Himmetdede Heap Leach Pad Prefeasibility Design

Report Prepared for

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Report Prepared by

SRK Consulting (U.S.), Inc.
216003
March 2012

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Executive Summary

The Himmetdede Project is located in central Anatolia approximately 35 kilometers (km) northwest of Kayseri, along road D260, and adjacent to the village of Himmetdede. The Project is located at an elevation of approximately 1,200 meters (m) and the project rises approximately 200 m above the village. The project is in an area of low relief with broad rolling hills in Central Anatolia between Ankara and Kayseri.

SRK Consulting (US), Inc. (SRK) issued a conceptual report titled "Himmetdede Heap Leach Pad Conceptual Design" (SRK, 2011). SRK considered available area and capital costs in selecting the heap leach pad that was most suitable for the site, and SRK selected an on-off heap leach pad (OHLP) from a footprint and cost perspective. Three potential heap leach sites were considered, and based on comments from Koza, SRK developed an OHLP design for the option that was closest to the mine and highway.

Samples of 32 mm and 9.5 mm nominal material (P_{80}) for the Project have been provided to McClelland Laboratories, Inc. (McClelland) from Sparks, Nevada for metallurgical testing. As of the effective cut-off date for the Himmetdede Project (Project), SRK did not have any site-specific ore material that could be tested for material properties. Therefore, SRK made assumptions on material properties to develop the HLP designs, and assumed conservative lift heights in the order of 4 m, which will be confirmed in subsequent stages of design.

The objective of this study is to provide a prefeasibility (PFS) level design for a Heap Leach Pad (HLP) at the Himmetdede Project (Project) that could contain approximately 29 million tonnes (Mt) of ore, corresponding to eight years of mining, at a rate of 11,000 tonnes per day (11 ktpd) and operating 360 days per year. SRK designed the OHLP with a composite liner configuration to minimize leach solution losses, along with an Overliner system comprised of free draining gravel and piping system to allow for timely solution recovery. Depending on the spent ore rinsing or detoxification method used, the ore may still need to be placed within an area that has a barrier system of some type and any recovered solution collected. Therefore, after the leaching has been completed and rinsing and draindown cycle of the ore has been completed, the spent ore would be removed from the OHLP and transported to the Spent Ore Facility (SOF). SRK's design allowed for a conveyor stacking and front end loader reclaim system.

Based on the cost assumptions developed in the report, SRK developed the Life of Mine (LoM) capital and operating cost estimate to be $133.5 MUSD The cost estimate includes a contingency (usually 35%) which is typical for a PFS level design.

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Disclaimer

Heap Leach Pad Prefeasibility Level Engineering Design - Himmetdede Project

The following document for the Himmetdede Gold Heap Leach Project has been prepared by the staff of SRK Consulting (US), Inc. (SRK) for Koza Altin Isletmeleri A.S. (Koza).

The report, figures, drawings and appendices for the Himmetdede Heap Leach Project facilities are presented within the limits described by Koza, and were prepared in accordance with generally accepted professional engineering principles and practice.

The opinions expressed in this Report have been based on the information supplied to SRK by Koza and are provided in response to a specific request from Koza to do so. SRK has exercised all due care in reviewing the supplied information. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them.

This document was prepared for the exclusive use of Koza and their staff and consultants for specific application of the Himmetdede Heap Leach Project. The findings, recommendations, and conclusions for this design are based on results of engineering analysis and review of information from SRK and Koza files, combined with SRK's experience on similar projects and understanding of the Project as stated in this document. If changes occur, the design documents presented herein will not be considered valid unless the changes are reviewed by SRK and the appropriate conclusions of this document are modified and verified in writing.

Neither SRK nor any of the authors of this report have any material present or contingent interest in the outcome of this report, nor do they have any pecuniary or other interest that could be reasonably regarded as being capable of affecting their independence or that of SRK. SRK's fee for completing this Report is based on its normal professional daily rates plus reimbursement of incidental expenses. The payment of that professional fee is not contingent upon the outcome of the Report.

List of Abbreviations

Abbreviation	Unit or Term
ATP	ATP İnşaat ve Ticaret A.Ş
BMP	Best Management Practices
°C	Degrees Celsius
CAPEX	Capital Expenditure
cm/sec	Centimeter per second
°	Degree (degrees)
DHLP	Dedicated Heap Leach Pad
Dwg	Drawing
EPCM	Engineering, Procurement and Construction Management
Fig	Figure
HDPE	High Density Polyethylene
H:1V	Horizontal to Vertical
HLP	Heap leach pad
HTVL	High tension voltage line
hr	Hour
ID	Inside Diameter
IFC	Issued for Construction
ILHLP	Interlift Heap Leach Pad
KIH	Koza-İpek Holding A.Ş.
kg/m^3	kilogram per cubic meter
km	Kilometer
Koza	Koza Altin Isletmeleri A.S.
kPa	Kilopascals
ktpd	Thousand tonnes per day
LCRS	Leak Collection Recovery System
$L/hr/m^2$	Litres per hour per square meter
LDS	Leak Detection System
LoM	Life of Mine
m	Meter
Mm^2	Million square meters
mm	Millimeter
MCE	Maximum Credible Earthquake
Mt	Million tonnes
NMAS	Normandy Madencilik A.Ş.
OHLP	On-off heap leach pad
OPEX	Operating Expenditure

PCPE	Perforated, corrugated, single-walled polyethylene
PGA	Peak ground acceleration
PLS	Pregnant Leachate Solution
psi	Pounds Per Square Inch
SOF	Spent Ore Facility
SRK	SRK Consulting, Inc.
tpd	tonnes per day
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
m^3	cubic meter

The metric system has been used throughout this report unless otherwise stated.

1 Introduction

In March 2005, Koza-İpek Holding A.Ş. (KIH) and ATP İnşaat ve Ticaret A.Ş, (ATP), an indirectly owned subsidiary of KIH, and together with KIH, collectively the "Koza Group", acquired 40% and 60%, respectively, of the shares of Normandy Madencilik A.Ş. (NMAS) from Newmont Mining Corporation Limited (Newmont). Subsequent to the Koza Group's acquisition of NMAS, NMAS's name was changed to its current name, Koza Altın İşletmeleri A.Ş. (Koza). In 2005, Koza became the first Turkish company in the history of the Republic of Turkey to realize gold production within Turkey. Koza's mission is to carry out gold mining operations using the best available technology while displaying the highest environmental performance.

The Himmetdede Project is located in central Anatolia approximately 35 kilometers (km) northwest of Kayseri, along road D260, and adjacent to the village of Himmetdede.

On August 15, 2011, SRK Consulting (US), Inc. (SRK) issued a conceptual report titled "Himmetdede Heap Leach Pad Conceptual Design" (SRK, 2011). SRK considered available area and capital costs in selecting the heap leach pad that was most suitable for the site and SRK selected an on-off heap leach pad from a footprint and cost perspective. Three potential heap leach sites were considered, and based on comments from Koza, SRK developed an on-off heap leach pad (OHLP) design for the option that was closest to the mine and highway.

1.1 Scope of Work

The objective of this study is to provide a prefeasibility (PFS) level design for a Heap Leach Pad (HLP) at the Himmetdede Project (Project) that could contain approximately 29 million tonnes (Mt) of ore, corresponding to eight years of mining, at a rate of 11,000 tonnes per day (11 ktpd) and operating 360 days per year. The scope of work performed by SRK for this report is outlined in the proposal for the PFS design for the Himmetdede OHLP (SRK, 2011a), and generally includes the following:

- Develop a PFS level OHLP facility design, based on design criteria that have been developed with the client;
- Using the available site topographic contours provided by Koza, develop an OHLP option and layout;
- Develop capital and operating cost estimates; and
- Provide a basis for detailed design and site characterization study recommendations.

1.2 Report Layout

The layout of the Design Report is as follows:

- Section 1 presents a brief introduction to the Project and an outline of the report;
- Section 2 provides a Project description and design criteria for the Project;
- Section 3 discusses the geotechnical, geological, and hydrogeological conditions in the Project area;
- Section 4 discusses the OHLP siting and recommendations;
- Sections 5, 6 and 7 describes the OHLP, Solution Pond and Spent Ore Facility (SOF) Design, respectively;
- Section 8 discusses material handling;
- Section 9 presents costing considerations;

- Section 10 presents the OHLP capital and operating cost estimate;
- Section 11 discusses environmental considerations; and
- Section 12 presents conclusions and recommendations for the Project.

1.3 Project Team

The following staff members from SRK were involved with this study:

- Dr. Dirk van Zyl: Senior Technical Reviewer;
- Terry Mandziak: Principal Engineer and Project Manager – Heap Leach Design;
- John Danio: Principal Associate Engineer;
- Eric Johnson: Senior Engineer; and
- Brian Ward: Staff Civil Engineering Consultant.

The SRK team was ably assisted by Koza staff.

2 Project Description and Design Criteria

2.1 General Site Location

The Himmetdede Project is located in central Anatolia approximately 35 km northwest of Kayseri, along road D260, and adjacent to the village of Himmetdede, as shown in Drawing 1.

The Project is located at an elevation of approximately 1,200 meters (m) and the project rises approximately 200 m above the village. The project is in an area of low relief with broad rolling hills.

2.2 Design Criteria

Appendix A presents typical design criteria and parameters that were utilized for the OHLP design, generally based on assumed values or previous experience on other projects. As part of subsequent levels of design, SRK recommends that a set of site specific design criteria should be developed.

2.2.1 Average Annual Precipitation and Evaporation

The Himmetdede Project is located in Central Anatolia between Ankara and Kayseri. This is a region with a continental climate, i.e. cold, harsh winters and dry summers with moderate to hot temperatures. Average temperatures range from 0°C in January to 22°C in July and August. The maximum temperatures may reach 40°C in the summer. Local rainfall data indicates average annual precipitation is 350 to 400 millimeters (mm), which falls as rain during the summer months and snow during the winter months.

Climatological data is presented in Appendix A, and summarized below.

Table 2-1: Climatological Data

Month	Average Precipitation (mm)	Average Evaporation (mm)	Average Minimum Temperature (°C)	Average Maximum Temperature (°C)
Jan	31.7	0	-6.9	3.8
Feb	33	0	-5.3	5.7
Mar	41.1	0.6	-1.5	11.5
Apr	56.3	58	3.5	17.6
May	57.4	124.5	6.8	22.1
Jun	36	172	9.7	26.7
Jul	13.1	216.5	12.1	30.5
Aug	6.5	201.6	11.5	30.6
Sep	11.4	140.4	7.4	26.5
Oct	33.3	68.9	3.8	20.2
Nov	38.2	1.7	-1.1	12.2
Dec	39.4	0	-4.7	5.8
Annual	397.4	984.2	2.9	17.8

2.2.2 Storm Events

SRK did not have site specific storm event data. For the purpose of the PFS, a 100-year, 24-hour storm event of 100 mm was assumed.

2.2.3 Topography

The site topography was provided by Koza and was generated on 5 m contour intervals.

3 Site Geotechnical, Geological and Hydrogeological Setting

3.1 Site Reconnaissance

As part of the conceptual scope, Mr. Terry Mandziak of SRK and Mr. Serhan Umurhan of Koza visited the Project site. Two site visits were made as part of the conceptual level field reconnaissance for the OHLP design: the first on March 17 and 18, 2011; and the second on May 12, 2011.

As part of the PFS scope, Mr. Terry Mandziak of SRK was onsite during part of the Phase I geotechnical program, on October 17 and 18, 2011. This is discussed in more detail in Section 3.7.

3.2 Geology

The hilly parts of the Himmetdede region consist of Lutetian Formation marbles and metamorphic rocks. Marbles are course- to fine-grained, crystalline and sometimes the presence of breccia zones is observed. The rocks are grey-white, pink or purple. The thickness of these marbles is about 20 to 30 cm but at places they are thicker and more massive. In some places marble levels are interbedded with chlorite schists. The Lutetian and Neogene aged geological formations are found within the OHLP and SOF areas.

The Miocen aged Neogen formation is composed of the following:

- Lacustrine Limestone; the lacustrine limestone which are generally flaggy (5 to 10 cm in thickness) or travertine in structure or passing from one to another laterally and vertically. These limestone layers overlie the marbles and crystalline schist levels;
- Tuffs; tuffs are generally 1 m thick and homogeneous in structure. Towards west they contain clay or sandy clayey beds. The color of these tuffs is generally white, pink and rarely black. These tuffs are used as building material all over the area; and
- Sandy, clayey, calcareous tuffs; these heterogeneous lake deposits generally are seen at the east and northeast of Himmetdede. At the project site, calcareous tuffs were only seen in Test Pits 24, 28 and 29.

3.3 Geologic Hazards

No geologic hazards investigation or characterization was performed as part of this study, and surface water data was limited to observations made as part of the field reconnaissance.

3.4 Seismicity

SRK undertook a review of the United States Geological Services (USGS) Seismic Hazard Setting Map (USGS, 2008), which provides an estimate of the peak ground acceleration (PGA) with a 10% chance of exceedance in 50 years, and is presented in Figure 1. Ground acceleration resulting from the Maximum Credible Earthquake (MCE) was estimated from the map as approximately 0.20 g.

3.5 Hydrogeology

No hydrogeologic investigation or characterization was performed as part of this study, and groundwater data was limited to a desktop review of existing information.

3.6 Surface Water

No surface water investigation or characterization was performed as part of this study, and surface water data was limited to observations made as part of the field reconnaissance. As the OHLP area is located near the top of the surface water basin area, SRK expects a relatively limited upgradient contributing area.

3.7 Geotechnical Investigation

3.7.1 Heap Leach Pad and Spent Ore Facility Foundation

A Phase I geotechnical program was performed by Fugro Sial Geosciences Consulting & Engineering Ltd. (Fugro) from October 17 through 19, 2011. The scope performed by Fugro consisted of the following items:

- Collect information about previous studies done on the project site and maps related with the study area;
- Excavate 35 Test Pits within the Mine, OHLP, SOF and Waste Rock Facilities, in order to determine the type, thickness, sequence, conditions and properties of the ground materials;
- Take representative bulk samples from the Test Pits for the laboratory works; and
- Perform geotechnical laboratory tests on the bulk samples from Test Pits.

The results of the Phase I program are presented in Appendix B.

3.7.2 Ore Characterization

Samples of 32 mm and 9.5 mm nominal material (P_{80}) for the Project have been provided to McClelland Laboratories, Inc. (McClelland) from Sparks, Nevada for metallurgical testing. As of the effective cut-off date for the Project, SRK did not have any site-specific ore material that could be tested for material properties. Therefore, SRK made assumptions on material properties to develop the HLP designs, which are discussed in subsequent sections and will need to be confirmed as part of the next stage of design.

Core photographs from a typical drillhole showed a high clay content, and the highly fractured appearance suggests that the ore will require agglomeration. SRK assumed conservative lift heights in the order of 4 m, which will be confirmed in subsequent stages of design.

3.7.3 Borrow Materials

Limited geotechnical investigations were performed as part of this study, and geotechnical data was limited to the Phase I Field Program and a desktop review of existing information. Therefore, SRK made assumptions on material properties to develop the OHLP design, which are discussed below and will need to be confirmed as part of the next stage of design.

Compacted Fill

From the Phase I Geotechnical Program, SRK assumed that local cut materials would be available for fill material required to meet the design grades. After removal of the topsoil and other deleterious materials, proper moisture conditioning and compactive efforts of excess cut could be used for Compacted Fill.

Soil Liner

The Phase I Geotechnical Program identified a potential Soil liner fill borrow source. Three permeability tests were performed, each of which achieved a permeability less than $1x10^{-6}$ cm/sec.

Overliner

While crushed ore is generally preferred as a source for Overliner material, the core photographs and SRK experience suggest that the material will not be durable enough to meet the Overliner requirements.

Koza had identified an offsite granite source located about 10 km from the OHLP site. Additional characterization work will need to be performed to verify that the physical and chemical durability meet the project requirements.

3.7.4 Blasting Rock Removal

During the geotechnical investigation of the heap leach pad site it was determined that a layer of rock was located directly under the proposed site that will require blasting for removal. Based on the following sources of information a rock surface was established:

- Phase 1 Geotechnical Report;
- Phase 2 Geotechnical Report; and
- Site Investigations by SRK Staff.

