Rico-Argentine Mine Site
Rico, Colorado

St. Louis Tunnel Adit Hydraulic Controls Work Plan

Atlantic Richfield Company
317 Anaconda Road
Butte, Montana 59701

July 2021

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ACRONYMS AND ABBREVIATIONS

amsl	above mean sea level
Atlantic Richfield	Atlantic Richfield Company
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CY	cubic yard
FCS	Flow Control Structure
ft	feet
gpm	gallons per minute

HDPE	high density polyethylene
IDF	interim drying facility
I&C	Instrumentation and controls
I/O	input and output
OSD	Optional Surface Ditch
P&ID	piping and instrumentation diagram
RAWP	Removal Action Work Plan
RTU	Remote Terminal Unit
SLT	St. Louis Tunnel
SPLP	Synthetic Precipitation Leaching Procedure
UAO	Unilateral Administrative Order for Removal Action
EPA	United States Environmental Protection Agency

1 INTRODUCTION & OBJECTIVES

This St. Louis Tunnel (SLT) Hydraulic Controls Work Plan (Work Plan) has been developed by Atlantic Richfield Company (Atlantic Richfield) in accordance with the Unilateral Administrative Order for Removal Action for the Rico-Argentine Site (Site), Docket No. CERCLA-08-2011-0005 (UAO) (EPA, 2011b) and Removal Action Work Plan (2011 RAWP) (EPA, 2011a) attached thereto. The response actions described in this Work Plan are intended to satisfy the requirements for implementation of "Task D – Hydraulic Control Measures for the Collapsed Area of the St. Louis Tunnel Adit" described in the UAO Removal Action Work Plan (2011 RAWP) (EPA, 2011a).

The SLT is an adit or tunnel, which connects and drains a complex network of interconnected mine shafts and tunnels. In approximately 1996, the opening of the SLT collapsed, restricting the free flow of water from the tunnel. Although the resulting soil and rock "debris plug" allows some water to flow out of the tunnel, an estimated 2.8 to 3 million gallons of water is currently impounded behind the debris plug(s) inside the tunnel. The permeability of the debris plug(s) is decreasing over time due to the accumulation of silts and clays in the soil/rock matrix. Hydraulic measurements within the SLT indicate the presence of two or more collapse features in the tunnel.

The implementation of an additional hydraulic control measure requires consideration of current real estate constraints, tunnel alignment, hydraulic containment risk, seasonal construction, operating requirements as well as the long-term objectives and full-scale water treatment for the Site.

This Work Plan includes the relief well design rationale, construction drawings, and additional supporting information for construction.

The objectives of the hydraulic controls as outlined in this Work Plan include the following:

1. Provide enhanced and redundant capacity in control of water levels within the SLT;
2. Minimize the potential for an uncontrolled release of adit discharge from the SLT;
3. Manage and convey flows to the full-scale Expanded Constructed Wetlands Treatment System; and
4. Provide metering of flow and maintain water quality for water treatment.

2 BACKGROUND

A series of adit and source water control investigations and hydraulic control alternatives were performed and evaluated pursuant to the UAO and 2011 RAWP. Interim adit hydraulic control measures in the form of two relief wells were implemented in accordance with the *St. Louis Tunnel Hydraulic Controls Interim Risk Reduction Measures Work Plan* (Atlantic Richfield, 2016a) to control water levels within the tunnel upgradient of the debris plug. The two relief wells (RW-2A and RW-2B) were drilled and installed in 2016. The current relief well system consisting of two relief wells (RW-2A and RW-2B) has been utilized since completion in 2016 to manage tunnel water level elevations behind the debris plug within the SLT. Additionally, the relief wells provide water quality data and head level measurements from a point in-by the inferred debris plug(s). The relief well capacity was originally designed to redundantly manage SLT discharge flows up to a 25-year recurrence period corresponding to an approximate flow rate of 1,250 gpm (based on modeling completed in 2015). However, in operation, the maximum functional capacity for each of the relief wells has been determined to range between 400-500 gpm due to variations with the actual completion and fouling that accumulates within the wellbores and piping. The remaining SLT flow not removed from the tunnel via the relief wells flows through the debris plug or is impounded within the SLT. The flow through the debris plug remains dependent on variables including water head levels behind the debris plug and the apparent permeability of the debris plug. Both permeability and flow through the debris plug follows a decreasing trend year-over-year, increasing the importance of the relief well system capacity for maintaining appropriate operating tunnel head levels (see Figure 1 and Figure 2). The water balance for the tunnel can be represented as:

> SLT In Flow [gallons per minute(gpm)] – SLT Out Flow (gpm) = Impounded SLT Water (gpm)

Assuming steady operating head levels measured at RW-2A and RW-2B without additional impounded water build up with the SLT, the total SLT flow can be represented as:

> SLT In Flow (gpm) = SLT Out Flow (gpm) = RW-2A Flow (gpm) + RW-2B Flow (gpm) + Debris Plug Flow (gpm)

In order to adequately determine future operational requirements that maintain appropriate operating head levels within the tunnel, the debris plug flow will be assumed to be zero gpm for scenarios including continued degradation in debris plug permeability and if future work tasks provide isolation of the debris plug flow and require 100-percent of total SLT flows to be managed through the relief well system. Currently, the total flow capacity of the relief well system is approximately 900 gpm. The total flow capacity is less than recently observed flows (refer to Figure 3) and less than the peak hydrologic model flows (AMEC Foster Wheeler, 2015; CEC, 2020). The peak SLT flows are typically observed in the months between May and July from a combination of runoff from mountain snowpack and seasonal precipitation. The highest demand for the design flow capacity is typically encountered during these peak flow months, which also coincide with Site access and corresponding work season.

The relief well system capacity and redundant flow paths are crucial parameters to perform maintenance tasks or improvements on the individual relief wells. Any maintenance task that requires a relief well to be taken offline could prevent the task from being completed due to the tunnel flow rate and required relief well flow capacity during that time. An additional flow path and increased system capacity will create improved flexibility to perform maintenance on the relief wells specifically during high SLT flows during the spring and early summer months. Overall, hydraulic control is improved with the corresponding improvement in overall relief well system flow capacity and redundancy in flow paths.

The anticipated requirements of the conceptual Expanded Constructed Wetlands Treatment System create additional considerations for flow paths and overall relief well system capacity. The relief well design includes a reduced distance for relief well flow to the conceptual Expanded Constructed Wetlands Treatment System inlet minimizing piping lengths and helps optimize system performance.

The additional relief well installed at a point in-by the current relief wells is expected to augment the understanding of actual conditions including additional collapses, water quality response, and volume of solids contained within the tunnel (see Attachment 1). A completion size larger than the current relief wells will improve the ability to deploy additional instrumentation and technology in the future to better understand conditions inside the tunnel.

The installation of the third relief well is intended to provide additional hydraulic control capacity and management of the hydraulic head within the SLT, without risk to the existing hydraulic control infrastructure. The increased capacity provides improved control and monitoring of head levels behind the debris plug(s) and helps to minimize the potential of an uncontrolled release from the SLT.

3 HYDRAULIC CONTROLS DESIGN CRITERIA

The design criteria listed within this section are intended to provide alignment for the desired objectives for the completed relief well with adequate operational control after implementation. The criteria for the design and implementation are integrated into the discussion sections and are as follows:

1. The implementation of the Work Plan will not temporarily or permanently increase the risk potential for SLT hydraulic failure or jeopardize current critical infrastructure. Adequate control of tunnel flow through current relief wells and the debris plug shall be maintained prior to and during implementation of the Work Plan.
2. The implementation of the relief well will improve system hydraulic control (capacity).
3. The implementation of the Work Plan is intended to align with the seasonal and Site conditions such that work could be temporarily interrupted without unnecessary consequence.
4. The Work Plan will provide flow paths to both the current demonstration-scale wetlands treatment systems as well as considerations to feed the full-scale Expanded Constructed Wetlands Treatment System.
5. The combined relief well capacity will meet or exceed the Expanded Constructed Wetlands Treatment System design capacity anticipated to be up to 1,250 gpm.
6. Surface infrastructure shall include component designs that allow maintenance and cleaning without significant flow disruption.
7. Remote monitoring and controls will be incorporated with the design that meet current data collection requirements as well as potential future requirements to automate controls.

3.1 Design Flow Capacity

The overall increased flow capacity with an additional relief well will, in part, provide improvements to operating conditions associated with water management and maintenance associated with the relief well system. The resulting increased flow capacity combined with an additional flow path will be utilized to help accomplish the following on-going tasks:

1. Allow one of the three relief wells be shut-in as required for maintenance or upgrades;
2. Improve data collection from a point further in-by current SLT collection points;
3. Maintain water level control within the SLT; and
4. Manage flows entering the current and future treatment system(s).

The current relief well system flow capacity of approximately 900 gpm is inadequate to handle peak flows observed since the relief wells installation in 2016 (see Figure 3) or for hydrologic model flows as represented in Figure 4 and listed in Table 1 below without relying on flow through the debris plug.

Table 1: *Hydrologic Model Pearson Type III - DR-3 Flow*

Recurrence Interval (years)	Pearson Type III (gpm)
5	1070
10	1150
15	1200
20	1230
25	1250
50	1340
75	1380
100	1410

The estimated flow capacity design requirements are listed in the tables below for (3) operating scenarios using output from the hydrologic model (CEC, 2020) for Pearson Type III 25-year recurrence modeled flow and assuming a 25% contingent flow reduction due to fouling. The tables below list the expected design capacity values for the indicated scenarios.

Table 2: *Normal Flow Capacity Scenario - Flow through RW-2A, RW-2B, and RW-3A*

Current Relief Well System Capacity (gpm)	Peak Anticipated SLT Flow (gpm)[1]	Flow Capacity Required (gpm)	Nominal Design Capacity (gpm)[2]
900	1250	350	450

Notes: 1) Peak anticipated SLT flow based on 25-year recurrence (CEC, 2020).
2) Required design capacity assumes 25% reduction for fouling.

Table 3: *Maintenance Flow Capacity Scenario - Flow through RW-2A and RW-3A*

Current Relief Well System Flow (gpm)	Peak Anticipated SLT Flow (gpm)[1]	Flow Capacity Required (gpm)	Nominal Design Capacity (gpm)[2]
400	1250	850	1070

Notes: 1) Peak anticipated SLT flow based on 25-year recurrence (CEC, 2020).
2) Required design capacity assumes 25% reduction for fouling.

Table 4: *Full Flow Capacity Scenario - Flow through RW-3A Only*

Current Relief Well System Flow (gpm)	Peak Anticipated SLT Flow (gpm)[1]	Flow Capacity Required (gpm)	Nominal Design Capacity (gpm)[2]
0	1250	1250	1570

Notes: 1) Peak anticipated SLT flow based on 25-year recurrence (CEC, 2020).
2) Required design capacity assumes 25% reduction for fouling.

The nominal design capacities listed for the scenarios above are designated as anticipated maximum flow requirements plus 25% excess flow capacity for fouling. Fouling reduces effective capacity of the final completion liner over time through normal operations. The final completion size for the relief well will include considerations for daily operations, fouling, average flow and low flow scenarios in addition to maximum flow requirements. There are some disadvantages of a larger diameter completion size that include increased construction requirements and drilling risks, lower fluid velocities, and expected increase in wellbore fouling. An increased fouling rate corresponds to increased cleaning and maintenance requirements that may overshadow benefits of a higher maximum flow capacity that a larger diameter completion provides.

The overall design strategy utilizes three flow modes (i.e., gravity, siphon, and pumping) that provide a flow capacity range to meet the example scenarios in Table 2, Table 3, and Table 4. The use of the three flow modes, specifically siphon and pumping flow for higher flow demand requirements, results in a more conservative final well completion diameter. The overall construction challenges are lowered, and daily operational concerns are alleviated with a more conservative design approach.

Corresponding design flow capacity calculations and corresponding output for optional casing and piping configurations are included in Attachment 4.

3.2 Well Completion Location & Elevation(s)

The current relief wells (RW-2A & RW-2B) were directionally drilled from their surface invert elevations with a negative slope to intercept the SLT. The surface invert elevations are approximately 8870.4 feet (ft) above mean sea level (amsl) and 8870.9 ft amsl for RW-2A and RW-2B respectively and correspond to an overall negative slope between -3° and -4°. The resulting intercept points between the relief wells and the SLT are 8856.8 ft amsl for RW-2A and 8856.2 ft amsl for RW-2B. The established operating head level envelope is currently between 8871 ft amsl and 8872 ft amsl (CEC, 2021). The invert elevations at 8870.4 ft amsl and 8870.9 ft amsl allow gravity flow for tunnel head elevations within the operating envelope and reach full pipe flow as the tunnel head elevations reach approximately 8871.1 ft amsl for RW-2A and 8871.5 ft amsl for RW-2B. Conversely, the tunnel head levels can be reduced below the wellhead invert elevation temporarily suspending flow in order to perform maintenance or replacement of the wellheads or installation of pre-constructed wellhouses without special equipment (i.e., dynamic sealing or retrievable packers) required to isolate flow to perform the tasks. Siphon flow can also be induced with the current wellhead setup across the operating range without tunnel head adjustments by utilizing the current wellhead configuration and a portable vacuum pump. Siphon flow can be utilized to lower the tunnel head levels below the gravity flow limits as needed for maintenance or to increase the overall flow rate through the relief wells within the SLT operating envelope. Considering the current operating parameters for RW-2A and RW-2B, a similar invert elevation for the additional relief well (RW-3A) would provide general operating synergies and reduce any complexities operating the wells at varying elevations. Flexibility would be retained to operate the wells within the operating envelope or at lower elevations utilizing siphon flow and/or an auxiliary centrifugal pumping equipment.

3.2.1 Invert Elevation

The proposed relief well (RW-3A) invert elevation will be located slightly lower than the current relief wells to take advantage of the increased flow capacity of the upsized completion at the lower limit of the operating envelope. The lower invert elevation will initiate full pipe flow for the larger completion in advance of the current relief wells. The larger surface casing and final completion size for the additional relief well will need to be considered in final drilling alignment as well as the final wellhead design in order determine the corresponding invert elevation. The current relief wells flow into MH-01 at an elevation of approximately 8865 ft amsl. The relief well flow and SLT daylight flow merge at a point above the Maelstrom Oxidizer located at MH-02 with an elevation of approximately 8850 ft amsl. The suggested invert elevation range provides adequate head drop between the wellhead and collection point for both gravity flow and siphon flow modes for the additional relief well.

The conceptual design for the Expanded Constructed Wetlands Treatment System provides additional considerations for the well invert elevation. An option for gravity flow operation is desired between proposed relief well invert to the Expanded Constructed Wetlands Treatment System inlet(s). Ideally, the relief well will gravity flow into the Expanded Constructed Wetlands Treatment System with the shortest feasible distance in efforts to reduce the amount of infrastructure required, frictional losses and maintenance requirements. The current concept for an upscaled water treatment system locates the system inlet within the Laydown Yard with an estimated inlet elevation of 8850 ft amsl. The proposed wellhead invert elevation would allow gravity and siphon flow options to the Expanded Constructed Wetlands Treatment System. The relief well location north of the current relief wells aligns with the future Expanded Constructed Wetlands Treatment System concept inlet and would provide the shortest overall distance for surface piping.

3.2.2 Intercept Location

The proposed SLT intercept for RW-3A is defined by the shortest well length that has an intercept point in-by the faulted zone and provides additional space for future hydraulic controls if needed. The intercept location evaluated for design is represented on Sheet G-1 and C-3B of Attachment 1. The proposed intercept location resulted in a well length of approximately 485 ft from surface and intercepts the SLT within the section of Hermosa sandstone believed to be relatively competent. The distance of the intercept location from the faulted zone located between station 4+35 and 4+65 is approximately 55 ft. The faulted zone is suspected of possible instability or additional collapse, which may cause some additional blockage at that point. The installation of a relief well in-by this location provides the opportunity to collect specific data to help assess the extent of a possible collapse in addition to avoiding the placement directly into a potentially compromised section of the tunnel (see Attachment 1 – Sheet C-3A).

The target intercept elevation is based on the mid-point between the SLT floor and ceiling as referenced by Attachment 2 - SLT Geometry Summary (Atlantic Richfield, 2017). The intercept elevations for current relief wells are located slightly higher than the estimated center point at 8856.2 ft amsl and 8856.8 ft amsl. The mid-point target at 8856.0 ft amsl provides the largest potential well path variance to intersect the SLT at the distance suggested.

Table 5: *Well Elevation Targets*

	Target	Minimum	Maximum	Range
Invert Elevation (ft amsl)	8869.5	8869.0	8870.0	+/- 0.5
Intercept Elevation (ft amsl)	8856.0	8855.0	8857.0	+/- 1.0
Expanded Constructed Wetlands Treatment System Inlet Elevation (ft amsl)[1]	8850.0	8845.0	8855.0	+/- 5.0

Notes: 1) Estimated based on preliminary Expanded Constructed Wetlands Treatment System conceptual design.

3.3 General Location, Access & Site Operations

The SLT alignment runs west to east into the base of Telescope Mountain with multiple crosscuts, drifts and adits to the north and south of the alignment. The current relief wells are located immediately north of the SLT flow channel and Flow Control Structure (FCS) and bordered to the west by the Soil Lead Repository. There is limited space surrounding the FCS and current relief wells for additional construction and heavy equipment access. Additionally, the Solids Repository is located immediately to the south of the FCS and bordered by the talus slope to the east that would require extensive dirt work and excavation. The talus slope is an inherently dangerous section of the Site due to periodic rock fall and avalanche potential and general instability for heavy equipment construction and excavation. The areas described near to and south of the current relief wells and south of the SLT are ruled out for construction of an additional relief well due to the risk and complexities associated with the points above and the likelihood of negatively affecting access or current infrastructure.

The area north of the Soil Lead Repository and current relief well access road has been determined to be the best option for relief well drilling pad construction and installation of an additional relief well with adequate space for new access and required relief well drilling pad dimensions (see Attachment 1 Sheet G-1, C-2A, and C-2B). Construction activities in this area would cause the least amount of interference with ongoing operations and current Site access. Additionally, the location selected for the wellhead installation provides the shortest distance for piping from the relief well to the future Expanded Constructed Wetlands Treatment System.

Standard operation of the Site will be maintained and coordinated with any additional construction work, and appropriate planning and considerations should be inclusive of this relief well work. Specifically, ongoing access and operational control of the current relief well system as well as the demonstration-scale wetlands treatment systems will need to be maintained during the proposed installation of the additional relief well. Additionally, access to the Soil Lead Repository must be maintained. The location proposed for the relief well north of the current relief well access would not require significant interruption to operations and maintenance activities.

3.4 Conveyance to Wetlands Treatment System

Designed flows from RW-3A will require operating considerations for (2) locations on-site: 1.) the current SLT flow collection for the Maelstrom Oxidizer at MH-02 and 2.) a future location inlet for the Expanded Constructed Wetlands Treatment System. The flowline will require a combination of both buried and above ground high density polyethylene (HDPE) piping sized for design capacity flow rates.

Routing of piping is shown on Attachment 1 Sheet C-2C and C-10. Pipe sizing calculations are included in Attachment 4. The RW-3A pipeline will route flows to the current collection point upstream of the Maelstrom Oxidizer until the future Expanded Constructed Wetlands Treatment System is completed. This pipeline will be ran on ground surface and covered so as not to impact the structural integrity of the Soil Lead Repository embankments. Additionally, the Expanded Constructed Wetlands Treatment System is intended to be constructed in the near term.

All piping will require cleanouts located where access is adequate for personnel and jetting equipment. These cleanouts are included in Sheet C-2C of Attachment 1.

3.5 Stormwater

Stormwater drainage paths will be incorporated into the drilling and final pad designs that will convey any surface water flows into existing stormwater control features on-site ultimately discharging to Pond 12. Any encountered waste rock will be managed as described in Section 4.4 and Section 7.2 such that stormwater will not be come into contact with waste rock. Primary flow paths include drainage on the north side of the relief well drilling pad that will flow along the access road and pass through the culvert at the bottom of the slope exiting into the Laydown Yard swale. Drainage for the south side of the pad will similarly be routed along the existing stormwater channel that follows the existing relief well access road. From the stormwater swales on the eastside of the Laydown Yard, the stormwater will follow the current route through the Site (see Attachment 1 – Sheet C-2A).

3.6 Well Completion Profile

The conceptual well profile for a 10-inch inner diameter (ID) final completion liner is represented in Attachment 1 – Sheet C-4D. The constant head level within the SLT requires a well design with long-term annular isolation through a combination of grouting and annular seals. The relief well design will incorporate concentric casing strings to improve overall success rate for the final desired completion diameter. The initial surface casing installation will be followed by primary and secondary intermediate casing strings to extend the cased hole section through potentially challenging bedrock and faulted sections to within a short distance from the final breakout point into the SLT. The extended intermediate casing strings will be drilled and cemented prior to breakout into the SLT providing a base wellbore with annular isolation and will also provide a smooth wellbore for the final liner installation with minimal open hole through bedrock. This method allows for full hydraulic isolation capability of SLT water while completing the boring and drilling into the reservoir.

The surface casing diameter will be sized appropriately to allow contingency for a secondary intermediate casing string if drilling conditions require, or if the primary intermediate string does not reach desired depth, or if the annulus is not effectively isolated.

A surface flow system and wellhead with flow control valving, redundant isolation and maintenance access is represented on Sheet C-6 and Sheet C-7 within Attachment 1. The wellhouse structure is required to enclose and protect the wellhead, backup electrical pump and associated components from conditions on-site including freezing temperatures and rock fall. A plan view for the wellhouse is shown on Sheet C-6. The wellhouse shall be sized to accommodate all the primary wellhead components including flange adapters, valving, and configured access port in addition to a flow meter with adequate straight runs before and after the meter as required by the manufacturer. Additional considerations for space inside of the wellhouse will include access for assembly/disassembly, maintenance, and inspections. An internal overhead hoist system will be required as an additional feature to provide adequate lifting compacity to move and install components within the wellhouse.

3.7 Electrical, Instrumentation, and Control

Electrical power and instrumentation will be installed or supplied to the final wellhouse and wellhead to provide climate control, data monitoring and controls. Permanent lighting fixtures will be installed in both modules of the wellhouse with emergency exit lighting at the doorways. Power receptacles will be installed with 120VAC/20amp ratings. An electric heater will be required to help minimize freezing potential within the wellhead components during winter months. The auxiliary electrical pump will be connected in parallel to the RW-3A wellhead to provide contingency and to supplement higher flow rates. The electrical pump(s) will require the largest power demand on the system and a power study will be completed after implementation and construction to verify system loads are as expected.

Instrumentation and controls (I&C) design meets requirements for collecting and monitoring in-well water level, flow rates and the status of the emergency pump among other parameters. Instrumentation and controls design include:

- Piping and instrumentation diagram (P&ID) naming all components and calling out relevant operating parameters like pump flow rate; and
- Control panel input and output (I/O) drawings labeling Remote Terminal Unit (RTU) landing points, wire numbers and instruments. The I/O drawings are sufficient to have the control panel fabricated from a manufacturer.

The electrical plan for the additional relief well is attached as Attachment 3 - RW-3A Electrical Design Drawings.

3.8 Design Life

All additional elements constructed or added to the hydraulic control system will be expected to operate up to 24 hours per day and 365 days per year. The functional life expectations for additional hydraulic control components are listed below. The components associated with the additional relief well will also require replacement and/or repair considerations.

Table 6: *Expected Functional Life for Well Components*

Component	Expected Functional Life (years)	Maintenance Option(s)
Well Completion	10-25	Repair
Wellhead	25	Replacement
Wellhouse	25	Repair/Replacement
Flowline / Piping	25	Repair/Replacement
Flow Meter(s)	3	Replacement
Valves	5	Replacement

Operations and maintenance of the relief well in a manner similar to existing relief wells are anticipated to lengthen the life and maintain the operational integrity of the relief well. The *Tunnel Relief Wells Water Management Operations and Procedures* (CEC, 2021) will be updated to include maintenance of the relief well in conjunction with the maintenance of the existing relief wells.

4 DRILLING PAD

The relief well completion design requires specific considerations for construction including sufficient space and stage elevations specified for the installation of vertical wells, drilling the horizontal well, and final pad completion for operation. In contrast to smaller directional rigs used for exploration on the Site in the past, the larger equipment capable of upscaled well completions will require a pad with minimum dimensions approximately 120 ft x 130 ft and with access suitable for tractor-trailer support equipment.

The area chosen for the relief well drilling pad and final completion infrastructure is located approximately 300 ft north of the existing RW-2B wellhead. This location was chosen due to accessibility, well alignment, and considerations for integration of flow conveyance to the Expanded Construction Treatment Wetlands system.

The following sections detail the access and pad design.

4.1 Site Access

Site access will be from the existing Site Access Road north of Rico from HWY 145 to the Site (see Attachment 1 – Sheet G-2). It is not anticipated that any improvements are required to support traffic to and from the Site aside from normal maintenance.

Primary and secondary access paths will be constructed to access the relief well drilling pad and reduce traffic thru the relief well drilling pad to minimize potential incidents related to equipment and vehicle movement. Primary access to the relief well drilling pad is anticipated from the north end of the Laydown Yard and secondary access will be constructed from the current relief well access pad from the south (see Attachment 1 – Sheet G-2). Construction of the pad will require an initial cut for installation of relief well drilling pad infrastructure (see Sections 4.2 and 4.3), a final cut for the drill rig set-up and installation of the relief well and fill of the final cut with compacted structural fill for final pad elevation and well infrastructure. The access roads will be maintained throughout the pad construction process.

4.2 Geotechnical Evaluation

The 2020 Test Pit Investigation (Atlantic Richfield, 2021a) revealed visual differences in subgrade materials and composite samples from the test pit excavation performed at the relief well drilling pad location. The observed soils from the three relief well drilling pad location test pits were generally similar in nature, consisting of a consistent mix of cobbles, gravels, sand, and clay. It was estimated in the field utilizing a hand loupe and field texture tests that this material contains fine material content ranging from 20-30% of total. Small pools of surface water were observed in the vicinity of test pits TP2020-01 through TP2020-03. The observed surface water is thought to originate from shallow groundwater seepage from the upgradient slope due to no recent precipitation events prior to test pit excavation. However, no water was observed in the bottom of the pits or along the sides of the test pit walls. All soils removed from the pits were observed to be less than saturated and did not contain free moisture.

A geotechnical slope stability analysis was performed for the upgradient slope surrounding the relief well and relief well drilling pad to determine the factor of safety for existing conditions and what changes to the phreatic conditions would meet a long-term factor of safety of 1.5. The analysis determined that the slope would require dewatering wells to reduce the phreatic surface to meet minimum applicable safety criteria.

Two options were analyzed for slope drainage and reduction of the phreatic surface:

- Vertical Wells: Drilled vertically into the alluvial aquifer and screened to full depth to convey slope seepage water from the colluvium to the alluvial aquifer, enhancing natural drainage; and
- Horizontal Wells: Drilled horizontally into the slope to intercept slope seepage water and convey it out the horizontal wells.

The selected slope drainage option is a vertical drain system (Vertical Wells) (see Attachment 1 – Sheet C-1A) utilizing approximately nine (9) 3-inch well casings spaced approximately 20 ft along the south and east perimeter of the relief well drilling pad dependent upon conditions observed and recommendations from the on-site geologist.

A slanted monitoring well and vertical test well will be installed prior to installation of the Vertical Wells. The slanted monitoring well will be utilized to monitor the phreatic surface prior to, during, and after Vertical Well installation. The vertical test well will be installed to confirm the location of the alluvium aquifer. The Vertical Wells will allow dewatering of the colluvium and reduction of the phreatic surface prior to the final pad cut and installation of RW-3A.

Additionally, a French drain system will be added to the east slope of the relief well drilling pad in order to mitigate potential seepage impacts to the relief well drilling pad. The French drain system installation is shown in Attachment 1, Sheet C-1A.

4.3 Phased Drilling Pad Construction

A phased construction approach will be utilized to transition between the different drilling pad elevation requirements for the various stages of construction including the Vertical Wells installation, RW-3A installation, and final completion pad infrastructure and relief well operation. (see Attachment 1 Sheets C-1A, C-1B, C-2A, C-2B, C-5A, and C-5B). The phased construction approach is summarized below:

1. Phase 1 – Relief Well Drilling Pad Prep and Slope Drainage
    a. Strip access road and the relief well drilling pad footprint. The target areas required for construction will be grubbed and stripped to provide initial access removing vegetation, large boulders, and topsoil.
    b. Access to install the Vertical Wells will include a cut to approximately 8868.5 ft amsl to provide access and a drilling pad for installation of the vertical drainage system.
    c. A slanted monitoring well will be installed to determine and monitor the phreatic water levels prior to, during, and after Vertical Well installation.
    d. A vertical test well will be installed to confirm the alluvium aquifer location prior to installing the Vertical Wells.
    e. A series of Vertical Wells will be installed upslope of the relief well pad to lower the phreatic water level in the slope.
    f. Cut to approximately 8863 ft amsl and install rig anchors and French drain system.
2. Phase 2 – Cut Relief Well Drilling Pad
    a. Cut to approximately 8858 ft amsl to complete the relief well drilling pad.
    b. Rig up drilling rig equipment and complete relief well installation.
3. Phase 3 – Completion Pad Construction

a. After RW-3A completion, the relief well drilling pad will be backfilled to approximately 8868.5 ft amsl in preparation for relief well wellhouse and piping completion.
b. The completion pad will be repaired from any equipment traffic as required and graded following installation of relief well infrastructure.

4.3.1 Phase 1 – Relief Well Drilling Pad Prep and Slope Drainage

Prior to relief well drilling pad excavation, the pad and access road footprints will be grubbed and stripped. Vegetation will be removed along with any rocks and boulders on the surface. Vegetation will be placed in a roll-off bin and disposed of off-site. Rock will be stockpiled in the rock stockpile in the Laydown Yard for potential future Site use. If topsoil and/or organic material is present in the relief well drilling pad and access road footprints, this material will be stripped with heavy equipment until only colluvium material is present on the surface. The topsoil/organic material will be stockpiled in a separate stockpile. The relief well drilling pad and access road footprint is shown in Attachment 1 – Sheet C-1A and stockpile locations are shown in Attachment 1 – Sheet C-2A.

Following grubbing and stripping, the pad area will be cut to provide access and a drilling pad for installation of the slanted monitoring well, vertical test well, and Vertical Wells. The access bench will be cut at an approximate elevation of 8868.5 ft amsl.

A slanted monitoring well, vertical test well, and Vertical Wells will be installed. The slanted monitoring well will be installed prior to the Vertical Wells to confirm water production and phreatic conditions. The slanted monitoring well will be equipped with a pressure transducer connected to the Site telemetry system to allow for continuous monitoring.

The vertical test well will be installed prior to the Vertical Wells to verify presence of the alluvial aquifer (see Attachment 1 – Sheet C-1A). In the unlikely event the aquifer is not encountered, then an optional contingency design will be explored to install either horizontal or slanted slope drainage wells.

After reviewing data obtained from the vertical test well and the slanted monitoring well, the Vertical Wells will be installed and screened to full depth to convey seepage water from the colluvium towards the alluvial aquifer, enhancing natural drainage and pulling the entire phreatic surface down, enhancing overall slope stability. The Vertical Wells will be spaced at approximately 20 ft along the northeast and east perimeter of the relief well drilling pad (see Attachment 1 – Sheet C-1A). A 3-inch casing will be installed for each Vertical Well.

Following installation of the slanted monitoring well, vertical test well, and Vertical Wells, precast concrete barriers will be installed along the northeast and east sides of the cut at approximately 8868.5 ft amsl surrounding the Vertical Wells and relief well drilling pad providing protection from rock fall and sloughing.

The relief well drilling pad and rig anchor system will require elevations specified for the drilling rig dimensions such that the drill rig rotary drive is aligned with the target centerline of 8870 ft amsl for the wellbore. The intermediate cut elevation for installation of the rig anchor system is approximately 8863 ft amsl.

The rig anchor system will be installed utilizing a sonic drill rig on the southeast side of the relief well drilling pad specific to the drill rig geometry, torque, snub and pull forces required for horizontal drilling. Lagging and a French drain will be installed on the upslope side of the anchors as referenced in Attachment 1 - Sheet C-1B. Following the installation of the retaining wall and the French drain, the area behind the retaining wall will be backfilled as shown in the Slope Drain detail on Sheet C-1A.

4.3.2 Phase 2 - Cut Relief Well Drilling Pad

The relief well drilling pad will require excavation and backfill to meet required size and elevation requirements specific to the drilling equipment. The relief well drilling pad will be approximately 120 ft x 130 ft at an approximate elevation of 8858 ft amsl as shown in Sheet C-1a of Attachment 1.

The drill rig will be spotted precisely in accordance with the specified well alignment as shown in Attachment 1. The relief well drilling pad elevation and inclination will be adjusted as required to meet drill rig elevation and alignment specifications prior to drilling operations. More information on the drilling execution is found below in Section 5.

4.3.3 Phase 3 - Completion Pad Construction

The relief well drilling pad will be modified to accommodate installation of the operating infrastructure including wellhead components, wellhouse, and flowline after drilling and completion of RW-3A. The relief well drilling pad will be backfilled from approximately 8858 ft amsl to approximately 8868.5 ft amsl as shown in Attachment 1 – Sheet C-5A. The backfill of the final pad shall include lifts of no more than 12-inches with 95% compaction using general fill up to approximately 8864.5 ft amsl. Fill used from 8864.5 to 8868.5 ft amsl shall be screened structural fill with less than 8% No. 200 sieve material for the 48-inch frost depth design criteria for the Rico area. Final foundation for the wellhouse pad is noted on Sheet C-8 of Attachment 1 along with additional details for pad completion as required by the manufacturer are noted. The final pad and access road will need to be graded and prepped for crane and low boy tractor trailer equipment access.

The final pad surface grading will be completed after the RW-3A wellhouse and associated infrastructure is installed. Final pad completion will include any repair or maintenance required from the previous equipment traffic and complete stormwater controls in accordance with the current stormwater management plan for the Site.

4.4 Earthworks Management Plan

The various phases reference above for the relief well drilling pad and access roads will be constructed in previously disturbed material containing colluvium, general fill, and potentially waste rock. Based on results of the Test Pit samples (Atlantic Richfield, 2021a), soils excavated from this area can be reused as engineered backfill. Currently, two stockpiles within the north laydown area are used for storage of general fill and rock (see Attachment 1 – Sheet G-1). Cut materials meeting the criteria of general fill will be placed in the general fill stockpile. Rocky materials will be placed in the rock stockpile. Excavated general fill material may need to be screened with a grizzly in order to remove oversized material. A 6-inch static rock screen (i.e., rock grizzly) will be used to screen material prior to utilization as relief well drilling pad backfill. Oversized material will be segregated and placed in the rock stockpile in the Laydown Yard for future Site use.

All backfill material will be placed in 12-inch lifts or less and compacted to meet 95% compaction criteria.

Stockpiles will be located at the designated locations shown on Attachment 1 - Sheet G-1. If stockpiling is required at additional locations, locations will be selected that will not impact access roads and/or critical infrastructure. Appropriate stormwater controls (i.e., silt fence, wattles, etc.) will be used to prevent material migration.

5 WELL DESIGN AND DRILLING EXECUTION PLAN

The drilling conditions for the well path planned are anticipated to be variable. Unknowns include but are not limited to: bedrock and colluvium interface, colluvium composition, size and frequency of boulders, faulted sections, and locations of other unknown obstacles within the well path and at the targeted SLT intercept location. Most of the unknown parameters could not be determined without drilling into the well path proposed. These potential challenges will require flexibility with planning and well design elements. Specific requirements will include additional intermediate casing strings and redundant annular isolation.

A dual rotary drilling system is planned for the project appropriately sized for the completion designated in Sections 3.2 and 3.6. Dual rotary drilling equipment is capable of both conventional and dual rotary drilling operations. The dual rotary method simultaneously advances casing with the drill string improving efficiency and improving the rate of successful casing installation especially in unconsolidated material such as the colluvium. The drilling system will require air, water, and chemical pumping system capacities necessary to return cuttings from the horizontal wellbore. A secondary water-based mud system may be necessary if conditions and directional drilling tools require a non-compressible fluid system.

The projected well path will require a horizontal inclination through an estimated 180 ft of unconsolidated colluvium and estimated 300 ft through bedrock. Actual drilling conditions and obstacles encountered such as potential boulders in the colluvium and faulting within the bedrock will require continuous trajectory monitoring while drilling in order to maintain target accuracy. Surveying tools will be used to validate well path while drilling and for the final as-built survey for the completed well.

The SLT tunnel profile is approximately 8 ft tall (Atlantic Richfield, 2017) with the target RW-3A elevation set as the centerline of the tunnel estimated at 8856 ft amsl. The corresponding well path requires a 13.5 ft drop in elevation over the horizontal distance from the surface invert of 8869.5 ft amsl to the SLT intercept target at 8856 ft amsl.

In order to prevent immediate tunnel flow into the proposed relief well and to minimize overall risks associated with waters in the tunnel while drilling, water in the tunnel will be lowered beneath the current operating envelop to the lowest possible level as allowed by RW-2A and RW-2B prior to initiation of horizontal drilling operations for the proposed relief well (RW-3A). Once the relief well is completed and associated infrastructure installed, the water level will be increased back to the normal operating envelope.

5.1 Well Path QA/QC

The designed well path design is constrained by two elevation points: the surface invert elevation designed to provide gravity flow for the completed well and the midpoint between the calculated tunnel floor and sill of the SLT (final target). The target invert elevation results in a centerline target of 8870 ft amsl and a SLT intercept elevation of 8856 ft amsl. These elevations are critical to retain gravity flow and at surface and desired conductivity from the SLT respectively.

The planned well path includes additional input from the contracted driller for expected behavior through the geological layers presented in Sheet C-3A. The general approach includes a conservative initial inclination such that the well path does not rise above the current operating envelope for the SLT that would prevent gravity flow or impede well capacity. The planned well path using the elevation bounds mentioned above as represented in Sheet C-3B of Attachment 1.

Directional surveying will be implemented throughout the drilling process to monitor and make necessary adjustments to maintain trajectory to the final target. Measured depth (MD) and inclination surveys will be completed between 20-ft – 40-ft intervals throughout the drilling process. Gyro surveys will also be utilized as needed and at critical thresholds to ensure well trajectory and final target. Any deviation from the proposed well path will require confirmation with a gyro survey and review of the results by Site Engineer and contracted driller.

5.2 Geotechnical Logging of Drill Cuttings

Drill cuttings will be produced by the drilling process and will be logged and monitored by a licensed and experienced senior geologist for the duration of the drilling operation. Recorded observations will be kept at 10-ft intervals and for each notable change in lithology layers or notable changes in drilling performance.

6 WATER MANAGEMENT

6.1 Drilling Fluids

Standard returned drilling cuttings and fluids will be controlled as indicated within the sections below. Drill cuttings returned to surface during drilling will be collected next to the drill rig at the cyclone separator or mud shaker. Management of the drill cuttings is discussed in Section 7.1. Liquids will be collected and routed or pumped into a storage tank (open top flow back tank (16,800 to 18,100 gallons)) for solids separation. Water produced during the drilling and completion process (produced water) will be handled as described in Section 6.2.

6.2 Produced Water

Produced water will be contained in open top flow back tanks on the relief well drilling pad. This includes impounded SLT water encountered during the final well punchout. Installation of the surface casing and completion of the primary grouting process will isolate potential groundwater flows or other water encountered while drilling through bedrock and the faulted zone prior to breakout into the SLT. The completion and annular grouting of the intermediate casing string will provide hydraulic control for punchout and the final completion liner isolating potential flow outside.

Two (2) open top flow back tanks (16,800 to 18,100 gallon capacity per each) will be staged on the drilling pad and used for initial containment of produced water from the drilling and completion operation. Produced water that exceeds flow back tank capacity on the drilling pad will be sampled on a batch basis and transferred via the 6-inch flowline from the relief well drilling pad to the storage tank battery or via the 10-inch HDPE flowline (see Attachment 1 – Sheet C-2C) to one of the water management options listed below based on the turbidity and solids loading observed during flow back.

1. Interim storage tank battery located in the Laydown Yard (pending sampling and final treatment and/or disposal decisions) described in Section 6.2.1.
2. Maelstrom Oxidizer and the demonstration-scale wetlands treatment systems (turbidity less than 75 NTU and pH greater than 5.0 s.u.).
3. Pond 15 (turbidity greater than 75 NTU and/or pH less than 5.0 s.u.).
4. Optional Surface Ditch (OSD) to the Laydown Yard swale.

The flow volume and water quality will be assessed on a per batch basis to determine if the water is routed through the demonstration-scale wetlands treatment systems or to Pond 15 based on the criteria outlined above. Water samples will be collected during flow back for accepted field parameters based on the safe operating limits provided in the *St. Louis Tunnel Discharge Enhanced Wetland Demonstration Treatability Study Operation & Maintenance Manual* (Atlantic Richfield, 2016b). Field parameters monitored include turbidity and pH. Water will be either stored or treated before transferring to the demonstration-scale treatment system. Once turbidity has decreased below 75 NTU and pH is above 5.0 s.u., the water will be directed to the Maelstrom Oxidizer and the demonstration-scale wetlands treatment systems; otherwise, water will be routed to Pond 15 as described above.

A 10-inch HDPE flowline will be installed prior to the drilling process for on-going RW-3A flow conveyance after completion. This flowline will also be used during the drilling process to route water (as needed) from the flow back tanks on the drilling pad to the Maelstrom Oxidizer. The flowline will be routed from the drilling pad around the east and south sides of the Soil Lead

Repository to the Maelstrom Oxidizer and DR-3 channel (see Attachment 1 – Sheet C-2C and Sheet C-10).

Continuous SLT flow thru RW-3A is not expected during drilling by reducing the tunnel operating head level to the extent practicable below the surface invert elevation with the current relief wells prior to horizontal drilling operations. SLT tunnel water will be circulated to surface while drilling into the SLT. If water production is encountered after drilling into the SLT, it will be routed to the Maelstrom Oxidizer as part of normal operating flows to maintain head levels.

6.2.1 Interim Storage Tank Battery

An interim storage tank battery located in the Laydown Yard will be connected in series to decant accumulated water and will be connected to the flow back tanks on the drilling pad to transfer excess water produced during the drilling process to the interim storage tank battery (see Attachment 1 – Sheet C-2C). The interim storage tank battery will include about 80,000 gallons of total capacity and will utilize filter boxes designed to help separate solids and fines from collected water.

Any material remaining in the interim storage tank battery after decanting accumulated water will be characterized to determine final Site use and/or management. Materials will likely be placed in an interim drying facility (IDF) for further dewatering. This material may be stockpiled on-site for future Site use (e.g., Expanded Constructed Wetlands Treatment System construction material, calcines cover, etc.) if below acceptable limits using the Synthetic Precipitation Leaching Procedure (SPLP) or an alternative testing method approved by EPA. If this material is above acceptable limits using the SPLP or an alternative testing method approved by EPA, the material will be consolidated with calcine materials in conjunction with the Site Solids Management Plan (Atlantic Richfield, 2021b).

6.3 RW-2A, RW-2B, and Debris Plug Flow

It is not anticipated that drilling prior to punchout will impact water quality at RW-2A, RW-2B, and the debris plug effluent until final punchout into the SLT. Turbidity and pH will be continuously monitored at OXINF (Maelstrom Oxidizer influent compartment) with a water quality sonde (WQ10) that is tied into the existing site telemetry system. Water from RW-2A, RW-2B, and the debris plug effluent will be routed to either the demonstration-scale constructed wetlands treatment systems or to Pond 12/15 as follows:

1. Demonstration-scale wetlands treatment systems (turbidity less than 75 NTU and pH greater than 5.0 s.u. at OXINF).
2. Pond 12 (turbidity greater than 75 NTU and/or pH less than 5.0 s.u. at OXINF and no decanted drilling water being directed to Pond 15).
3. Pond 15 (turbidity greater than 75 NTU and/or pH less than 5.0 s.u. at OXINF and decanted drilling water being directed to Pond 15).

7 SOLIDS MANAGEMENT

7.1 Drill Cuttings

Drill cuttings are expected to be angular gravel with sand and silt. These materials will be collected at the cyclonic separator (cyclone). As this material builds up on the relief well drilling pad, they will be manually removed using a skid-steer or other loader. A maximum estimation of 100 cubic yard (CY) is expected to be produced from the full drilling operation. These materials will be collected and placed in a designated area in the Laydown Yard for XRF testing (see Attachment 1 – Sheet G-1). The drill cuttings are expected to contain similar geochemical characteristics of the parent rock including 100 ft of previously placed backfill, native colluvium, and native bedrock including the Hermosa sandstone. The native colluvium and native bedrock encountered is expected to have a low potential for mineralization; however mineralized rock could be encountered throughout any point in the drill trajectory. If this material meets acceptable criteria for use as general fill using the SPLP or an alternative testing method approved by EPA, the material may be reused or placed in the general fill stockpile for future on-site use. If this material does not meet acceptable criteria for use as general fill using the SPLP or an alternative testing method approved by EPA, the material will be managed the same as waste rock (described below in Section 7.2).

7.2 Waste Rock

If waste rock cannot be utilized as engineered backfill due to gradation, the waste rock will be consolidated with calcine materials in conjunction with the Site Solids Management Plan (Atlantic Richfield, 2021b). Waste rock has angular rock with edges, and its iron is highly oxidized at depth. Distinct (orange) color differences and the angular nature of blasted rock visually signify waste rock materials.

7.3 General Fill

Any excess general fill excavated during drilling pad and well pad construction will be stockpiled with existing stockpiled general fill in the Laydown Yard for future use on-site. Stockpiles will be located at the designated locations shown on Attachment 1 – Sheet G-1. If stockpiling is required at additional locations, locations will be selected that will not impact access roads and/or critical infrastructure. General fill material has sub-rounded to rounded edges, and moderate fine-material content.

7.4 Oversized Material

Oversized material from screening of general fill will be stockpiled with existing stockpiled oversized material in the Laydown Yard for future use on-site. Stockpiles will be located at the designated locations shown on Attachment 1 – Sheet G-1. If stockpiling is required at additional locations, locations will be selected that will not impact access roads and/or critical infrastructure.

8 WELLHEAD AND WELLHOUSE

8.1 Wellhead

The wellhead configuration will be assembled after drilling and completion of RW-3A with the same overall functionality of the current RW-2A and RW-2B wellheads modified in 2019. The wellhead will include three full opening valves, an access wye, supports, siphon break, and required flanged adapters. The master valve will be placed as close to the casing flange as possible to isolate the entire wellbore during assembly, disassembly, and maintenance of the wellhead components. The master valve will be normally operated in a fully open position while the pressure transducer cable is installed through the master valve to the end of the wellbore via the access wye. An isolation valve will be installed immediately downstream of the access wye to shut off flow the while the pressure transducer or other equipment is passed through the wellbore and the open master valve. The isolation valve provides well control for assembly/disassembly and maintenance of the flow control valve and all downstream piping without the need to remove the pressure transducer.

The elevations noted in Section 3.2 of this document along with the wellhead geometry will be used to determine the final elevation profile for the completed wellhead assembly such that the additional relief well will function concurrently with the current relief wells and as the primary flow path to manage the SLT tunnel head levels.

8.2 Wellhouse

The completed wellhead assembly requires security and protection from year-round conditions on-site including freezing conditions, precipitation and rock fall while maintaining personnel access. A pre-cast concrete building installation is an efficient alternative to standard on-site construction options providing improved security and protection over typical hand constructed options. The wellhouse structure will be constructed at the manufacturer's location, then transported and installed prior to final wellhead assembly on-site. This reduces travel and construction time.

The wellhouse will include the following design features:

- Reinforced concrete wells with pre-tension roof and floor sections;
- Metal double access doors;
- Internal hoist system;
- Provisions for electrical lighting, heating, and ventilation; and
- Adequate space for wellhead and backup electrical pump.

9 ANTICIPATED CONSTRUCTION SCHEDULE

The installation of relief well RW-3A is expected to be completed during the 2021 work season. The Site is typically accessible by light-duty vehicles following the spring thaw during the month of May. Mobilization of heavy equipment is anticipated in early July to begin excavation and drilling pad construction. Well spudding of RW-3A will commence after final Site preparations expected in early August. Drilling operations are anticipated to take approximately 35 days with well completion in September. These construction times are estimates completely dependent on Site conditions and high-elevation mountain weather.

10 REFERENCES

AMEC Foster Wheeler and Pioneer Technical Services, Inc., 2015. Development of the Rico Argentine Mine DR-3 Hydrologic Model Memo. Prepared for Atlantic Richfield by AMEC Foster Wheeler and Pioneer Technical Services, Inc., dated April 22, 2015.

Atlantic Richfield, 2016a. Work Plan St. Louis Tunnel Hydraulic Controls Interim Risk Reduction Measures, Rico-Argentine Mine Site – Rico Tunnels Operable Unit OU01, submitted by Atlantic Richfield Company to US EPA, dated April 18, 2016.

Atlantic Richfield, 2016b. St. Louis Tunnel Discharge Enhanced Wetland Demonstration Treatability Study Operation & Maintenance Manual, Rico-Argentine Mine Site, Dolores County, Colorado, prepared by AEEC and REMC, dated September 1, 2016.

Atlantic Richfield, 2017. Appendix C.2 Calculation Summary No. 2. St. Louis Tunnel Hydraulic Controls Interim Risk Reduction Measures Flow Control Structure Design and Field Implementation Plan. Prepared by Pioneer Technical Services, Inc., dated February 2017.

Atlantic Richfield, 2021a. 2020 Test Pits Data Summary Report, Rico-Argentine Mine Site, Rico, Colorado. Prepared by Copper Environmental Consulting, dated March 2021.

Atlantic Richfield, 2021b. Solids Management Plan, Rico-Argentine Mine Site, Rico, Colorado. Prepared by Copper Environmental Consulting, dated April 2021.

CEC, 2020. Updated DR-3 Hydrologic Model Memo, Rico-Argentine Mine Site, Rico Colorado. Prepared for Atlantic Richfield by Copper Environmental Consulting, dated June 26, 2020.

CEC, 2021. Tunnel Relief Wells Water Management Operations and Procedures Version 4.0, Rico-Argentine Mine re Rico Tunnels Operable Unit OU01. Prepared for Atlantic Richfield Company by Copper Environmental Consulting, dated January 2021.

U.S. Environmental Protection Agency (EPA), (2011a). Removal Action Work Plan. Rico-Argentine Mine Site – Rico Tunnels Operable Unit OU01, Rico, Colorado, dated March 9, 2011.

U.S. Environmental Protection Agency (EPA), (2011b). Unilateral Administrative Order for Removal Action, U.S. EPA Region 8, Docket No. CERCLA-08-2011-0005; Rico-Argentine Site, Dolores County, Colorado, dated March 23, 2011.

