phelps dodge Tyrone Inc. P. O. Drawer 571, Tyrone, New Mexico 88065 • (505) 538-5331

December 22, 2005

Via Certified Mail #70041160000099653074
Return Receipt Requested

Mr. Clint Marshall
New Mexico Environment Department
Mining Environmental Compliance Section
P.O. Box 26110
Santa Fe, New Mexico 87502

Dear Mr. Marshall:

Re: Phelps Dodge Tyrone, Inc., Discharge Permit 27 Settlement Agreement Paragraph 18, Analysis for Discharge Elimination of Effluent Collected From the 1X Tailing Dam Interceptor Well System

Phelps Dodge Tyrone, Inc. (Tyrone) submits the attached Analysis for Discharge Elimination of Effluent Collected From the 1X Tailing Dam Interceptor Well System in partial fulfillment of Paragraph 18 of the Stipulated Final Order, DP 27. Specifically this document addresses article two (2) of Paragraph 18; effluent elimination analysis from the 1X Tailing Dam interceptor well system to the No. 1X Tailing Impoundment.

One additional analysis will be forwarded to your attention on December 23, 2005. This additional information addresses article 1 of Paragraph 18, specifically the elimination of mine dewatering discharges to the 1X Tailing Impoundment.

Should you have questions or comments please contact Mr. Michael Jaworski at (505) 538-7181.

Very truly yours,

for

E.L. (Ned) Hall, Manager
Environment, Land & Water
New Mexico Operations

ELH:mj
Attachment
20051222-104

cc: Holland Shepherd, MMD
GRIP
CEGEP

ANALYSIS FOR DISCHARGE ELIMINATION OF EFFLUENT COLLECTED FROM THE 1X TAILING DAM INTERCEPTOR WELL SYSTEM

DP-27 Settlement Agreement, Paragraph 18

Prepared by:
Phelps Dodge Tyrone Inc.
Tyrone New Mexico

December 22, 2005

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1.0 INTRODUCTION

Phelps Dodge Tyrone, Inc. (Tyrone) is submitting this document in partial fulfillment of the requirements of Paragraph 18 (Elimination of Discharges to Tailing Impoundments) of the Settlement Agreement and Stipulated final Order dated October 11, 2003 for Discharge Permit 27 (DP-27) for the Tyrone Mine tailing area. Specifically, this document addresses item number two (2) of Paragraph 18 of the Final Order, which relates to effluent collected from the interceptor wells located at the toe of the 1X Tailing Dam and discharge onto top surface of the No. 1X Tailing Dam. The objective of this document is to present Tyrone's preferred alternative for eliminating the discharge from interceptor wells to the No. 1X Tailing Dam. The study reported herein was conducted in accordance with the *Discharge Elimination Work Plan for Interceptor System Water from 1X Tailing, Tyrone Mine Facility* submitted by Tyrone (Tyrone, January 14, 2004) and subsequent correspondence with the New Mexico Environment Department (NMED).

The selected alternative would need to be implemented before construction (reclamation) begins on Tailing Dam 1X. According to Tyrone's current permit conditions, construction (reclamation) is expected to begin in the second quarter of 2008 for this facility. However, Tyrone is currently pursuing a construction schedule that would allow construction for closure to begin in the second quarter of 2007. For the purposes of this report, Tyrone assumed that each option would require that seepage discharges cease by the fourth quarter of 2006.

The anticipated period of operation for the alternatives listed herein is assumed to be from the fourth quarter of 2006 until such time as the seepage through the 1X tailing dam ceases. For the purposes of this evaluation, Tyrone assumed that the operational life of the alternatives would be not more than 5 years. The reason for this assumption is that historical operations of the system indicate that when the discharges cease, the groundwater associated with the 1X should meet standards within a relatively short period (within a year or two) and pumping of the interceptor system should not be necessary.

1.1 Background

The 1X tailing impoundment was placed into service in 1981 to store tailing from the Tyrone concentrator. In 1992, when concentrator operations ceased, the deposition of tailings on the 1X impoundment stopped. Based on a study by Woodward-Clyde in 1991 which suggested that sulfate and TDS concentrations in the shallow groundwater down gradient of the 1X Tailing Dam would rise from the continuing deposition on top of the dam, a series of interceptor and monitoring wells were installed at the toe of the 1X dam in 1991. The interceptor well system has the capacity to recover and pump impacted water at the rate of up to 230 gallons per minute (gpm) but has not typically operated at this flow rate. DP 27 was modified over time to authorize the pumping and discharge of the impacted water captured by this system. The April 17, 1993 DP 27 renewal and the November 13, 1996 permit modification approval letters from NMED authorized the ongoing discharge of the 1X Interceptor Well water to the top surface of the 1X tailing dam.

2.0 ALTERNATIVE ANALYSIS

Tyrone evaluated six (6) alternatives for eliminating the discharge of pump-back effluent from the 1X Interceptor Wells to the No. 1X Tailing Dam. The alternatives are the same as those identified in the work plan dated January 14, 2004, except that two new alternatives were added to this analysis. A description of each analysis is provided in the following list.

1. Treatment and direct discharge of water.

2. Utilization of the effluent to replace mine process water for dust control during mine reclamation activities.

3. Collection of the effluent in a tank or lined pond for transfer to the #3 PLS pond for use in the SX/EW process. The tank or lined pond would include a pumping system, equipped with automated high and low level controls. The tank or lined pond and pump back system would be a shared system for DP-Settlement Agreement, Paragraph 18, Item 2, and interceptor system water from No. 1 X Tailing Impoundment, and Item 3, seepage collected from the Little Rock Mine.

4. Collection of the effluent in tank or lined pond for transfer to the SX/EW plant raffinate tank for use in the SX/EW process. The tank or lined pond would include a pumping system, equipped with automated high and low level controls. The tank or lined pond and pump back system would be a shared system for DP-Settlement Agreement, Paragraph 18, Item 2, interceptor system water from No. 1X Tailing Impoundment, and Item 3, seepage collected from the Little Rock Mine.

5. Evaporation of the effluent at the concentrator thickeners.

6. Passive evaporation of the effluent at a site-built lined pond.

The new alternatives evaluated are Alternatives 4 and 6. Alternative 4 is a variation of Alternative 3.

2.1 Assessment Criteria

Tyrone compared the six alternatives for eliminating the discharge of Interceptor Well effluent to the 1X Tailing Dam with respect to five primary criteria. These criteria include:

1. Impact on closure schedule;
2. Environmental considerations;
3. Permitting requirements;
4. Cost of implementation and
5. Operational compatibility.

2.1.1 Impact to Schedule

The impact on closure schedule was evaluated according to anticipated time periods required to:

a. Establish a valid project scope;

b. Develop an effective project design;

c. Obtain NMED approval;

d. Procure materials and

e. Construct the project.

2.1.2 Environmental Considerations

Environmental considerations included an analysis of the performance of each alternative with respect to New Mexico groundwater regulations and other appropriate environmental regulations.

2.1.3 Permitting Requirements

The analysis included a review of the permitting steps, estimated timeline and cost for each alternative at a conceptual level to assess the level of difficulty and potential impacts to the reclamation schedule.

2.1.4 Cost of Implementation

The cost of implementation was developed through the use of a number of sources, including:

- "Scoping Study, Treatment and Disposal Options for Water in Main Pit, Phelps Dodge Tyrone Inc.", M3 Engineering & Technology Corp., December 2000.
- "Discharge Elimination Work Plan for Interceptor System Water from No. 1X Tailing, Tyrone Mine Facility", Phelps Dodge Tyrone Inc., January 14, 2004.
- "Building Construction Cost Data 2004", RS Means.
- "Heavy Construction Cost Data 1999", RS Means.
- Recent Tyrone project cost data.
- Recent Engineers Inc. project cost data.

Because this is a relatively short-lived project, operating costs were given minimal consideration.

2.1.5 Operational Compatibility

As this project must be operated within the framework of the existing SX/EW and mine operations, the advantages to and/or interferences with operations were considered.

2.2 Alternative Discussion and Evaluation

In the following sections, each alternative is discussed in the context of the criteria listed above. Table 2 contains a Summary of the Alternatives Analysis and provides a side by side comparison.

2.2.1 Alternative 1, Water Treatment

Treatment is the general heading for processing the effluent in such a way as to lower the concentrations of contaminants to insure the treated water is suitable for discharge or use in other applications. For this alternative, Tyrone assumed that the water would be treated to levels acceptable for direct discharge to a surface water course or to the groundwater. Two methods of water treatment were evaluated: dilution and contaminant removal.

The interceptor well system was designed with the capacity to recover and pump impacted water at the rate of up to 230 gallons per minute (gpm). For this exercise, the average flow of effluent from the interceptor well system is assumed at 50 gpm. Periods of increased precipitation accompanied by continued discharge of effluents upon the 1X tailing dam may increase the production from the interceptor wells. As the effluent discharge onto the 1X tailing dam is eliminated as part of this project, the phreatic surface in the vicinity of the interceptor wells should fall, reducing the inflow to the wells and the required flow into the water treatment plant.