Required blasting volumes were then calculated based on the following criteria:

- Minimum blasting depth of 1m; and
- Overblasting depth of 0.5 meters to ensure a competent base for compacted fill.

A final blasting volume of approximately 122,700 m^3 was calculated for the base OHLP design.

Quantities were estimated assuming 5% of the compacted fill volume of the ponds.

4 Heap Leach Pad Siting

As part of the Conceptual OHLP Design (SRK, 2011) SRK evaluated site-specific criteria, such as ore characteristics, available area, and costs, considering the following OHLP options for the Himmetdede Project:

- Dedicated Heap Leach Pad (DHLP);
- Heap Leach Pad with Interlift liners (ILHLP); and
- OHLP with conveyor stacking and front end loader reclaim system.

Based on an inspection of the core and core photos, SRK had assumed that the ore would require agglomeration and that ore lift heights would be in the order of 4 m. Therefore, for the purpose of the conceptual study, SRK selected an OHLP from a footprint and cost perspective. This assumption was continued as part of the PFS design, and will need to be confirmed in subsequent stages of design.

During the conceptual study site visit, three potential OHLP sites were identified in the area around the Himmetdede open pit mine, and include the following information:

- Option 1: Area northwest of the town of Tathasankuyusu, north of the mine and west of railroad tracks;
- Option 2: Area northwest of the town of Himmetdede; and
- Option 3: Area west of the town of Duver.

SRK developed a set of ranking criteria that can be used in a semi-quantitative evaluation system. Based on the siting study performed, Option 2 was selected as the preferred location for the OHLP, and was used in the PFS.

5 On Off Heap Leach Pad Design

The OHLP was designed based on the following operating requirements:

- 11 ktpd crushed and agglomerated ore;
- 70-day leach cycle;
- Maximum stacked ore height of 4 m;
- Nominal or angle of repose of 1.3 H:1V;
- Average inplace ore dry density of 1,600 kilograms per cubic meter (kg/m^3); and
- 100-year, 24-hour Design Storm Event.

5.1 On Off Heap Leach Pad Size and Configuration

For each the OHLP design and configurations considered, the maximum layout was generally constrained by the following:

- To the north and east, by a 500 m buffer between the OHLP limits and the railroad line;
- To the south, by a 500 m buffer between the OHLP limits and the highway;
- To the east, by a 1000 m buffer between the OHLP limits and the town of Duver;
- Twin high tension voltage lines (HTVL) that run through the center of the Project; and
- A buried natural gas line that runs through the center of the project.

Physical constraints and buffers were discussed in the conceptual report (SRK, 2011), along with the basis for recommending an OHLP.

5.2 On Off Heap Leach Pad Liner System

5.2.1 Composite Liner System

The composite liner configuration for the Project was selected to minimize leach solution losses which could be mainly due to defects in geomembrane manufacturing process or damage from the installation and construction.

SRK developed the PFS design to have the following configuration (from bottom to top):

- Prepared subgrade;
- 300 mm thick low permeability Soil Liner compacted to achieve a minimum permeability of $1x10^{-6}$ centimeters per second (cm/sec); and
- 2.0 mm High Density Polyethylene (HDPE) geomembrane synthetic liner.

No Leak Detection System (LDS) has been proposed in the OHLP PFS design, as the above liner configuration was considered to minimize the risk of operational seepage losses.

5.3 On Off Heap Leach Pad Solution Collection System

SRK has defined the Solution Collection system for the OHLP as the Overliner and the Solution Collection Piping. The design of these two components is discussed in the following sections.

5.3.1 On Off HLP Overliner Design Considerations

The Overliner for the OHLP was designed to account for the following:

- Construction and Static Loading. Static loading conditions refer to the ore placed at a depth of 4 m and correspond to a normal load of approximately 60 kilopascals (kPa) assuming an ore density of 1,600 kg/m^3. This is a relatively minor static load and the Overliner thickness should be based on construction placement limitations and should not be less than 600 mm (i.e., there is sufficient Overliner to prevent construction equipment damage to the geomembrane);
- Dynamic Loading. Ore will be placed onto the Overliner using one of either:
  - A track mounted ore stacking system and removed using a track mounted reclaiming system. Data provided from the manufacturer of the system indicate a maximum track/soil contact pressure of approximately 200 kPa (29 pounds per square inch (psi)) when a loaded tripper is working directly over a single track. For the dynamic loading conditions, SRK developed the design with a minimum of 600 mm of Overliner should be placed over the Geomembrane; and
  - Grasshoppers and removal with loaders. Ground contact pressures of wheel mounted equipment are significantly higher than track mounted equipment, and can be in the range of 550 to 690 kPa (80 to 100 psi). For this condition, SRK considered a minimum Overliner thickness of 900 mm ; and
- Overliner Performance. A key issue that impacts the performance of an OHLP is the long term performance of the Overliner material. The performance of the Overliner is particularly sensitive to a low permeability boundary that can be created at the Ore and Overliner interface from one, or a combination of, the following:
  - During the spent ore reclaiming process, the tracks from the reclaim stacker or wheels from the loader can compact the surface and ripping this interface is a common means of improving the permeability. The ripping process usually mixes the spent ore and the Overliner surface material, creating a layer or interface that has a lower permeability;
  - Breakdown of particles from the repeated trafficking of the stacking and reclaiming equipment on the Overliner surface, as well as any other mechanical equipment that may be working on the Overliner surface; and
  - The migration of fines from the ore through the leaching process.

In addition to increasing the solution recovery time, decreasing the permeability of the Overliner at this interface would increase the thickness of the saturated zone in the ore and could adversely impact the stability of the stacked ore.

While SRK has made recommendations for the thickness of the Overliner material based on static, dynamic, and construction loading, SRK has designed the OHLP so that additional 300 mm of Overliner material can be placed to allow for Overliner material being removed via the reclaimer (and replaced by regular construction methods) every two years in order to maintain an efficient and effective permeability at the Ore / Overliner interface.

For the material handling system proposed, SRK recommended an Overliner thickness of 1200 mm to account for the increase static and dynamic loading.

5.3.2 On Off Heap Leach Pad Solution Collection Piping

SRK would propose a solution collection system that consists of a solution collection piping network placed directly on the geomembrane liner and buried within the Overliner material. The solution collection piping system was designed to meet the following criteria:

- Generate a maximum head of 300 mm on the Geomembrane;
- Convey the design flow capacity of the pipe, considering the maximum length of each pipe, the pipe spacing (calculated from the maximum head calculations) and the design solution application rate of 10 L/hr/m^2;
- Pipe loading, considering both static and cyclic loading; and

- Minimize thermal expansion.

SRK would propose the following Solution Collection configuration for the OHLP:

- Tertiary solution collection pipes consisting of 100 mm inside diameter (ID) perforated, corrugated, single-walled polyethylene (PCPE), placed directly on the geomembrane at a 1% grade;
- Secondary solution collection pipes, such as 251 mm ID double walled PCPE or 380 mm ID double walled PCPE. The pipes would be placed in Solution Trench with a minimum flow line grade of about 1%; and
- At the edge of the OHLP, solutions from the Secondary HDPE pipes would then be transferred into an open trench or an HDPE SDR 17 / PN 10 Primary solution collection pipe to the Solution Ponds.

5.4 On Off Heap Leach Pad Closure

SRK developed the PFS cost estimate, assuming the following reclamation activities for the OHLP area:

- Spent ore from the OHLP, including Overliner material, would be removed after the last leach cycle and placed in the SOF;
- The OHLP geomembrane would be cut, removed and placed within in the Solution Pond footprint by the general labor crew; and
- The OHLP area would be regraded to blend with natural contours by the general labor crew and covered with 300 mm of topsoil.

6 Solution Pond Design

6.1 Solution Pond Sizing and Configuration

Typically, a site specific water balance is developed in order to adequately size the Solution Ponds as well as to identify any makeup water needs or excess water treatment requirements. This water balance model is typically developed on a monthly basis, and reflects seasonal variations in precipitation, evaporation and operating parameters (leach cycle, irrigation rates, etc.). Using the project design criteria, the water balance considers inflow (such as precipitation and solution application), as well as outflows (such as evaporation from both pad and pond areas and losses due to ore uptake), as well as changes in the heap leaching parameters (ore loading, losses due to ore uptake, etc.) on a monthly basis.

A site specific water balance was constructed using an Excel™ spreadsheet developed specifically for the Himmetdede Project. A general discussion of the water balance components and results appears below in section 6.1.1. An electronic and hard copy of the water balance spreadsheet along with a detailed column by column description of the water balance calculations appears in Appendix C.

6.1.1 Water Balance Calculations and Results

The Solution Pond system was developed utilizing the following mass balance systems as described below and presented in Appendix C:

- Mass Balance 1 (OHLP Active Leaching Cells): Ore enters into the system from the mine where it is agglomerated and stacked on to the OHLP. Barren Solution enters Mass Balance 1 from the Process Plant, and is either used to wet the ore in the Agglomeration drum or is used to leach the ore. Pregnant solution is collected and reports to the Pregnant Pond, where gold is recovered and Barren Solution is re-introduced into the system. Mass Balance 1 is then used to size the Pregnant Pond;
- Mass Balance 2 (OHLP Rinsing Cells): At the end of leaching, ore from mass Balance 1 is rinsed with freshwater for 14 days to remove cyanide solution. The Rinse Solution then reports to a Rinse Pond, where it is pumped to the Process Plant and introduced into Mass Balance 1 as makeup water. Mass Balance 2 is then used to size the Rinse Pond, and any excess Rinse solution that the Process Plant cannot accept must be treated and discharged; and
- The Storm Pond sizing is independent of the Mass Balances, and based on the design storm event depth, multiplied by the total OHLP and Pond areas.

The results of the water balance for the active leaching cells (Mass Balance 1) indicate that the system is a net user, or requires makeup water addition. However, the rinse cells (Mass Balance 2) are a net water producer, or generates excess water. SRK investigated combining the two systems, performing a combined mass balance between excess water created annually by the rinsing system against the amount of make-up water by altering the application rate of the freshwater rinse solution. The effect of this overall water balance calculated a maximum rinse application rate of 1.50 l/hr/m^2 in order to achieve a net balance on an annual basis between Mass Balance 1 and Mass Balance 2. In other words, if the rinse application rate exceeds 1.50 l/hr/m^2, then water treatment of the rinse solution will be required. If the application rate is less than this amount then make-up water will be required for the process plant.

Table 6-1 shows the sizing for the Pregnant, Rinse and Storm Ponds as calculated from the water balance calculations.

Table 6-1: Pond Sizing

Output	Pregnant	Rinse	Storm
Max Pond volume (m^3)	7,500	38,000	27,000

6.1.2 Pond Configuration

The Ponds were designed based on the following operating requirements:

- 2.0 H:1V sideslopes; and
- 5 m maximum excavation depth.

6.1.3 Pond Liner System

There are two types of pond liner systems that have been designed for the Project, and they are as follows:

- Ponds that will be containing leach solution and having a head on the liner system on a regular basis have been designed with a double liner system and compacted low permeability soil. The double liner system will have a high permeability drainage layer that will allow solution that may leak from the upper Secondary geomembrane to be collected and removed via pumping, to minimize the head acting on the lower Primary geomembrane; and
- Ponds that will be containing solution on an infrequent basis have been designed with a single liner system.

6.1.4 Pregnant and Rinse Ponds

As the Pregnant and Rinse Ponds will have solution stored on a regular basis (and generate a corresponding head on the geomembrane), SRK proposes a design with the following double liner systems (from the foundation upward):

- Prepared subgrade;
- 300 mm thick low permeability Soil Liner compacted to achieve a maximum permeability of $1x10^{-6}$ cm/sec;
- 1.5 mil HDPE geomembrane secondary liner;
- Geonet drainage layer; and
- 1.5 mil HDPE geomembrane primary liner.

The HDPE geomembrane was selected due to its superior UV resistance as compared to other geomembrane materials.

The geonet will function as part of the Leak Collection Recovery System (LCRS). This layer has been added to prevent the excessive head being generated on the lower (Secondary) geomembrane should a defect or leak occur in the upper (Primary) geomembrane. The LCRS will have a highly permeable free draining geonet material, and any fugitive solution will be collected in the LCRS and flow via gravity to the LCRS sump where it can be collected and pumped back into the pond system. Beneath the geonet is an HDPE primary geomembrane, which will be installed on a layer of compacted low permeability soil liner material.

6.1.5 Stormwater Pond

As the Stormwater Pond will be used on an infrequent basis (during extreme storm events when the capacity of the other ponds has been exceeded), SRK would propose that the Stormwater Pond be designed with the following single liner configuration (from the foundation upward):

- Prepared subgrade;
- 300 mm thick low permeability Soil Liner compacted to achieve a minimum permeability of $1x10^{-6}$ cm/sec; and
- 1.5 mil HDPE geomembrane liner.

The HDPE geomembrane was selected due to its superior UV resistance as compared to other geomembrane materials.

6.2 Solution Ponds Closure

SRK developed the PFS cost estimate, assuming the following reclamation activities for the Solution Pond areas:

- The Solution Pond geomembrane would be cut, removed and placed within in the Solution Pond footprint by the general labor crew; and
- The Solution Pond areas would be regraded to blend with natural contours by the general labor crew and covered with 300 mm of topsoil.

7 Spent Ore Facility Design

Depending on the spent ore rinsing or detoxification method used, the ore may still need to be placed within an area that has a barrier system of some type and any recovered solution collected. Therefore, after the leaching has been completed and rinsing and draindown cycle of the ore has been completed, the spent ore would be removed from the OHLP and transported to the SOF. The difference between the SOF and the OHLP is that the SOF is typically designed for stability (which may include an elevated phreatic surface), not percolation and leaching of the ore.

The SOF was designed based on the following operating requirements:

- Total storage volume of 29.2 Mt, which corresponds to 8 years of storage operating at 360 days per year;
- Maximum spent ore height of 30 m (typical);
- Average inplace ore dry density of 1,600 kg/m^3; and
- Located within 3 km of the OHLP.

7.1 Spent Ore Facility Constraints

For each the SOF design and configurations considered, the maximum layout was generally constrained by the following:

- A 30 m maximum height;
- To the north and east, by a 500 m buffer between the OHLP limits and the railroad line;
- To the south, by a 500 m buffer between the OHLP limits and the highway;
- To the east, by a 1000 m buffer between the OHLP limits and the town of Duver;
- Twin HTVL that run through the center of the project; and
- A buried natural gas line that runs through the center of the project.

7.2 Spent Ore Facility Liner System

The liner configuration for the SOF was selected to minimize leach solution losses which could be mainly due to defects in geomembrane manufacturing process or damage from the installation and construction. However, consideration was given to the fact that spent ore was being permanently placed at a lower water content, and ore would not be subjected to secondary leaching. Therefore, SRK developed the PFS design of the SOF to have the following configuration (from bottom to top):

- Prepared subgrade;
- 300 mm thick low permeability Soil Liner compacted to achieve a minimum permeability of 1x10^{-6} cm/sec; and
- 1.5 mm High Density Polyethylene (HDPE) geomembrane synthetic liner.

No LDS has been proposed in the SOF PFS design.

7.3 Spent Ore Facility Solution Collection System

SRK has defined the Solution Collection system for the SOF as the Overliner and the Solution Collection Piping. The design of these two components is discussed in the following sections.

7.3.1 SOF Overliner Design Considerations

The Overliner for the SOF was designed to account for the following:

- Construction and Static Loading. Static loading conditions refer to the ore placed at a maximum depth of 30 m and correspond to a normal load of approximately 440 kPa assuming an ore density of 1,600 kg/m^3. This is a relatively minor static load and the Overliner thickness should be based on construction placement limitations and should not be less than 600 mm (i.e., there is sufficient Overliner to prevent construction equipment damage to the geomembrane); and
- Dynamic Loading. Ore will be placed onto the Overliner using one of either:
  - A wheel mounted portable conveying system. For the dynamic loading conditions, SRK developed the design with a minimum of 600 mm of Overliner should be placed over the Geomembrane; and
  - Trucks. Ground contact pressures of wheel mounted equipment are significantly higher than track mounted equipment, and can be in the range of 550 to 690 kPa (80 to 100 psi). For this condition, SRK considered a minimum Overliner thickness of 900 mm.