FIGURES

Figure 1: *Debris Plug Flow*

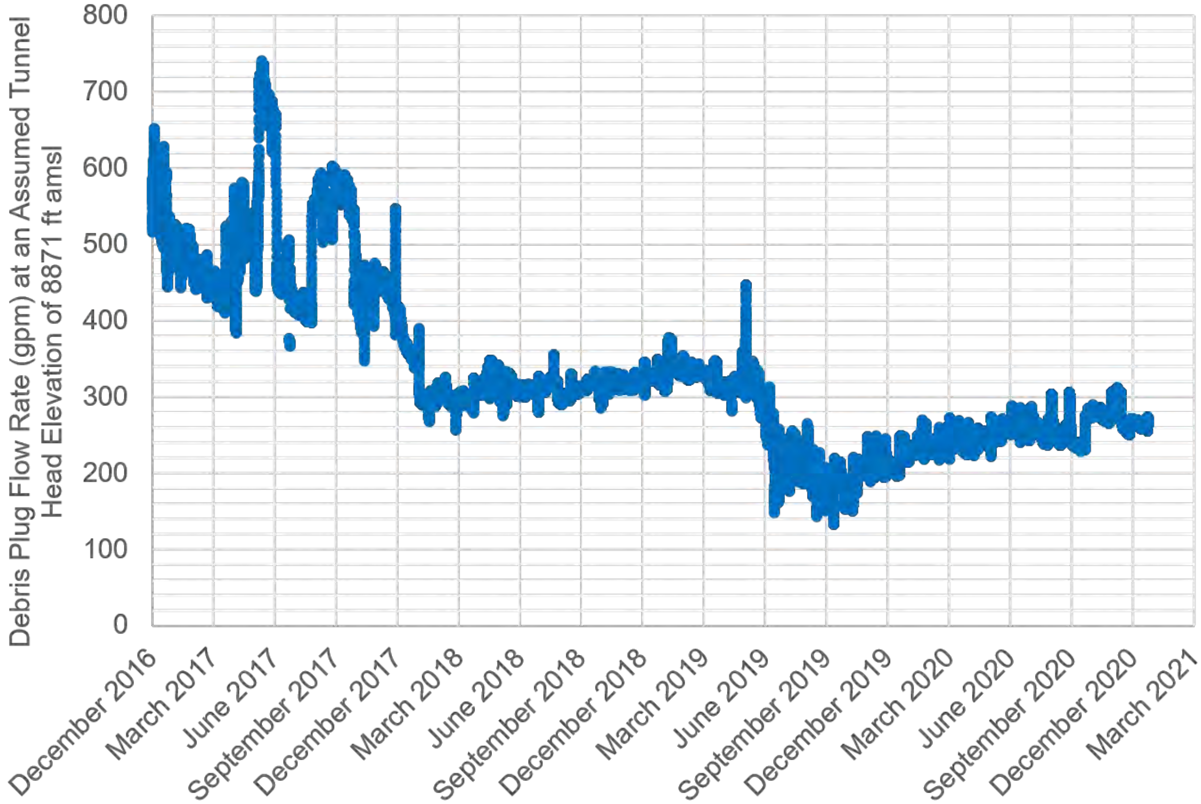


Figure 2: *Debris Plug Apparent Permeability*

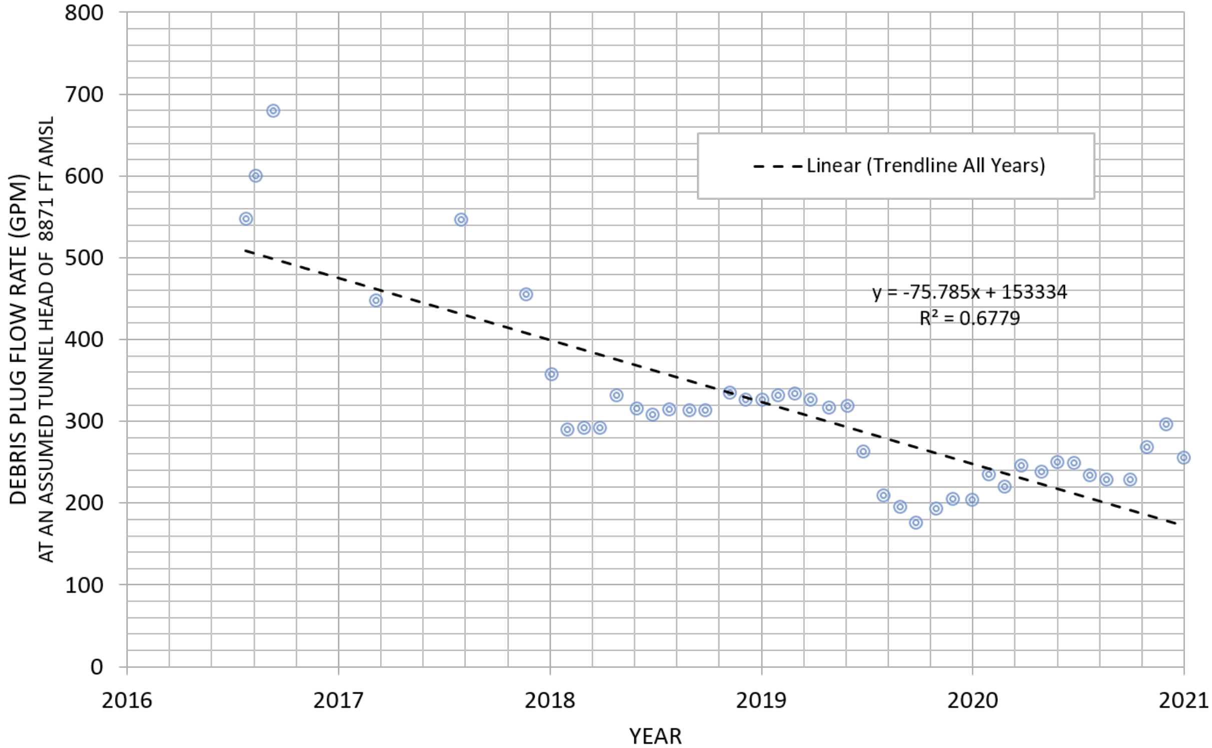


Figure 3: *DR-3 Hydrograph (2011 – 2020 Daily Average)*

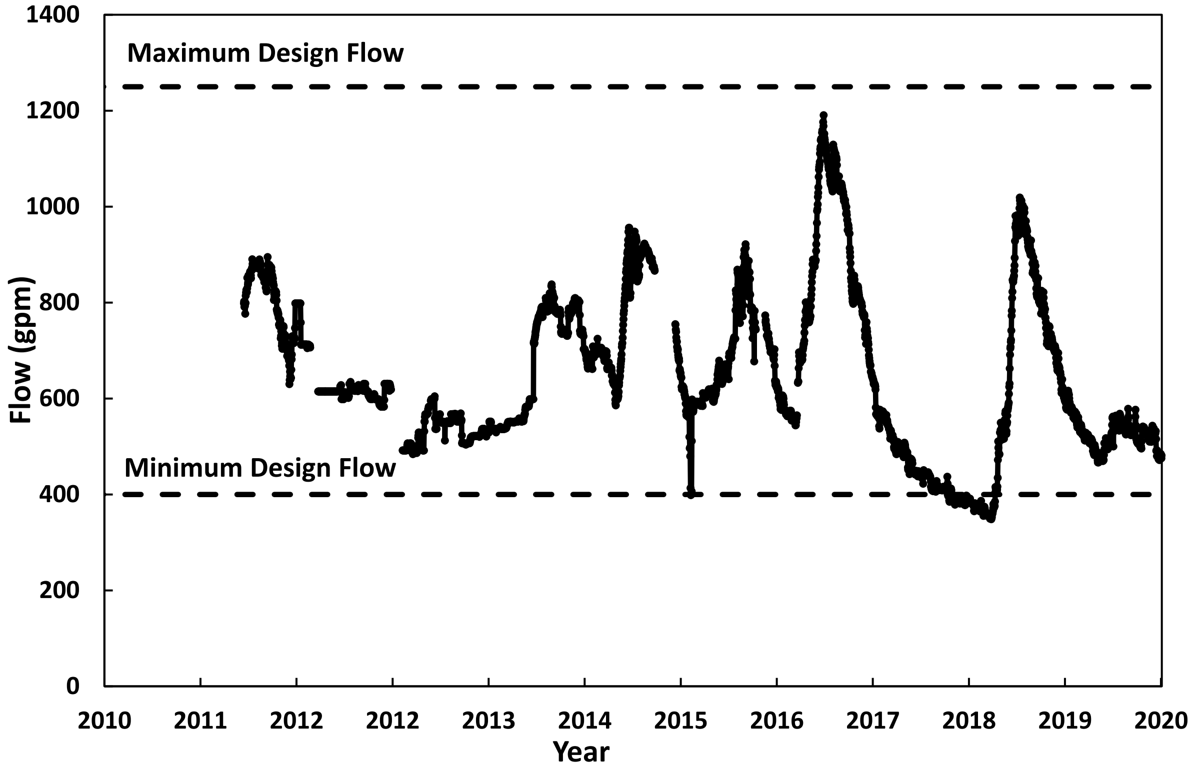
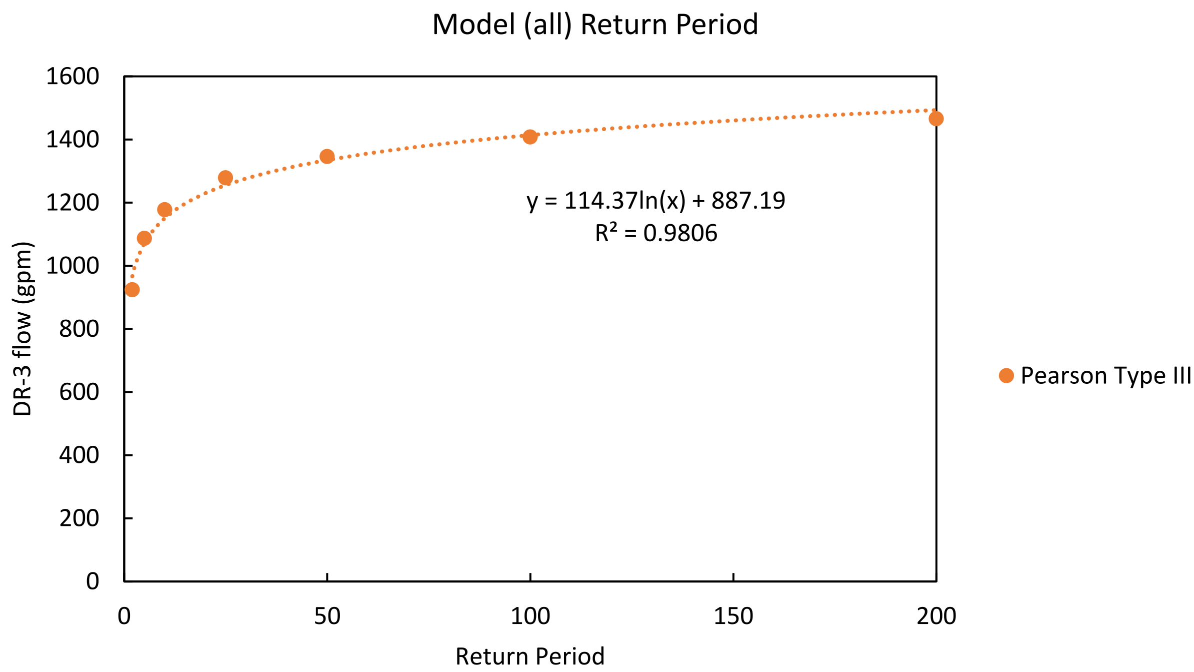


Figure 4: *Hydrologic Model Output*

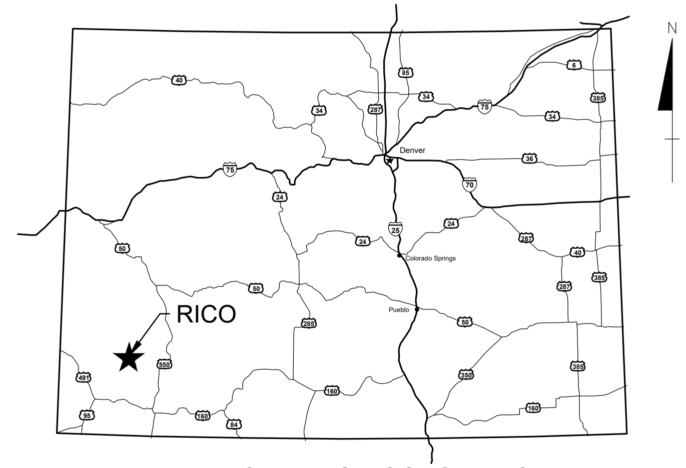


ATTACHMENT 1 – CONSTRUCTION DRAWING SET RW-3A 10-INCH COMPLETION

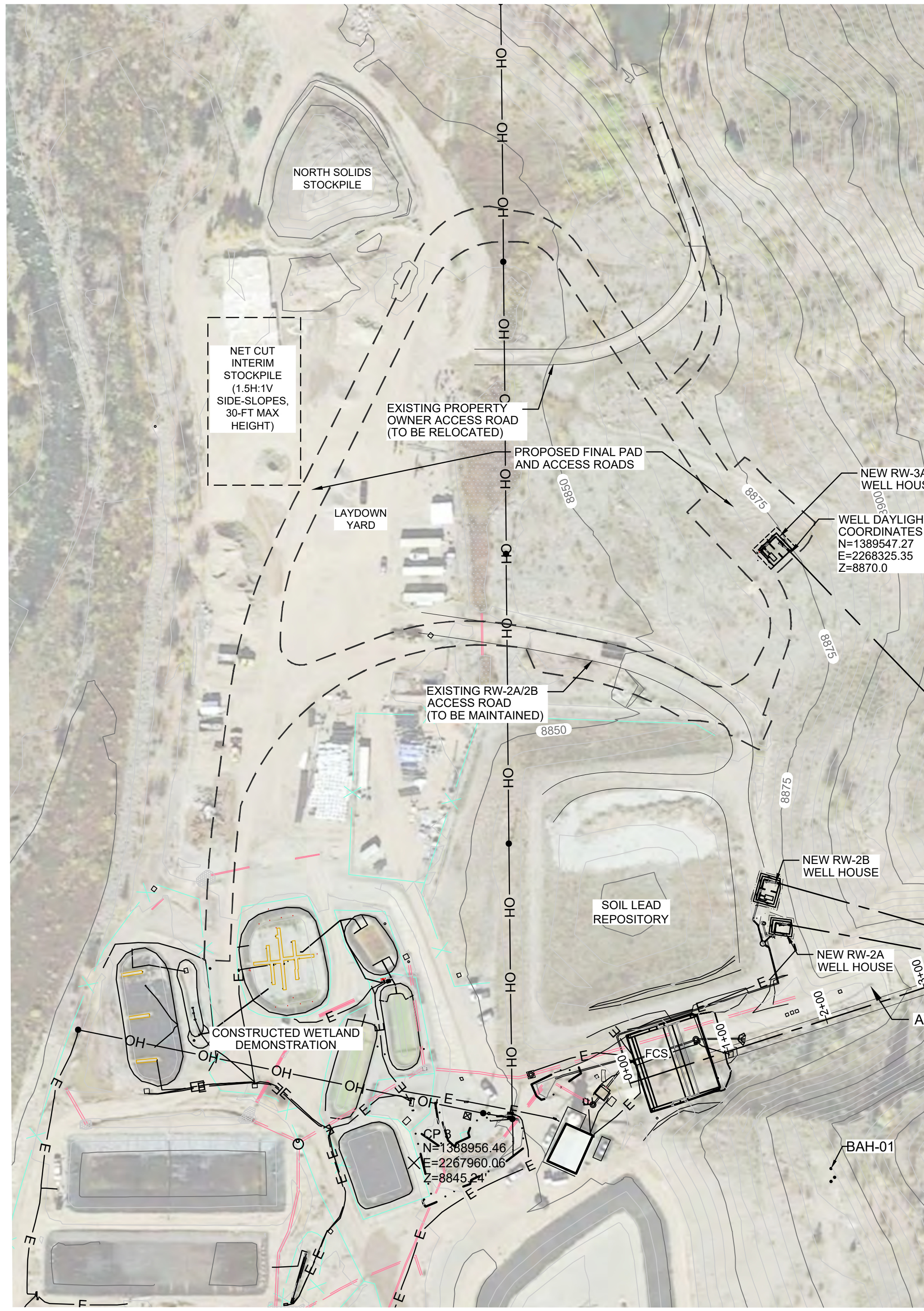
DRAFT CONSTRUCTION DRAWINGS

FOR

RW-3A WELL COMPLETION (10" Well)



STATE OF COLORADO
(NOT TO SCALE)



SITE VICINITY MAP

SHEET INDEX

SHEET NO.	FILENAME	SHEET TITLE	REVISION NO.	ISSUE DATE
		CIVIL DRAWINGS		
G-1	70817_RW3A -G100 Cover	COVER SHEET AND DRAWING INDEX	5	06/28/21
G-2	70817_RW3A-G200 PadAccess	WELL PAD ACCESS ROUTES	2	07/01/21
C-1A	70817_RW3A-C303 Drill-VH	SLOPE DRAIN PLAN	3	07/01/21
C-1B	70817_RW3A-C303 Drill-VH	DRILL RIG ANCHOR PLAN	2	07/01/21
C-2A	70817_RW3A-C303 Drill	DRILL PAD GRADING PLAN	6	07/01/21
C-2B	70817_RW3A -C303 Isopach	DRILL PAD GRADING PLAN CUT/FILL ISOPACH	4	06/28/21
C-2C	70817_RW3A -C200 Route	DRILL DISCHARGE ROUTE	6	07/01/21
C-3A	STL_Tunnel Plans	RELIEF WELL 3 PLAN AND PROFILE	2	05/12/21
C-3B	70817_RW3A-C201 Drill PP	PLAN AND PROFILE WITH DRILLER 0 DEGREE AND 1 DEGREE WELL PATHS	3	07/01/21
C-4A	70817_RW3A-C601 Details	CONSTRUCTION STAGES INITIAL BORING AND CONDUCTOR CASING	3	06/10/21
C-4B	70817_RW3A-C601 Details	CONSTRUCTION STAGES INTERMEDIATE BORING AND CASING	3	06/10/21
C-4C	70817_RW3A-C601 Details	CONSTRUCTION STAGES PUNCHOUT/COMPLETION DRILL	3	06/10/21
C-4D	70817_RW3A-C601 Details	CONSTRUCTION STAGES FINAL COMPLETION PROFILE	3	06/10/21
C-5A	70817_RW3A-C304 Crane	COMPLETION PAD GRADING PLAN	5	07/01/21
C-5B	70817_RW3A-C304 Isopach	COMPLETION PAD GRADING PLAN CUT/FILL ISOPACH	6	07/01/21
C-6	70817_RW3A-C600 Details	WELL HOUSE PLAN VIEW	3	06/14/21
C-7	70817_RW3A-C600 Details	WELLHEAD DETAILS	2	06/14/21
C-8	70817_RW3A-C600 Details	DETAILS	3	06/10/21
C-9	70817_RW3A-C700 MatQty	OVERVIEW LAYOUT AND MATERIAL QUANTITIES	6	07/01/21
C-10	70817_RW3A-C306 DISCHARGE PIPE_PP	RELIEF WELL DISCHARGE PIPE PLAN AND PROFILE	1	07/01/21
		ELECTRICAL DRAWINGS		
E0.0	RW3A_E0.0_TITLEPAGE	TITLE PAGE	0	05/22/20
E0.1	RW3A_E0.1_GEN NOTES & ABBREV	GENERAL NOTES AND ABBREVIATIONS	0	05/22/20
E0.2	RW3A_E0.2_ELEC SYMBOL LEGEND	ELECTRICAL SYMBOLS LEGEND	0	05/22/20
E1.1	RW3A_E1.1_SINGLE-LINE-CONT	SINGLE-LINE DIAGRAM - CONT.	0	05/22/20
E2.0	RW3A_E2.0_SITE_KEY_PLAN	ST. LOUIS TUNNEL PUMP STATION OVERALL SITE PLAN	0	05/22/20
E2.0A	RW3A_E2.0A_RW3A CONDUIT PLAN	ST. LOUIS TUNNEL PUMP STATION RW-3A CONDUIT PLAN	0	05/22/20
E2.1	RW3A_E2.1_PRW & CTRL CBL & COND SCH	POWER & CONTROL CABLE & CONDUIT SCHEDULES	0	05/22/20
E2.2A	RW3A_E2.2A_DUCTBANK_SECTIONS-CONT	UNDERGROUND DUCT BANK SECTIONS -CONT.	0	05/22/20
E2.5	RW3A_E2.5_RW-3A & PUMP HOUSE 2 LTG & RECEPT PLAN	WELL HOUSE (RW3A) AND PUMP HOUSE (PH-2) LIGHTING & RECEPTACLES PLAN	0	05/22/20
E2.6	RW3A_E2.6_DUCTBANK_TYP_DTLS	UNDERGROUND DUCTBANK TYPICAL DETAILS	0	05/22/20
E2.10	RW3A_E2.10_PNLBOARD SCHEDULES	PANELBOARD LOAD SCHEDULES	0	05/22/20
E5.1	RW3A_E5.1_SCHEMATIC DIAGRAM	SKID-MOUNT TRASH PUMP (3A) MOTOR SCHEMATIC DIAGRAM	0	05/22/20
E7.5	RW3A_E7.5_SCHEMATIC-AI-RW3A	SCHEMATIC DIAGRAM - ANALOG INPUT FOR RW-3A	0	05/22/20
E7.6	RW3A_E7.6_SCHEMATIC-A0-RW3A	SCHEMATIC DIAGRAM - ANALOG OUTPUT FOR RW-3A	0	05/22/20
E7.7	RW3A_E7.7_SCHEMATIC-DI-RW3A	SCHEMATIC DIAGRAM - DIGITAL INPUT FOR RW-3A	0	05/22/20
E7.8	RW3A_E7.8_SCHEMATIC-D0-RW3A	SCHEMATIC DIAGRAM - DIGITAL OUTPUT FOR RW-3A	0	05/22/20
G0.0	RW3A_G0.0_GROUNDING NOTES	GENERAL GROUNDING NOTES	0	05/22/20
G1.1	RW3A_G1.1_GROUNDING PLAN	WELL HOUSE (3A) AREA GROUNDING PLAN	0	05/22/20
G2.0	RW3A_G2.0_GROUNDING DTLS	GROUNDING DETAILS	0	05/22/20

GENERAL NOTES:

1. WORK SHALL BE PERFORMED BY THE CONTRACTOR IN ACCORDANCE WITH THE METHODS AND PROCEDURES OUTLINED IN THE TECHNICAL SPECIFICATIONS.
2. GRADING FEATURES SHOWN ON THE DRAWINGS WERE DESIGNED USING THE BASE TOPOGRAPHY NOTED IN THE REFERENCE SECTION. IF AT ANY TIME DURING CONSTRUCTION, ANY ERROR OR DISCREPANCY SHOULD BECOME EVIDENT OR OCCUR IN THE LOCATION, GRADES, DIMENSIONS OR ALIGNMENT OF ANY PART OF THE WORK, THE ENGINEER SHALL BE IMMEDIATELY NOTIFIED TO ASSESS THE POTENTIAL IMPACT(S), AND (IF NECESSARY) IDENTIFY THE REQUIRED REMEDY.
3. ALL EARTHWORK QUANTITIES ARE BASED ON BANK CUBIC YARDS (BCY) AND DO NOT ACCOUNT FOR POTENTIAL SHRINKAGE/SWELL OF THE MATERIAL DURING REGRADING. CONTRACTOR SHALL BE RESPONSIBLE FOR ACCOUNTING FOR SHRINK/SWELL INTO UNIT COSTS.
4. PRIOR TO THE START OF CONSTRUCTION/EXCAVATION, CONTRACTOR SHALL PERFORM UTILITY LOCATES.
5. CONTRACTOR SHALL PROTECT ALL UTILITIES AND ANY DAMAGED MATERIALS SHALL BE REPLACED WITH SAME LIKE AND KIND AT NO COST. EXISTING PIPELINE AND UTILITY LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE. ACTUAL EXISTING BURIED AND ABOVE GROUND PIPELINE AND OTHER UTILITY LOCATIONS ARE TO BE LOCATED AND VERIFIED IN THE FIELD BY THE CONTRACTOR.
6. CONTRACTOR SHALL MAINTAIN ITS OWN HEALTH AND SAFETY PROGRAM IN ACCORDANCE WITH OWNER/STATE/FEDERAL REQUIREMENTS.
7. CONTRACTOR TO MONITOR QUALITY CONTROL (QC) OVER ALL MATERIALS SUPPLIERS, MANUFACTURERS, MATERIALS, SERVICES, SITE CONDITIONS AND WORKMANSHIP TO PRODUCE THE SPECIFIED WORK QUALITY. ALL MATERIALS SHALL BE APPROVED BY ENGINEER PRIOR TO USE. CONTRACTOR SHALL PROVIDE ENGINEER WITH ALL MATERIAL PRODUCT SPECIFICATION SHEETS FOR REVIEW PRIOR TO DELIVERY TO THE SITE.

REFERENCES:

1. EXISTING TOPOGRAPHY REFERENCED FROM AUTOCAD DRAWING FILES '60239806-REF-00-0000-V-TOPO-MASTER.DWG' (2012); 15010 SITEWIDE TOPO 2016 UPDATE 12-08-17.DWG (2017); AND FOLEY ASSOCIATES, INC.'S '15010 SITEWIDE TOPO 2016 UPDATE NORTH OF ADIT 11152019.DWG' (2019).
2. AERIAL BACKGROUND REFERENCED FROM IMAGE FILES 'OVERVIEW IMAGE.JPG' AND 'RICOSITE_ORTHOMOSAIC_EXPORT_FRIJUL20162002.TIFF'.

NOTES:

1. DRAWING COORDINATE SYSTEM: COLORADO STATE PLANE SOUTH ZONE, FEET.
2. PROJECT SURVEY CONTROL POINTS

	CP 1	CP 2	CP 3
N:	1386421.37'	1388176.94'	1388956.46'
E:	2268187.03'	2267993.74'	2267960.06'
Z:	8786.90'	8827.94'	8845.24'

DETAIL/SECTION INDICATORS:

DETAIL NUMBER (1)
DRAWING ON WHICH DETAIL APPEARS (C-2)
CONTROL POINT (CORRESPONDS TO A POINT ON A TABLE SHOWING NORTHING, EASTING, AND/OR ELEVATION AND STATION)

ABBREVIATIONS:

RW -- RELIEF WELL
NTU -- NEPHELOMETRIC TURBIDITY UNIT
O.D. -- OUTSIDE DIAMETER
I.D. -- INSIDE DIAMETER

NO:	DATE	CADD	CHECK	APP'D	ISSUE / REVISION DESCRIPTION
2	05/21/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW
3	06/04/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW
4	06/10/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW
5	07/01/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW

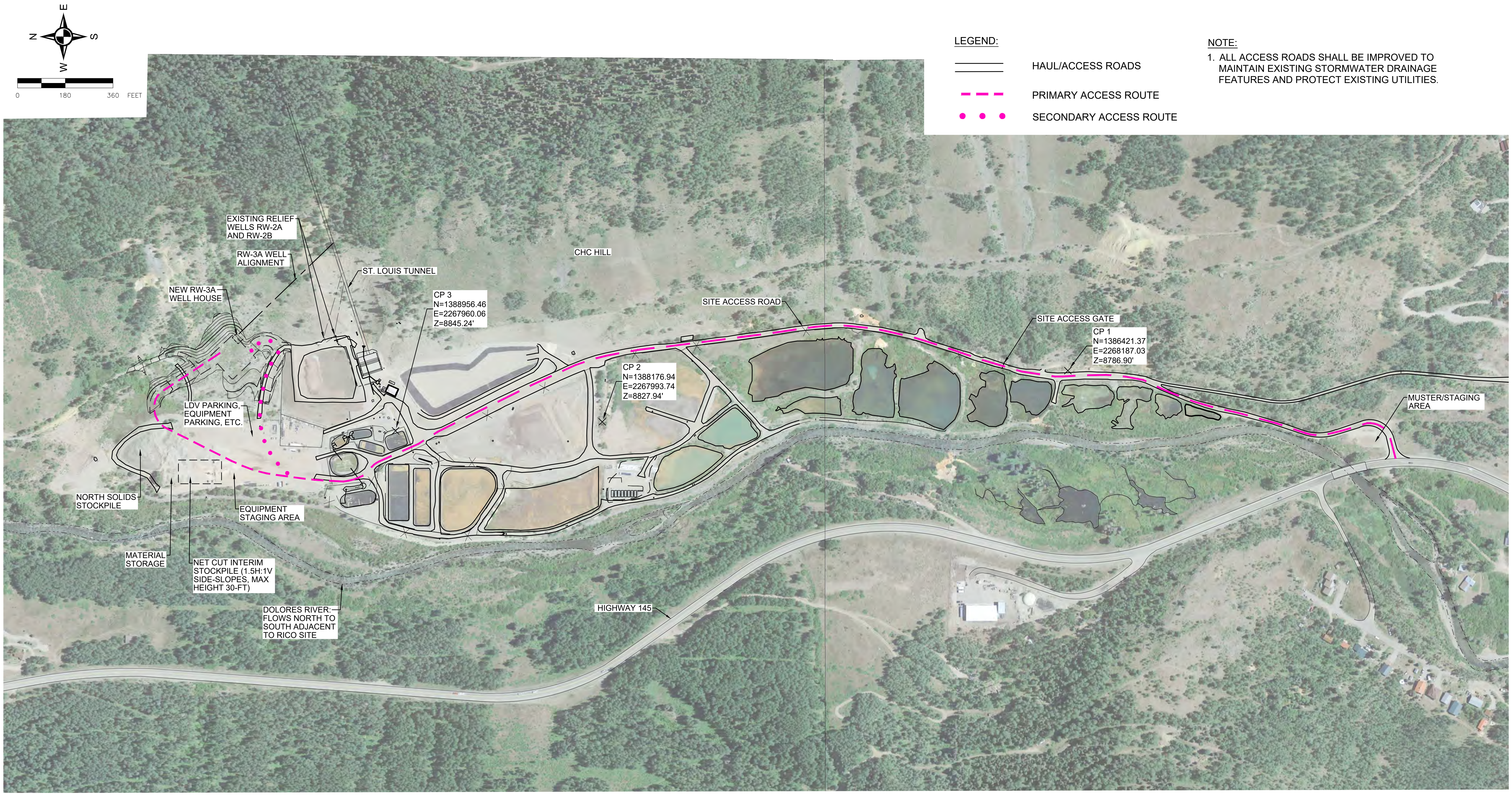
Alloy GROUP
2211 East Highland Avenue, Suite 215
Phoenix, AZ 85016
Tel: (602) 331-3859

Atlantic Richfield Company

TITLE: COVER SHEET AND DRAWING INDEX

PROJECT: RW-3A Well Completion (10" Well)
Rico - Argentine Mine Site
Dolores County, Colorado

SHEET G-1



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0	06/04/21	DCC	SPB	LE	ISSUED FOR CLIENT REVIEW
1	06/10/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW
2	07/01/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW

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2211 East Highland Avenue, Suite 215
Phoenix, AZ 85016
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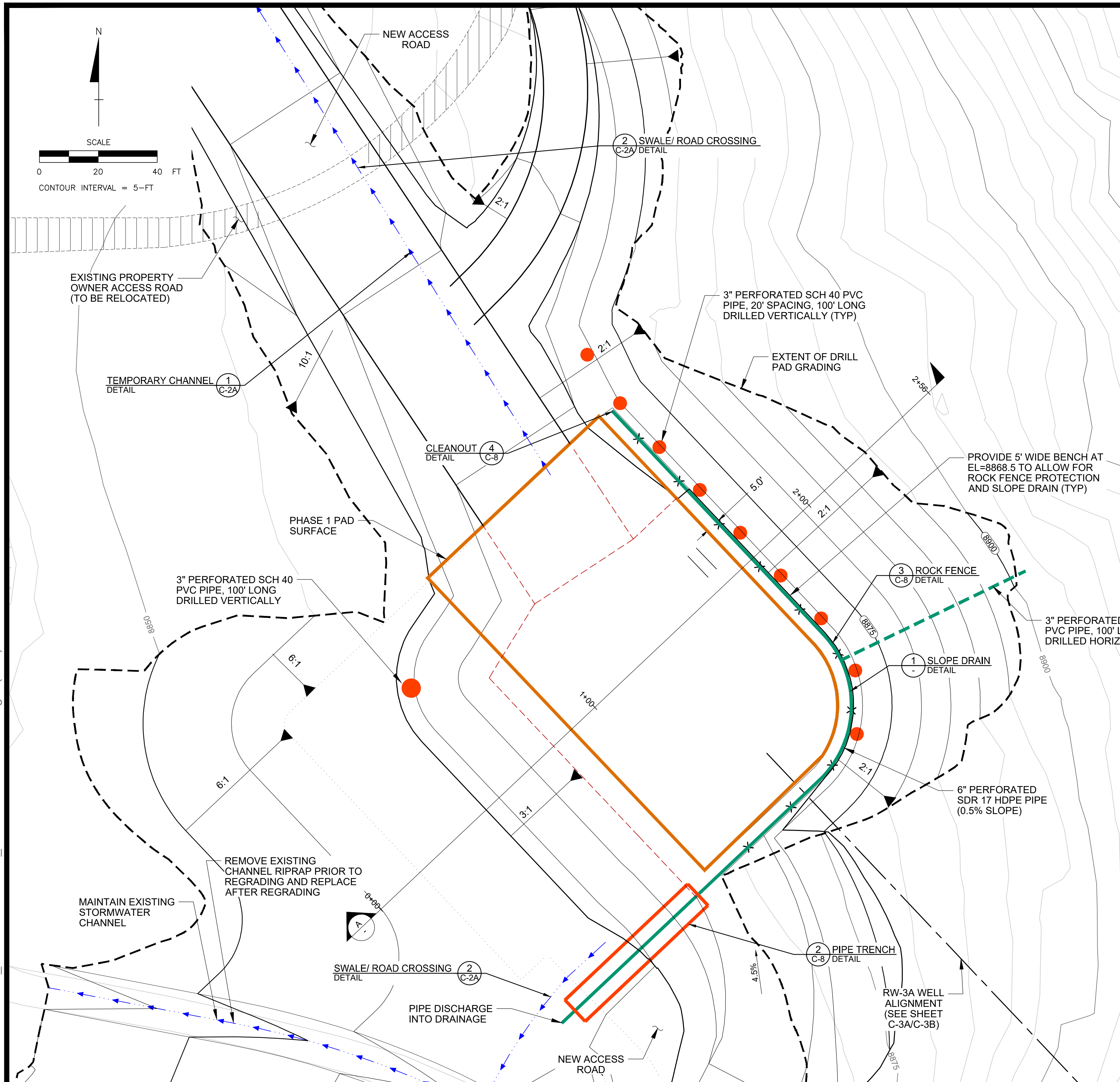
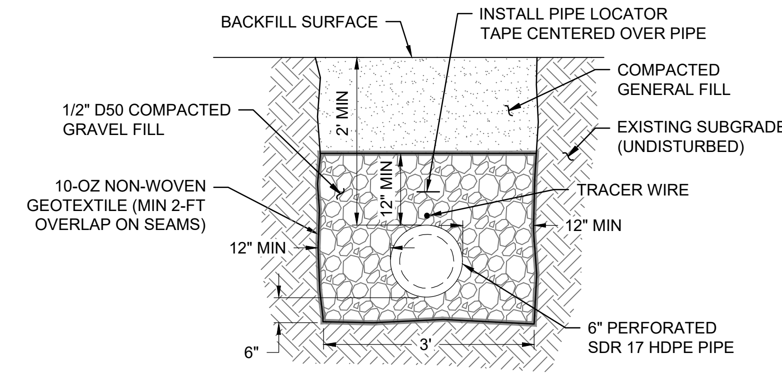
Atlantic Richfield Company

TITLE:
WELL PAD ACCESS ROUTES

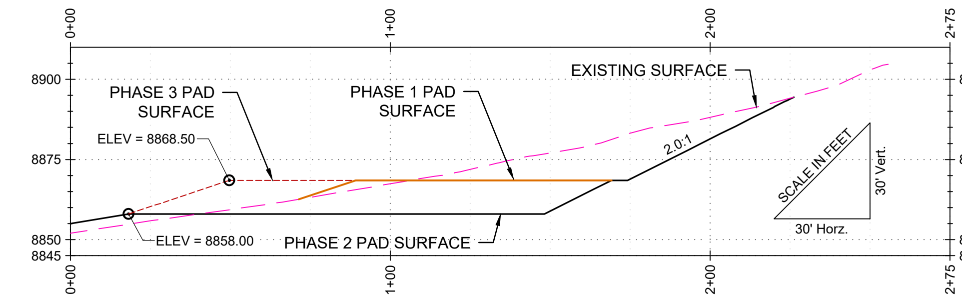
PROJECT:
RW-3A Well Completion (10" Well)
Rico - Argentine Mine Site
Dolores County, Colorado

SHEET
G-2





1 SLOPE DRAIN DETAIL (NTS)



A SECTION

QUANTITY SUMMARY

ITEM	QTY	UNIT
100' DEEP VERTICAL DRAIN	10	EA
HORIZONTAL DRAIN	100	LF
SLOPE DRAIN PIPE	280	LF
1/2" D50 GRAVEL FILL	91	CY

CY = CUBIC YARDS, EA = EACH; LF = LINEAR FEET

NOTE:

1. REGRADE CONTOURS REPRESENT WELL HOUSE GRADING FOR PHASE 1/3 (SEE SHEET C-5A/C-5B)

NO:	DATE	CADD	CHECK	APP'D	ISSUE / REVISION DESCRIPTION
0	06/04/21	DCC	SPB	LE	ISSUED FOR CLIENT REVIEW
1	06/10/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW
2	06/28/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW
3	07/01/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW

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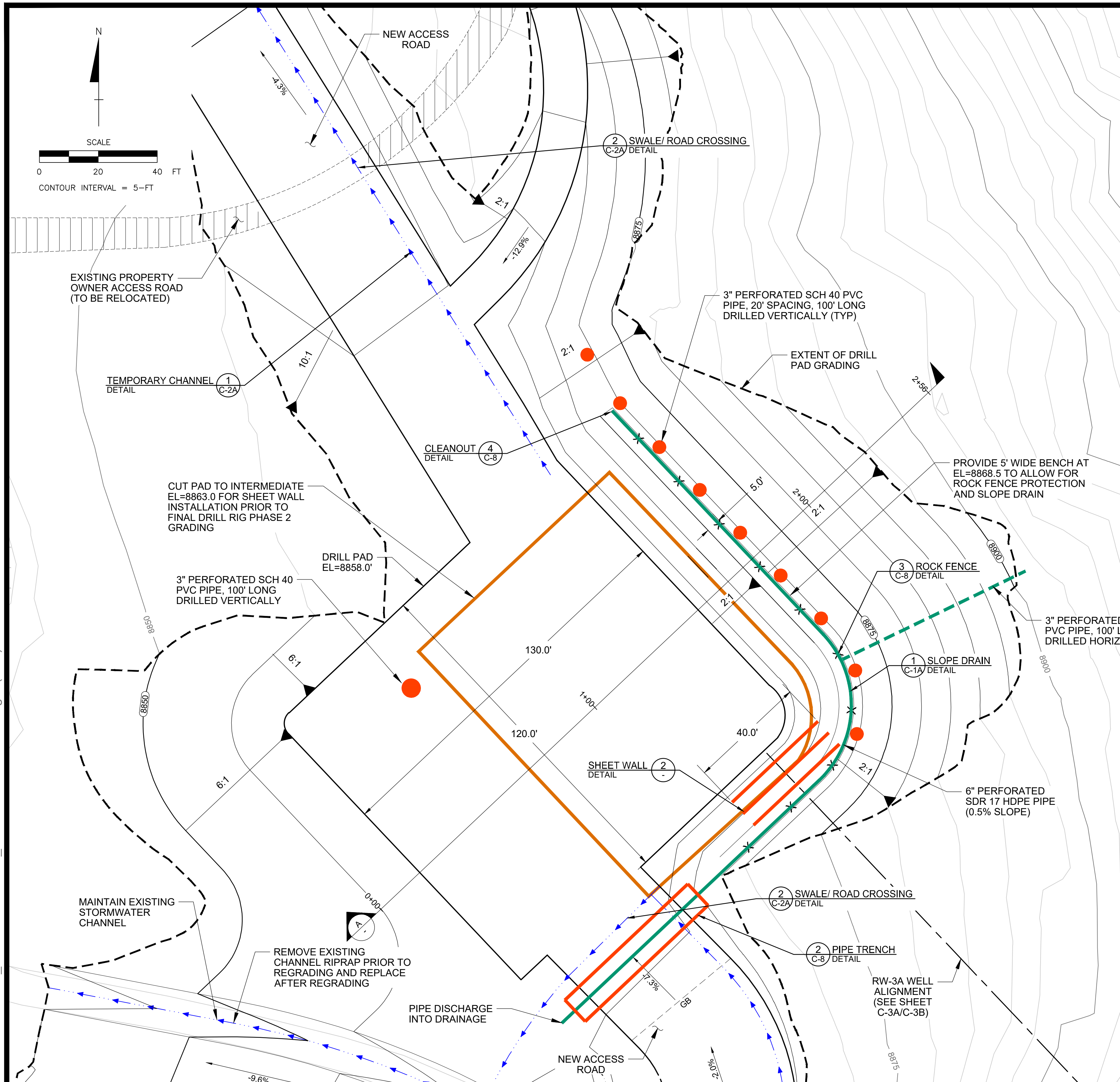
Phoenix, AZ 85016
Tel: (602) 331-3859

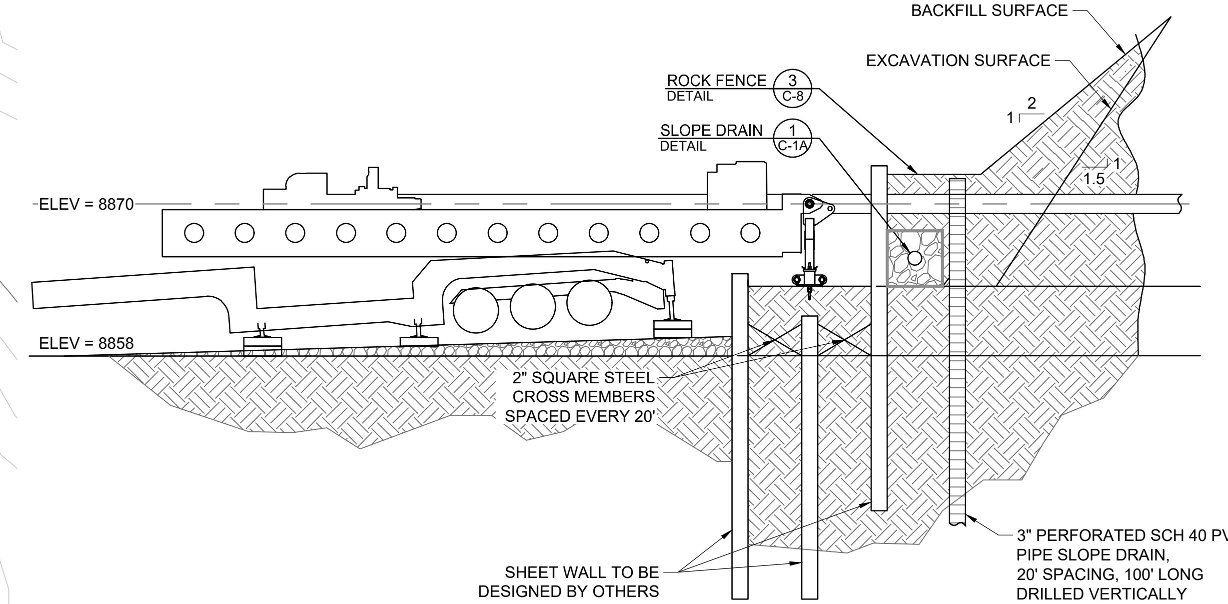
Atlantic Richfield Company

TITLE: SLOPE DRAIN PLAN

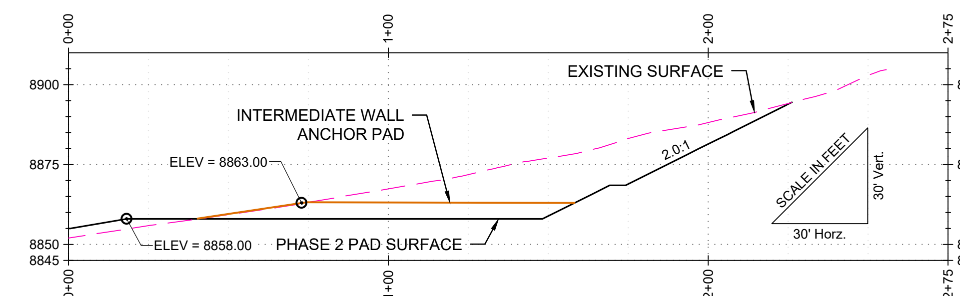
PROJECT: RW-3A Well Completion (10" Well)
Rico - Argentine Mine Site
Dolores County, Colorado

SHEET C-1A





2 SHEET WALL DETAIL (NTS)



A - SECTION

NOTE:

1. REGRADE CONTOURS REPRESENT WELL HOUSE GRADING FOR PHASE 2 (SEE SHEET C-2A/C-2B)

NO:	DATE	CADD	CHECK	APP'D	ISSUE / REVISION DESCRIPTION
0	06/04/21	DCC	SPB	LE	ISSUED FOR CLIENT REVIEW
1	06/10/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW
2	07/01/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW

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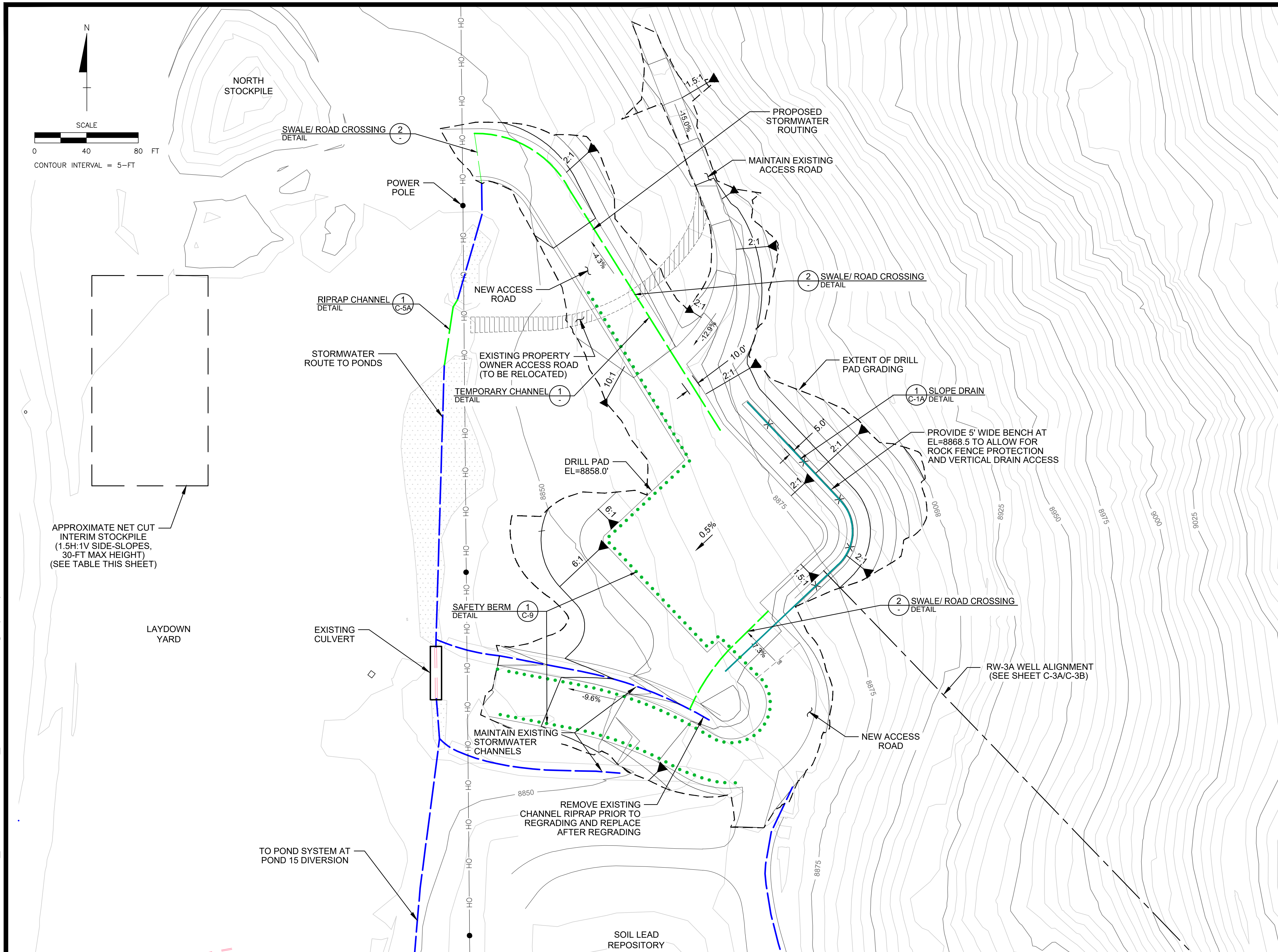
Tel: (602) 331-3859

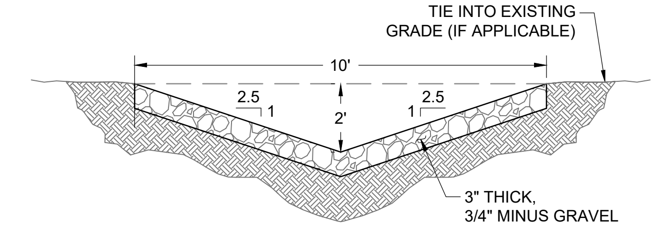
Atlantic Richfield Company

TITLE: DRILL RIG ANCHOR PLAN

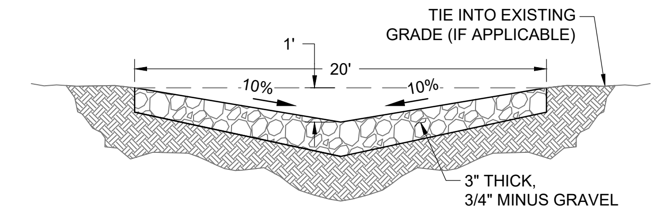
PROJECT: RW-3A Well Completion (10" Well)
Rico - Argentine Mine Site
Dolores County, Colorado

SHEET C-1B





1 TEMPORARY CHANNEL
DETAIL (NTS)



2 SWALE/ROAD CROSSING
DETAIL (NTS)

LEGEND:

- EXISTING STORMWATER FLOW PATH (MIXED MEDIUM)
- NEW STORMWATER FLOW PATH (CHANNEL)
- EXISTING STORMWATER ATTENUATION BASIN
- SAFETY BERM

EARTHWORK QUANTITY SUMMARY		
CUT (CY)	FILL (CY)	NET CUT (CY)
13,828	3,660	10,168

CY = CUBIC YARDS

NOTE:

1. ALL ACCESS ROADS AND PAD TO BE ARMORED WITH 3" THICK , 3/4" MINUS GRAVEL (SEE SHEETC-9).

NO:	DATE	CADD	CHECK	APP'D	ISSUE / REVISION DESCRIPTION
3	06/04/21	PAF	TSL	LE	ISSUED FOR CLIENT REVIEW
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5	06/28/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW
6	07/01/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW

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Atlantic Richfield Company

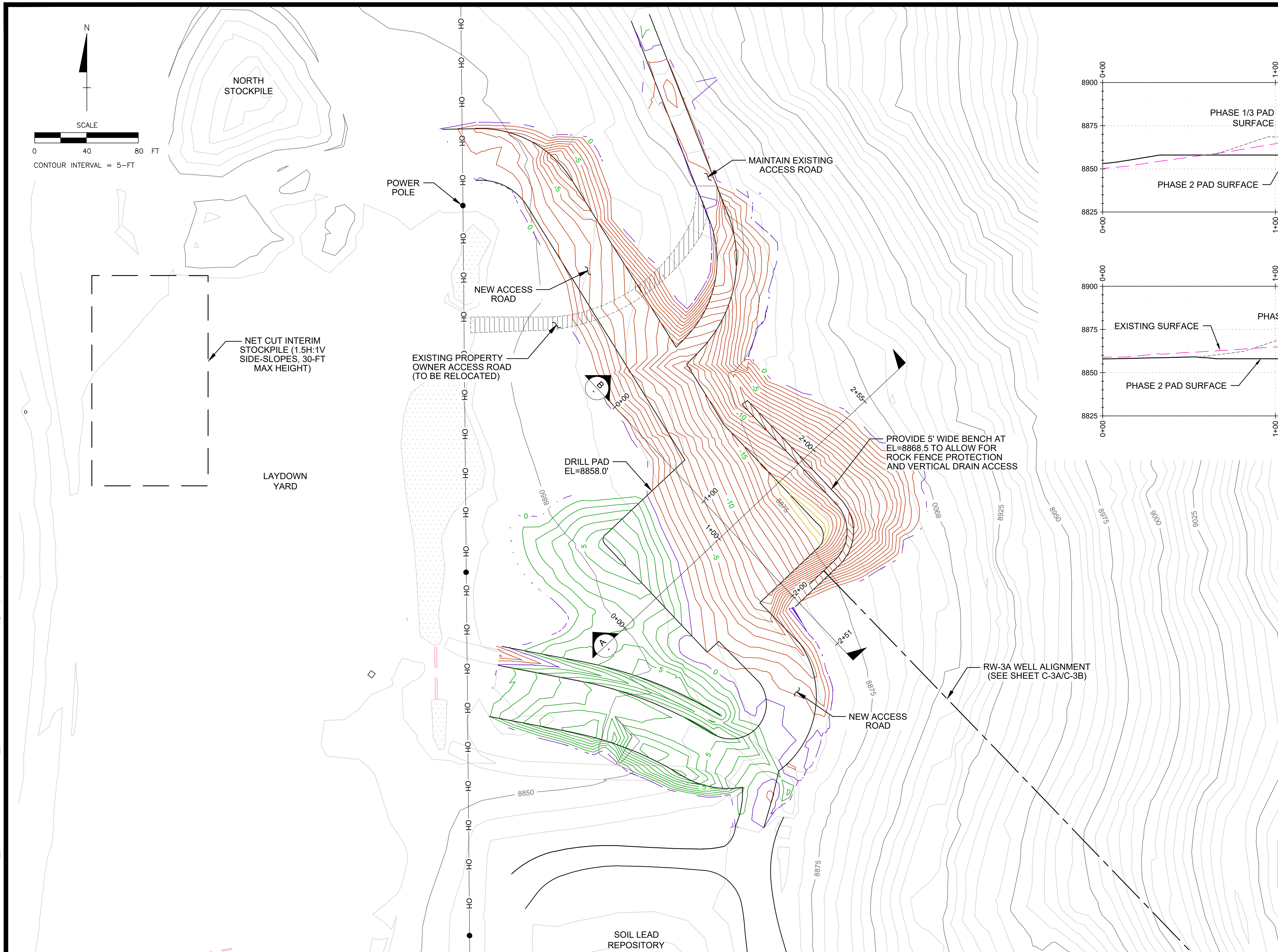
TITLE:
DRILL PAD GRADING PLAN

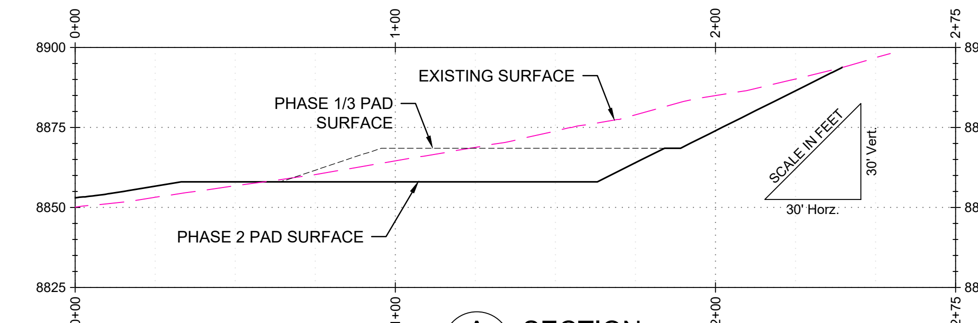
PROJECT:
RW-3A Well Completion (10" Well)
Rico - Argentine Mine Site
Dolores County, Colorado

SHEET
C-2A

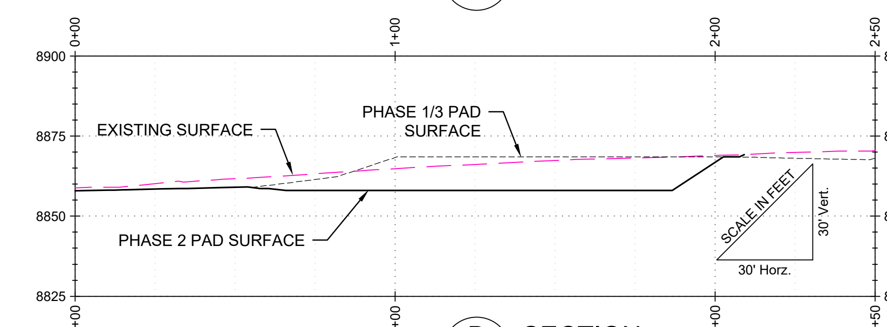
Jul 01, 2021 - 5:04pm Patricia F
U:\Work Files\Copper\70817 Rico\CADD_WellHouses\70817_RW3A-C303 Drill.dwg -(C2A)

PENTABLE: Copper_FULL.ctb





A SECTION



B SECTION

LEGEND

- ISOPACH CUT (FEET)
- ISOPACH FILL (FEET)
- ISOPACH ZERO CUT/FILL

EARTHWORK QUANTITY SUMMARY		
CUT (CY)	FILL (CY)	NET CUT (CY)
13,828	3,660	10,168

CY = CUBIC YARDS

NOTE:

1. ALL ACCESS ROADS AND PAD TO BE ARMORED WITH 3" THICK , 3/4" MINUS GRAVEL (SEE SHEET C-9).

NO:	DATE	CADD	CHECK	APP'D	ISSUE / REVISION DESCRIPTION
1	05/12/21	MRT	SPB	LE	ISSUED FOR CLIENT REVIEW
2	06/04/21	MRT	SPB	LE	ISSUED FOR CLIENT REVIEW
3	06/10/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW
4	06/28/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW

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Phoenix, AZ 85016
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Atlantic Richfield Company

TITLE:
DRILL PAD GRADING PLAN CUT/FILL ISOPACH

PROJECT:
RW-3A Well Completion (10" Well)
Rico - Argentine Mine Site
Dolores County, Colorado

SHEET
C-2B

Jul 01, 2021 - 12:25pm Patricia F
U:\Work Files\Copper\Rico\CADD_WellHouses\70817_RW3A-C303 Isopach.dwg -(C2B)

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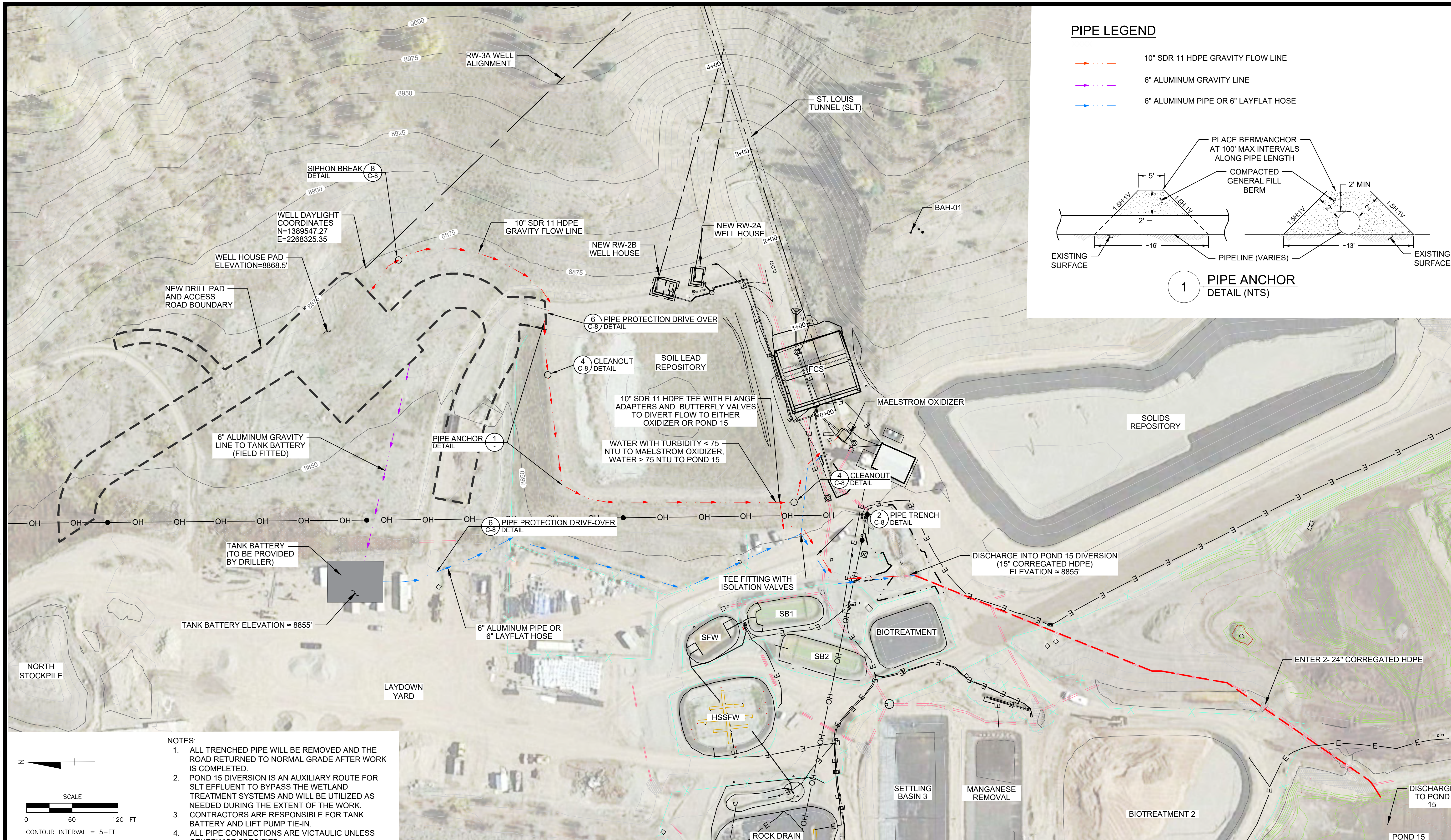

NOTES:

1. ALL TRENCHED PIPE WILL BE REMOVED AND THE ROAD RETURNED TO NORMAL GRADE AFTER WORK IS COMPLETED.
2. POND 15 DIVERSION IS AN AUXILIARY ROUTE FOR SLT EFFLUENT TO BYPASS THE WETLAND TREATMENT SYSTEMS AND WILL BE UTILIZED AS NEEDED DURING THE EXTENT OF THE WORK.
3. CONTRACTORS ARE RESPONSIBLE FOR TANK BATTERY AND LIFT PUMP TIE-IN.
4. ALL PIPE CONNECTIONS ARE VICTAULIC UNLESS OTHERWISE SPECIFIED.

