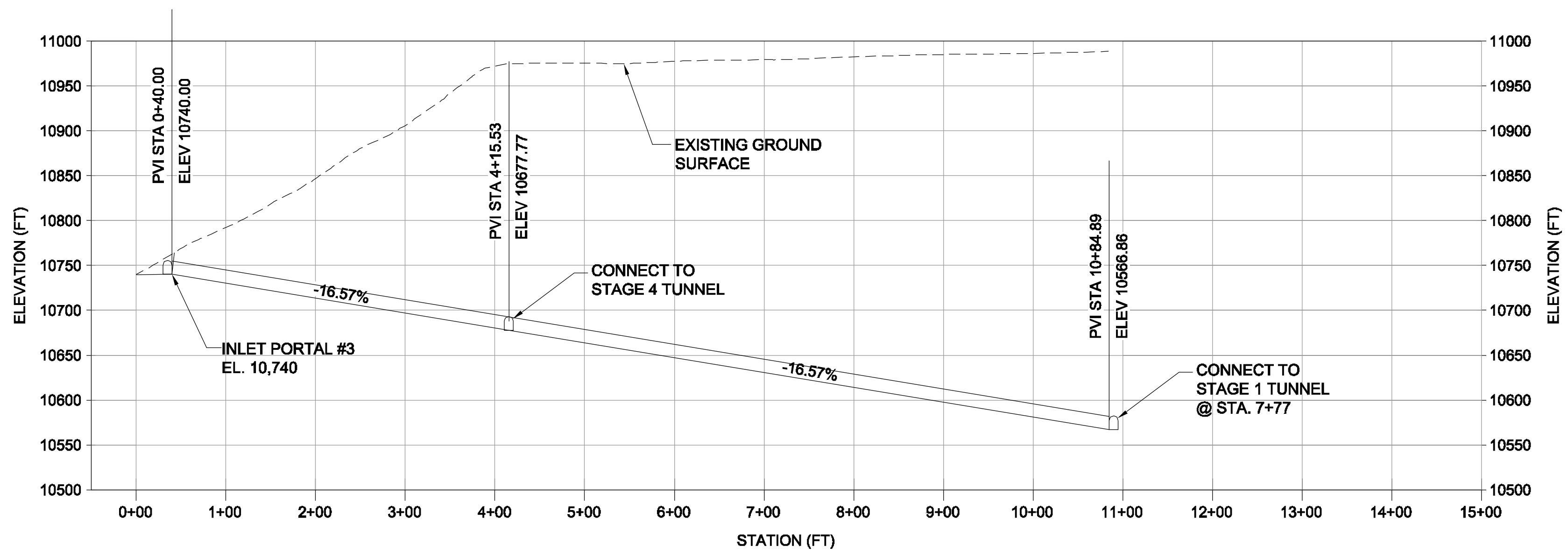
SHEET TITLE
STAGE 1 PROFILE

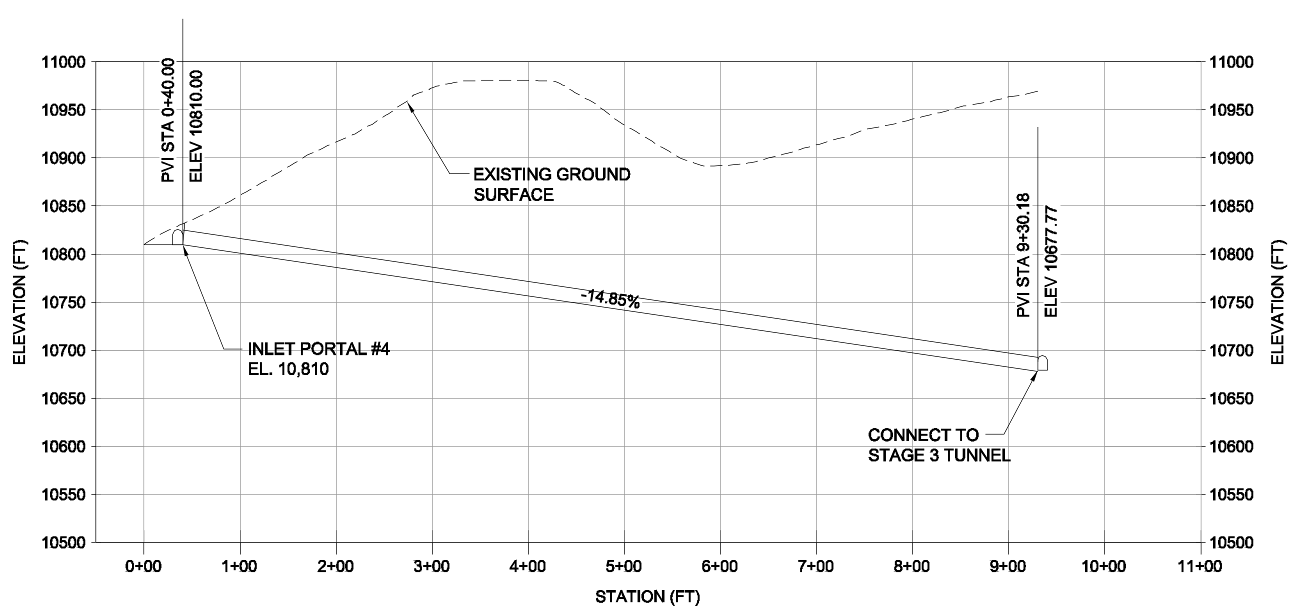
C-03
SHEET 5 OF 8



CONCEPTUAL STAGE 2 PROFILE



CONCEPTUAL STAGE 3 PROFILE



CONCEPTUAL STAGE 4 PROFILE

NOTE:

1. GEOLOGIC MODEL AND INTERPRETATIONS FOR STAGE 2 THROUGH STAGE 4 WILL BE COMPLETED AFTER "PHASE 2 GEOTECHNICAL INVESTIGATIONS" ARE PERFORMED.

0 100 200 300
SCALE IN FEET

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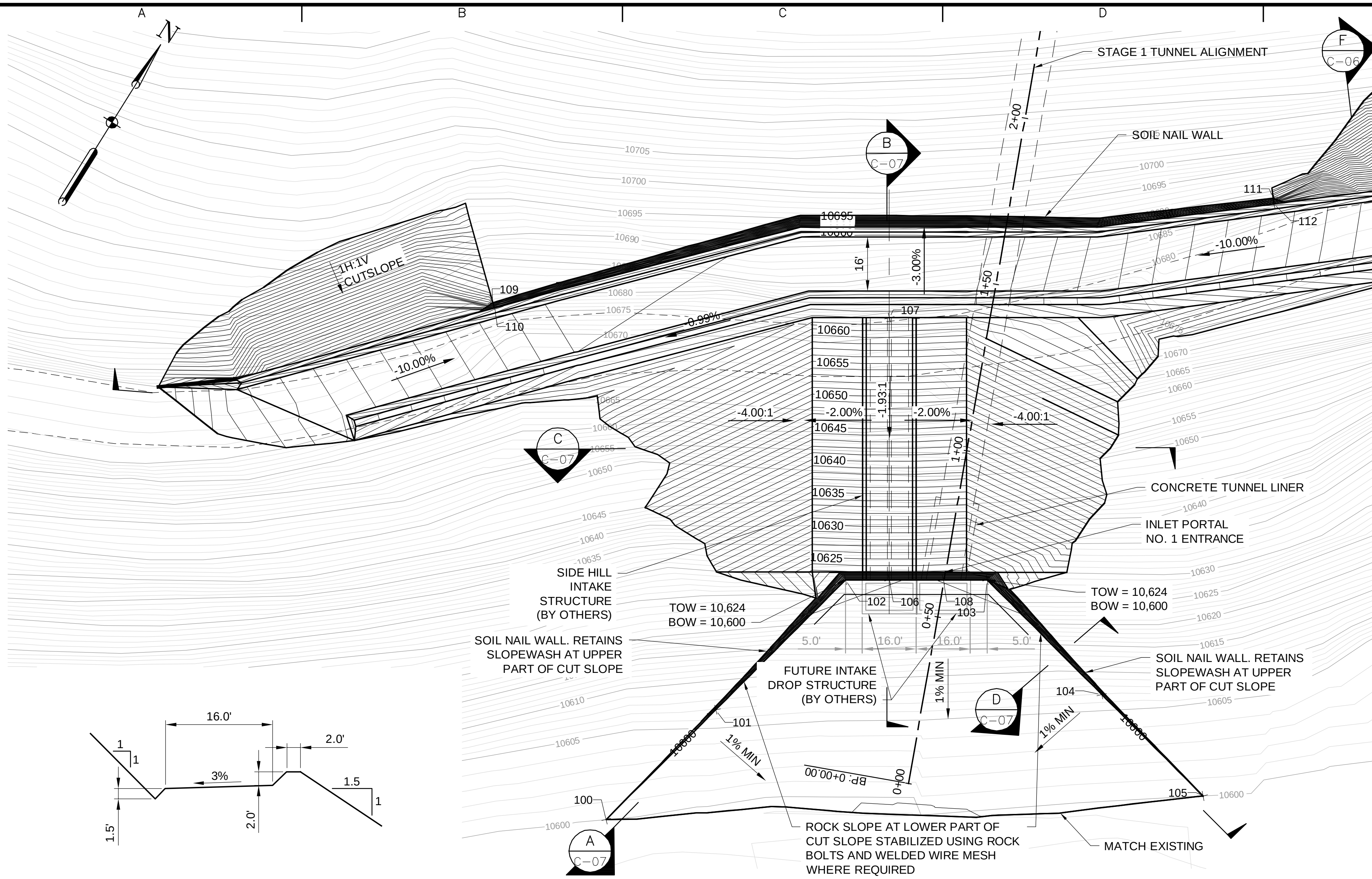
SCALE:	AS SHOWN
ACAD VER:	2011

SHEET TITLE

CONCEPTUAL STAGE 2, 3, AND 4 PROFILES

C-04

SHEET 6 OF 8



ROAD SECTION (F / C-06)

INLET PORTAL NO. 1 PLAN

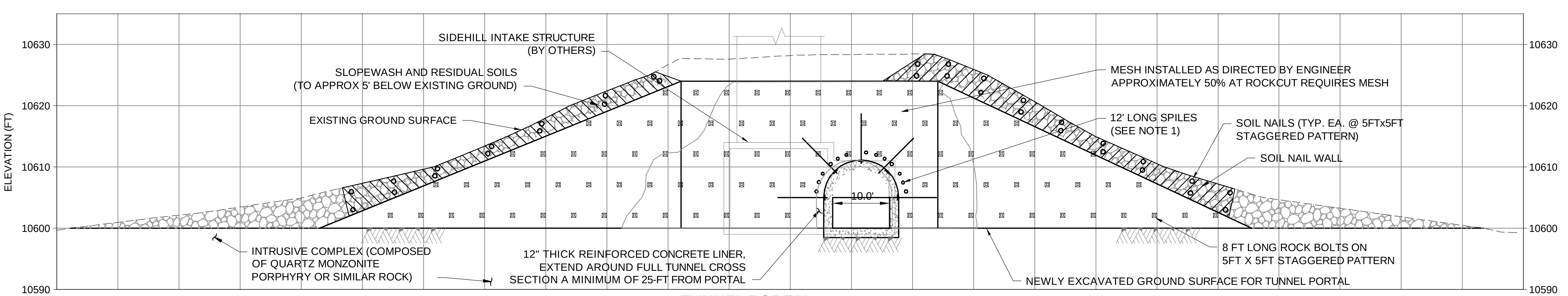
0 20 40 60
SCALE IN FEET

POINT TABLE

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
100	29907.24	5851.54	10600.00	TOE SLOPE
101	29952.01	5861.85	10600.00	TOE WALL
102	30005.03	5874.06	10600.00	TOE WALL
103	30027.30	5909.67	10600.00	TOE WALL
104	30016.53	5956.45	10600.00	TOE WALL
105	30006.99	5997.86	10600.00	TOE SLOPE
106	30011.92	5885.09	10600.00	CL STRUCT
107	30077.74	5843.91	10670.00	CL STRUCT
108	30020.41	5898.65	10600.00	CL STRUCT
109	30019.14	5741.88	10678.36	TOP WALL
110	30018.12	5743.10	10662.45	TOE WALL
111	30168.07	5921.59	10687.58	TOP WALL
112	30166.73	5922.67	10670.41	TOE WALL

NOTES:

1. SPILE - NO. 8 WILLIAMS THREADBAR, 12' TOTAL LENGTH,GROUTED AND CENTRALIZED, INSTALLED ON 18" SPACING AROUND BROW OF TUNNEL, 12" FROM B-LINE, BETWEEN SPRINGLINE AND TUNNEL ROOF.



TUNNEL PORTAL STABILIZATION FRONT SECTION (A / C-06)

0 10 20 30
SCALE IN FEET

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SHEET TITLE

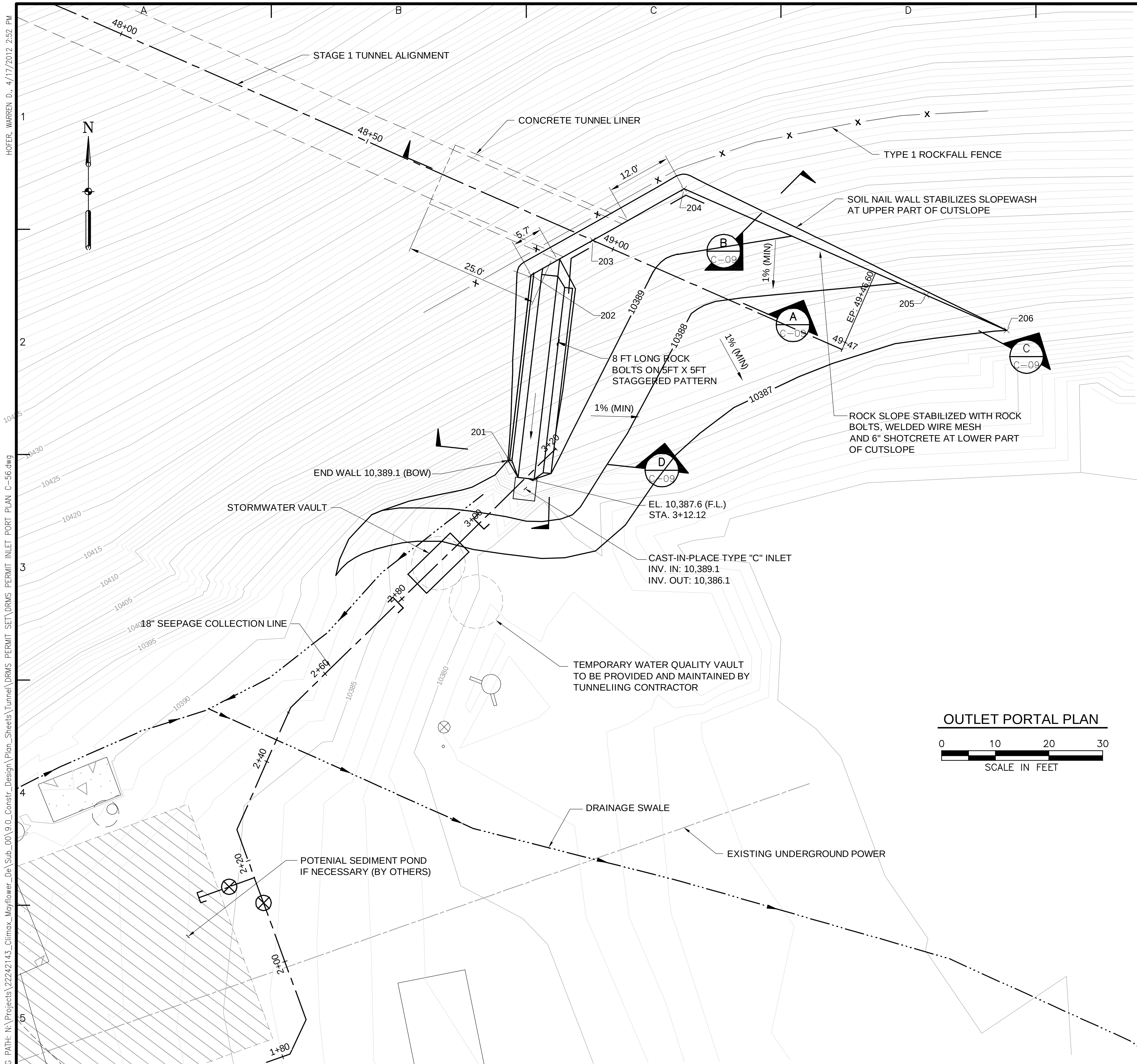
INLET PORTAL NO. 1 PLAN

C-05

SHEET 7 OF 8

HOFER, WARREN D., 3/12/2012 2:10 PM

DRAWING PATH: N:\Projects\22242143_Climax_Mayflower_De\Sub_00\9.0_Constr_Design\Plan_Sheets\Tunnel\DRMS PERMIT SET\DRMS PERMIT INLET PORT PLAN C-56.dwg



OUTLET PORTAL PLAN

0 10 20 30
SCALE IN FEET

POINT TABLE

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
200	31805.49	9390.54	10389.00	TOE SLOPE
201	31812.27	9391.41	10389.10	TOE WALL
202	31813.26	9391.44	10390.00	TOE WALL
203	31853.25	9406.85	10390.00	CL STRUCT
204	31862.83	9423.85	10390.00	TOE WALL
205	31843.04	9469.02	10387.75	TOE WALL
206	31836.48	9483.99	10387.00	TOE SLOPE

NOTES:

1. SEDIMENT POND WILL BE DESIGNED FOR ANTICIPATED SEEPAGE FLOWRATE.
2. SEDIMENT POND WILL BE CONSTRUCTED AND MAINTAINED BY OTHERS.