For the material handling system proposed, SRK recommends an SOF Overliner thickness of 900 mm to account for the static and dynamic loading.

7.3.2 On Off Heap Leach Pad Solution Collection Piping

As the spent ore material is not under active leach, SRK assumed that a solution collection system would not be required.

7.4 Spent Ore Facility Phased Design

In order to reduce the problems associated with storm water management, including ponding and potential flooding on the upstream face, along with deferring capital, the SOF could be constructed in phases. The SOF construction should start from the upgradient side in the uppermost portion of the proposed area, with downstream sections added in subsequent phases. This plan would allow surface water to be diverted around the SOF, allows the construction of the SOF to be completed in stages to reduce costs to later periods in the project's life, and while achieving a stable design.

In order to accommodate a phased approach, SRK developed a flexible design that allows for spent ore to be taken off the conveyor belt line at two points:

- The end of the discharge conveyor from the OHLP; and
- At the end of the first overland conveyor that parallels the SOF north-west corner.

7.5 SOF Closure

SRK developed the PFS cost estimate, assuming the following reclamation activities for the SOF areas:

- All side slopes of the SOF be final graded to a grade not to exceed 3 H:1V;
- The surface of the SOF regraded with a 1% cross slope;
- All side slopes be armoured with a 500 mm thickness of D_{50} = 250 mm rock; and
- The crest be covered with 300 mm of topsoil, and revegetated.

8 Material Handling and Equipment Design Considerations

The conveying system design assumed for OHLP loading and unloading was developed to provide robust and flexible operations. All the conveyors proposed have been designed to work as a team and share the following common characteristics:

- 750 tph capacity at 115 m/min belt speed; and
- 915 mm belt width.

Information provided by material handling vendors is presented in Appendix D.

8.1 Pad Loading System

Ore will be transferred from the crushing and agglomerating areas to the HLP area using a fresh ore fixed conveyer. The fixed conveyor has rail road rails on either side to accommodate a rail tripper. The rail tripper diverts the ore from the fixed conveyor and discharges the material onto the first of a series of grasshopper conveyors. The grasshoppers have been designed at 35 m lengths to provide maximum length consistent with stability and mobility, with the power and control logic interlocked. Each grasshopper has rubber tires for easy movement and has a feed hopper designed to receive material from another grasshopper. Based on the OHLP dimensions, ten grasshoppers will be needed to traverse the length of the OHLP.

The last grasshopper in the series then discharges onto the horizontal feed conveyor, which in turn discharges onto the horizontal conveyor. The horizontal feed conveyor and the horizontal conveyor are designed to work in concert with the conventional stacker. These two belts provide a flexible feed location for the conventional stacker so that 35 m of pad can be stacked before a grasshopper needs to be removed from the system. The horizontal feed conveyor is at an angle of 90 degrees to the other belts in the system and elevates the ore from the discharge elevation of the grasshopper to the higher elevation of the horizontal conveyor. The horizontal conveyors discharge elevation is fixed to the conventional stacker feed hopper.

The horizontal conveyor discharges to the conventional stacker which is the last conveyor in the system. The conventional stacker places the ore onto the OHLP. The conventional stacker is 36.5 m long with an extendable 6 m stinger belt for a total length of 42.5 m. The 36.5 m stacker operates over a 180 degree arc, and this geometry then defines the cell's typical width of 60 m with some overlap on the sides. The stacker places the ore in the OHLP at the design height, with the stacking height hydraulically adjusted, so that the ore depth can be varied should ore characteristics change. The traverse speed, or the rate at which the stacker moves along its arc, is hydraulically controlled so that operator can monitor the characteristics of the ore. Probes can be mounted on the end to automatically move the discharge position. The stinger belt, 6 m long, is set up to retract in 1 m increments so that the ore is stacked in thin layers with a reasonably smooth top surface. Once the stinger belt is completely retracted, the stacker is then moved up 6 m and operations resume.

8.2 Spent Ore Material Handling Options

Spent ore from the OHLP will be off-loaded using a front end loader that places spent ore from the pad onto a mobile conveyor hopper. The hopper dimensions are coordinated with the loader bucket width and normal dump height. The mobile conveyor hopper has a flight-type feeder in the hopper

bottom to positively move the spent ore onto an integral elevating belt that discharges onto the first of a series of eleven grasshopper conveyors. The last of the grasshoppers discharges the spent ore into the rail hopper which is mounted over the fixed conveyer located on the upgradient side of the OHLP.

SRK considered five options to place the spent ore from the leach pad onto the designed area, as follows:

- Overland Conveyors along NW side of pad with 3 grasshoppers, for elevation, and scrapers for final placement;
- Overland Conveyors and 20 grasshoppers with radial stacker;
- Overland Conveyors with 1 radial stacker, loader and trucks;
- No overland Conveyor(s) with 1 radial stacker, loader and trucks; and
- Overland Conveyor(s) to mid-point then loader and trucks, extend overland in year 3. A radial stacker would be used to provide stockpile capacity.

For PFS costing purposes, SRK costed the final option, and assumed that spent ore would be transferred to a 35 m long radial stacker at the end of the fixed conveyor, placing the spent ore material into a stockpile, with an estimated volume of 13 kt. A front end loader would load spent ore from the stockpile onto one of two trucks for transport to the SOF dump face. The face would be built in an up gradient manner, keying off of the internal berm, and use a tracked dozer for final maintenance. The top surface of the spent ore would be graded to direct any runoff to the northwest side where it would be added to any runoff from the plant or pad.

8.3 Material Handling Closure Considerations

SRK developed the PFS cost estimate, assuming the following reclamation activities for the Material handling corridors:

- All roadways connecting the OHLP and SOF be ripped to a depth of 150 mm, regraded to match the natural terrain, and revegetated;
- Surface infrastructure (piping and conveyors) removed; and
- Surface infrastructure areas regraded to blend with natural contours, covered with topsoil and revegetated.

9 Costing

9.1 Purpose and Scope of the Estimate

The PFS capital cost estimate for the Project provides the estimated cost to construct the OHLP proper and is to be used as part of an internal decision making process, document the design and assumptions, and provide recommendations to reduce the costing uncertainty. As no geotechnical investigations were performed as part of this study, SRK developed the PFS design and costing using the following assumptions and key observations made during the field reconnaissance:

- Excess cut material from within the HLP footprint is suitable for fill;
- Borrow materials (low permeability clays) meeting specified requirements are readily available onsite; and
- Overliner material will be from an offsite source.

9.2 Units of Measurement

All units are metric, unless otherwise noted.

9.3 Exchange Rates

Costs are provided in 2011 US dollars.

9.4 Take Off Procedures, Allowances and Factors

All earthworks quantities are taken off neat in place, with no allowance for swell or compaction of materials. Industry-standard allowances for swell and compaction are incorporated into the unit cost assumptions.

9.5 Contingency

Contingency is defined as an allowance to cover unforeseeable items within the scope of this capital cost estimate. Contingency can arise due to currently undefined items of work or equipment, lack of site-specific geotechnical data, uncertainty in the estimated quantities and unit prices for labor and equipment, or uncertainty in the estimated quantities and unit prices for labor, equipment, and materials. Contingency does not cover scope changes nor the Project exclusions noted.

Due to the lack of site-specific geotechnical data, it is difficult to quantitatively estimate the level of accuracy of the design. Therefore, SRK assigned a contingency for each item, based on the level of certainty. For example, for items such as the conventional stacker and grasshopper belts, in which quantities could be reasonably estimated and site-specific vendor quotes could be obtained, a contingency of 30% was assigned. For items such as the Low Permeability Soil Liner in which there was no data to support the quality and quantity assumptions, a contingency of 40% was assigned. The contingency was then weighted by the item costs, and an overall contingency was estimated.

9.6 Scope Items

The main cost items included in the HLP cost estimate are as follows:

- Site Preparation;
- Earthworks;

- Geosynthetics;
- Overliner;
- Piping;
- Miscellaneous Mechanical Equipment;
- Closure;
- Construction and Engineering;
- Contingency; and
- Operational Expenses

9.6.1 Site Preparation

Item 110: Mobilization and Demobilization

The Work shall provide for establishment of the site including mobilization of construction equipment, labor, materials, and temporary facilities including the setting up of temporary facilities including field offices, temporary utilities and services, as well as all other related activities and administration and overhead cost relative to site establishment.

Payment shall be lump sum, and was estimated to be 10% of the sum of earthworks, geosynthetics and miscellaneous costs.

Quantities were estimated assuming one mob/demob for one construction period.

Item 120: Clear and Grub

The Work shall include clearing and grubbing as required to remove vegetation prior to cutting and filling.

Payment shall be by the hectare.

Quantities were estimated using the ultimate OHLP footprint area, corrected for slope.

Item 130: Topsoil Removal and Stockpiling

The Work shall include the excavation, loading, hauling and stockpiling of an average of approximately 300 mm of growth medium prior to cutting and filling within the disturbance limits as shown on the drawings.

Payment shall be by the cubic meter of material.

Quantities were estimated using the ultimate OHLP footprint area, corrected for slope, and multiplied by a topsoil thickness of 300 mm.

9.6.2 Earthworks

Item 210: OHLP Over-excavation

The Work will include the excavation, loading, hauling, stockpiling and placement of waste or unsuitable foundation material from within the embankment limits of the OHLP.

Payment shall be by the cubic meter of material.

Quantities were estimated assuming 5% of the compacted fill volume.

Item 211: SOF Over-excavation

The Work will include the excavation, loading, hauling, stockpiling and placement of waste or unsuitable foundation material from within the embankment limits of the SOF pad.

Payment shall be by the cubic meter of material.

Quantities were estimated assuming 5% of the compacted fill volume.

Item 220: OHLP Compacted Fill (Regrading)

The Work shall include the excavation, loading, hauling, placing, moisture conditioning, oversize segregation, and compacting of Structural Fill within the OHLP area. Any cut shall be considered incidental to the Work. The source of compacted fill was assumed to be excess cut material from within the OHLP limits.

Payment shall be by the cubic meter of material.

Quantities were estimated by comparing the existing ground surface to the final regrade surface.

Item 221: SOF Compacted Fill (Regrading)

The Work shall include the excavation, loading, hauling, placing, moisture conditioning, oversize segregation, and compacting of Structural Fill within the SOF area. Any cut shall be considered incidental to the Work. The source of compacted fill was assumed to be excess cut material from within the SOF limits.

Payment shall be by the cubic meter of material.

Quantities were estimated by comparing the existing ground surface to the final regrade surface.

Item 230: OHLP Subgrade Preparation

The Work associated with the Subgrade Preparation includes the surface preparation prior to geomembrane deployment within the OHLP area.

Payment shall be by the square meter (neatline).

Quantities were estimated using the OHLP geomembrane area, corrected for slope.

Item 231: SOF Subgrade Preparation

The Work associated with the Subgrade Preparation includes the surface preparation prior to geomembrane deployment within the SOF area.

Payment shall be by the square meter (neatline).

Quantities were estimated using the SOF geomembrane area, corrected for slope.

Item 240: OHLP Soil Liner

The Work includes the excavation of suitable low permeability onsite material, processing and stockpiling for use as Soil Liner Fill. The Work shall include the loading, hauling, placing, grading, scarifying, moisture conditioning, and compacting as required. The borrow source was assumed to be within 3 km from the site.

Payment shall be by the cubic meter, based on a survey of the geomembrane area multiplied by the neatline thickness.

Quantities were estimated using the OHLP geomembrane area, corrected for slope, and multiplied by a neatline thickness of 300 mm.

Item 241: SOF Soil Liner

The Work includes the excavation of suitable low permeability onsite material, processing and stockpiling for use as Soil Liner Fill. The Work shall include the loading, hauling, placing, grading, scarifying, moisture conditioning, and compacting as required. The borrow source was assumed to be within 3 km from the site.

Payment shall be by the cubic meter, based on a survey of the geomembrane area multiplied by the neatline thickness.

Quantities were estimated using the SOF geomembrane area, corrected for slope, and multiplied by a neatline thickness of 300 mm.

Item 250: OHLP Single Anchor Trench

The Work shall include the excavation, shaping, and backfilling, including the supply and placement of Anchor Trench Backfill, for a single anchor trench. Anchor trenches shall be backfilled after deployment to prevent the geomembrane from pulling out of the anchor trench.

Payment shall be by the lineal meter (neatline).

Quantities were estimated by measuring the perimeter of the OHLP, and Storm Pond geomembrane area.

Item 251: SOF Single Anchor Trench

The Work shall include the excavation, shaping, and backfilling, including the supply and placement of Anchor Trench Backfill, for a single anchor trench. Anchor trenches shall be backfilled after deployment to prevent the geomembrane from pulling out of the anchor trench.

Payment shall be by the lineal meter (neatline).

Quantities were estimated by measuring the perimeter of the Spent Ore Facility geomembrane area.

Item 255: HLP Double Anchor Trench

The Work shall include the excavation, shaping, and backfilling, including the supply and placement of Anchor Trench Backfill, for a double anchor trench configuration. Anchor trenches shall be backfilled after deployment to prevent the geomembrane from pulling out of the anchor trench.

Payment shall be by the lineal meter (neatline).

Quantities were estimated by measuring the perimeter of the Pregnant and Rinse Ponds geomembrane area.

Item 260: Blasting

The Work shall include the drilling, loading, blasting and excavating of unrippable rock, with unrippable rock defined as material that cannot be ripped with two passes of a CAT D-9 class dozer with a single shank ripper. Oversized material may be hauled to an area approved by Owner at the Contractor's expense.

Blasting calculations are based on a minimum blasting depth of 1 meter with an overblast of 0.5 meter, within the limits of the OHLP and solution ponds. No blasting was assumed within the limits of the SOF. Payment shall be by the cubic meter.

9.6.3 Geosynthetics

Item 310: HLP 2.0mm HDPE Geomembrane

The Work shall include the manufacturing, supply and installation of a 2.0 mm smooth HDPE geomembrane. This Work shall include packaging, shipping, freight, unloading, stockpiling, staging, retrieving geomembrane material from storage area, deployment, seaming, testing, and protecting the geomembrane from weather during all phases of construction. Wastage, overlap and material installed in the anchor trenches shall be considered incidental to the Work.

Payment shall be by the square meter (neatline).

Quantities were estimated using the OHLP geomembrane footprint area, corrected for slope.

Item 320: OHLP 1.5mm HDPE Geomembrane

The Work shall include the manufacturing, supply and installation of a 1.5 mm smooth HDPE geomembrane. This Work shall include packaging, shipping, freight, unloading, stockpiling, staging, retrieving geomembrane material from storage area, deployment, seaming, testing, and protecting the geomembrane from weather during all phases of construction. Wastage, overlap and material installed in the anchor trenches shall be considered incidental to the Work.

Payment shall be by the square meter (neatline).

Quantities were estimated using the Storm Pond geomembrane footprint area, corrected for slope.

Item 321: SOF 1.5mm HDPE Geomembrane

The Work shall include the manufacturing, supply and installation of a 1.5 mm smooth HDPE geomembrane. This Work shall include packaging, shipping, freight, unloading, stockpiling, staging, retrieving geomembrane material from storage area, deployment, seaming, testing, and protecting the geomembrane from weather during all phases of construction. Wastage, overlap and material installed in the anchor trenches shall be considered incidental to the Work.

Payment shall be by the square meter (neatline).

Quantities were estimated using the SOF geomembrane footprint area, corrected for slope.

Item 325: Solution Ponds 1.5mm HDPE Geomembrane (Double) and Drain Net

The Work shall include the manufacturing, supply and installation of both the upper and lower a 1.5 mm smooth HDPE geomembrane and drainage geonet. This Work shall include packaging, shipping, freight, unloading, stockpiling, staging, retrieving geomembrane material from storage area, deployment, seaming, testing, and protecting the geomembrane from weather during all

phases of construction. Wastage, overlap and material installed in the anchor trenches shall be considered incidental to the Work.

Payment shall be by the square meter (neatline).