Jul 01, 2021 - 12:21pm Patricia F
U:\Work Files\Copper\70817 Rico\CADD_WellHouses\70817_RW3A-C200 Route.dwg -(C2c)

NO:	DATE	CADD	CHECK	APP'D	ISSUE / REVISION DESCRIPTION
3	06/04/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW
4	06/10/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW
5	06/28/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW
6	07/01/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW

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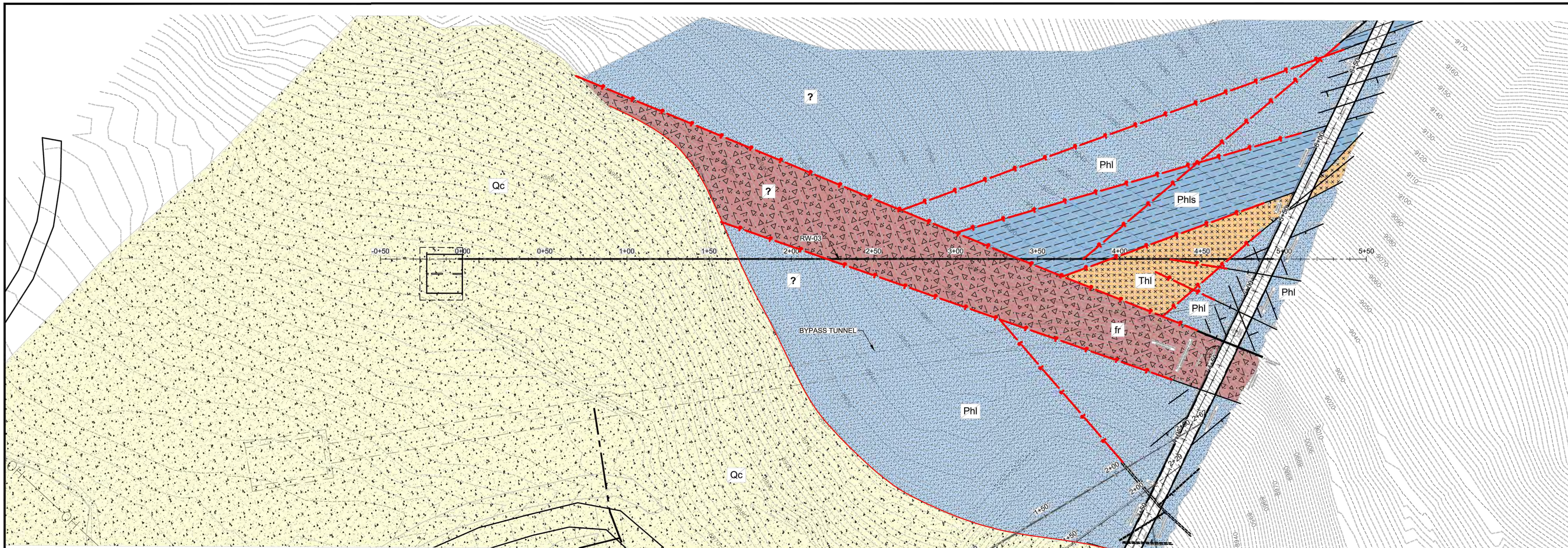
Atlantic Richfield Company

TITLE: DRILL DISCHARGE ROUTE

PROJECT: RW-3A Well Completion (10" Well)
Rico - Argentine Mine Site
Dolores County, Colorado

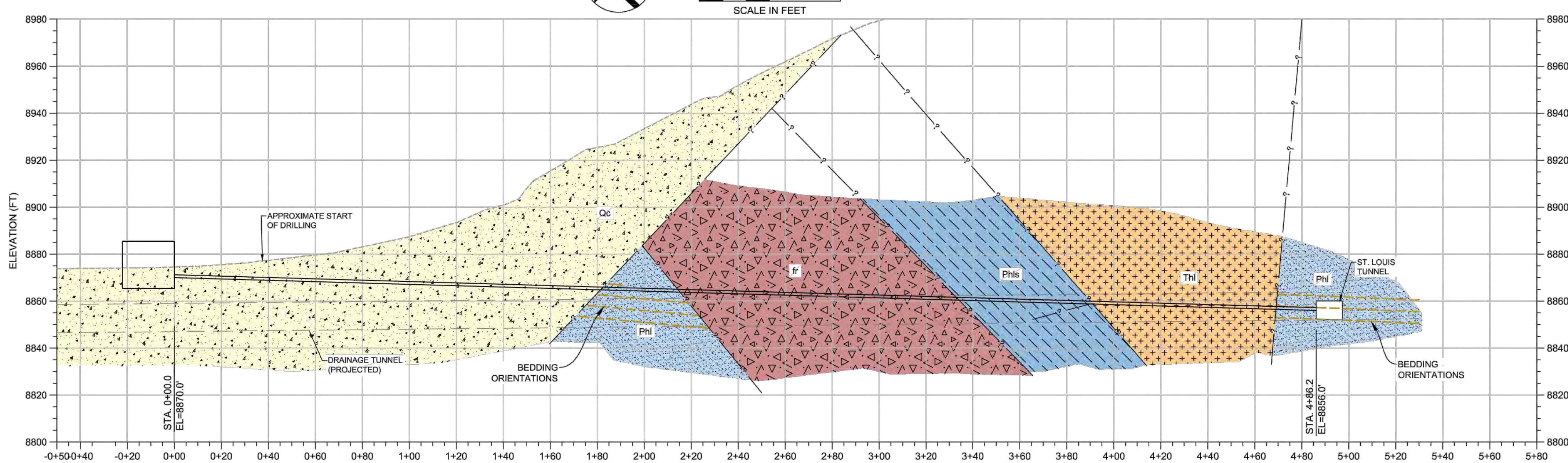
SHEET C-2C

PENTABLE: Copper_FULL.ctb



RELIEF WELL RW-03 PLAN

0 30 60
SCALE IN FEET



RELIEF WELL RW-03 PROFILE

0 30 60
SCALE IN FEET

LEGEND:

fr	FAULT ROCK: SANDSTONE AND PORPHYRY BOULDERS WITH CLAY RESEMBLING CHANNEL FILL, PARTIALLY CONSOLIDATED INTO BRECCIA
Qc	COLLUVIUM: INCLUDES BOTH SLOPEWASH AND/OR LANDSLIDE DEPOSITS, AN AMALGAMATION OF UNITS FROM THE SURROUNDING REGION WITH CLAST SIZES VARYING FROM ¾ INCH TO 12+ INCH.
Thl	HORNBLENDE LATITE PORPHYRY: A MIX OF PLAGIOCLASE AND HORNBLENDE CRYSTALS, WHICH ARE OCCASIONALLY ALTERED CLAY MINERALS, IN A GREY APHANITIC GROUNDMASS. WHERE ALTERATION OCCURS THE ROCK IS STIPPLED.
Phl	LOWER HERMOSA FORMATION SANDSTONE: VARIES FROM QUARTZ/ARKOSIC SANDSTONE, SILTSTONE, WITH LOCAL CONGLOMERATES TO BLACK SHALE OR LIMESTONE. VARIES FROM CROSS BEDDED TO MASSIVE. SHALY PARTINGS COMMON IN SANDSTONE.
Phls	LOWER HERMOSA FORMATION SHALE: BLACK TO DARK PLATY SHALE TO SANDY SHALE, SUBJECT TO DESICCATION AND SLAKING,
	FAULT MAPPED IN ST. LOUIS TUNNEL
	ESTIMATED CONTINUATION OF FAULT

NOTE:

1. GEOLOGY IS BASED ON THE ELEVATION OF THE GEOLOGIC FEATURES IN THE ST. LOUIS TUNNEL. THE GEOLOGY DOES NOT REPRESENT THE GROUND SURFACE EXPRESSION OF FEATURES.
2. WELL ALIGNMENT IS APPROXIMATE, SEE SHEET C-3B FOR WELL TRAJECTORY.

CONCEPTUAL DESIGN ONLY
NOT FOR CONSTRUCTION

Wednesday, June 10, 2020 3:32:07 PM DRAWING: U:\7784 BP\001 St Louis Tunnel\CAD\Working\STL_Tunnel Plans.DWG

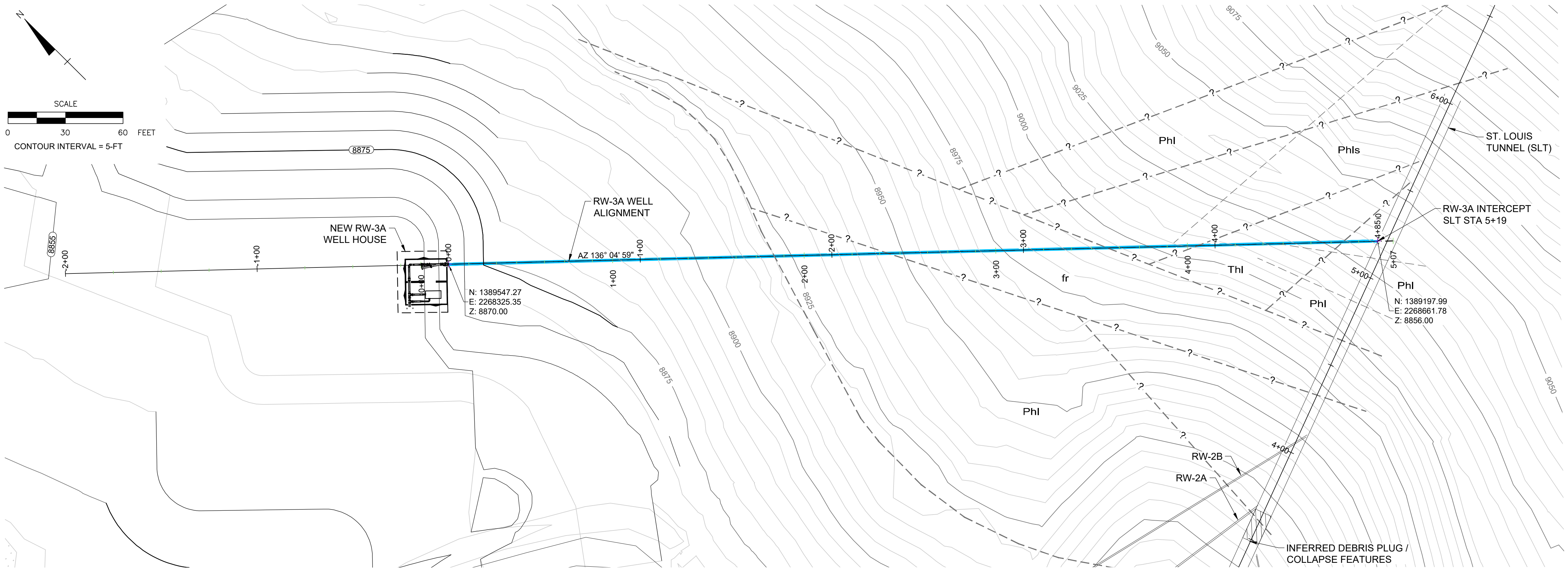
REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	30% DESIGN	4-15-20	CMG

ST LOUIS TUNNEL DRAINAGE

Relief Well 3 Plan & Profile

DEERE & AULT — A SCHNABEL ENGINEERING COMPANY
600 S. AIRPORT RD., BLDG. A, SUITE 205
LONGMONT, CO 80503
TEL 303.651.1468

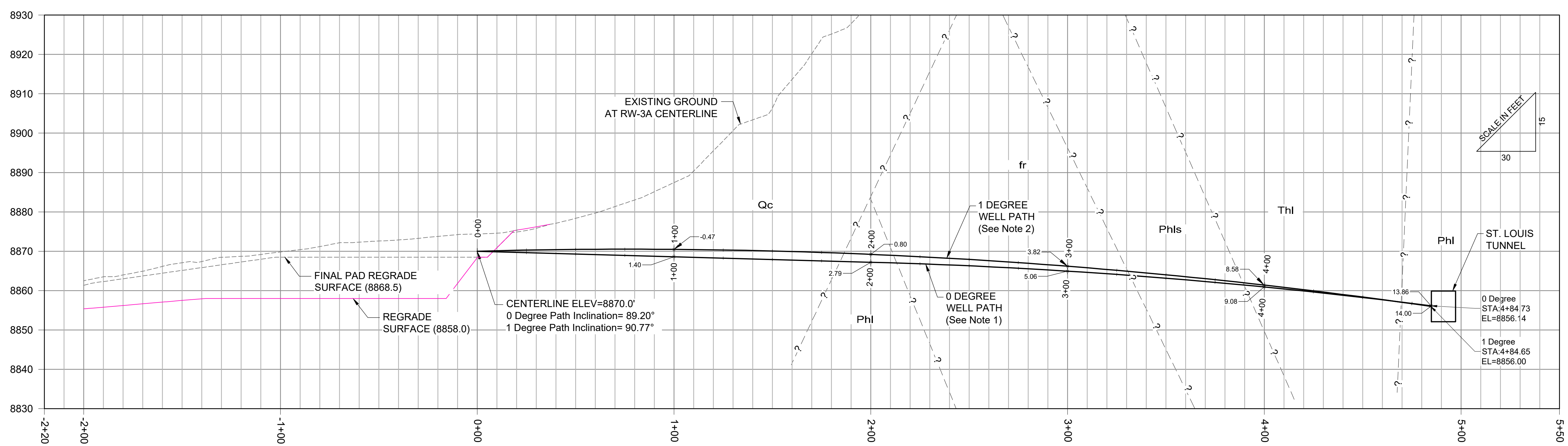
DESIGNED BY: CMG	APPROVED BY:	JOB NO.	SHEET:
DRAWN BY: HOG	DATE:	DA784001.01	C-3A
CHECKED BY: EPJ	SCALE: AS NOTED		



PLAN VIEW

SITE GEOLOGY LEGEND

fr	FAULT ROCK
Phl	LOWER HERMOSA SANDSTONE FORMATION
Phls	LOWER HERMOSA FORMATION SHALE
Qc	COLLUVIUM
Thl	HORNBLENDE LATITE PORPHYRY



PROFILE VIEW

LEGEND

5.65	WELL PATH WITH TOTAL VERTICAL DISTANCE (TVD) FROM CENTERLINE ELEVATION OF 8870.0
DLS	DOGLEG SEVERITY

NOTES:

1. 0 DEGREE PATH: STA 0+00 TO STA 2+00 (DLS=0); STA 2+00 TO STA 4+85 (DLS=1)
2. 1 DEGREE PATH: STA 0+00 TO STA 4+85 (DLS=1), T.O.P.= 8870.52' @ HIGH PT. 0+77.12

REFERENCES:

1. WELL PATHS BASED ON EXCEL FILES 'RICO TUNNEL 1DEGREE A.XLS' DATED 05/04/21 AND 'RICO TUNNEL 0DEGREE A.XLS' DATED 5/7/21 PROVIDED BY BOART LONGYEAR.
2. GEOLOGIC INFORMATION TAKEN FROM 'RELIEF WELL 3 PLAN & PROFILE' BY DEERE & AULT DATED 4/15/20.

NO:	DATE	CADD	CHECK	APP'D	ISSUE / REVISION DESCRIPTION
0	05/10/21	PAF	SPB	TSL	ISSUED FOR DRAFT REVIEW
1	06/10/21	PAF	SPB	TSL	ISSUED FOR DRAFT REVIEW
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3	07/01/21	PAF	SPB	TSL	ISSUED FOR DRAFT REVIEW

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Atlantic Richfield Company

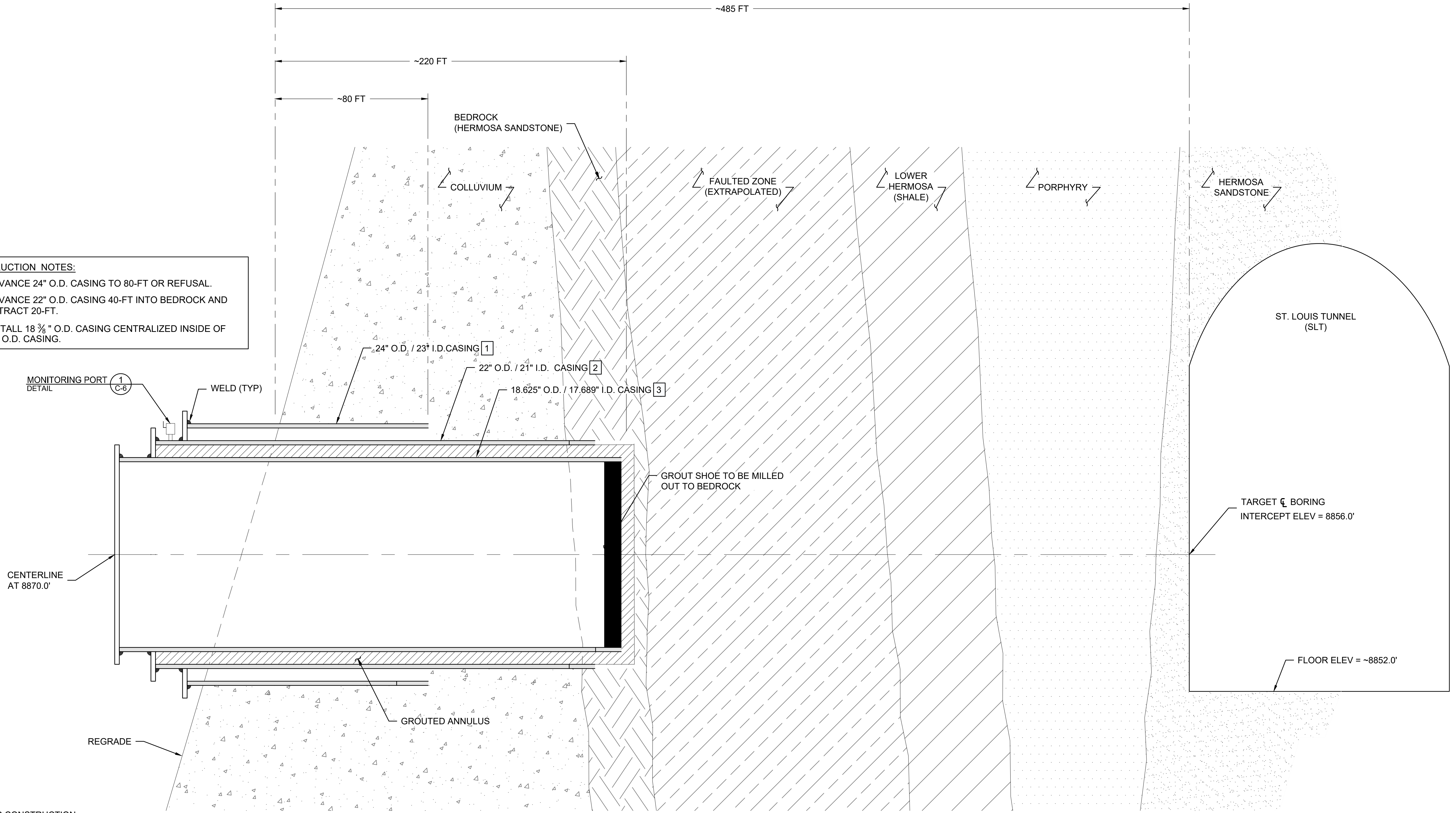
TITLE:
PLAN AND PROFILE
WITH DRILLER 0 DEGREE AND 1 DEGREE WELL PATHS

PROJECT:
RW3A Well Completion (10" Well)
Rico - Argentine Mine Site
Dolores County, Colorado

SHEET
C-3B

CONSTRUCTION NOTES:

1. ADVANCE 24" O.D. CASING TO 80-FT OR REFUSAL.
2. ADVANCE 22" O.D. CASING 40-FT INTO BEDROCK AND RETRACT 20-FT.
3. INSTALL 18 ⅝" O.D. CASING CENTRALIZED INSIDE OF 22" O.D. CASING.



WELL COMPLETION DIAGRAM
(NTS)

NOTE:

1. DRAFT, NOT FOR CONSTRUCTION.
2. ACTUAL CASING LENGTHS ARE ESTIMATED BASED ON GEOLOGY.
3. GEOLOGY REFERENCED FROM DEERE & AULT'S RELIEF WELL 3 PLAN & PROFILE (SEE SHEET C-3A).
4. SURFACE CAPPED WITH MONITORING PORTS.
5. THE DEPICTIONS SHOWN ARE CONSIDERED AN ASSUMED GENERALIZATION OF THE STRATIGRAPHY. THE SUBSURFACE CONDITIONS SHOWN ARE BASED ON INTERPRETATION OF LIMITED TEST HOLE DATA AND HISTORICAL MAPPING OF THE ST. LOUIS TUNNEL AND THEREFORE THE DEPICTED CONDITIONS ARE FOR GENERAL INFORMATION AND DISCUSSION PURPOSES ONLY.
6. ALL PIPE CASINGS ARE CARBON STEEL, WITH THE EXCEPTION OF THE 10.75" CASING WHICH IS 316L STAINLESS STEEL.

NO:	DATE	CADD	CHECK	APP'D	ISSUE / REVISION DESCRIPTION
0	02/10/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW
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3	06/17/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW

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Phoenix, AZ 85016
Tel: (602) 331-3859

Atlantic Richfield Company

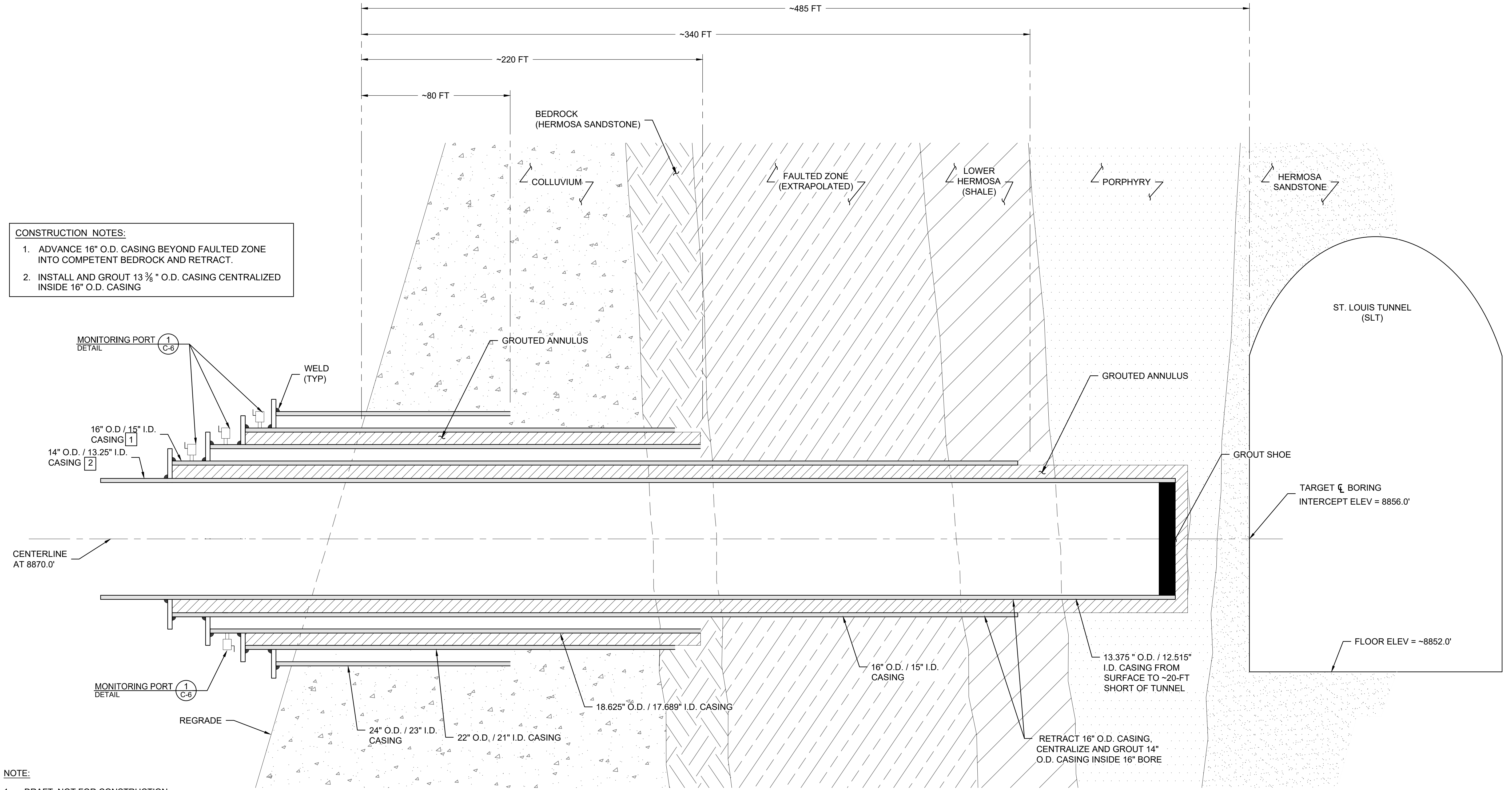
TITLE:
CONSTRUCTION STAGES
INITIAL BORING AND CONDUCTOR CASING

PROJECT:
RW-3A Well Completion (10" Well)
Rico - Argentine Mine Site
Dolores County, Colorado

SHEET
C-4A

CONSTRUCTION NOTES:

1. ADVANCE 16" O.D. CASING BEYOND FAULTED ZONE INTO COMPETENT BEDROCK AND RETRACT.
2. INSTALL AND GROUT 13 3/8 " O.D. CASING CENTRALIZED INSIDE 16" O.D. CASING



WELL COMPLETION DIAGRAM
(NTS)

NOTE:

1. DRAFT, NOT FOR CONSTRUCTION.
2. ACTUAL CASING LENGTHS ARE ESTIMATED BASED ON GEOLOGY.
3. GEOLOGY REFERENCED FROM DEERE & AULT'S RELIEF WELL 3 PLAN & PROFILE (SEE SHEET C-3A).
4. SURFACE CAPPED WITH MONITORING PORTS.
5. THE DEPICTIONS SHOWN ARE CONSIDERED AN ASSUMED GENERALIZATION OF THE STRATIGRAPHY. THE SUBSURFACE CONDITIONS SHOWN ARE BASED ON INTERPRETATION OF LIMITED TEST HOLE DATA AND HISTORICAL MAPPING OF THE ST. LOUIS TUNNEL AND THEREFORE THE DEPICTED CONDITIONS ARE FOR GENERAL INFORMATION AND DISCUSSION PURPOSES ONLY.
6. ALL PIPE CASINGS ARE CARBON STEEL, WITH THE EXCEPTION OF THE 10.75" CASING WHICH IS 316L STAINLESS STEEL.

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3	06/17/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW

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2211 East Highland Avenue, Suite 215
Phoenix, AZ 85016
Tel: (602) 331-3859

Atlantic Richfield Company

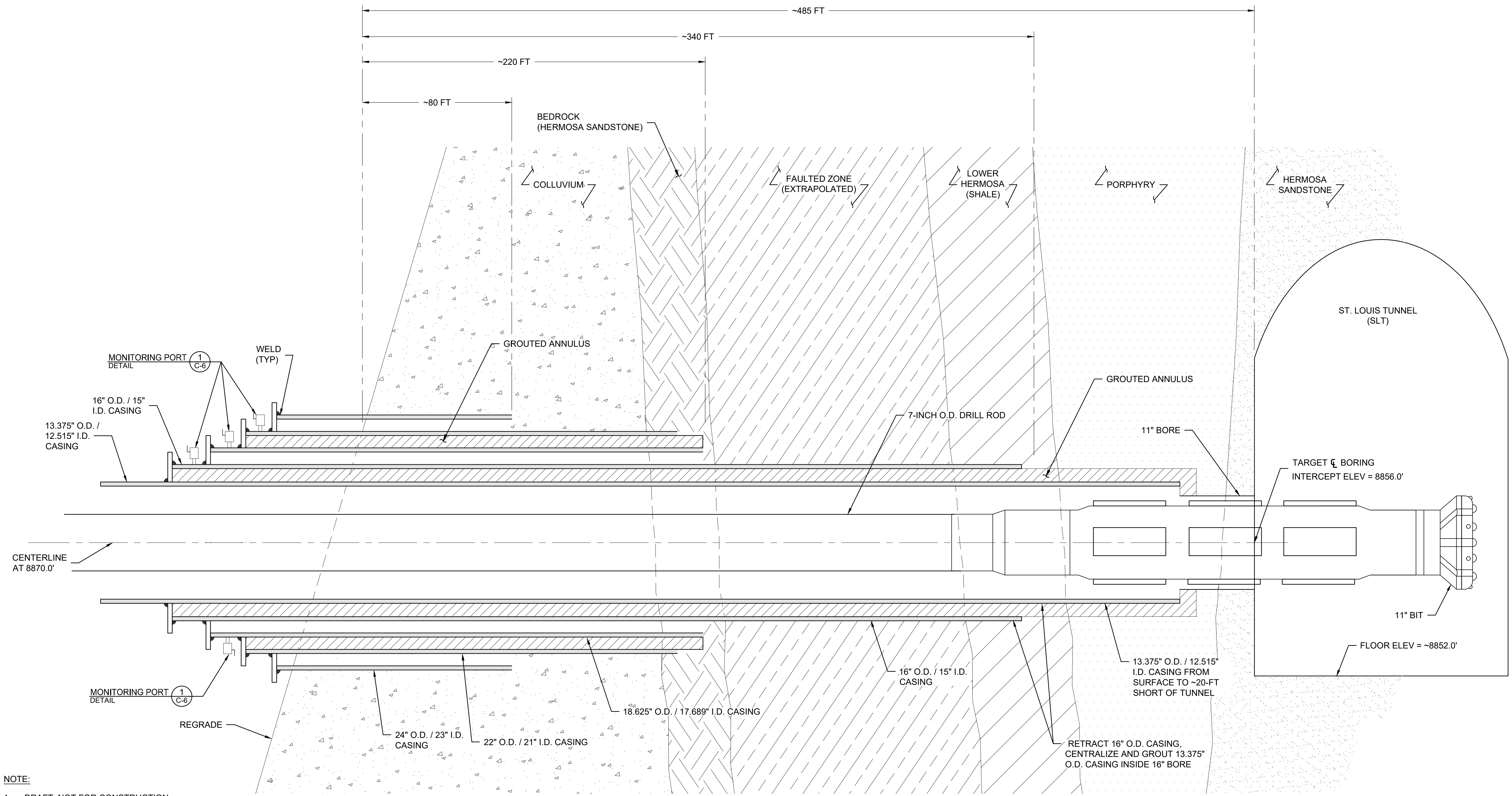
TITLE:
CONSTRUCTION STAGES
INTERMEDIATE BORING AND CASING

PROJECT:
RW-3A Well Completion (10" Well)
Rico - Argentine Mine Site
Dolores County, Colorado

SHEET
C-4B

Jul 01, 2021 - 12:29pm Patricia F
U:\Work Files\Copper\70817 Rico\CADD_WellHouses\70817_RW3A-C601 Details.dwg -(C4B (10.75))

PENTABLE: Copper_FULL.ctb



WELL COMPLETION DIAGRAM
(NTS)

NOTE:

1. DRAFT, NOT FOR CONSTRUCTION.
2. ACTUAL CASING LENGTHS ARE ESTIMATED BASED ON GEOLOGY.
3. GEOLOGY REFERENCED FROM DEERE & AULT'S RELIEF WELL 3 PLAN & PROFILE (SEE SHEET C-3A).
4. SURFACE CAPPED WITH MONITORING PORTS.
5. THE DEPICTIONS SHOWN ARE CONSIDERED AN ASSUMED GENERALIZATION OF THE STRATIGRAPHY. THE SUBSURFACE CONDITIONS SHOWN ARE BASED ON INTERPRETATION OF LIMITED TEST HOLE DATA AND HISTORICAL MAPPING OF THE ST. LOUIS TUNNEL AND THEREFORE THE DEPICTED CONDITIONS ARE FOR GENERAL INFORMATION AND DISCUSSION PURPOSES ONLY.
6. ALL PIPE CASINGS ARE CARBON STEEL, WITH THE EXCEPTION OF THE 10.75" CASING WHICH IS 316L STAINLESS STEEL.

NO:	DATE	CADD	CHECK	APP'D	ISSUE / REVISION DESCRIPTION
0	02/10/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW
1	03/16//21	MRT	SPB	LE	ISSUED FOR CLIENT REVIEW
2	05/12/21	MRT	SPB	LE	ISSUED FOR CLIENT REVIEW
3	06/17/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW

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Atlantic Richfield Company

TITLE:
CONSTRUCTION STAGES
PUNCHOUT/COMPLETION DRILL

PROJECT:
RW-3A Well Completion (10" Well)
Rico - Argentine Mine Site
Dolores County, Colorado

SHEET
C-4C

Jul 01, 2021 - 12:29pm Patricia F
U:\Work Files\Copper\70817 Rico\CADD_WellHouses\70817_RW3A-C601 Details.dwg -(C4C (10.75'))

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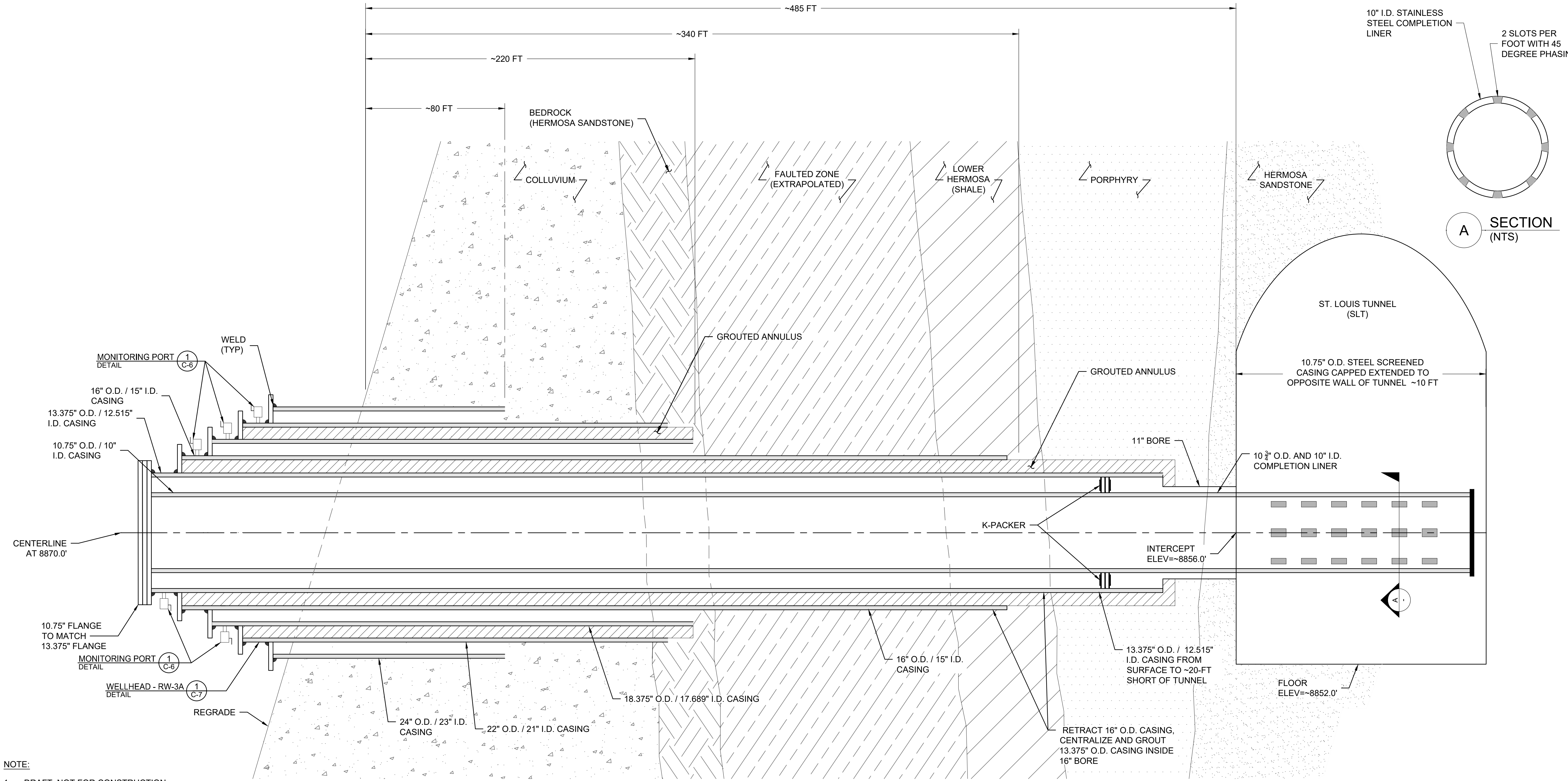

WELL COMPLETION DIAGRAM
(NTS)

NOTE:

1. DRAFT, NOT FOR CONSTRUCTION.
2. ACTUAL CASING LENGTHS ARE ESTIMATED BASED ON GEOLOGY.
3. GEOLOGY REFERENCED FROM DEERE & AULT'S RELIEF WELL 3 PLAN & PROFILE (SEE SHEET C-3A).
4. SURFACE CAPPED WITH MONITORING PORTS.
5. THE DEPICTIONS SHOWN ARE CONSIDERED AN ASSUMED GENERALIZATION OF THE STRATIGRAPHY. THE SUBSURFACE CONDITIONS SHOWN ARE BASED ON INTERPRETATION OF LIMITED TEST HOLE DATA AND HISTORICAL MAPPING OF THE ST. LOUIS TUNNEL AND THEREFORE THE DEPICTED CONDITIONS ARE FOR GENERAL INFORMATION AND DISCUSSION PURPOSES ONLY.
6. ALL PIPE CASINGS ARE CARBON STEEL, WITH THE EXCEPTION OF THE 10.75" CASING WHICH IS 316L STAINLESS STEEL.

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0	02/10/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW
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2	05/12/21	MRT	SPB	LE	ISSUED FOR CLIENT REVIEW
3	06/17/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW

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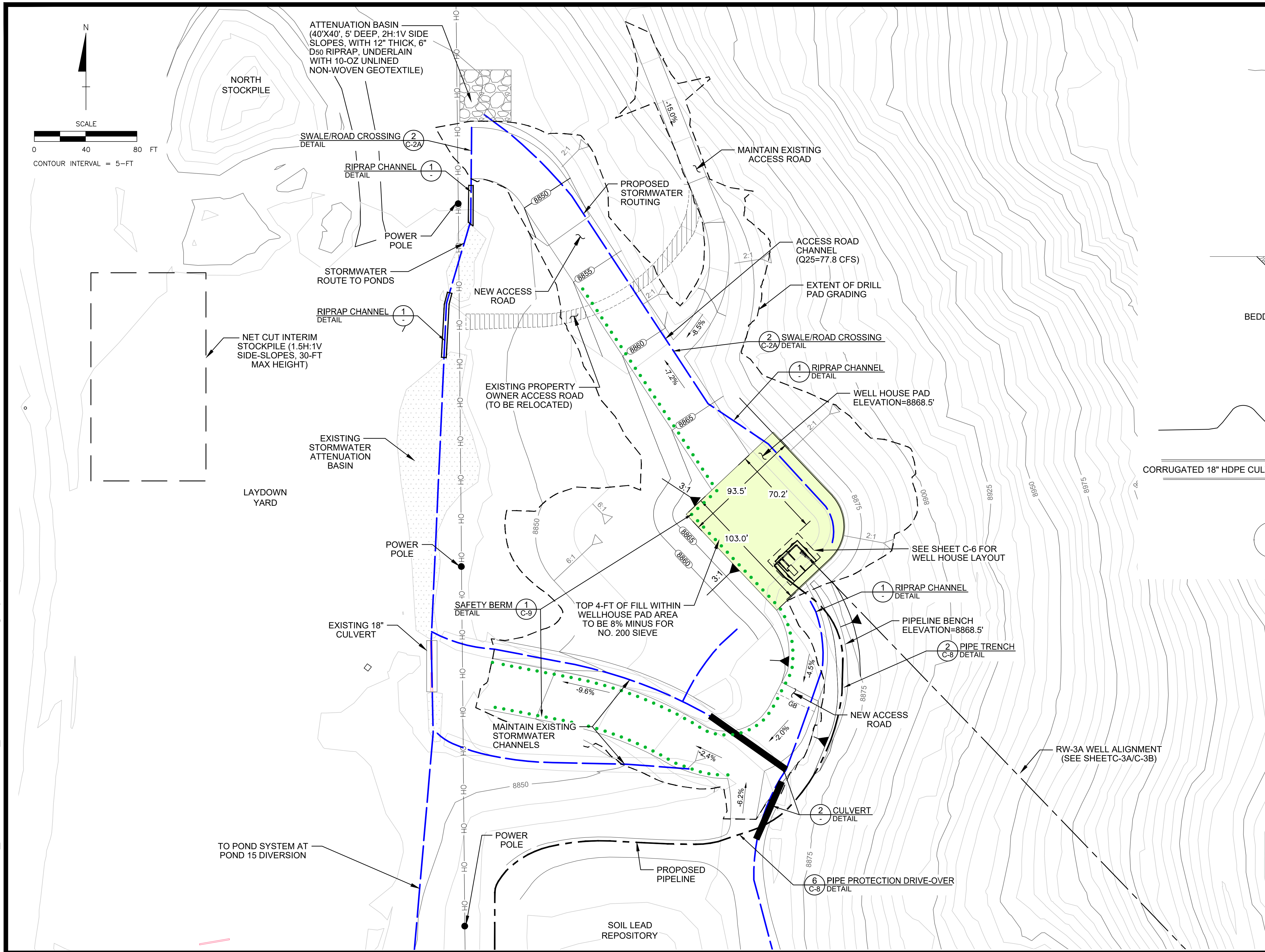
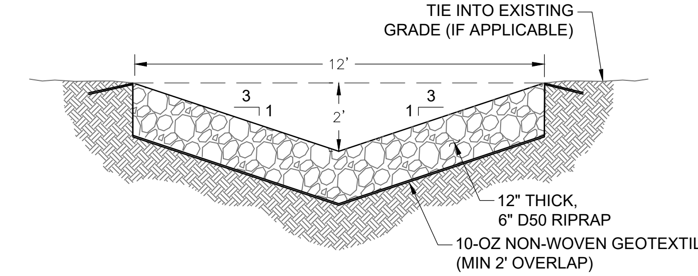
Atlantic Richfield Company

TITLE: CONSTRUCTION STAGES FINAL COMPLETION PROFILE

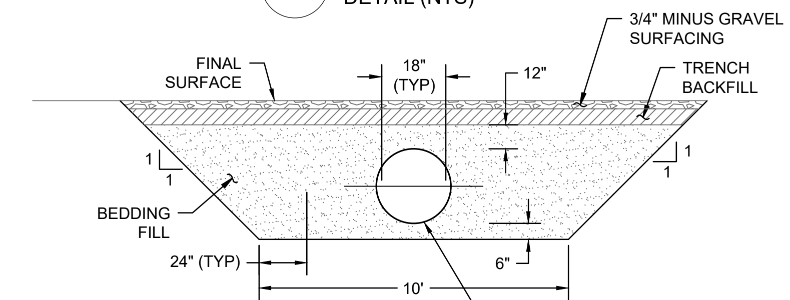
PROJECT: RW-3A Well Completion (10" Well)
Rico - Argentine Mine Site
Dolores County, Colorado

SHEET C-4D

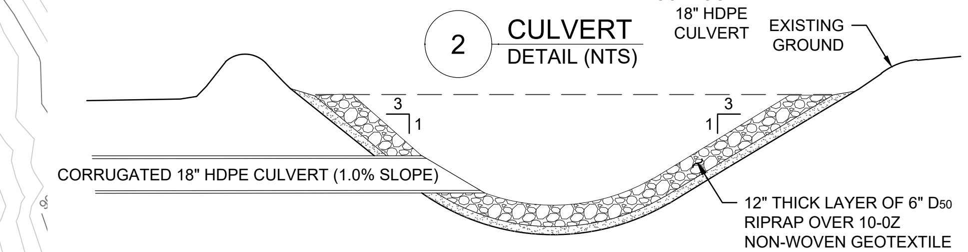




1 RIPRAP CHANNEL
DETAIL (NTS)



2 CULVERT
DETAIL (NTS)



3 CULVERT INLET / OUTLET ARMORING
DETAIL (NTS)

NOTE:

1. ALL ACCESS ROADS AND PAD TO BE ARMORED WITH 3" THICK , 3/4" MINUS GRAVEL (SEE SHEET C-9)

NO:	DATE	CADD	CHECK	APP'D	ISSUE / REVISION DESCRIPTION
2	05/21/21	PAF	TSL	LE	ISSUED FOR CLIENT REVIEW
3	06/10/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW
4	06/28/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW
5	07/01/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW

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Phoenix, AZ 85016
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Atlantic Richfield Company

TITLE: COMPLETION PAD GRADING PAD

PROJECT: RW-3A Well Completion (10" Well)
Rico - Argentine Mine Site
Dolores County, Colorado

SHEET C-5A

Patricia F
Jul 01, 2021 - 5:00pm
U:\Work Files\Copper\70817 Rico\CADD_WellHouses\70817_RW3A-C304 Crane.dwg -(C5a)
PENTABLE: Copper_FULL.ctb

LEGEND

- ISOPACH CUT (FEET)
- ISOPACH FILL (FEET)
- ISOPACH ZERO CUT/FILL

EARTHWORK QUANTITY SUMMARY		
CUT (CY)	FILL (CY)	NET FILL (CY)
227	6,962	6,735

CY = CUBIC YARDS

NOTE:

1. ALL ACCESS ROADS AND PAD TO BE ARMORED WITH 3" THICK , 3/4" MINUS GRAVEL (SEE SHEET C-9).

NO:	DATE	CADD	CHECK	APP'D	ISSUE / REVISION DESCRIPTION
3	06/04/21	PAF	TSL	LE	ISSUED FOR CLIENT REVIEW
4	06/10/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW
5	06/28/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW
6	07/01/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW

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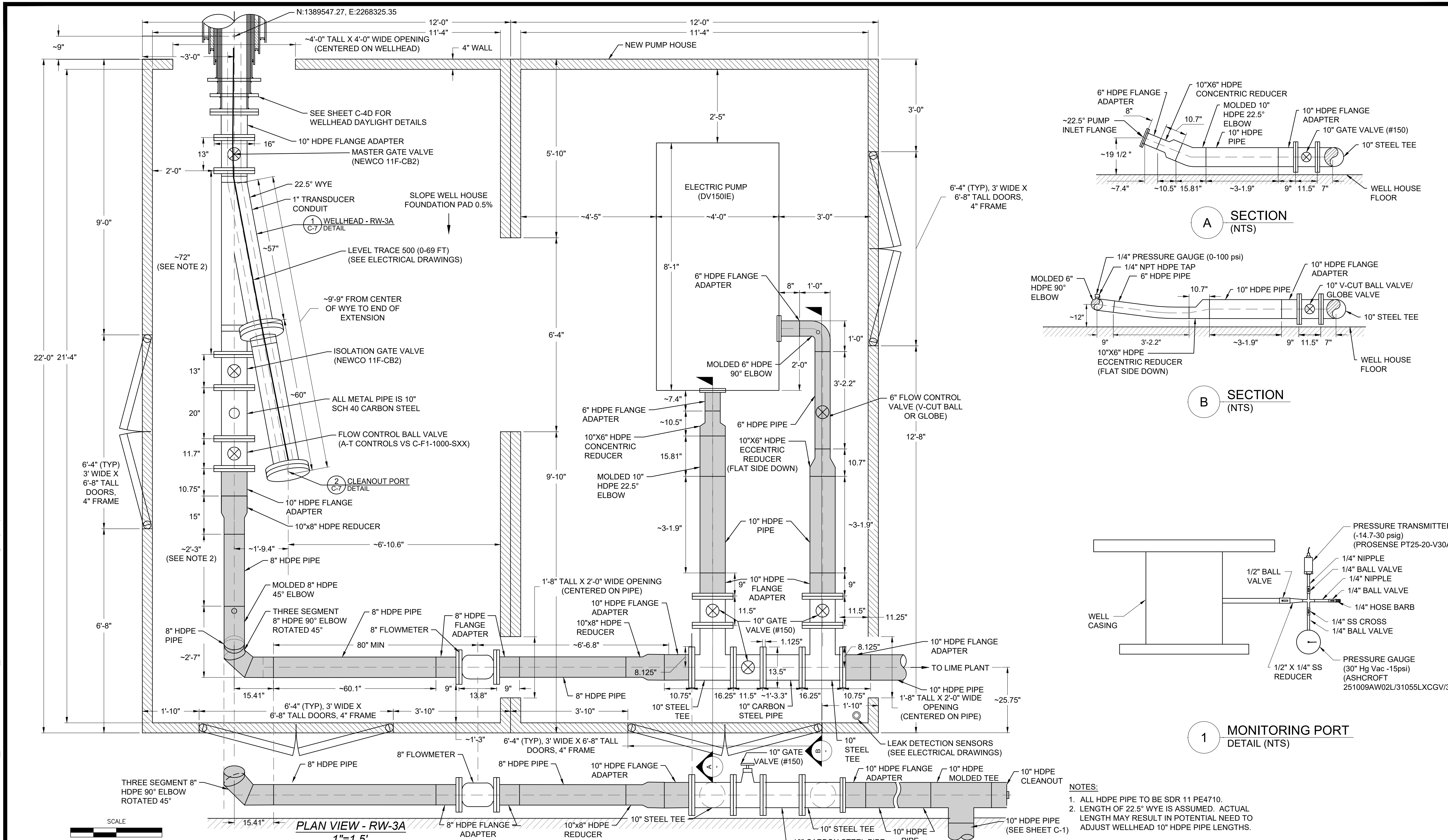
Phoenix, AZ 85016
Tel: (602) 331-3859

Atlantic Richfield Company

TITLE:
COMPLETION PAD GRADING PLAN CUT/FILL ISOPACH

PROJECT:
RW-3A Well Completion (10" Well)
Rico - Argentine Mine Site
Dolores County, Colorado

SHEET
C-5B



NO:	DATE	CADD	CHECK	APP'D	ISSUE / REVISION DESCRIPTION
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1	05/12/21	MRT	SPB	LE	ISSUED FOR CLIENT REVIEW
2	05/21/21	PAF	TSL	LE	ISSUED FOR CLIENT REVIEW
3	06/14/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW

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Tel: (602) 331-3859

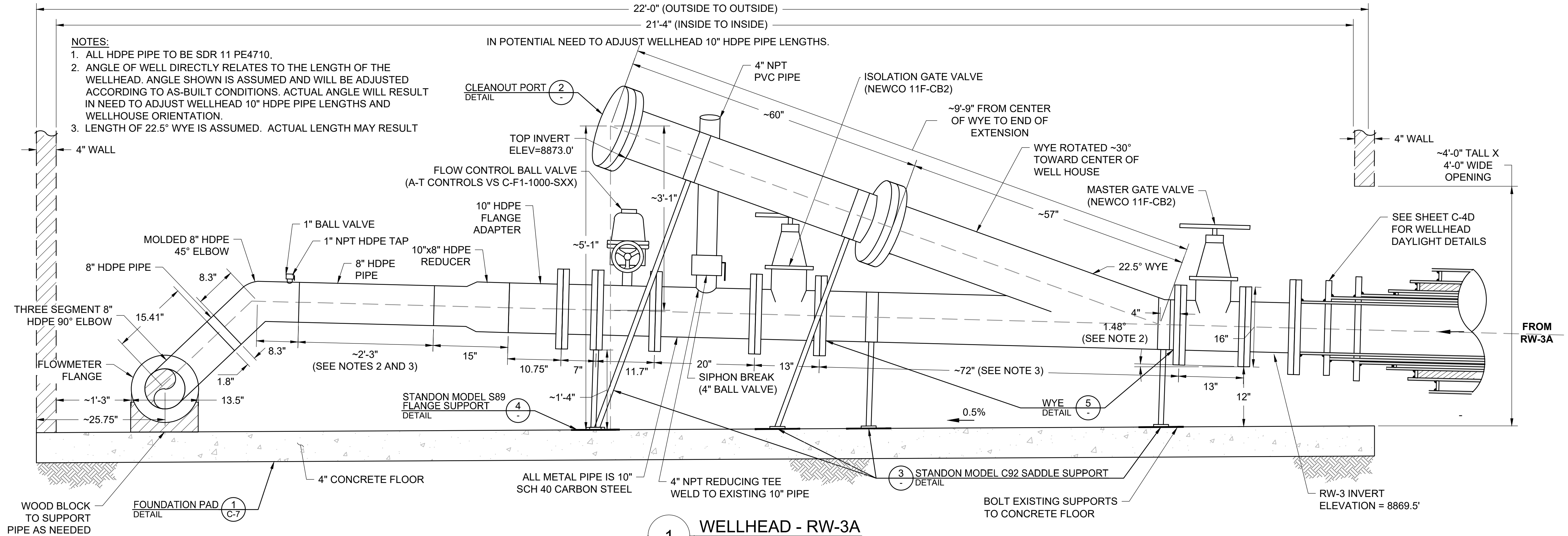
Atlantic Richfield Company

TITLE: WELL HOUSE PLAN VIEW

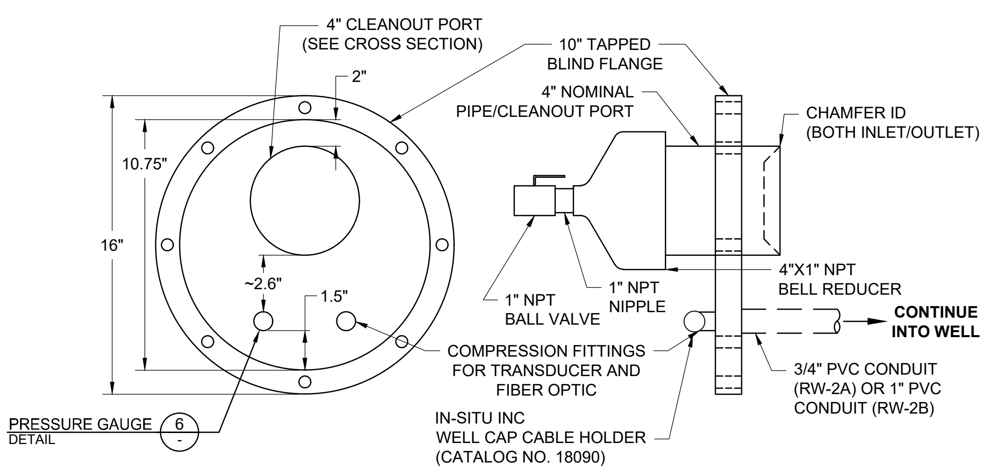
PROJECT: RW-3A Well Completion (10" Well)
Rico - Argentine Mine Site
Dolores County, Colorado

SHEET C-6

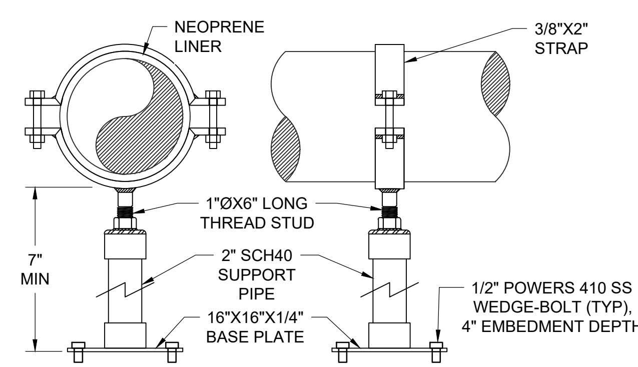
NOTES:
1. ALL HDPE PIPE TO BE SDR 11 PE4710.
2. ANGLE OF WELL DIRECTLY RELATES TO THE LENGTH OF THE WELLHEAD. ANGLE SHOWN IS ASSUMED AND WILL BE ADJUSTED ACCORDING TO AS-BUILT CONDITIONS. ACTUAL ANGLE WILL RESULT IN NEED TO ADJUST WELLHEAD 10" HDPE PIPE LENGTHS AND WELLHOUSE ORIENTATION.
3. LENGTH OF 22.5° WYE IS ASSUMED. ACTUAL LENGTH MAY RESULT IN POTENTIAL NEED TO ADJUST WELLHEAD 10" HDPE PIPE LENGTHS.



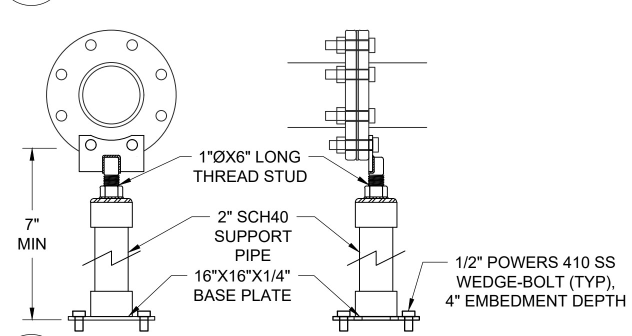
1 WELLHEAD - RW-3A
DETAIL (1"=1')



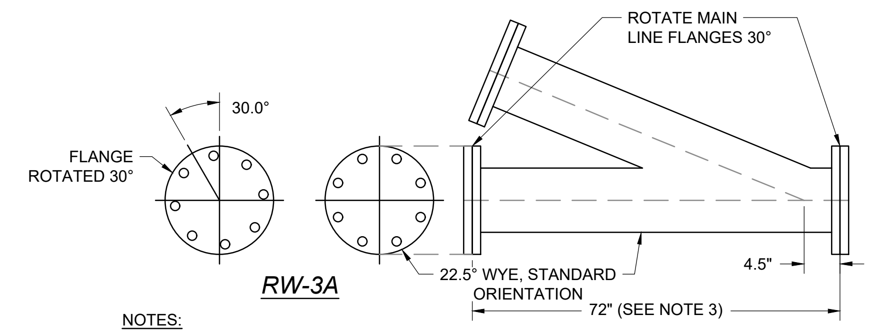
2 CLEANOUT PORT
DETAIL (NTS)



3 STANDON MODEL C92 SADDLE SUPPORT
DETAIL (NTS)

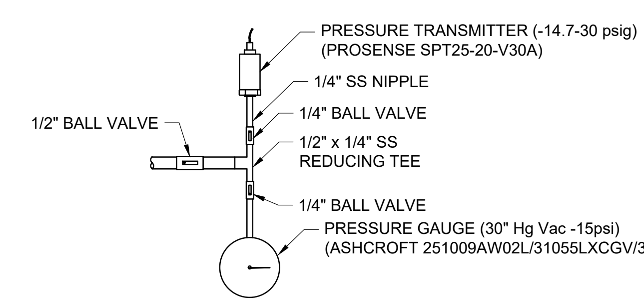


4 STANDON MODEL S89 FLANGE SUPPORT
DETAIL (NTS)



NOTES:
1. ALL HDPE PIPE TO BE SDR 11 PE4710.
2. LENGTH OF 22.5° WYE IS ASSUMED. ACTUAL LENGTH MAY RESULT IN POTENTIAL NEED TO ADJUST WELL HOUSE DIMENSIONS.

5 WYE
DETAIL (NTS)



6 PRESSURE GAUGE
DETAIL (NTS)

NO:	DATE	CADD	CHECK	APP'D	ISSUE / REVISION DESCRIPTION
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1	05/12/21	MRT	SPB	LE	ISSUED FOR CLIENT REVIEW
2	06/14/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW

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Phoenix, AZ 85016
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Atlantic Richfield Company

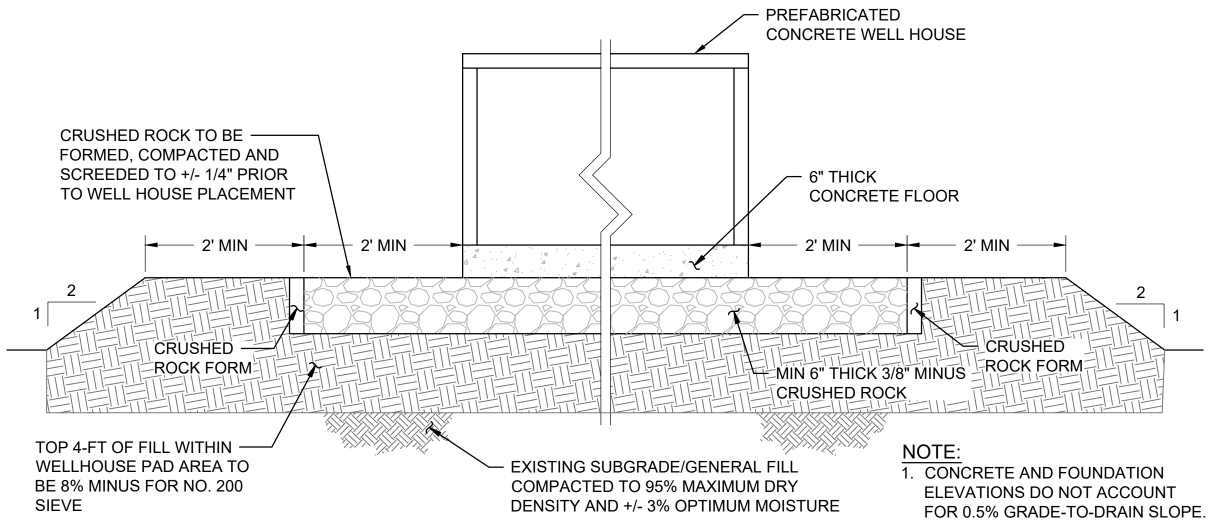
TITLE: WELLHEAD DETAILS

PROJECT: RW-3A Well Completion (10" Well)
Rico - Argentine Mine Site
Dolores County, Colorado

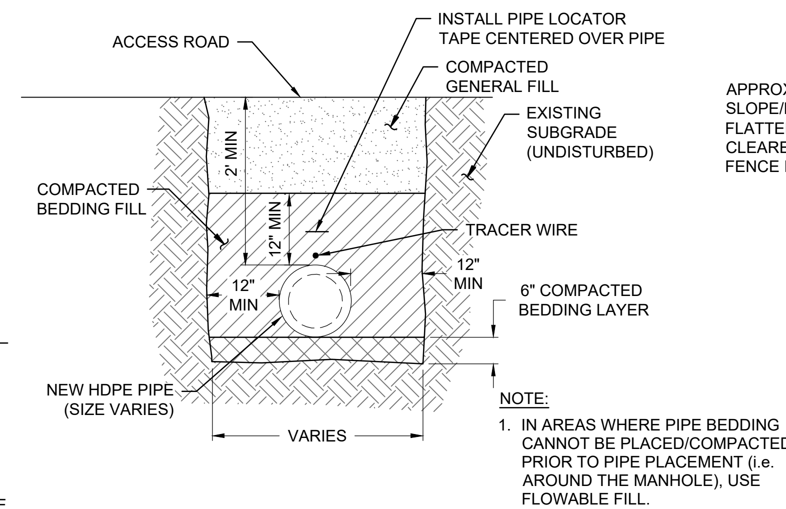
SHEET C-7

Jul 01, 2021 - 12:46pm Patricia F
U:\Work Files\Copper\70817 Rico\CADD_WellHouses\70817_RW3A-C600 Details.dwg -(C7)

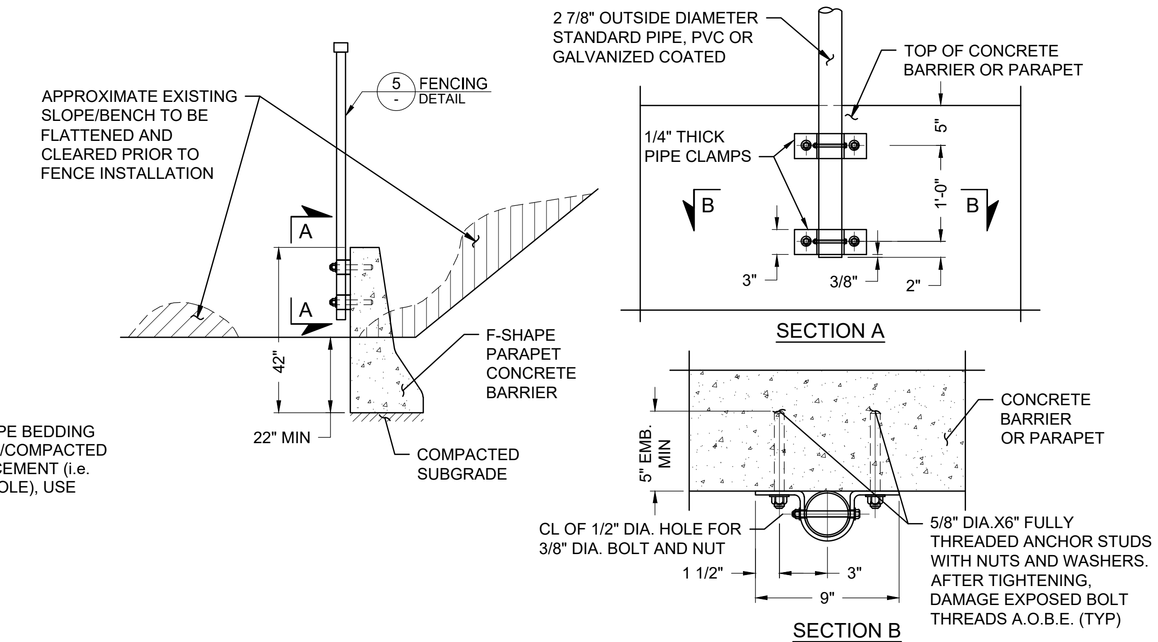
PENTABLE: Copper_FULL.ctb



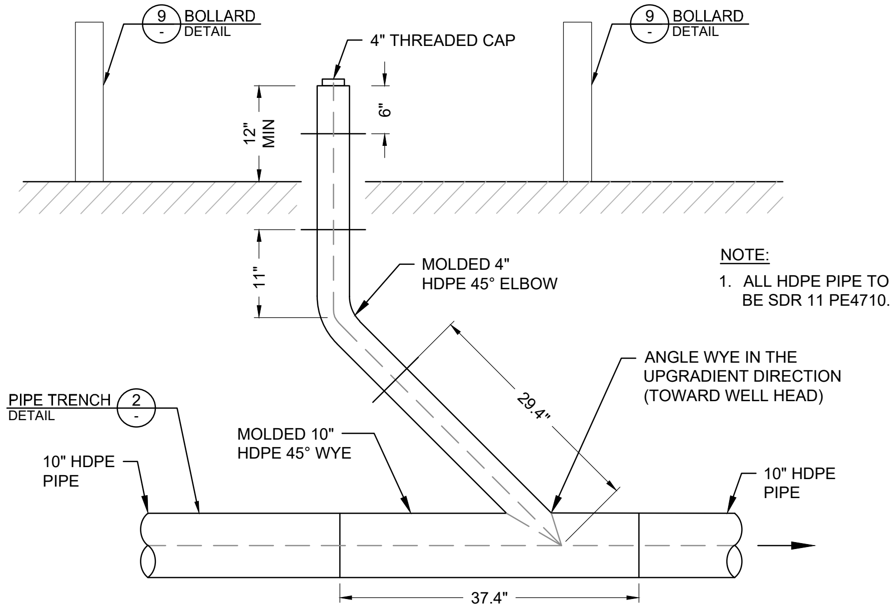
1 WELLHOUSE FOUNDATION PAD
DETAIL (NTS)



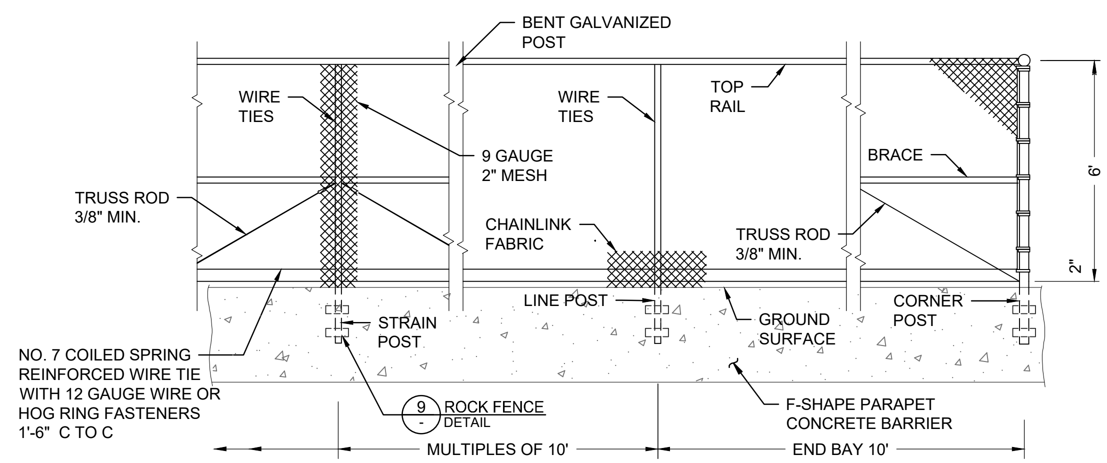
2 PIPE TRENCH
DETAIL (NTS)



3 ROCK FENCE
DETAIL (NTS)



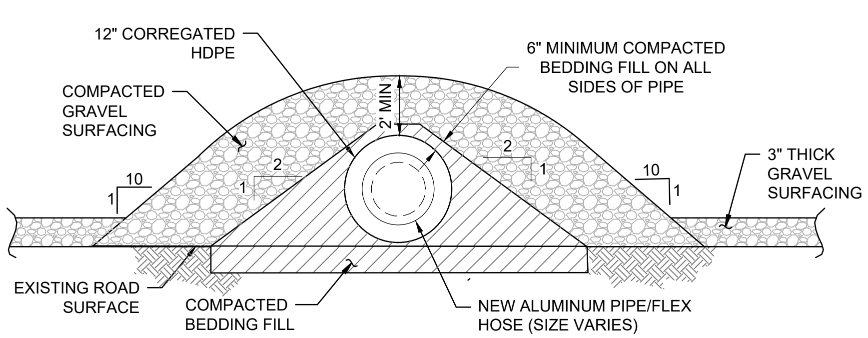
4 CLEANOUT
DETAIL (NTS)



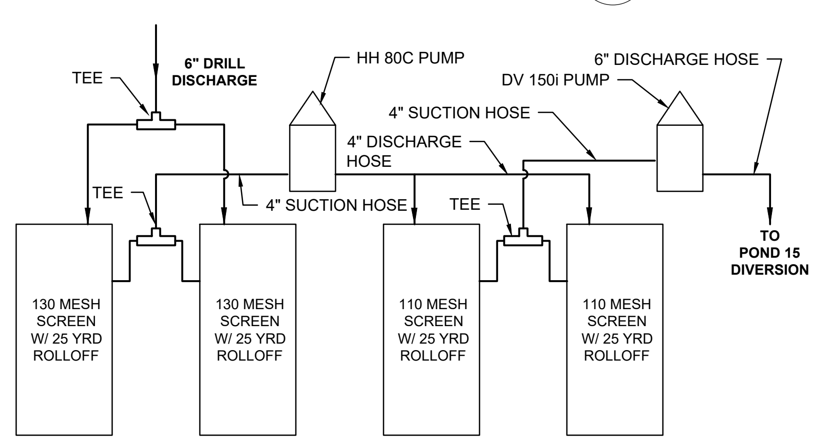
NOTES
1. FITTINGS NOT SPECIFICALLY DETAILED SHALL BE HEAVY DUTY DESIGN.
2. BOTH CORNER AND STRAIN POSTS SHALL HAVE STRAIN PANELS.
3. ALL POSTS SHALL BE CAPPED.
4. MEMBER SIZES SHALL BE THE FOLLOWING:

MEMBER	AISC SIZE	OUTSIDE DIA.
CORNER POST	2-1/2"	2.875"
LINE POST	1-1/2"	1.900"
STRAIN POST	1-1/2"	1.900"
BRACE	1-1/4"	1.666"
STRETCH BAR	3/16"x3/4" FLAT	3/16"x3/4" FLAT
GATE POST	3-1/2"	4.000"
TOP RAIL	1-1/4"	1.666"

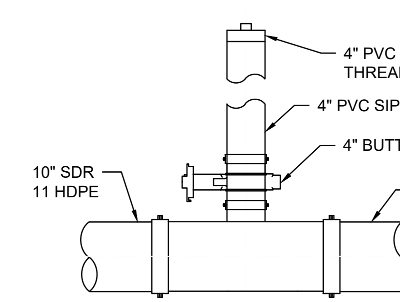
5 FENCING
DETAIL (NTS)



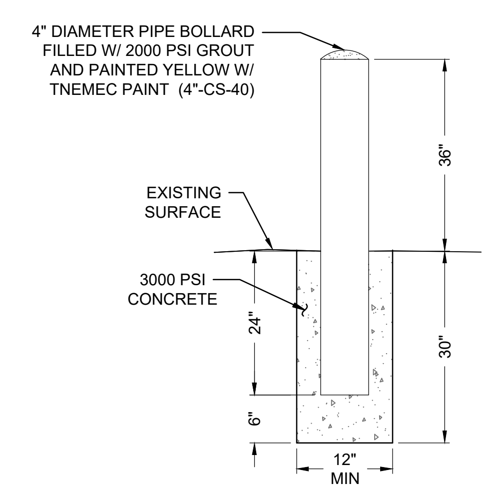
6 PIPE PROTECTION DRIVE-OVER
DETAIL (NTS)



7 TANK BATTERY
LAYOUT



8 SIPHON BREAK
DETAIL (NTS)



9 BOLLARD
DETAIL (NTS)

NO:	DATE	CADD	CHECK	APP'D	ISSUE / REVISION DESCRIPTION
0	02/10/21	DCC	SPB	LE	ISSUED FOR CLIENT REVIEW
1	05/12/21	MRT	SPB	LE	ISSUED FOR CLIENT REVIEW
2	06/04/21	MRT	SPB	LE	ISSUED FOR CLIENT REVIEW
3	06/10/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW

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Atlantic Richfield Company

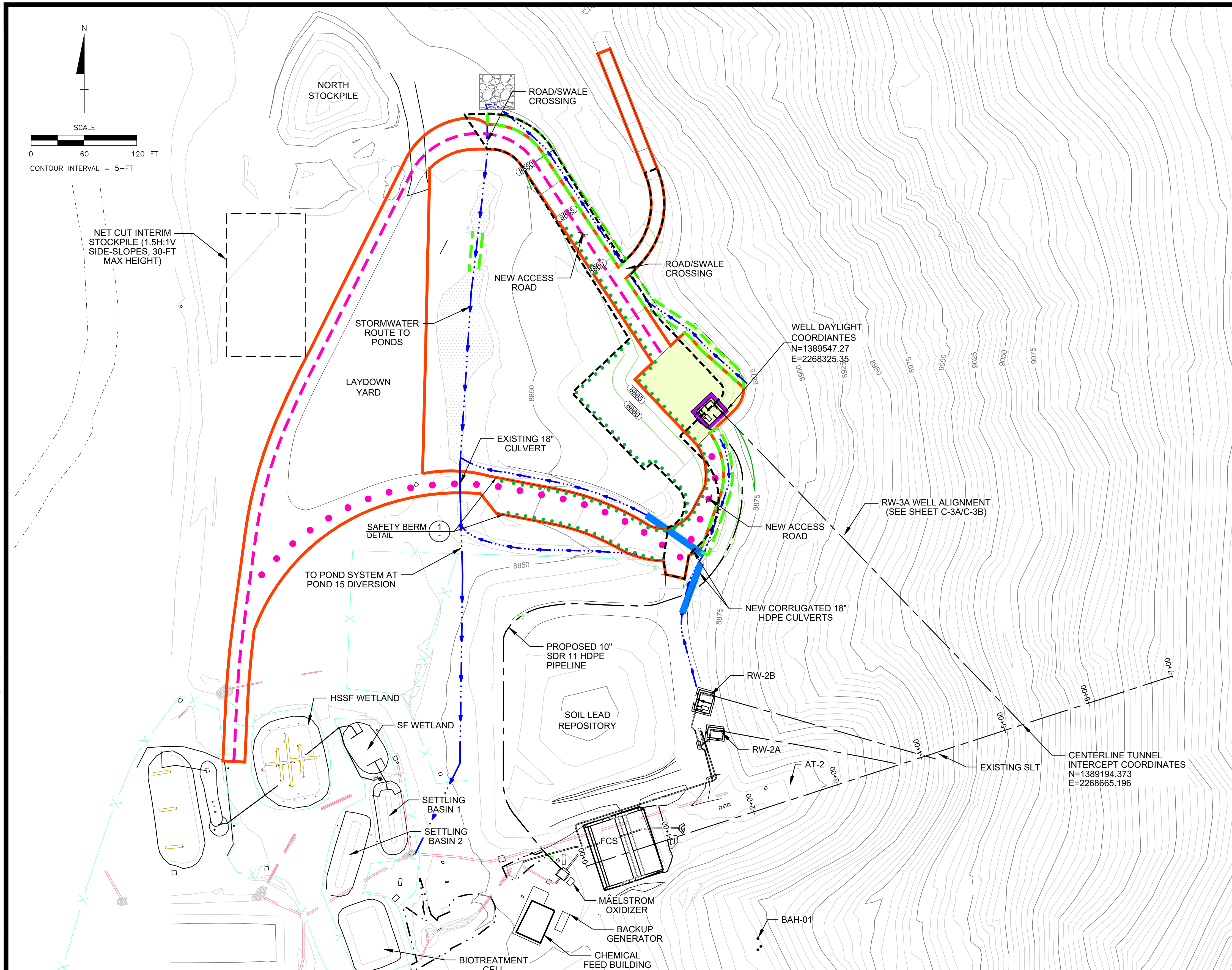
TITLE: DETAILS

PROJECT: RW-3A Well Completion (10" Well)
Rico - Argentine Mine Site
Dolores County, Colorado

SHEET
C-8

Jul 01, 2021 - 12:46pm Patricia F
U:\Work Files\Copper\70817 Rico\CADD_WellHouses\70817_RW3A-C603 Details.dwg -(C8)

PENTABLE: Copper_FULL.ctb



LEGEND

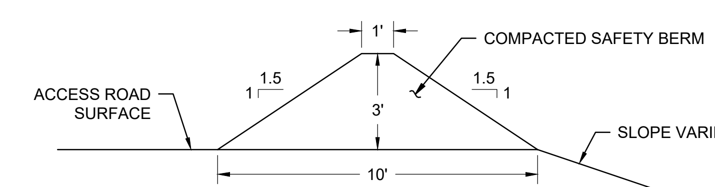
- WELL HOUSE PAD 6" THICK, 3/8" MINUS CRUSHED ROCK
- EXTENT OF AREA TO RECEIVE 3" THICK, 3/4" MINUS GRAVEL SURFACING (SEE NOTE 1)
- EXTENT OF AREA TO RECEIVE 3" THICK, 3/4" MINUS GRAVEL SURFACING FOR DRILL PAD ACCESS GRADING (SEE NOTE 1)
- 12" THICK, 6" D50 RIPRAP CHANNEL
- NEW 24" CMP CULVERT
- RW-3A PIPELINE ALIGNMENT
- EXISTING STORMWATER FLOW PATH
- PRIMARY ACCESS ROUTE
- SECONDARY ACCESS ROUTE
- SAFETY BERM

QUANTITY SUMMARY

ITEM	QTY	UNIT
NET CUT	3,433	CY
6" THICK, 3/8" MINUS CRUSHED ROCK	13.5	CY
3" THICK, 3/4" GRAVEL SURFACING	1,245	CY
12" THICK, 6" D50 RIPRAP	349	CY
CORRUGATED 18" HDPE CULVERT	140	LF
10" SDR 11 HDPE PIPE	760	LF
CLEANOUT ASSEMBLY	2	EA
ROCK FENCE	206	LF
SAFETY BERM	1,176	LF
	719	CY

CY = CUBIC YARDS, EA = EACH; LF = LINEAR FEET

NOTE:
1. THE 3/4" MINUS GRAVEL QUANTITY INCLUDES 342 CY FOR PLACING A 3" THICK LAYER FOR THE DRILL PAD AND ASSOCIATED ACCESS ROADS.
2. NET CUT MATERIAL MAY NEED TO BE SEPARATED FURTHER FOR CHARACTERIZATION
3. SEE SHEET C-1A FOR VERTICAL/HORIZONTAL DRAIN AND TRENCHING QUANTITIES.



1 SAFETY BERM DETAIL (NTS)

NO:	DATE	CADD	CHECK	APP'D	ISSUE / REVISION DESCRIPTION
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4	06/14/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW
5	06/28/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW
6	07/01/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW

Alloy GROUP
2211 East Highland Avenue, Suite 215
Phoenix, AZ 85016
Tel: (602) 331-3859

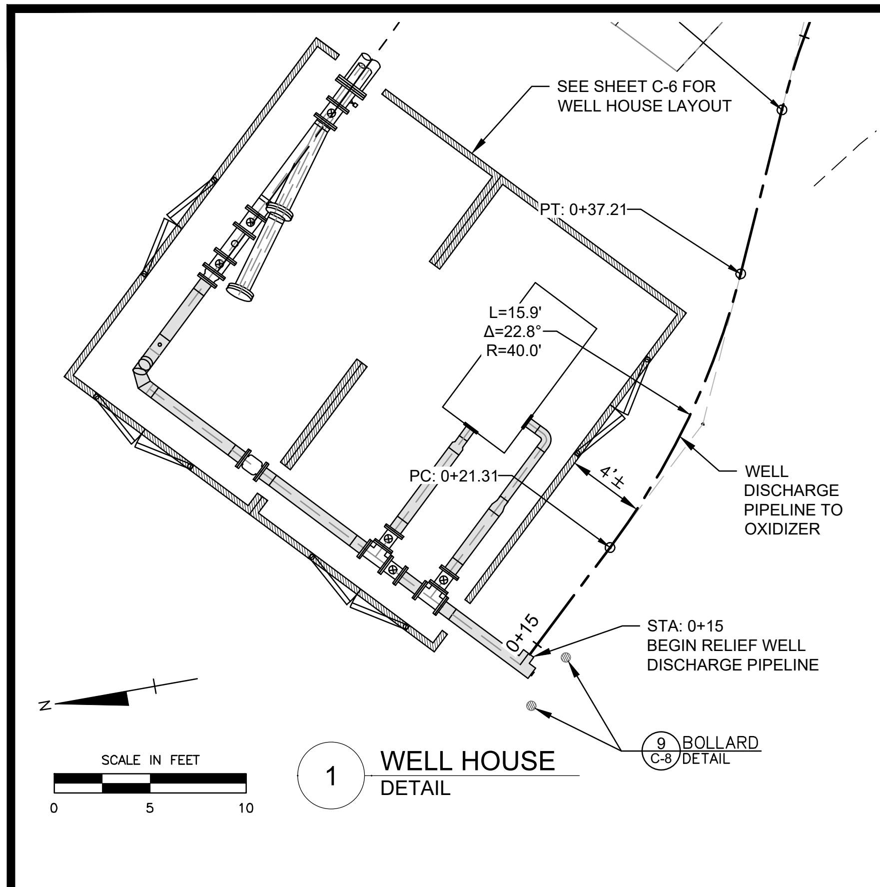
Atlantic Richfield Company

TITLE: OVERVIEW LAYOUT AND MATERIAL QUANTITIES

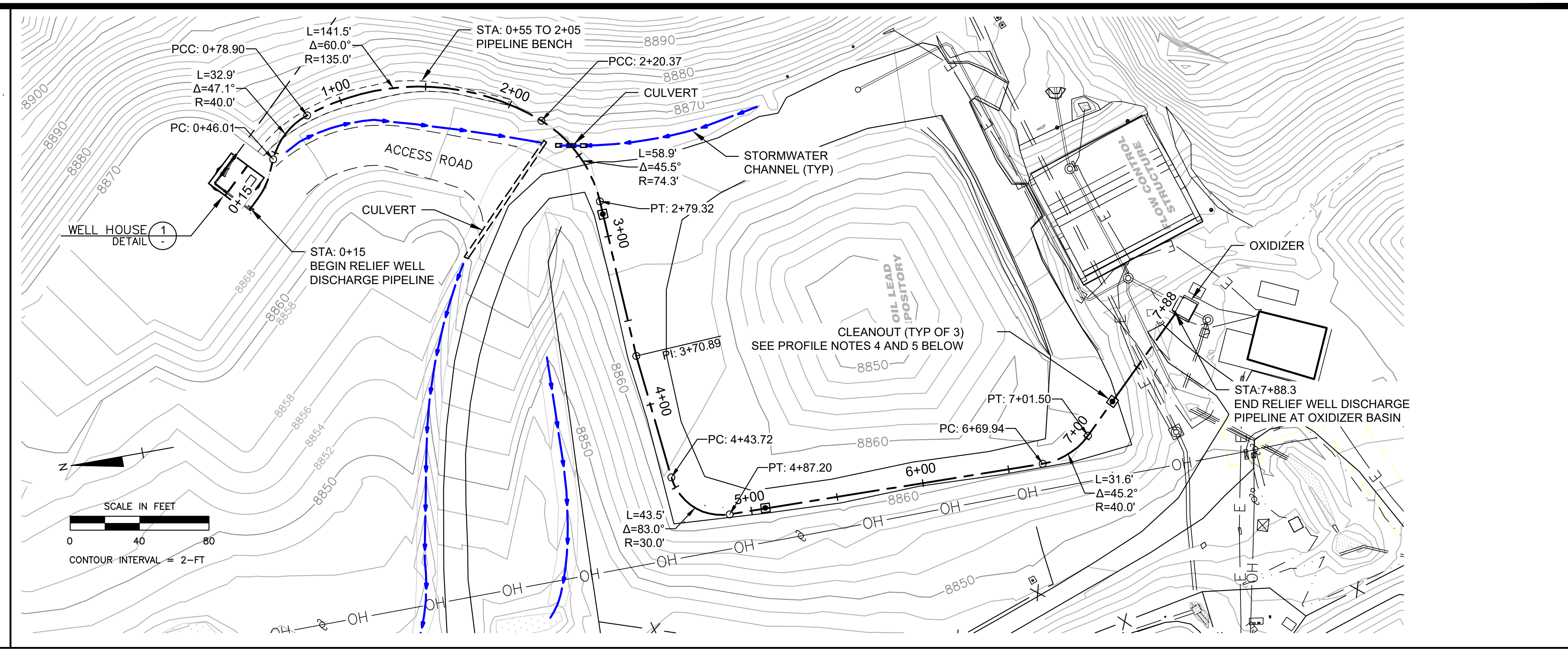
PROJECT: RW-3A Well Completion (10" Well)
Rico - Argentine Mine Site
Dolores County, Colorado

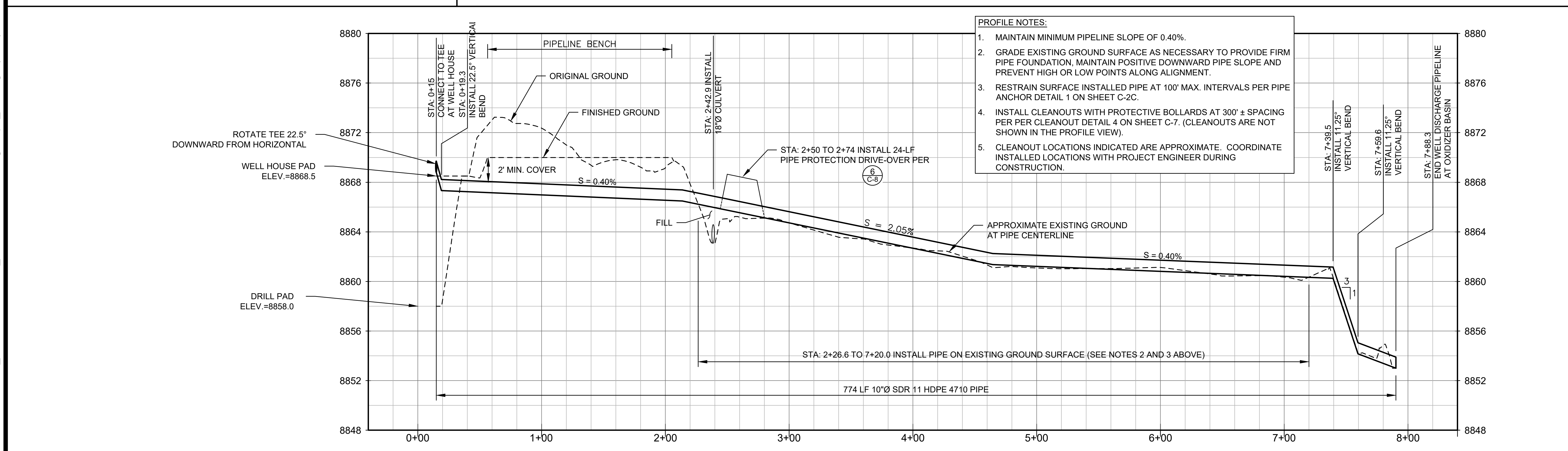
SHEET C-9

Jul 01, 2021 - 3:41pm Delia
U:\Copper\70817 Rico\CADD_WellHouses\70817_RW3A-C700 MatQty.dwg -(C9)
PENTABLE: Copper_FULL.ctb



1 WELL HOUSE DETAIL





PROFILE NOTES:

1. MAINTAIN MINIMUM PIPELINE SLOPE OF 0.40%.
2. GRADE EXISTING GROUND SURFACE AS NECESSARY TO PROVIDE FIRM PIPE FOUNDATION, MAINTAIN POSITIVE DOWNWARD PIPE SLOPE AND PREVENT HIGH OR LOW POINTS ALONG ALIGNMENT.
3. RESTRAIN SURFACE INSTALLED PIPE AT 100' MAX. INTERVALS PER PIPE ANCHOR DETAIL 1 ON SHEET C-2C.
4. INSTALL CLEANOUTS WITH PROTECTIVE BOLLARDS AT 300' ± SPACING PER PER CLEANOUT DETAIL 4 ON SHEET C-7. (CLEANOUTS ARE NOT SHOWN IN THE PROFILE VIEW).
5. CLEANOUT LOCATIONS INDICATED ARE APPROXIMATE. COORDINATE INSTALLED LOCATIONS WITH PROJECT ENGINEER DURING CONSTRUCTION.

NO:	DATE	CADD	CHECK	APP'D	ISSUE / REVISION DESCRIPTION
0	06/24/21	EJ	SPB	LE	ISSUED FOR CLIENT REVIEW
1	07/01/21	PAF	SPB	LE	ISSUED FOR CLIENT REVIEW

Alloy GROUP
2211 East Highland Avenue, Suite 215
Phoenix, AZ 85016
Tel: (602) 331-3859

Atlantic Richfield Company

TITLE: Relief Well Discharge Pipe Plan and Profile

PROJECT: RW-3A Well Completion
Rico - Argentine Mine Site
Dolores County, Colorado

SHEET C-10

Jul 01, 2021 - 1:00pm Patricia F
U:\Work Files\Copper\70817 Rico\CADD_WellHouses\70817_RW3A-C306 Discharge Pipe_PP.dwg -(C-10)
PENTABLE: Copper_FULL.ctb

ATTACHMENT 2 – SLT GEOMETRY SUMMARY

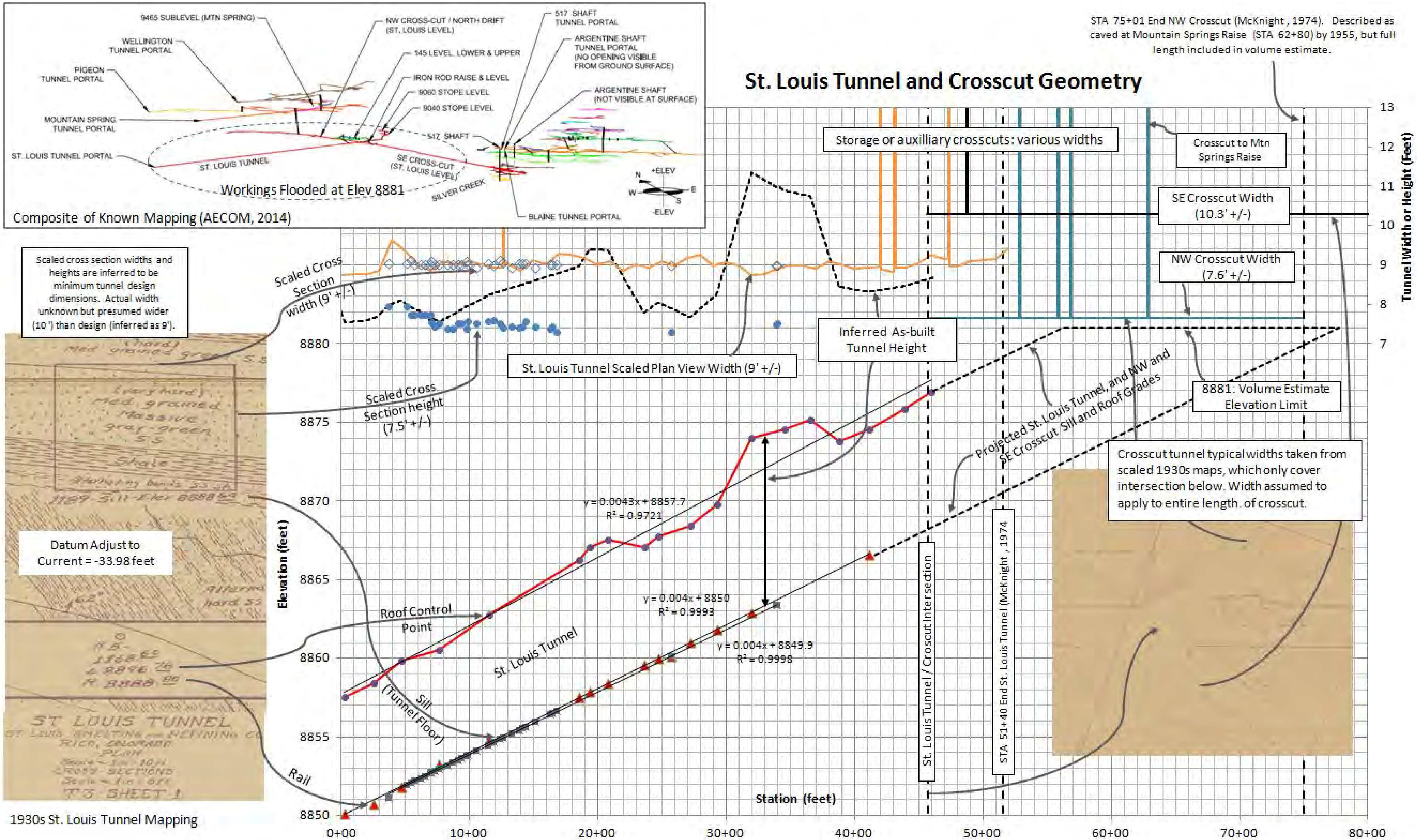


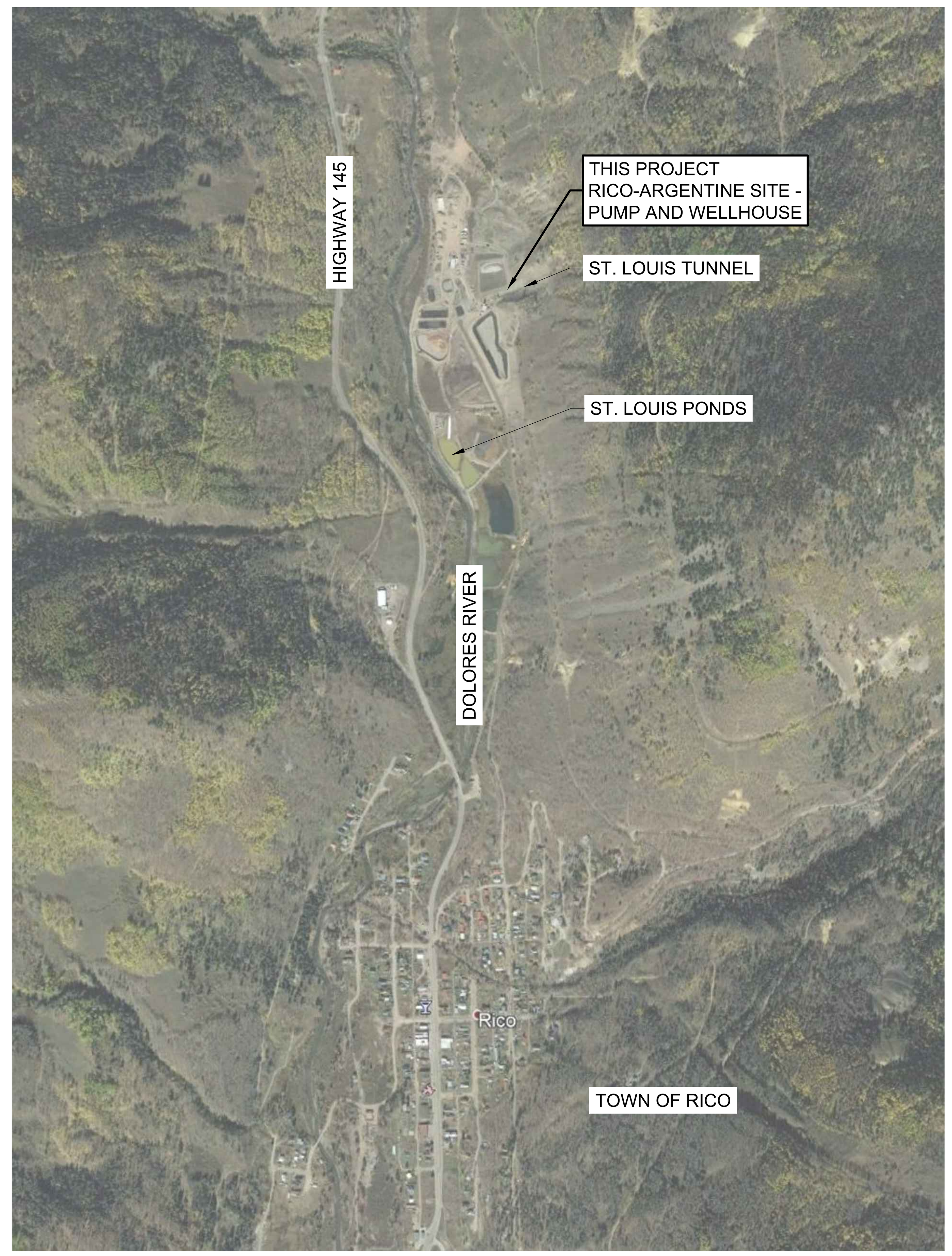
Figure II-1 – St. Louis Tunnel and Crosscut Geometry

ATTACHMENT 3 – RW-3A ELECTRICAL DESIGN DRAWINGS

RICO-ARGENTINE MINE SITE

RICO PUMP AND WELLHOUSE RW3A
RICO, COLORADO

LOCATION MAP
TOWN OF RICO
DOLORES COUNTY
STATE OF COLORADO, USA



VICINITY MAP
N.T.S.

DWG No.	DRAWING TITLE
GENERAL	
E0.0	TITLE PAGE
E0.1	GENERAL NOTES AND ABBREVIATIONS
E0.2	ELECTRICAL SYMBOLS LEGEND
SINGLE-LINE DIAGRAM	
E1.1	SINGLE-LINE DIAGRAM - CONT.
WORK PLANS AND DETAILS	
E2.0	ST. LOUIS TUNNEL PUMP STATION OVERALL SITE PLAN
E2.0A	ST. LOUIS TUNNEL PUMP STATION RW-3A CONDUIT PLAN
E2.1	POWER & CONTROL CABLE & CONDUIT SCHEDULES
E2.2A	UNDERGROUND DUCTBANK SECTIONS -CONT.
E2.5	WELLHOUSE (RW-3A) AND PUMPHOUSE (PH-2) LIGHTING & RECEPTACLES PLAN
E2.6	UNDERGROUND DUCTBANK TYPICAL DETAILS
E2.10	PANELBOARD LOAD SCHEDULES
MOTOR SCHEMATIC DIAGRAMS	
E5.1	SKID-MOUNT ELECTRIC PUMP (3A) MOTOR SCHEMATIC DIAGRAM
CONTROL SCHEMATIC DIAGRAMS	
E7.5	SCHEMATIC DIAGRAM - ANALOG INPUT FOR RW-3A
E7.6	SCHEMATIC DIAGRAM - ANALOG OUTPUT FOR RW-3A
E7.7	SCHEMATIC DIAGRAM - DIGITAL INPUT FOR RW-3A
E7.8	SCHEMATIC DIAGRAM - DIGITAL OUTPUT FOR RW-3A
GROUNDING	
G0.0	GENERAL GROUNDING NOTES
G1.1	WELLHOUSE (3A) AREA GROUNDING PLAN
G2.0	GROUNDING DETAILS

⚠ - **ATTENTION!**

SCOPE OF WORK:

THIS PROJECT SCOPE COVERS THE DESIGN AND DRAWINGS NECESSARY TO FABRICATE AND CONSTRUCT THE ELECTRICAL SYSTEMS FOR RELIEF WELL RW3A.