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ISSUED FOR CONSTRUCTION DATE BY

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SHEET TITLE

OUTLET PORTAL PLAN

C-06

SHEET 8 OF 9

HOFER, WARREN D., 4/17/2012 2:52 PM
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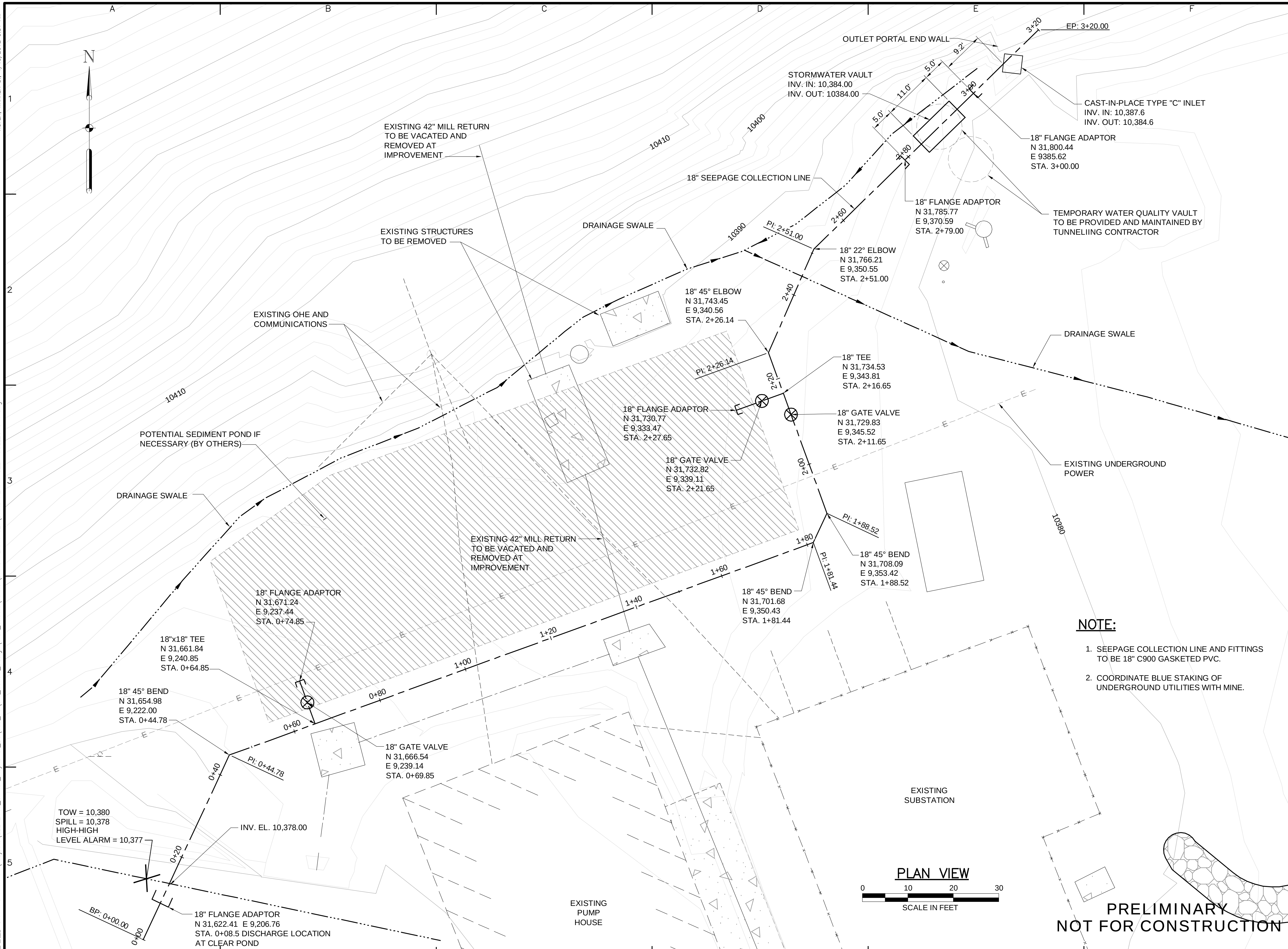

NOTE:

1. SEEPAGE COLLECTION LINE AND FITTINGS TO BE 18" C900 GASKETED PVC.
2. COORDINATE BLUE STAKING OF UNDERGROUND UTILITIES WITH MINE.

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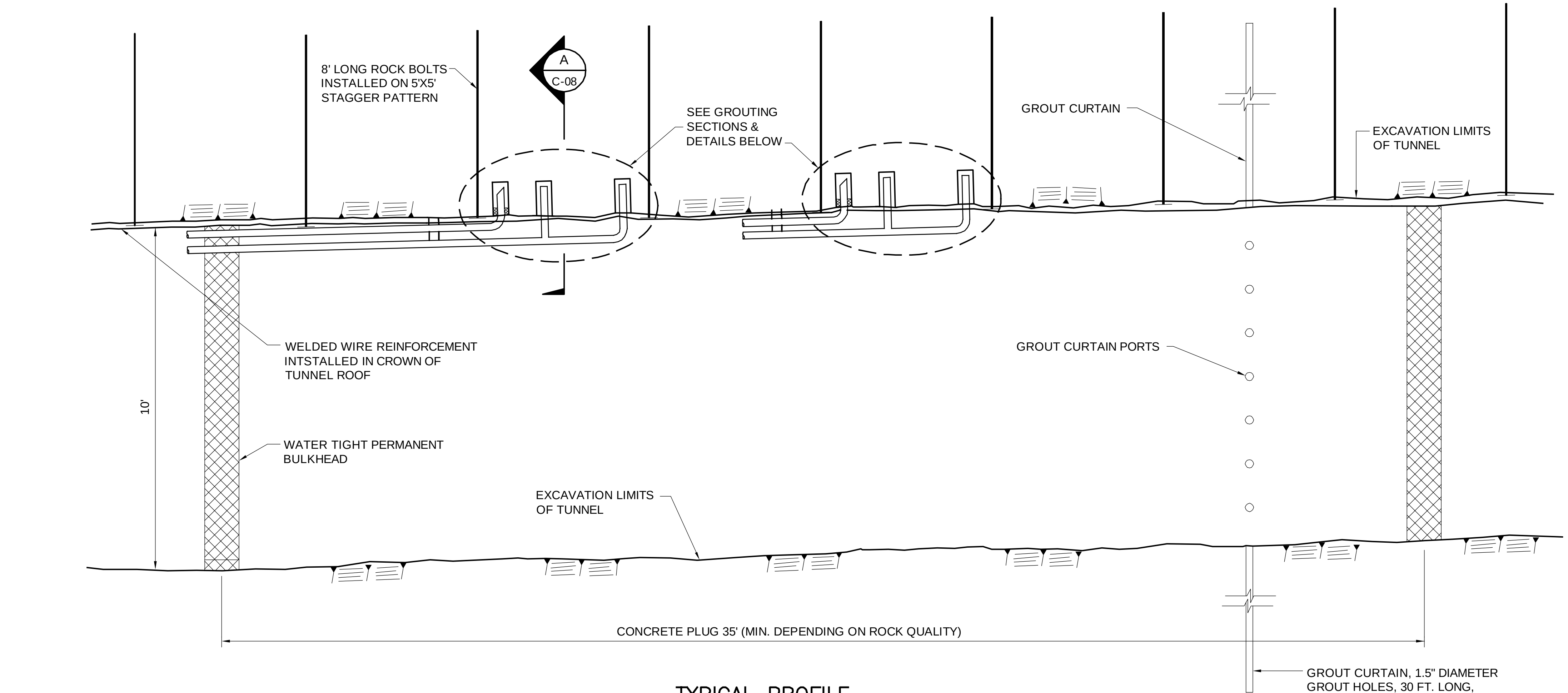
SHEET TITLE

SEEPAGE COLLECTION SYSTEM

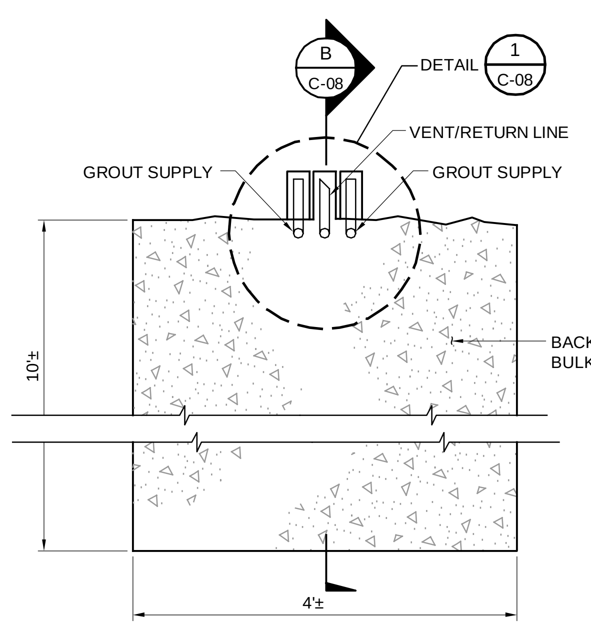
C-07

SHEET 9 OF 10

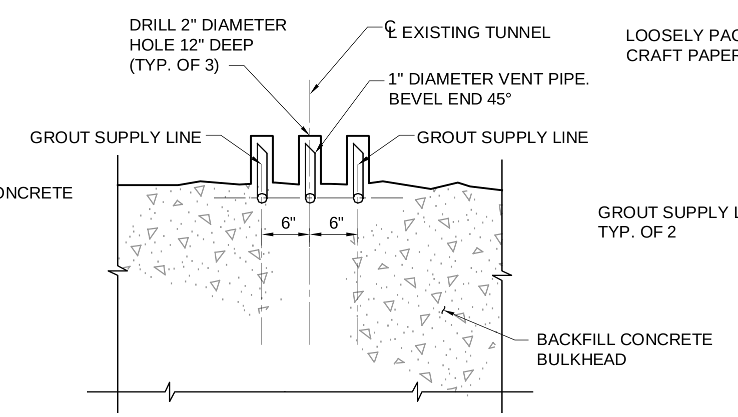
HOFER, WARREN D., 4/18/2012 9:31 AM
URS DRAWING PATH: N:\Projects\22242143_Climax_Mayflower_De\Sub_00\9.0_Constr_Design\Plan_Sheets\Tunnel\DRMS PERMIT SET\DRMS PERMIT SEEP COLLEC C-7.dwg



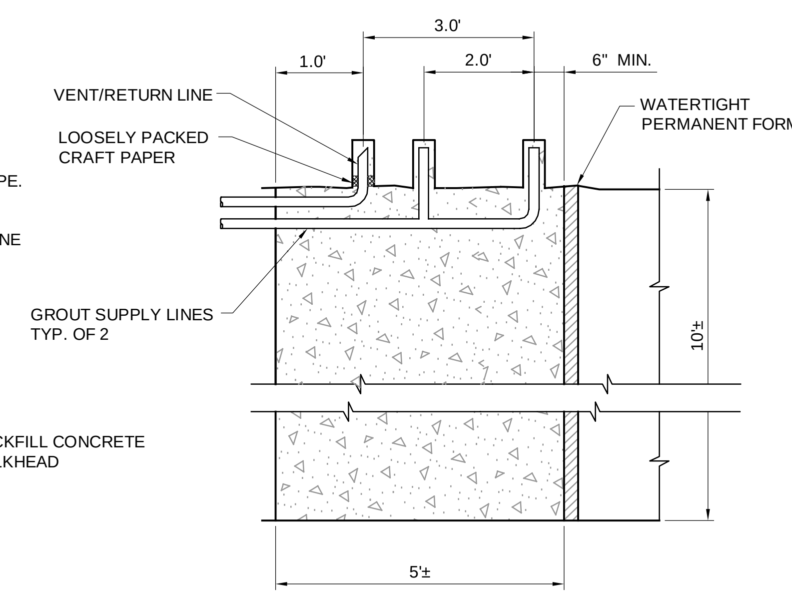
TYPICAL PROFILE
NOT TO SCALE



GROUTING SECTION A / C-08
NOT TO SCALE



DETAIL 1 / C-08
NOT TO SCALE



GROUTING SECTION B / C-08
NOT TO SCALE

NOTES:

1. THE TUNNEL GEOLOGY WILL BE ASSESSED BY THE ENGINEER TO SELECT THE EXACT PLUG LOCATION.
2. POST EXCAVATION GROUTING WILL BE PERFORMED AS DIRECTED BY THE ENGINEER TO LOWER THE PERMEABILITY OF THE SURROUNDING ROCK–MASS. GROUT HOLES WILL BE ORIENTATED TO INTERSECT MAJOR (OPEN, WIDE APERTURE, PARTIAL OR NO INFILLING) FRACTURES.
3. GROUT CURTAIN SHALL BE CONSTRUCTED IF ERODIBLE ROCK OR DISCONTINUITY INFILLINGS ARE PRESENT WITHIN THE ROCK–MASS, SURROUNDING THE PLUG INTERVAL. GROUT CURTAIN WILL DIRECTED BY THE ENGINEER.
4. CONTACT GROUT PORTS (2 INJECTION AND 1 VENT) SHALL BE INSTALLED WITHIN THE CROWN OF THE TUNNEL ROOF, EVERY 5 FEET ALONG PLUG INTERVAL.

PRELIMINARY
NOT FOR CONSTRUCTION

URS
URS Center
8181 East Tufts Avenue
Denver, Co. 80237–2637
303 694–2770 (phone)
303–694–3946 (fax)

CLIMAX MOLYBDENUM COMPANY

MAYFLOWER FLOOD BYPASS TUNNEL SYSTEM
DRMS PERMIT SET

ISSUED FOR BIDDING ____ DATE BY

ISSUED FOR CONSTRUCTION ____ DATE BY

REVISIONS

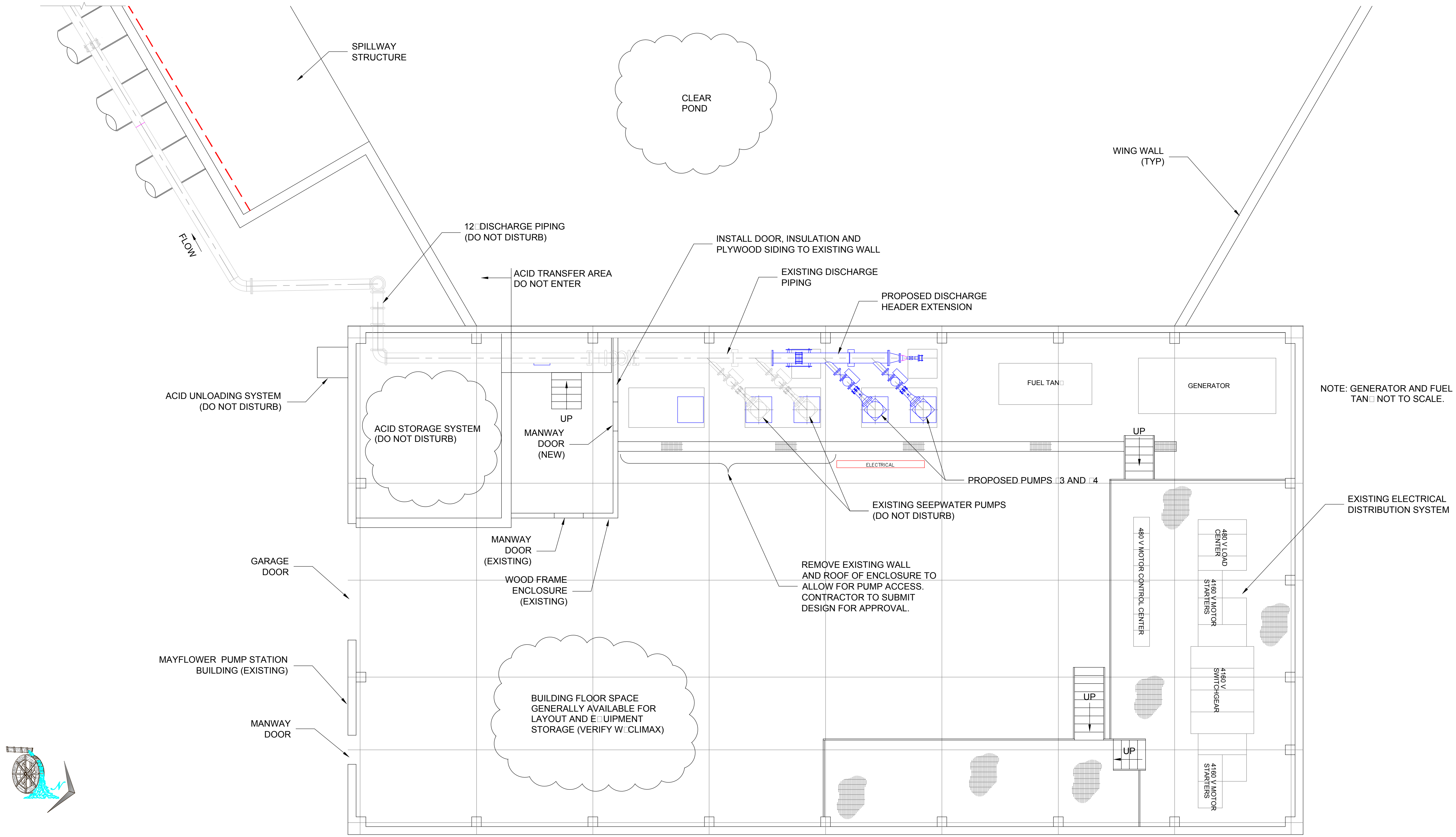
NO.	DESCRIPTION	DATE
4	–	–

URS PROJECT NO:	22242752.00100
DRAWN BY:	WDH
DESIGNED BY:	DL
CHECKED BY:	–
DATE CREATED:	3/2012
PLOT DATE:	3/2012
SCALE:	AS SHOWN
ACAD VER:	2011

SHEET TITLE
CONCRETE PLUG CLOSURE DETAILS

C-8
SHEET 10 OF 10

HOFER, WARREN D., 4/18/2012 10:50 AM
DRAWING PATH: N:\Projects\22242143_Climax_Mayflower_De\Sub_00\9.0_Constr_Design\Plan_Sheets\Tunnel\DRMS PERMIT SET\Tunnel Concrete Plug Details C-8.dwg



1 MAYFLOWER PUMP STATION

PLAN VIEW

0 4 8 12

Scale in Feet

R:1000\1051\1051.19\1051.19.10 (4 pumps)\DRAWINGS\PUMP STATION 4-18-12 03:28pm SteveM XREFS

REVISIONS

NO.	DATE	MADE BY	C□D. BY	REMAR□S
A	4□16□12	DCM	SMM	FOR REVIEW AND APPROVAL

"This drawing together with any and all additions, corrections, changes and alterations thereof is the property of Climax Molybdenum Company and is furnished on the express condition that it shall not be reproduced, copied, lent, or disposed of directly or indirectly, nor used for any other purpose than for which it is specifically furnished without the prior written consent of said Climax Molybdenum Company."