Quantities were estimated using the geomembrane footprint area for the Pregnant and Rinse Ponds, corrected for slope.

9.6.4 Overliner

Item 410: OHLP Overliner

The Work shall include the drilling, blasting, crushing, loading, hauling, placement and grading of the Overliner. The borrow source was assumed to be 10 km from site.

Payment shall be by the cubic meter, based on a survey of the geomembrane area multiplied by the neatline thickness.

Quantities were estimated using the OHLP geomembrane area, corrected for slope, and multiplied by a neatline thickness of 1200 mm. SRK assumed that the 300 mm of replacement Overliner would be replaced every two years.

Item 411: SOF Overliner

The Work shall include the drilling, blasting, crushing, loading, hauling, placement and grading of the Overliner. The borrow source was assumed to be 10km from site.Payment shall be by the cubic meter, based on a survey of the geomembrane area multiplied by the neatline thickness.

Quantities were estimated using the SOF geomembrane area, corrected for slope, and multiplied by a neatline thickness of 900 mm.

9.6.5 Piping

Item 510: Drainage Piping

The Work shall include the manufacturing, supply and installation of all Tertiary, Secondary and Primary piping, including fabricated fittings and mechanical connections. Contractors shall ensure that piping is properly located to intercept flows and not moved or damaged during Overliner placement. Depth requirements for crossing, travelling or working above are measured at top of pipe.

Payment shall be by the square meter (neatline).

Quantities were estimated using the OHLP geomembrane footprint area, corrected for slope.

9.6.6 Miscellaneous Mechanical Equipment

Item 710: Fixed Conveyor

The Work shall include the manufacturing, supply and installation of a fixed conveyor system. The fixed conveyors are electrically powered and mounted on foundation blocks resting on a prepared earthen surface. Belt width is 915 mm and carrying capacity is 750 tph. The corridor where this belt is located also contains the power supply for the system using 4 kv cable and plugs. Rail road rails on both side of the fixed conveyer are included and are used to support the rail tripper or the rail hopper.

Payment shall be by the lineal meter, and was estimated to be $2,900, based on a preliminary vendor estimate.

Item 720: Rail Tripper

The Work shall include the manufacturing, supply and installation of a rail tripper. The rail tripper mounts over the fixed conveyor on the installed rail road rails and moves the entire length of the heap leach pad. This machine removes ore from the fixed conveyor and transfers it to the grasshopper belts. It moves along the fixed conveyor beltline when a stacking panel, 60 m wide, is completed. All conveyors are electrically powered and 915 mm wide and capable of carrying 750 tph

Payment shall be lump sum, and was estimated to be $655,000 each, based on a preliminary vendor estimate.

Item 760: Rail Hopper

The Work shall include the manufacturing, supply and installation of a rail hopper. The rail hopper mounts on the installed rail road rails of the fixed conveyor and moves the entire length of the heap leach pad. This hopper receives spent ore from the grasshopper belts and transfers it to the fixed conveyor. It moves along the fixed conveyor beltline when a stacking panel, 60 m wide, is completed. All conveyors are electrically powered and 915 mm wide and capable of carrying 750 tph

Payment shall be lump sum, and was estimated to be $343,000 each, based on a preliminary vendor estimate.

Item 761: Mobile Conveyor Hopper

The Work shall include the manufacturing, supply and installation of a mobile conveyor hopper. The hopper receives spent ore from the front end loader and transfers it, using an integral elevating flight chain feeder, to the grasshopper belts. Capacity is 750 tph. The machine is electrically powered.

Payment shall be lump sum, and was estimated to be $1,300,000 each, based on a preliminary vendor estimate.

Item 765: Grasshoppers

The Work shall include the manufacturing, supply and installation of grasshopper conveyor belts. Grasshoppers are 35 m long with 915 mm belt width, electrically powered with 4.1 kv cables and on-board transformers for 480/3. The grasshoppers receive material from the rail tripper and are added as needed to reach the far end of a panel. They have a rigid frame, a feed hopper, a discharge chute and a set of high flotation tires for easy movement. Each grasshopper has a capacity of 750 tph. All grasshopper belts used for stacking and spent ore functions are identical.

Payment shall be lump sum, and was estimated to be $148,000 each, based on a preliminary vendor estimate.

Item 766: Horizontal Feed Conveyor

The work includes the supply and installation of a horizontal feed conveyor. This 27.5 m long belt elevates the ore from the discharge from the last grasshopper and discharges it onto the horizontal conveyor.

Payment shall be lump sum, and was estimated to be $244,000 each, based on a preliminary vendor estimate.

Item 767: Horizontal Conveyor

The work includes the supply and installation of a horizontal conveyor. This belt is able to be loaded anywhere along its length from the horizontal feed conveyor and thus allows continuous operation as ore is placed onto the leach pad. The discharge from this conveyor ties to the feed point of the conventional stacker. The conveyor is 915 mm wide and has a capacity of 750 tph and is electrically powered.

Payment shall be lump sum, and was estimated to be $694,000 each, based on a preliminary vendor estimate.

Item 770: Conventional Stacker

The Work shall include the manufacturing, supply and installation of a conventional stacker. The stacker is the last belt in the system, receiving ore from the horizontal conveyor. In operation, the conventional stacker slowly places ore onto the OHLP in an arc. The height and speed are hydraulically adjustable and probes are mounted on the end to automatically slew the position of the discharge. The stacker is track mounted for stability and to prevent damage to the pad lining system. The stacker includes a 6 m long stinger belt that is used to fill voids and create a smooth surface. The stacker uses a 915 mm wide conveyor belt and is 36.5 m long with the stinger retracted and has a capacity of 750 tph.

Payment shall be lump sum, and was estimated to be $774,000 each, based on a preliminary vendor estimate.

Item 771: Radial Stacker

The Work shall include the manufacturing, supply and installation of a 35 m long radial stacker with a 915 mm wide belt. The stacker has a fixed height and receiving hopper. The radial stacker has hydraulically powered rubber tires that traverse a 90 degree arc to build a stockpile. A concrete path is used where the wheels run. The capacity is 750 tph.

Payment shall be lump sum, and was estimated to be $465,000 each, based on a preliminary vendor estimate.

Item 780: 20 Tonne Haul Truck

The Work shall include the manufacturing, supply and delivery of a 20 t haul truck. Twenty-tonne capacity articulated haul trucks were chosen for this analysis. The haul cycle was calculated based upon a 3.5 km round trip and an average speed of 25 kph.

Payment shall be lump sum, and was estimated to be $375,000 each, based on a preliminary vendor estimate.

Item 781: CAT 958 Loader

The Work shall include the manufacturing, supply and delivery of a CAT 958 loader (or equivalent). Cycle times were calculated to check the size of rubber tire loader necessary to meet an 11ktpd schedule, using a 6.9 m^3 bucket.

Payment shall be lump sum, and was estimated to be $730,000 each, based on a preliminary vendor estimate.

Item 782: CAT 12M Grader

The Work shall include the manufacturing, supply and delivery of a CAT 12M motor grader (or equivalent).

Payment shall be lump sum, and was estimated to be $320,000 each, based on a preliminary vendor estimate.

Item 783: 20m^3 Water Truck

The Work shall include the manufacturing, supply and delivery of 20 m^3 water truck.

Payment shall be lump sum, and was estimated to be $275,000 each, based on a preliminary vendor estimate.

Item 784: CAT D7 Dozer

The Work shall include the manufacturing, supply and installation of a CAT D7 dozer (or equivalent).

Payment shall be lump sum, and was estimated to be $570,000 each, based on a preliminary vendor estimate.

Item 790: Overland Conveyor

The Work shall include the manufacturing, supply and installation of an overland conveyor system. The overland conveyors are electrically powered and mounted on foundation blocks resting on a prepared earthen surface. Belt width is 915 mm and carrying capacity is 750 tph. The belt corridor also includes the power supply for the system.

Payment shall be by the lineal meter, and was estimated to be $2,350, based on a preliminary vendor estimate.

9.6.7 Closure

Item 810: Mobilization and Demobilization

The Work shall provide for reclamation of the site including mobilization of construction equipment, labor, materials, and temporary facilities including the setting up of temporary facilities including field offices, temporary utilities and services, as well as all other related activities and administration and overhead cost relative to reclamation.

Payment shall be lump sum, and was estimated to be 10% of the sum of earthworks, geosynthetics and miscellaneous costs based on preliminary reclamation designs.

Quantities were estimated assuming one mob/demob for one construction period.

Item 820: Site Reclamation Regrading

The Work shall include the regrading of the OHLP (after removal of the geomembrane), roadways, conveyor alignments (after removal of the conveyors), and the regarding of the final SOF including

side slopes, roadways, and re-vegetated crest area, as needed to conform to final site reclamation designs.

Payment shall be by the square meter based on the disturbed surface areas within the boundaries of the OHLP and SOF.

Item 830: Rock Armour Placement

The Work shall include the drilling, blasting, crushing, loading, hauling, placement and grading of the rock armour. The borrow source was assumed to be offsite.

Payment shall be by the cubic meter, based on a survey of the SOF slope.

Quantities were estimated using the reclaimed SOF slope area, with one meter strip on the top of the SOF inward from the SOF crest. The rock armour placement is assumed to be D_{50} = 250 mm material, 500 mm in thickness.

Item 840: Topsoil Placement

The Work includes the loading, hauling, placing, and grading of topsoil on the SOF crest area and reclaimed OHLP footprint area. The topsoil stockpile was assumed to be onsite.

Payment shall be by the cubic meter, based on a survey of the disturbed OHLP and SOF areas multiplied by a thickness of 300 mm.

Item 841: Structure Removal Conveyors

The Work includes the removal of all fixed conveyor systems including dismantlement, breakdown, and removal from the site to an approved reclamation area.

Payment shall be by the lineal meter and is based on an estimated six person crew cost at $40 per lineal meter.

Item 842: General Labor Crew

The Work includes the removal of the OHLP geomembrane and piping, and Solution Pond geomembrane. SRK developed the estimate assuming fourteen weeks of time, at a cost $1200 per day for a six man crew.

Payment was estimated to be lump sum.

9.6.8 Construction and Engineering

Item 910: Engineering

The Work shall provide for the feasibility (permitting) and Issued for Construction (IFC) design and drawings, along with specifications.

Payment shall be lump sum, and was estimated to be 2% of the sum of site preparation, earthworks, geosynthetics and miscellaneous costs.

Item 920: CM and CQA

The Work shall provide for the construction management and quality assurance required during construction.

Payment shall be lump sum, and was estimated to be 10% of the sum of site preparation, earthworks, geosynthetics and miscellaneous costs.

Item 930: Owner Costs

The Work shall provide for owner costs required during construction.

Payment shall be lump sum, and was estimated to be 10% of the sum of site preparation, earthworks, geosynthetics and miscellaneous costs.

9.6.9 Operational Expenditures

Item 1000: Operational Expenditures

The operational expenditures shall reflect the cost of placing the fresh ore onto the OHLP, removal and handling of spent ore from the OHLP to the SOF.

Payment is based on a per ton basis based on the summation of the individual operating expenditures.

10 Capital and Operating Cost Estimate

Based on the cost model noted in Section 9, SRK developed the Life of Mine (LoM) capital and operating cost estimate summarized in Table 10-1, for an OHLP that considered a conveyor stacking and front end loader reclaim system, sized for an ore height of 4 m, and an SOF-sized to contain the design quantity of 29.2 Mt. The cost estimate includes a contingency (usually 35%) which is typical for a PFS level design. Detailed costs are presented in Appendix E.

Table 10-1: TSF LoM Capital and Operating Cost Estimate

Description	**OHLP with Trucks and Loader ('000USD)**
Site Preparation	$4,321
Earthworks	$3,516
Geosynthetics	$6,349
Overliner	$21,665
Piping	$315
Miscellaneous Mechanical Equipment	$17,780
Construction and Engineering	$6,877
Closure	$3,366
Subtotal Costs	**$64,189**
Contingency (35%)	$22,581
OPEX	$46,767
Total	**$133,538**

11 Environmental Considerations

SRK has incorporated numerous Best Management Practises (BMP's) in to the design to minimize solution release to the environment and associated risks. These recommendations are summarized in the following sections.

11.1 Liner Leakage Rates

The performance of the composite liner proposed for the OHLP can be approximated by estimating the liner leakage rate or the rate of flow through a geomembrane liner. This is basically an estimate of the volume of water that could be lost through a geomembrane due to defects in the liner that could be introduced in the quality control process during manufacturing, accidental punctures during installation and cover placement, or defects in seams that are not located during construction quality assurance.

Key factors affecting the composite liner performance or liner leakage rate include the following:

- Size of the defect. This is basically the area of an assumed circular shaped defect;
- Hydraulic conductivity of the soil. Hydraulic conductivity values differ greatly depending on the material. For example, sand materials have high hydraulic conductivities as water can pass through this material fairly easily. However, clay materials tend to have low hydraulic conductivities as it is more difficult for water to pass through this material. Therefore, the liner leakage rate through a composite liner is significantly less than the liner leakage rate through a similar defect in a geomembrane placed on a high-permeability soil like sand or gravel (Giroud and Badu-Tweneboah, 1992);
- Solution Head. The head of water is basically the vertical height at which solution is expected to "pond" over the geomembrane, i.e. the higher the solution level, the larger the head. A higher head basically means that there is greater water pressure at the surface of the liner and this would result in more water being pushed through the defect. The water level in a material can be lowered by using a free draining granular layer, a piping collection system or both, above the liner; and
- Contact quality. The quality of the contact between the geomembrane and low permeability soil is one of the key factors governing the rate of flow through the composite liner, because it governs the radius of the wetted area (Qian, Koerner and Gray 2002). They can be categorized as:
  - Good contact conditions correspond to a geomembrane installed, with as few waves or wrinkles as possible, on top of a low-permeability soil layer that has been adequately compacted and has a smooth surface; and
  - Poor contact conditions correspond to a geomembrane that has been installed with a certain number of waves or wrinkles, and/or placed on a low-permeability soil that has not been well compacted and is not smooth. (Bonaparte, 1989).

The following equations were used in estimating the rate of leakage through a circular hole in the geomembrane component of a composite liner. These are empirical formulas based on analytical studies and model tests (Giroud and Bonaparte, 1989b; Giroud et al., 1989).

For composite liners with 'good' contact conditions, the liner leakage rate can be estimated by the following equation:

$$Q = 0.21 * a^{0.1} * h^{0.9} * k_s{}^{0.74}$$

For composite liners with 'poor' contact conditions, the liner leakage rate can be estimated by the following equation:

$$Q = 1.15 * a^{0.1} * h^{0.9} * k_s{}^{0.74}$$

Where:

a is the area of the defect in m^2

h is the level of water (head) above the liner in m

k_s is the hydraulic conductivity of the underlaying soil in m/sec

Using the equations referenced above, the following assumptions were then used in estimating liner leakage rates for the Project:

- The solution head acting on the liner was 300 mm;
- A single 1 cm^2 defect per acre (or 2.2 defects per hectare) of composite liner;
- 'Good' contact between the geomembrane and the soil liner; and
- The hydraulic conductivity of the soil underlaying the geomembrane was $1x10^{-6}$ cm/sec.

The results show that having a clay liner with a hydraulic conductivity of $1x10^{-6}$ cm/sec and a pipe spacing of 5 meter centers will result in an estimated liner leakage rate per cell of approximately 17 ℓ/d for an OHLP. Calculations are presented in Appendix F.

12 Conclusions and Recommendations

12.1 Conclusions

Using the recommendations from the conceptual report as a basis (SRK, 2011), SRK developed a PFS level designs and cost estimates for an OHLP that considered ore placement in 4 m high lifts, with ore placement and spent ore removal using a grasshopper stacking and reclaiming system. Pregnant Leach Solution (PLS) would be collected and report to a Pregnant Pond. Rinse solution would be collected and report to a Rinse Pond, where it would be used as makeup water in the leaching circuit. Spent ore would be conveyed to a SOF for containment and closure, designed to contain a total capacity of 29.2 Mt.