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AS-BUILT DRAWING		
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RICO-ARGENTINE MINE SITE
RICO PUMP AND WELLHOUSE RW3A
TITLE PAGE

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FILENAME: RW3A_E0.0_TITLE PAGE
SHEET NO.: **E0.0**
REV.: 1

Date & Time plotted: 6/7/2021 12:54:07 PM

GENERAL NOTES:

1. THE COLOR OF THE LIGHT FIXTURES SHALL BE SELECTED BY THE OWNER. MINIMUM SIZE OF CONDUIT TO BE 3/4".
2. USE RIGID STEEL SET SCREW TYPE TYPE FITTINGS ONLY. DIE CAST FITTINGS SHALL NOT BE USED.
3. SUPPORT THE LAY-IN TYPE FIXTURES FROM THE CEILING DECK INDEPENDENT OF THE CEILING GRID, AS SHOWN ON THE TYPICAL RECESSED FIXTURE MOUNTING DETAIL.
4. ALL NEW WORK MUST MEET THE CURRENT NATIONAL ELECTRICAL CODE.
5. THE SIZE OF THE NEUTRAL CONDUCTORS SHALL BE #10 AWG FOR ALL HOME RUNS WITH COMMON NEUTRAL (LIGHTING AND POWER CIRCUITS).
6. THE MINIMUM SIZE OF THE CONDUCTORS ARE TO BE #12 AWG THHN COPPER, UNLESS INDICATED OTHERWISE ON THE DRAWINGS.
7. ALL PANELBOARDS SHALL HAVE FULL SIZE ISOLATED NEUTRAL AND GROUND BUSSBARS.
8. SECURE ALL J-BOXES AS SHOWN IN THE DETAILS. FURNISH AND INSTALL PROPER MUD RINGS.
9. ALL EXPOSED CONDUIT MUST RUN AGAINST THE WALLS OR CEILINGS. DO NOT PENDANT MOUNT ANY CONDUIT FROM THE CEILINGS. UTILIZE APPROVED CONDUIT SUPPORT METHODS AS SHOWN IN THE DETAILS.
10. MARK ON ALL THE J-BOXES THE CIRCUIT NAMES AND NUMBERS. USE #10 AWG THHN CONDUCTORS FOR HOMERUNS OVER 100 FEET, #8 AWG THHN OVER 200 FEET, #6 AWG THHN OVER 300 FEET AND #4 AWG THHN OVER 400 FEET LENGTH.
11. LIGHT SWITCHES INSTALLED ADJACENT TO EACH OTHER SHALL BE GANGED TOGETHER WITH ONE PIECE COVER PLATE.
12. AT THE END OF THE JOB, PROVIDE BLANK COVER PLATES TO MATCH THE OTHER COVER PLATES FOR ALL J-BOXES WHERE DEVICES HAVE NOT YET BEEN INSTALLED.
13. SEAL AROUND ALL CONDUIT PENETRATIONS THROUGH WALLS AND CEILINGS WITH FIRE RATED MATERIAL. 3M IS AN APPROVED MANUFACTURER.
14. ALL MATERIALS USED IN THIS INSTALLATION SHALL BE U.L. APPROVED AND NEW.
15. ALL PANELS SHALL HAVE ALUMINUM BUSSES AND SHALL BE BRACED FOR A MINIMUM OF 10,000 AIC OR AS SPECIFIED.
16. ELECTRICAL WIRING MAY BE IN MC CABLE WHERE HIDDEN IN WALLS AND ABOVE LAY-IN CEILINGS. HOME RUNS SHALL BE RAN IN CONDUIT. EXPOSED INTERIOR WIRING SHALL BE RAN IN EMT CONDUIT. (ROMEX NOT PERMITTED).
17. NO CONDUITS SHALL RUN IN DUCT WORK.
18. PRIOR TO SUBMITTING A BID THE ELECTRICAL CONTRACTOR SHALL INSPECT THE SITE AND INCLUDE IN HIS BID PACKAGE ALL CHARGES DUE TO EXISTING CONDITIONS. SHOP DRAWINGS ARE REQUIRED. ALL LABOR, MATERIAL AND WORKMANSHIP SHALL BE GUARANTEED FOR A PEERIOD OF 1 YEAR FROM THE DATE OF ACCEPTANCE BY THE TENANT. REPLACE OR REPAIR ALL DEFECTS DURING THE GUARANTEED PERIOD.
19. ALL DUPLEX OUTLETS AND SWITCHES SHALL BE NEMA #5-20R, 20 AMP, 120 VOLT SPEC GRADE. HUBBELL AND PASS & SEYMOUR AND LEVITON ARE APPROVED MANUFACTURERS.
20. THE ELECTRICAL CONTRACTOR SHALL NOTIFY AND COORDINATE WITH THE MECHANICAL CONTRACTOR SO THAT NO PIPING, DUCTS, OR OTHER EQUIPMENT SHALL BE INSTALLED ABOVE OR BELOW ELECTRICAL PANELS.
21. ELECTRICAL CONTRACTOR SHALL VERIFY ALL ELECTRICAL LOADS (VOLTAGE, PHASE, CONNECTION REQUIREMENT, ETC.) OF EQUIPMENT FURNISHED UNDER OTHER DIVISIONS WITH APPROVED SHOP DRAWINGS PRIOR TO BEGINNING ROUGH-IN. COORDINATE WITH SIMULATOR EQUIPMENT CONTRACTOR FOR EXACT LOCATION OF ALL DISCONNECTS, OUTLETS, AND J-BOXES USED FOR TERMINATION OF THE EQUIPMENT. THE ELECTRICAL CONTRACTOR SHALL TERMINATE THE ELECTRICAL CONNECTIONS TO ALL THE EQUIPMENT BY PROVIDING THE NECESSARY MALE/FEMALE CONNECTOR, RECEPTACLE, PLUG, ETC.
23. ALL CONDUITS STUBBED UP FROM BELOW THE FLOOR SHALL BE RIGID GALVANIZED STEEL.
24. LABEL ALL OUTLETS & DISCONNECTS WITH ADHESIVE, MACHINE-PRINTED LABELS INDICATING PANEL AND CIRCUIT BREAKER THEY ARE TIED TO.

ABBREVIATIONS

A	AMMETER
AC	ALTERNATING CURRENT
A.C.	ABOVE COUNTER - VERIFY HEIGHT
ACB	AIR CIRCUIT BREAKER
AF	AMPERES FRAME SIZE
AFCI	ARC-FAULT CIRCUIT INTERRUPTER
AFF	ABOVE FINISH FLOOR
AG	ABOVE COUNTER/GROUND FAULT INTERRUPTING
ALM	ALARM
AMP	AMPERE
ASA	AMERICAN STANDARDS ASSOCIATION
AT	AMPERES TRIP (CONTINUOUS)
ATS	AUTOMATIC TRANSFER SWITCH
AWG	AMERICAN WIRE GAUGE
AUTO	AUTOMATIC
AUX	AUXILIARY
BATT	BATTERY
BKR	BREAKER
BLDG	BUILDING
BOM	BILL OF MATERIALS
BTM	BOTTOM
BSHG	BUSHING
ZSM	BELT MISALIGNMENT SWITCH
C OR CAP	CAPACITOR
CB	CIRCUIT BREAKER
CKT	CIRCUIT
CL	CENTER LINE
C OR COND	CONDUIT
CONT	CONTROL
CP	CONTROL PANEL
CR	CONTROL RELAY
IE	CURRENT TRANSFORMER
kcmil	CIRCULAR MILLS, THOUSANDS
DB	DUCT BANK
DC	DIRECT CURRENT
DIM	DIMENSION
DS	DISCONNECT SWITCH
DTL	DETAIL
DWN	DOWN
DWG	DRAWING
E	EXISTING TO REMAIN
EA	EACH
EF	EXHAUST FAN
EC	ELECTRICAL CONTRACTOR
EF	EXHAUST FAN
ELEC	ELECTRICAL
ELL	ELBOW
EL	ELEVATION (HEIGHT)
ELEV	ELEVATION (VIEW)
EMERG	EMERGENCY
ENCL	ENCLOSURE
ENGR	ENGINEER
EP	EXPLOSION PROOF
EQUIP	EQUIPMENT
ER	EXISTING TO BE RELOCATED
EST	ESTIMATE
EX	EXISTING TO BE REMOVED
EXIST	EXISTING
EWC	ELECTRICAL WATER COOLER
F	FAHRENHEIT
FDR	FEEDER
FIG	FIGURE
FF OR FIN FLR	FINISH FLOOR
FG OR FIN GR	FINISH GRADE
FIX	FIXTURE
FLEX	FLEXIBLE
FREQ	FREQUENCY
FS	FLOW SWITCH
FT OR (')	FEET
FU	FUSE
FV	SOLENOID VALVE
FWD	FORWARD
GA	GAUGE
GALV	GALVANIZED
GS	GALVANIZED STEEL
GEN	GENERAL OR GENERATOR
GFI	GROUND FAULT INTERRUPTER
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GM	GROUND MONITOR
GND	GROUND
GP	GENERAL PURPOSE
H-O-A	HAND-OFF-AUTO
HP	HORSE POWER
HS	PUSHBUTTON OR SELECTOR SWITCH
HT	HEAT TRACE
HTR	HEATER
HZ OR Hz	HERTZ
IE	CURRENT TRANSFORMER
IH	INSTA HOT
IN OR (")	INCH
INST	INSTANTANEOUS
IT	INSTANTANEOUS TRIP
J	JOG
JB	JUNCTION BOX
JS	JOG STOP
JY	MAIN CONTACTOR
kcmil	CIRCULAR MILLS, THOUSANDS
KV OR kV	KILOVOLT
KVA	KILOVOLT-AMPERE
KVAR	KILOVAR
KW	KILOWATT
KWH	KILOWATT HOUR
LA	LIGHTNING ARRESTER
LP	LIGHTING PANEL
LTG	LIGHTING
ZS( )	LIMIT SWITCH
M	SPRING CHARGING MOTOR
MAIN	MAIN CIRCUIT BREAKER
MAN	MANUAL
MAX	MAXIMUM
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
MCR	MASTER CONTROL RELAY
MCS	MULTILIN CURRENT SENSOR
MG	MOTOR GENERATOR
MH	MANHOLE
MIN	MINIMUM
MISC	MISCELLANEOUS
MLO	MAIN LUGS ONLY
MTD	MOUNTED
MTG	MOUNTING
MTR	MOTOR
MVA	MEGA VOLT-AMPERE
MW	MEGAWATTS
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE
NEG	NEGATIVE
NEMA	NATIONAL ELEC. MFR'S. ASSOCIATION
NEUT	NEUTRAL
NO	NORMALLY OPEN
NO. OR #	NUMBER
NTS	NOT TO SCALE
OC	OVERCURRENT
OCB	OIL CIRCUIT BREAKER
OL	OVERLOAD
OS	OIL SWITCH
OV	OVERVOLTAGE
(P) OR (PART)	PARTIAL CIRCUIT USED IN MULTIPLE LOCATIONS
P	POLE
PF	POWER FACTOR
PH OR ϕ	PHASE
PMP	PROGRAMMABLE MOTOR PROTECTOR
POS	POSITIVE
PP	POWER PANEL OR POWER POLE
PR	PROTECTIVE RELAY
PS( )	PRESSURE SWITCH
HS	PUSHBOTTON
JB	PULL BOX (USE JUNCTION BOX)
QTY	QUANTITY
RVS	REDUCED VOLTAGE STARTER
SCH	SCHEDULE
SCHEM	SCHEMATIC
SPEC	SPECIFICATION
SR	SPRING RELEASE COIL (CLOSE CALL)
SS( )	SPEED SWITCH
ST1	SHUNT TRIP
STA	STATION
STD	STANDARD
SW	SWITCH
SUB	SUBSTATION
SWGR	SWITCHGEAR
FV	SOLENOID VALVE
HS	SELECTOR SWITCH
SWITCHES:	
SPSW	SINGLE POLE SWITCH
SPST	SINGLE POLE SINGLE THROW
DPST	DOUBLE POLE SINGLE THROW
DPDT	DOUBLE POLE DOUBLE THROW
3PSW	TRIPLE POLE SWITCH
3PST	TRIPLE POLE SINGLE THROW
3PDT	TRIPLE POLE DOUBLE THROW
4PSW	FOUR POLE SWITCH
4PST	FOUR POLE SINGLE THROW
4PDT	FOUR POLE DOUBLE THROW
T OR XFMR	TRANSFORMER
TACH	TACHOMETER GENERATOR
TC	TRIP COIL
TD	TIME DELAY
TEFC	TOTALLY ENCLOSED FAN COOLED
TEL	TELEPHONE
TEMP	TEMPERATURE
TERM	TERMINAL
TOF	TIME DELAY OFF
TON	TIME DELAY ON
TTB	TELEPHONE TERMINAL BOARD
TYP	TYPICAL
UG OR U/G	UNDERGROUND
UON	UNLESS OTHERWISE NOTED
UV	UNDERVOLTAGE
V	VOLTMETER
VA	VOLTAMPERE
VFD	VARIABLE FREQUENCY DRIVE
VR	VOLTAGE RELAY
VSD	VARIABLE SPEED DRIVE
W	WATT METER
WG	WEATHER PROOF/GROUND FAULT INTERRUPTING
WH	WATTHOUR
WHM	WATTHOUR METER
WP	WEATHER PROOF
XFMR OR T	TRANSFORMER
Y	ANTI PUMP RELAY
ZS( )	LIMIT SWITCH
ZSM	BELT MISALIGNMENT SWITCH

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RICO-ARGENTINE MINE SITE
RICO PUMP AND WELLHOUSE RW3A
GENERAL NOTES AND ABBREVIATIONS

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FILENAME: RW3A_E0.1_GEN NOTES & ABBREV

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LINE TYPES

- EQUIPMENT ENCLOSURE / AREA DESIGNATION
- EQUIPMENT / VENDOR WIRING
- FIELD WIRING
- SHIELD
- TERMINAL JUMPER / BRIDGE
- EXISTING 600V SECONDARY POWER FEEDER
- NEW 600V SECONDARY POWER FEEDER
- EXISTING
- FUTURE
- EXISTING HIGH VOLTAGE POWER FEEDER
- NEW HIGH VOLTAGE POWER FEEDER
- BUILDING MANUFACTURER WIRING
- EXISTING SUBSTATION FENCE (X)
- NEW SUBSTATION FENCE (X)
- EXISTING OVERHEAD ELECTRIC LINE (OHE)
- NEW OVERHEAD ELECTRIC LINE (OHE)
- EXISTING UNDERGOUND ELECTRIC LINE (UGE)
- NEW UNDERGROUND ELECTRIC LINE (UGE)
- EXISTING FIBER OPTIC LINE (F/O)
- NEW FIBER OPTIC LINE (F/O)
- EXISTING ETHERNET CABLE
- NEW ETHERNET CABLE (ETH)
- TWISTED PAIR
- SHIELDED CABLE (SHLD)
- INDICATES FIELD MOUNTED DEVICE (F)

GENERAL

- NEW / IN SCOPE OF WORK / FUTURE
- 5XXX — LINE REFERENCE NUMBER, XXXX = MOTOR SCHEM, 7XXXX = PLC SCHEM

SINGLE-LINE LEGEND

- 12.47kV, 3ϕ, 60Hz. — AC POWER SUPPLY
- CIRCUIT BREAKER (A)
- FUSE
- FUSED DISCONNECT
- DISCONNECT SWITCH
- STABS
- CONDUCTORS RISE/FALL DOWN OVERHEAD POLE
- CONDUCTORS ENTER/EXIT DUCTBANK OR RACEWAY
- STRESS CONE
- 480V X FLA / 120/240V X FLA — LT — LIGHTING TRANSFORMER kVA, 3ϕ, 60Hz 480VΔ - 120 VAC POLE/PAD MOUNTED
- 12.47kV X FLA / 480V X FLA — DT — DISTRIBUTION TRANSFORMER 300kVA, 3ϕ, 60Hz 12.47kVΔ - 480 VAC POLE/PAD MOUNTED
- LLF — LONG LEAD FILTER
- VFD — VARIABLE FREQUENCY DRIVE
- SS — SOFT START (REDUCED VOLTAGE STARTER)
- DNX:XX — DEVICENET NETWORK:NODE
- M SIZE X — MOTOR STARTER CONTACTOR
- MOTOR OVERLOAD HEATER
- X — VISUAL CIRCUIT BREAKER
- FD — POWER FUSED CUTOUT HOOK STICK OPERATED
- N.C. FD — FUSED DISCONNECT
- CAPACITOR
- NGR
- MINE GROUND GRID — NGR — R
- LA — L.A. (3) X kV RATED XkV MCOV — LIGHTNING ARRESTOR
- VR — VOLTAGE REGULATOR
- ATS — AUTOMATIC TRANSFER SWITCH
- X FLA — FLEX CONDUIT
- X HP MTR — MOTOR
- PP / LP — POWER OR LIGHTING PANELBOARD
- FEEDER ONLY
- C.T. — CURRENT TRANSFORMER
- FS — FUSED SWITCH
- GROUND

MOTOR & PLC SCHEMATIC LEGEND

INSTRUMENTS

- PS — NORMALLY OPEN PRESSURE SWITCH
- PS — NORMALLY CLOSED PRESSURE SWITCH
- TAS — NORMALLY OPEN TEMPERATURE SWITCH
- TAS — NORMALLY CLOSED TEMPERATURE SWITCH
- FLS — NORMALLY OPEN FLOW SWITCH
- FLS — NORMALLY CLOSED FLOW SWITCH
- FS — NORMALLY OPEN LEVEL OR FLOAT SWITCH
- FS — NORMALLY CLOSED LEVEL OR FLOAT SWITCH
- LS — NORMALLY OPEN LIMIT SWITCH
- LS — NORMALLY CLOSED LIMIT SWITCH
- DEVICE
- SOLENOID
- 4-20mA ANALOG SIGNAL SENSOR / CONTROLLER

EQUIPMENT IN PLC CABINET

- CR — CONTROL RELAY
- CR — NORMALLY OPEN CONTROL RELAY CONTACT
- CR — NORMALLY CLOSED CONTROL RELAY CONTACT
- LT G — LIGHT BEACON. LETTER INDICATES LENS COLOR: A = AMBER, R = RED, B = BLUE, W = WHITE, C = CLEAR, Y = YELLOW, G = GREEN
- HAND START PUSH BUTTON PB2 — NORMALLY OPEN MOMENTARY PUSH BUTTON
- HAND STOP PUSH BUTTON PB1 — NORMALLY CLOSED MOMENTARY PUSH BUTTON
- PROGRAMMING PORT / RECEPTACLE
- RECEPTACLE
- ENCLOSURE LIGHT
- (-) (+) — TEMPERATURE RTD

PLC IO

- X DI:X.X/XX X — I/O ADDRESS, I/O TYPE, RACK, SLOT, I/O NUMBER — PLC INPUT MODULE CONNECTION; X — MODULE I/O PIN, MODULE I/O PIN DESCR.; PLC I/O DESCRIPTION
- X DO:X.X/XX X — PLC OUTPUT MODULE CONNECTION

120VAC EQUIPMENT

- SS HAND OFF AUTO (14 13, 24 23, 44 43, 54 53) — HAND OFF AUTO SELECTOR SWITCH
- M — MOTOR STARTER RELAY
- M — NORMALLY OPEN MOTOR RELAY CONTACT
- M — NORMALLY CLOSED MOTOR RELAY CONTACT
- OL1 95 96 — THERMAL OVERLOAD CONTACT
- HAND START PUSH BUTTON PB2 — NORMALLY OPEN MUSHROOH HEAD PUSH BUTTON
- HAND STOP PUSH BUTTON PB1 — NORMALLY CLOSED MUSHROOH HEAD PUSH BUTTON
- FU3 2 1 1A — FUSE
- CIRCUIT BREAKER
- ON R LT1 — LIGHT BEACON. LETTER INDICATES LENS COLOR: A = AMBER, B = BLUE, C = CLEAR, G = GREEN, R = RED, W = WHITE, Y = YELLOW

COMMUNICATION

- DNX:XX — DEVICENET NETWORK, NODE, NETWORK
- XXX.XXX.XXX.XXX — IPv4 IP ADDRESS

480VAC EQUIPMENT

- DRIVE MOTOR — X HP, X FLA, DESC 1, DESC 2, DESC 3
- FLEX CONDUIT
- CB1 MCP-__ —:— — MOTOR CIRCUIT BREAKER, 3ϕ
- OL E3 PLUS OL1 DN__:__ — MOTOR OVERLOAD HEATER, 3ϕ
- M1 SIZE X — MOTOR STARTER, 3ϕ
- MCC1 L1 L2 L3 — MAIN BUS 1 480VAC, 3ϕ, 60Hz. — MCC BUS
- 1 FU1 0.75A 2 — FUSE
- H1 H3 H2 H4 T1 X1 X2 — 0.08kVA 480V - 120V — TRANSFORMER

CONTINUATION ARROWS

"SOURCE" ARROW
- 019 — INDICATES "DESTINATION" LADDER RUNG
- 009 — INDICATES WIRE NUMBER
- 120VAC — INDICATES SOURCE VOLTAGE

"DESTINATION" ARROW
- 120VAC — INDICATES SOURCE VOLTAGE
- 009 — INDICATES WIRE NUMBER
- 020 — INDICATES "SOURCE" LADDER RUNG

"SOURCE" ARROW
- 009 — INDICATES WIRE NUMBER
- 019 — INDICATES "DESTINATION" LADDER RUNG
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"DESTINATION" ARROW
- 120VAC — INDICATES SOURCE VOLTAGE
- 009 — INDICATES WIRE NUMBER
- 020 — INDICATES "SOURCE" LADDER RUNG

TERMINAL BLOCKS

- DEVICE TERMINAL POINT
- PLC (I/O & IFM) MODULE SCREW TERMINAL
- IFM TERMINAL POINT
- SINGLE LEVEL PLC TERMINAL BLOCK

MCC BUCKET TERMINAL BLOCK
- X — TERMINAL LABEL
- X — TERMINAL STRIP

MULTI-LEVEL PLC TERMINAL BLOCKS
- FOR "DO" — F01 250mA DOX; 01 M DOX — TERMINAL NUMBER, TERMINAL STRIP
- FOR "DI" — 01A L DIXX; 01 U DIXX
- FOR "AI" & "AO" — U F01 AOX, M 01, G G01; U 02 AOX, L 02A — LOCATION / LEVEL ON MULTI-LEVEL TERM. BLOCK: U = UPPER, M = MIDDLE, L = LOWER, G = GROUND
- FOR "AI" — 250mA F03 AIX — TERMINAL STRIP; FUSED TERMINAL BLOCK (ON UPPER LEVEL); M 03; G G03 — TERMINAL NUMBER

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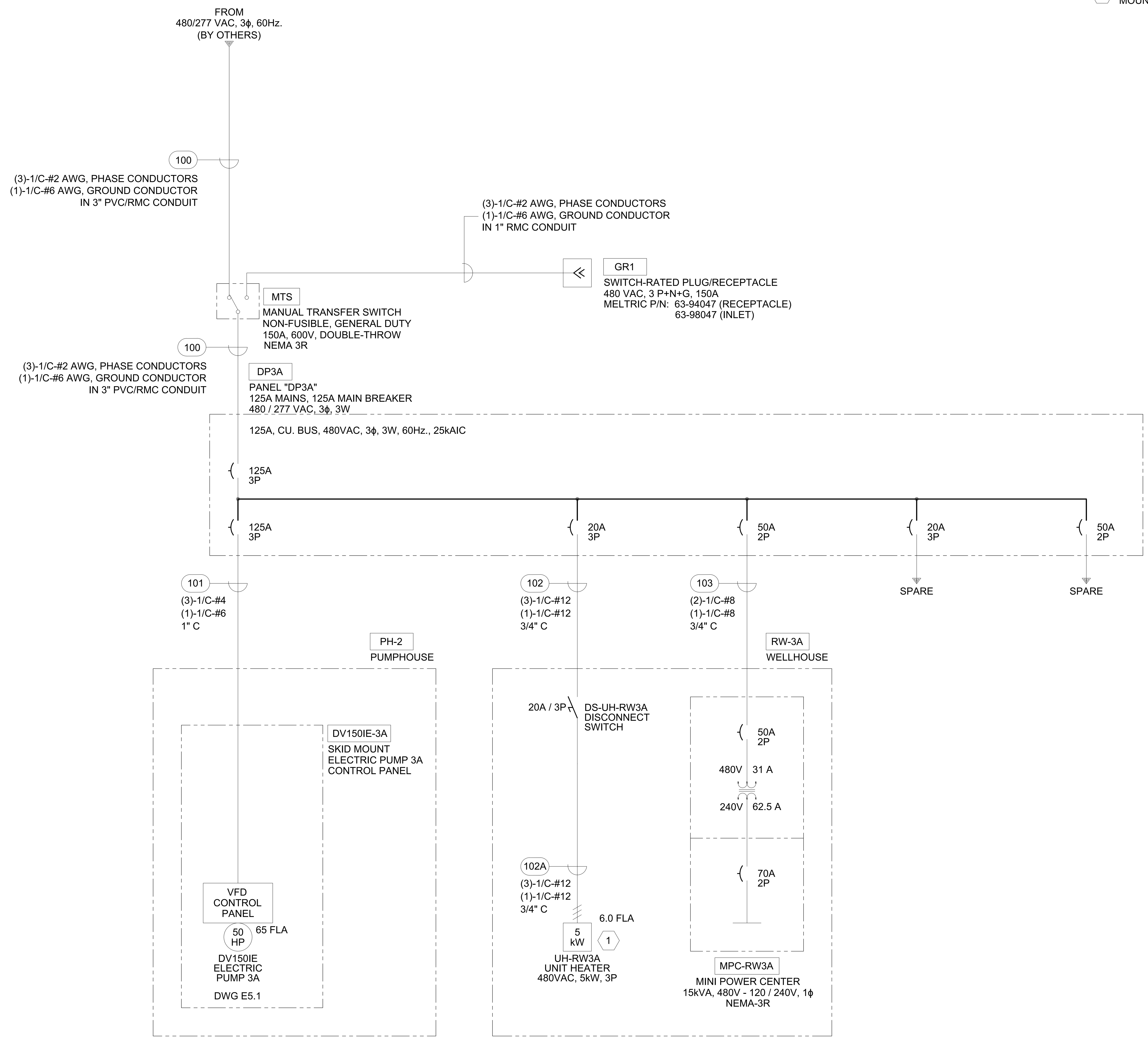
RICO-ARGENTINE MINE SITE
RICO PUMP AND WELLHOUSE RW3A
ELECTRICAL SYMBOLS LEGEND

ENGR'D BY: SMB | DRAWN BY: MVW | APRV'D BY: SMB | SHEET NO.: E0.2 | REV.: 1
FILENAME: RW3A_E0.2_ELEC SYMBOL LEGEND

SHEET NOTES:

1. UNIT HEATER SHALL BE 3-PHASE CHROMALOX #LUH-05-43-32-40-1 WITH MOUNTING BRACKET AND BUILT-IN THERMOSTAT OR APPROVED EQUAL.



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RICO-ARGENTINE MINE SITE
RICO PUMP AND WELLHOUSE RW3A
SINGLE-LINE DIAGRAM

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FILENAME: RW3A_E1.1_SINGLE-LINE-CONT
SHEET NO.: E1.1
REV.: 2

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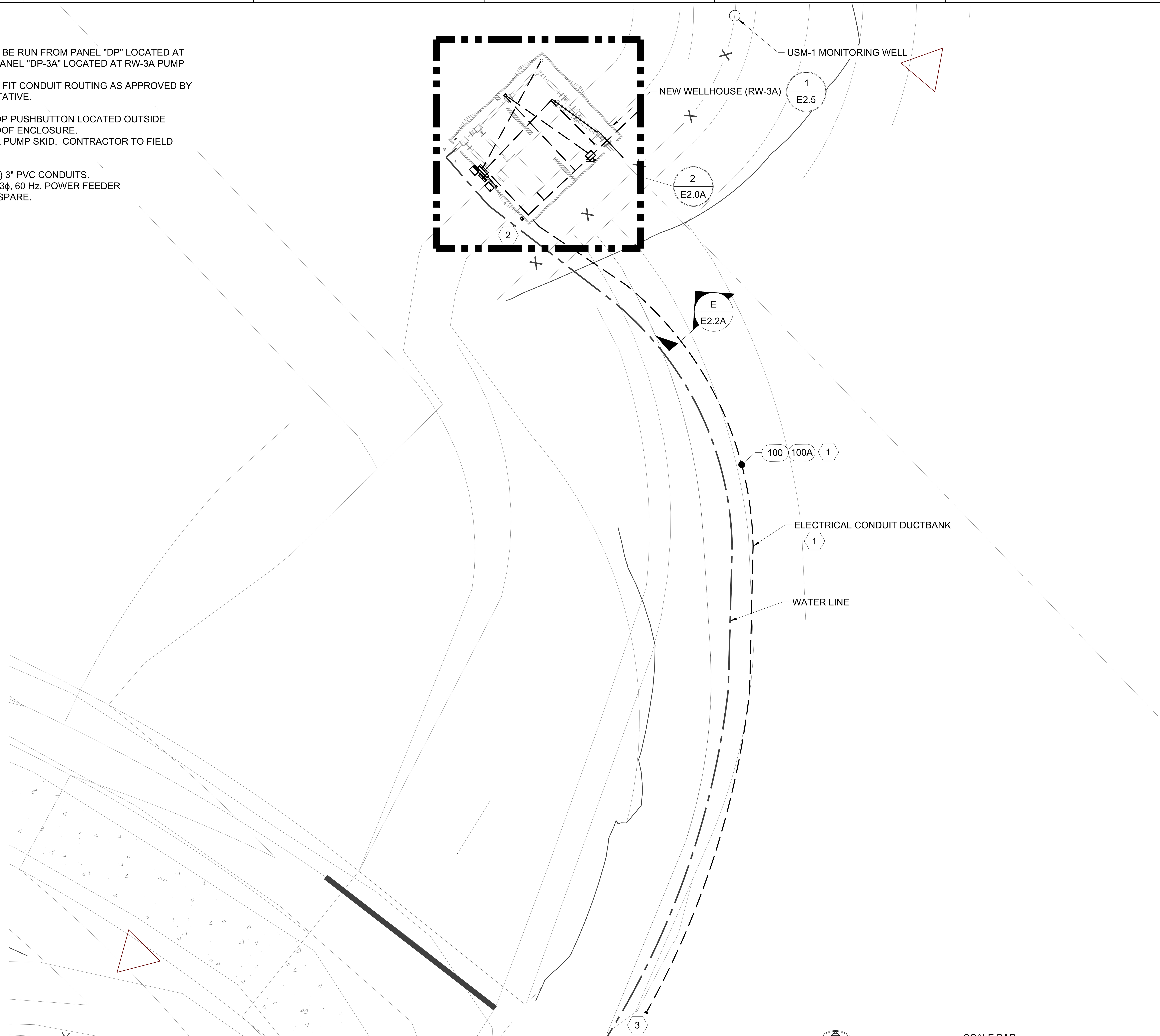
SHEET NOTES:

1. ELECTRICAL CONDUIT WILL BE RUN FROM PANEL "DP" LOCATED AT RW-2A PUMP STATION TO PANEL "DP-3A" LOCATED AT RW-3A PUMP STATION.
   CONTRACTOR SHALL FIELD FIT CONDUIT ROUTING AS APPROVED BY OWNER OR ITS REPRESENTATIVE.
2. VFD ELECTRIC PUMP E-STOP PUSHBUTTON LOCATED OUTSIDE BUILDING IN WEATHER-PROOF ENCLOSURE.
   H/O/A BUTTON ON OR NEAR PUMP SKID. CONTRACTOR TO FIELD LOCATE.
3. STUB OUT AND CAP TWO (2) 3" PVC CONDUITS.
   ONE (1) FOR FUTURE 480V, 3ϕ, 60 Hz. POWER FEEDER CONNECTION AND ONE (1) SPARE.



1
E2.0
ST. LOUIS TUNNEL PUMP STATION OVERALL SITE PLAN
SCALE: 1" = 10'-0"

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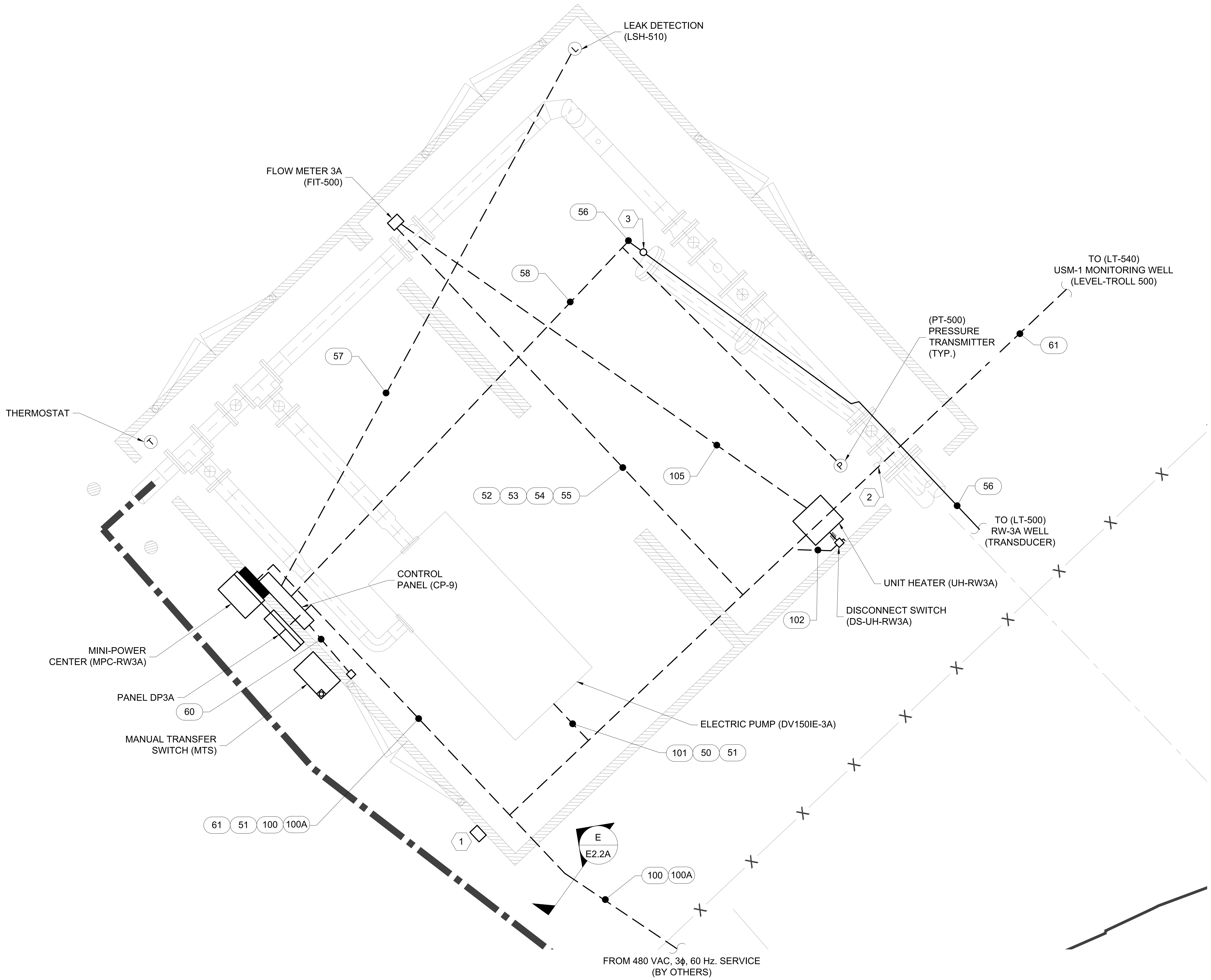
RICO PUMP AND WELLHOUSE RW3A
ST. LOUIS TUNNEL PUMP STATION OVERALL SITE PLAN

ENGR'D BY: SMB | DRAWN BY: JCN | APRV'D BY: SMB | SHEET NO.: E2.0 | REV.: 2
FILENAME: RW3A_E2.0_SITE_KEY_PLAN

Date & Time plotted: 6/7/2021 12:54:22 PM



LEGEND

A / E2.0	INDICATES DETAIL NUMBER / INDICATES DRAWING ON WHICH DETAIL APPEARS
1	INDICATES CONDUIT TAG NUMBER
L	LEAK DETECTION
P	PRESSURE TRANSMITTER
T	THERMOSTAT

GENERAL NOTES:

1. ALL WORK SHALL CONFORM TO THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE (2017 NEC), ALL OTHER STATE AND LOCAL CODES, AND ALL NATIONAL FIRE PROTECTION ASSOCIATION RULES.
2. EXISTING UTILITIES HAVE NOT BEEN VERIFIED BY BRUNO ENGINEERING. THE CONTRACTOR SHALL EXERCISE DUE CAUTION WHEN EXCAVATING. THE CONTRACTOR IS RESPONSIBLE TO REPAIR/REPLACE ANY UTILITY DAMAGED DURING CONSTRUCTION/EXCAVATING. COORDINATE WITH THE OWNER PRIOR TO EXCAVATION IN ANY AREA.
3. DISTANCES AND QUANTITIES SHOWN ARE FOR INFORMATION ONLY. CONTRACTOR IS RESPONSIBLE FOR VERIFYING AND MAKING THEIR OWN MATERIAL TAKE-OFFS. DISTANCES DO NOT ACCOUNT FOR MULTIPLE CIRCUITS BETWEEN THE SAME LOCATION, OR REQUIRED MAKE-UP DISTANCES.

SHEET NOTES:

1. VFD ELECTRIC PUMP E-STOP PUSHBUTTON LOCATED OUTSIDE BUILDING IN WEATHER-PROOF ENCLOSURE. H/O/A BUTTON ON OR NEAR PUMP SKID. CONTRACTOR TO FIELD LOCATE.
2. SEE ALLOY GROUP, SHEET C-5, DETAIL 1 FOR MONITOR PORT DETAILS.
3. SEE ALLOY GROUP, SHEET C-6, DETAIL 2 FOR CLEANOUT PORT DETAILS. TRANSDUCER CABLE WILL RUN THROUGH CLEANOUT PORT, VALVE, AND TO THE WELL. GATE VALVE WILL BE NORMALLY OPEN. IF NEED TO CLOSE THE VALVE TRANSDUCER WILL BE REMOVED.

1 / E2.0A **ST. LOUIS TUNNEL PUMP STATION RW-3A CONDUIT PLAN**
SCALE: 1/2" = 1'-0"

NORTH

ISSUED FOR APPROVAL

REVISIONS

NO.	DESCRIPTION	DATE	BY	CHK'D	APRVD
1					
2					
3					
4					
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CURRENT DRAWING

STATUS	ACTION	DATE
PRELIMINARY /PLANNING		
DESIGN DEVELOPMENT		
ISSUED FOR APPROVAL	X	05/28/21
APPROVED FOR BIDDING		
APPROVED FOR CONSTRUCTION		
AS-BUILT DRAWING		
PROJECT NO.:	21174	

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AEEC
RICO-ARGENTINE MINE SITE
RICO PUMP AND WELLHOUSE RW3A
ST. LOUIS TUNNEL PUMP STATION RW3A CONDUIT PLAN

ENGR'D BY: SMB | DRAWN BY: JCN | APRV'D BY: SMB | SHEET NO.: **E2.0A** | REV.: 4
FILENAME: RW3A_E2.0A_RW3A CONDUIT PLAN

Date & Time plotted: 6/7/2021 12:54:27 PM

POWER CABLE & CONDUIT SCHEDULE

RACEWAY NO.	CIRCUIT NO.	FROM	RACEWAY TYPE	RACEWAY SIZE	TO	PHASE	NEUTRAL	GROUND	INSUL. TYPE	INSUL. VOLTS	REMARKS	CABLE LENGTH	REV.
100		PANEL DP	PVC / RGS	3"	PANEL DP3A	(3) #2 AWG	-	(1) #6 AWG	THHN	600V	DP3A POWER FEEDER		A
100A		PANEL DP	PVC / RGS	3"	PANEL DP3A	-	-	-	THHN	600V	SPARE		A
101		PANEL DP	PVC / RGS	1"	DV150IE-3A	(3) #4 AWG	-	(1) #6 AWG	THHN	600V	ELECTRIC PUMP (DV150IE-3A) FEEDER		A
102		PANEL DP	PVC / RGS	3/4"	DS-UH-RW3A	(3) #12 AWG	-	(1) #12 AWG	THHN	600V	RW3A UNIT HEATER		A
102A		DS-UH-RW2A	PVC / RGS	3/4"	UH-RW3A	(3) #12 AWG	-	(1) #12 AWG	THHN	600V	RW3A UNIT HEATER		A
103		PANEL DP	PVC / RGS	3/4"	MPC-RW3A	(3) #8 AWG	-	(1) #8 AWG	THHN	600V	RW3A POWER CENTER		A
104		CP-9	PVC / RGS	1"	MCP-RW3A	-	-	-	THHN	600V	SPARE		A
105		MCP-RW3A	PVC / RGS	3/4"	FLOW METER 3A	(3) #12 AWG	-	(1) #12 AWG	THHN	600V	RW3A FLOW METER CONTROL POWER		A
107		MCP-RW3A	PVC / RGS	3/4"	CP-9	(3) #12 AWG	-	(1) #12 AWG	THHN	600V	CONTROL PANEL CP-9 FEEDER		A

CONTROL CABLE & CONDUIT SCHEDULE

RACEWAY NO.	CIRCUIT NO.	FROM	RACEWAY TYPE	RACEWAY SIZE	TO	NO. OF CONDUCTORS	CONDUCTOR SIZE	SHIELD	INSUL. VOLTS	REMARKS	CABLE LENGTH	REV.
50		CONTROL PANEL CP-9	PVC/RGS	1"	DV150IE-3A	(3) - #16 TWSP	#16	YES	600V	DV150IE-3A 4-20mA SPEED REF		A
51		CONTROL PANEL CP-9	PVC/RGS	1"	DV150IE-3A	9	#14	NO	600V	DV150IE-3A DI / DO		A
52		PANEL DP3A	PVC/RGS	3/4"	RW3A VALVE BOX	4	#12	NO	600V	RW3A VALVE MOTOR		A
53		CONTROL PANEL CP-9	PVC/RGS	3/4"	RW3A VALVE BOX	9	#14	NO	600V	RW3A VALVE POSITION INDICATOR		A
54		CONTROL PANEL CP-9	PVC/RGS	3/4"	RW3A VALVE BOX	(3) - #16 TWSP	#16	YES	600V	RW3A MODULATOR INPUT / OUTPUT		A
55		CONTROL PANEL CP-9	PVC/RGS	3/4"	FIT-500	(2) - #16 TWSP	#16	YES	600V	FLOW METER 3A CONTROLS		A
56		CONTROL PANEL CP-9	PVC/RGS	1"	LT-500, TT-500	(2) - 2 PAIR	#24	YES	300V	3A RS-485 COMMS		A
57		CONTROL PANEL CP-9	PVC/RGS	3/4"	LSH-510	4	#12	NO	600V	RW3A LEAK DETECTION		A
58		CONTROL PANEL CP-9	PVC/RGS	3/4"	PT-500	(1) - #16 TWSP	#16	YES	600V	RW3A INLET PRESSURE PSI		A
60		CONTROL PANEL CP-9	RGS	3/4"	ZIC-510	3	#14	NO	600V	RW3A DOOR SWITCH (DOOR OPEN)		A
61		CONTROL PANEL CP-9	PVC/RGS	1"	LT-540, TT-540	(2) - 2 PAIR	#24	YES	300V	MONITORING WELL RS-485 COMMS		A

ISSUED FOR APPROVAL

REVISIONS					
NO.	DESCRIPTION	DATE	BY	CHK'D	APRV'D
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CURRENT DRAWING		
STATUS	ACTION	DATE
PRELIMINARY /PLANNING		
DESIGN DEVELOPMENT		
ISSUED FOR APPROVAL	X	05/28/21
APPROVED FOR BIDDING		
APPROVED FOR CONSTRUCTION		
AS-BUILT DRAWING		
PROJECT NO.: 21174		

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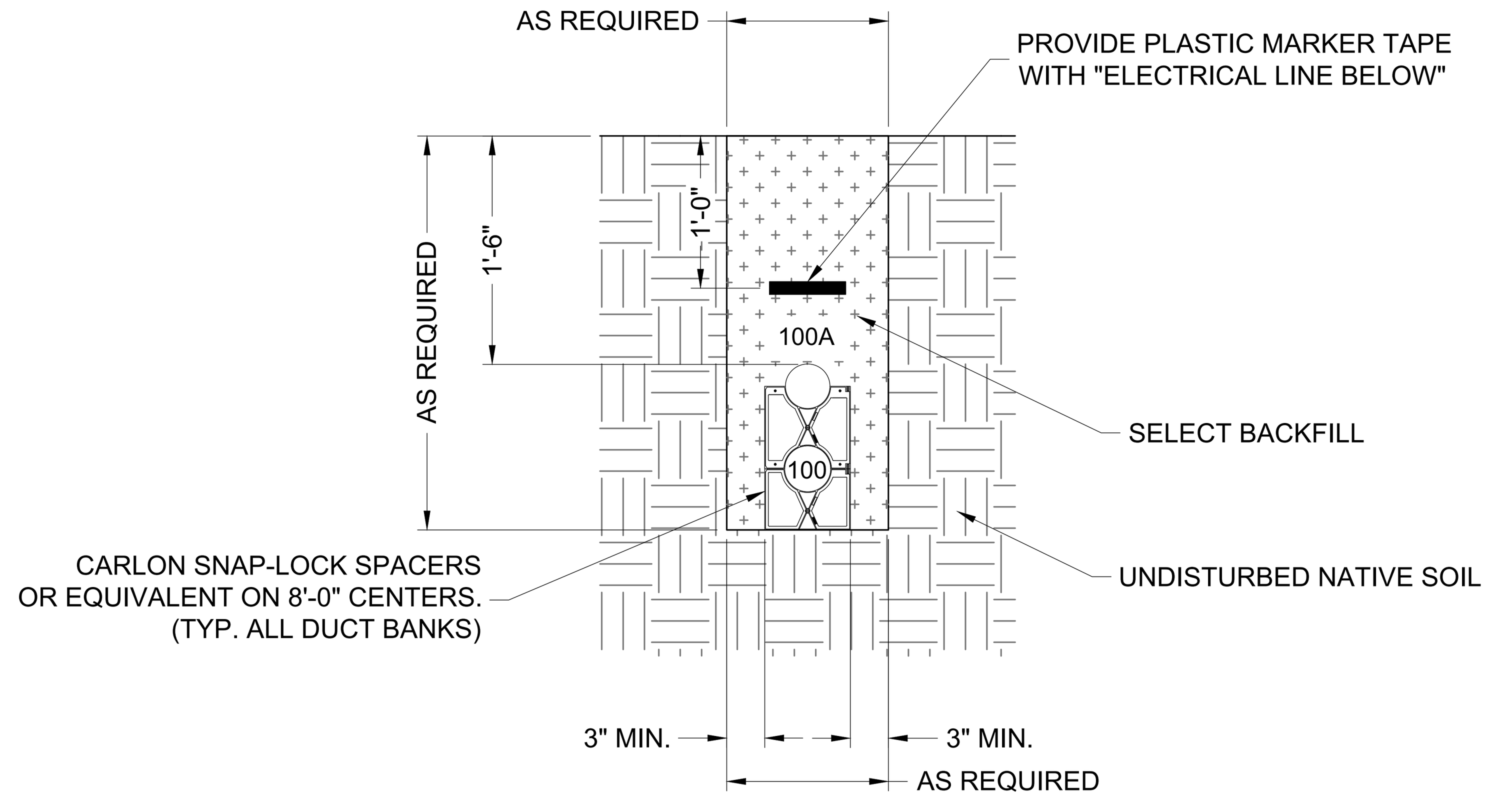
AEEC
RICO-ARGENTINE MINE SITE
RICO PUMP AND WELLHOUSE RW3A
POWER & CONTROL CABLE & CONDUIT SCHEDULES

ENGR'D BY: SMB | DRAWN BY: MVW | APRV'D BY: SMB | SHEET NO.: E2.1 | REV.: 3
FILENAME: RW3A_E2.1_PWR & CTRL CBL & COND SCH

Date & Time plotted: 6/7/2021 12:54:30 PM



E
E2.2A

UNDERGROUND DIRECTLY BURIED CONDUIT DUCT BANK (SECTION "E")

SCALE: 1" = 1'-0"

CONDUIT TAGS:

(100) 3" PVC:
(3) #2 AWG, TYPE THHN PHASE CONDUCTORS,
(1) #6 AWG, TYPE THHN GROUND CONDUCTOR

(100A) 3" PVC:
SPARE

ISSUED FOR APPROVAL

REVISIONS

NO.	DESCRIPTION	DATE	BY	CHK'D	APRV'D
1					
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CURRENT DRAWING

STATUS	ACTION	DATE
PRELIMINARY /PLANNING		
DESIGN DEVELOPMENT		
ISSUED FOR APPROVAL	X	05/28/21
APPROVED FOR BIDDING		
APPROVED FOR CONSTRUCTION		
AS-BUILT DRAWING		
PROJECT NO.: 21174		

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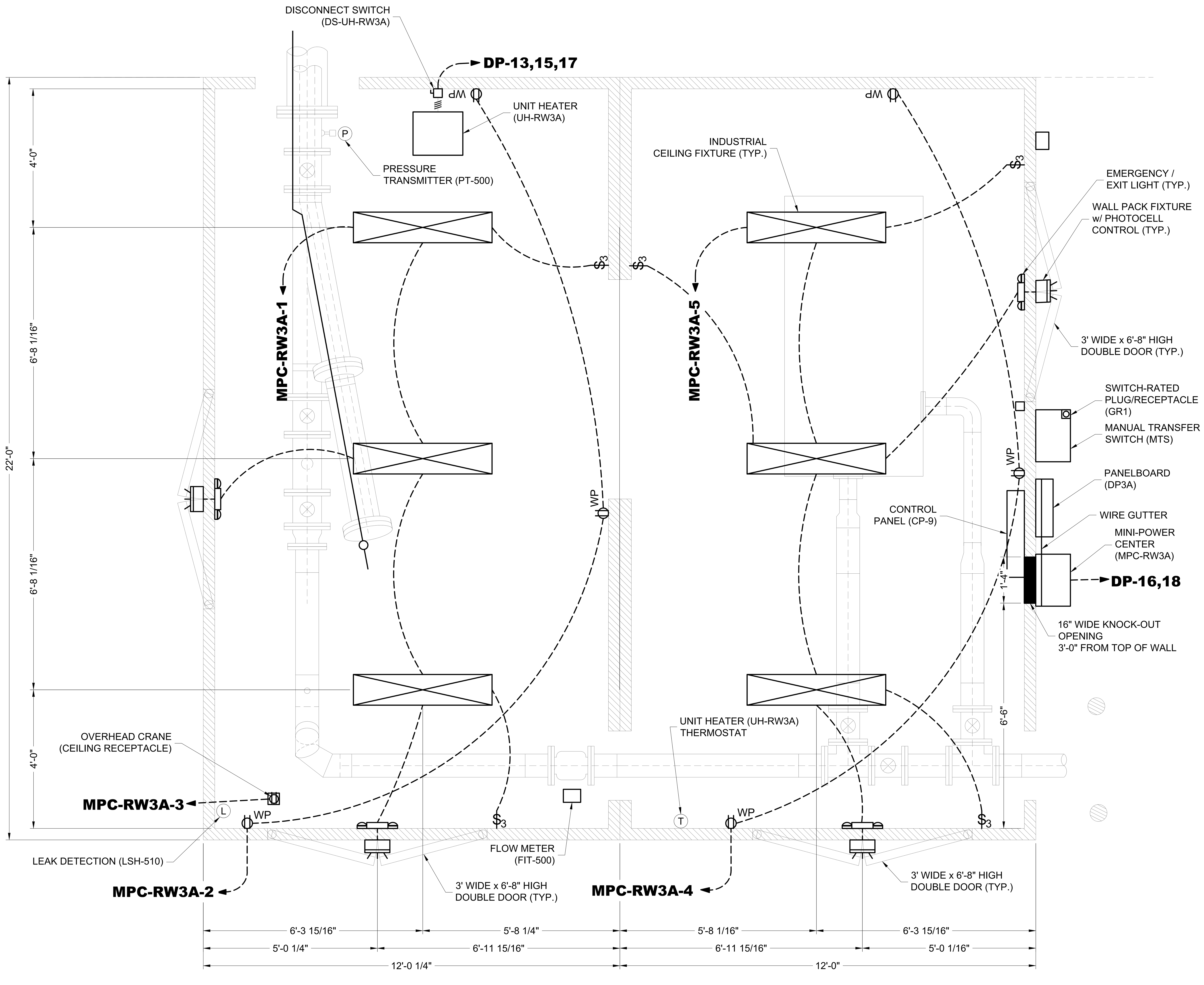
AEEC
RICO-ARGENTINE MINE SITE
RICO PUMP AND WELLHOUSE RW3A
UNDERGROUND DUCTBANK SECTIONS - CONT.