PRINT RECORD

ISSUED / REV. NO.	1	2	3	4	5	6	7	8	DRAWING NO.

REFERENCE DWGS

DRAWING NO.	REFERENCE

W. W. Wheeler and Associates, Inc. Water Resources Engineers

Wheeler Dwg. No. □1051.19.10

5 Dam Seepwater Pumping System	Climax Molybdenum Co. - Climax Mine Climax, CO		
Pump Addition	MADE BY DCM	4□17□12	SCALE As Noted
Pump Station Building	CHEC□ED BY SMM	4□17□12	DRAWING NO.
General Arrangement	ACCEPTED BY ...		MPS-G-01 A

APPENDIX B

BLASTING ANALYSIS

April 11, 2012

Mr. Ron Valentine
Climax Molybdenum Company
Climax Mine
Highway 91 – Fremont Pass
Climax, CO 80429

Subject: Mayflower Tunnel Blast Vibration Assessment, Mayflower Tailing Dam, Climax Mine, Climax, Colorado
Project No. 22242752 (T00100)

Dear Mr. Valentine:

URS Corporation (URS) was requested by Climax Molybdenum Company (Climax) to review the potential impact on tailing dam stability of ground vibrations generated by blasting activities during excavation of the proposed Mayflower Tunnel. Presented below is a brief discussion of the vibration evaluation, conclusions of the geotechnical review, and our recommendations moving forward.

VIBRATION EVALUATION

URS is in the process of completing engineering design on the proposed Mayflower Tunnel at the Mayflower Tailing Storage Facility (TSF). The tunnel will function as a flood bypass structure and is to be located within the bedrock units at the left abutment of the TSF impoundment. The proposed tunnel excavation method is drilling and blasting. The blasting will generate ground vibrations that will propagate through adjacent structures. Identified critical structures in the blast vicinity include the tailing embankment and Mayflower pump house.

URS has contracted Rock Solid Solutions (RSS) to perform an assessment of the potential ground vibrations and establish criteria for blasting limits for the project. The results of RSS's evaluation are provided in Attachment A. A brief summary of the RSS evaluation is provided below.

Summary of Blast Design Principles

The RSS evaluation provides discussion on the difference between blasting vibrations and earthquake vibrations (ground motions). Blast vibrations have short durations at relatively high frequencies while earthquake vibrations have longer durations at lower frequencies. Earthquake shear waves typical generate large strains and shears within an embankment that shake the embankment as a whole. Conversely, the waves generated from a blast charge dissipate with distance traveled and create a motion in a structure that is not in phase.

RSS reports the Bureau of Mines & Office of Surface Mining (OSM) has prepared guidelines for blasting limits, based on their own studies, have been included in state codes and other regulations and used as reference by International Society of Explosives Engineers (ISEE). Generally the guidelines specifically reference the Peak Particle Velocity (PPV) limit of 2.0 inches per second (ips) as the upper limit of vibration.

Feasibility Level Blast Plan

Blast vibrations are of interest at the dam embankment and pump house. The pump house is located about 60 feet from the outlet portal, with "distance to blast" increasing as the tunnel excavation advances. The embankment is generally about 300 feet away from the tunnel at the nearest location. RSS developed a graph using PPV limits versus the Scaled Distance Method (per OSM guidelines) that considers a potential blast plan that assumes a full-face heading and perimeter blasting corresponding to 19 pounds per delay (lbs/delay).

Calculated PPV at the embankment was < 0.3 ips, which is well below the OSM limit of 2.0 ips. The calculated PPV at the pump house was greater than 2.0 ips, requiring modification to the blast plan for the outlet portal and up to 50 feet into the tunnel. The modification requires a reduced blast plan of 9 lbs/delay, which may require the tunnel contractor to "deck the holes" and extend the tunnel blast delays. Decking is not an unusual industry practice.

Geotechnical Embankment Review

Review of the URS (2007) stability analyses for the Mayflower TSF indicated a calculated factor-of-safety (FS) of 2.9 for existing height under steady-state conditions. The factor of safety for the post-earthquake stability analysis was 2.4, and would be representative of undrained conditions. As discussed previously, blast vibrations have short durations at relatively high frequencies and should not generate significant excess pore pressures. The relatively high FS values for steady-state and undrained conditions do not indicate a need for stricter requirements than the OSM guidelines as proposed by RSS above.

RECOMMENDATIONS

Based on the RSS evaluation of blast vibrations and the URS (2007) evaluation of geotechnical stability of the Mayflower embankment, URS is comfortable that blast vibrations should not be a problem for this project. The conclusions and recommendations provided by RSS in their evaluation, and agreed upon by URS, include:

- Preparing a Blast Plan that sets charges at:
    - 9 lbs/delay at the outlet portal and for 50 upstream of the outlet portal
    - 19 lbs/delay throughout the remaining tunnel excavation

- Requiring a series of test blasts to confirm the assumptions and calculations of the proposed blast plan and observe the contractor’s blasting practices

- Conducting blast monitoring at three locations using seismographs during tunnel excavation to confirm the blast vibrations are within specified limits and provide documentation for quality assurance purposes. The first seismograph is to be located at the pump house, another at the left side of the dam embankment, and the third along the left abutment between the other stations (see attached Figure 1).

GENERAL INFORMATION

URS represents that our services are performed within the limits as prescribed by the Client in a manner consistent with the level of care and skill ordinarily exercised by other consultants under similar circumstances. No other representation to the Client is expressed or implied and no other warrantee or guarantee is included or intended.

URS

CLOSING

As always, we appreciate the continuing opportunity to work with Climax on this project. Please feel free to call with any questions or comments.

Sincerely,

Tiffany Adams, Ph.D., P.E.
Geotechnical Project Engineer

Richard Davidson, P.E.
Principal Engineer

John Sikora, P.E.
Project Manager

KJY:kjy
REV:JS

Attachments:
Attachment A –Blast Vibrations Memo from Rock Solid Solutions
Figure 1 – Seismograph Monitoring System Plan View

cc: John Barnes, Climax Molybdenum Company
Raymond Lazuk, Climax Molybdenum Company
Daryl Longwell, Tetra Tech

ROCK SOLID SOLUTIONS

January 29, 2012

BLAST VIBRATIONS MEMO

Mr. John Sikora
Manager, Mayflower Dam Diversion Tunnel Project
713 Cooper Avenue, Suite 100
Glenwood Springs, CO 81601

Subject: Feasibility Blast Plan Evaluation for Vibration Assessment, Tunnel Option**,** URS Project No. 22242143

Dear John:

Design and construction of a Diversion system for the Mayflower Tailings Dam for the Climax Mining operations has considered numerous options for the project. The option that has been considered the most effective for the long term operation of the facilities is a bypass tunnel located on the left abutment of the dam. Since the structure is a tailings dam, constructed using the upstream beach tailings method, the embankment is considered to be very sensitive to seismic and potentially blasting vibrations. This conclusion indicates that the embankment may be vulnerable to seismically-induced strength reduction.

URS and Freeport McMoran (FM&I) requested that Rock Solid Solutions (RSS) evaluate the typical construction blasting vibrations and establish criteria for the tunneling contractor to maintain safe vibration levels during construction of the bypass tunnel. As requested, evaluation of the blasting operations will help assess what can be done to minimize the impact of blast vibration to the embankment and adjacent structures. See Figure 1 attached for the Tunnel Alignment relative to Critical Structures at the project site.

Blast Design Principles

To assess the impact of blast vibrations on the embankment, we need to understand the difference in characteristics of ground vibration generated by a large regional earthquake and construction blasting. An earthquake will generate vibrations at a very low frequency (0.1 Hz to almost always <1 Hz) and displacements over a relatively long duration (minutes). Construction blasting generally produces vibrations that are at higher frequency (20 to 100 Hz) with small displacements and short durations (seconds). In general, acceleration is proportional to the square of the frequency. If we double the frequency and the displacement remains the same, there is a four fold (4x) increase in acceleration. An example of blasting vibrations compared to an earthquake is shown on Figure 2 (Dowding 1985).

Table 1, provides vibration parameters (particle velocity, displacement and wavelength) for different frequencies all with the same acceleration (0.12g from Oriard, 2003). Large earthquake displacements generate large strains and shear within an embankment. The long waves shake the embankment as a unit, simultaneously throughout. Blasting will not generate that type of motion, the small charges send a transient wave through the earth, dying out rapidly with the distance they travel. The waves are short, therefore, motion in a structure are not in phase. Understanding these different vibration properties clarifies the potential impacts due to blasting at the project.

The Bureau of Mines & Office of Surface Mining (OSM) have conducted numerous studies of blast vibrations and prepared guidelines that have been incorporated into a number of state codes, regulations, ordinances and project specifications. Peak particle velocity is the standard measurement for blasting operations and has more meaning then acceleration when comparing the potential for damage. The OSM guidelines recommend a Peak Particle Velocity (PPV) limit of 2.0 inch per sec (ips) for residences near blasting with frequencies above 30Hz. A graph of the OSM guidelines is attached as Figure 3 (ISEE Blaster's Handbook 1998). The guidelines have been widely accepted as the upper limit of vibration, where no damage has been observed in residential structures exposed to repeated blast vibrations. Mayflower Dam is significantly more robust than a residential plaster wall. OSM has taken this effort a step further to develop a very conservative "Scaled Distance" equation ($W=(D/50)^2$ where $D<300$ ft) for blasters to utilizes. When a blaster utilizes the Scaled Distance formula in design, they are not even required to monitor for vibrations.

Mayflower Dam Feasibility Level Blast Design

Mayflower Dam was constructed using the upstream beach method of tailings dam construction, making the wide embankment fairly robust. However, being a saturated sand upstream may make it a bit more sensitive to construction blasting vibrations and activities. Therefore, URS is warranted in requiring limits to the blasting operations. As a result, RSS has evaluated the vibrations required for construction blasting and assess the ability to conduct the work within restricted levels of Peak Particle Velocity. An upper limit PPV that is within the OSM guidelines should be utilized as the starting point guidelines as a conservative value for design, PPV=2.0 ips.

The dam embankment and the pump house structure have been identified as the "critical locations" where blast vibrations need to be limited during construction of the Tunnel Diversion System. Since vibrations decay with distance, these points represent locations (on the embankment) where the highest vibration condition should occur, all other vibrations in the embankment should be lower and transient. The distance from the blasting operations to the pump house structure are as close as 60-ft at the outlet portal (Sta 48+09) and increase rapidly (to over 100-ft) by the time the tunnel has advanced some 50-ft in (Sta 47+50). The tunnel alignment has been moved out away from the dam embankment to avoid shallow surface geologic structures. As a result, the tunnel alignment is generally greater than 300-ft from the embankment, Figure 4. Using the OSM "Scaled Distance" Method ($W=(D/50)^2$) the allowable charge weight would be less than 2 lbs/delay, almost nothing during portal development and initial tunneling operations near the pump house. It however, would be on the order of about 20 lbs/delay for the tunneling operations adjacent to the dam embankment.

Oriard (1970, 1992) has developed a typical bound of Peak Particle Velocity (PPV) versus Scaled Distance ($ft/(lbs^{1/2})$) for ground vibrations from blasting, Figure 5. Equations for the typical (range) bounds provides a starting point to estimate the ground vibrations at a new site for various charges and distances. The equation is linear and the data is bound by a low and high line with different constant (24 to 242) values based upon the range of data accumulated over the years.

A potential blast plan for the tunnel was developed assuming a full face heading and perimeter blasting to control back break. The tunnel blast plan layout is shown on Figure 6 attached. A maximum of 19 lbs/delay was developed for the 10-ft horseshoe tunnel pulling an 8-ft round. Blasting in the tunnel adjacent to the dam embankment would likely produce vibrations well below the OSM criteria due to the distance away (300+ft) and limited pounds (19 lbs/delay) of explosives that would likely be used to drive the tunnel. A PPV of < 0.3 ips was calculated for the dam embankment structure using the proposed blast design.

The pump house structure on the other hand will require some design modifications to the proposed blast plan (at least for the first 50-ft of tunneling) to remain within the OSM standard of PPV< 2.0ips. To develop an estimate of what charge can be used at the downstream portal and tunnel of the Mayflower Dam Diversion Tunnel Project, we have utilized a maximum Peak Particle Velocity of 2.0 ips and an upper bound (lower charge weight) constant of 242. The downstream portal of the tunnel is the closest to the critical pump house location at 60 ft. Using Oriard's upper bound equation and the distance of 60 ft, a charge weight of about 9 lbs per delay has been computed. This should not present a significant problem for a contractor during portal development, they will merely have to deck their holes and extend the tunnel delays more to control the blast vibrations at the pump house structure. A revised timing sequence for the first 50-ft of tunnel from the downstream portal is shown on Figure 7, attached.

A recommended seismograph monitoring system has been prepared to confirm that the tunneling contractor stays within the OSM standards and Project guidelines is shown on Figure 8. Three seismographs, one placed at the pump house structure (SM#1); and 2 placed along the left abutment of the embankment near the access roads (SM#2 & SM#3) will document the vibration conditions and confirm that the blast vibrations during the tunneling operations stay within the OSM and Project guidelines..

Summary

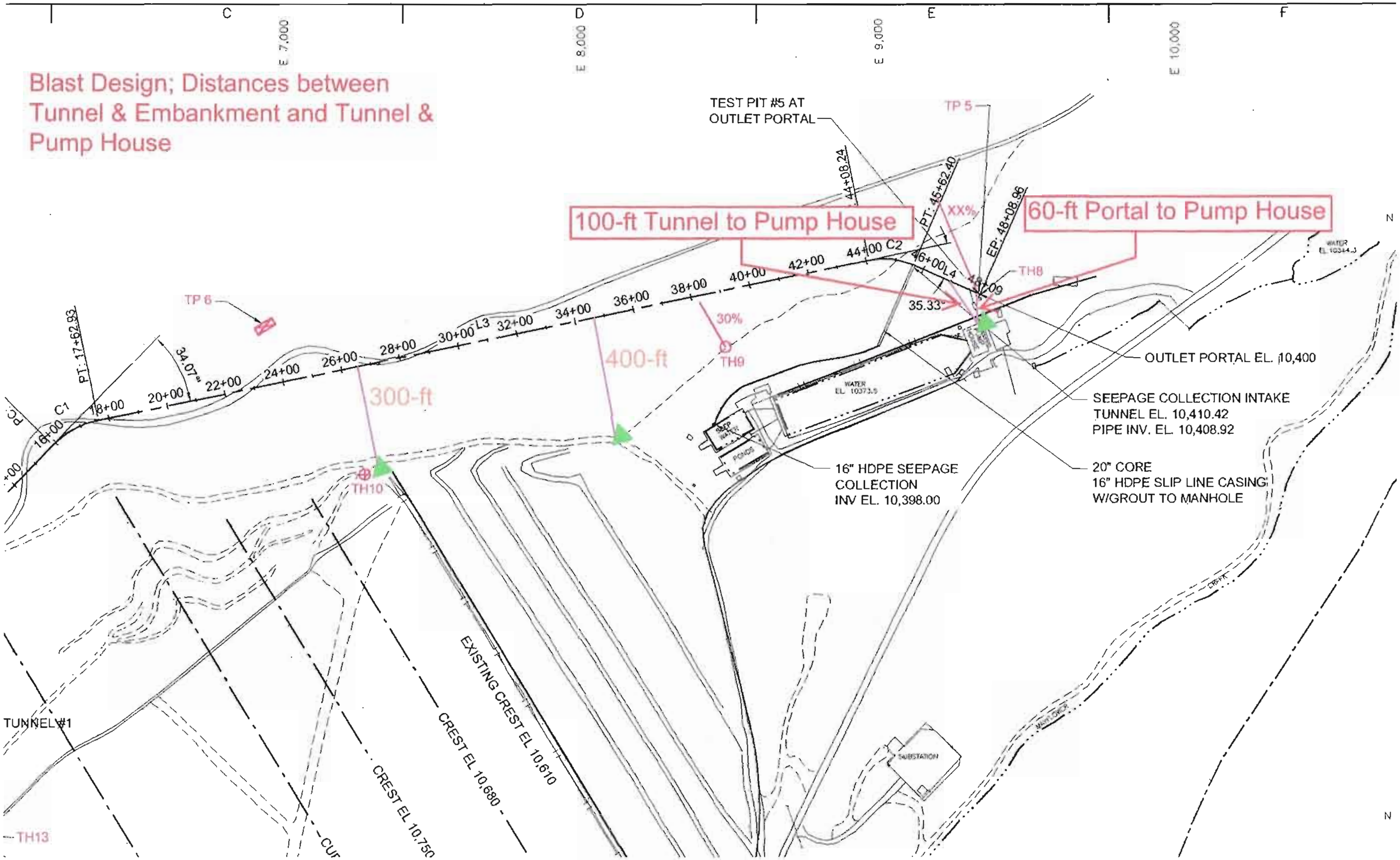
In summary, the blasting operations will produce vibrations that are significantly different then vibrations caused by an earthquake. Peak particle velocity is the appropriate measure for damage control and not acceleration. The pump house structure and the contact between the left abutment and the dam embankment has been selected as the critical locations for limiting vibration, based upon vibration decay with distance. Use of the OSM Scaled Distance equation will not provide enough blast energy to successfully fracture the rock. Vibration prediction methods (Oriard 1970, 1992) Figure 5, provide a reasonable method to estimate charge weight versus distance to critical locations. The critical charge weight was estimated to be 9 lbs/delay for a PPV of 2.0 ips at the pump house structure and the first 50-ft of the downstream tunnel. A typical tunnel blast round having a charge weight of 19 lbs/delay for tunnel blasting should easily stay within the OSM limits with minimal impact to the embankment. Downstream portal blasting will require some creative methods such as decking to maintain the vibrations within the limits desired, however, this effort is not unusual for the industry.

A series of test blasts (3 surface blasts and 2 tunnel rounds) should be part of the specifications for blasting on the Mayflower Dam Diversion Tunnel Project. This will confirm the assumptions in this assessment as well as allow the construction management team to assess the blasting contractor's practices at a safe distance from the embankment.

If you have any questions or concerns regarding this summary memo, please contact us.