<u>Dilution</u>

Dilution would be accomplished by mixing the impacted effluent from the 1X Interceptor Wells with Tyrone’s process water supply to allow the effluent to comply with surface and groundwater standards prior to direct discharge.

For the purpose of this analysis, a suitable location for the plant was assumed to be in the Mangas Valley, to the north of and as close to the 1X Interceptor Well field as possible.

The requirement for dilution of specific contaminants in the interceptor well effluent may range from zero to 0.78 times, as shown in Table 1: Water Quality Data and Dilution Requirement. The dilution requirement was established by comparing concentrations of contaminants in samples, as reported in Table 1 of the January 14, 2004

Work Plan (Attached), to the New Mexico Water Quality Control Commission Regulations Title 20.6.2.3103.A, B and C and past test results for process water from the Mimbres well field as the dilutent.

The dilution requirement for the contaminant of greatest concentration, as compared to the allowable limit, was 0.78 for Total Dissolved Solids. The dilution requirement for SO4 was 0.58. Design plant flow would be the sum of the maximum effluent and dilutent or approximately 90 gpm.

The pipelines from the interceptor well pumps discharge the effluent into a holding tank, from which it is presently pumped to the 1X tailings dam. The dilution plant should be located near the existing holding tank to minimize the pumping required. See Figure INT1.

The design of this plant assumes the following basic elements:

- 20,000 foot long, 4 inch process water pipeline to the dilution plant (assume the distance from the SXEW plant to the dilution plant for this evaluation);
- 90 gpm dilution plant;
- The available site power should be appropriate for this plant;
- 45 ft. x 45 ft. x 10 ft. deep (50 gpm @ 24 hrs) lined plant feed pond, soil excavation;
- 80 ft. x 80 ft. x 20 ft. deep (90 gpm @ 48 hrs) lined plant product pond, soil excavation; and
- Security fence.

Sampling and process controls within the plant would be redundant to provide the quality control necessary to prevent non-compliant discharge.

As derived from "Heavy Construction Cost Data 1999", the capital cost per gallon of a low order waste water treatment plant capacity for a 90 gpm plant, in 2005 dollars, is approximately $3.97 per gallon per day of plant capacity, or $517,000. Process water pipeline cost from the SXEW is $118,000. The product holding tank would cost approximately $24,000. Fencing cost is approximately $60,000. The total construction cost is approximately $719,000. Engineering for such a plant would be approximately 10% of construction costs, or $72,000. The preparation, submittal and approval of a new discharge permit may cost approximately $60,000. Design, permitting and construction costs may total $851,000. Adding GRT @ 7% and contingencies of 20% yields an estimated total project cost of $1,081,000.

Tyrone assumed that a new discharge permit for discharging the treated effluent from the new plant would be required. Permitting would occur after design is complete. The preparation, submittal and approval of a new discharge permit may require 12 months. The preparation, submittal and approval of a new discharge permit may cost approximately $50,000.

Design time for a treatment facility may be 4 months, after the scope and size of project was determined. Procurement and construction may require 6 months. Discharges to the 1X Tailings Dam must be eliminated early enough to allow the dam to dry prior to reclamation. As stated above, Tyrone estimates that the discharge would need to stop by the fourth quarter of 2006.

As stated above, the requirement to pump the interceptor wells should be eliminated within a year or two after the discharge to the top surface is terminated. Therefore, it is likely that this system may operate for only 3 to 5 years.

Because of conflict with the reclamation schedule and relatively small operating life, this alternative was eliminated from further consideration.

<u>Removal of Contaminants</u>

Contaminants can be removed from the effluent through filtering, chemical reaction and electrocoagulation (electrostatic precipitation). The “Scoping Study: Treatment and Disposal Options for Water in Main Pit” for Tyrone by M3 Engineering & Technology Corporation (December 2000) was used as a source for a portion of the data.

- Chemical Reaction: Typically metals can be precipitated from the effluent by increasing the pH through the use of lime or other alkaline chemicals. Sulfate reduction using a chemical processes may be very cost effective. The resultant sludge may be difficult to dewater, greatly increasing its disposal cost. However, detailed analysis of the dissolved solids must also be performed to determine if they can be removed from the effluent.

- Filtering/Membrane Technology: Reverse osmosis (RO) systems can effectively remove a great number of constituents from the process flow. The effluent must first be clarified, neutralized, softened, filtered and softened again prior to being fed into a two-stage nanofilter and discharged to the RO system for removal of constituents like fluorine. If the sulfates can be removed by precipitation with the addition of lime, a simple RO system may be very effective in removing the remaining dissolved solids in the effluent.

- Bioremediation: Small scale bioremediation cells have been used to process effluent from mine water outfalls, especially from gob piles at coal cleaning plants. The major coal waste pile contaminates are typically iron and sulfates. Bioremediation may be the most appropriate treatment for the effluent from the 1X interceptor wells. The cycles of wet and dry weather, however, may be detrimental to bioremediation and the short time frame of the project may also limit its use.

- Electrocoagulation: Testing has shown that dissolved metals and solids can be removed from effluent through the application of an electrical charge. The process equipment in an electrocoagulation plant may be acceptable for extended idle periods. This may be a very effective way to treat these effluents.

For the purpose of this analysis, a suitable location for the plant was assumed to be in the Mangas Valley, to the north of and as close to the 1X Interceptor Well field as possible. See Figure INT1.

The design of any of these plants assumes the following basic elements.

- 20,000 foot long, 4 inch process water pipeline to transport process water to the treatment plant (assume the distance from the plant to the SXEW Plant for this level of evaluation);
- 20,000 foot long power line from the SXEW plant area to the treatment plant;
- 45 ft. x 45 ft. x 10 ft. deep (50 gpm @ 24 hrs) lined plant feed pond, soil excavation;
- 50 gpm treatment plant;
- 60 ft. x 60 ft. x 10 ft. deep (50 gpm @ 48 hrs) lined product pond, soil excavation; and
- security fence

Because of the relatively low design flow of 50 gpm and the minimal treatment requirement to achieve groundwater standards, plant design can be focused to treat the few contaminants that do not meet standards. Even though the plant will be designed for greatest efficiency, capital costs will be significant. In the case of the most proven and effective treatment technologies, RO, plant maintenance costs will be substantial in order to prevent deterioration of the filters and membranes during idle periods. As derived from “Heavy Construction Cost Data 1999”, the capital cost per gallon of waste water treatment plant with a capacity of 50 gpm, in 2005 dollars, is approximately $6.37 per gallon per day, or $460,000. Process water pipeline cost from the SXEW is $118,000. Power line cost from the SXEW is $323,000. Plant feed pond would cost approximately $8,000. A product storage tank would cost approximately $14,000. Fencing cost is estimated at $60,000. The total construction cost is approximately $983,000. Engineering for such a plant would be approximately 10% of construction costs, or $98,000. The preparation, submittal and approval of a new discharge permit may cost approximately $60,000. Design, permitting and construction costs may total $1,141,000. Adding GRT @ 7% and contingencies of 20% yields an estimated total project cost of $1,449,000.

A discharge permit for the new treatment plant was assumed to be required. Permitting would occur after the design is complete. Design time for a treatment facility may be 6 months, after the scope and size of project is determined. The preparation, submittal and approval of a new discharge permit may require 12 months. Procurement and construction may require 12 months. Discharges to the 1X Tailings Dam must be eliminated early enough to allow the dam to dry prior to reclamation. As stated above, Tyrone estimates that the discharge would need to stop by the fourth quarter of 2006.

As stated above, the requirement to pump the interceptor wells should be eliminated within a year or two after the discharge to the top surface is terminated. Therefore, it is likely that this system may operate for only 3 to 5 years.

Because of conflict with the reclamation schedule and relatively small operating life, this alternative was eliminated from further consideration.

2.2.2 Alternative 2, Substitute Effluent for Makeup/Process Water

Fresh water is presently being used for dust control during reclamation activities of the tailing impoundments. It is possible that the effluent from the 1X interceptor wells could replace the fresh water, creating a cost savings for the plant.

The design of the substitution system assumes the following basic elements beyond existing infrastructure:

- 20,000 gallon head tank;
- head tank loading pump and
- 1,000 foot long, 4 inch water line from collection tank to head tank.

The pumped effluent from the 1X Interceptor wells is presently being collected in a tank prior to discharge on the top surface of the 1X Dam A head tank would be erected nearby, from which the water wagons could load by gravity. An electric pump, controlled by high and low level switches, would operate the pump. The head tank and water fill area would be constructed within an unlined containment. Existing structures would be utilized, where possible. The total cost of the water fill tank would be approximately $50,000. See Figure INT2.

The pH of the interceptor well water, as checked in the field and in the lab, is slightly basic. No testing has been performed to determine the response of the effluent to changes in temperature or to the addition of oxygen. No additional testing or analysis was completed to verify that an exceedance of surface or groundwater quality standards would not occur. Tyrone assumes for the purposes of this analysis that the volume of water that would be discharged is small enough that it would not cause a surface or groundwater exceedance; however, Tyrone believes that in order to actually implement this alternative, Tyrone would need to provide water quality testing and monitoring to prove that the use of this water as a dust suppressant would not cause an exceedance of surface or groundwater standards. For purposes of the analysis, Tyrone assumed that a process similar to obtaining a new discharge permit would be required for this alternative and this would require about 1 year to accomplish with a real risk that the agency may not approve the application at the end of the process.