ENGR'D BY: SMB | DRAWN BY: MVW | APRV'D BY: SMB | SHEET NO.: **E2.2A** | REV.: 1

FILENAME: RW3A_E2.2A_DUCTBANK_SECTIONS-CONT

Date & Time plotted: 6/7/2021 12:54:34 PM



1 / E2.5 — WELLHOUSE (RW-3A) LIGHTING & RECEPTACLES PLAN
SCALE: 5/8" = 1'-0"

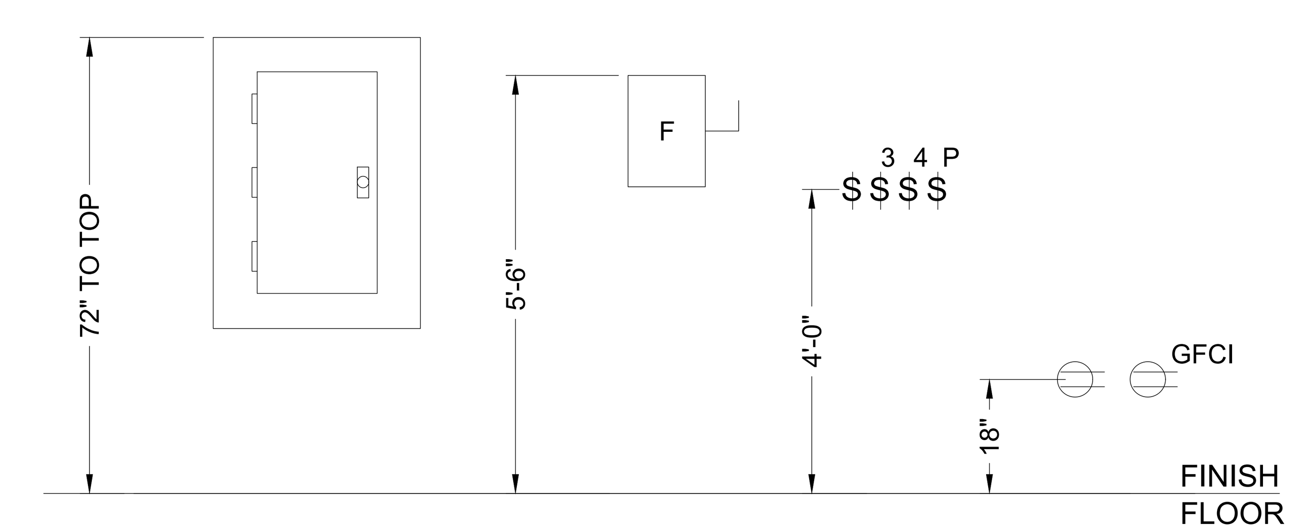
2 / E2.5 — PUMPHOUSE (PH-2) LIGHTING & RECEPTACLES PLAN
SCALE: 5/8" = 1'-0"

GENERAL NOTES:

1. CONTRACTOR SHALL VERIFY EQUIPMENT DIMENSIONS AND LOCATIONS BEFORE BEGINNING ROUGH-IN.
2. CONTRACTOR SHALL VERIFY ELECTRICAL LOADS (VOLTAGE, PHASE, CONNECTION REQUIREMENTS, ETC.) OF ACTUAL EQUIPMENT FURNISHED WITH APPROVED CONSTRUCTION DRAWINGS BEFORE BEGINNING ROUGH-IN.
3. ALL PENETRATION OF FLOORS, WALLS, AND CEILING SHALL BE SEALED WITH APPROVED MATERIAL.
4. UNLESS OTHERWISE INDICATED, ALL CONDUIT, J-BOXES, SWITCHES, DEVICES, ETC. SHALL BE SURFACE MOUNTED ON WALLS OR CEILINGS.
5. ALL CONDUIT INSTALLED INSIDE THE BUILDING SHALL BE RIGID GALVANIZED STEEL (RGS) SECURED WITH STEEL COMPRESSION TYPE FITTINGS.
6. ALL CONDUIT INSTALLED OUTSIDE THE BUILDING SHALL BE RGS/PVC CONDUIT.
7. INSTALL ALL SURFACE MOUNT RGS CONDUIT PARALLEL TO FINISHED FLOOR AND TIGHT AGAINST WALL.
8. CONTRACTOR TO UTILIZE #10 THWN CONDUCTOR FOR ALL 120V CIRCUITS EXCEEDING 100 FEET FOR VOLTAGE DROP CORRECTION.
9. CONTRACTOR IS RESPONSIBLE TO MAINTAIN SUFFICIENT ACCESS AND WORKING SPACE ABOUT ALL ELECTRICAL EQUIPMENT AS SPECIFIED IN TABLE 110.26(A)(1) AND TABLE 110.34(A) OF THE 2017 NATIONAL ELECTRICAL CODE.
10. SEE SHEET E2.10 FOR PANELBOARD LOAD SCHEDULES.

FIXTURE SCHEDULE/LOAD DATA

SYMBOL	DESCRIPTION	MANUF.	PART NUMBER
	ENCLOSED INDUSTRIAL CEILING FIXTURE, FIBERGLASS HOUSING, GASKETED, LED. 120 VAC, 31W, 4000 LUMENS	HOLOPHANE	EMSL484000LMIMAFL
	GREEN EMERGENCY EXIT / LIGHT, LED. 120VAC, 3W, FOR WET LOCATION	HOLOPHANE	LNTLLAMWSGS
	WALL PACK FIXTURE, LED, WALL MOUNTED, BLACK PHOTOCELL CONTROLLED, 120VAC, 39W, 3377 LUMENS	HOLOPHANE	W4GLED 10C 1000 40K T3M 120 BK
GFCI	GROUND FAULT CURRENT INTERRUPTER; INDOOR DUPLEX - 20 AMP - 120VAC SPECIFICATION GRADE	HUBBELL	GF5362W
WP	GROUND FAULT CURRENT INTERRUPTER; RECEPTACLE WITH IN-USE WEATHERPROOF COVER 20 AMP - 120VAC SPECIFICATION GRADE	LEVITON	8599-CPW
$3	LIGHT SWITCH, HEAVY-DUTY THREE WAY - 20 AMP, 120/277VAC SPECIFICATION GRADE	HUBBELL	HBL1223W
	ELECTRIC UNIT HEATER 5kW, 17076 BTU's, 480VAC, 3ϕ, 60 Hz., 6.3 AMPS	CHROMALOX	LUH-05-43-32-40-1



3 / E2.5 — TYPICAL MOUNTING HEIGHTS DETAIL
SCALE: N.T.S.

NOTE:
DIMENSIONS INDICATED ARE TO THE CENTER OF THE OUTLET BOX.

ISSUED FOR APPROVAL

REVISIONS

NO.	DESCRIPTION	DATE	BY	CHK'D	APRV'D
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CURRENT DRAWING

STATUS	ACTION	DATE
PRELIMINARY /PLANNING		
DESIGN DEVELOPMENT		
ISSUED FOR APPROVAL	X	05/28/21
APPROVED FOR BIDDING		
APPROVED FOR CONSTRUCTION		
AS-BUILT DRAWING		

PROJECT NO.: 21174

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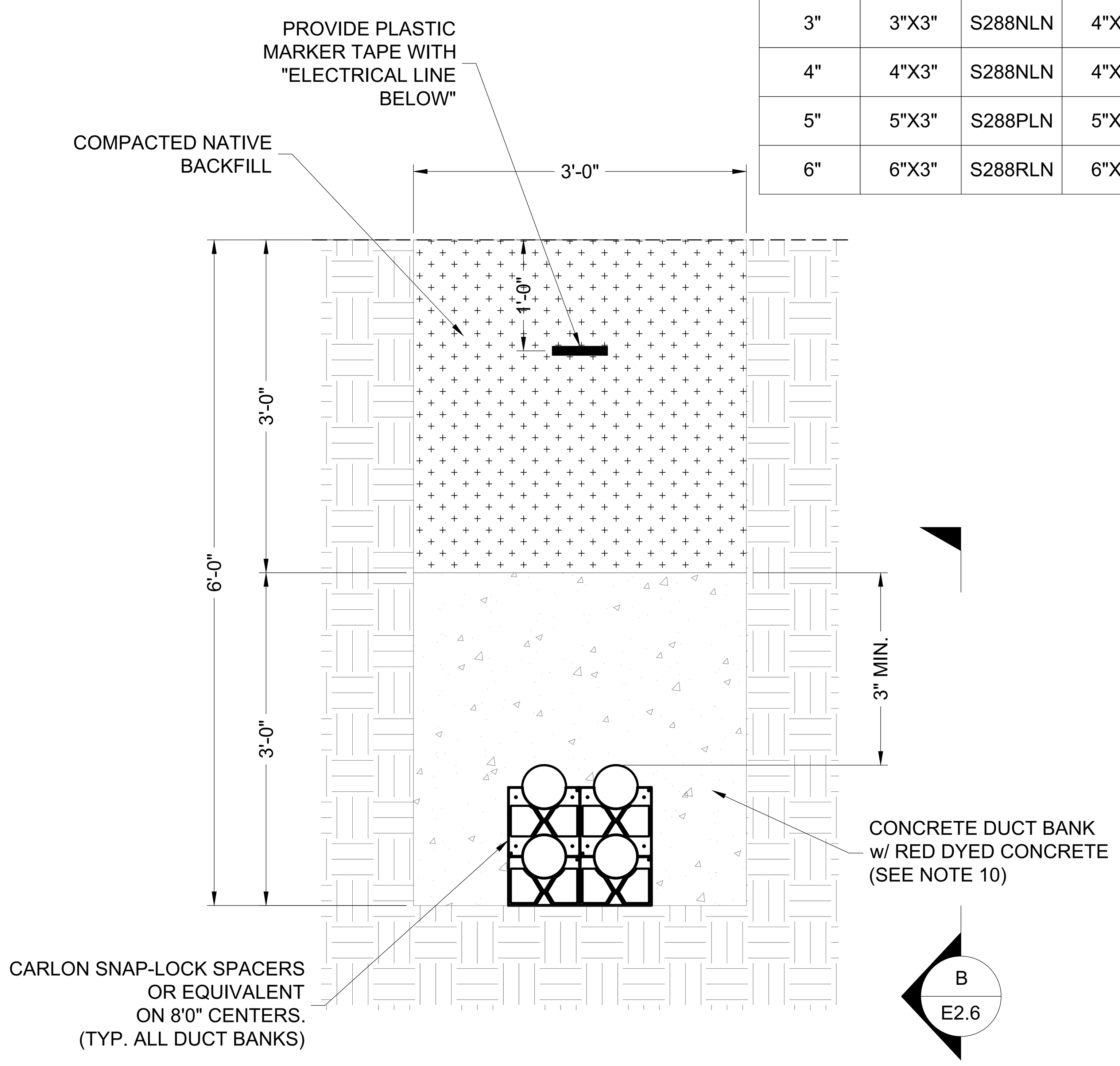
RICO-ARGENTINE MINE SITE
RICO PUMP AND WELLHOUSE RW3A
WELLHOUSE (RW-3A) & PUMPHOUSE (PH-2) LIGHTING & RECEPTACLES PLAN

ENGR'D BY: SMB | DRAWN BY: JCN | APRV'D BY: SMB | SHEET NO.: E2.5 | REV.: 2
FILENAME: RW3A_E2.5_RW-3A & PUMPHOUSE 2 LTG & RECEPT PLAN

Date & Time plotted: 6/7/2021 12:54:37 PM

CARLON "SNAP-LOC" SPACERS SPECIFICATION CHART

PVC CONDUIT TRADE SIZE	BASE SPACERS		INTERMEDIATE SPACERS	
	SIZE	PART NO.	SIZE	PART NO.
2"	2"X3"	S288JLN	2"X3"	S289JLN
3"	3"X3"	S288NLN	4"X3"	S289LLN
4"	4"X3"	S288NLN	4"X3"	S289NLN
5"	5"X3"	S288PLN	5"X3"	S289PLN
6"	6"X3"	S288RLN	6"X3"	S289RLN

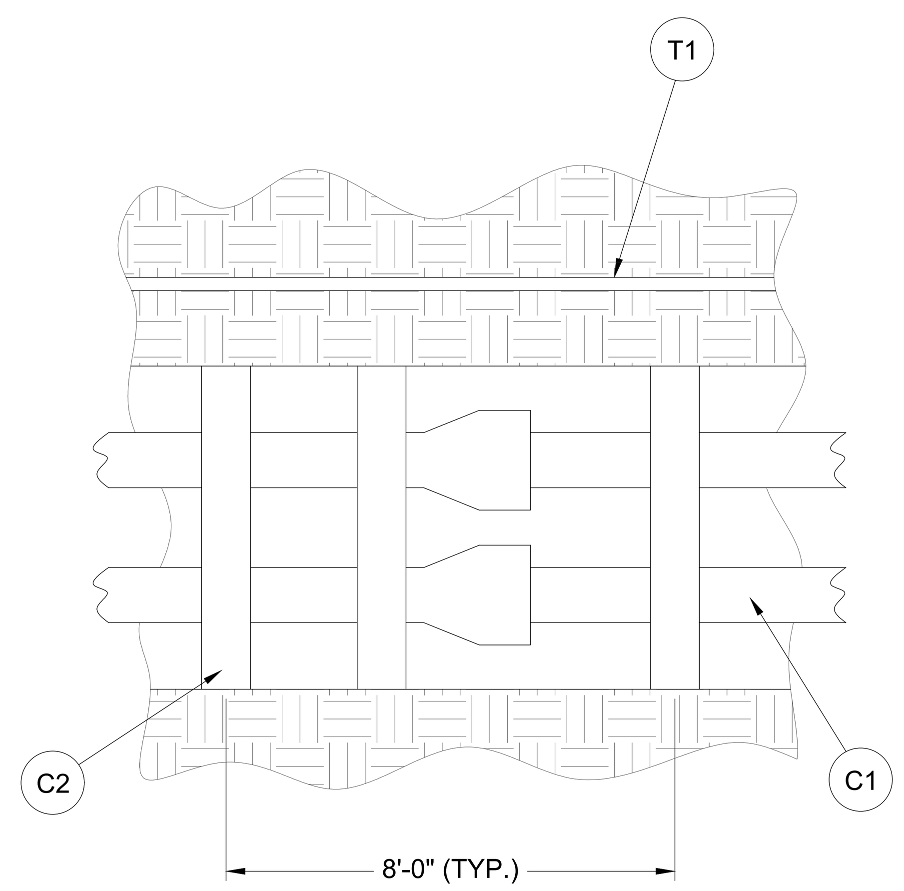


A
E2.6

TYPICAL CONCRETE ENCASED DUCTBANK (SCH. 40 PVC)

SCALE: 1"=1'-0"

ITEM	QTY.	DESCRIPTION
C1	AS REQ.	4" SCH 40 CONDUIT
C2	AS REQ.	CONDUIT SPACER - INTERMEDIATE (8' CENTERS)
T1	AS REQ.	CONTINUOUS MARKER TAPE "ELECTRIC LINE BELOW"



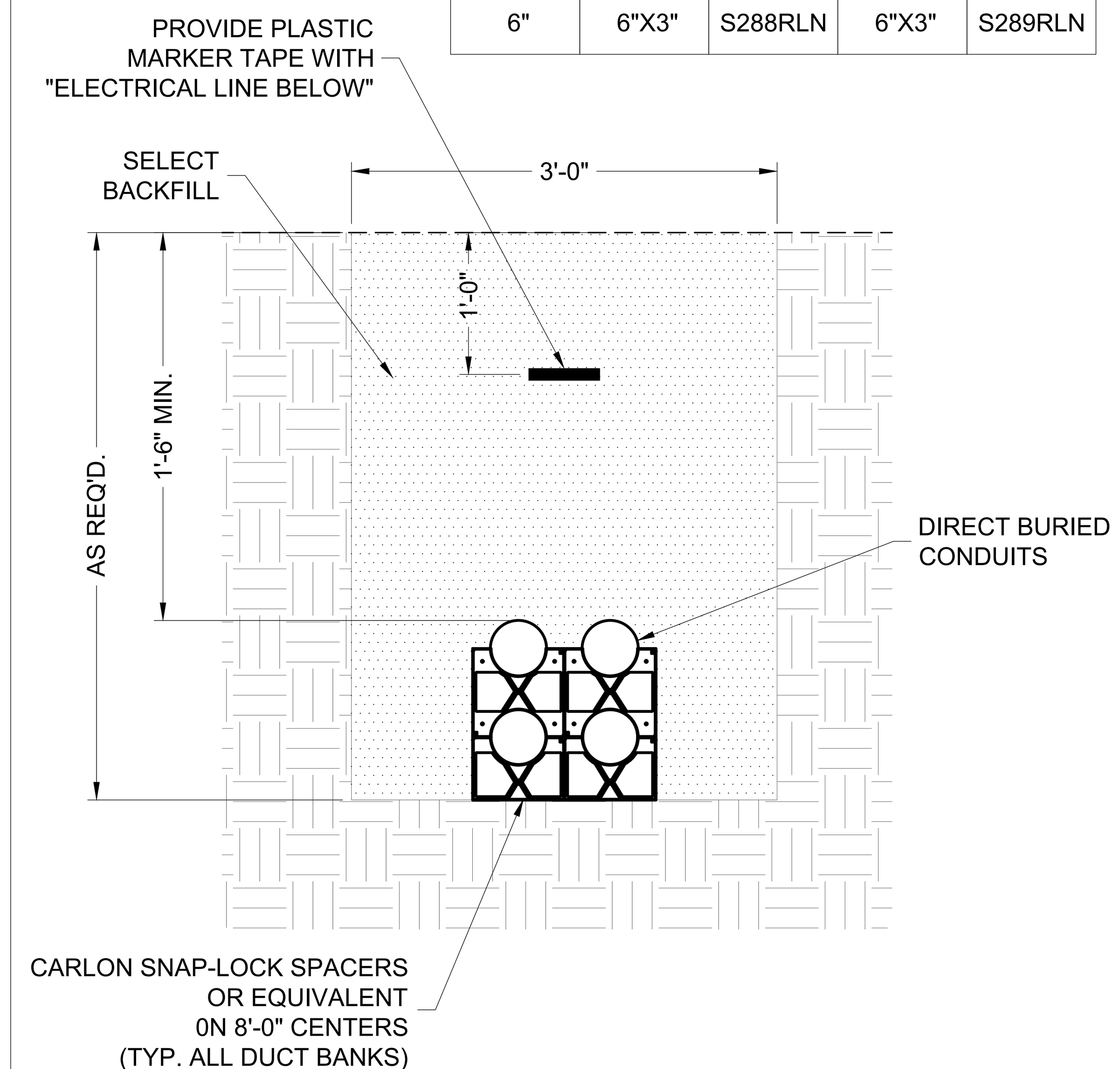
B
E2.6

TYPICAL CONCRETE ENCASED DUCTBANK (SCH. 40 PVC) SECTION B-B

SCALE: NTS

CARLON "SNAP-LOC" SPACERS SPECIFICATION CHART

PVC CONDUIT TRADE SIZE	BASE SPACERS		INTERMEDIATE SPACERS	
	SIZE	PART NO.	SIZE	PART NO.
2"	2"X3"	S288JLN	2"X3"	S289JLN
3"	3"X3"	S288NLN	4"X3"	S289LLN
4"	4"X3"	S288NLN	4"X3"	S289NLN
5"	5"X3"	S288PLN	5"X3"	S289PLN
6"	6"X3"	S288RLN	6"X3"	S289RLN



C
E2.6

TYPICAL DIRECT BURIED CONDUIT DETAIL (SCH. 40 PVC)

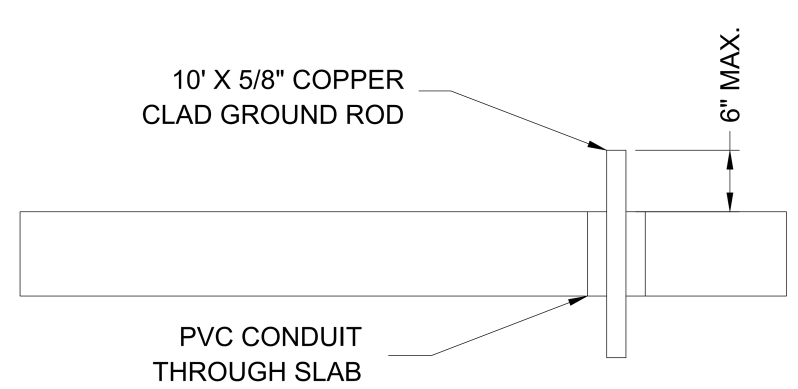
SCALE: 1"=1'-0"

GENERAL NOTES:

1. THE TRENCH BOTTOM SHALL BE FREE FROM ROCKS EXCEEDING 2 INCHES IN THEIR LARGEST DIMENSION.
2. BASE AND INTERMEDIATE CONDUIT SPACERS SHALL BE INSTALLED TO MAINTAIN CONDUIT SPACING DURING THE BACKFILL OPERATION.
3. ALL BENDS SHALL BE RIGID GALVANIZED STEEL.
4. ALL EXPOSED CONDUIT SHALL BE RIGID GALVANIZED STEEL (RGS) OR PVC CONDUIT. UNDERGROUND CONDUIT SHALL BE PVC OR RGS CONDUIT WITH CORROSION PROTECTION.
5. ALL EXPOSED METAL CONDUIT SHALL BE BONDED TO GROUND MAT.
6. ALL BURIED RIGID GALVANIZED STEEL CONDUIT SHALL BE PROVIDED WITH A CORROSION-RESISTANT COVERING.
7. CONDUIT TO VIBRATING EQUIPMENT SHALL BE SEAL TIGHT FLEXIBLE METAL CONDUIT.
8. ALL PENETRATIONS THROUGH EXTERIOR WALLS SHALL BE FILLED WITH AN APPROVED SEALANT.
9. A HIGHLY VISIBLE RED PLASTIC MARKER TAPE SHALL BE INSTALLED 12" BELOW THE GROUND LINE DIRECTLY ABOVE THE CONDUITS AND SHALL READ "ELECTRIC LINE BELOW" OR SIMILAR.
10. SEE THIS SHEET FOR TYPICAL CONDUIT INSTALLATION DETAILS AND THE INSTALLATION OF CARLON "SNAP-LOC" SPACERS. CARLON "SNAP-LOC" SPACERS SHALL BE INSTALLED AT INTERVALS OF 8'-0". SEE CHART ON THIS SHEET FOR CARLON "SNAP-LOC" SPACER SPECIFICATIONS.
11. ALL CONDUITS THAT ARE SPECIFIED TO BE STUBBED OUT AND CAPPED SHALL BE LOCATED BY MEANS OF SURVEYING. CONTRACTOR SHALL BE RESPONSIBLE FOR SURVEYING, AND SHALL PROVIDE SURVEYING DATA TO THE OWNER. COORDINATES OF THE ENDS OF THE CONDUITS SHALL BE CLEARLY IDENTIFIED CONDUITS SHALL BE CAPPED WITH STANDARD CONDUIT FITTINGS SPECIFICALLY DESIGNED FOR THE APPLICATION AND TYPE OF CONDUIT UTILIZED.
12. IN ALL CASES WHERE CONDUITS MUST CROSS DUE TO STUB-OUTS OR BRANCHES. THE STUBBED CONDUIT SHALL BE ELEVATED TO CROSS OVER THE TOP OF THE OTHER CONDUITS. IN ALL CASES CONDUIT BURIAL MUST BE A MINIMUM OF 18" FOR PVC AND 12" FOR RGS.
13. TRENCH WALLS SLOPED AS REQUIRED TO ACCOMMODATE LOCAL SOIL CONDITIONS.

NOTE:

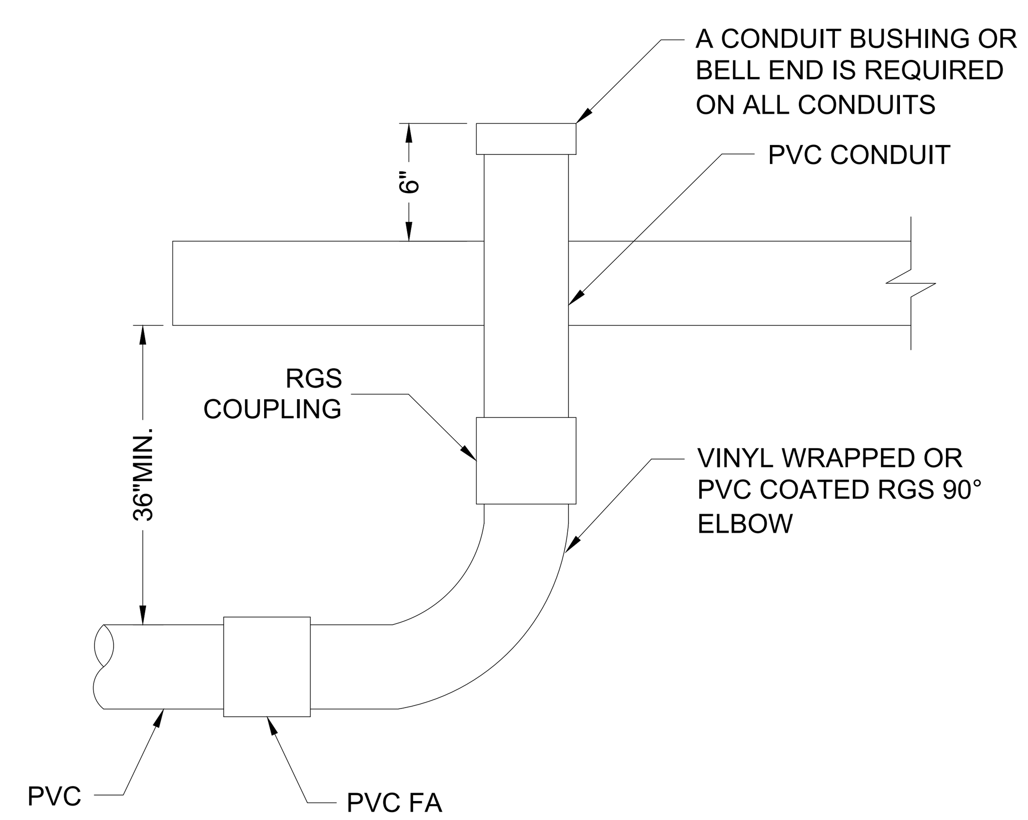
GROUND RODS SHALL BE INSTALLED IN PVC CONDUIT THROUGH CONCRETE SLAB. GROUND ROD SHALL NOT EXTEND ABOVE SLAB MORE THAN 6".



D
E2.6

TYPICAL PVC CONDUIT ENTRANCE DETAIL

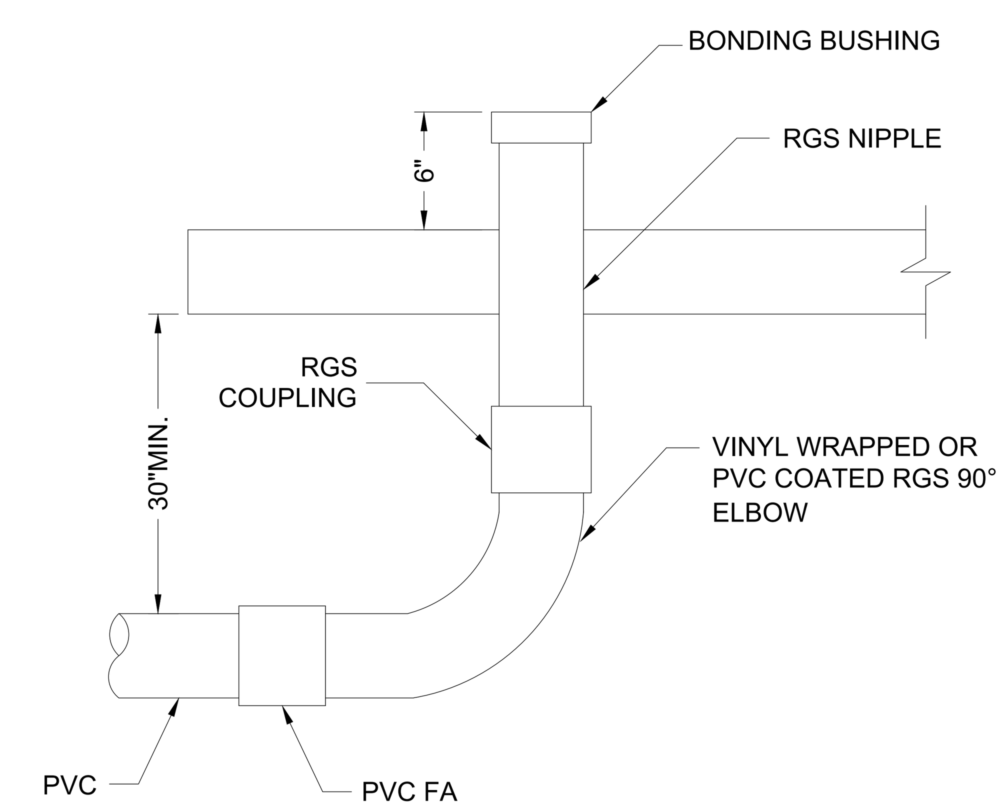
SCALE: NTS



E
E2.6

TYP. PVC CONDUIT ENTRANCE DETAIL

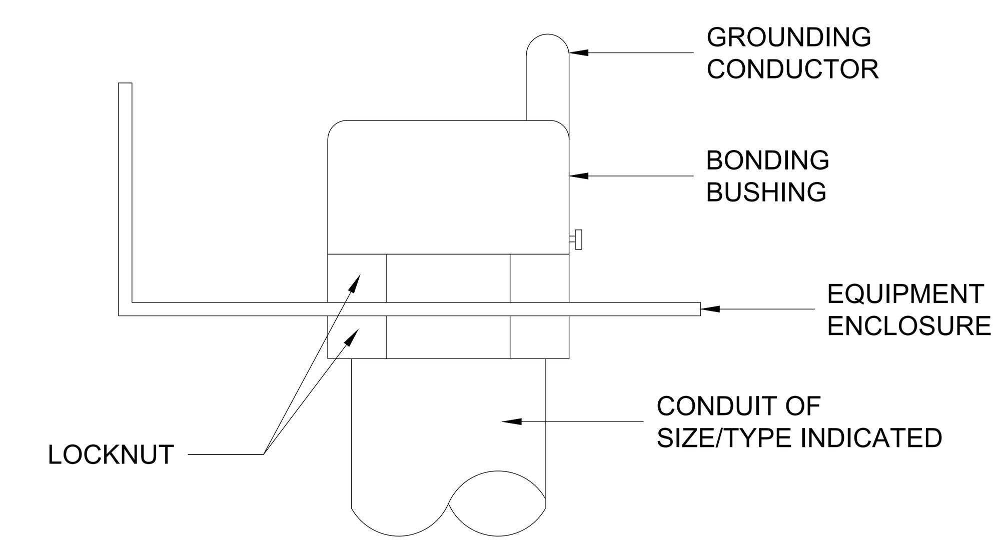
SCALE: NTS



F
E2.6

TYP. RGS CONDUIT ENTRANCE DETAIL

SCALE: NTS



G
E2.6

EQUIPMENT ENTRANCE DETAIL

SCALE: NTS

ISSUED FOR APPROVAL

REVISIONS

NO.	DESCRIPTION	DATE	BY	CHK'D	APRV'D
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CURRENT DRAWING

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DESIGN DEVELOPMENT		
ISSUED FOR APPROVAL	X	05/28/21
APPROVED FOR BIDDING		
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AS-BUILT DRAWING		
PROJECT NO.:	21174	

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AEEC
RICO-ARGENTINE MINE SITE
RICO PUMP AND WELLHOUSE RW3A
UNDERGROUND DUCTBANK TYPICAL DETAILS

ENGR'D BY: SMB | DRAWN BY: MVW | APRV'D BY: SMB | SHEET NO.: E2.6 | REV.: 1

FILENAME: RW3A_E2.6_DUCTBANK_TYP_DTLS

Date & Time plotted: 6/7/2021 12:54:40 PM

8 | 7 | 6 | 5 | 4 | 3 | 2 | 1

D | C | B | A

PANELBOARD SCHEDULE PNL-DP

PANEL RATING : MAINS: 225A Breaker: 225A VOLTS 480|277 PHASE 3 WIRE 4

LOAD DESCRIPTION	MINIMUM CONDUIT SIZE/TYPE	WIRE SIZE/TYPE (AWG)	NO. POLES	BKR. AMPS	CKT. NO.	TOTAL AMPS	LOAD DEMAND CALCULATION (kVA) LEFT AØ	LEFT BØ	LEFT CØ	RIGHT AØ	RIGHT BØ	RIGHT CØ	TOTAL AMPS	CKT. NO.	BKR. AMPS	NO. POLES	WIRE SIZE/TYPE (AWG)	MINIMUM CONDUIT	LOAD DESCRIPTION
					1		1.67			1.67				2					
UH-RW2A	3/4"	#12	3	20	3	6.0		1.67			1.67		6.0	4	20	3	#12	3/4"	UH-RW2B
					5				1.67			1.67		6					
					7		14.92			1.01			10.2	8	50	2	#8	3/4"	MCP-RW2A
DV150E-2B	1"	(3)#4, (1)#6	3	125	9	65.0		14.92			1.44			10					
					11				14.92			0.99	10.4	12	50	2	#8	3/4"	MCP-RW2B
					13		0.00			1.50				14					
SPACE	-	-	3	-	15	0.0		0.00			0.00		0.0	16	-	-	-	-	SPACE
					17				0.00			0.00		18					
					19					20.93				2					
SPACE	-	-	3	-	21	0.0					21.36		0.0	4	125	3	#2	3"	"FUTURE" PANEL DP-3A
					23							19.92		6					

	AØ / A	BØ / B	CØ / C	AØ	BØ	CØ
COLUMN TOTALS (kVA)	16.59	16.59	16.59	25.11	24.47	22.58
PANELBOARD PHASE TOTALS (kVA)	41.70	41.06	39.17			
AMPS PER PHASE TOTALS (AMPS)	150.54	148.23	141.41			
AVERAGE PHASE CURRENT(AMPS)	146.66					
HIGHEST PHASE CURRENT(AMPS)	150.54					
TOTAL CONNECTED LOAD (kVA)	121.93					

1 | 1 E2.10

PANELBOARD LOAD SCHEDULE (PNL-DP)

SCALE: N.T.S.

PANELBOARD SCHEDULE PNL-DP3A

PANEL RATING : MAINS: 125A Breaker: 125A VOLTS 480|277 PHASE 3 WIRE 4

LOAD DESCRIPTION	MINIMUM CONDUIT SIZE/TYPE	WIRE SIZE/TYPE (AWG)	NO. POLES	BKR. AMPS	CKT. NO.	TOTAL AMPS	LOAD DEMAND CALCULATION (kVA) LEFT AØ	LEFT BØ	LEFT CØ	RIGHT AØ	RIGHT BØ	RIGHT CØ	TOTAL AMPS	CKT. NO.	BKR. AMPS	NO. POLES	WIRE SIZE/TYPE (AWG)	MINIMUM CONDUIT	LOAD DESCRIPTION
					1		1.67			0.00				2					
UH-RW3A	3/4"	#12	3	20	3	6.0		1.67			0.00		0.0	4	-	3	-	-	SPACE
					5				1.67			0.00		6					
					7		14.92			1.01			10.2	8	50	2	#8	3/4"	MCP-RW3A
DV150IE-3A	1"	(3)#4, (1)#6	3	125	9	65.0		14.92			1.44			10					
					11				14.92			0.00	0.0	12	-	2	-	-	SPACE
					13		0.00			0.00				14					
SPACE	-	-	3	-	15	0.0		0.00			0.00		0.0	16	-	2	-	-	SPACE
					17				0.00			0.00		18					
					19		0.00			0.00				2					
SPACE	-	-	3	-	21	0.0		0.00			0.00		0.0	4	-	3	-	-	SPACE
					23				0.00			0.00		6					

	AØ / A	BØ / B	CØ / C	AØ	BØ	CØ
COLUMN TOTALS (kVA)	16.59	16.59	16.59	1.01	1.44	0.00
PANELBOARD PHASE TOTALS (kVA)	17.60	18.03	16.59			
AMPS PER PHASE TOTALS (AMPS)	63.54	65.09	59.89			
AVERAGE PHASE CURRENT(AMPS)	62.81					
HIGHEST PHASE CURRENT(AMPS)	65.09					
TOTAL CONNECTED LOAD (kVA)	52.22					

4 E2.10

PANELBOARD LOAD SCHEDULE (PNL-DP3A)

SCALE: N.T.S.

PANELBOARD SCHEDULE MINI-POWER CENTER (MPC-RW3A)

PANEL RATING : MAINS: 100A Breaker: 100A VOLTS 240|120 PHASE 1 WIRE 3

LOAD DESCRIPTION	MINIMUM CONDUIT SIZE/TYPE	WIRE SIZE/TYPE (AWG)	NO. POLES	BKR. AMPS	CKT. NO.	TOTAL AMPS	LOAD DEMAND CALCULATION (kVA) LEFT AØ	LEFT BØ	LEFT CØ	RIGHT AØ	RIGHT BØ	RIGHT CØ	TOTAL AMPS	CKT. NO.	BKR. AMPS	NO. POLES	WIRE SIZE/TYPE (AWG)	MINIMUM CONDUIT	LOAD DESCRIPTION
RW-3A LIGHTS	3/4"	12	1	20	1	1.88	0.23			0.54			4.50	2	20	1	12	3/4"	RW-3A RECEPTACLES
OVERHEAD CRANE RECEPTACLE	3/4"	12	1	20	3	6.00		0.72						4					
FM-RW3A	3/4"	12	1	20	5	2.00	0.24							6					
CONTROL PANEL CP-9	3/4"	12	1	20	7	6.00		0.72						8					
					9									10					
					11									12					
					13									14					
					15									16					
					17									18					
					19									20					
					21									22					
					23									24					

	AØ / A	BØ / B	AØ	BØ
COLUMN TOTALS (kVA)	0.47	1.44	0.54	0.00
PANELBOARD PHASE TOTALS (kVA)	1.01	1.44		
AMPS PER PHASE TOTALS (AMPS)	8.38	12.00		
AVERAGE PHASE CURRENT(AMPS)	10.19			
HIGHEST PHASE CURRENT(AMPS)	12.00			
TOTAL CONNECTED LOAD (kVA)	2.45			

5 E2.10

PANELBOARD LOAD SCHEDULE (MPC-RW3A)

SCALE: N.T.S.

GENERAL NOTES:

1. ALL WORK SHALL CONFORM TO THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE (2019 NEC), MSHA REGULATIONS, ALL THE LOCAL AND STATE ELECTRICAL CODES AND NATIONAL FIRE PROTECTION ASSOCIATION RULES AND REGULATIONS.
2. REFER TO SHEET E0.2 FOR ELECTRICAL SYMBOLS LEGEND.
3. ALL FEEDER CONDUCTORS SHALL BE STRANDED COPPER, TYPE THHN.
4. COLOR CODE SHALL BE AS FOLLOWS:

CONNECTION	VOLTAGE CLASS 240/120	208Y/120	480Y/277
PHASE A	BLACK	BLACK	ORANGE
PHASE B	RED	RED	YELLOW
PHASE C	-	BLUE	BROWN
NEUTRAL	WHITE	WHITE	WHITE
GROUND	GREEN	GREEN	GREEN

COLOR CODE SHALL BE CONSISTENT THROUGHOUT

5. ALL CONDUIT PENETRATION THROUGH EXTERIOR WALLS SHALL BE SEALED WITH APPROVED MATERIAL.
6. REFER TO SHEET E1.0 FOR SINGLE-LINE DIAGRAM.
7. ALL BRANCH ELECTRIC CIRCUITS INSTALLED INSIDE THE BUILDING SHALL BE ENCASED IN RIGID GALVANIZED STEEL (RGS) CONDUIT AND SECURED WITH COMPRESSION TYPE FITTINGS. EXCEPT FOR CONNECTIONS TO VIBRATING EQUIPMENT. ALL CONNECTIONS TO VIBRATING EQUIPMENT SHALL BE MADE WITH SEAL TIGHT FLEXIBLE METAL CONDUIT. ALL EXTERIOR CIRCUITS SHALL BE ENCASED IN RIGID GALVANIZED STEEL (RGS) CONDUIT AND SECURED WITH THREADED CONNECTIONS. ALL WIRING METHODS SHALL COMPLY WITH SECTIONS 518.4(A)(B)(C) OF THE 2017 NATIONAL ELECTRICAL CODE (NEC).
8. ALL BRANCH CIRCUITS ORIGINATING ON BREAKERS OF 20 AMPS OR LESS SHALL BE #12 AWG STRANDED, THHN, CU., 600V UNLESS INDICATED OTHERWISE.

SHEET NOTES:

1. NOT A PART OF THIS PROJECT SCOPE. SEE "RICO PUMP AND WELLHOUSE RW2A AND RW2B" DRAWINGS BY BRUNO ENGINEERING.

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REVISIONS NO.	DESCRIPTION	DATE	BY	CHK'D	APRV'D
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CURRENT DRAWING STATUS	ACTION	DATE
PRELIMINARY /PLANNING		
DESIGN DEVELOPMENT		
ISSUED FOR APPROVAL	X	05/28/21
APPROVED FOR BIDDING		
APPROVED FOR CONSTRUCTION		
AS-BUILT DRAWING		
PROJECT NO.: 21174		

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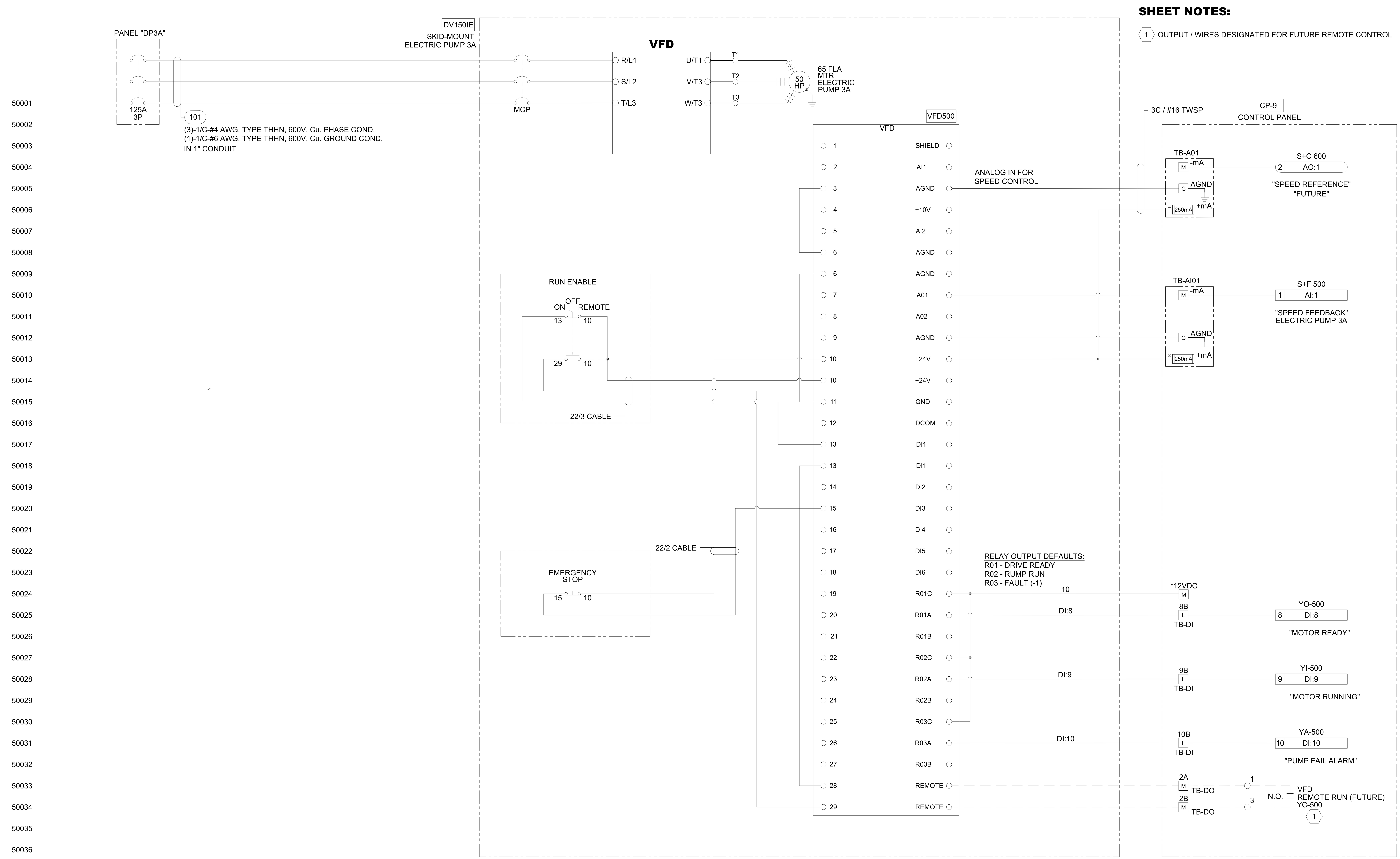
RICO-ARGENTINE MINE SITE
RICO PUMP AND WELLHOUSE RW3A
PANELBOARD LOAD SCHEDULES

ENGR'D BY: SMB | DRAWN BY: MVW | APRV'D BY: SMB | SHEET NO.: **E2.10** | REV.: 2

FILENAME: RW3A_E2.10_PNLBOARD SCHEDULES

Date & Time plotted: 6/7/2021 12:54:45 PM



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DESIGN DEVELOPMENT		
ISSUED FOR APPROVAL	X	05/28/21
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APPROVED FOR CONSTRUCTION		
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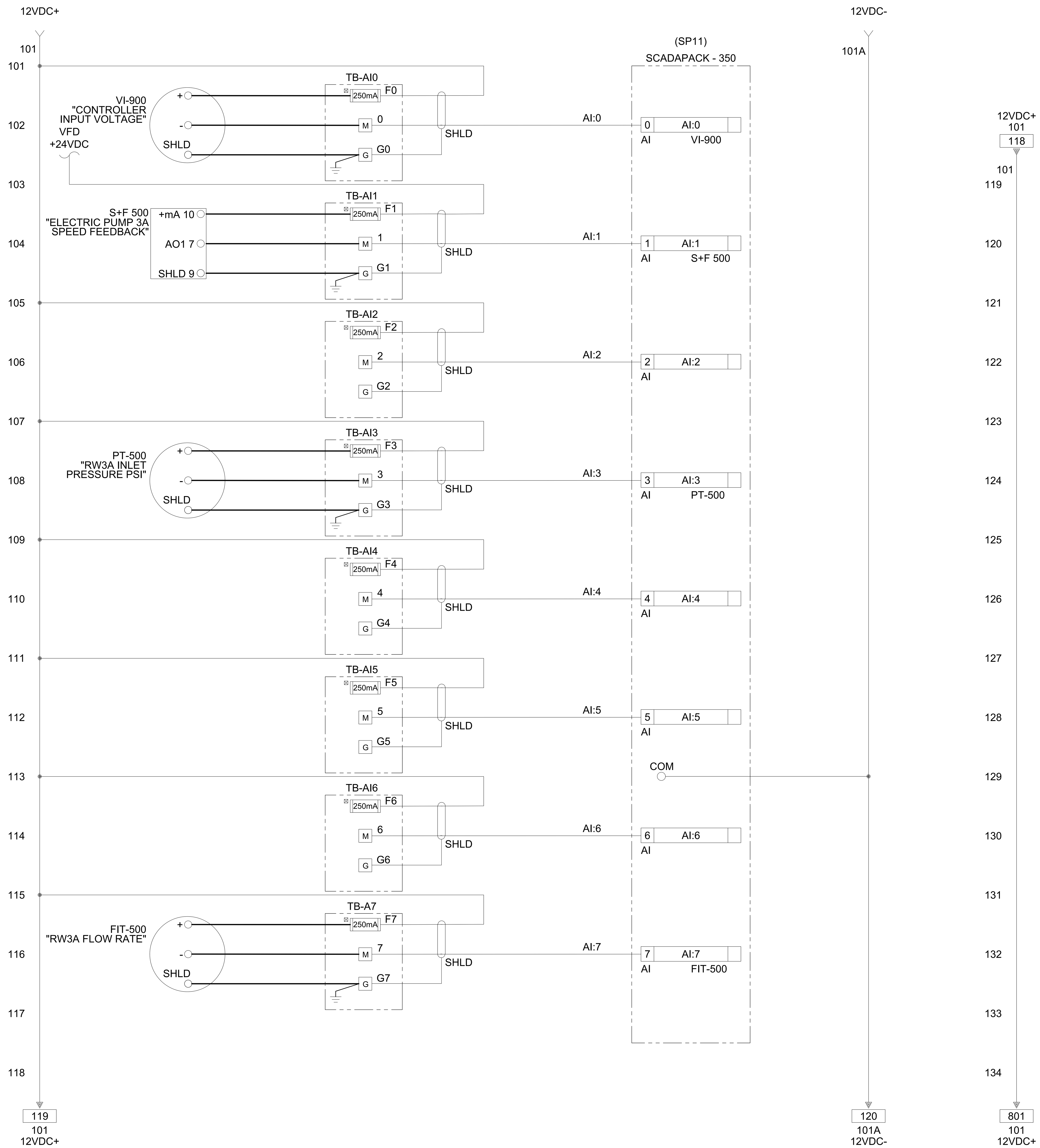
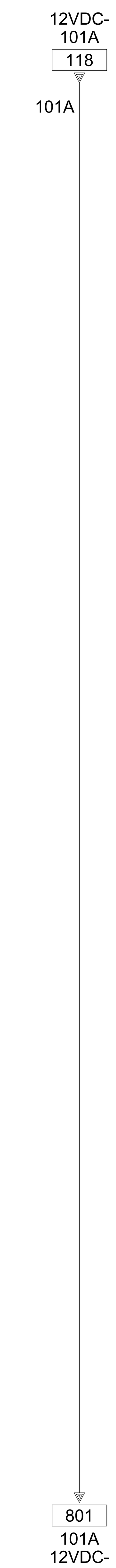
RICO-ARGENTINE MINE SITE
RICO PUMP AND WELLHOUSE RW3A
SKID-MOUNT ELECTRIC PUMP (3A) MOTOR SCHEMATIC DIAGRAM

ENGR'D BY: SMB | DRAWN BY: JCN | APRV'D BY: SMB | SHEET NO.: E5.1 | REV: 3
FILENAME: RW3A_E5.1_SCHEMATIC DIAGRAM

Date & Time plotted: 6/7/2021 12:54:48 PM





GENERAL NOTES:

1. ALL WORK SHALL CONFORM TO THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE (2017 NEC), ALL OTHER STATE AND LOCAL CODES, AND ALL NATIONAL FIRE PROTECTION ASSOCIATION RULES AND REGULATIONS.
2. ALL NEW CONTROL WIRING SHALL BE #14 AWG, TYPE THHN, 600V, COPPER, UNLESS OTHERWISE NOTED.
3. MULTI-LEVEL TERMINAL BLOCKS ARE USED PHOENIX CONTACT PN: 3214325

LEGEND

- EQUIPMENT ENCLOSURE OR MULTI-LEVEL TERMINAL BLOCK
- EQUIPMENT / VENDOR WIRING
- DEVICE
- FUTURE INSTALLATION
- DEVICE TERMINAL POINT

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APPROVED FOR CONSTRUCTION		
AS-BUILT DRAWING		
PROJECT NO.: 21174		

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RICO PUMP AND WELLHOUSE RW3A
SCHEMATIC DIAGRAM - ANALOG INPUT FOR RW-3A