Sincerely,
Rock Solid Solutions

Donald J Berger, PE
Project Engineer
(970) 987-2743



Blast Design; Distances between Tunnel & Embankment and Tunnel & Pump House
100-ft Tunnel to Pump House
60-ft Portal to Pump House
300-ft
400-ft
TEST PIT #5 AT OUTLET PORTAL
TP 5
TP 6
TH8
TH9
TH10
TH13
30%
XX%
OUTLET PORTAL EL. 10,400
SEEPAGE COLLECTION INTAKE TUNNEL EL. 10,410.42 PIPE INV. EL. 10,408.92
20" CORE 16" HDPE SLIP LINE CASING W/GROUT TO MANHOLE
16" HDPE SEEPAGE COLLECTION INV EL. 10,398.00
EXISTING CREST EL 10,610
CREST EL 10,680
CREST EL 10,750
TUNNEL #1
E 7,000
E 8,000
E 9,000
E 10,000

FIGURE 1

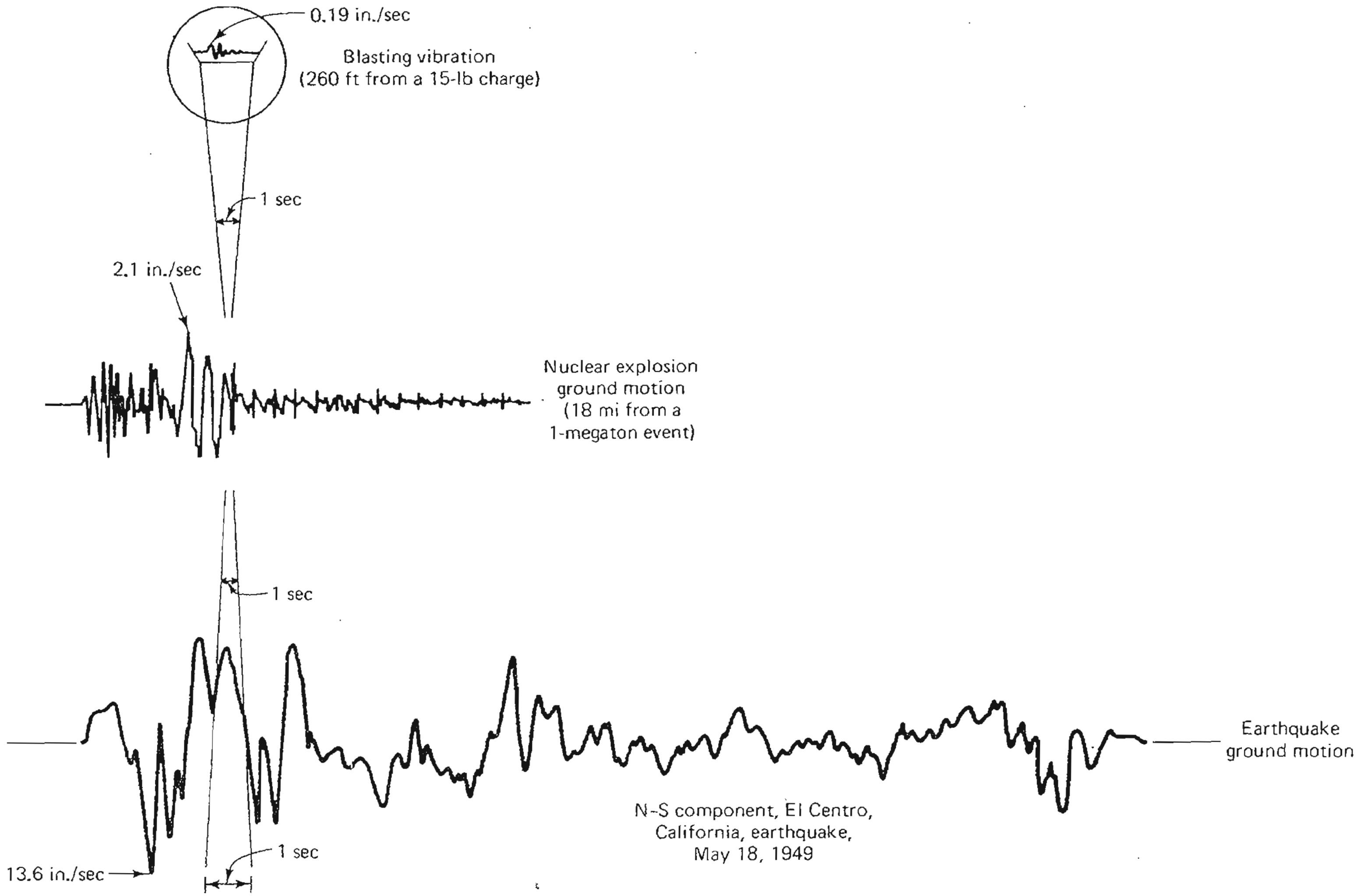


Figure 2-7 Blasting vibration compared to nuclear and earthquake motions.

FIGURE 2 DOWDING 1985

TABLE 1

COMPARISON OF VIBRATION PARAMETERS AT DIFFERENT FREQUENCIES					
ACCELERATION	FREQUENCY	VELOCITY	DISPLACEMENT	WAVE LENGTH SOIL (2000 fps)	WAVE LENGTH ROCK (10,000 fps)
0.12 g	0.1 Hz	75 in/s	120 in	20,000 ft	100,000 ft
0.12 g	1 Hz	7.5 in/s	1.2 in	2,000 ft	10,000 ft
0.12 g	10 Hz	0.75 in/s	0.012 in	200 ft	1,000 ft
0.12 g	100 Hz	0.075 in/s	0.00012 in	20 ft	100 ft
0.12 g	1000 Hz	0.0075 in/s	0.0000012 in	2 ft	10 ft
0.12 g	10,000 Hz	0.00075 in/s	0.000000012 in	0.2 ft	1 ft

* For conversion of units — in x 25.4 = mm and ft x 0.3048 = m

For sinusoidal motion:

Acceleration $a = 0.1\ f^2\ D$
Displacement $D = a / 0.1\ f^2$ (Also, $D = V / (2\ \pi\ f)$
Particle velocity $V = a\ (2\ \pi) / (0.1\ f)$ Also $V = 2\ \pi\ f\ D)$
Wave length = propagation velocity / frequency

In the following table, we see first those very long surface waves from a large earthquake at frequencies down to 0.1 Hz. The last item might represent very small blasting charges in a concrete wall or structural rock perimeter.

ORIARD 2003

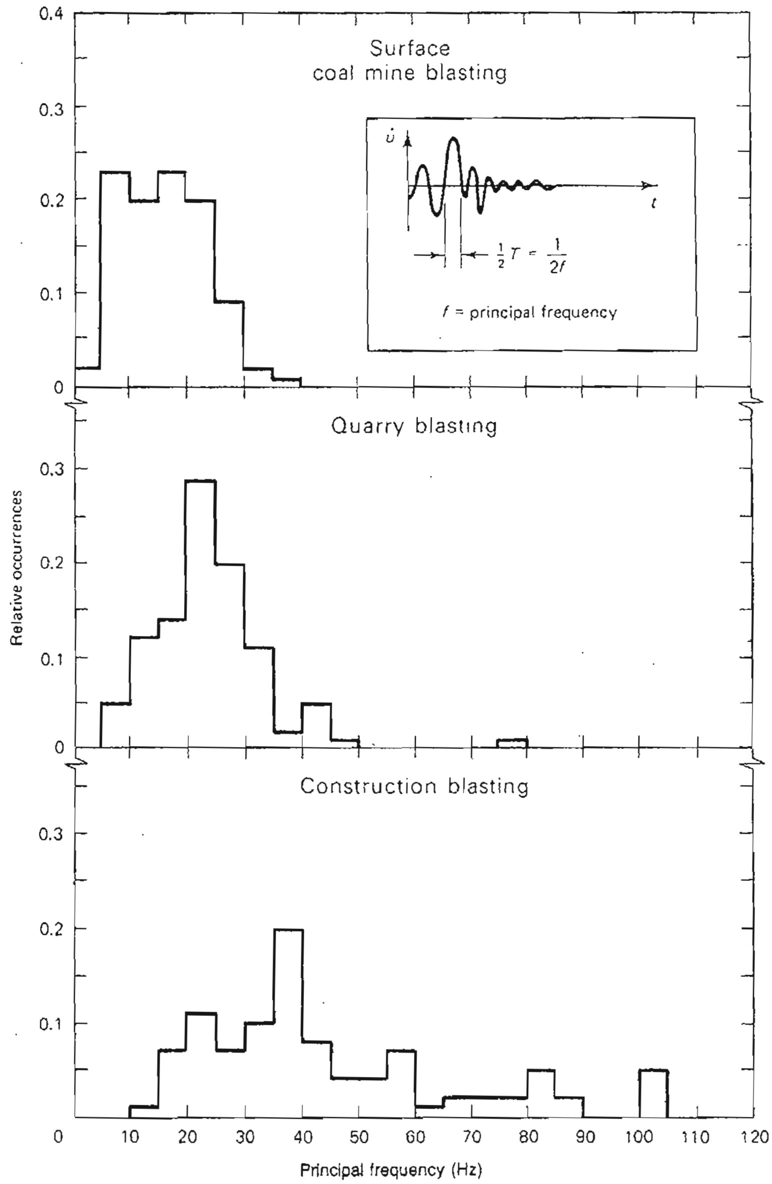


Figure 2-8 Predominant frequency histograms at structures of concern. (After Siskind, 1980b.)

TABLE 1B

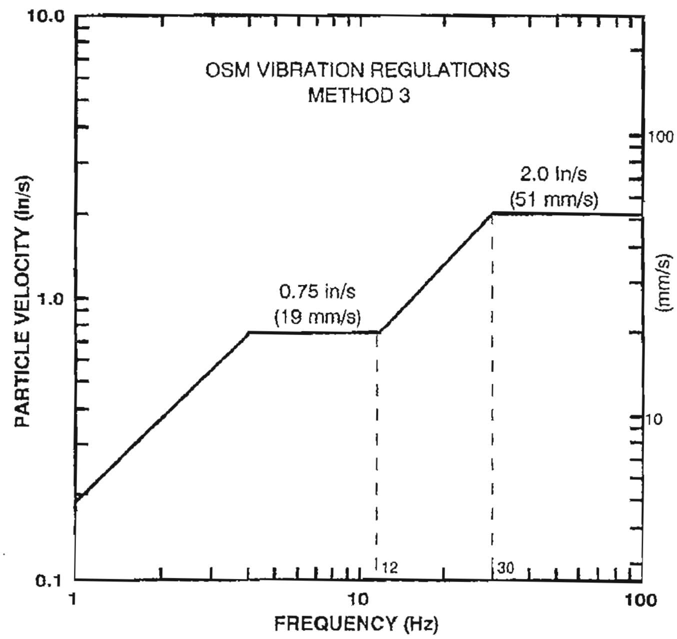
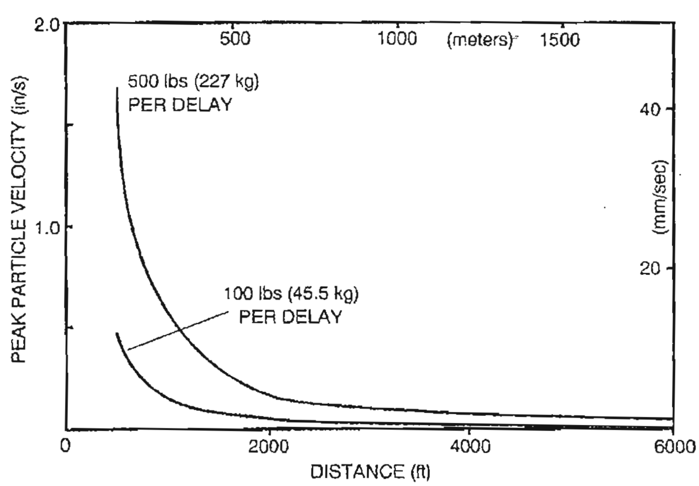


FIGURE 3



EXAMPLE OF DECAY OF VIBRATION INTENSITY WITH DISTANCE
PLOTTED ON A LINEAR GRAPH

Figure 38.2 – A typical vibration decay plotted as a linear graph of vibration intensity versus distance.

ISEE Blasters' Handbook™

FIGURE 3A

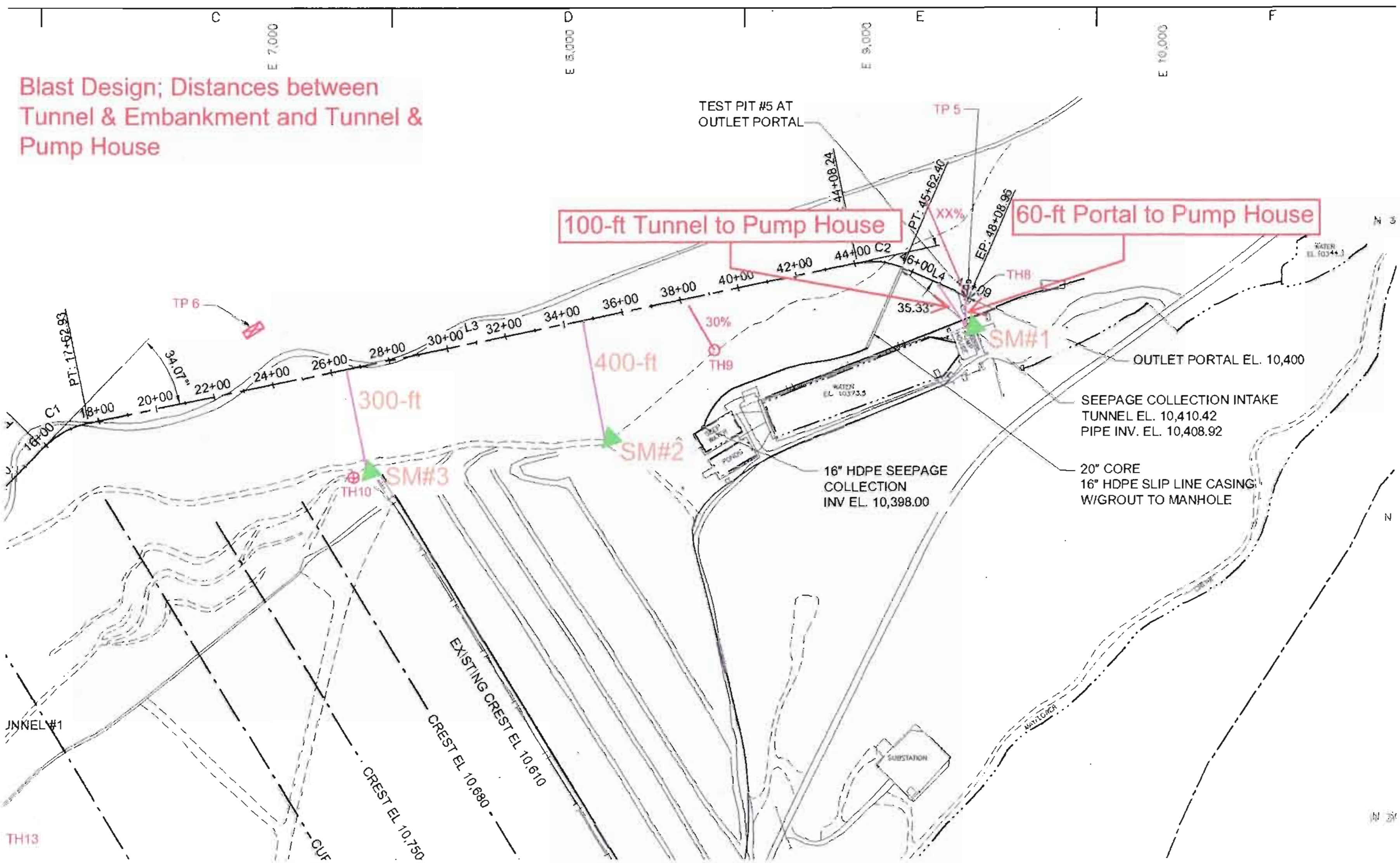
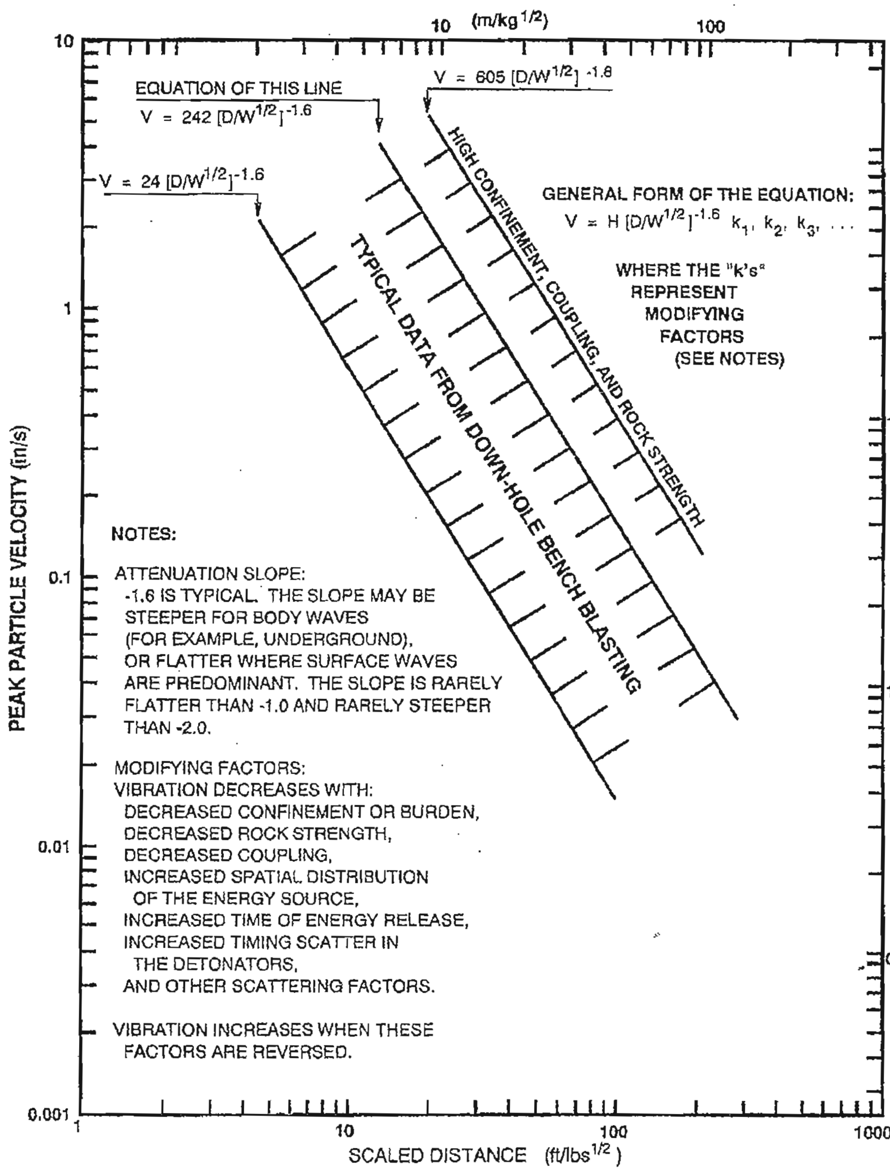