The water head tank would be located near the toes of the #1 and 1X tailing dams. The greatest requirement for dust suppression would occur during the reclamation of the #1, 1A and 1X dams. The effluent would be filled into the water wagon, and then hauled to the south sides of the dams to reach the roadways. This haulage pattern will cause the water wagons to travel past an existing water fill that was utilized during the construction of the starter dam for the #1A tailings dam.

Because of potential reclamation schedule conflicts and the risk of having a permit application denied, this alternative was eliminated from further consideration.

2.2.3 Alternative 3, Collect 1X Interceptor Well Water and Discharge to the No. 3 PLS Pond.

The SX/EW process is a net user of water. The greatest proportion of makeup water added to the solution process is to offset losses from evaporation of irrigation solutions on the leach stockpiles. The effluent from the 1X interceptor wells and the seeps at Little Rock Mine could be pumped into the #3 PLS pond as a source of makeup water.

A multiple-use lined pond would be constructed in Deadman Canyon downstream of the Whitewater Diversion to collect the combined pumped effluent from the 1X interceptor wells and seepage water from the Little Rock Mine (DP 27 Settlement Agreement, Paragraph 18, Item 3). This pond would be sized for stormwater capture requirements of approximately 1 million gallons. A pump system would transfer the water from the lined pond to the SXEW #3 PLS pond. This catchment pond in Deadman Canyon would be actively dewatered whenever stormwater or seepage was collected.

The effluent from the 1X interceptor wells is presently being collected in a tank near the well field prior to being pumped and discharged on the top surface of the 1X dam. It is assumed that the existing booster pump has insufficient head to reach the lined pond and must be replaced. Approximately 13,000 feet of new 4” HDPE pipe, running along the west toe of the 1X dam, is required to span the distance between the holding tank and the new lined pond located in Deadman Canyon.

Little Rock seepage would flow by gravity to the lined pond. See Figure INT3.

The design of this system assumes the following basic elements beyond the existing infrastructure:

- 160 ft. x 100 ft. x 10 ft. deep, lined pond in Deadman Canyon;

- 13,000 foot long, 4 inch pipeline from the 1X interceptor wells to the lined pond in Deadman Canyon;
- new booster pump from 1X interceptor wells;
- use of an existing diesel pump at the lined pond in Deadman Canyon;
- 9,000 foot long, 8 inch pipeline to #3 PLS pond and
- security fence

The portable diesel pump used to dewater the #1X tailing dam would be installed at the lined pond. This pump will lift the effluent to the #3 PLS pond in a single stage. The pump discharge line would be constructed across disturbed and undisturbed terrain between the #1A tailing dam on the north and the 2A leach stockpile on the south to the No. 3 PLS pond. This 9,000 foot long pipeline would cross the effluent pipeline from the #1, 1A and 1X dewatering project to discharge into the #3 PLS pond.

The lined pond and pump station must be secured by an adequate fence. A chain link fence that surrounds the pond may cost approximately $60,000. The pond would have to be monitored for migratory bird activity.

Construction cost for the stormwater pond is estimated at $174,000. The cost for the new Interceptor Well booster pump is approximately $50,000. The cost for the additional Interceptor Well transfer pipeline is approximately $77,000. The cost for the discharge pipeline to the #3 PLS is approximately $197,000. The perimeter fence will cost approximately $60,000. Total construction cost is approximately $558,000. Engineering for such a plant would be approximately 10% of construction costs, or $56,000. Design and construction costs may total $614,000. Adding GRT @ 7% and contingencies of 15% yields an estimated total project cost of $749,000.

Volume contributions from the 1X interceptor wells into the PLS system would be minor and out of phase with stormwater surges. The contribution of the Little Rock seepage in this plan could, however create a number of operational difficulties within the SX/EW operation. Effluent would be transferred into the SX/EW system as it collected from Little Rock. This transfer system would provide minimal delay in stormwater surges and would dilute PLS solutions. The turbidity of stormwater effluent may also contribute to poor recoveries and upset the solvent extraction circuit. This dilution would increase PLS pump demand, while storm turbidity may create impacts to the SX/EW circuit.

Because this system does not result in a discharge that could impact either surface water or groundwater, it was assumed, for the purposes of this analysis, that no additional discharge permit is required.

Design time for the pumping facility may be 2 months, after the scope and size of project was determined. The preparation, submittal and approval of a modification to the discharge permit may require 12 months. Procurement and construction may require 6 months. Effluents to the 1X Tailings Dam must be eliminated early enough to allow the dam to dry prior to reclamation, which is scheduled for the fourth quarter of 2006.

Because of the potential operational issues, this alternative was dropped from further consideration.

2.2.4 Alternative 4, Collect 1X Interceptor Well Water and Discharge into SX/EW Raffinate Tank.

The SX/EW process is a net user of water. The greatest proportion of makeup water added to the solution process is to offset losses from evaporation of irrigation solutions on the leach stockpiles. The effluent from the 1X interceptor wells and Little Rock seepage could be added to the SX/EW raffinate tank as a source of make up water.

A multiple-use lined pond would be constructed in Deadman Canyon downstream of the Whitewater Diversion to collect the combined pumped effluent from the 1X interceptor wells and seepage from the Little Rock Mine (DP 27 Settlement Agreement, Paragraph 18, Item 3). This pond would be sized for stormwater capture requirements of approximately 1 million gallons. A pump system would transfer the water from the lined pond to the SXEW Raffinate Tank. This catchment pond in Deadman Canyon would be actively dewatered whenever stormwater or seepage was collected.

The pumped discharge from the 1X interceptor wells is presently being collected in a tank near the well field, prior to being pumped and discharged to the top surface of the 1X Dam. It is assumed that the existing booster pump has insufficient head to reach the lined pond and must be replaced. Approximately 13,000 feet of new 4” HDPE pipe running along the west toe of the 1X dam is required to span the distance between the holding tank and a possible new lined pond in Deadman Canyon.

Little Rock seepage would flow by gravity into the lined pond, See Figure INT4.

The design of any of this system assumes the following basic elements beyond the existing infrastructure:

- 160 ft. x 100 ft. x 10 ft. deep lined pond in Deadman Canyon;

- 13,000 foot long, 4 inch pipeline from the 1X interceptor wells to the lined pond in Deadman Canyon;

- new booster pump from 1X interceptor wells;

- use of an existing diesel pump at the lined pond in Deadman Canyon;

- 6,500 foot long, 8 inch pipeline to the 1X Dewatering Booster at the toe of the #3 Leach Stockpile and

- security fence

The portable diesel pump used to dewater the #1X tailing dam would be installed at the lined pond. This pump will lift the effluent to the 1X Dewatering Booster pump in a single stage. The pump discharge line would be constructed across disturbed and undisturbed terrain between the #1A tailing dam on the north and the 2A leach stockpile on the south. This 6,500 foot long effluent pipeline would intersect the effluent pipeline from the #1, 1A and 1X dewatering project at the 1X Dewatering Booster pump.

The lined pond and pump station must be secured by an adequate fence. A chain link fence that surrounds the pond may cost approximately $60,000. The pond would have to be monitored for migratory bird activity.

Construction cost for the stormwater pond is estimated at $174,000. The cost for the new Interceptor Well booster pump is approximately $50,000. The cost for the additional Interceptor Well transfer pipeline is approximately $77,000. The cost for the discharge pipeline to the 1X Dewatering Booster pump is approximately $132,000. The perimeter fence will cost approximately $60,000. Total construction cost is approximately $493,000. Engineering for such a plant would be approximately 10% of construction costs, or $49,000. Design and construction costs may total $542,000. Adding GRT @ 7% and contingencies of 15% yields an estimated total project cost of $661,000.

The effluent from the 1X Interceptor Wells combined with the Little Rock seepage would be added to the leaching system as make-up water. Operational leach issues could arise from the introduction of excess turbidity and dilution of raffinate during storm surges.

Because this system does not result in a discharge that could impact either surface water or groundwater, it was assumed, for the purposes of this analysis, no additional discharge permit is required.

Design time for the pumping facility may be 2 months, after the scope and size of project was determined. Procurement and construction may require 6 months. Discharges to the 1X Tailings Dam must be eliminated early enough to allow the dam to dry prior to reclamation. As stated above, Tyrone estimates that the discharge would need to stop by the fourth quarter of 2006. This appears to be achievable with this alternative.

Because of the lower combined construction costs and potential beneficial use as make up water for the SXEW Process, this is the preferred alternative for eliminating the effluent pumped from the 1X interceptor wells and collected Little Rock seepage. This alternative fits well with the stormwater management plan that Tyrone has submitted to NMED for approval.