12.2 Recommendations

SRK recommends that the following work be performed to advance the OHLP and SOF to the next level of design:

- Detailed Topographic Survey. A topographic survey in the area of the OHLP should be performed to an accuracy level of +/- one meter. The area should be sufficiently large to account for the diversion channels and any borrow areas;
- Field investigation. Field investigations should be performed for the OHLP footprint area, including characterizing the foundation conditions and potential borrow areas. These investigations include the following:
  - Field reconnaissance. A field reconnaissance should be done to confirm the site conditions and any geologic hazards. The geology within and adjacent to the OHLP area should be mapped, including any faulting that may impact the performance of the structure;
  - Geotechnical investigation. A geotechnical program including boreholes and test pits within the OHLP footprint, in addition to borrow areas should be performed. Samples should also be taken for laboratory testing, such as water content, grain size, Atterberg Limits, permeability, shear strength, interface shear strength testing, liner load testing, etc.;
  - Ore characterization. The largest driver in the OHLP selection is the lift height that has been assumed. Laboratory test work should be done to confirm ore design assumptions, such as the densities, water contents and lift heights; and
- Sideslope configuration. Site-specific peak ground accelerations should be established for the site, so that a pseudo-static stability analysis can be done to confirm the sideslopes required from a stability perspective. The sideslopes used in the design should also consider construction and closure requirements;
- Water Balance. SRK requests that the following activities be confirmed:
  - Koza confirm the assumptions made in the water balance calculations, such as draindown period to be considered in the draindown volume calculations or the design storm precipitation event;
  - Koza confirm if a Barren Pond is required;
  - The water balance indicated that if rinsing is done at a rate greater than approximately 1.50 l/hr/m^2, excess water will be generated that will most likely need to be treated and discharged. Therefore, the pore volumes needed for rinsing the ore should be evaluated and the rinsing rate confirmed;
  - The water balance assumed that all precipitation in the winter months reported through the system immediately, with no accounting for accumulation of snow. This will affect the water balance calculations as snow would accumulate during the winter months and spring snow melt could report during April and May, leading to surges of water through the system; and

  - Ramp up conditions, which includes ore loading and leaching rates along with solution chemistry and pond recirculation schedules, can impact makeup water requirements quite significantly during start-up. SRK recommends that the water balance be expanded to include ramp up conditions once more definitive ramp up plans have been developed.

- A site specific water balance should be performed for the OHLP that considers the monthly climatological conditions, as well as the OHLP footprint area;
- Closure Requirements. The next stage of design should develop a closure plan and criteria based on National standards and requirements;
- Environmental Baseline Data. Baseline data collection, such as ground and surface water, should be assembled immediately to establish a database and support permitting requirements;
- Climatological data. Site specific daily precipitation data should be reviewed, and design storm events estimated using statistical methods;
- Overliner. A free draining layer of granular material, with a gradation sized to meet the filter criteria with the spent ore, should be developed. The Overliner source should also be characterized;
- OHLP LDS. SRK assumed that no LDS was required under the OHLP or SOF. This assumption should be confirmed against Turkish regulations and permitting requirements;
- Ore Zone. The depth and volume of overburden (waste) and ore should be confirmed as this could be a potential borrow source, as well as the thickness of oxidized ore;
- Soil Liner thickness. SRK assumed that 300 mm of low permeability Soil Liner would be used in the OHLP, Solution Ponds and SOF as well. During subsequent stages of design, the Soil Liner thickness or permeability requirements for the Solution Ponds and SOF could be reconsidered depending on site specific and regulatory requirements;
- Freeboard. The freeboard assumptions should be confirmed;
- Groundwater. SRK had assumed that the groundwater conditions would not impact the design. This should be confirmed;
- Surface water. SRK did not design diversion channels around the perimeter of the OHLP or SOF. Surface water controls should be designed and included in the cost estimate, based on site specific storm data; and
- Monitoring program, including piezometers, slope indicators, survey monuments and groundwater monitoring wells should be developed and incorporated into the cost model.

13 References

SRK Consulting, Letter titled "*Work Order No. 1*", February 2011

Datamine International (September 2009), Mineral Resource Estimate for the Himmetdede Prospect, Turkey, Technical Report

Giroud, J.P. and Bonaparte, R., 1989, "Leakage through Liners Constructed with Geomembranes, Part II: Composite Liners", Geotextiles and Geomembranes, Vol. 8, No.2, pp. 71-111

Giroud, J.P., Khatami, A. and Badu-Tweneboah, K., 1989, "Evaluation of the Rate of Leakage through Composite Liners", Geotextiles and Geomembranes, Vol. 8, No. 4, pp. 337-340.

Giroud, J.P., Badu-Tweneboah, K. and Bonaparte, R., 1992, "Rate of Leakage Through a Composite Liner due to Geomembrane Defects", Geotextiles and Geomembranes, Vol. 11, No. 1, pp. 1- 8.

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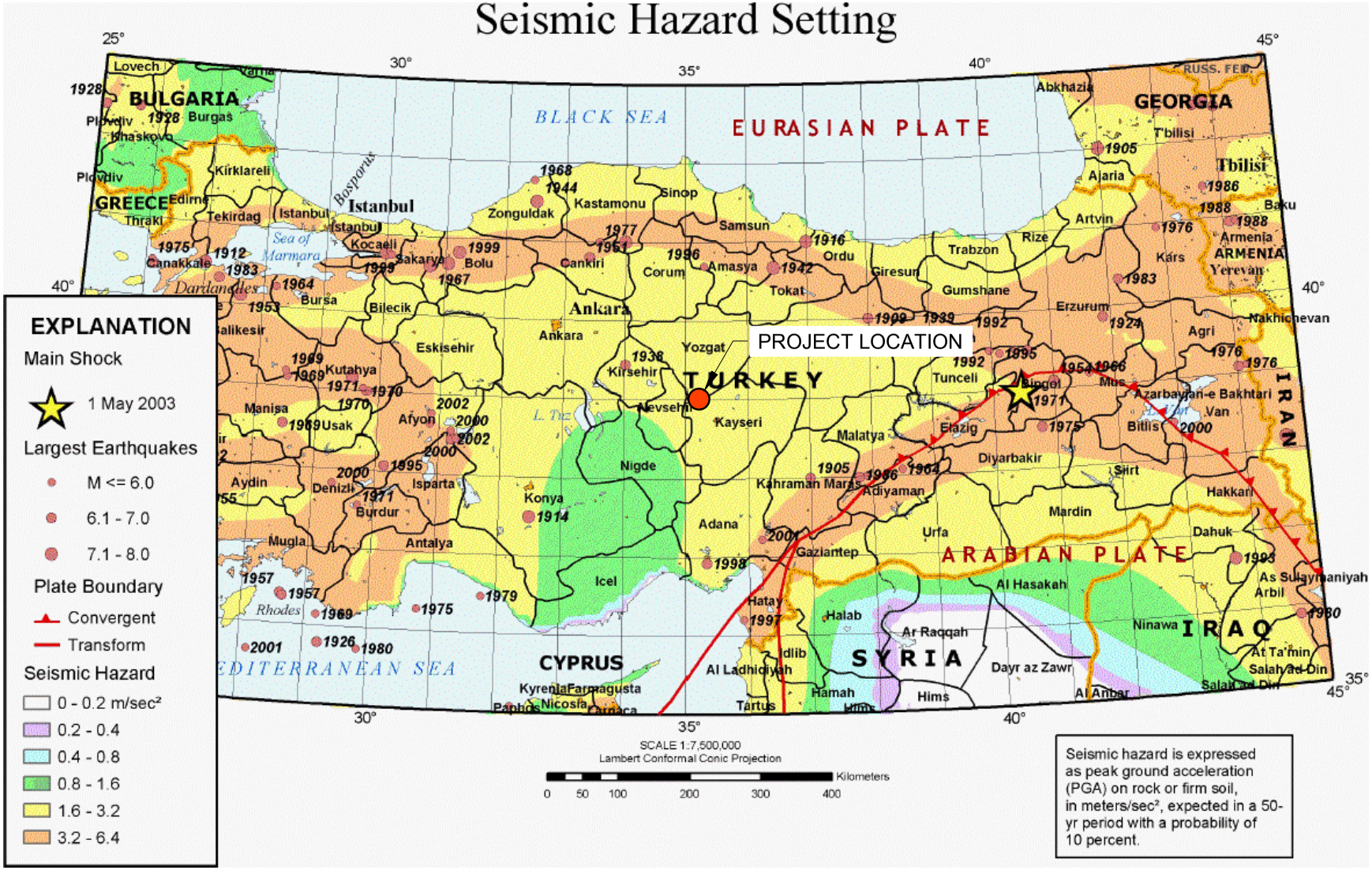
Figures

Seismic Hazard Setting



Seismic hazard is expressed as peak ground acceleration (PGA) on rock or firm soil, in meters/sec², expected in a 50-yr period with a probability of 10 percent.

REFERENCE:
FILE DOWNLOADED FROM THE USGS WEBSITE:
http://neic.usgs.gov/neis/eq_depot/2003/eq_030501/neic_tgac_maps.html

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SRK JOB NO.: 216003

FILE NAME: 216003.Fig.1.Rev.C.Seismic.Hazard.Setting.2012-03-05.dwg

PRE-FEASIBILITY STUDY
HIMMETDEDE HEAP LEACH PROJECT

HEAP LEACH PAD

SEISMIC HAZARD SETTING

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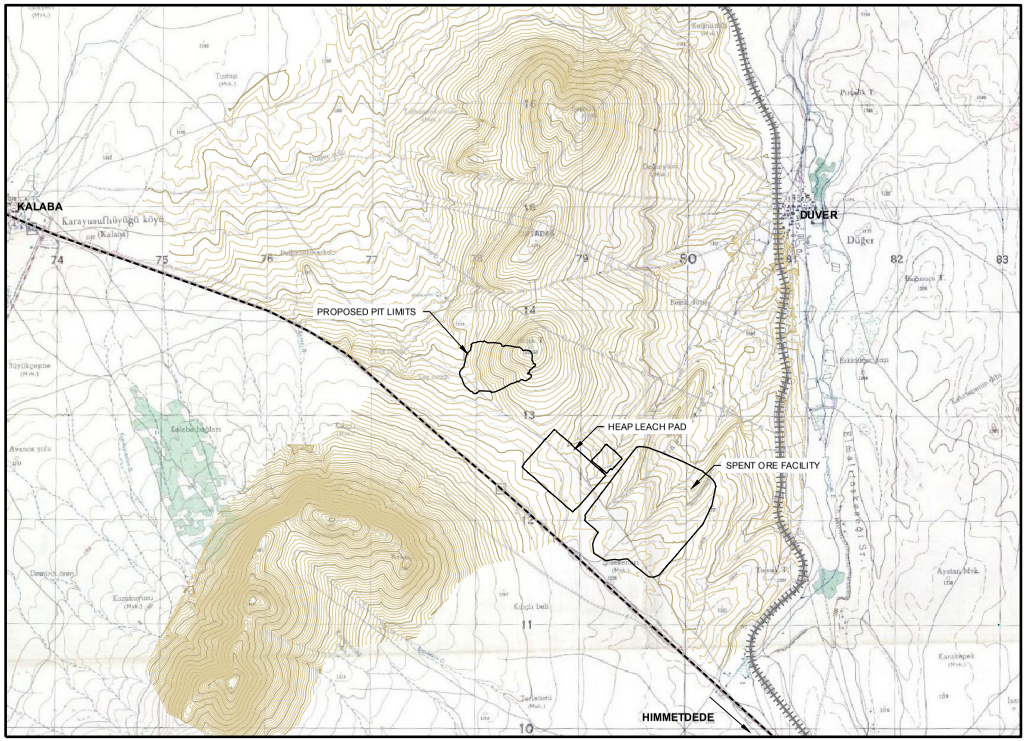
Drawings

HIMMETDEDE PROJECT

HEAP LEACH PAD

REFERENCE:
UNIVERSITY OF TEXAS LIBRARY ONLINE.
http://www.lib.utexas.edu/maps/atlas_middle_east/turkey_map.jpg



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LIST OF DRAWINGS

DRAWING	DRAWING TITLE
DRAWING 1	SITE LOCATION MAP AND LIST OF DRAWINGS
DRAWING 2	AREA MAP
DRAWING 3	EXISTING SITE CONDITIONS
DRAWING 4	FACILITY LAYOUT
DRAWING 5	PROJECT AREA GEOLOGY MAP AND FIELD PROGRAM
DRAWING 6	HEAP LEACH PAD PLAN VIEW
DRAWING 7	HEAP LEACH PAD ISOPACH VIEW
DRAWING 8	HEAP LEACH PAD CROSS SECTIONS
DRAWING 9	HEAP LEACH PAD DETAILS
DRAWING 10	SOLUTION PONDS PLAN VIEW
DRAWING 11	SOLUTION PONDS ISOPACH PLAN VIEW
DRAWING 12	SOLUTION PONDS CROSS SECTIONS
DRAWING 13	SOLUTION PONDS DETAILS
DRAWING 14	SPENT ORE FACILITY
DRAWING 15	SPENT ORE FACILITY ISOPACH AND FINAL CONTOURS
DRAWING 16	SPENT ORE FACILITY CROSS SECTIONS

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FILE NAME: 216003.Rev.C.Dwg.1.Site.Location.2012-03-05.dwg

PRE-FEASIBILITY STUDY
HIMMETDEDE HEAP LEACH PROJECT

HEAP LEACH PAD

SITE LOCATION MAP AND LIST OF DRAWINGS

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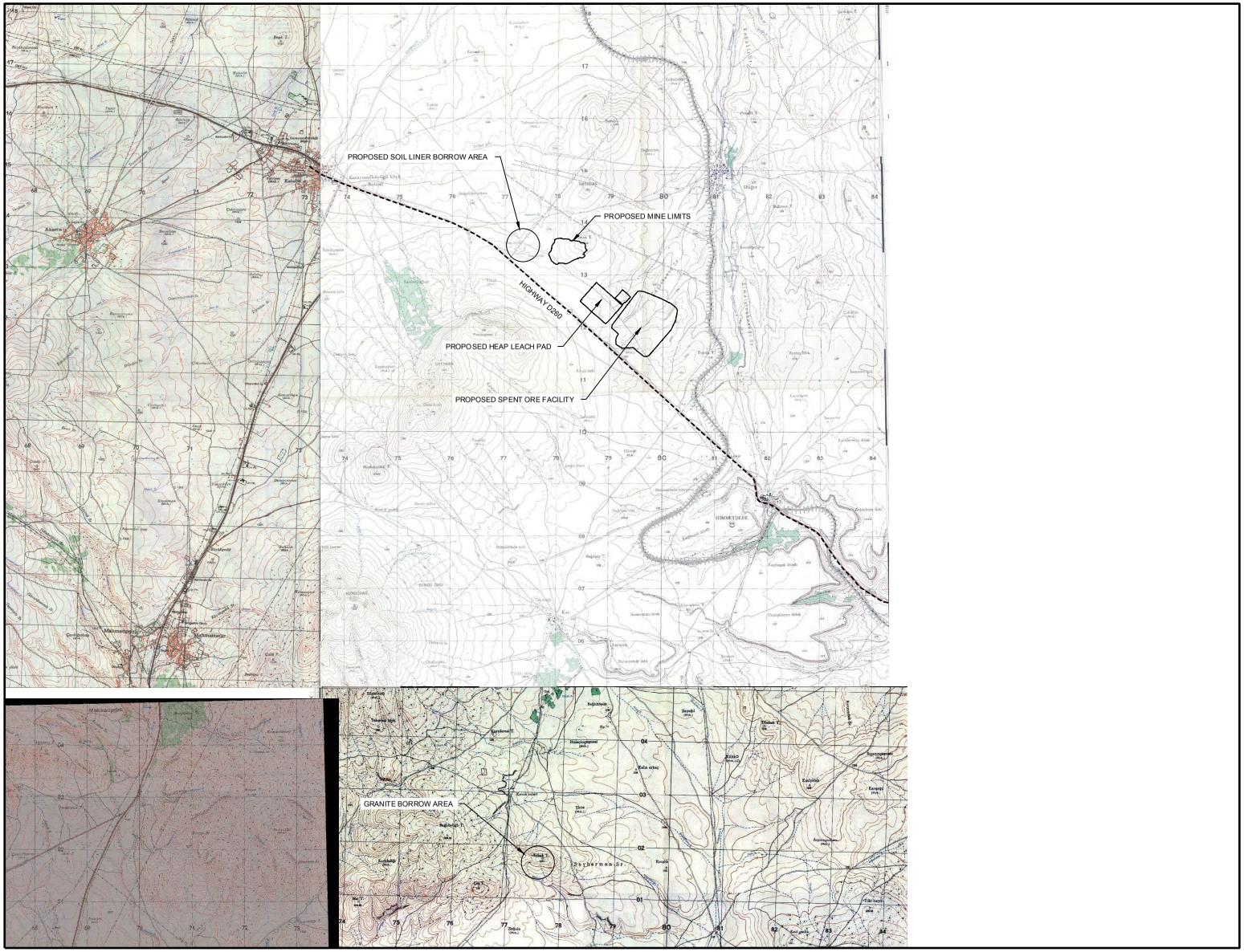

LEGEND

- 5280 EXISTING GROUND CONTOURS (MAJOR/MINOR)
- EXISTING HIGHWAY
- EXISTING RAIL LINE
- EXISTING GAS LINE
- EXISTING POWER LINE

REFERENCES

1. EXISTING ROAD AND RAIL LINE DIGITIZED BY SRK FROM GENERAL COMMAND TOPOGRAPHIC MAPS PROVIDED BY KOZA.

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Scale in Metres

srk consulting

Koza Altın İşletmeleri A.Ş.