C
D
E
F
E 7,000
E 8,000
E 9,000
E 10,000
Blast Design; Distances between Tunnel & Embankment and Tunnel & Pump House
TEST PIT #5 AT OUTLET PORTAL
TP 5
44+08.24
PT: 45+62.40
EP: 48+08.96
XX%
100-ft Tunnel to Pump House
60-ft Portal to Pump House
TH8
TP 6
PT: 17+62.93
34.07°
C1
16+00
18+00
20+00
22+00
24+00
26+00
28+00
30+00
L3
32+00
34+00
36+00
38+00
40+00
42+00
44+00
C2
46+00
L4
35.33'
30%
TH9
300-ft
400-ft
SM#1
SM#2
SM#3
TH10
OUTLET PORTAL EL. 10,400
SEEPAGE COLLECTION INTAKE TUNNEL EL. 10,410.42 PIPE INV. EL. 10,408.92
16" HDPE SEEPAGE COLLECTION INV EL. 10,398.00
20" CORE 16" HDPE SLIP LINE CASING W/GROUT TO MANHOLE
EXISTING CREST EL 10,610
CREST EL 10,680
CREST EL 10,750
TUNNEL #1
TH13
SUBSTATION

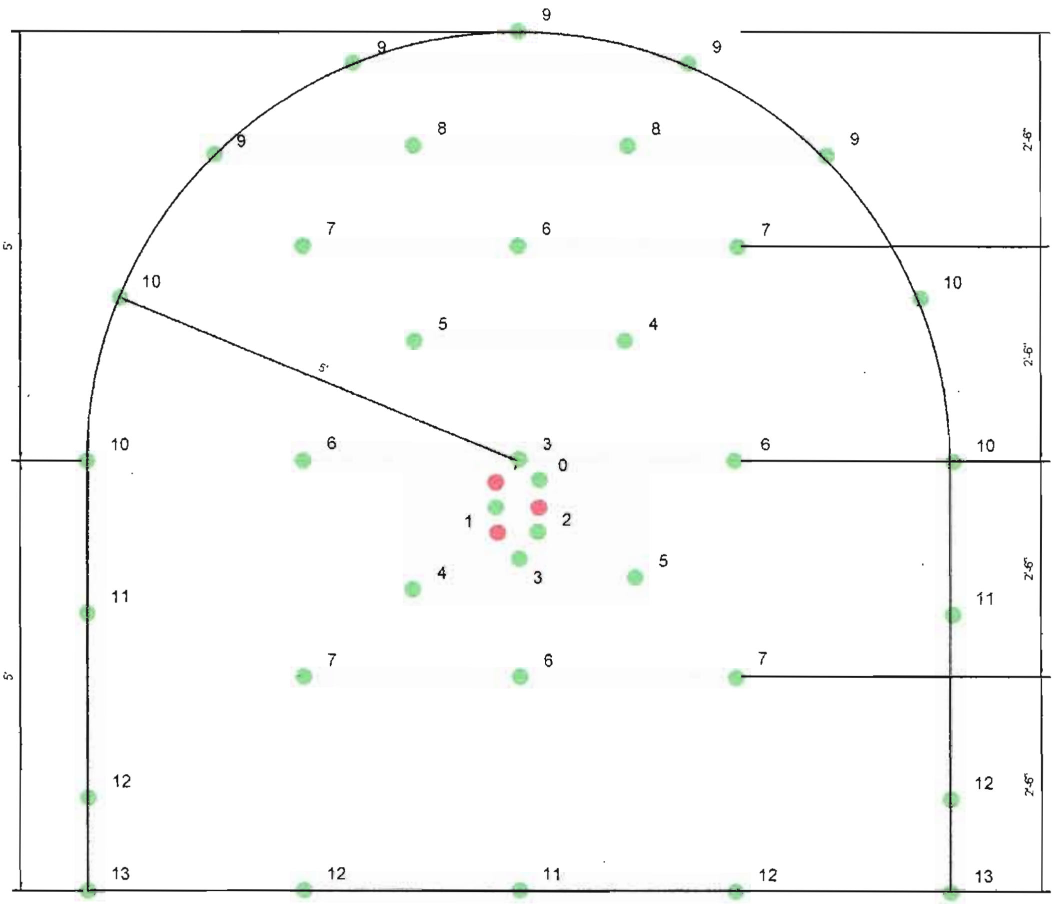
FIGURE 4



GROUND VIBRATIONS FROM BLASTING.
(ORIARD, 1970, 1992)

FIGURE 5

Typical Tunnel Blast 8-ft Round



- 2-inch Dia Blasthole, 8-ft Deep
- 2-inch Dia Relief hole, 8-ft Deep

3 Burn (Relief) Holes
5 Initiation Blastholes
14 Production Blastholes
5 Lifter Blastholes
13 Perimeter Blastholes
40 Total Drill holes/round 320BHF

Blasthole Loading Requirements
5 Initiation Blastholes (#1 thru #3)
  Load with 5 - 1 1/2" x 16" Sticks of Senatel Ultrex
14 Production Blastholes
  Load with 4 - 1 1/2" x 16" Sticks of Senatel Ultrex
5 Lifter Blastholes
  Load with 5 - 1 1/2" x 16" Sticks of Senatel Ultrex
17 Perimeter Blastholes
  Load with 5 - 1 1/4" x 16" Sticks of Power split

Delays (200ms per number)
& # Required

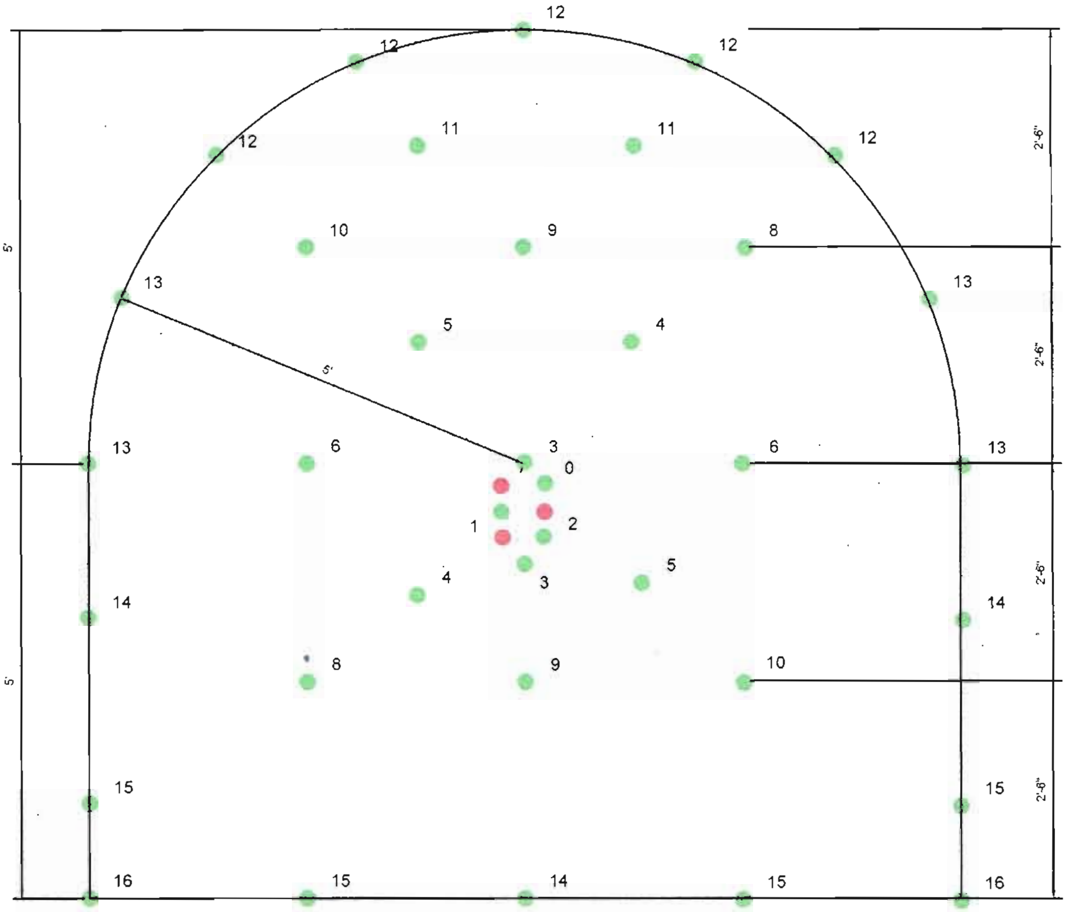
0	-	1	(0)
1	-	1	(500ms)
2	-	1	(800ms)
3	-	2	(1,100ms)
4	-	2	(1,400ms)
5	-	2	(1,700ms)
6	-	4	(2,000ms)
7	-	4	(2,300ms)
8	-	2	(2,700ms)
9	-	5	(3,100ms)
10	-	4	(3,500ms)
11	-	3	(3,900ms)
12	-	4	(4,400ms)
13	-	2	(4,900ms)

Total Time of Shot 4.9sec

Summary of Blasthole Loading Quantities
  106 Sticks of - 1 1/2" x 16" Senatel Ultrex or 121.9 lbs @ 1.15 lbs/stx
  85 - 1 1/4" x 16" Sticks of Power split or 33.15 lbs @ 0.39 lbs/stx
Powder Factor (139.3cf/ft @ 8-ft = 41.3cy/round) PF=(155.05 lbs/41.3cy) = 3.75 lbs/cy
Max lbs/delay = 18.4 lbs at Delays #6 & #7 (4 production holes each)

FIGURE 6

Modified Tunnel Blast 8-ft Round



- 2-inch Dia Blasthole, 8-ft Deep
- 2-inch Dia Relief hole, 8-ft Deep

3 Burn (Relief) Holes
5 Initiation Blastholes
14 Production Blastholes
5 Lifter Blastholes
13 Perimeter Blastholes
40 Total Drill holes/round 320BHF

Blasthole Loading Requirements
5 Initiation Blastholes (#1 thru #3)
Load with 5 - 1 1/2" x 16" Sticks of Senatel Ultrex
14 Production Blastholes
Load with 4 - 1 1/2" x 16" Sticks of Senatel Ultrex
5 Lifter Blastholes
Load with 5 - 1 1/2" x 16" Sticks of Senatel Ultrex
17 Perimeter Blastholes
Load with 4 - 1 1/4" x 16" Sticks of Power split

Delays (200ms per number)
& # Required

0 -	1	(0)
1 -	1	(500ms)
2 -	1	(800ms)
3 -	2	(1,100ms)
4 -	2	(1,400ms)
5 -	2	(1,700ms)
6 -	2	(2,000ms)
7 -	2	(2,300ms)
8 -	2	(2,700ms)
9 -	2	(3,100ms)
10 -	2	(3,500ms)
11 -	2	(3,900ms)
12 -	5	(4,400ms)
13 -	4	(4,900ms)
14 -	3	(5,400ms)
15 -	4	(5,900ms)
16 -	2	(6,500ms)

Total Time of Shot 6.5sec

Summary of Blasthole Loading Quantities
106 Sticks of - 1 1/2" x 16" Senatel Ultrex or 121.9 lbs @ 1.15 lbs/stx
68 - 1 1/4" x 16" Sticks of Power split or 26.5 lbs @ 0.39 lbs/stx
Powder Factor (139.3cf/ft @ 8-ft = 41.3cy/round) PF=(148.42 lbs/41.3cy) = 3.59 lbs/cy
Max lbs/delay = 9.2 lbs at Delays #3 thru #11 (2 production holes each)

FIGURE 7

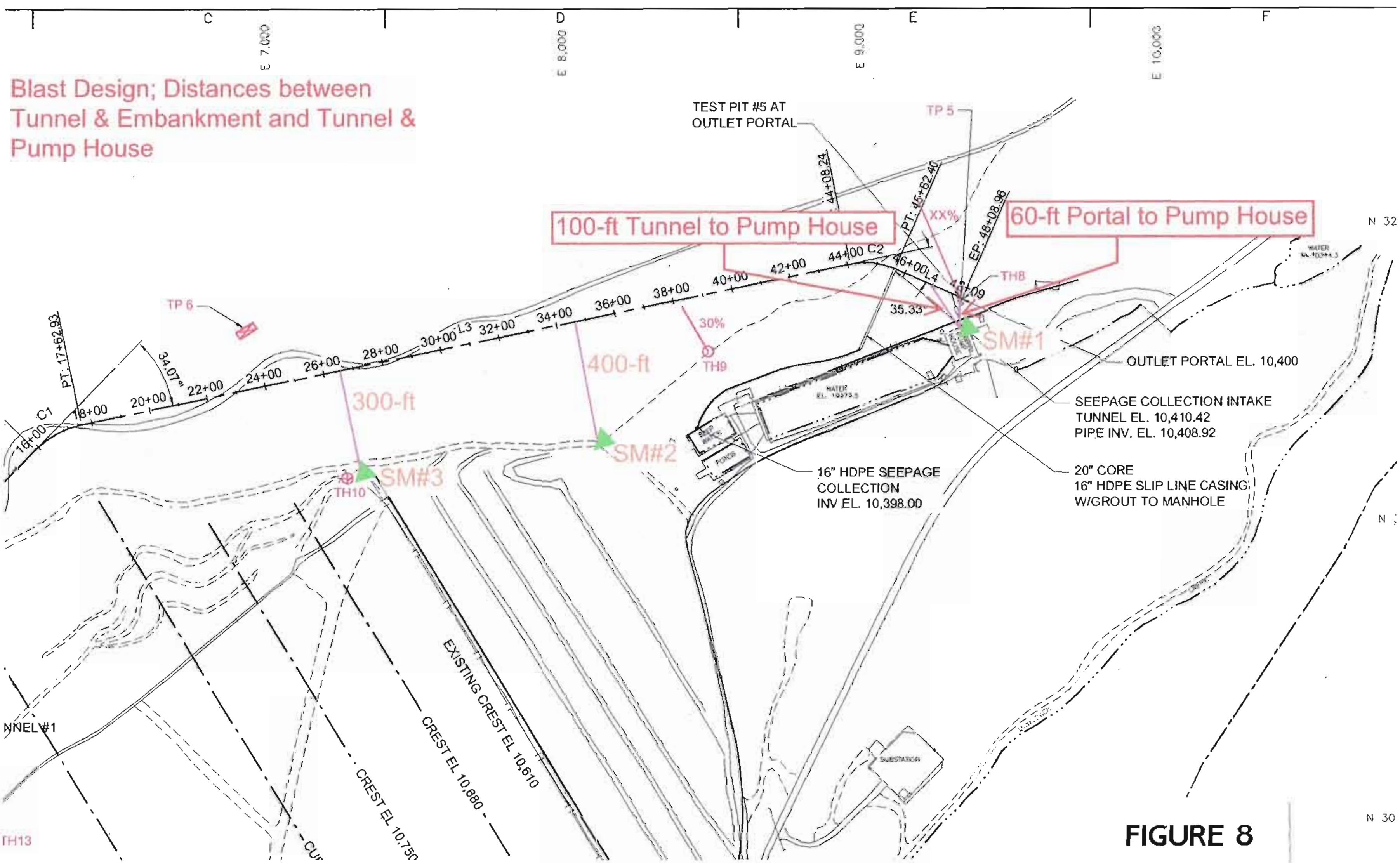

Blast Design; Distances between Tunnel & Embankment and Tunnel & Pump House
C
D
E
F
E 7,000
E 8,000
E 9,000
E 10,000
TEST PIT #5 AT OUTLET PORTAL
TP 5
100-ft Tunnel to Pump House
60-ft Portal to Pump House
XX%
44+08.24
PT: 45+62.40
EP: 48+08.96
N 32
TH8
35.33'
SM#1
OUTLET PORTAL EL. 10,400
SEEPAGE COLLECTION INTAKE TUNNEL EL. 10,410.42 PIPE INV. EL. 10,408.92
20" CORE 16" HDPE SLIP LINE CASING W/GROUT TO MANHOLE
16" HDPE SEEPAGE COLLECTION INV EL. 10,398.00
TP 6
PT: 17+62.93
34.07°
C1
16+00
18+00
20+00
22+00
24+00
26+00
28+00
30+00
L3
32+00
34+00
36+00
38+00
40+00
42+00
44+00
C2
46+00
L4
30%
TH9
300-ft
400-ft
SM#2
SM#3
TH10
EXISTING CREST EL 10,610
CREST EL 10,680
CREST EL 10,750
NNEL #1
TH13
SUBSTATION
N 30

FIGURE 8

ROCK SOLID SOLUTIONS

PROJECT: Mayflower Dam Diversion Tunnel

SUBJECT: Blast Vibrations Evaluation

PREPARED BY: DJ Bryan 1-29-12

PROJECT #

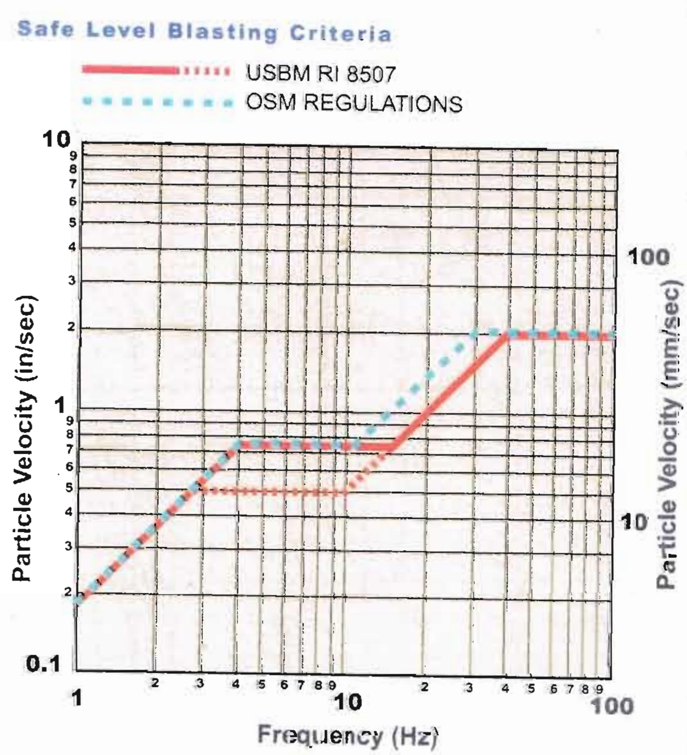
SHEET NO. 1 OF 1

CHECKED BY:

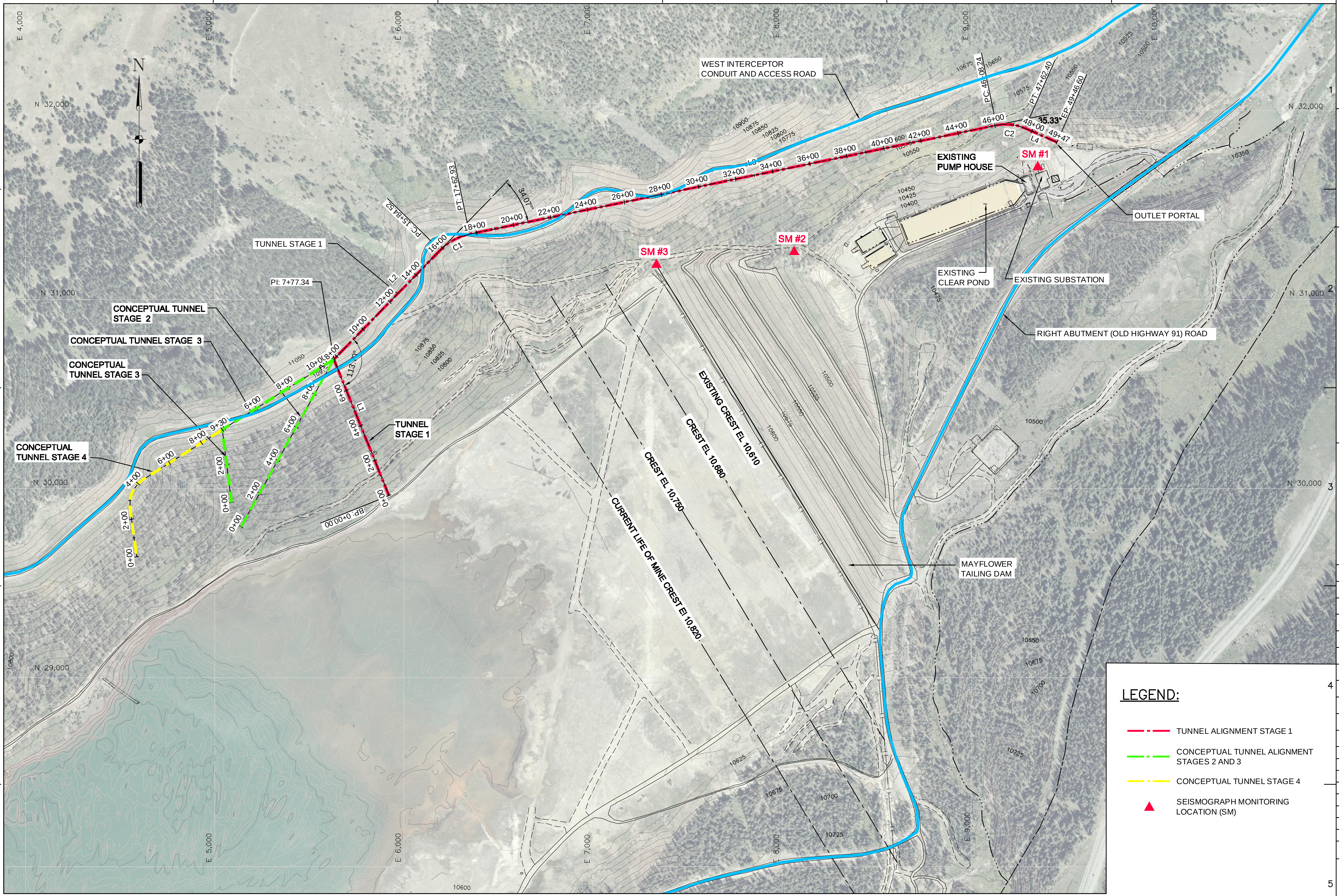
DATE:

John Sikora & Tiffany

Based upon the Blasting Constructibility Review I believe we should use the Industry Standard for Vibration Limits on the Mayflower Dam Diversion Tunnel Project. It appears that the standard limitations are not too restrictive and should be widely accepted by Contractors, Owners and Agencies.



Most of our vibrations should be greater than 20 Hz for this project and construction in general



LEGEND:

- TUNNEL ALIGNMENT STAGE 1
- CONCEPTUAL TUNNEL ALIGNMENT STAGES 2 AND 3
- CONCEPTUAL TUNNEL STAGE 4
- SEISMOGRAPH MONITORING LOCATION (SM)

PLAN VIEW

0 250 500 750

SCALE IN FEET

PRELIMINARY
NOT FOR CONSTRUCTION

URS

URS Center
8181 East Tufts Avenue
Denver, Co. 80237-2637
303 694-2770 (phone)
303-694-3946 (fax)

CLIMAX MOLYBDENUM COMPANY

MAYFLOWER FLOOD BYPASS TUNNEL SYSTEM

ISSUED FOR BIDDING ____ DATE BY

ISSUED FOR CONSTRUCTION ____ DATE BY

REVISIONS

NO.	DESCRIPTION	DATE
△	–	–
△		
△		
△		
△		

URS PROJECT NO:	22242752.00100
DRAWN BY:	WDH
DESIGNED BY:	DL
CHECKED BY:	–
DATE CREATED:	12/2011
PLOT DATE:	3/2/2012
SCALE:	AS SHOWN
ACAD VER:	2011

SHEET TITLE

SEISMOGRAPH MONITORING SYSTEM EXHIBIT

FIG. 1

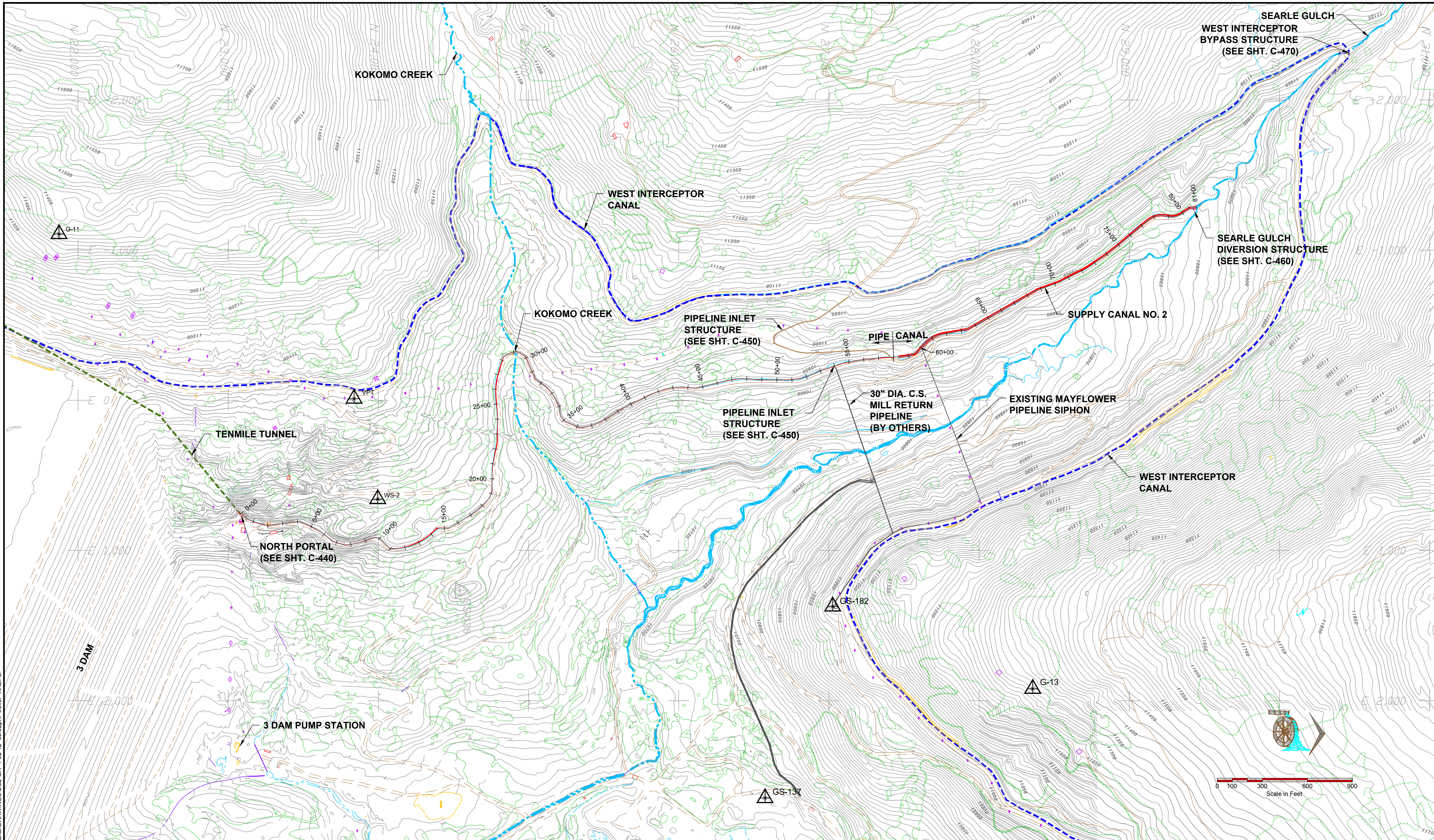
SHEET – OF

HOFER, WARREN D., 4/2/2012 12:57 PM

DRAWING PATH: N:\Projects\22242143_Climax_Mayflower_De\Sub_00\9.0_Constr_Design\Plan_Sheets\Tunnel\TUNNEL C-02 SEISMOGRAPH.dwg

APPENDIX C

RECLAIM WATER SYSTEM AND SUPPLY CANAL NO. 2 DRAWINGS



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Sheet No.	Drawing No.	Title

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Water Resources Engineers
3700 S. Inca Street | Englewood, CO 80110-3405
303-761-4130 | Fax 303-761-2802

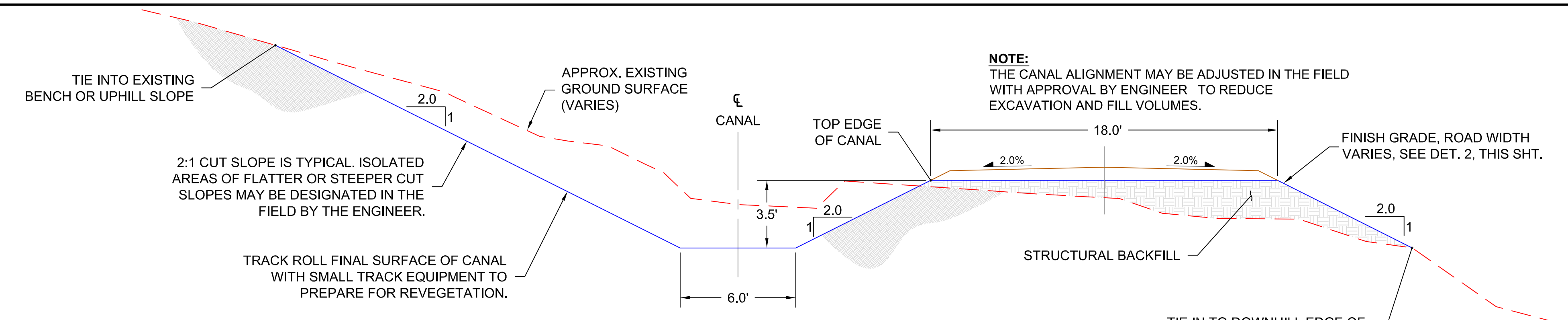
SUPPLY CANAL NO. 2
OVERALL SITE PLAN

CLIMAX MINE
CLIMAX, CO

Client: CLIMAX MOLYBDENUM COMPANY

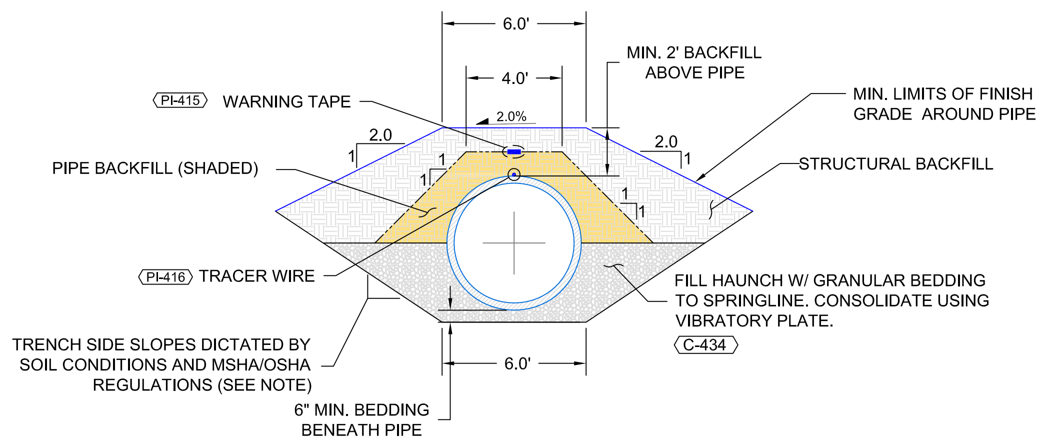
Design	TEM	3/12	Wheeler No. 1051.37
Drawn	TEM	3/12	Sheet No.
Check	MDS	3/12	
Plot Date 04/02/2012	B		Drawing No. 542-C-401

NOTE:
BASED ON TEST PIT DATA PROVIDED IN THE GEOTECHNICAL ENGINEERING STUDY BY KUMAR & ASSOCIATES FOR THE PDWTP (1-26-2012), MOST SOILS ALONG THE SUPPLY CANAL NO. 2 ALIGNMENT CAN BE CLASSIFIED AS TYPE B WITH OCCASIONAL AREAS OF TYPE C. OSHA 1926 SUBPART P APP B INDICATES THAT TRENCHES SHALL HAVE A MAXIMUM SLOPE OF 1H:1V IN TYPE B SOILS AND 1.5H:1V IN TYPE C SOILS. TRENCH SIDE SLOPES SHALL BE AS STEEP AS PRACTICABLE AND WITHIN OHSA REGULATIONS. TRENCH SIDE SLOPES FLATTER THAN 1.5H:1V ARE NOT ALLOWED WITHOUT JUSTIFICATION FROM THE CONTRACTOR AND APPROVAL FROM THE ENGINEER.

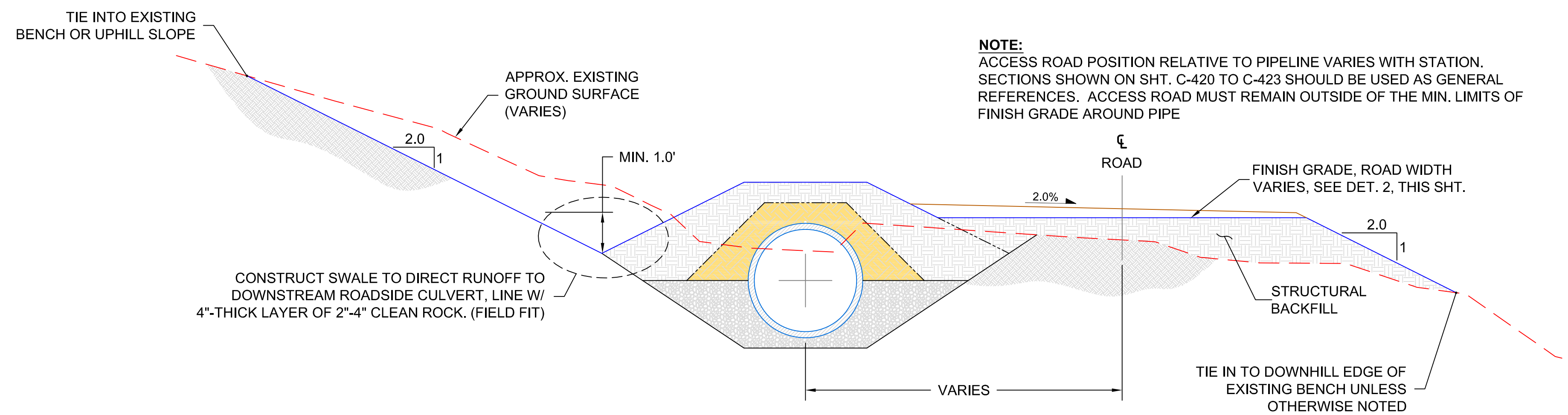


NOTE:
THE CANAL ALIGNMENT MAY BE ADJUSTED IN THE FIELD WITH APPROVAL BY ENGINEER TO REDUCE EXCAVATION AND FILL VOLUMES.