2.2.5 Alternative 5, Discharge the Effluent into the Existing Tank at the Concentrate Thickeners for Evaporation

Passive evaporation of the effluent pumped from the 1X interceptor wells to the tailings thickeners could utilize existing infrastructure. The effluent from the 1X Interceptor Wells could be pumped from the wells to the holding tank and then conveyed by pipeline to the tailing thickeners.

The design of this alternative assumes the following basic elements, beyond the existing infrastructure:

- new booster pump from 1X interceptor wells;
- 20,000 foot long, 4 inch pipeline from the 1X interceptor wells to the concentrator tailing thickeners;
- crossing of Mangas wash;
- repairs, as required, to seal the thickener tanks and
- construction of a distribution manifold into the thickener tanks.

The overflow and underflow manifolds at each of the thickeners must be sealed to prevent the discharge of effluent into the abandoned tailings management system. Sealing of the thickeners will cost approximately $10,000.

A new pipe manifold, with control valves, must be constructed to allow discharge to potentially six to eight thickeners. Because flow velocities and pressures will be low, carbon steel pipe for the manifold and valves would be adequate to handle the nearly pH neutral effluent. The manifold will cost approximately $26,000.

A four (4) inch diameter, 20,000 foot long pipeline would be constructed from the existing collection tank to the tailings thickeners. The cost of that pipeline will be approximately $118,000. The pipeline would cross the Mangas Wash below the #3 PLS Pond. See Figure INT5.

The total static head from the tailing thickeners to the collection tank is approximately 340 feet. It is expected that the effluent will be pumped from the collection tank to the tailings thickeners in a single stage. Nominal pump horsepower will be approximately 25. One (1) new pad mounted cast iron pump with switchgear would be needed to transfer the water to the thickeners. The cost of the pump, switchgear, pad and fittings may be $60,000.

A dual wall pipeline is planned where it crosses Mangas Wash. There must be a lined catchment at the downstream end of the sleeve. The containment shall have the capacity for approximately 6,500 gallons, the approximate volume of the upper half of the pipeline. The containment must be fenced. This containment, with fence, will cost approximately $10,000.

Tyrone estimates that the existing electric power supply in the areas where the pump will operate is adequate.

Construction cost for the loading manifold at the thickeners is $26,000. It will cost $10,000 to seal the thickeners. The pipeline will cost approximately $118,000. The pump and switchgear will cost $60,000. The dual wall pipeline will cost $10,000. Total construction cost is approximately $224,000. Engineering for such a plant would be approximately 10% of construction costs, or $22,000. Design and construction costs may total $246,000. Adding GRT @ 7% and contingencies of 15% yields an estimated total project cost of $300,000.

Because this system does not result in a discharge that could impact either surface water or groundwater, it was assumed, for the purposes of this analysis, that no additional discharge permit is required.

Design time for the pumping facility may be 2 months, after the scope and size of project was determined. Procurement and construction may require 6 months. Discharges to the 1X Tailings Dam must be eliminated early enough to allow the dam to dry prior to reclamation. As stated above, Tyrone estimates that the discharge would need to stop by the fourth quarter of 2006.This appears to be achievable for this alternative.

This alternative should meet environmental standards; however, the effects of evapoconcentration of contaminants would need to be evaluated, regarding the continued effectiveness of the evaporation system. This alternative only addresses one discharge (the interceptor wells) as compared to the previous two alternatives that are designed to address two of the discharges required to be eliminated. Evaporation at the tailings thickeners was eliminated from further consideration since the alternative is not as compatible with other proposals to eliminate discharges and the stormwater management plan.

2.2.6 Alternative 6, Discharge the Effluent into a Lined Pond for Evaporation

The water elimination concept of passive evaporation entails construction of a large enough evaporation pond to handle the pumped effluent from the 1X Interceptor wells. This pond would be sized according to the requirement to evaporate the average pump discharge flow rate (50 gpm) and 120% of the average annual precipitation at the Tyrone property (19.2 inches). The nearest location to the 1X Interceptor Wells for an evaporation pond would be in the Mangas valley, north of the Interceptor Well field. See Figure INT6.

The 50 gpm 1X Interceptor Well pump discharge will generate approximately 26 million gallons of effluent per year. The 30 year average annual precipitation in the area of the 1X tailing dam and Mangas Valley is approximately 16 inches (Monthly and Annual Precipitation, Phelps Dodge Tyrone Inc., 1954-2004). According to pan evaporation rates for Santa Rita from 1949 through 1952 (http://weather.nmsu.edu/Pan_Evaporation/santa_rita_evap.htm), the annual pan evaporation would be approximately 83 inches.

The lined pond was designed to have sufficient surface area to evaporate the 50 gpm well effluent plus 120% of the normal rainfall amount over the course of a calendar year. In a 15.4 acre pond, the maximum water depth would be approximately 10.3 inches during the month of April. The pond would be dry during September, October and November.

The constructed pond will have approximately 15.4 acres (672,000 SF) of area and 30 acre feet of capacity (2 feet deep). A pond excavation would be constructed and lined with an 80 mil HDPE liner, overlying a 12 oz. fabric.

The design of the evaporation system assumes the following basic elements beyond existing infrastructure.

- 15.4 acre lined evaporation pond, 2 feet deep, soil excavation;
- pipeline from the collection tank to the lined pond; and
- security fence

Tyrone assumed that since there is no discharge to surface or groundwater associated with this alternative that no additional permitting would be required.

Construction cost for the lined pond is $1,620,000. Perimeter chain link fence would cost $90,000. Total construction cost is approximately $1,710,000. Engineering for such a plant would be approximately 5% of construction costs, or $86,000. The preparation, submittal and approval of a modification to the discharge permit may cost approximately $40,000. Design, permitting and construction costs may total $1,836,000. Adding GRT @ 7% and contingencies of 15% yields an estimated total project cost of $2,240,000.

The time required to design an evaporation facility may be 3 to 6 months, after the scope of the project was determined. Procurement and construction may require 6 additional months. As stated earlier, the goal is to eliminate the discharges to the 1X Tailings Dam by the fourth quarter of 2006. Given that the activities above would require a minimum of about one year; this alternative may adversely impact the schedule requirements.

This alternative is not as compatible with the stormwater management plan that Tyrone is implementing and only addresses one of the 1X discharges.

This alternative should meet environmental standards; however, the effects of evapoconcentration of contaminants would need to be evaluated with respect to the continued effectiveness of the evaporation system. The relatively high capital cost for a single use lined pond is significant. This alternative was eliminated from further consideration, since it is very costly for short operational life and is not consistent with other discharge and stormwater management options.

3.0 CONCLUSION

Tyrone has evaluated six alternatives for the elimination of the effluent from the 1X Interceptor Wells to the 1X Tailing Impoundment. This analysis was based on five criteria, which considered 1) impact on closure schedule, 2) permitting requirements, 3) operational compatibility, 4) environmental considerations, and 5) costs. Permitting issues, operational compatibility and the ability to meet the required reclamation schedules were the primary determining factors. Unreasonable costs as compared to alternatives of similar results were also a factor in some cases.

As discussed in the analyses above Tyrone rejected alternatives 1, 2, 3, 5 and 6 due to adverse impacts on the closure schedule, operational incompatibility and cost. Several options were also eliminated because other options were more consistent with the tailing stormwater management plan and the elimination of other discharges. Alternative 4, Collection of 1X Interceptor Well Water and Discharge to the SX/EW Raffinate Tank, is the preferred alternative. This alternative was selected because it is the most compatible with the overall water management plan, and with operations.

4.0 REFERENCES

1. Scoping Study: Treatment and Disposal Options for Water in Main Pit. M3 Engineering & Technology Corporation, December 2000.
2. Evaluation of the Suitability of Main Pit Interceptor Well Water for Industrial Supply, Tyrone, New Mexico, John Shomaker & Associates, Inc., June, 2005
3. New Mexico Water Quality Control Commission Regulations Title 20.6.2.3103.A, B and C.
4. Discharge Elimination Work Plan for Mine Dewatering Water and Main Pit Interceptor Well Water to the 1X Tailing Dam, Phelps Dodge Tyrone Inc., January 14, 2004
5. Building Construction Cost Data 2004", RS Means.
6. Heavy Construction Cost Data 1999", RS Means.
7. Main Pit Water Management Project report on Evaluation of Treatment Alternatives, John Shomaker & Associates, Inc., July 14, 2002

1X Interceptor Wells		Table 1								
		Water Quality Data & Dilution Requirement								
		Contaminant								
Source	Sample Date	Al, Diss (mg/l)	B, Diss (mg/l)	Cd, Diss (mg/l)	Cl, Tot (mg/l)	Co, Diss (mg/l)	Cr, Diss (mg/l)	Cu, Diss (mg/l)	F. Tot (mg/l)	Fe, Diss (mg/l)
New Mexico Water Quality Standard		5	0.1	0.01	250	0.05	0.05	1	1.5	1
Mimbres Wellfield	3/18/2005	0.034	0	0	7.9	0	0	0.059	0.71	0.88
1X Monitor Wells										
18	11/6/2003	<0.02	<0.04	<0.002	27.8			0.0041	0.24	0.01
18	12/3/2003	0.06	<0.04	<0.002	28.4			0.0782	0.3	0.041
20	11/6/2003	<0.02	<0.04	<0.002	37.2			0.003	0.33	0.01
20	12/3/2003	0.088	<0.04	<0.002	42.5			0.113	0.36	0.074
1X Interceptor Wells										
PT.1	7/22/2003	<0.05	0.03	<0.001	24			0.024	0.1	0.02
PT.1	8/18/2003	0.12	0.05	<0.001	24.8			0.049	0.23	0.08
Sample Average		0.045	0.04	0.001	30.78			0.05	0.26	0.04
Dilution Requirement - Mimbres Water/1X Interceptors										