SRK JOB NO.: 216003

FILE NAME: 216003.Rev.C.Dwg.2.AreaMap.2012-03-05.dwg

PRE-FEASIBILITY STUDY
HIMMETDEDE HEAP LEACH PROJECT

HEAP LEACH PAD

AREA MAP

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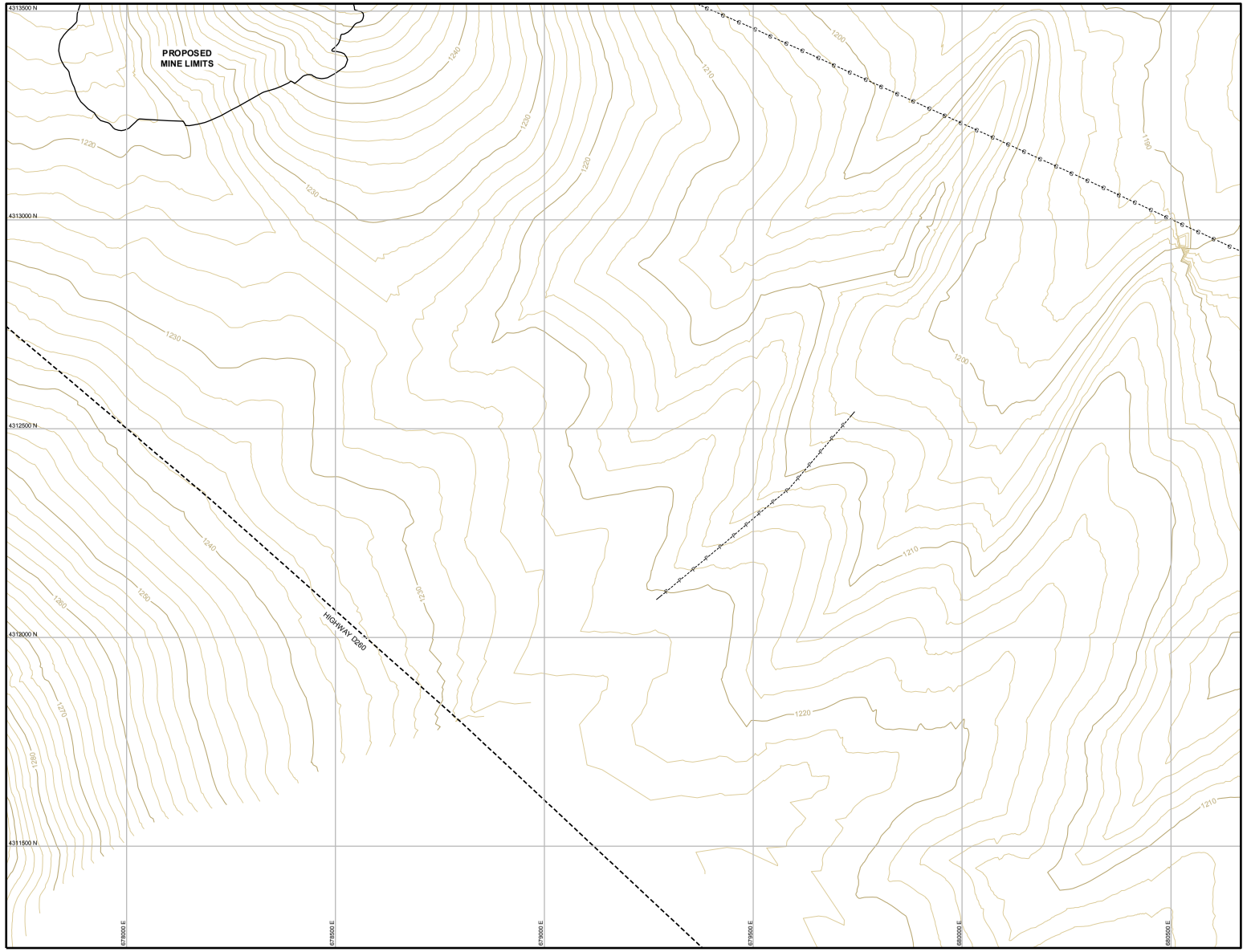

LEGEND

- EXISTING GROUND CONTOURS (MAJOR/MINOR)
- EXISTING HIGHWAY
- PROPOSED PIT LIMITS
- EXISTING GAS LINE
- EXISTING POWER LINE

REFERENCES

1. EXISTING GROUND TOPOGRAPHY IS A COMPOSITE SURFACE OF DATA RECEIVED FROM CLIENT IN GIS FORMAT, AND DXF TOPOGRAPHY ISSUED FROM KOZA ON 06APR11.
2. EXISTING ROAD AND RAIL LINE DIGITIZED BY SRK FROM GENERAL COMMAND TOPOGRAPHIC MAPS PROVIDED BY KOZA.

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FILE NAME: 216003.Rev.C.Dwg.3.Existing.Site.Conditions.2012-03-05.dwg

PRE-FEASIBILITY STUDY
HIMMETDEDE HEAP LEACH PROJECT

HEAP LEACH PAD

EXISTING SITE CONDITIONS

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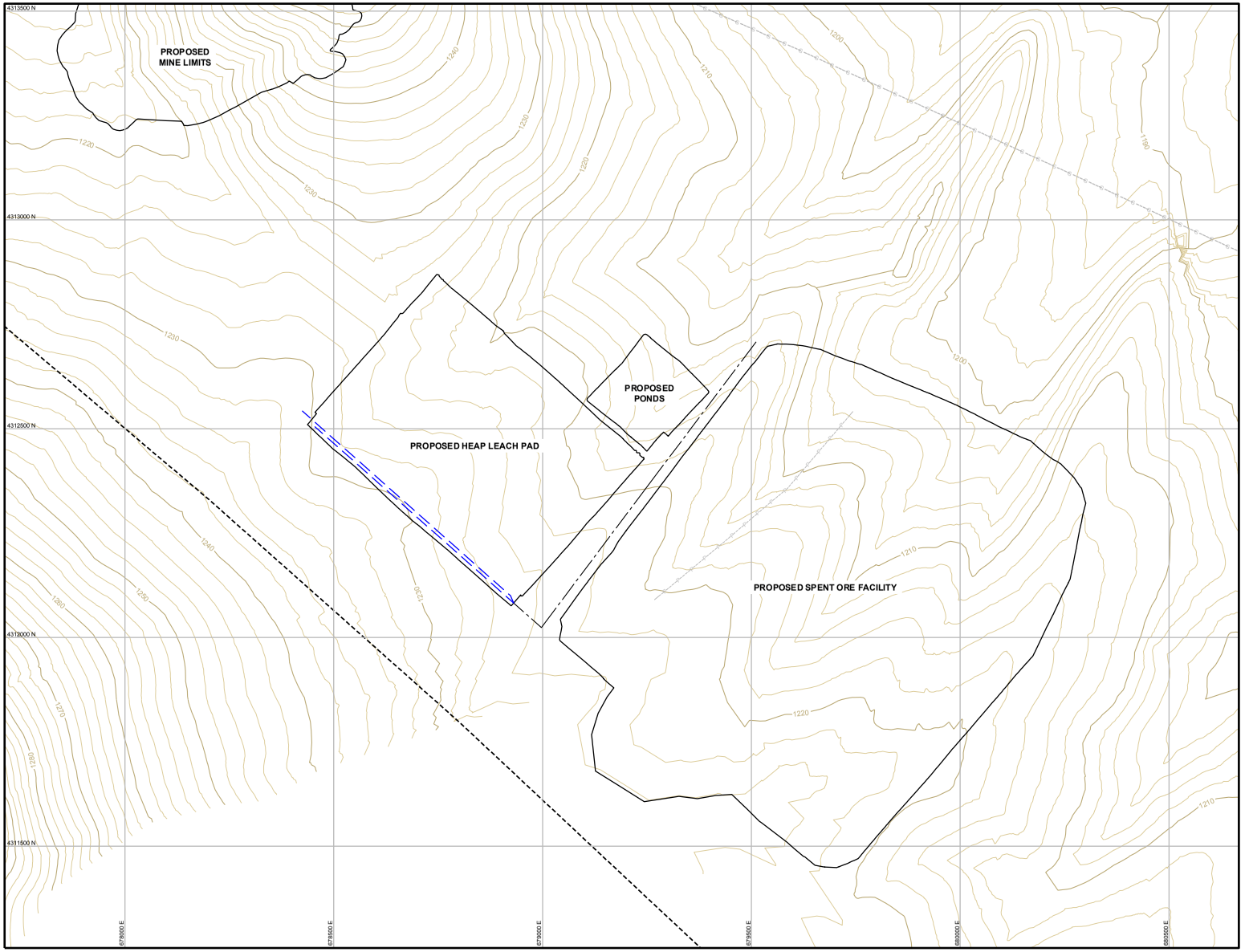

LEGEND

- EXISTING GROUND CONTOURS (MAJOR/MINOR)
- EXISTING HIGHWAY
- EXISTING GAS LINE
- EXISTING POWER LINE
- OVERLAND CONVEYOR
- FIXED CONVEYORS

REFERENCES

1. EXISTING GROUND TOPOGRAPHY IS A COMPOSITE SURFACE OF DATA RECEIVED FROM CLIENT IN GIS FORMAT, AND DXF TOPOGRAPHY ISSUED FROM KOZA ON 06APR11.
2. EXISTING ROAD AND RAIL LINE DIGITIZED BY SRK FROM GENERAL COMMAND TOPOGRAPHIC MAPS PROVIDED BY KOZA.

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Scale in Metres

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SRK JOB NO.: 216003

FILE NAME: 216003.Rev.C.Dwg.4.Facility Layout.2012-03-05.dwg

PRE-FEASIBILITY STUDY
HIMMETDEDE HEAP LEACH PROJECT

HEAP LEACH PAD

FACILITY LAYOUT

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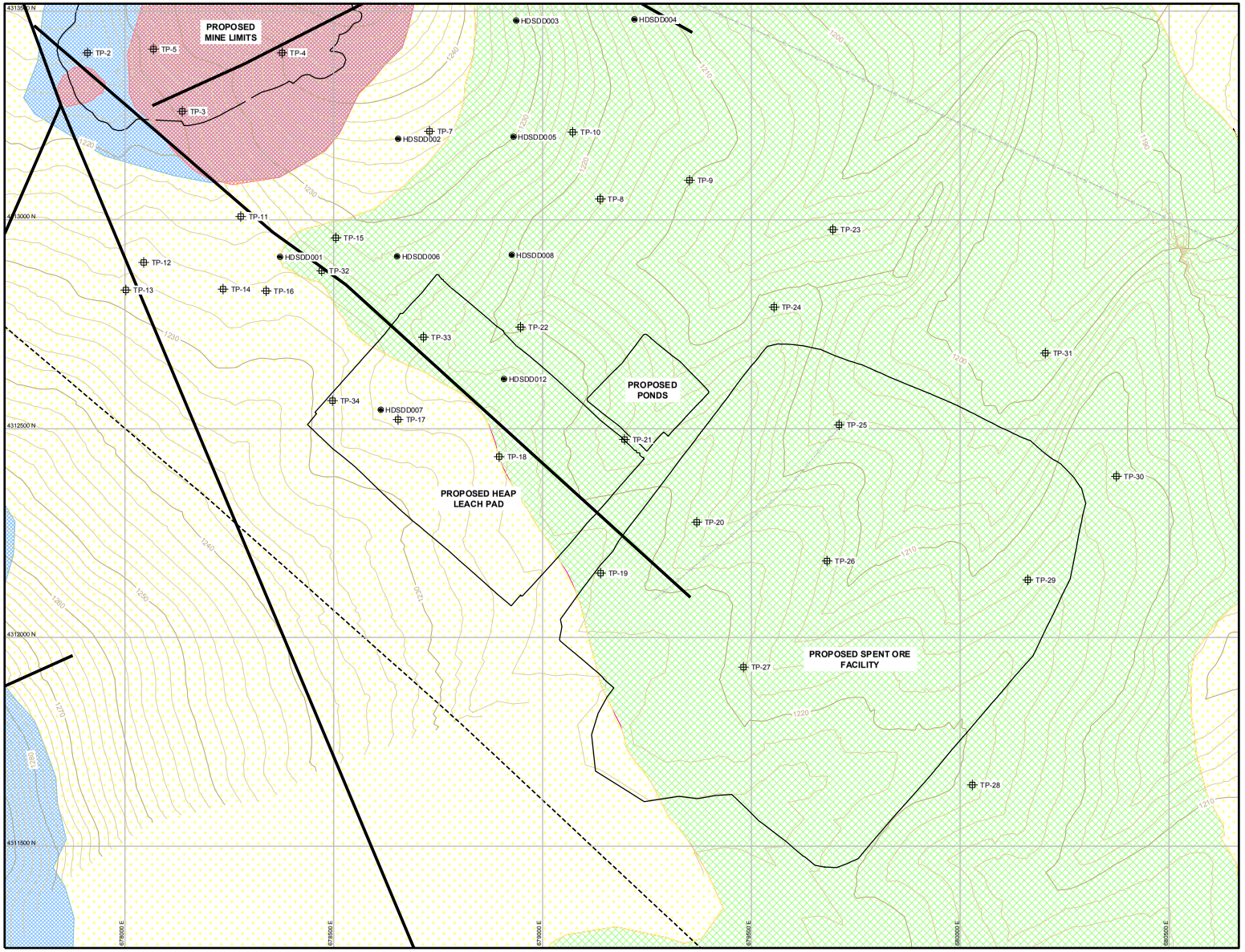

LEGEND

- EXISTING GROUND CONTOURS (MAJOR/MINOR)
- EXISTING HIGHWAY
- EXISTING GAS LINE
- EXISTING POWER LINE
- FAULT
- CONDEMNATION DRILLHOLES
- TEST PITS
- NEOGENE LACUSTRINE SEDIMENTS
- MARINE LIMESTONE
- QUARTZ FLOATS
- IGNIMBRITE

REFERENCES

1. EXISTING GROUND TOPOGRAPHY IS A COMPOSITE SURFACE OF DATA RECEIVED FROM CLIENT IN GIS FORMAT, AND DXF TOPOGRAPHY ISSUED FROM KOZA ON 06APR11.
2. EXISTING ROAD AND RAIL LINE DIGITIZED BY SRK FROM GENERAL COMMAND TOPOGRAPHIC MAPS PROVIDED BY KOZA.