ENGR'D BY: SMB | DRAWN BY: JCN | APRV'D BY: SMB | SHEET NO.: E7.5 | REV: 2

FILENAME: RW3A_E7.5_SCHEMATIC-AI-RW3A

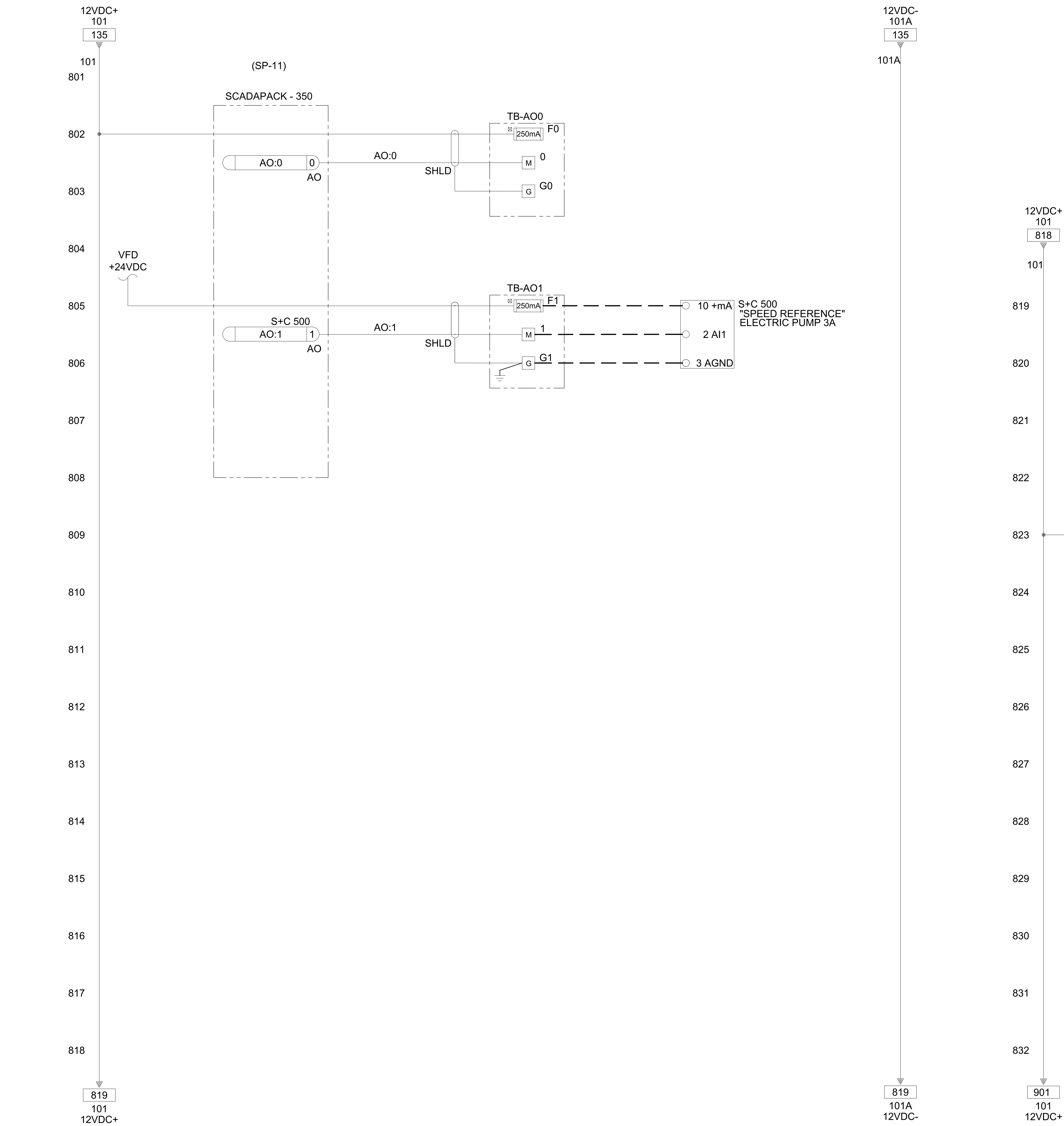
Date & Time plotted: 6/7/2021 12:54:50 PM

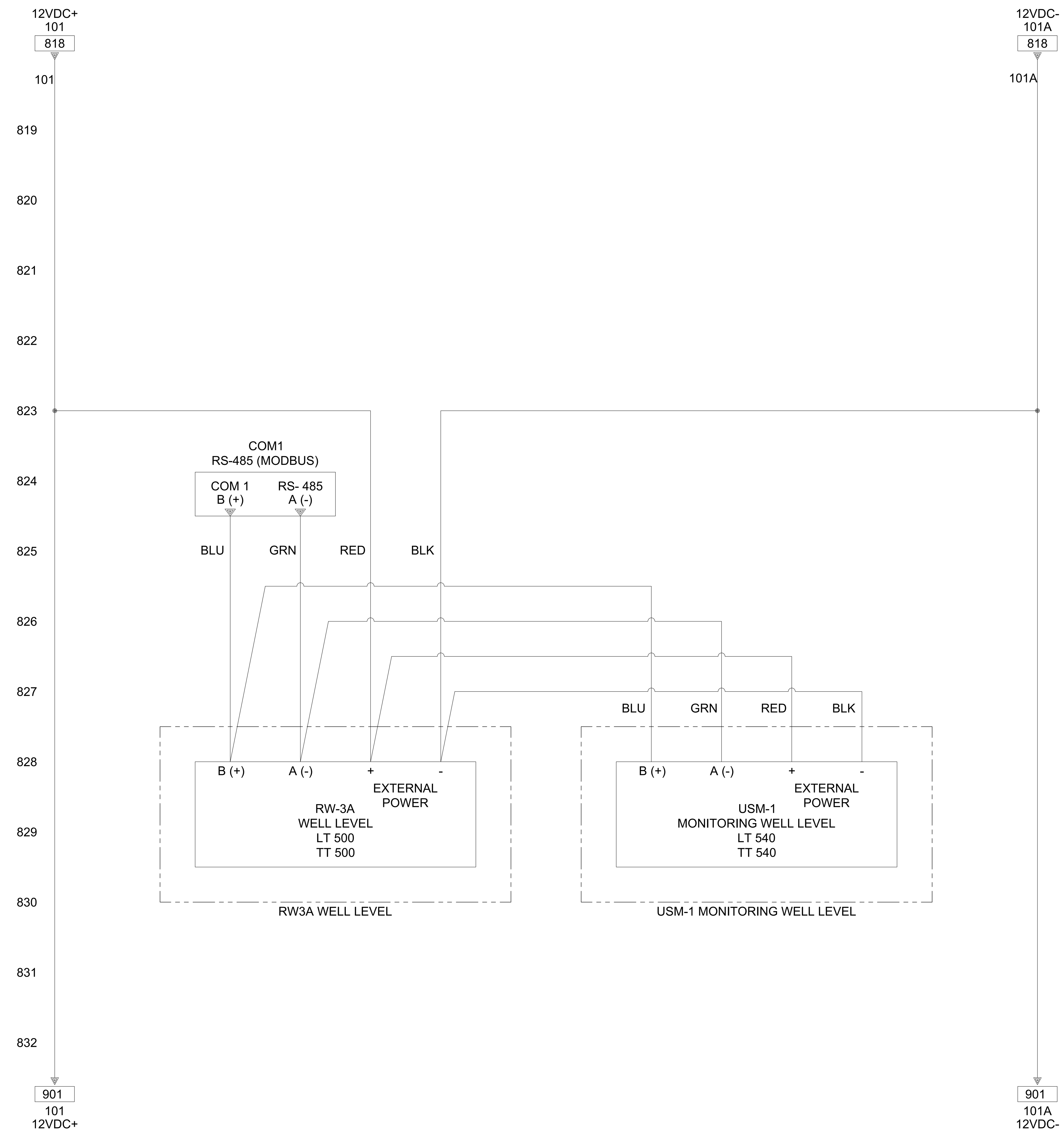
GENERAL NOTES:

1. ALL WORK SHALL CONFORM TO THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE (2017 NEC), ALL OTHER STATE AND LOCAL CODES, AND ALL NATIONAL FIRE PROTECTION ASSOCIATION RULES AND REGULATIONS.
2. ALL NEW CONTROL WIRING SHALL BE #14 AWG, TYPE THHN, 600V, COPPER, UNLESS OTHERWISE NOTED.
3. MULTI-LEVEL TERMINAL BLOCKS ARE USED PHOENIX CONTACT PN: 3214325

LEGEND

— · — · —	EQUIPMENT ENCLOSURE OR MULTI-LEVEL TERMINAL BLOCK
———	EQUIPMENT / VENDOR WIRING
———	DEVICE
— — —	FUTURE INSTALLATION
o	DEVICE TERMINAL POINT





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DESIGN DEVELOPMENT		
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APPROVED FOR BIDDING		
APPROVED FOR CONSTRUCTION		
AS-BUILT DRAWING		
PROJECT NO.: 21174		

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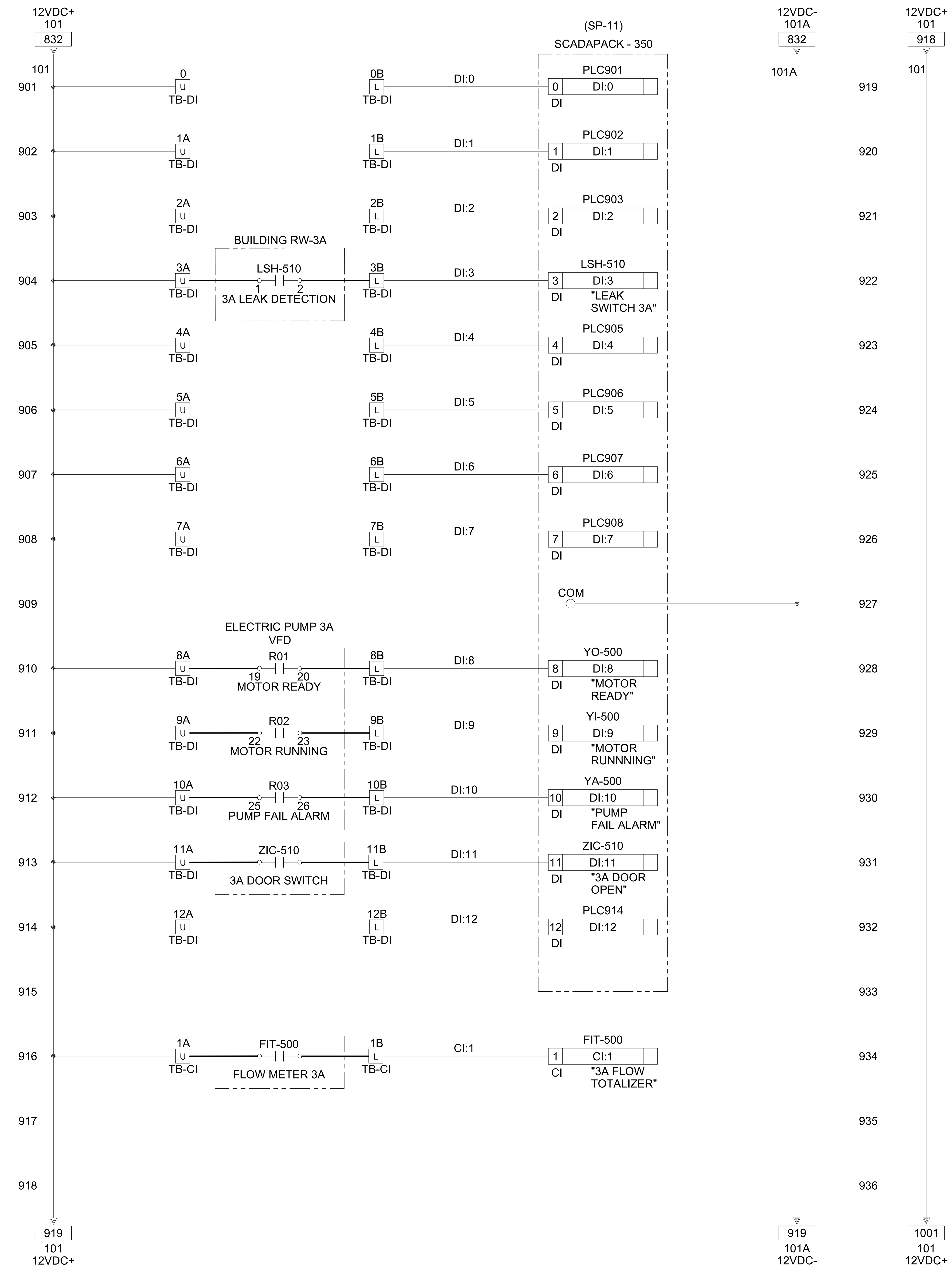
RICO PUMP AND WELLHOUSE RW3A
SCHEMATIC DIAGRAM - ANALOG OUTPUT FOR RW-3A

ENGR'D BY: SMB | DRAWN BY: JCN | APRV'D BY: SMB | SHEET NO.: **E7.6** | REV.: 3
FILENAME: RW3A_E7.6_SCHEMATIC-AO-RW3A

Date & Time plotted: 6/7/2021 12:54:53 PM



LEGEND

-	EQUIPMENT ENCLOSURE OR MULTI-LEVEL TERMINAL BLOCK
-	EQUIPMENT / VENDOR WIRING
-	DEVICE
-	FUTURE INSTALLATION
-	DEVICE TERMINAL POINT

GENERAL NOTES:

1. ALL WORK SHALL CONFORM TO THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE (2017 NEC), ALL OTHER STATE AND LOCAL CODES, AND ALL NATIONAL FIRE PROTECTION ASSOCIATION RULES AND REGULATIONS.
2. ALL NEW CONTROL WIRING SHALL BE #14 AWG, TYPE THHN, 600V, COPPER, UNLESS OTHERWISE NOTED.
3. MULTI-LEVEL TERMINAL BLOCKS ARE USED PHOENIX CONTACT PN: 3214325

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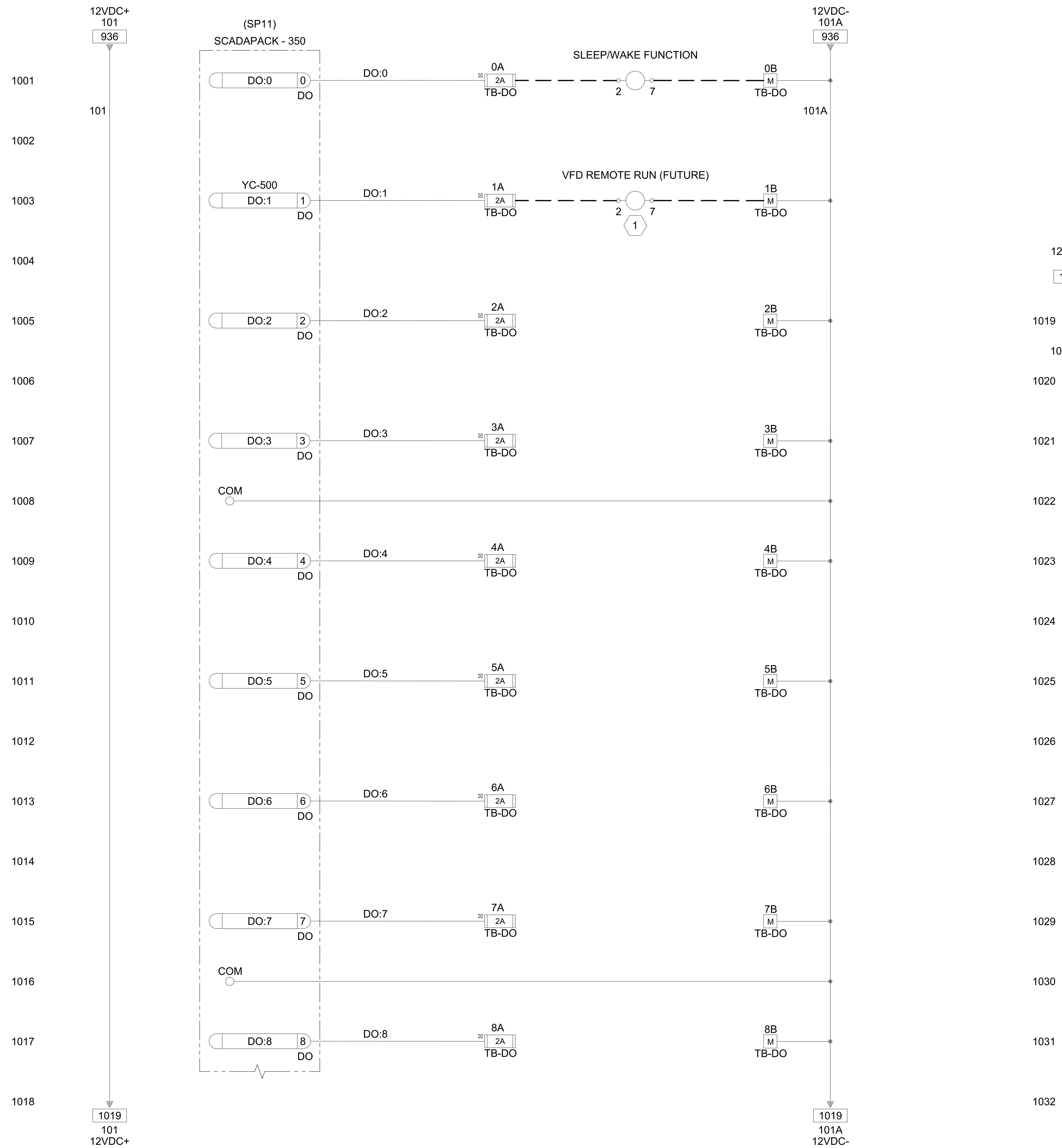
SCHEMATIC DIAGRAM - DIGITAL INPUT FOR RW-3A

ENGR'D BY: SMB | DRAWN BY: JCN | APRV'D BY: SMB | SHEET NO.: E7.7 | REV.: 3

FILENAME: RW3A_E7.7_SCHEMATIC-DI-RW3A

Date & Time plotted: 6/7/2021 12:54:56 PM



GENERAL NOTES:

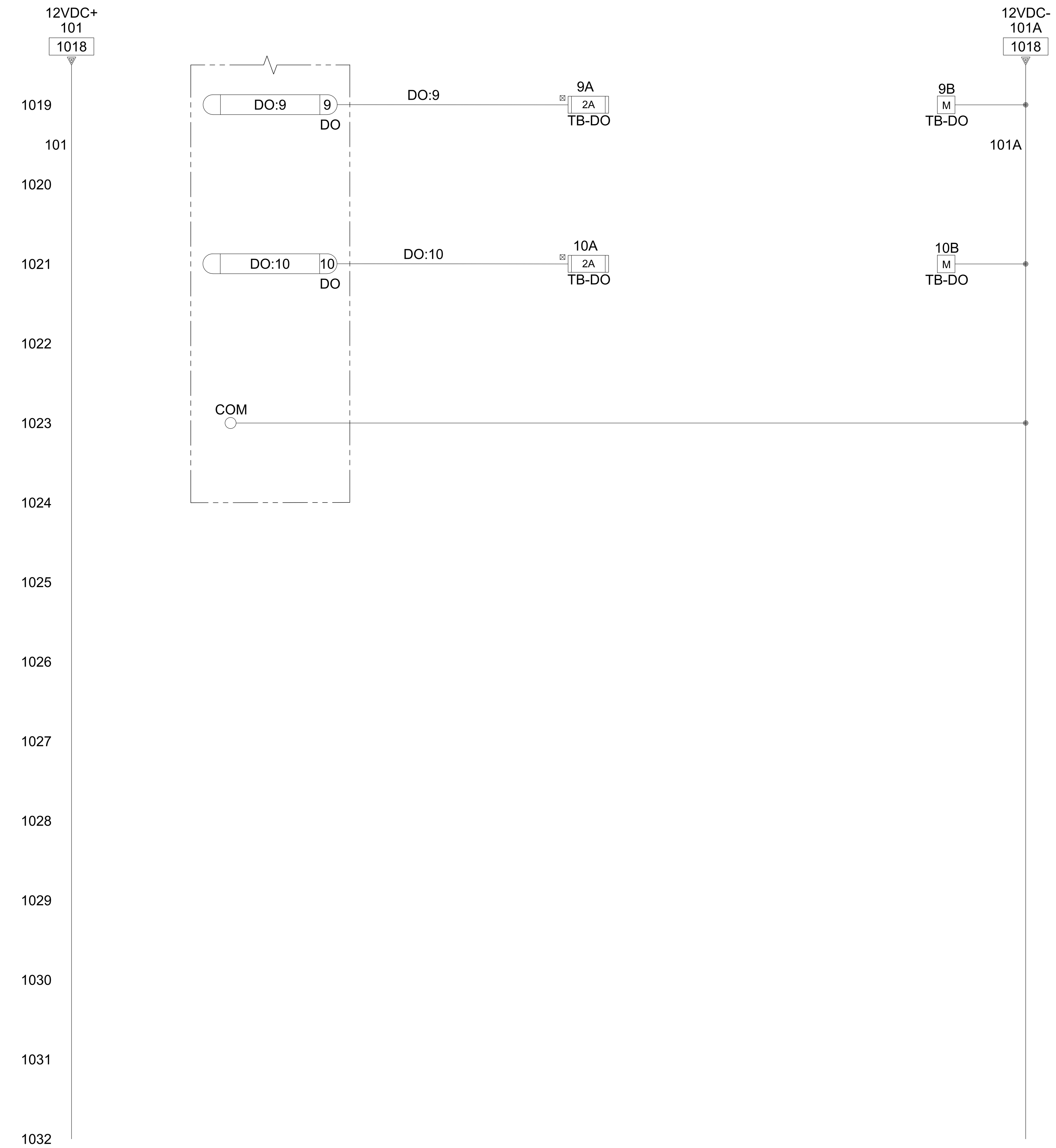
1. ALL WORK SHALL CONFORM TO THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE (2017 NEC), ALL OTHER STATE AND LOCAL CODES, AND ALL NATIONAL FIRE PROTECTION ASSOCIATION RULES AND REGULATIONS.
2. ALL NEW CONTROL WIRING SHALL BE #14 AWG, TYPE THHN, 600V, COPPER, UNLESS OTHERWISE NOTED.
3. MULTI-LEVEL TERMINAL BLOCKS ARE USED PHOENIX CONTACT PN: 3214325

SHEET NOTES:

1 OUTPUT / WIRES DESIGNATED FOR FUTURE REMOTE CONTROL

LEGEND

- - - — - - -	- EQUIPMENT ENCLOSURE OR MULTI-LEVEL TERMINAL BLOCK
———	- EQUIPMENT / VENDOR WIRING
———	- DEVICE
— — —	- FUTURE INSTALLATION
o	- DEVICE TERMINAL POINT



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CURRENT DRAWING

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DESIGN DEVELOPMENT		
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SCHEMATIC DIAGRAM - DIGITAL OUTPUT FOR RW-3A

ENGR'D BY: SMB | DRAWN BY: JCN | APRV'D BY: SMB | SHEET NO.: E7.8 | REV.: 2

FILENAME: RW3A_E7.8_SCHEMATIC-DO-RW3A

Date & Time plotted: 6/7/2021 12:54:59 PM

GENERAL GROUNDING NOTES

1. SCOPE

THIS STANDARD COVERS THE GENERAL REQUIREMENTS FOR THE CONSTRUCTION OF SUBSTATION GROUNDING SYSTEMS. IT OUTLINES GROUND GRID CONSTRUCTION AND REQUIRED GROUNDING CONNECTIONS. THE METHODS OUTLINED HEREIN ARE NATIONALLY RECOGNIZED GROUNDING PROCEDURES.

2. GENERAL

2.1 PRIMARY FUNCTIONS

THE PRIMARY FUNCTION OF THE GROUNDING SYSTEM IS TO INCREASE SAFETY, BOTH TO PERSONS AND PROPERTY. IT'S SECOND FUNCTION IS TO AID IN SYSTEM OPERATION. ADEQUATE GROUND SYSTEMS ARE ESSENTIAL TO ATTAIN LOW GROUND RESISTANCE AND SAFE GROUND VOLTAGE GRADIENTS WITHIN AND ADJACENT TO ELECTRICAL EQUIPMENT AND BUILDINGS. THE SPECIFICATIONS SET FORTH HEREIN SHALL BE FOLLOWED AS CLOSELY AS POSSIBLE TO ENSURE THE SAFETY OF COMPANY PERSONNEL.

3. GROUNDING DESIGN

THE GROUNDING DESIGN SHALL PROVIDE A CONTINUOUS GROUND SYSTEM CONSISTING OF A BURIED MAIN GROUND GRID WITH GROUND RODS. ALL EQUIPMENT, STRUCTURES, FENCING, GATES, AND BUILDINGS SHALL BE CONNECTED TO THE MAIN GROUND GRID.

ALL GROUNDING GRID CONDUCTORS BELOW THE SURFACE SHALL BE BONDED AT EACH JOINT AND AT EACH GROUND ROD BY CADWELD EXOTHERMIC AND/OR APPROVED COMPRESSION GRID/CROSS TYPE CONNECTORS APPROVED FOR DIRECT BURIAL.

3.1 WIRE SIZES AND REQUIREMENTS

ALL GROUND WIRES SHALL BE BARE AND FREE OF ANY INSULATION, EXCEPT AS OTHERWISE SPECIFIED HEREIN.

3.1.1 MAIN GROUND GRID

THE MAIN GROUND GRID SHALL BE CONSTRUCTED USING #4/0 AWG COPPER WIRE UNLESS SPECIFIED OTHERWISE. THE MAIN GROUND GRID SHALL NEVER BE CONSTRUCTED WITH WIRE SMALLER THAN #4/0 AWG COPPER.

3.1.2 EQUIPMENT

THE MINIMUM CONDUCTOR SIZE USED FOR GROUNDING MAJOR SUBSTATION EQUIPMENT SUCH AS POWER TRANSFORMERS, CIRCUIT BREAKERS, REGULATORS, AND CAPACITOR FRAMES SHALL BE #4/0 AWG COPPER WIRE.

OTHER SUBSTATION EQUIPMENT SHALL BE GROUNDED WITH COPPER WIRE AS SPECIFIED IN TABLE 1.

GROUND WIRE SIZES SHALL BE INDICATED ON THE GROUNDING PLAN, GROUNDING DETAILS, AND OTHER DRAWINGS AS NECESSARY TO ENSURE THE INSTALLATION OF GROUND CONDUCTORS AS SPECIFIED IN TABLE 1. WHERE WIRE IS LIABLE TO BE DAMAGED, LARGER SIZES SHOULD BE SUBSTITUTED OR PROTECTION PROVIDED.

TABLE 1 - WIRE SIZE FOR GROUNDING OF SUBSTATION EQUIPMENT

EQUIPMENT	COPPER WIRE SIZE
STEEL STRUCTURES	#4/0 AWG
COUPLING CAPACITORS, INSTRUMENT TRANSFORMERS, AND STATION SERVICE TRANSFORMERS	#4/0 AWG
SURGE ARRESTERS	#4/0 AWG
DISTRIBUTION CLASS SURGE ARRESTERS	#2 OR LARGER
GROUNDING SWITCHES	#4/0 AWG
SWITCH AND FUSE BASES ON WOOD POLES	#4/0 AWG
SWITCH OPERATING MECHANISM	#4/0 AWG
INDEPENDENT YARD LIGHT SUPPORTS, STEEL BUILDINGS, METAL ENCLOSURES, AND FENCING.	#4 AWG OR LARGER
STEEL SWITCHBOARD PANELS	#4/0 AWG
METERS, RELAYS, AND SIMILAR EQUIPMENT ON INSULATING PANELS.	#8

3.2 MAIN GROUND GRID

THE MAIN GROUND GRID DESIGN SHALL PROVIDE A CONTINUOUS GROUND SYSTEM CONSISTING OF #4/0 AWG COPPER WIRE BURIED 12 INCHES BELOW SUBGRADE AND SPACED IN A PATTERN OF 50 FEET OR LESS. THE GROUND GRID SPACING CAN BE APPROXIMATELY DOUBLED IN AREAS INSIDE THE FENCED YARD WHERE NO EQUIPMENT OR STRUCTURES ARE TO BE GROUNDED, PROVIDED THAT THE GROUND SYSTEM IS OTHERWISE SATISFACTORY. ALL GROUND RODS, GRIDS, AND STRUCTURES SHALL BE CONNECTED TO THE MAIN GRID.

3.2.1 PERIPHERAL GROUND CONDUCTORS

PERIPHERAL GROUND CONDUCTORS SHALL BE INSTALLED 4 FEET INSIDE AND OUTSIDE, AND PARALLEL TO, THE FENCE. THE PERIPHERAL GROUND CONDUCTOR SHALL BE #4/0 AWG COPPER WIRE BURIED 12 INCHES BELOW SUBGRADE AND CONNECTED TO THE MAIN GROUND GRID AT INTERVALS OF 50 FEET OR LESS. NO BUILDING, METALLIC FENCE, OR ANY OTHER CONDUCTIVE STRUCTURE OF ANY KIND IS TO BE LOCATED BETWEEN THE FENCE AND THE PROPERTY LINE.

3.2.2 GATE GROUNDING

A GROUND GRID SHALL BE INSTALLED AT GATES IN SUCH A WAY THAT A PERSON IN CONTACT WITH THE GATE DURING OPENING AND CLOSING WILL ALWAYS BE STANDING OVER THE GRID. GATE GROUND GRIDS SHALL BE CONNECTED DIRECTLY TO THE PERIPHERAL GROUND CONDUCTORS AND TO THE MAIN (SUBSTATION) GROUND GRID.

3.2.3 GROUND RODS

GROUND ROD REQUIREMENTS SHALL BE AS SPECIFIED IN THIS SUBSECTION. GROUND RODS SHALL BE 5/8 INCH DIAMETER COPPERWELD, 8 FEET LONG. GROUND RODS SHALL BE FULLY DRIVEN BELOW THE SURFACE OF THE EARTH.

GROUND RODS SHALL BE CONNECTED TO THE GROUND GRID WITH APPROXIMATELY EQUAL SPACING WITHIN THE YARD AND ALONG THE FENCE. THE NORMAL MAXIMUM SPACING SHOULD BE 50 FEET.

ONE GROUND ROD SHALL BE INSTALLED FOR EVERY GRID CONNECTION AT POWER TRANSFORMERS. ONE GROUND ROD SHOULD BE LOCATED WITHIN 2 FEET OF THE POINT WHERE MAJOR EQUIPMENT NEUTRALS INTERCONNECT WITH THE MAIN (SUBSTATION) GROUND GRID. IF THERE ARE LARGE AREAS WITHIN THE SUBSTATION FENCE THAT ARE NOT TO BE USED IMMEDIATELY, SPACING OF RODS MAY BE INCREASED TO APPROXIMATELY DOUBLE THE SPACING IN OTHER AREAS.

3.3 STRUCTURE GROUNDING

1. ALL STEEL STRUCTURES AND ALL MISCELLANEOUS STEEL, INCLUDING LIGHT FRAMEWORK, STEEL SUPPORT STRUCTURES, AND METAL BUILDINGS, SHALL BE SOLIDLY CONNECTED TO THE MAIN GROUND GRID WITH #4/0 AWG COPPER WIRE.
2. ALL WIRES SHOWN ON DRAWINGS ARE TO BE STRANDED, SOFT DRAWN, BARE COPPER WIRE; SIZES 250kcmil, #4/0, #2/0, #1/0, #1, #2, #4, AND #6.
3. THE GROUND WIRE OUTSIDE THE BUILDING IS TO BE BURIED NO LESS THAN 30" BELOW GRADE. THIS GROUND LOOP SHALL BE CONNECTED TO GROUND RODS (ELECTRODES) AS INDICATED ON SHEET WE-40.
4. COPPER CLAD STEEL ELECTRODES, 5/8" DIA. X 8'-0" LONG (MIN.), ARE TO BE LOCATED CLOSE TO THE OUTSIDE BUILDING WALL (BUT ARE TO MISS COLUMN FOOTERS) AND ARE TO BE SPACED AS INDICATED ON SHEET WE-40.

3.4 EQUIPMENT GROUNDING

1. TAPS FROM THE MAIN GROUND LOOP ARE TO BE CONNECTED TO THE BUILDING STRUCTURAL STEEL, BUILDING WATER PIPING SYSTEM, TRANSFORMERS, SWITCHGEAR, MOTOR CONTROL CENTERS, PUSHBUTTON DESKS AND THE CONDUIT SYSTEM. CONNECT GROUND WIRE TO THE WIRE THROUGH UNDER AND THE GROUND BUS INSIDE THE MOTOR CONTROL CENTERS. GROUND THE LIGHTING TRANSFORMERS' NEUTRALS AND ENCLOSURES AND ALL ELECTRICAL PANEL ENCLOSURES TO THE GROUNDING SYSTEM. SMALL MOTORS (UNDER 25 HP) ARE GROUNDED THROUGH CONTACT WITH THE CONDUIT SYSTEM AND THE BUILDING STRUCTURAL STEEL. LARGE MOTORS (25 HP AND LARGER) ARE GROUNDED WITH A BARE WIRE THERMIT WELDED TO THE NEAREST BUILDING COLUMN.
2. GROUND WIRE CONNECTIONS TO THE LOOP, TO THE ELECTRODES AND TO THE BUILDING STRUCTURAL STEEL SHALL BE BY THERMIT WELD. BOLTED GROUND CLAMPS SHALL BE USED ON ALL ELECTRICAL EQUIPMENT AND THE BUILDING WATER PIPING SYSTEM. BOND CONDUITS TO THE PANELBOARDS AND WIRE TROUGHS. BONDING IS TO BE PROVIDED ACROSS ALL CONDUIT CONNECTIONS THAT ARE NOT FULLY THREADED AND ACROSS ALL FLEXIBLE CONDUITS 1-1/2" DIAMETER AND LARGER.

3.5 TRANSFORMER GROUNDING

TRANSFORMER TANKS SHALL BE CONNECTED TO THE MAIN GRID.

NEUTRALS OF GROUNDED WYE CONNECTED POWER TRANSFORMERS SHALL BE CONNECTED TO THE MAIN GROUND GRID THROUGH THE NEUTRAL COPPER BUS BAR INSTALLED ON THE TANK WALL OF THE TRANSFORMER.

LIGHTNING ARRESTERS SHALL BE GROUNDED TO THE MAIN GROUND GRID THROUGH A DUAL #4/0 AWG COPPER WIRE PATH.

ONE GROUND ROD SHALL BE INSTALLED WITHIN 2 FEET OF THE POINT WHERE THE TRANSFORMER NEUTRAL INTERCONNECTS WITH THE MAIN GROUND GRID. ONE GROUND SHALL BE INSTALLED FOR EACH NEUTRAL AND LIGHTNING ARRESTER GROUND CONNECTION TO THE MAIN GROUND GRID.

THE NEUTRALS, OR GROUNDED SIDE, OF WYE CONNECTED INSTRUMENT AND STATION SERVICE TRANSFORMER PRIMARIES SHALL BE SOLIDLY CONNECTED TO THE MAIN GROUND SYSTEM WITH #4/0 AWG COPPER WIRE.

THE NEUTRALS OF INSTRUMENT TRANSFORMER SECONDARIES, WHETHER THAT OF A SINGLE TRANSFORMER OR A SET OF INTERCONNECTED TRANSFORMERS, SHALL BE GROUNDED AT ONE POINT ONLY. THIS ALSO APPLIES TO CERTAIN TYPES OF SECONDARY CIRCUIT INTERCONNECTIONS, SUCH AS DIFFERENTIAL RELAYING OR CURRENT TOTALIZING, AND ANY AUXILIARY TRANSFORMERS THAT MAY BE REQUIRED IN THE CIRCUIT. THE LOCATION FOR THE CONNECTION TO THE MAIN GROUND SYSTEM SHALL BE AT THE SWITCHBOARD AND MADE IN SUCH A MANNER THAT IT WILL NOT BE REMOVED UNINTENTIONALLY DURING TESTING OR OTHER WORK ON THE CIRCUIT.

THE NEUTRALS OF UNRELATED SECONDARIES SHALL BE CONNECTED TO GROUND INDIVIDUALLY. NOT THROUGH THE USE OF A SINGLE CONDUCTOR JUMPERED FROM POINT TO POINT ON THE TERMINAL BOARDS AND NOT MORE THAN ONE CONNECTION UNDER A SINGLE SCREW.

THE NEUTRALS OF STATION SERVICE TRANSFORMER SECONDARIES SHALL BE GROUNDED AT THE TRANSFORMER AND AT THE MAIN SWITCH UNDER THE LUG PROVIDED IN THE SWITCH ENCLOSURE FOR THIS PURPOSE, HENCE TO THE MAIN GROUND SYSTEM.

3.6 CONDUIT AND CABLE GROUNDING

3.6.1 GENERAL

ALL METALLIC CONDUIT SHALL BE EFFECTIVELY CONNECTED TO THE MAIN GROUND GRID, EITHER BY DIRECT CONNECTION OR BY ATTACHMENT TO METAL ENCLOSURES WHICH ARE ADEQUATELY CONNECTED TO THE MAIN GROUND GRID.

NEUTRAL CONDUCTOR PLACED OUTSIDE METALLIC CONDUIT THAT IS CARRYING FEEDER CABLES SHALL BE BONDED TO THE METALLIC CONDUIT AT BOTH ENDS.

3.6.2 DISTRIBUTION SUBSTATIONS

METALLIC SHEATHS OF CONTROL CABLE IN DISTRIBUTION SUBSTATIONS SHALL BE GROUNDED AT ONE END ONLY, UNLESS SPECIFIED OTHERWISE. CONTROL CABLE SHEATHS SHALL BE GROUNDED AT THE CONTROL-HOUSE END OF THE CABLE. THE CONTROL CABLE SHEATH AT THE EQUIPMENT END SHALL BE COVERED WITH ELECTRICAL TAPE.

3.7 SWITCHBOARD GROUNDING

ALL METALLIC SWITCHBOARDS, BASES, SUPPORTS, AND BRACES SHALL BE CONNECTED TO THE MAIN (SUBSTATION) GROUND GRID WITH A MINIMUM SIZE OF #6 COPPER WIRE. ALL METER, RELAY, AND INSTRUMENT CASES AND ALL INSTRUMENT AND CONTROL SWITCHES THAT ARE MOUNTED ON INSULATING PANELS SHALL BE GROUNDED WITH #10 COPPER WIRE.

3.8 FENCE GROUNDING

ALL METALLIC FENCING SHALL BE SECURELY TIED TO THE MAIN GROUND SYSTEM AT EACH GATE POST, CORNER POST (OMIT CORNER TIE IF 30 FEET OR CLOSER TO THE GROUNDED GATE POST), AND LINE POSTS AT INTERVALS OF NO MORE THAN 50 FEET. THE MAIN GROUND GRID GROUNDS TO THE GATE POSTS, CORNER POSTS, AND LINE POSTS AND FABRIC SHALL BE GROUNDED ON BOTH SIDES OF ANY LINE CROSSING. THE PERIPHERAL CONDUCTOR OF THE MAIN GROUND GRID SHALL BE LOCATED BOTH 4 FEET INSIDE AND OUTSIDE OF, AND PARALLEL TO, THE FENCE AND SHALL BE BURIED 12 INCHES BELOW SUBGRADE. THE FENCE SHALL BE GROUNDED TO THE MAIN GROUND GRID AT INTERVALS OF NO MORE THAN 50 FEET APART. GROUND RODS SHALL BE DRIVEN ALONG THE CONDUCTOR, AND BONDED THERETO, AT EACH FENCE CORNER AND AT INTERMEDIATE INTERVALS OF NO MORE THAN 40 FEET.

FENCE POSTS SHALL BE GROUNDED BY EXTENDING #4 AWG COPPER WIRE FROM THE MAIN GROUND GRID TO THE FENCE POST AND CONNECTING THE #4 AWG COPPER WIRE TO THE FENCE POST USING A BOLTED GROUND CONNECTOR. THE #4 AWG COPPER WIRE, CONNECTED TO THE FENCE POST, SHALL BE EXTENDED , BY WEAVING, AND CONNECTED TO THE FENCE FABRIC USING A BRONZE VISE TYPE CONNECTOR FOR #4 AWG COPPER TO #4 AWG AL (OR #4 AWG COPPER) CONDUCTORS. THE #4 AWG AL OR #4 AWG COPPER GROUND WIRE SHALL BE EXTENDED TOWARD THE TOP OF THE BARBED WIRE WITH CONNECTIONS MADE TO THE FABRIC AND EACH BARBED WIRE STRAND USING BRONZE VISE TYPE CONNECTORS.

GATES SHALL BE GROUNDED BY EXTENDING #4 AWG COPPER WIRE TO GATE POSTS AND CONNECTING THE #4 AWG COPPER WIRE TO THE GATE POST USING A BRONZE VISE TYPE CONNECTOR. THE GATE SHALL BE GROUNDED BY CONNECTING A FLEXIBLE BRAIDED COPPER STRAP, WITH TIN PLATED FERRULE AT EACH END, BETWEEN THE GATE POST AND GATE FRAME. THE #4 AWG COPPER OR #4 AWG AL WIRE CONNECTING THE GATE POST TO THE MAIN GROUND GRID SHALL BE EXTENDED FROM THE GATE POST TO THE GATE FABRIC AND CONNECTED USING A BRONZE VISE TYPE CONNECTOR. THE #4 AWG WIRE SHALL THEN BE EXTENDED TOWARD THE TOP OF THE BARBED WIRE WITH CONNECTIONS MADE TO THE FABRIC AND EACH BARBED WIRE STRAND USING BRONZE VISE TYPE CONNECTORS.

ON GATES WHICH MAY BE OPENED OUTWARD, AN ADDITIONAL GROUND CONDUCTOR SHALL BE LAID 4 FEET BEYOND THE EXTREME REACH OF THE GATE AS IT IS SWUNG OUT. EACH END OF THIS CONDUCTOR SHALL BE BONDED TO THE MAIN GRID, MAKING IT AN INTEGRAL PART THEREOF.

3.9 CONTROL BUILDING

THE CONTROL BUILDING SHALL BE GROUNDED TO THE MAIN (SUBSTATION) GRID AT ALL FOUR (4) CORNERS USING #4/0 AWG COPPER WIRE OR LARGER. METAL BUILDINGS WITH PANEL SECTIONS BONDED TOGETHER BY BRAZED OR BOLTED CONNECTIONS MAY BE CONSIDERED ADEQUATELY GROUNDED. METAL BUILDINGS WITH PANEL SECTIONS NOT BONDED TOGETHER IN THIS MANNER SHOULD BE CONSIDERED NOT EFFECTIVELY GROUNDED AND SHALL REQUIRE AN EXTERNALLY PLACED #4 AWG COPPER WIRE ALONG THE ENTIRE WALL LENGTH WITH CONNECTIONS MADE TO EACH PANEL SECTION. IF THE INNER AND OUTER WALLS OF THE BUILDING ARE ISOLATED FROM EACH OTHER AND FROM EACH PANEL SECTION, A #4 AWG COPPER WIRE SHALL BE PLACED ALONG THE ENTIRE WALL LENGTH OF BOTH THE INTERIOR AND EXTERIOR WALLS WITH CONNECTIONS MADE TO EACH PANEL SECTION.

CONTROL BUILDINGS OR HOUSES WITH CABLE TRENCHES SHALL HAVE A #4/0 AWG COPPER WIRE LOOPED THROUGHOUT THE TRENCH WITH ATTACHMENTS MADE TO THE TRENCH WALL USING BRONZE VISE TYPE CONNECTORS. SWITCHBOARD PANELS SHALL BE GROUNDED BY TAPPING #4 COPPER WIRE OFF THE #4/0 AWG COPPER LOOP AND TERMINATING TO THE SWITCHBOARD PANEL USING A BOLTED GROUND CONNECTOR.

CONTROL BUILDINGS OR HOUSES WITH OVERHEAD CABLE TRAYS SHALL HAVE A #4/0 AWG COPPER WIRE LOOPED THROUGH THE TRAY WITH CONNECTIONS MADE TO THE TRAY WALL USING BRONZE VISE TYPE CONNECTORS. SWITCHBOARD PANELS SHALL BE GROUNDED IN A SIMILAR MANNER TO THE METHOD PRESENTED IN THE PREVIOUS PARAGRAPH.

CABLE ENTRANCE VAULTS SHALL BE USED FOR BOTH THE CABLE TRENCH AND OVERHEAD CABLE TRAY DESIGNS. IN BOTH CASES THE LOOPED #4/0 AWG COPPER WIRE SHALL BE BROUGHT INTO THE CONTROL HOUSE THROUGH THE CABLE ENTRANCE VAULT. IN CASES WHERE CABLE TERMINATION CABINETS ARE USED, THE CABINETS SHALL BE GROUNDED BY TAPPING #4 AWG COPPER WIRE OFF THE #4/0 AWG COPPER LOOPED WIRE AND CONNECTING TO THE GROUND BUS BAR OF THE CABINET.

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AEEC
RICO-ARGENTINE MINE SITE
RICO PUMP AND WELLHOUSE RW3A
GENERAL GROUNDING NOTES

ENGR'D BY: SMB | DRAWN BY: MVW | APRV'D BY: SMB
FILENAME: RW3A_G0.0_GROUNDING NOTES
SHEET NO.: G0.0
REV.: 1

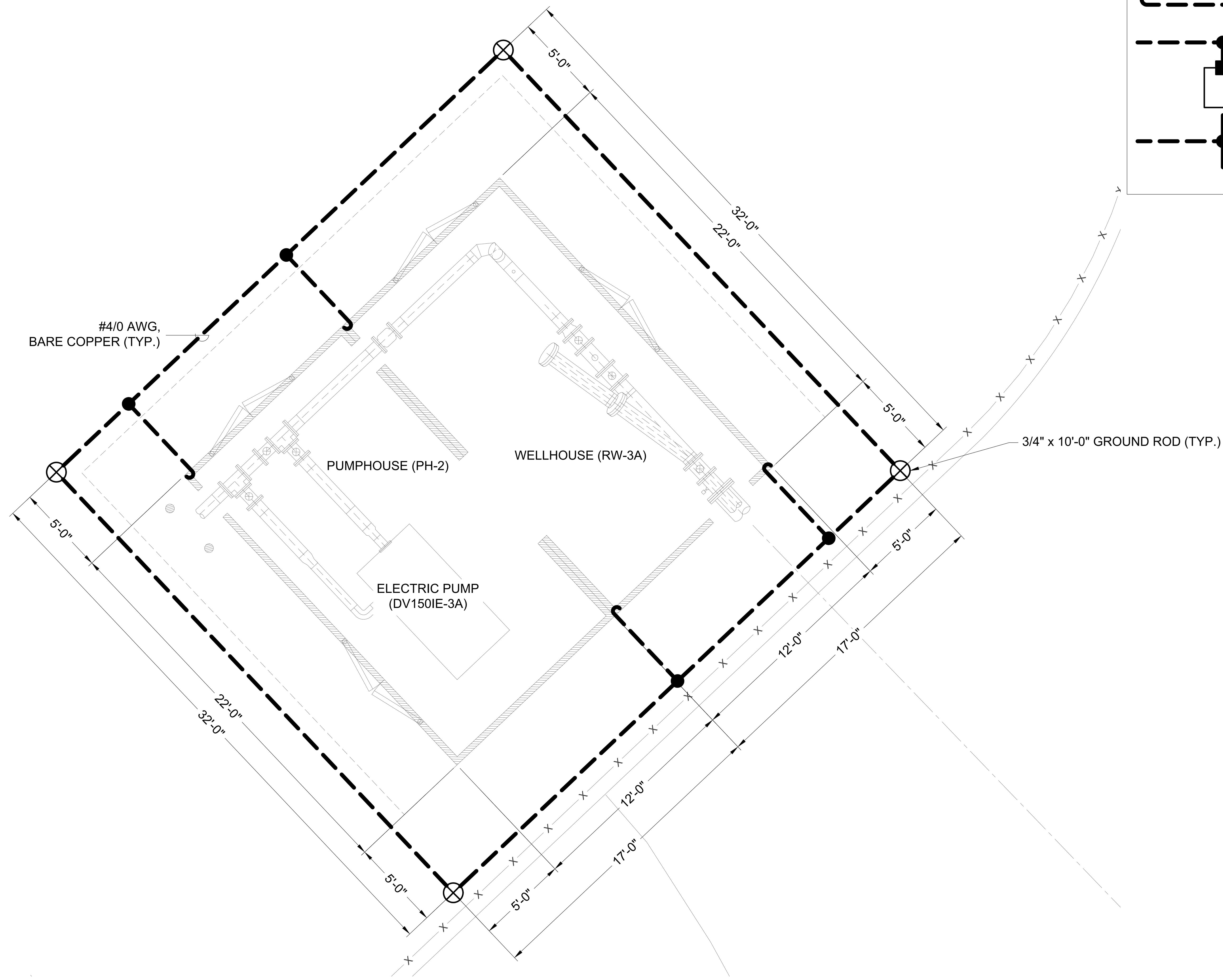
Date & Time plotted: 6/7/2021 12:55:02 PM

GENERAL NOTES:

1. THE GROUND GRID SHALL BE MADE OF #4/0 BARE, STRANDED, COPPER CONDUCTOR. IT IS TO BE BURIED 30" BELOW GRADE. THE TAPS SHALL BE MADE WITH #4/0 BARE COPPER CONDUCTOR.
2. TAPS AND CONNECTIONS TO COLUMNS AND GROUND RODS SHALL BE MADE WITH EXOTHERMIC WELDING (CAD WELDS), NON-ACCESSIBLE CONNECTIONS SHALL BE EXOTHERMIC, OR USE UL LISTED CRIMP CONNECTIONS.
3. CONNECTIONS TO EQUIPMENT FRAMES SHALL BE MADE WITH NEMA 2-HOLE PAD COMPRESSION TYPE CONNECTOR.
4. THE BUILDING SHALL BE GROUNDED TO THE MAIN GRID AT TWO (2) DIAGONALLY OPPOSITE CORNERS.
5. ALL EQUIPMENT FRAMES MUST BE BONDED TO THE GROUND GRID AT TWO (2) OPPOSITE DIAGONAL CORNERS.
6. ALL METAL CONDUITS SHALL BE GROUNDED WITH PROPER BUSHINGS OR CLAMPS.
7. MAIN GROUND GRID SHALL HAVE A COMPLETED RESISTANCE TO EARTH OF THREE (3) OHMS OR LESS AS MEASURED BY A STANDARD GROUND RESISTANCE METER.
8. ALL STEEL STRUCTURES AND MISCELLANEOUS STEEL, INCLUDING LIGHT FRAMEWORK, STEEL SUPPORT STRUCTURES, AND METAL BUILDINGS, SHALL BE SOLIDLY CONNECTED TO THE MAIN GROUND GRID WITH #4/0 AWG COPPER WIRE.
9. ALL METAL STRUCTURES SHALL BE BONDED TO THE MAIN GROUND GRID.
10. ALL METALLIC EQUIPMENT ENCLOSURES AND METALLIC RACEWAYS SHALL BE BONDED TO THE MAIN GROUND GRID.
11. GROUND TAPS TO EQUIPMENT ARE DIAGRAMMATIC ONLY. CONTRACTOR SHALL FIELD DETERMINE BEST ROUTE.
12. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE LATEST EDITION OF NEC CODE (2017 NEC) AND OTHER LOCAL CODES THAT APPLY.
13. FOR UFER GROUND SYSTEMS, CONCRETE REBAR TIED OPPOSITE CORNERS BONDED TO UFER GROUND SYSTEM.

LEGEND

- 3/4" x 10'-0" COPPER ROD CONNECTION
- TEST WELL
- GROUND CONDUCTOR BOND CONNECTION (CADWELD)
- EXISTING GROUND WIRE
- #4/0 AWG STRANDED BARE COPPER (BELOW GROUND)
- #4/0, BARE COPPER GROUND WIRE (ABOVE GROUND)
- #4/0 AWG, BARE COPPER GROUND LEAD UP TO BUILDING / EQUIPMENT
- #4/0 AWG, BARE COPPER GROUND LEAD UP TO EQUIPMENT
- GROUND CONDUCTOR BOND CONNECTION (CADWELD OR UL LISTED CRIMP)



1
G1.1
WELLHOUSE (3A) AREA GROUNDING PLAN
SCALE: 1/4" = 1'-0"

NORTH

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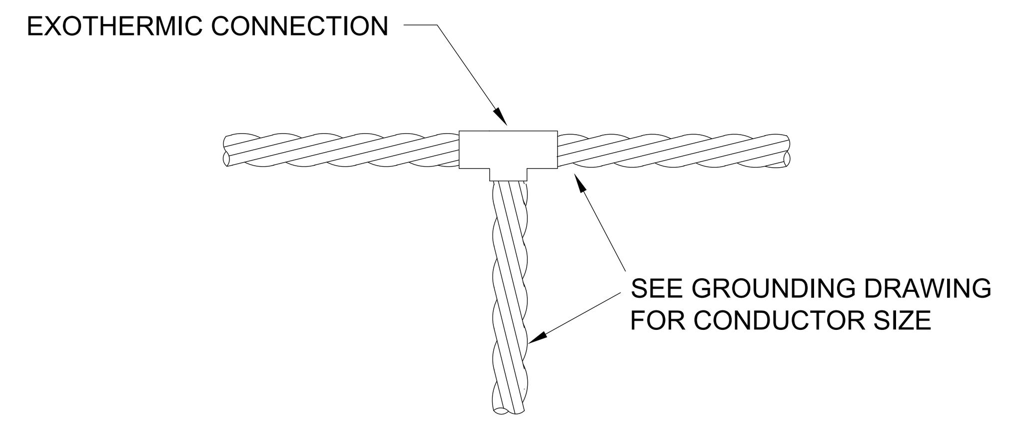
RICO-ARGENTINE MINE SITE
RICO PUMP AND WELLHOUSE RW3A
WELLHOUSE (3A) AREA GROUNDING PLAN

ENGR'D BY: SMB | DRAWN BY: JCN | APRV'D BY: SMB | SHEET NO.: G1.1 | REV.: 2
FILENAME: RW3A_G1.1_GROUNDING PLAN

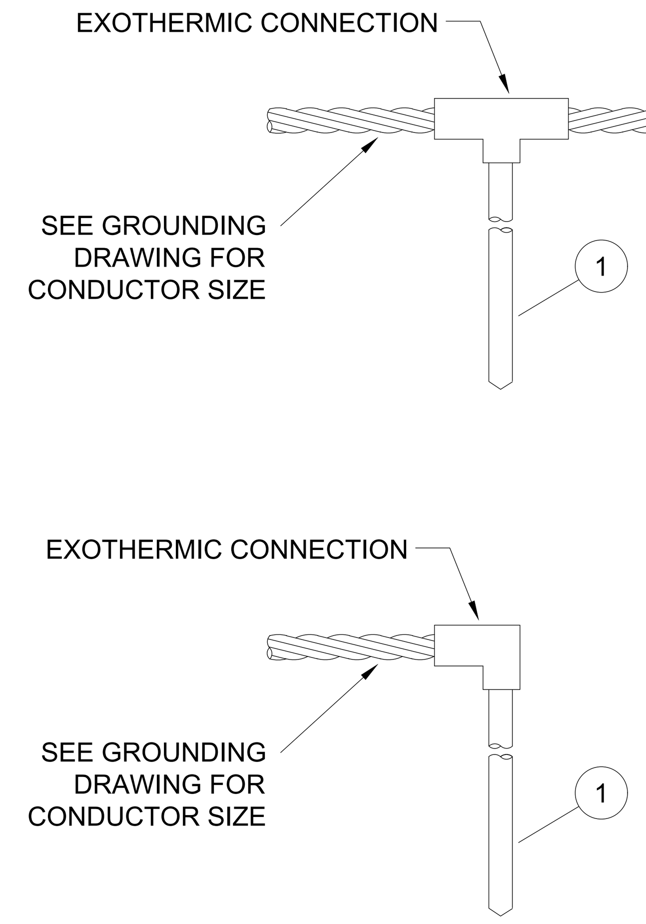
Date & Time plotted: 6/7/2021 12:55:05 PM



	DESCRIPTION	QTY	REMARKS

1 G2.0 CABLE TO CABLE EXOTHERMIC CONNECTION

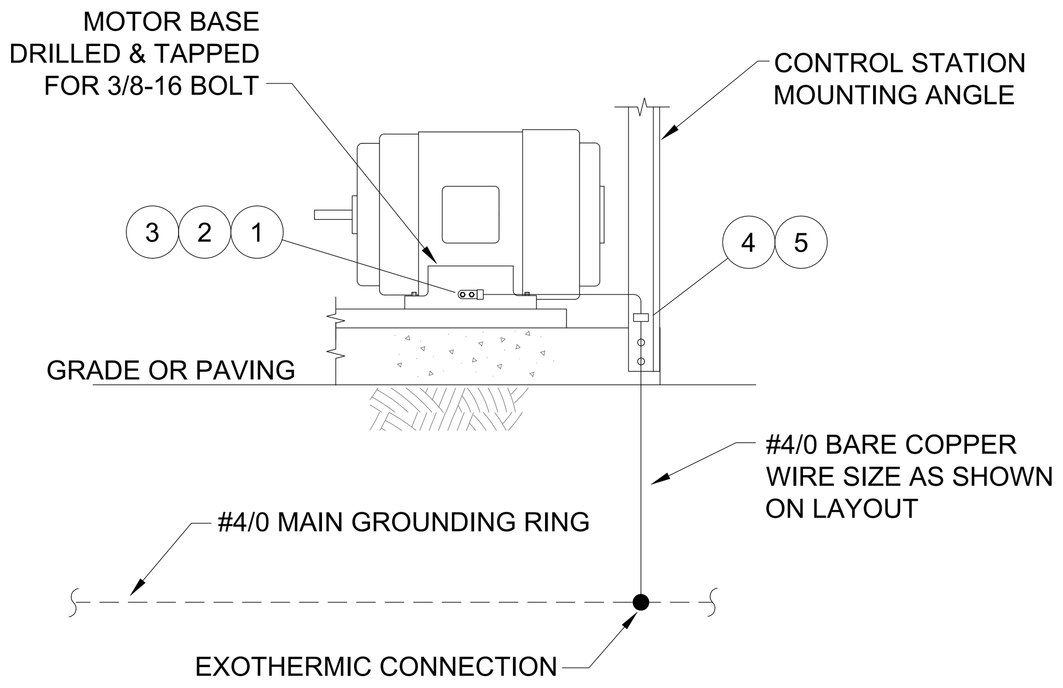
SCALE: N.T.S.