			Contaminant							
			Mn, Diss (mg/l)	Ni, Diss (mg/l)	Pb, Diss (mg/l)	Zn, Diss (mg/l)	pH, field	ph, Lab	SO4, Tot (mg/l)	TDS (mg/l)
New Mexico Water Quality Standard			0.2	0.2	0.05	10	6 to 9	6 to 9	600	1000
Mimbres Wellfield	3/18/2005		0.012	0	0.026	0.065		8.04	29	220
1X Monitor Wells										
18	11/6/2003		0.02		<0.005	0.004	7.1	7.32	1320	2010
18	12/3/2003		0.0306		<0.005	0.0529	7.12	7.28	1260	2060
20	11/6/2003		0.001		<0.005	0.004	7.59	7.7	176	498
20	12/3/2003		0.0319		<0.005	0.0876	7.57	7.73	196	509
1X Interceptor Wells										
PT.1	7/22/2003		0.03		<0.005	0.04	6.92	7.8	1290	2320
PT.1	8/18/2003		0.14		<0.005	0.06	7.04	7.7	1340	2230
Sample Average			0.04		<0.005	0.04	7.22	7.59	930	1604
Dilution Requirement - Mimbres Water/1X Interceptors									0.58	0.78

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Phelps Dodge Tyrone - 1X Tailing Effluent Elimination

Job PDT0505P

Table 1 **1X INTERCEPTOR WELLS - DILUTION WORKSHEET**

Water Quality Monitoring Data

				Contaminant																
Source	Sample Date			Al, Diss	B, Diss	Cd, Diss	Cl, Tot	Co, Diss	Cr, Diss	Cu, Diss	F. Tot	Fe, Diss	Mn, Diss	Ni, Diss	Pb, Diss	Zn, Diss	pH, field	ph, Lab	SO4, Tot	TDS
				(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)			(mg/l)	(mg/l)
New Mexico Water Quality Standard				5	0.75	0.01	250	0.05	0.05	1	1.5	1	0.2	0.2	0.05	10	6 to 9	6 to 9	600	1000
Mimbres Wellfield	3/18/2005			0.034	0	0	7.9	0	0	0.059	0.71	0.88	0.012	0	0.026	0.065		8.04	29	220
1X Monitor Wells																				
18	11/6/2003			<0.02	<0.04	<0.002	27.8			0.0041	0.24	0.01	0.02		<0.005	0.004	7.1	7.32	1320	2010
18	12/3/2003			0.06	<0.04	<0.002	28.4			0.0782	0.3	0.041	0.0306		<0.005	0.0529	7.12	7.28	1260	2060
20	11/6/2003			<0.02	<0.04	<0.002	37.2			0.003	0.33	0.01	0.001		<0.005	0.004	7.59	7.7	176	498
20	12/3/2003			0.088	<0.04	<0.002	42.5			0.113	0.36	0.074	0.0319		<0.005	0.0876	7.57	7.73	196	509
1X Interceptor Wells																				
PT.1	7/22/2003			<0.05	0.03	<0.001	24			0.024	0.1	0.02	0.03		<0.005	0.04	6.92	7.8	1290	2320
PT.1	8/18/2003			0.12	0.05	<0.001	24.8			0.049	0.23	0.08	0.14		<0.005	0.06	7.04	7.7	1340	2230
Average				0.045	0.04	0.001	30.78			0.05	0.26	0.04	0.04		<0.005	0.04	7.22	7.59	930.33	1604.50
Dilution Calculations																				
1X Interceptor Well	Quantity Cont.			465.5625	18.75	10	10.57975	#DIV/0!	#DIV/0!	-68.2709	-1.75556	-0.14272	6.298157	#DIV/0!	#VALUE!	-421.272			0.633506	0.56338
	Quantity Dilute			-464.563	-17.75	-9	-9.57975	#DIV/0!	#DIV/0!	69.27086	2.755556	1.142716	-5.29816	#DIV/0!	#VALUE!	422.2721			0.366494	0.43662
	Dilution Ratio			-0.99785	-0.94667	-0.9	-0.90548	#DIV/0!	#DIV/0!	-1.01465	-1.56962	-8.00694	-0.84122	#DIV/0!	#VALUE!	-1.00237			0.578517	0.775
Check				5	0.75	0.01	250	#DIV/0!	#DIV/0!	1	1.5	1	0.2	#DIV/0!	#VALUE!	10			600	1000

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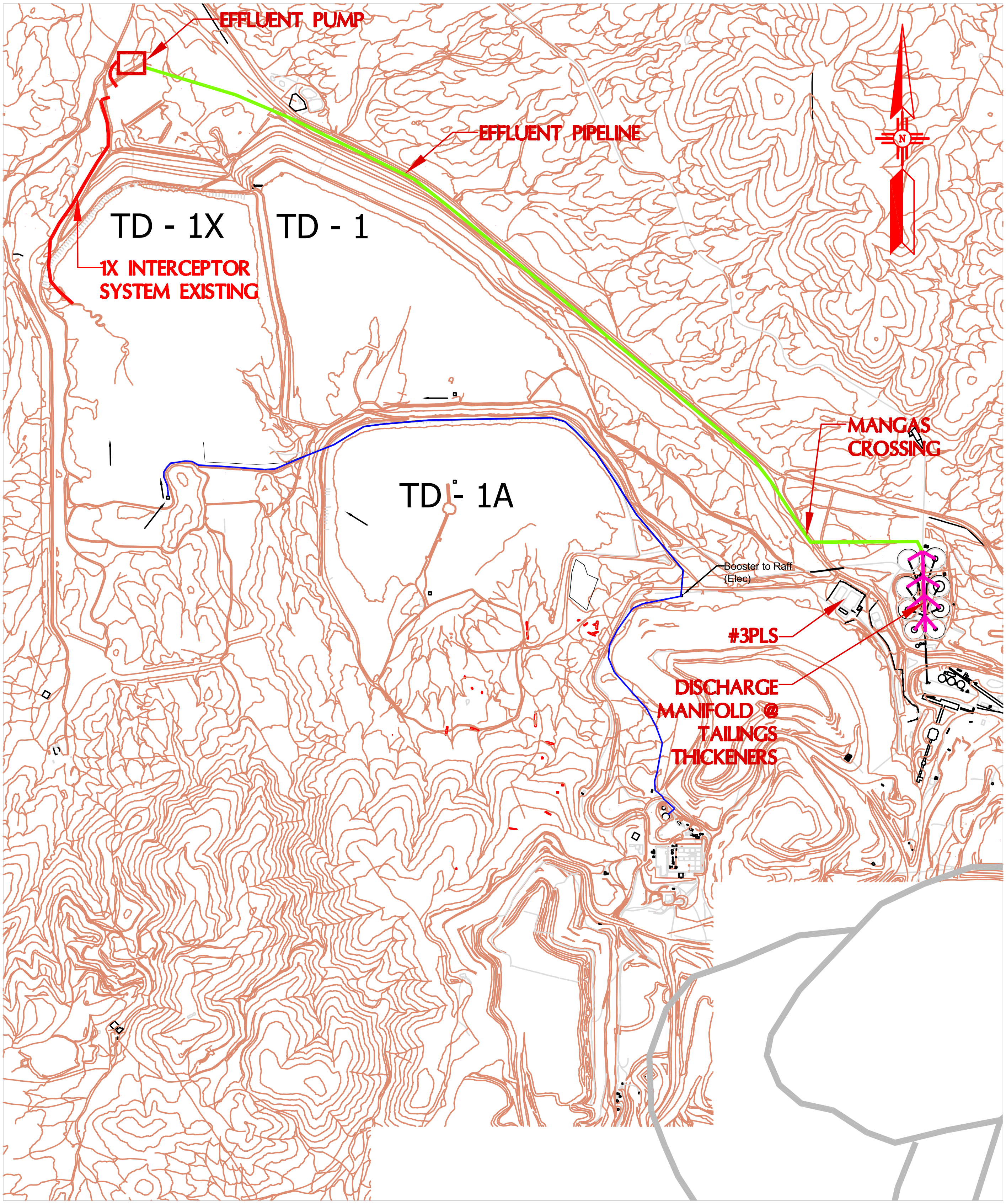
1X Interceptor Wells Effluent - Passive evaporation