3 SUPPLY CANAL W/ ACCESS ROAD (STA. 58+00 TO END)
TYPICAL SECTION

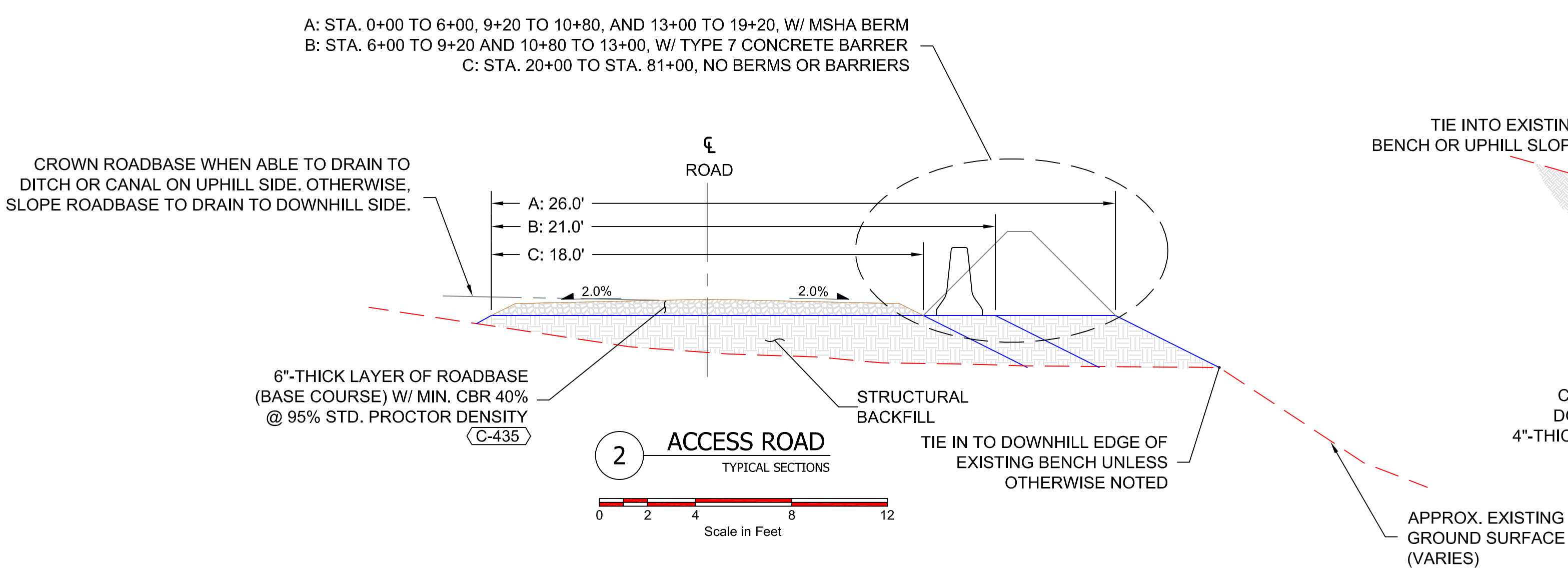


1 PIPE ZONE
TYPICAL SECTION

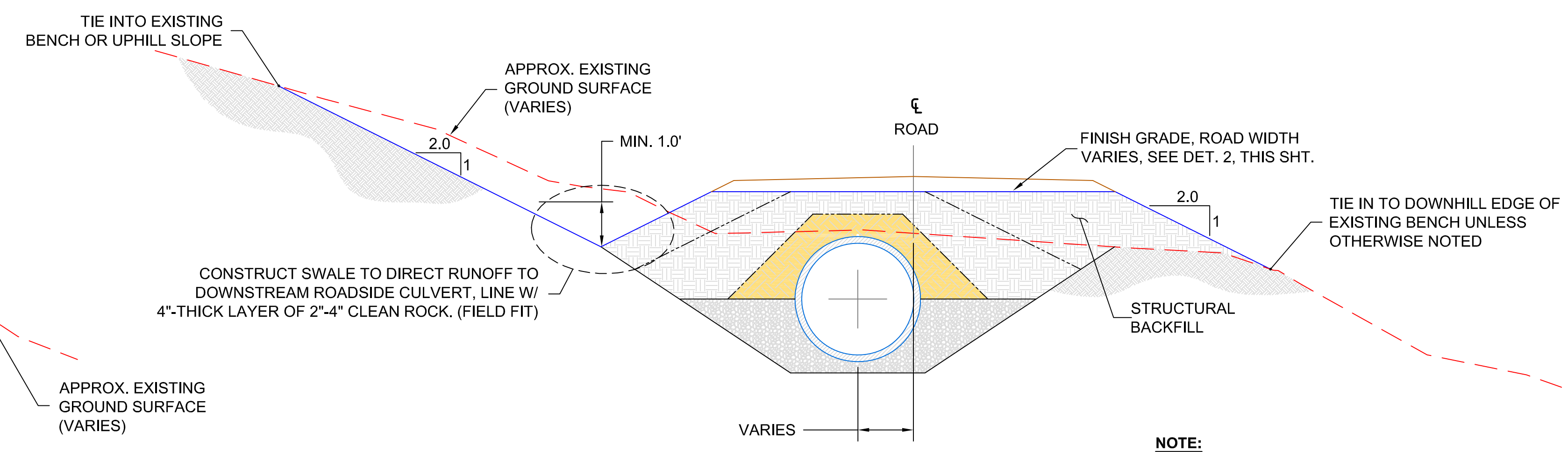


NOTE:
ACCESS ROAD POSITION RELATIVE TO PIPELINE VARIES WITH STATION. SECTIONS SHOWN ON SHT. C-420 TO C-423 SHOULD BE USED AS GENERAL REFERENCES. ACCESS ROAD MUST REMAIN OUTSIDE OF THE MIN. LIMITS OF FINISH GRADE AROUND PIPE

4 SUPPLY CANAL PIPELINE W/ ROAD ADJACENT (VARIES)
TYPICAL SECTION (N.T.S)



2 ACCESS ROAD
TYPICAL SECTIONS



NOTE:
SOME PIPELINE SECTIONS WILL BE PLACED UNDER ROAD TO AVOID LARGE FILLS BEYOND THE EXISTING CANAL TERRACE. THOSE SECTIONS IDENTIFIED BY THE ENGINEER ARE NOTED ON THE PLAN AND PROFILE DRAWINGS.

5 SUPPLY CANAL PIPELINE W/ ROAD ABOVE (VARIES)
TYPICAL SECTION (N.T.S)

R:\1000\1051\1051.37 Supply Canal\DRAWINGS\SC2-430 4-02-12 08:36pm mike XREFS:

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B	4/2/12	TEM	MDS	ISSUED FOR BID

REFERENCE

SHEET NO.	DRAWING NO.	TITLE
	C-410 TO C-415	PLAN AND PROFILE STA. (ALL)

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Water Resources Engineers
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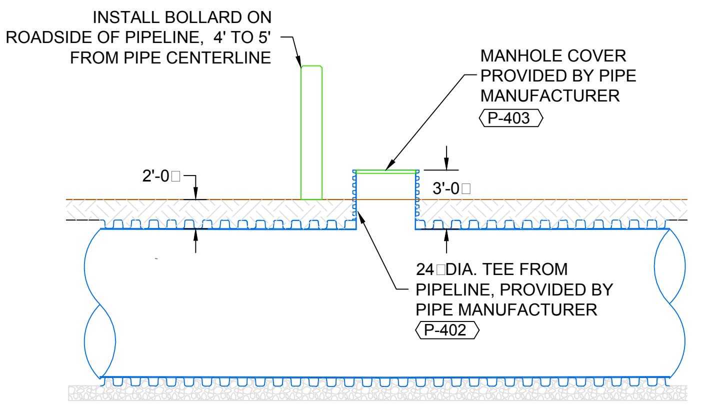
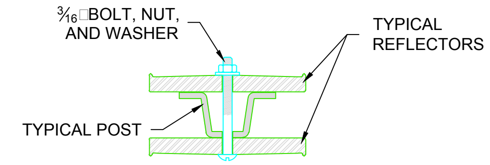
303-761-4130 | fax 303-761-2802

SUPPLY CANAL NO. 2
TYPICAL CANAL AND PIPELINE SECTIONS AND DETAILS

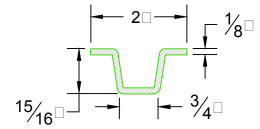
CLIENT			
CLIMAX MOLYBDENUM COMPANY			
DESIGN	TEM	3/12	WHEELER NO. 1051.37
DRAWN	TEM	3/12	SHEET NO.
CHECK	MDS	3/12	
PLOT DATE 04/02/2012	B		DRAWING NO. 542-C-430



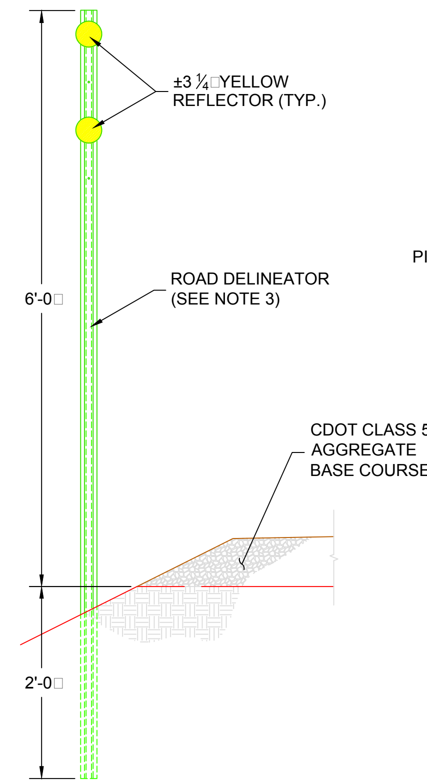
1 24" ACCESS MANWAY
TYPICAL PROFILE (N.T.S)



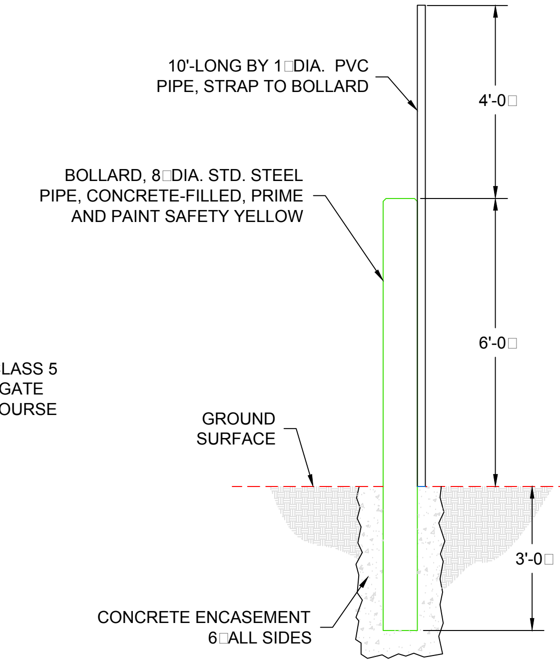
4 REFLECTOR
DETAILS (NOT TO SCALE) M-421



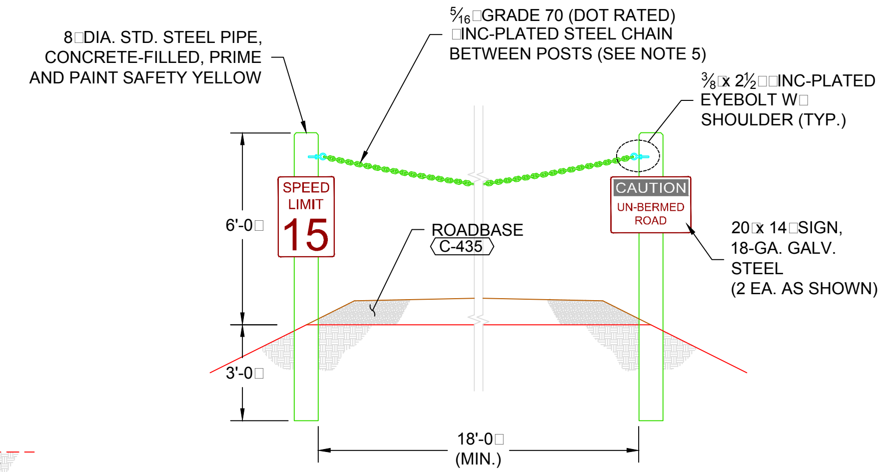
5 DELINEATOR POST
DETAILS (NOT TO SCALE) M-421



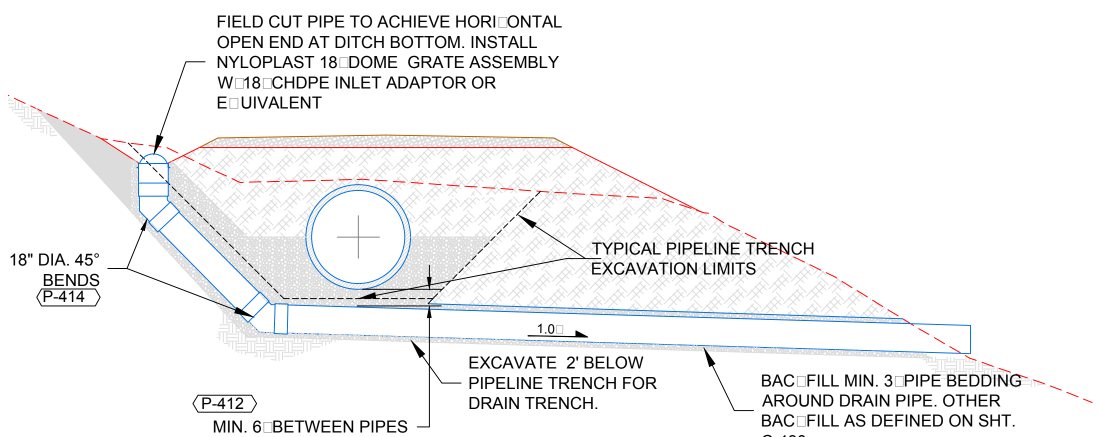
6 ROAD DELINEATOR
DETAILS (NOT TO SCALE) M-421



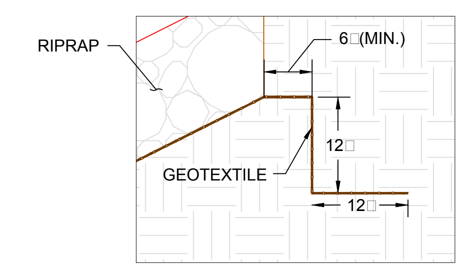
7 SAFETY BOLLARD
DETAILS (NOT TO SCALE)
M-422



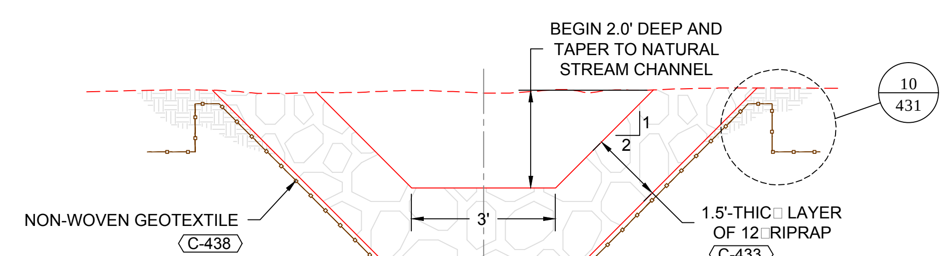
8 POST-CHAIN ROAD GATE
DETAILS (NOT TO SCALE)
M-420



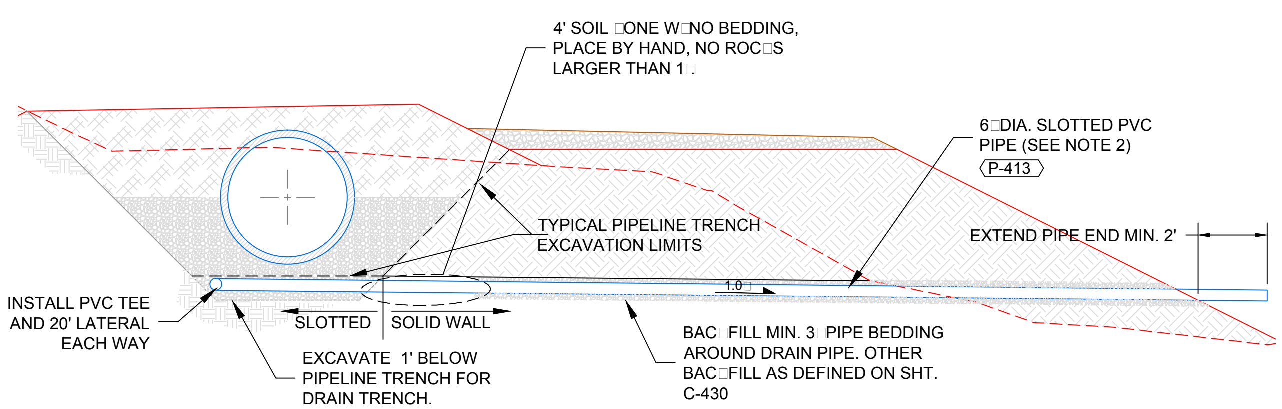
2 ROADSIDE CULVERT
TYPICAL PROFILE (N.T.S)



GEOTEXTILE ANCHOR 10/431
DETAL (N.T.S.)



9 CULVERT INLET AND OUTLET REVETMENT
SECTION (NOT TO SCALE)



3 TRENCH DRAIN
TYPICAL PROFILE (N.T.S)

NOTES:
1. INSTALL ROADSIDE CULVERTS AT APPROXIMATE 1000' INTERVALS ALONG PIPELINE ALIGNMENT. FIELD FIT UNLESS SPECIFIED ON PLAN DRAWINGS.
2. INSTALL TRENCH DRAIN AT APPROXIMATE 200' INTERVALS ALONG PIPELINE ALIGNMENT.
3. INSTALL ROAD DELINEATORS AT APPROXIMATE 100' INTERVALS ALONG ACCESS ROAD.
4. CONNECT CHAIN TO EYE BOLTS W□5⁄16□THREADED CHAIN CONNECTOR ON ONE SIDE AND PADLOC□ ON THE OTHER.
5. FIELD FIT CHAIN LENGTH TO ALLOW 12□TO 18□OF DROP MAXIMUM.