ITEM	DESCRIPTION	QTY	REMARKS
1	3/4" X 10'-0" COPPERWELD ROD	1	

2 G2.0 CABLE TO GROUND ROD EXOTHERMIC CONNECTION

SCALE: N.T.S.

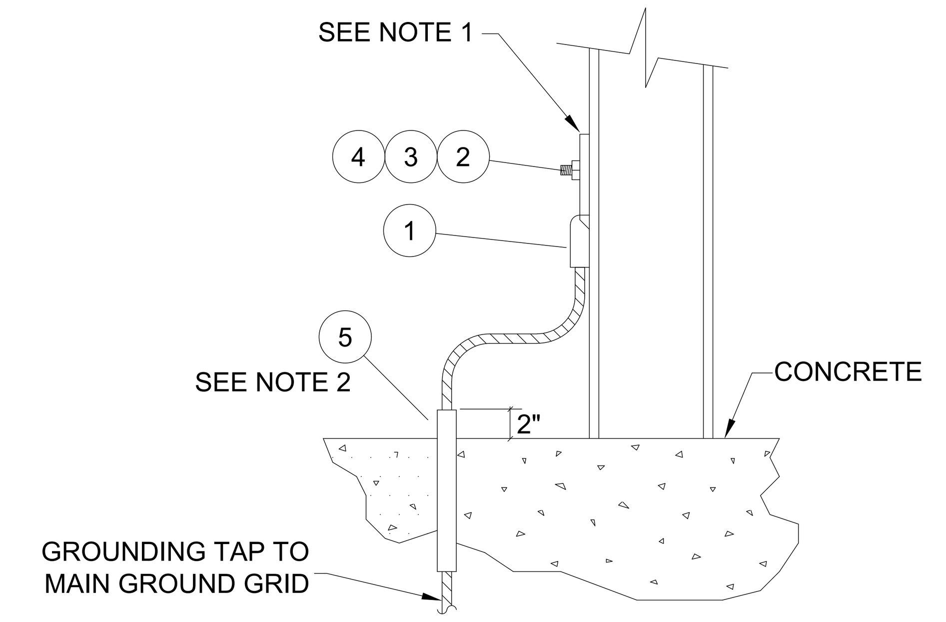


MOTOR GROUNDING TO GROUND RING

ITEM	DESCRIPTION	QTY	REMARKS
1	COMPRESSION LUG, BURNDY #YGHA28-2N	1	#4/0 STR.
2	S.S. BOLT, HEX HD 3/8"-16 X 1" LONG	2	
3	LOCK WASHER, 3/8"	2	
4	SERVIT CONNECTOR, BURNDY #KC26	1	
5	S.S. LOCK WASHER	1	

3 G2.0 MOTOR GROUNDING TO GROUND RING

SCALE: NTS

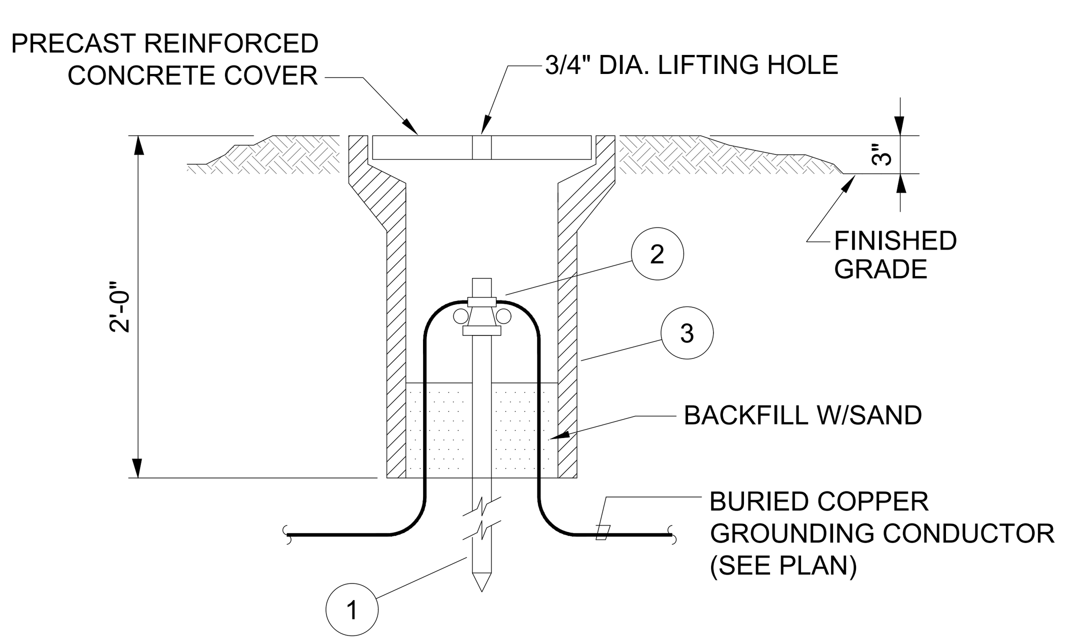


NOTES:
1. STEEL SURFACE MUST BE CLEANED TO BARE METAL & CROUSE-HINDS TYPE STL CONDUCTING GREASE APPLIED PRIOR TO LUG ATTACHMENT.
2. USE WHEN ROUTED THROUGH CONCRETE.

ITEM	DESCRIPTION	QTY	REMARKS
1	COMPRESSION LUG, BURNDY #YGHA28-2N	1	#4/0 STR.
2	BOLT, HEX HD 1/2" UNC X 3/4" LONG	2	
3	WASHER, 1/2"	2	
4	NUT, HEX 1/2" UNC	2	
5	1" PVC CONDUIT	AR	

4 G2.0 STRUCTURE BOLTED GROUND CONNECTION

SCALE: NTS

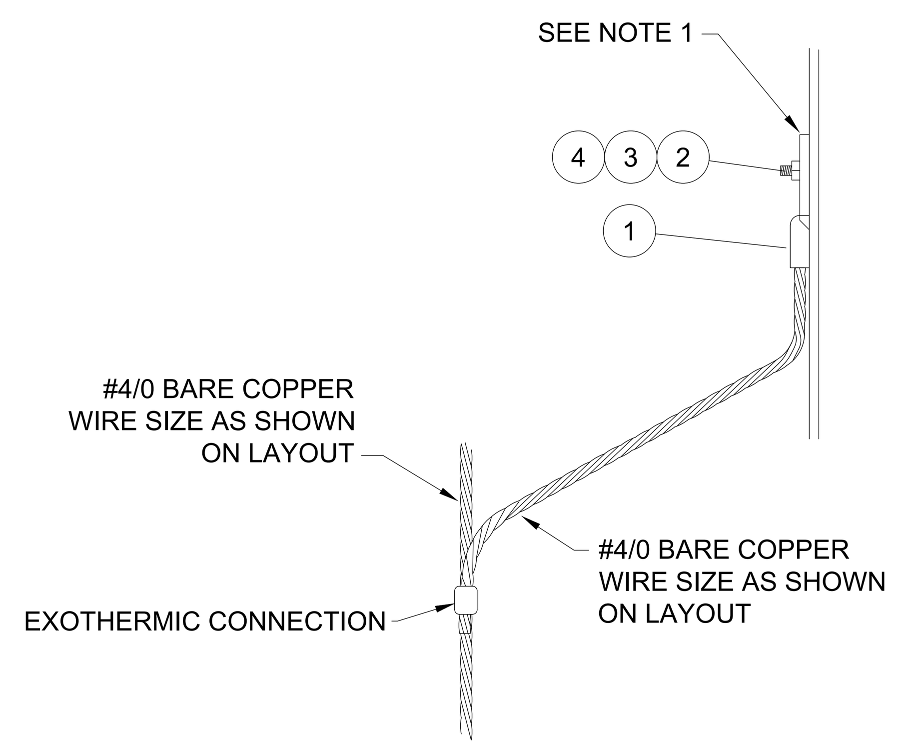


NOTES:
1. TOP OF GROUND TEST WELLS SHALL BE INSTALLED EVEN WITH FINISHED GRADE.

ITEM	DESCRIPTION	QTY	REMARKS
1	3/4" X 10'-0" COPPERWELD ROD	1	
2	CONNECTOR, BURNDY #GAR 6429	1	
3	10" DIA. X 2'-0" LONG VITRIFIED CLAY PIPE	1	

5 G2.0 TEST WELL

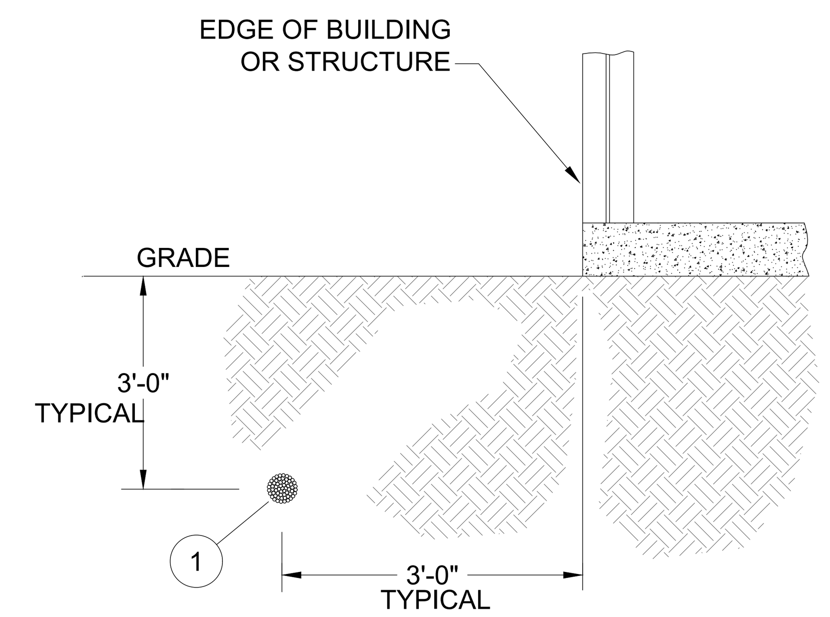
SCALE: NTS



ITEM	DESCRIPTION	QTY	REMARKS
1	COMPRESSION LUG, BURNDY #YGHA28-2N	1	#4/0 STR.
2	BOLT, HEX HD 1/2" UNC X 3/4" LONG	2	
3	WASHER, 1/2"	2	
4	NUT, HEX 1/2" UNC	2	

6 G2.0 GROUND WIRE TO GROUND WIRE

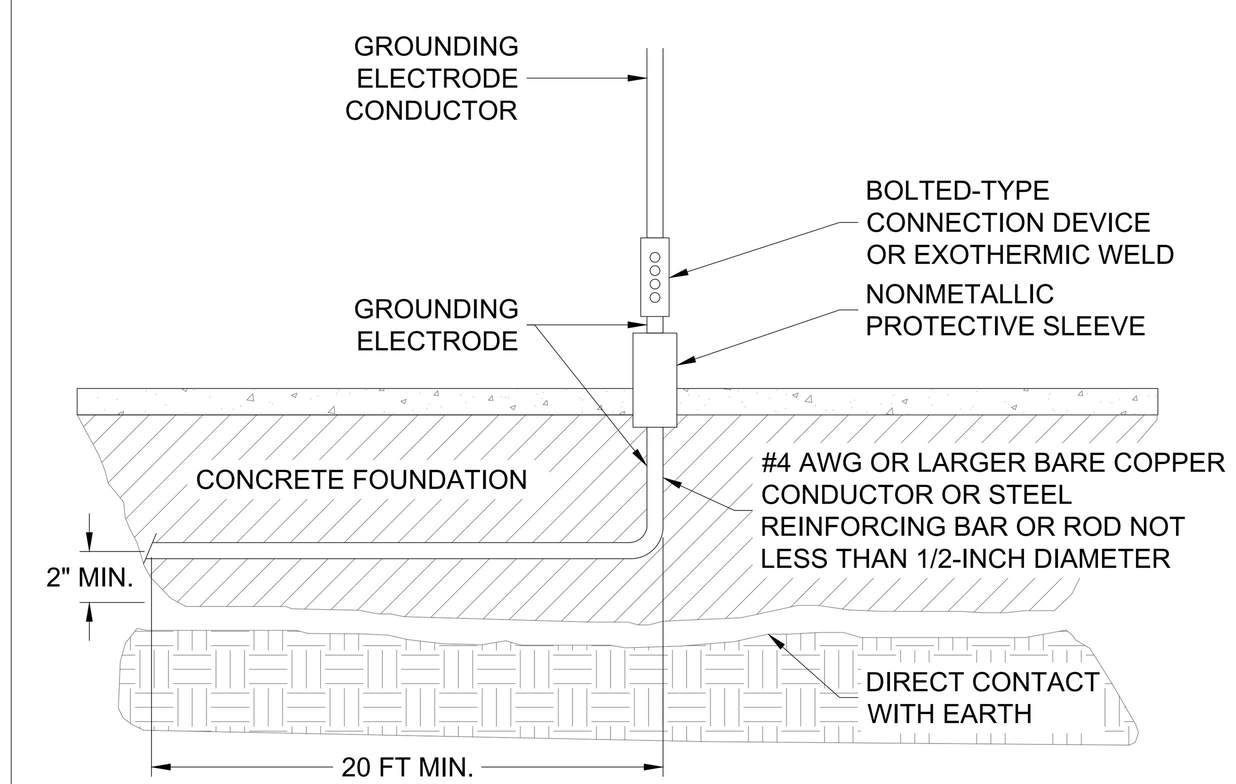
SCALE: NTS



ITEM	DESCRIPTION	QTY	REMARKS
1	#4/0 AWG BARE COPPER CONDUCTOR	AR	

7 G2.0 BURIED GROUNDING ELECTRODE CONDUCTOR

SCALE: N.T.S.



8 G2.0 CONC. ENCASED ELECTRODE (UFER GROUND)

SCALE: N.T.S.

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RICO-ARGENTINE MINE SITE
RICO PUMP AND WELLHOUSE RW3A
GROUNDING DETAILS

ENGR'D BY: SMB | DRAWN BY: MVW | APRV'D BY: SMB | SHEET NO.: G2.0 | REV.: 1

FILENAME: RW3A_G2.0_GROUNDING DTLS

Date & Time plotted: 6/7/2021 12:55:08 PM

ATTACHMENT 4 – RW-3A WELL CAPACITY CALCULATION BRIEF

By: Sara Cline Date: 6/11/2021
Ed Janney
Ck'd: Luke Evans Date: 6/11/2021
Ap'd Kevin Pfeifer Date: 6/11/2021

CALCULATION BRIEF

Subject: RW-3A Calculation Brief, Revision 3
Rico-Argentine Mine Site
Rico, Colorado

INTRODUCTION

Design and specification of the RW-3A relief well piping system and pump station for increased hydraulic control of impounded water in the St. Louis Tunnel (SLT) at the Rico-Argentine Mine Site (Site). RW-3A was designed to close the gap in hydraulic capacity required to maintain desired water head within the St. Louis Tunnel (SLT) and provide redundancy for the existing RW-2A and RW-2B relief well systems.

DESIGN METHOD AND ASSUMPTIONS

Design Flow Rate

Design flow rates required for the relief well system were determined based on the Site hydrologic model, debris plug permeability, and maximum observed capacities of the existing RW-2A and RW-2B relief wells. The relief wells can be operated in three different modes including: gravity flow, siphon flow, and pumped flow via centrifugal pump. The variable flow capacity required may be obtained using all three operating modes; low and moderate capacity scenarios will only require gravity flow, siphon flow or a hybrid mode using a combination of modes across the three relief well system. The high flow or contingency demand scenarios will utilize the centrifugal pumping mode as required. RW-3A completion is intended to provide flow capacity ranging from observed season flow rates up to modeled 25-year recurrence peak flow of 1,250 gpm. A 25% safety factor was utilized to account for reduced capacity due to fouling in the lines, providing a maximum design flow capacity of 1,570 gpm for RW-3A. Additional capacity requirements include 1,060 gpm of siphon flow capacity and 450 gpm of gravity flow capacity (including the 25% safety factor). Detail on design flow determination is discussed in the *Adit Hydraulic Controls Design.*

Calculation Input Assumptions

The RW-3A relief well system was designed for a target SLT interception invert elevation of 8856.0 feet above mean sea level (ft-amsl) and a high point invert elevation of 8869.5 ft-amsl. Design variables include discharge point invert elevation and distance from the wellhead, size of well casing and discharge piping, and size and models of centrifugal pumps. The wellhead and pump piping design mimics the existing design of the RW-2B wellhead. The discharge piping from the wellhead and pump is designed to provide gravity flow from the RW-3A invert to the discharge point(s) for current and future treatment systems. Well completion design drawings are included in the *Adit Hydraulic Controls Design.*

The design calculations are completed with the currently defined safe operating envelope of 8871 ft to 8872 ft as the anticipated base operating conditions for the SLT. The assumptions and corresponding operating levels for primary hydraulic control of the SLT provide a baseline discharge rates adequate to meet design criteria. The calculated discharge rates are limited by the SLT head levels which as designed are only slightly above the well invert elevation and are the limiting factor for maximum theoretical flow through the well discharge system. The discharge flow capacities for the different flow modes will correspondingly increase in the event that head levels are increased within the tunnel.

Pipe Materials for Calculations

The materials of construction chosen for this design will be similar to the existing relief wells on site. The wellhead wye will be constructed of carbon steel and the remainder of the pipeline beginning at the wellhead daylight will be constructed of high-density polyethylene (HDPE). The final completion casing will be constructed of stainless steel for reliability and protection against corrosion. See Table 4 of Attachment A for piping specifications used in the calculations.

CALCULATION METHODS

Pumped Flow Calculation

The expected performance of the RW-3A system for pumped flow was determined by calculating the total head loss of the system and utilizing the manufacturer provided pump curves to correlate the maximum expected flow rate as a function of the total dynamic head and net positive suction head available. Because the pump is pumping downhill, the pump discharge will need to be equipped with a throttling valve to provide sufficient backpressure to the pump. The total dynamic head (TDH) is equal to the summation of all head losses due to friction and elevation changes between the inlet (SLT water level head) and discharge points:

$$TDH = \left(h_{z(d)} - h_{z(s)}\right) + h_f + h_m$$

Where: TDH = total dynamic head (ft)

$h_{z(d)}$ = static discharge head [pump centerline to discharge point] (ft)

$h_{z(s)}$ = static suction head [SLT elevation to pump centerline] (ft)

h_f = major friction loss due to skin friction for suction and discharge piping (ft)

h_m = minor friction loss due to fittings/valves for suction and discharge (ft)

The Hazen-Williams method was used to calculate friction losses in straight pipe sections, accounting for roughness of the material of construction, size of the pipe, and flow rate:

$$h_f = 10.44 \frac{LQ^{1.85}}{C_{HW}^{1.85} D^{4.87}}$$

Where: h_f = major friction loss due to skin friction (ft)

L = pipe length (ft)

Q = flow rate (gpm)

C_{HW} = Hazen-Williams roughness coefficient (unitless)

D = pipe internal diameter (in)

The Hazen-Williams roughness coefficients used for this calculation are 100 for steel pipe and 140 for HDPE pipe. The Darcy-Weisbach friction loss formula utilizing the Fanning friction factor was also used to calculate major losses due to friction in straight pipe to compare results obtained from the Hazen-Williams method.

Manufactured components utilized for the concept wellhead and discharge piping have published flow loss coefficients for each type and diameter. These friction coefficients used for calculating losses across fittings and valves are listed in Table 2 and the corresponding friction loss is calculated using the following equation:

$$h_m = K\frac{\mathrm{v}^2}{2g}$$

Where: h_m = minor friction loss due to fittings/valves (ft)

K = friction loss coefficient (unitless)

v = fluid velocity (ft/s)

g = acceleration due to gravity (32.174 ft/s^2)

In addition to calculation of total dynamic head, the net positive suction head available ($NPSH_a$) to the suction side of the pump was calculated at various flow rates to determine that the pump system is designed with sufficient suction head to prevent cavitation in the pump. Due to the length of the relief well casing, the limiting factor for pump performance is Net Positive Suction Head (NPSH). The $NPSH_a$ was compared to the net positive suction head required ($NPSH_r$) provided by the pump manufacturer to determine the maximum operating flow rate. The $NPSH_a$ must be greater than $NPSH_r$ to prevent cavitation and should include an acceptable operational safety margin. $NPSH_a$ was estimated using the following equation:

$$NPSH_a = h_{atm} + h_{z(s)} - h_{f(s)} - h_{m(s)} - h_{vp} - SF$$

Where: h_{atm} = atmospheric head (ft)

$h_{z(s)}$ = static suction head [SLT elevation to pump centerline] (ft)

$h_{f(s)}$ = major friction loss due to skin friction for suction only (ft)

$h_{m(s)}$ = minor friction loss due to fittings/valves for suction only (ft)

h_{vp} = vapor pressure head (ft)

SF = safety factor (ft)

Siphon Flow Calculation—Method 1

Siphon flow for RW-3A was calculated for various completion sizes using a derived form of the Bernoulli Equation and the Darcy friction factor as shown:

$$\frac{P_1 g_c}{\rho} + \frac{1}{2}\mathrm{v}_1^2 + gZ_1 = \frac{P_2 g_c}{\rho} + \frac{1}{2}\mathrm{v}_2^2 + gZ_2 + h_f + h_m$$

Where:

$$h_f + h_m = \left(\sum f\frac{L}{D} + \sum K\right)\frac{1}{2}\mathrm{v}_2^2$$

P_1 = pressure at SLT (lb_f/ft^2)

P_2 = pressure at pipe outlet (lb_f/ft^2)

g_c = gravitational conversion constant (32.174 $lb_m \cdot ft/lb_f \cdot s^2$)

ρ = fluid density (62.4 lb_m/ft^3 for water at 68°F)

D = pipe internal diameter (ft)

g = acceleration due to gravity (32.174 ft/s^2)

Z_1 = elevation at SLT water level (ft)

Z_2 = invert elevation at pipe exit (ft)

f = Darcy friction factor (unitless)

L = length of pipe (ft)

K = friction loss coefficient (unitless)

v = fluid velocity (ft/s)

h_f = major friction loss due to skin friction (ft)

h_m = minor friction loss due to fittings/valves (ft)

The Bernoulli Equation was solved for velocity of the system outflow, assuming that the pressure at both the surface of the water in the STL and at the open pipe outlet are both atmospheric ($P_1 \approx P_2$) and velocity at the water surface in the SLT is negligible ($v_1 \approx 0$):

$$v = \sqrt{\frac{2g(Z_1 - Z_2)}{\sum f\frac{L}{D} + \sum K + 1}}$$

This velocity equation was substituted into the following equation for volumetric flow rate (Q):

$$Q = vA = \left(\frac{\pi D^2}{4}\right)\sqrt{\frac{2g(Z_1 - Z_2)}{\sum f\frac{L}{D} + \sum K + 1}}$$

Where: Q = volumetric siphon flow rate at pipe exit (cfs)

A = Cross-sectional area of inside pipe (ft^2)

A siphon depends on the differential of kinetic and potential energy from a drop in elevation between the feed source and the discharge. The average velocity or flow rate for a siphon can be determined by equating the kinetic and potential energy. Following this principle, the equation was equated to zero by subtracting the volumetric flow rate (velocity times area):

$$0 = \left(\frac{\pi D^2}{4}\right)\sqrt{\frac{2g(z_1 - z_2)}{\sum f\frac{L}{D} + \sum K + 1}} - vA$$

This equation was then used to solve for velocity at the pipe exit by forcing the equation to zero using the Goal Seek function of Microsoft Excel. The resulting velocity could then be used to find the maximum siphon volumetric flow rate (Q) of the system.

The Darcy friction factor was calculated using the Churchill Equation as a function of the relative roughness of the pipe and the Reynolds number:

$$f = 8\left[\left(\frac{8}{Re}\right)^{12} + \frac{1}{(A+B)^{3/2}}\right]^{1/12}$$

Where:

$$A = \left[2.457\ln\left(\frac{1}{\left(\frac{7}{Re}\right)^{0.9} + 0.27\left(\frac{\epsilon}{D}\right)}\right)\right]^{16}$$

$$B = \left(\frac{37{,}530}{Re}\right)^{16}$$

$$Re = \frac{D\mathrm{v}}{v}$$

f = Darcy friction factor (unitless)

Re = Reynolds Number (unitless)

$\in$= roughness coefficient of pipe (ft)

D = pipe internal diameter (ft)

v = fluid kinematic viscosity (1.08E-05 ft^2/s for water at 68°F)

Siphon flow was calculated for various completion sizes over a range of SLT water elevation heads. For calculation of all scenarios, the piping system design downstream of the well casing daylight remained constant and only the size of the well casing and an appropriately sized reducer were varied. Siphon flow rate was calculated assuming full pipe flow.

Calculations were also completed for siphon flow under fouled conditions by assuming a 25% reduction in flow capacity:

$$Q_F = 0.25 \times Q$$

Where: Q_F = Siphon volumetric flow rate under fouled conditions (cfs)

Siphon Flow Calculation—Method 2

A second method was utilized to calculate anticipated siphon flow rates following the *Guidelines for Use of Pumps and Siphons for Emergency Reservoir Drawdown* prepared by Morrison Maierle, Inc., and provided as a technical reference document by the Montana Department of Natural Resources and Conservation. This resource calculates siphon flow for drawdown of a reservoir using the following equation:

$$Q = 0.0438D^{2.5}H^{0.5}(12fL + KD + D)^{-0.5}$$

Where:

$$f = 425\left({n^2}/{D^{0.33}}\right)$$

Q = volumetric siphon flow rate at pipe exit (cfs)

D = pipe diameter (in)

H = elevation change from SLT water elevation to outlet pipe elevation (ft)

f = friction factor (unitless)

K = sum of friction loss coefficients for minor losses (unitless)

n = Manning's roughness value (unitless)

Expected siphon flow rates were calculated for various casing sizes, discharge piping diameters and lengths, and discharge invert elevations to determine what system configurations would be able to meet design flow criteria.

Gravity Flow Calculation

Gravity flow rate for the relief well casing was estimated for various completion sizes using the Hazen-Williams equation for velocity:

$$\text{v} = 1.318 C_{HW} R^{063} S^{0.54}$$

Where:

$$R_H = \frac{A}{P} = \frac{\pi D^2/4}{\pi D} = \frac{D}{4} \qquad !*$$

$$S = \frac{\Delta H}{L}$$

v = fluid velocity (ft/s)

C_{HW} = Hazen-Williams roughness coefficient (unitless)

R_H = hydraulic radius (ft)

S = Hydraulic slope (unitless)

A = Cross-sectional area of inside pipe (ft^2)

P = wetted perimeter of pipe (ft)

D = pipe internal diameter (ft)

ΔH = vertical elevation change over pipe length L (ft)

L = length of pipe (ft)

!* This equation for hydraulic radius is only valid under the assumption of full pipe flow (100% wetted pipe perimeter)

Friction loss through the screen was considered to be negligible due to the screen flow area being greater than 4x the pipe cross-sectional area.

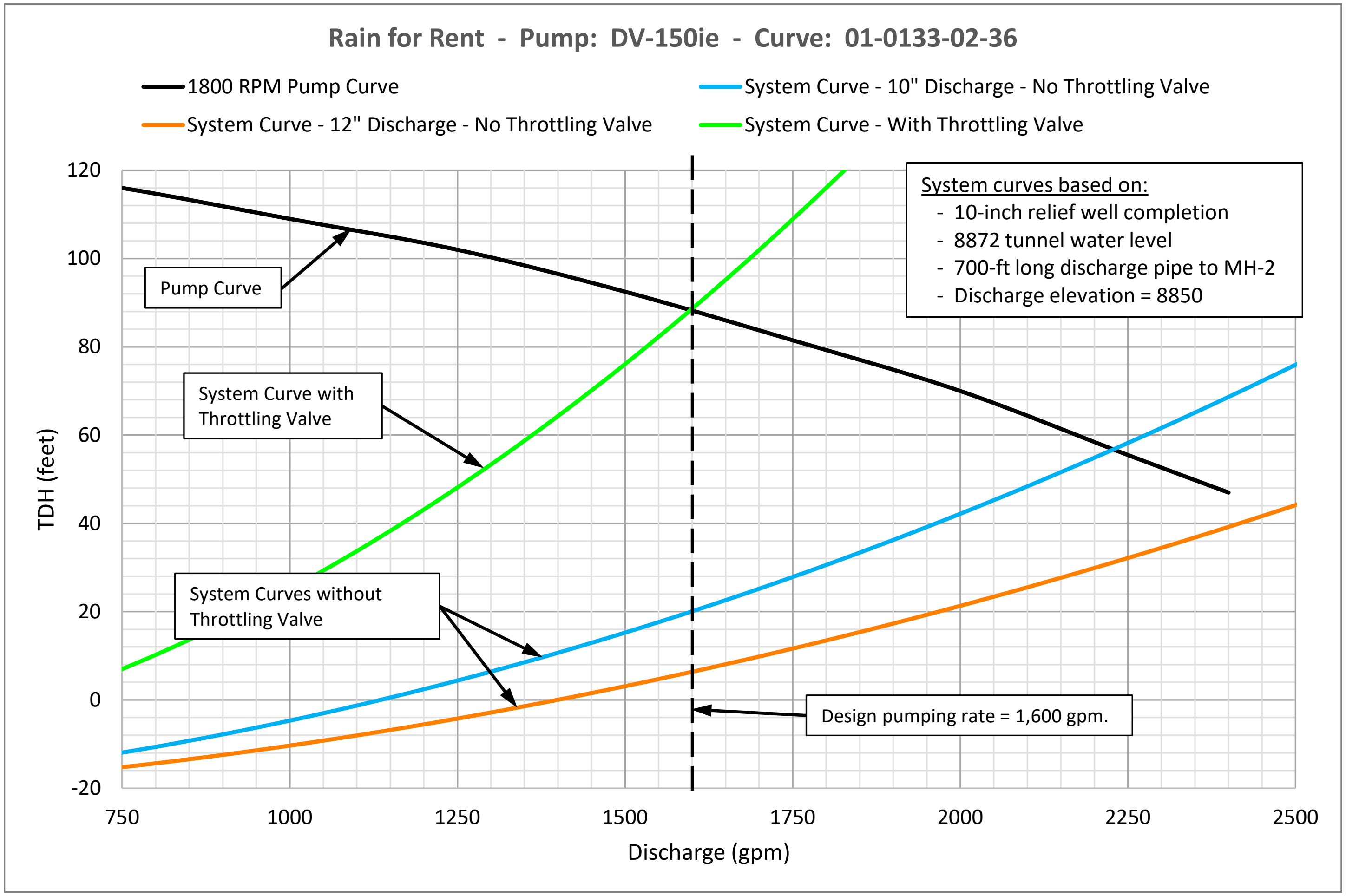
Velocity was converted to flow rate by multiplying the velocity by the cross-sectional area of the pipe. The Hazen-Williams equation only accounts for major losses due to friction in the system and does not account for minor losses due to valves or fittings. The equation is only valid for flow when SLT water elevation is above the invert elevation of the wellhead. Gravity flow at for the relief well is only possible when the head in the SLT is greater than the invert elevation of the wellhead (8869.5 ft). Flow below the invert does not have sufficient head to initiate gravity flow and must be operated by siphon or pumping.

Well casing gravity flow rate was calculated for various completion sizes and for well casing material of construction of HDPE and stainless steel.

LIST OF ATTACHMENTS

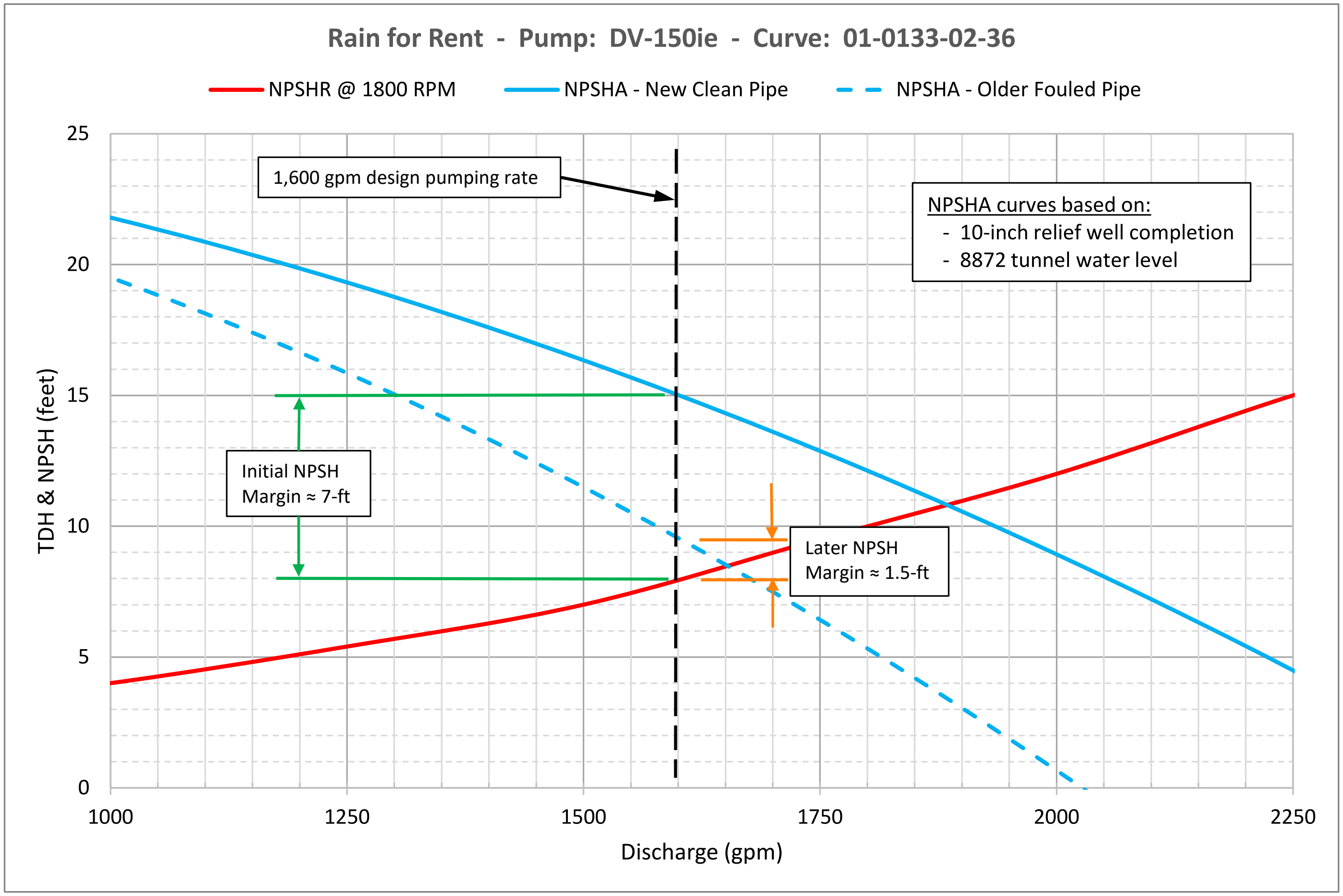
Attachment A –Figures and Tables:

Figure 1. Pump Curve vs System Curve for 10-inch Relief Well Completion



The pump and system curves plotted in Figure 1 above illustrate the expected performance of a DV150ie centrifugal pump connected to the discharge of the proposed relief well (RW-3A) with a 10-inch final completion diameter. The estimated required pump capacity of 1,600 gpm is attainable within the conceptual design parameters for RW-3A. A throttling valve on the discharge line will be required to control the pump discharge rate and prevent loss of suction head, cavitation and pump damage. *Note: Flow capacity represented by the pump curve in Figure 1 is limited by the NPSH available. See Figure 2 and Table 1 below.*

Figure 2. Net Positive Suction Head (NPSH) Required versus NPSH Available for 10-inch Relief Well



The Net Positive Suction Head (NPSH) is plotted above in Figure 2 for the DV150ie pump under new and fouled pipe conditions. The NPSH is the single most limiting factor for pump performance within the relief well system. The NPSH is most affected by the casing diameter, the tunnel water level and the fouling on the interior casing wall. Figure 2 indicates the anticipated NPSH available for the relief well system meets requirements for the DV150ie for both clean and fouled pipe conditions.

Table 1. Maximum Pump Capacity based on NPSH Available

Tunnel Water Level Elevation (Feet AMSL)	Maximum Pump Capacity (GPM) [A, B] Rain for Rent Model DV-150ie		
	8-inch Well Completion	10-inch Well Completion	12-inch Well Completion
8869	950	1474	1887
8870	975	1511	1934
8871	1000	1548	1980
8872	1023	1584	2024
8873	1047	1619	2067

Footnotes:

A. Based on NPSH limitation of NPSH required plus 2-ft safety margin as recommended by the American National Standard for Rotodynamic Pumps Guideline for NPSH Margin (ANSI/HI 9.6.1-2017).
B. Considering pipe friction coefficients representative of older, fouled pipe conditions.

Table 1 summarizes maximum pump capacity for the DV150ie over the range of current safe operating envelope water levels based on available suction head for 8-inch, 10-inch, and 12-inch well completion diameters. As mentioned under Figure 2 above, NPSH is most affected by casing diameter and tunnel water level. The capacity information in Table 1 demonstrates that:

- An 8-inch well completion does not meet design capacity for the 25-year recurrence flow for the current operating elevations.
- A 10-inch well completion meets the design capacity for the 25-year recurrence flow at 8872-ft and above.
- A 12-inch well completion exceeds the design capacity for the 25-year recurrence flow at 8869-ft to 8873-ft inclusive of the current safe operating envelope.

Figure 3. Gravity Flow Rate vs Tunnel Head Elevations for 8-inch, 10-inch & 12-inch Completion Liners

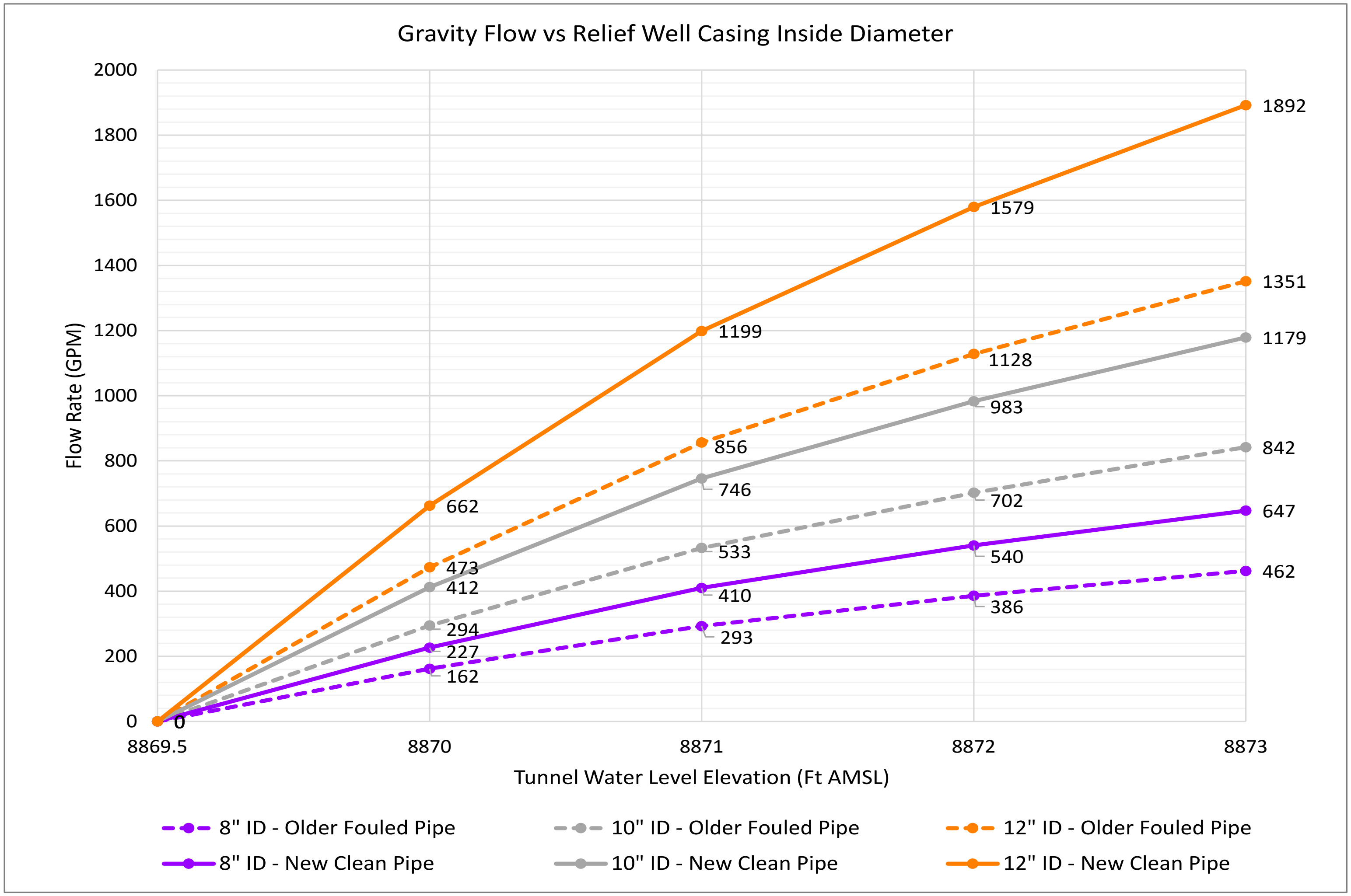


Figure 3 contains the range of calculated gravity flow capacities for 8-inch, 10-inch and 12-inch completion diameters for RW-3A considering new and fouled conditions. *Note: The flow rate capacities in Figure 3 assume discharge line diameters match the well completion.*

Figure 4. Siphon Flow at Various Casing and Discharge Pipe Diameter Combinations

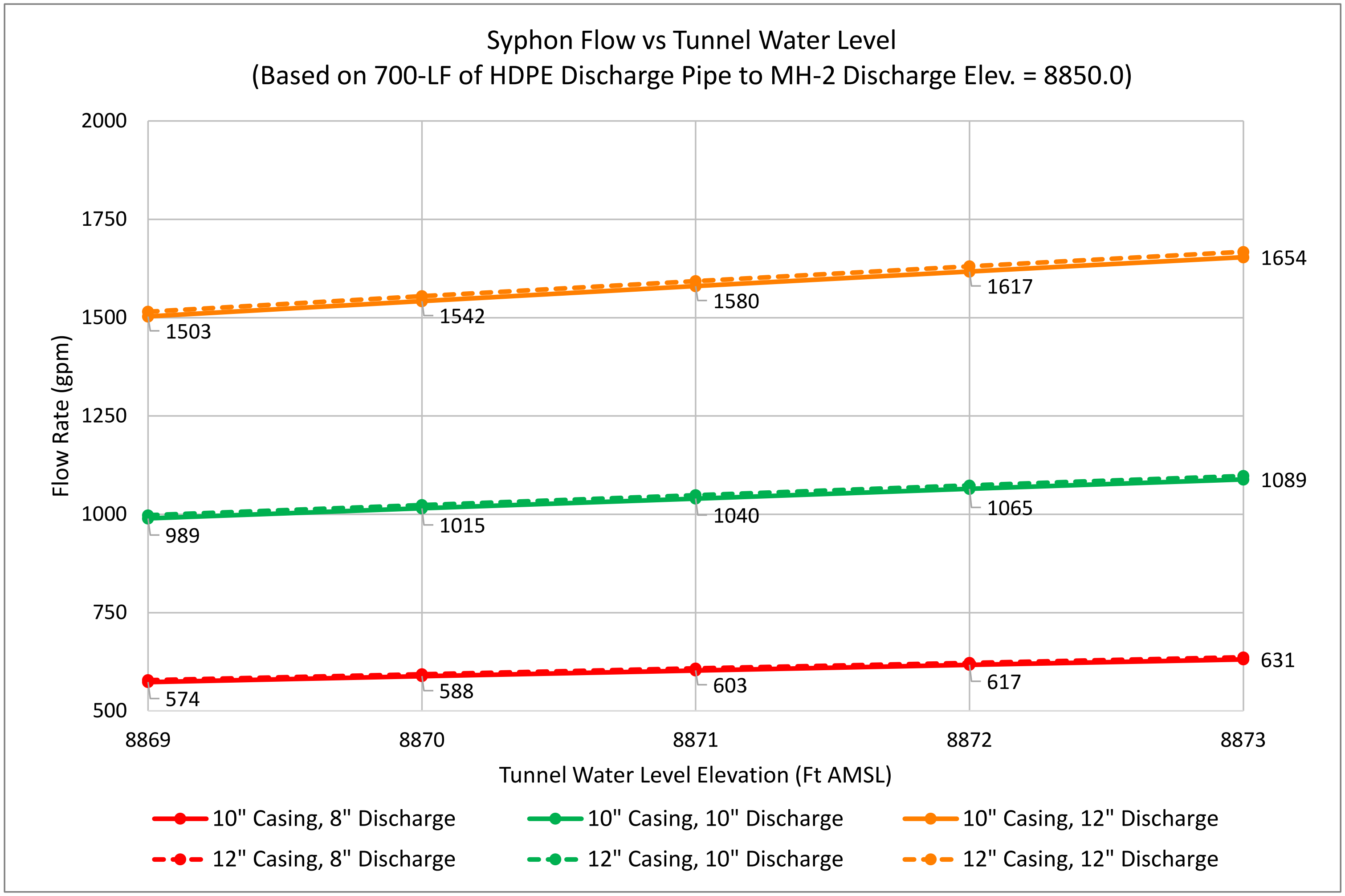


Figure 4 represents calculated siphon flow rates for 10-inch and 12-inch well completions with 8-inch, 10-inch, and 12-inch discharge pipe diameters. There is significant improvement expected in siphon flow capacity with an increase in pipe diameter. *Note: The calculated increase in siphon flow capacity between a 10-inch and 12-inch well completion for a given discharge pipe diameter is so minor, that the capacity lines in the above figure (dashed line versus solid line) are almost identical.*

Table 2. Gravity Flow versus Siphon Flow Summary – 10-inch Well Completion & 10-inch Discharge Piping

Gravity and Syphon Flow Rates in Gallons/Minute for 10-inch Casing and 10-inch Discharge Pipe						
Tunnel Water Level (Feet AMSL)	Gravity Flow		Syphon Flow [A]		Syphon/Gravity Flow Ratio [B]	
	New Clean Pipe	Older Fouled Pipe	New Clean Pipe	Older Fouled Pipe	New Clean Pipe	Older Fouled Pipe
8869.0	0	0	989	742	na	na
8870.0	412	294	1015	761	2.5	2.6
8871.0	746	533	1040	780	1.4	1.5
8872.0	983	702	1065	798	1.1	1.1
8873.0	1179	842	1089	816	0.9	1.0

Footnotes:

A. Based on 700 feet of discharge pipe to MH-2 at discharge elevation = 8850.0.

B. Syphon/Gravity Flow Ratio = Syphon Flow Rate / Gravity Flow Rate

Table 2 above contains calculated gravity flow and siphon flow capacities for a 10-inch well completion casing with 10-inch discharge piping for clean and fouled conditions at tunnel head elevations ranging from 8869-ft to 8873-ft inclusive of the current safe operating envelope. The siphon to gravity flow ratios on the right side of the table indicates that at lower tunnel water levels siphon flow is significantly higher than gravity flow, but as the tunnel water level increases, gravity flow more closely matches siphon flow.

Table 3. Gravity Flow versus Siphon Flow Summary – 10-inch Well Completion and 12-inch Discharge Pipe

Gravity and Syphon Flow Rates in Gallons/Minute for 10-inch Casing and 12-inch Discharge Pipe						
Tunnel Water Level (Feet AMSL)	Gravity Flow		Syphon Flow [A]		Syphon/Gravity Flow Ratio [B]	
	New Clean Pipe	Older Fouled Pipe	New Clean Pipe	Older Fouled Pipe	New Clean Pipe	Older Fouled Pipe
8869.0	0	0	1503	1127	na	na
8870.0	412	294	1542	1157	3.7	3.9
8871.0	746	533	1580	1185	2.1	2.2
8872.0	983	702	1617	1213	1.6	1.7
8873.0	1179	842	1654	1240	1.4	1.5

Footnotes:

A. Based on 700 feet of discharge pipe to MH-2 at discharge elevation = 8850.0.

B. Syphon/Gravity Flow Ratio = Syphon Flow Rate / Gravity Flow Rate

Table 3 above contains calculated gravity flow and siphon flow capacities for 10-inch casing and 12-inch discharge piping for clean and fouled conditions and at tunnel head elevations ranging from 8869-ft to 8873-ft inclusive of the current safe operating envelope. The siphon to gravity flow ratios on the right side of the table indicates that at lower tunnel water levels siphon flow is significantly higher than gravity flow, but as the tunnel water level increases, gravity and siphon flow rates begin to even out with siphon flow still dominant.

Table 4. Pipe Specifications

Pipe Variable	Sch 40S Seamless Stainless Steel & Sch 40 Carbon Steel			SDR 11 IPS HDPE		
Nominal Size (in)	12	10	8	12	10	8
Inside Diameter (in)[1]	12.00	10.02	7.98	10.29	8.68	6.96
Hazen Williams Roughness Coefficient (C_{HW})[2]	140 - new clean pipe 100 - older fouled pipe			150 - new clean pipe 140 - older fouled pipe		
Pipe Roughness (feet)[3, 4] for Darcy-Weisbach formula	1.5×10^{-4} - new clean pipe 5.5×10^{-3} - older fouled pipe			5×10^{-6} - new clean pipe 1.5×10^{-4} - older fouled pipe		

Notes:

1. https://www.piping-designer.com/index.php/datasheets/piping-datasheets
2. https://www.engineeringtoolbox.com/hazen-williams-coefficients-d_798.html
3. https://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-roughness
4. Merritt, Loftin and Ricketts, Standard Handbook for Civil Engineers 4th Edition, McGraw Hill, 1995, Table 21.3, page 21.22.

Roughness for carbon steel was assumed to be the same as for stainless steel for simplicity due to comparatively short carbon steel sections.

Table 5. Friction Loss Calculation Constants

Fittings and Pipe Friction Coefficients		
Fitting/Pipe	K value[1]	C_{HW}[2]
Entrance Loss	0.78	
Stainless Steel Casing		100
Gate Valve (open)	0.17	
Wye (straight)	0.4	
Carbon Steel Pipe		100
10" x 8" Reducer	0.15	
HDPE Pipe		140
8" x 6" Reducer	0.318	
22.5° Elbow	0.11	
90° Elbows	0.75	
45° Elbows	0.35	
Tee (straight)	0.4	
Tee (elbow)	1	
Butterfly Valve (open)	0.24	

Notes:

1. https://neutrium.net/fluid-flow/pressure-loss-from-fittings-excess-head-k-method/
2. https://www.engineeringtoolbox.com/hazen-williams-coefficients-d_798.html