Month	Abs.	Ave.	Net Water	Cum Water		20% Precip	Net Water	Cum Water		Effluent	Effluent Depth @ Pond Areas							Net Water	Cum Water			Net Water	Cum Water
	Pan Evap.	Precip.	Depth	Depth		Increase	Depth	Depth		Addition								Depth	Depth			Depth	Depth
	in.	in.	in.	in.		in.	in.	in.		ft^3	300 x 300	600 x 600	700 x 700	800 x 800	850 x 850		850 x 850	in.	in.		820 x 820	in.	in.
										@ 50 gpm	90,000	360,000	490,000	640,000	722,500		722500				672,400		
											in.	in.	in.	in.	in.		in.				in.		
Dec	3.77	1.26	-2.51	-2.51		1.512	-2.258	-2.258		298,396	39.79	9.95	7.31	5.59	4.96		4.96	2.70	2.70		5.33	3.07	3.07
Jan	2.5	1.15	-1.35	-3.86		1.38	-1.12	-3.378		298,396	39.79	9.95	7.31	5.59	4.96		4.96	3.84	6.53		5.33	4.21	7.27
Feb	3.61	1.12	-2.49	-6.35		1.344	-2.266	-5.644		269,519	35.94	8.98	6.60	5.05	4.48		4.48	2.21	8.74		4.81	2.54	9.82
Mar	5.93	0.9	-5.03	-11.38		1.08	-4.85	-10.494		298,396	39.79	9.95	7.31	5.59	4.96		4.96	0.11	8.85		5.33	0.48	10.29
Apr	6.5	0.36	-6.14	-17.52		0.432	-6.068	-16.562		288,770	38.50	9.63	7.07	5.41	4.80		4.80	-1.27	7.58		5.15	-0.91	9.38
May	7.91	0.5	-7.41	-24.93		0.6	-7.31	-23.872		298,396	39.79	9.95	7.31	5.59	4.96		4.96	-2.35	5.22		5.33	-1.98	7.39
June	12.29	0.5	-11.79	-36.72		0.6	-11.69	-35.562		288,770	38.50	9.63	7.07	5.41	4.80		4.80	-6.89	-1.67		5.15	-6.54	0.86
July	9.19	2.8	-6.39	-43.11		3.36	-5.83	-41.392		298,396	39.79	9.95	7.31	5.59	4.96		4.96	-0.87	-2.54		5.33	-0.50	0.35
Aug	8.94	2.78	-6.16	-49.27		3.336	-5.604	-46.996		298,396	39.79	9.95	7.31	5.59	4.96		4.96	-0.65	-3.19		5.33	-0.28	0.07
Sept	8.61	1.93	-6.68	-55.95		2.316	-6.294	-53.29		288,770	38.50	9.63	7.07	5.41	4.80		4.80	-1.50	-4.69		5.15	-1.14	-1.07
Oct	8.8	1.59	-7.21	-63.16		1.908	-6.892	-60.182		298,396	39.79	9.95	7.31	5.59	4.96		4.96	-1.94	-6.62		5.33	-1.57	-2.63
Nov	5.18	0.97	-4.21	-67.37		1.164	-4.016	-64.198		288,770	38.50	9.63	7.07	5.41	4.80		4.80	0.78	-5.84		5.15	1.14	-1.50
										3,513,369	468.45	117.11	86.04	65.88	58.35		58.35				62.70		
	83.23	15.86	-67.37			19.032	-64.198																
															Acres		Acres				Acres		
															16.59		16.59				15.44		

Table 2: Summary of Alternatives Analysis
#1X Interceptor Wells Effluent Discharge

ALTERNATIVE	IMPACT on CLOSURE SCHEDULE	ENVIRONMENTAL CONSIDERATIONS	PERMITTING REQUIREMENTS	OPERATIONAL ISSUES	PROCESS WATER USE	COST of IMPLEMENTATION
Treatment/Dilution	Adverse	Requires Construction of Stand-Alone Plant. Direct Discharge of Product. Significant Quantities of Fresh Water Required.	Discharge Permit for new plant operation required.	Variability in both quantity of effluent and requirement for treatment.	High	High
Treatment/Removal of Contaminants	Adverse	Requires Construction of Stand-Alone Plant. Direct Discharge of Product.	Discharge Permit for new plant operation required.	Variability in both quantity of effluent and requirement for treatment.	Moderate	High
Collect into Shared Pond & Transfer to #3 PLS Pond	None	Additional lined pond and pipeline.	None	Dilution of PLS solution. Introduction of suspended solids into PLS solution.	Advantage to utilize impacted water	Moderate
Collect into Shared Pond & Transfer to Raffinate Tank	None	Additional lined pond and pipeline.	None	Some potential, but more managable in raffinate system, most compatible with stormwater plan	Advantage to utilize impacted water	Moderate
Evaporation of Effluent in Concentrator Tailings Thickeners	None	Requires construction of discharge pipeline and distribution manifold.	None	None	None	Moderate
Evaporation of Effluent in Dedicated Lined Pond	None	Requires construction of lined pond with large surface area.	None	None	None	Moderate



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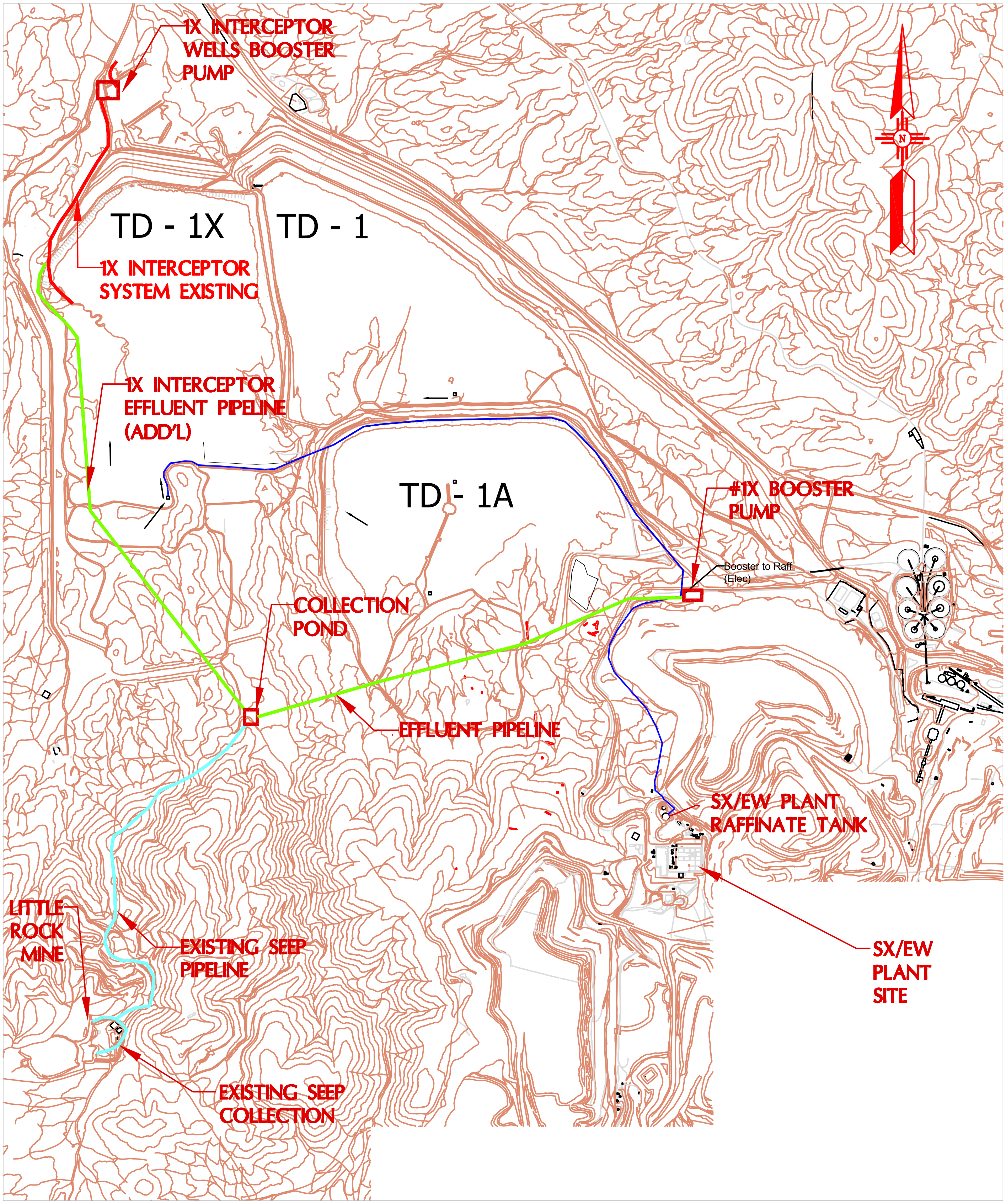
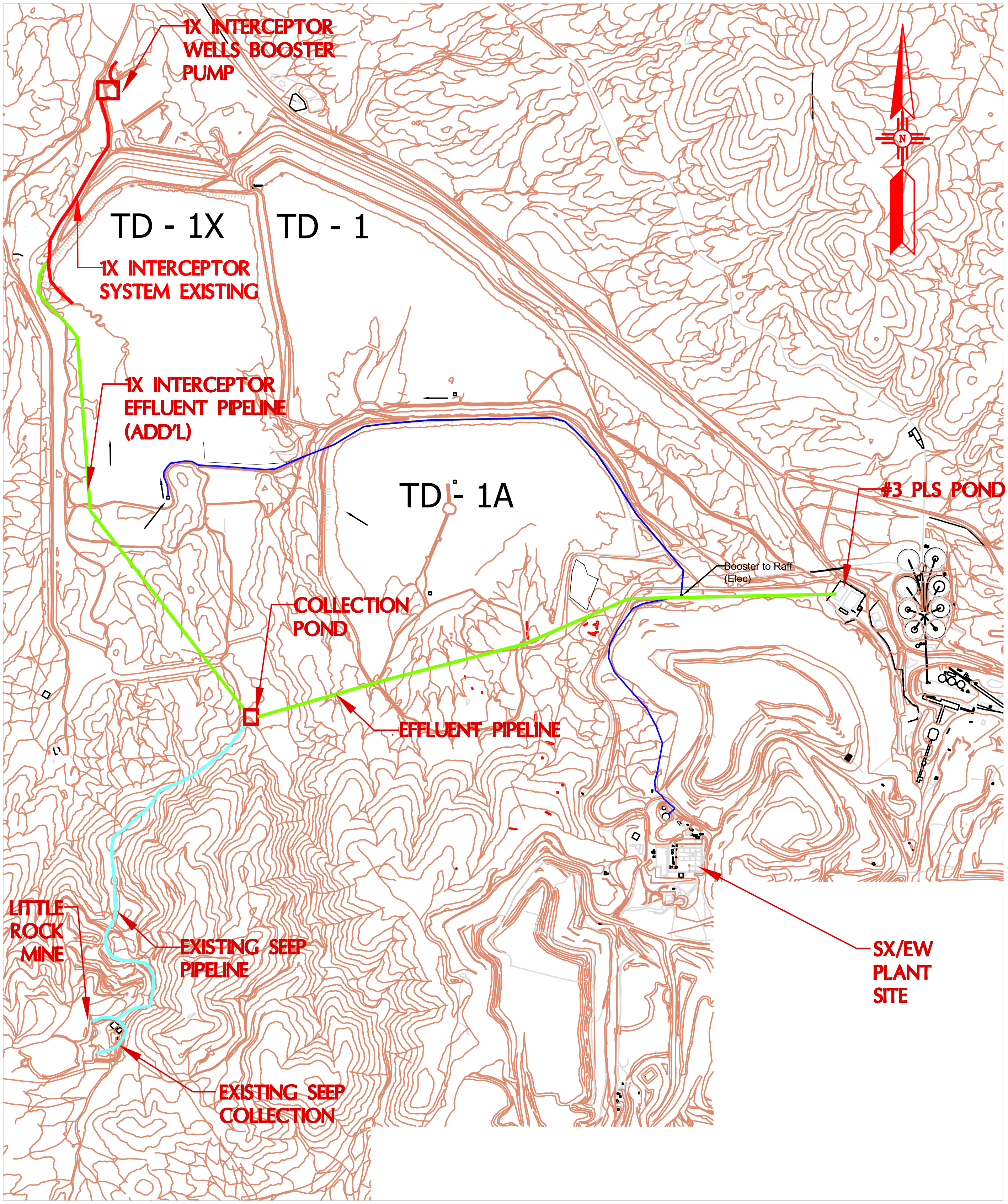
REVISIONS ---	DRAWING #1X INTERCEPTOR WELLS EVAPORATOR AT CONCENTRATOR THICKENERS ALTERNATIVE #5	DWG BY: WM JOB #: PDT0505P SCALE: NTS	SHEET INT5
DATE 9/02/05	PROJECT 1X EFFLUENT ELIMINATION PHELPS DODGE, TYRONE	PATH: P:\PDT0505P/1X INTERCEPTOR WELLS\1XINTERCEPTWELLS.DWG	