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Scale in Metres

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SRK JOB NO.: 216003

FILE NAME: 216003.Rev.C.Dwg.5.Geology.2012-03-05.dwg

PRE-FEASIBILITY STUDY
HIMMETDEDE HEAP LEACH PROJECT

HEAP LEACH PAD

PROJECT AREA GEOLOGY MAP AND FIELD PROGRAM

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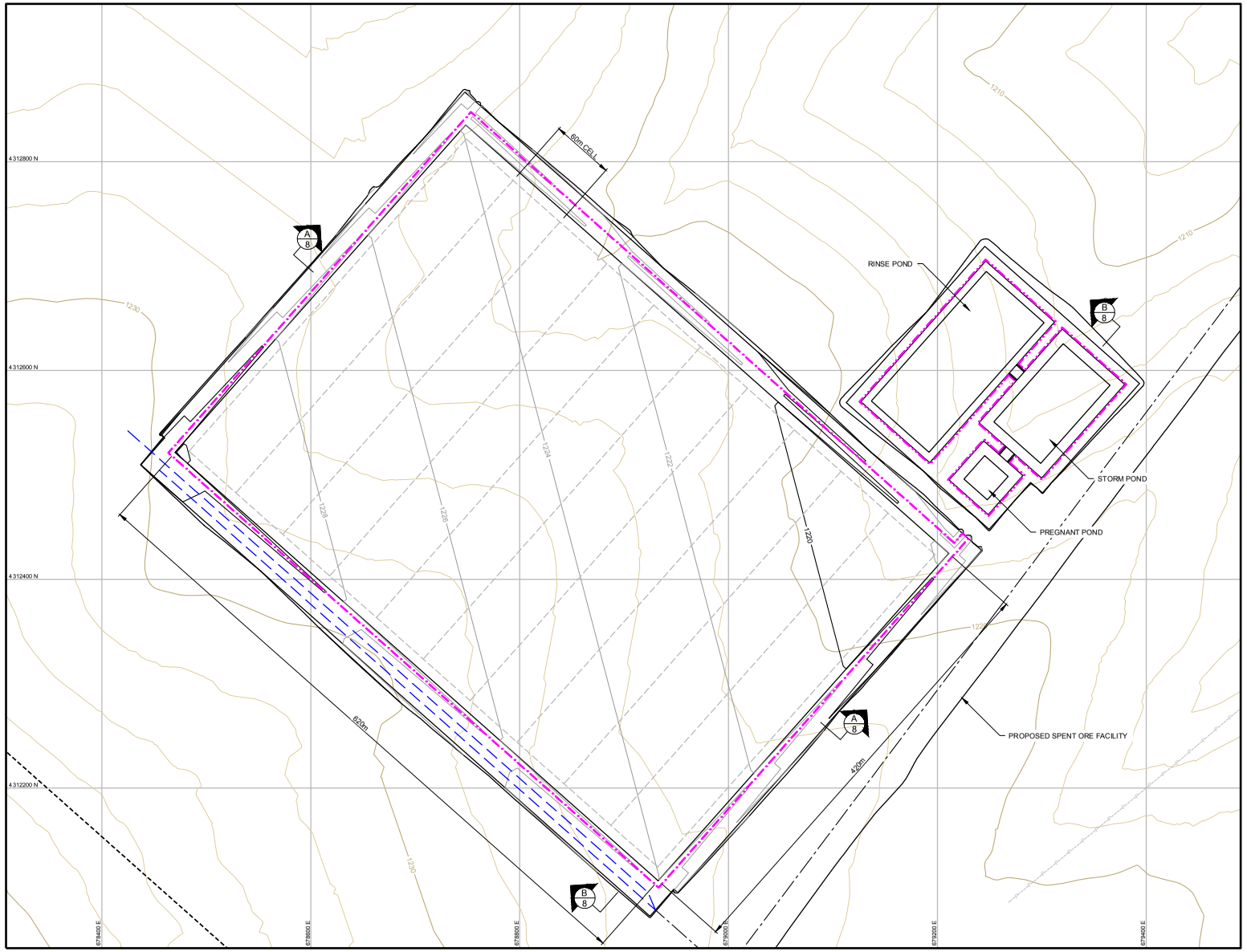

LEGEND

- EXISTING GROUND CONTOURS (MAJOR/MINOR)
- PROPOSED HLP CONTOURS (MAJOR/MINOR)
- EXISTING HIGHWAY
- GEOMEMBRANE LINER (DOUBLE)
- GEOMEMBRANE LINER (SINGLE)
- OVERLAND CONVEYOR
- FIXED CONVEYORS

REFERENCES

1. EXISTING GROUND TOPOGRAPHY IS A COMPOSITE SURFACE OF DATA RECEIVED FROM CLIENT IN GIS FORMAT, AND DXF TOPOGRAPHY ISSUED FROM KOZA ON 06APR11.
2. EXISTING ROAD AND RAIL LINE DIGITIZED BY SRK FROM GENERAL COMMAND TOPOGRAPHIC MAPS PROVIDED BY KOZA.

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Scale in Metres

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SRK JOB NO.: 216003

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PRE-FEASIBILITY STUDY
HIMMETDEDE HEAP LEACH PROJECT

HEAP LEACH PAD

HEAP LEACH PAD PLAN VIEW

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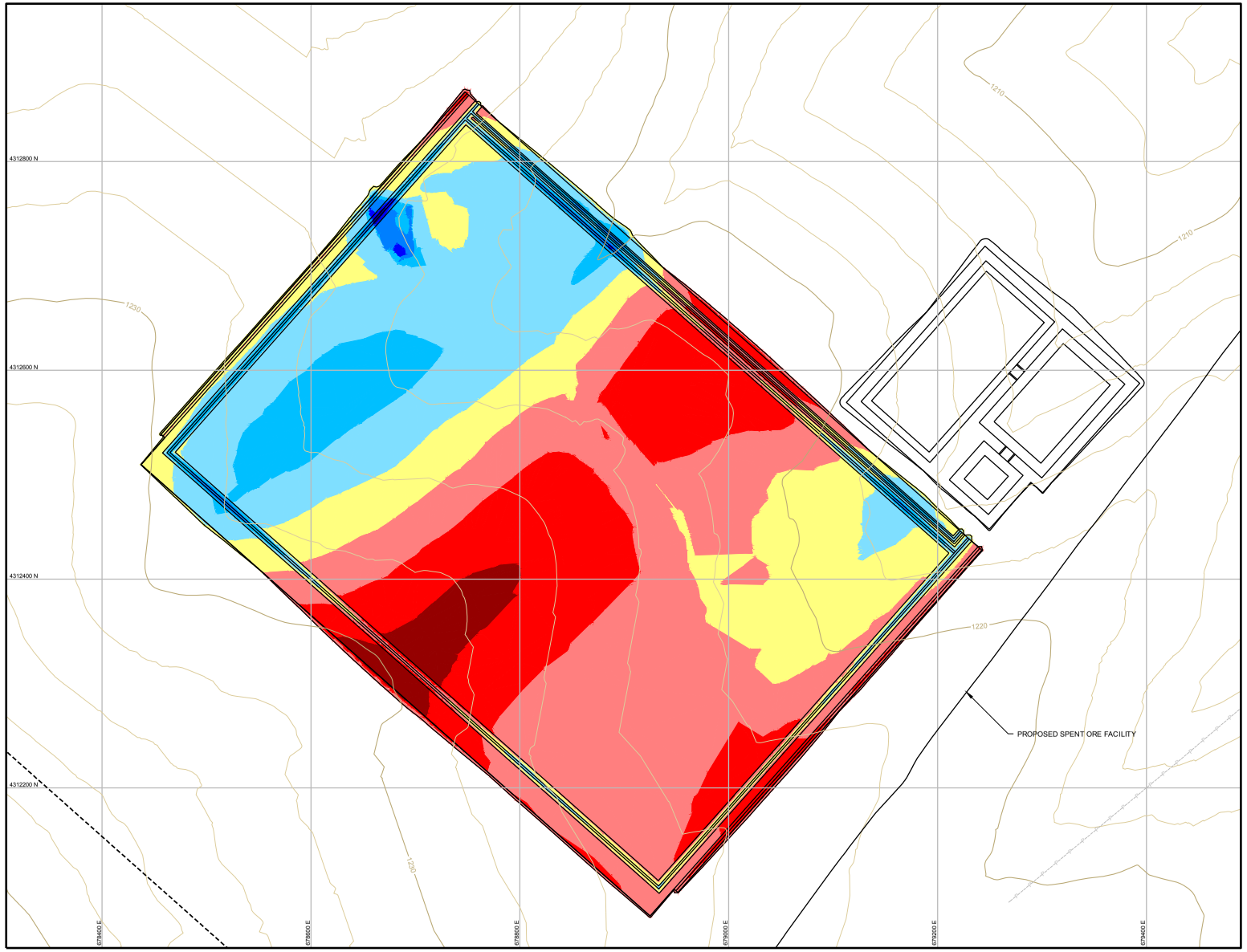

LEGEND

- EXISTING GROUND CONTOURS (MAJOR/MINOR)
- EXISTING HIGHWAY
- EXISTING POWER LINE

REFERENCES

1. EXISTING GROUND TOPOGRAPHY IS A COMPOSITE SURFACE OF DATA RECEIVED FROM CLIENT IN GIS FORMAT, AND DXF TOPOGRAPHY ISSUED FROM KOZA ON 06APR11.
2. EXISTING ROAD AND RAIL LINE DIGITIZED BY SRK FROM GENERAL COMMAND TOPOGRAPHIC MAPS PROVIDED BY KOZA.

CUT/FILL ISOPACH

MINIMUM DEPTH	MAXIMUM DEPTH	COLOR	AREA (2D m^2)	VOLUME (m^3)
-3.00	-2.00		9137	1450
-2.00	-1.00		60844	35463
-1.00	0.00		99485	121502
0.00	1.00		61468	114842
1.00	2.00		63915	54633
2.00	3.00		19833	7188
3.00	4.00		2093	1160
4.00	5.00		254	145
5.00	6.00		65	22

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0 20 40 60 80 100
Scale in Metres

srk consulting

SRK JOB NO.: 216003

FILE NAME: 216003.Rev.C.Dwg.7.HLP.Isopach.2012-03-05.dwg

PRE-FEASIBILITY STUDY
HIMMETDEDE HEAP LEACH PROJECT

HEAP LEACH PAD

HEAP LEACH PAD ISOPACH VIEW

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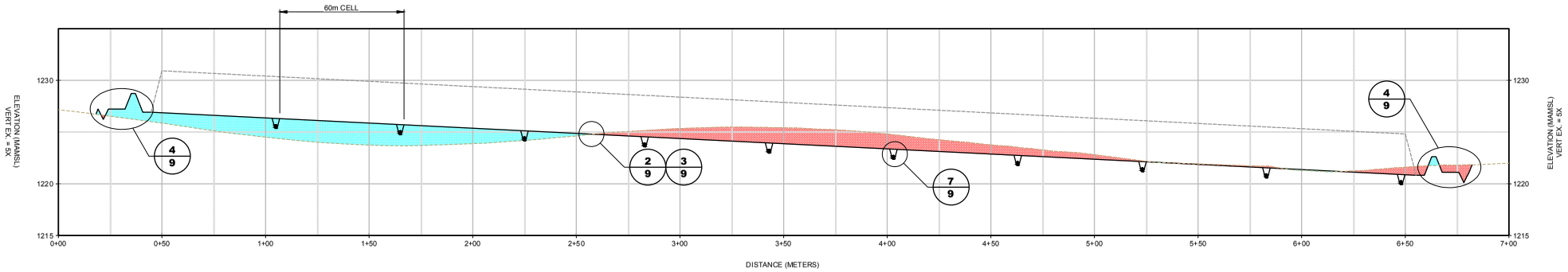
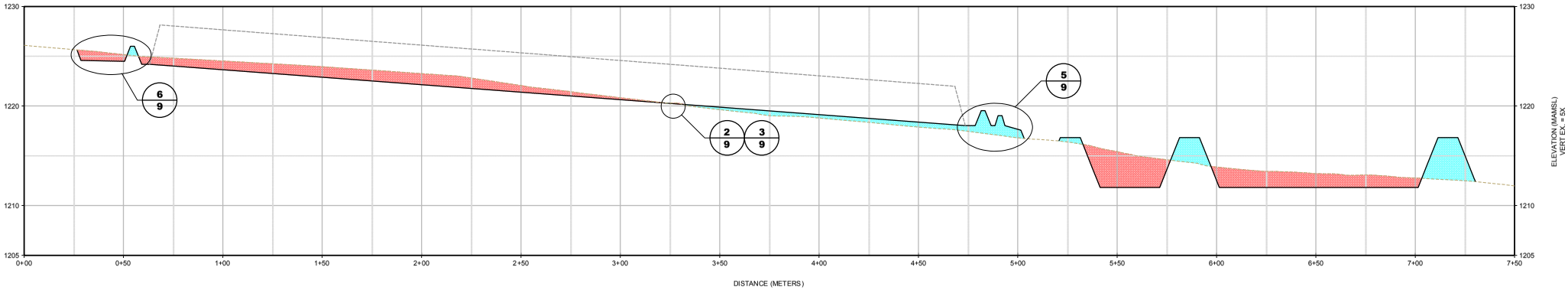


A/8 PROPOSED HEAP LEACH PAD CROSS SECTION
PER GRID



B/8 PROPOSED HEAP LEACH PAD CROSS SECTION
PER GRID

srk consulting

SRK JOB NO.: 216003

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PRE-FEASIBILITY STUDY
HIMMETDEDE HEAP LEACH PROJECT

HEAP LEACH PAD

HEAP LEACH PAD CROSS SECTIONS

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MAR. 2012	TM	8	C

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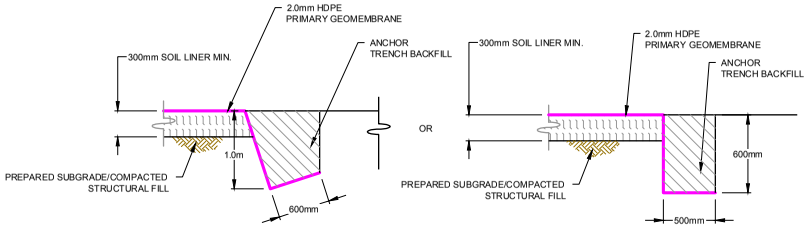
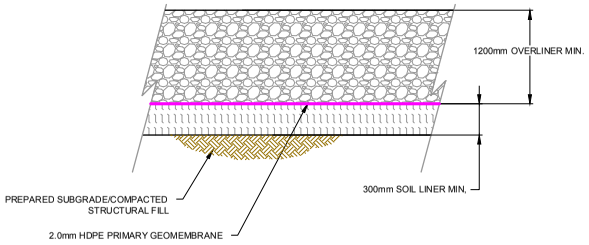


1/9 ANCHOR TRENCH DETAIL
NOT TO SCALE



2/9 HEAP LEACH PAD LINER DETAIL
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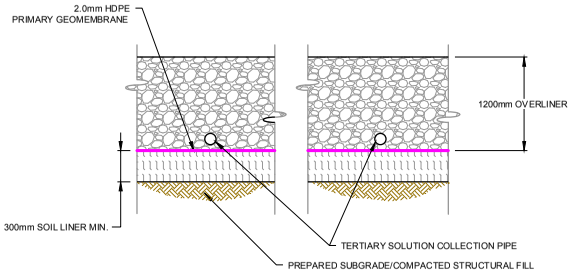

3/9 HEAP LEACH PAD TERTIARY PIPING DETAIL
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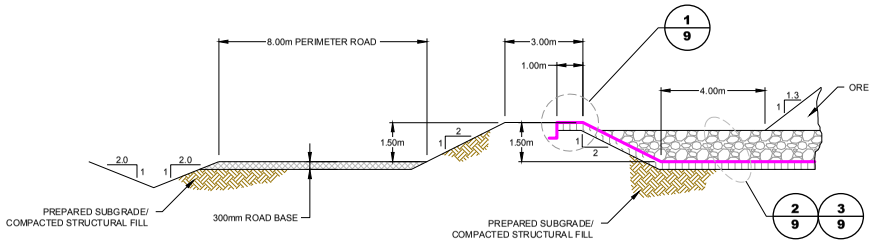