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REVISIONS

No.	Date	Made	Checked	Remarks
A	3/19/12	TEM	MDS	ISSUED FOR REVIEW
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REFERENCE

Sheet No.	Drawing No.	Title
	C-410 TO C-415	PLAN AND PROFILE STA. (ALL)
	C-430	TYPICAL CANAL AND PIPELINE SECTIONS AND DETAILS

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Water Resources Engineers
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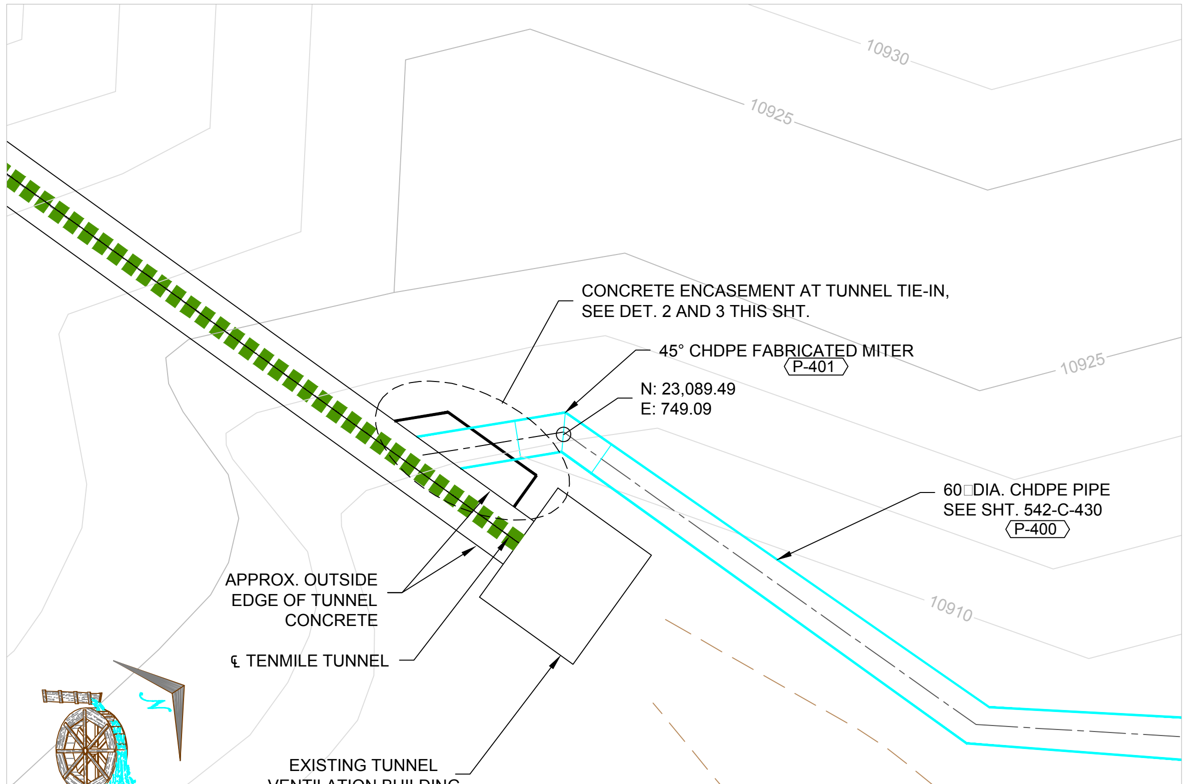
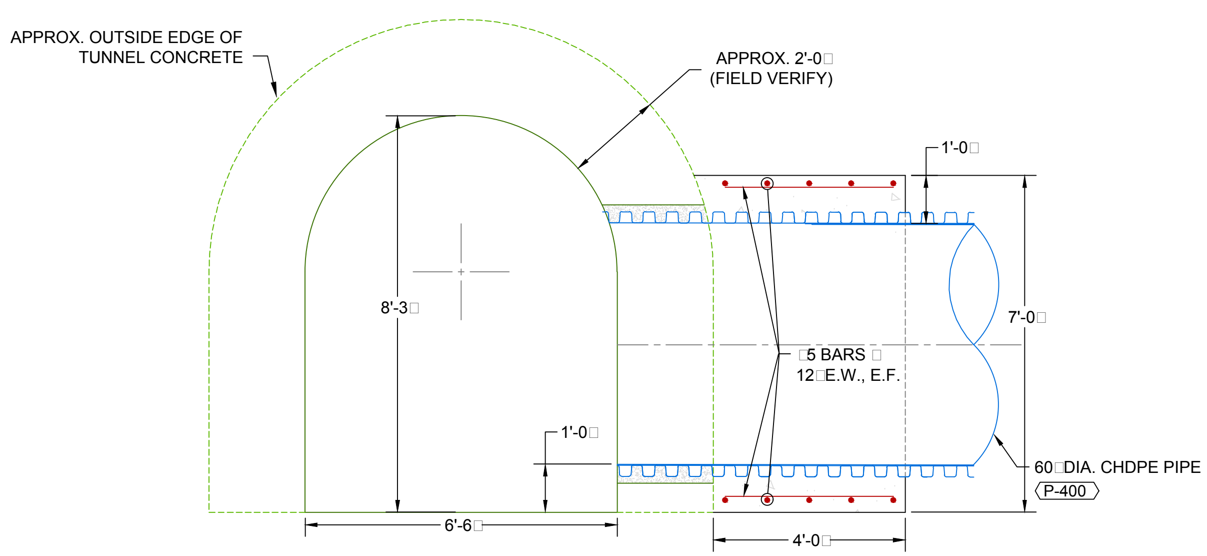
303-761-4130 | Fax 303-761-2802

SUPPLY CANAL NO. 2
MISCELLANEOUS DETAILS
CLIMAX MINE
CLIMAX, CO

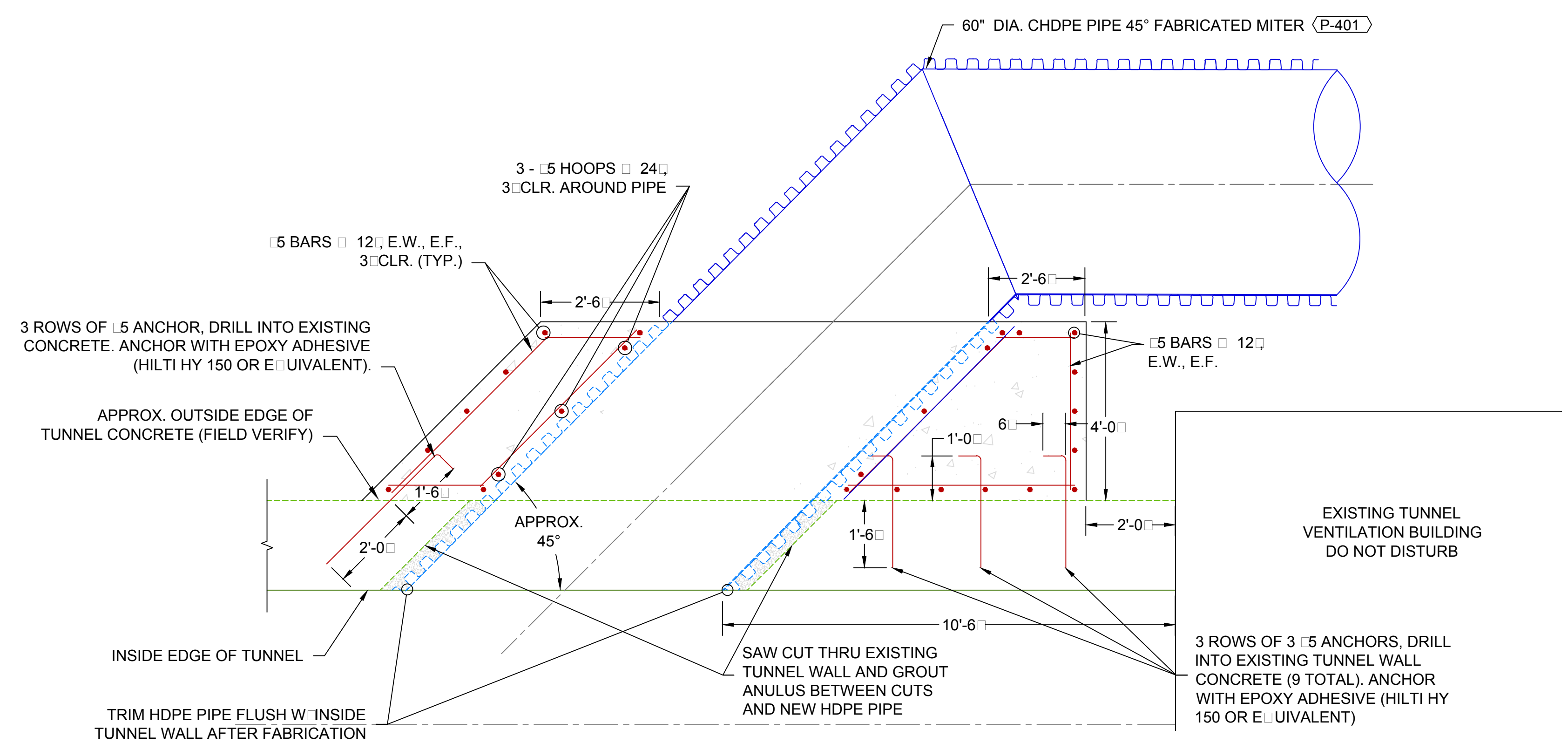
Client	CLIMAX MOLYBEDENUM COMPANY			
Design	TEM	3/12	Wheeler No.	1051.37
Drawn	TEM	3/12	Sheet No.	
Check	MDS	3/12		
Plot Date	04/02/2012	B	Drawing No.	542-C-431



1 TENMILE TUNNEL CONNECTION
PLAN VIEW



2 TENMILE TUNNEL CONNECTION
ELEVATION (NTS)



3 TENMILE TUNNEL CONNECTION
REBAR DETAIL (NTS)

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	C-430	TYPICAL PIPELINE AND CANAL SECTIONS AND DETAILS

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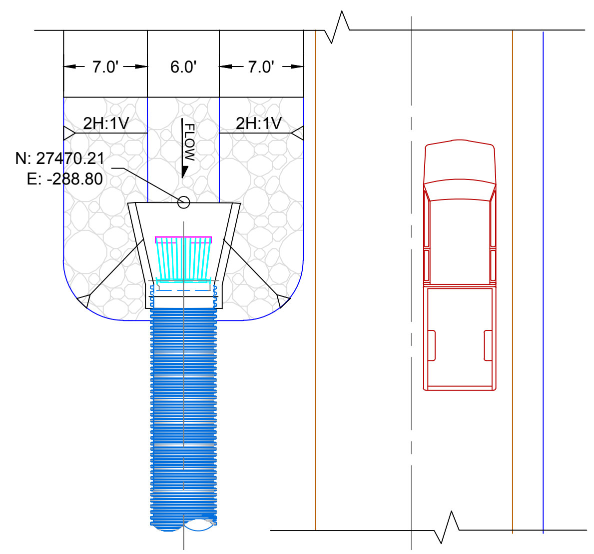
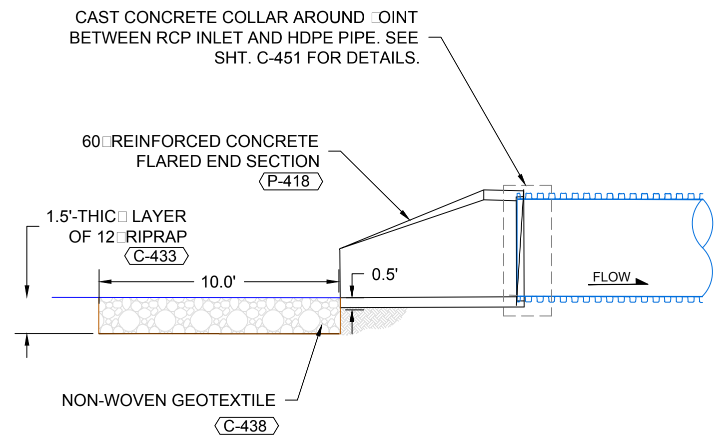
303-761-4130 | Fax 303-761-2802

SUPPLY CANAL NO. 2
TENMILE TUNNEL INLET STRUCTURE
CIVIL DETAILS
CLIMAX MINE
CLIMAX, CO

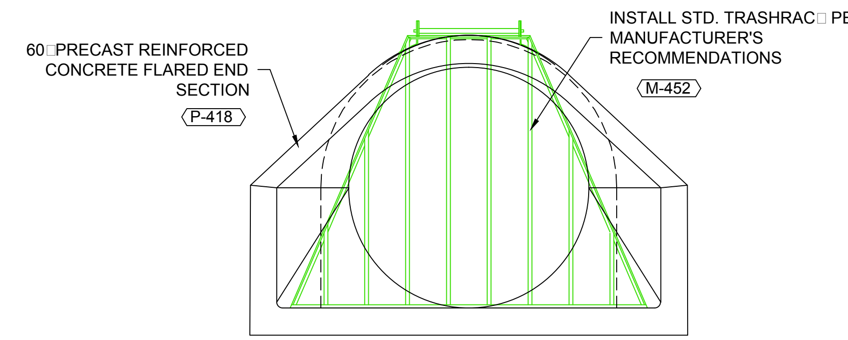
Client	CLIMAX MOLYBDENUM COMPANY		
Design	TEM	3/12	Wheeler No. 1051.37
Drawn	TEM	3/12	Sheet No.
Check	MDS	3/12	
Plot Date	04/2/2012	B	Drawing No. 542-C-440



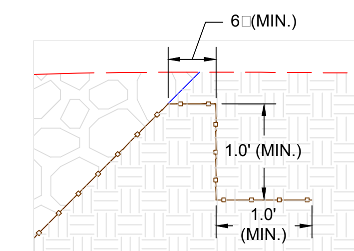
1 PIPELINE INLET
PLAN
0 4 8 16 24
Scale in Feet



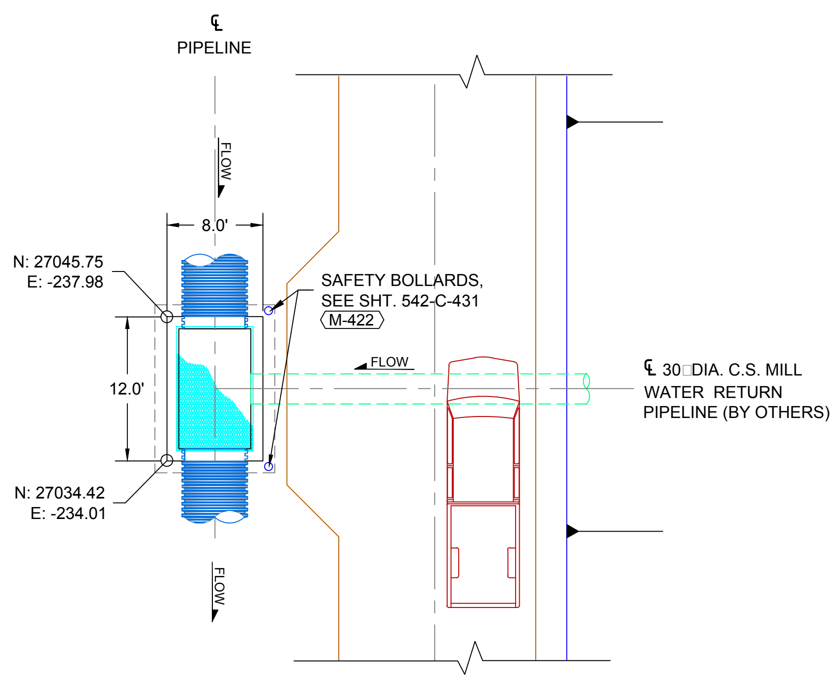
2 PIPELINE INLET PROFILE
ELEVATION (NOT TO SCALE)



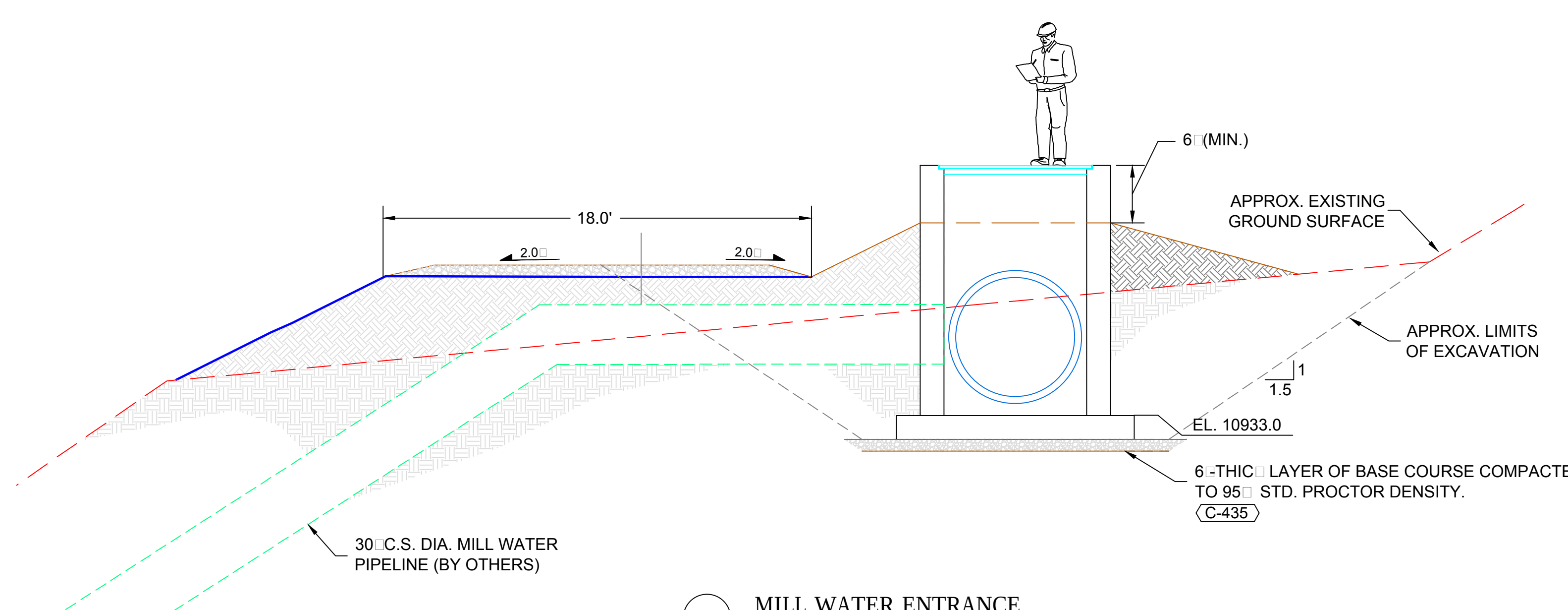
3 PIPELINE INLET
SECTION (NOT TO SCALE)



4 GEOTEXTILE ANCHOR
DETAIL



5 MILLWATER RETURN STRUCTURE
PLAN
0 4 8 16 24
Scale in Feet



6 MILL WATER ENTRANCE
PROFILE
0 2 4 8 12
Scale in Inches

R:\1000\1051\1051.37 Supply Canal\DRAWINGS\SC2-450 4-02-12 08:42pm trevor XREFS:

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REFERENCE

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303-761-4130 | FAX 303-761-2802

SUPPLY CANAL NO. 2
PIPELINE INLET STRUCTURE
CIVIL DETAILS
CLIMAX MINE
CLIMAX, CO

Client	CLIMAX MOLYBDENUM COMPANY		
Design	TEM	3/12	Wheeler No. 1051.37
Drawn	TEM	3/12	Sheet No.
Check	MDS	3/12	
Plot Date	04/02/2012	B	Drawing No. 542-C-450