ENGINEERS INC 301 W. COLLEGE AVE. SUITE 1 SILVER CITY, NEW MEXICO (505) 538-5395 (OFFICE) (505) 538-5410 (FAX)	REVISIONS ---	DRAWING #1X INTERCEPTOR WELLS COMMINGLED EFFLUENTS DISC'D TO #1X BOOSTER ALTERNATIVE #4	DWG BY: WM JOB #: PDT0505P SCALE: NTS	SHEET INT4
	DATE 9/02/05	PROJECT 1X EFFLUENT ELIMINATION PHELPS DODGE TYRONE	PATH: P:\ PDT0505P/1X INTERCEPTOR WELLS \1XINTERCEPTWELLS.DWG	



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REVISIONS	DRAWING	DWG BY: PAS	SHEET
---	#1X INTERCEPTOR WELLS COMMINGLED EFFLUENTS DISC'D TO #3 PLS ALTERNATIVE #3	JOB #: PDT0505P	INT3
DATE	PROJECT	SCALE: NTS	
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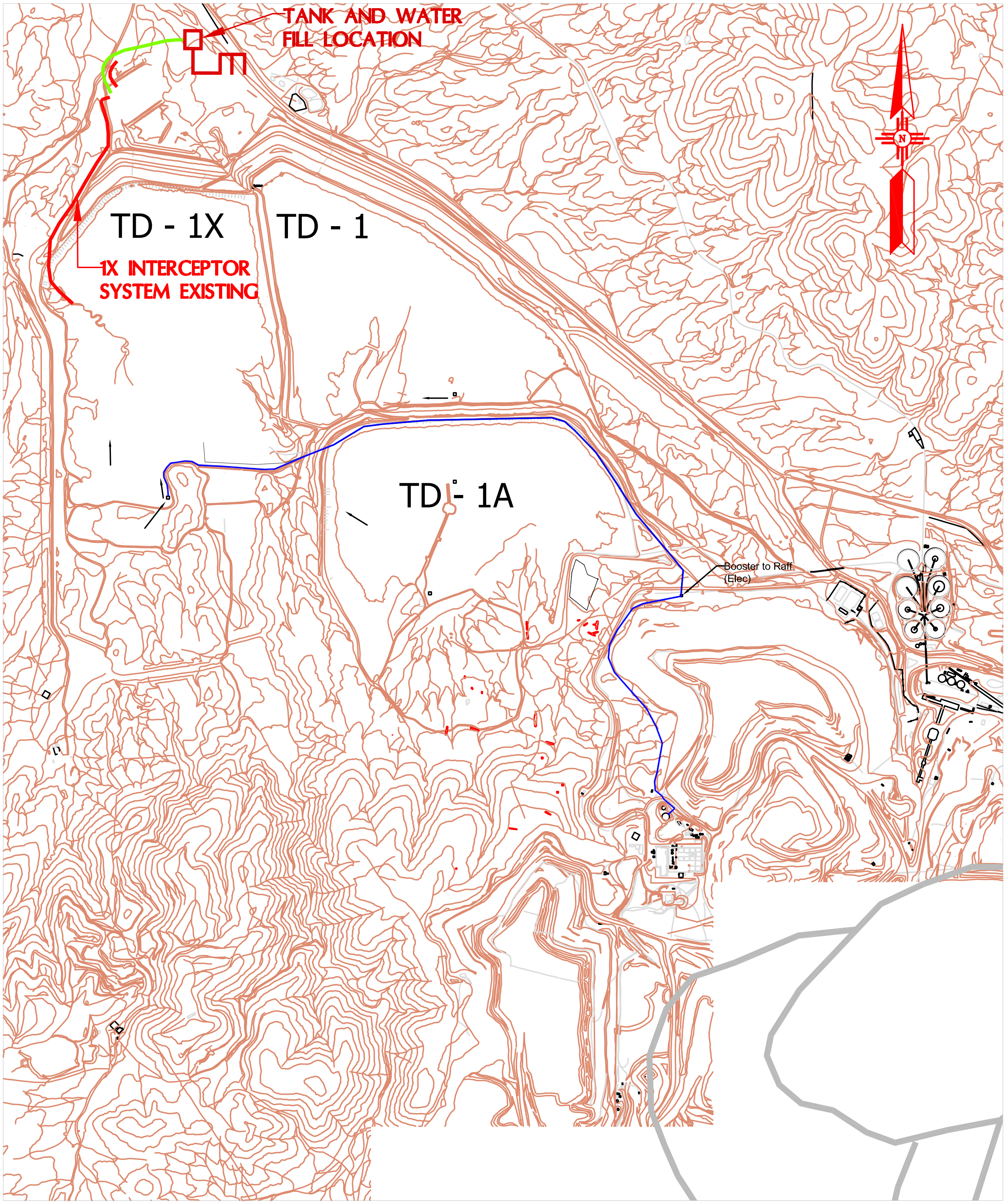

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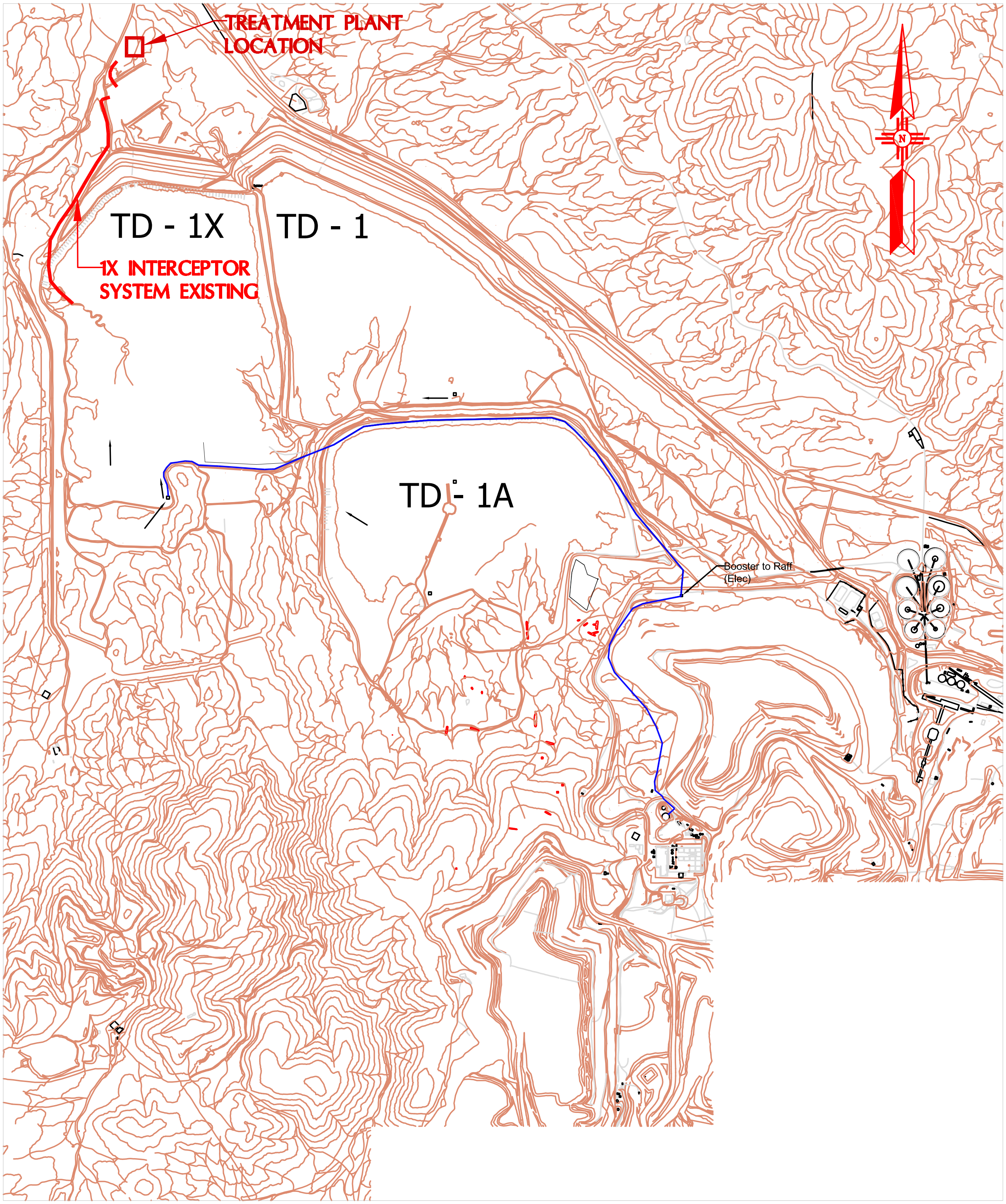
REVISIONS ---	DRAWING #1X INTERCEPTOR WELLS WATER FILL LOCATION ALTERNATIVE #2	DWG BY: WM JOB #: PDT0505P SCALE: NTS	SHEET INT2
DATE 9/02/05	PROJECT 1X EFFLUENT ELIMINATION PHELPS DODGE, TYRONE	PATH: P:\PDT0505P/1X INTERCEPTOR WELLS \1XINTERCEPTWELLS.DWG	



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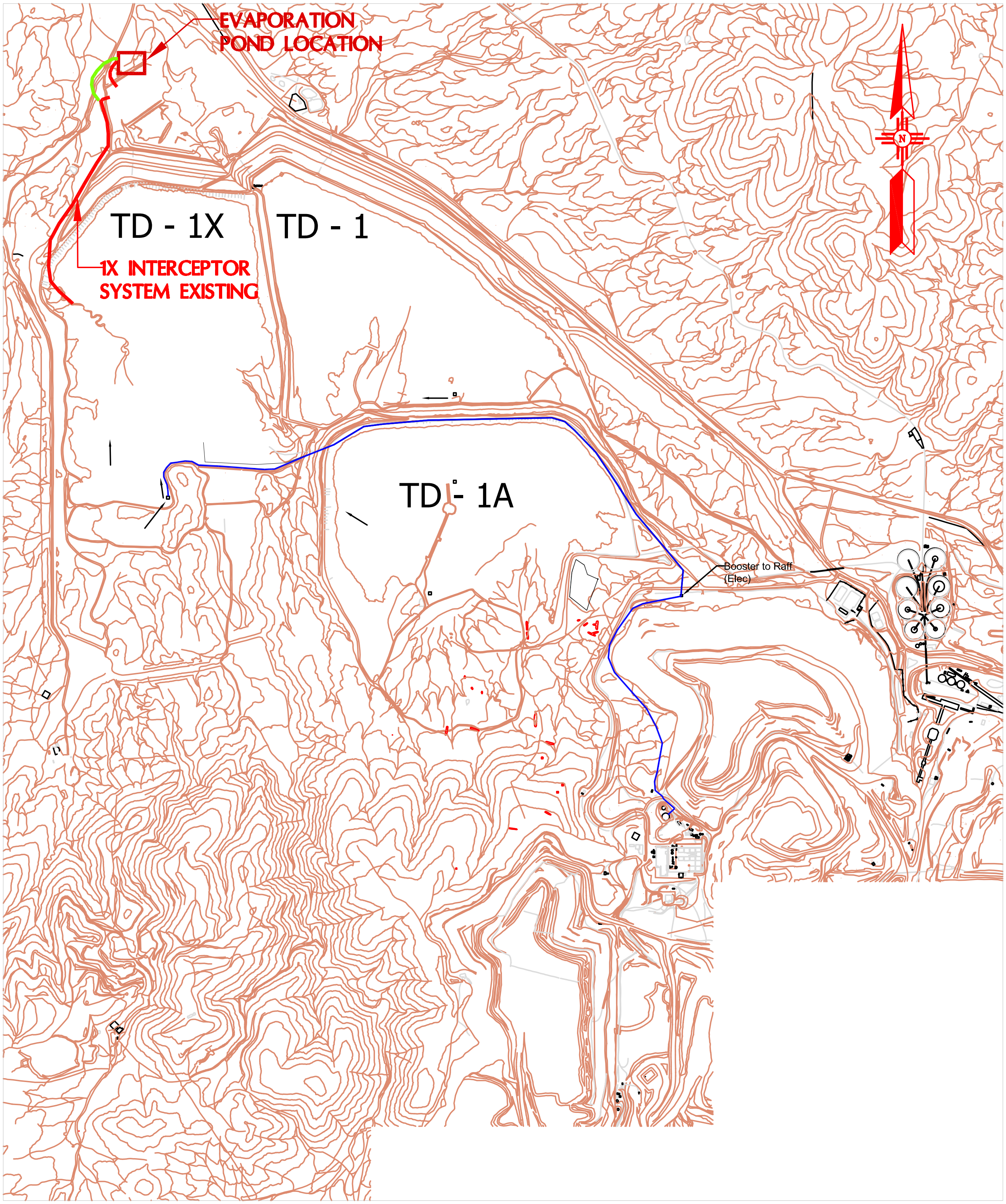
REVISIONS	DRAWING		
---	#1X INTERCEPTOR WELLS TREATMENT PLANT LOCATION ALTERNATIVE #1	DWG BY: WM JOB #: PDT0505P SCALE: NTS	SHEET INT1
DATE 9/02/05	PROJECT 1X EFFLUENT ELIMINATION PHELPS DODGE, TYRONE	PATH: P:\ PDT0505P/1X INTERCEPTOR WELLS \1XINTERCEPTWELLS.DWG	



ENGINEERS INC 301 W. COLLEGE AVE. SUITE 1 SILVER CITY, NEW MEXICO (505) 538-5395 (OFFICE) (505) 538-5410 (FAX)	REVISIONS ---	DRAWING	#1X INTERCEPTOR WELLS EVAPORATION POND ALTERNATIVE #6	DWG BY: WM JOB #: PDT0505P SCALE: NTS	SHEET INT6
	DATE 9/02/05	PROJECT	1X EFFLUENT ELIMINATION PHELPS DODGE TYRONE	PATH: P:\ PDT0505P/1X INTERCEPTOR WELLS \1XINTERCEPTWELLS.DWG	