4/9 HEAP LEACH PAD NORTHWEST AND SOUTHWEST EDGE
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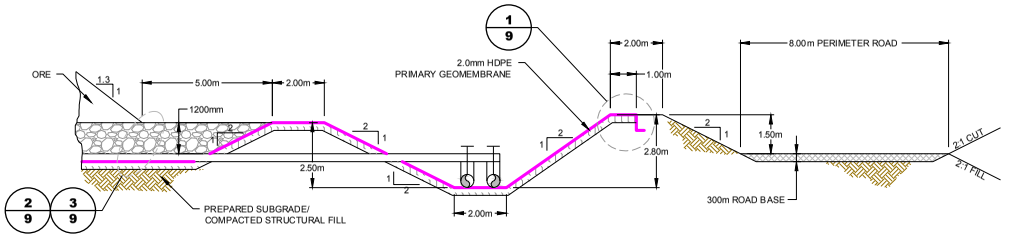

5/9 HEAP LEACH PAD NORTHEAST EDGE AND SOULTION CORRIDOR DETAIL
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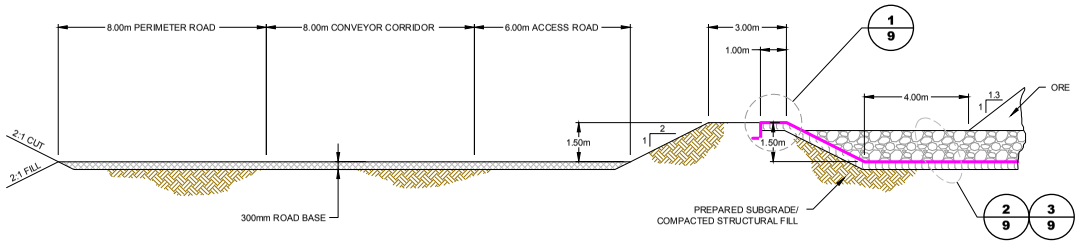

6/9 HEAP LEACH PAD SOUTHWEST EDGE
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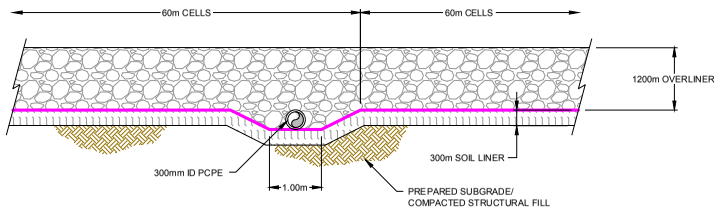

7/9 HEAP LEACH PAD PIPE TRENCH DETAIL
NOT TO SCALE

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PRE-FEASIBILITY STUDY
HIMMETDEDE HEAP LEACH PROJECT

HEAP LEACH PAD

HEAP LEACH PAD DETAILS

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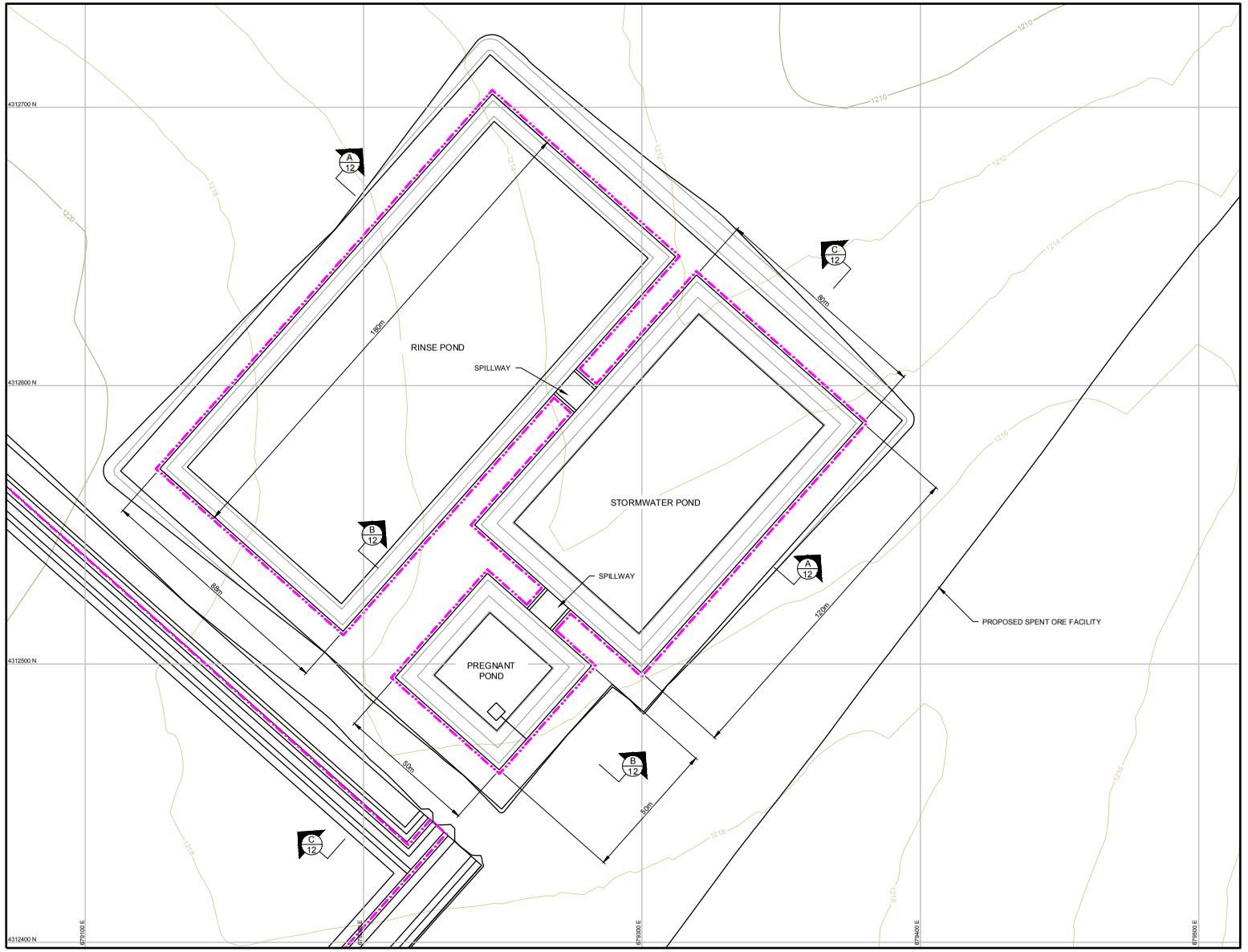

LEGEND

- EXISTING GROUND CONTOURS (MAJOR/MINOR)
- GEOMEMBRANE LINER (DOUBLE)
- GEOMEMBRANE LINER (SINGLE)
- LCRS

REFERENCES

1. EXISTING GROUND TOPOGRAPHY IS A COMPOSITE SURFACE OF DATA RECEIVED FROM CLIENT IN GIS FORMAT, AND DXF TOPOGRAPHY ISSUED FROM KOZA ON 06APR11.
2. EXISTING ROAD AND RAIL LINE DIGITIZED BY SRK FROM GENERAL COMMAND TOPOGRAPHIC MAPS PROVIDED BY KOZA.

N

0 20 40 60 80 100
Scale in Metres

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FILE NAME: 216003.Rev.C.Dwg.10.Pond.Plan.2012-03-05.dwg

PRE-FEASIBILITY STUDY
HIMMETDEDE HEAP LEACH PROJECT

HEAP LEACH PAD

SOLUTION PONDS PLAN VIEW

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LEGEND

EXISTING GROUND CONTOURS (MAJOR/MINOR)

REFERENCES

1. EXISTING GROUND TOPOGRAPHY IS A COMPOSITE SURFACE OF DATA RECEIVED FROM CLIENT IN GIS FORMAT, AND DXF TOPOGRAPHY ISSUED FROM KOZA ON 06APR11.
2. EXISTING ROAD AND RAIL LINE DIGITIZED BY SRK FROM GENERAL COMMAND TOPOGRAPHIC MAPS PROVIDED BY KOZA.

CUT/FILL ISOPACH

MINIMUM DEPTH	MAXIMUM DEPTH	COLOR	AREA (2D m^2)	VOLUME (m^3)
-6.00	-5.00		545	131
-5.00	-4.00		2326	1573
-4.00	-3.00		4487	4984
-3.00	-2.00		5889	10089
-2.00	-1.00		7297	16894
-1.00	0.00		5912	23735
0.00	1.00		6000	12457
1.00	2.00		3423	7567
2.00	3.00		2353	4757
3.00	4.00		1868	2713
4.00	5.00		1196	1167
5.00	6.00		619	207

N

0 5 10 15 20 25
Scale in Metres

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SRK JOB NO.: 216003

FILE NAME: 216003.Rev.C.Dwg.11.Pond.Isopach.Plan.2012-03-05.dwg

PRE-FEASIBILITY STUDY
HIMMETDEDE HEAP LEACH PROJECT

HEAP LEACH PAD

SOLUTION PONDS ISOPACH PLAN VIEW

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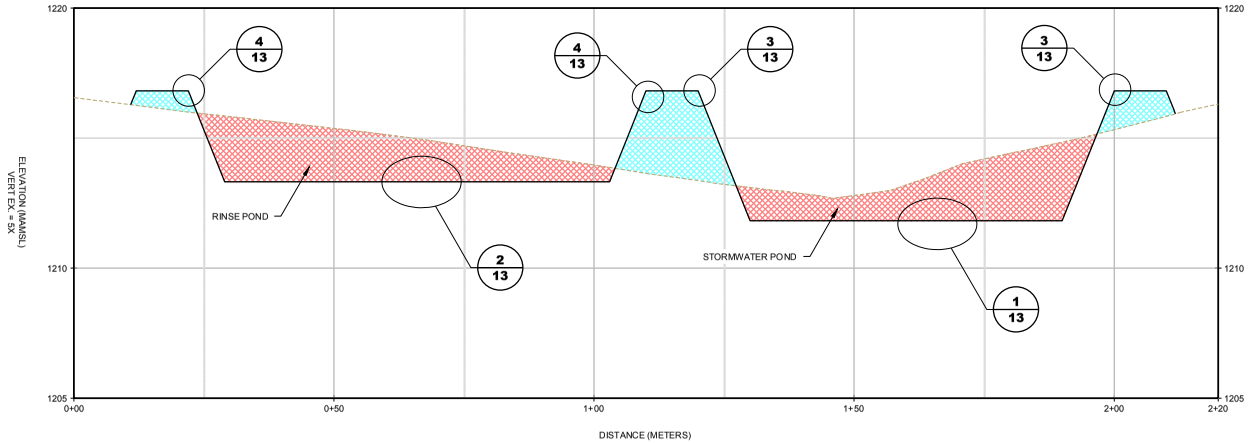
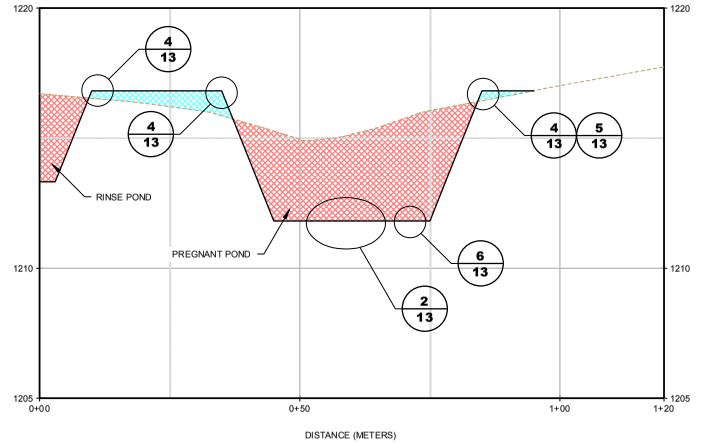
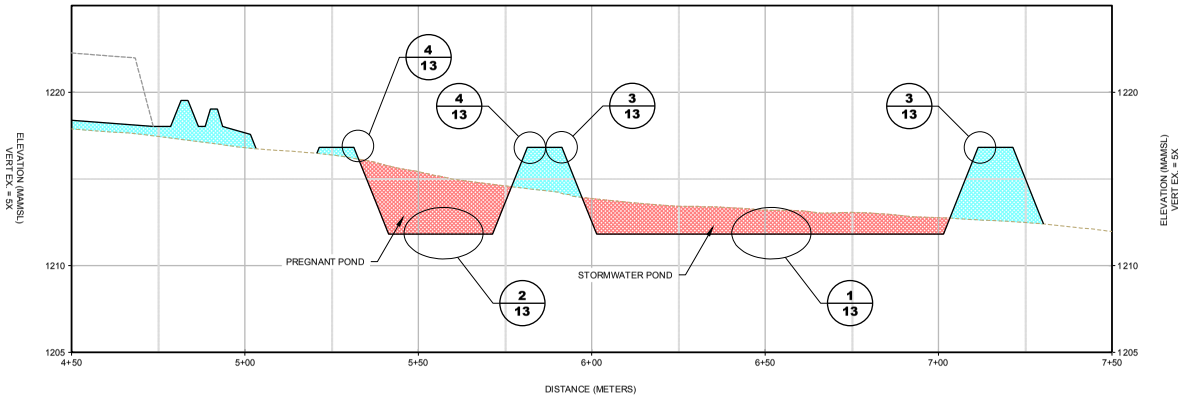


A/12 PROPOSED STORMWATER AND RINSE POND CROSS SECTION
PER GRID



B/12 PROPOSED PREGNANT POND CROSS SECTION
PER GRID



C/12 PROPOSED SOLUTION PONDS CROSS SECTION
PER GRID

srk consulting

SRK JOB NO.: 216003

FILE NAME: 216003.Rev.C.Dwg.12.Pond.Cross.Sections.2012-03-05.dwg

PRE-FEASIBILITY STUDY
HIMMETDEDE HEAP LEACH PROJECT

HEAP LEACH PAD

SOLUTION PONDS CROSS SECTIONS

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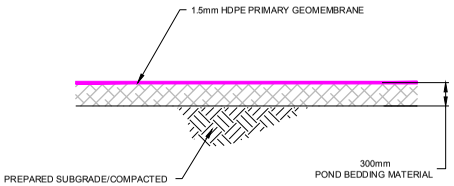
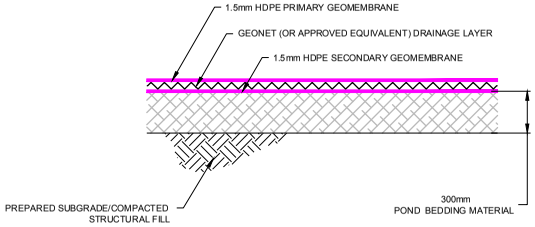


1/13 SINGLE LINER DETAIL
NOT TO SCALE



2/13 DOUBLE LINER DETAIL
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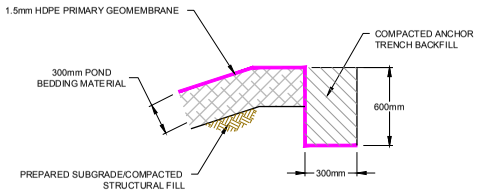

3/13 SINGLE ANCHOR TRENCH DETAIL
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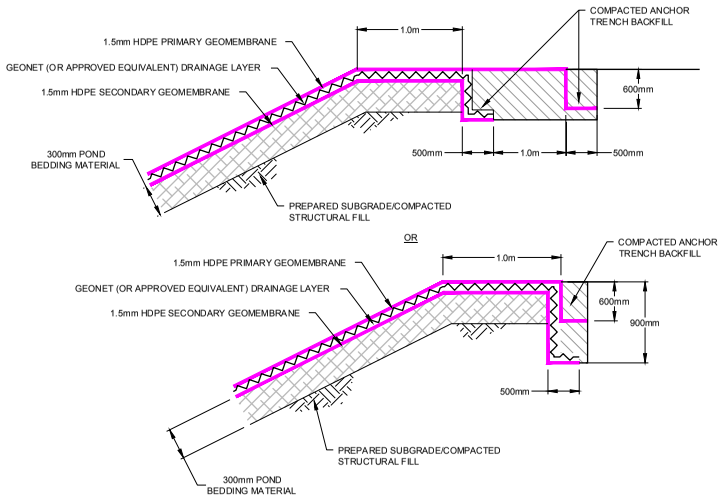

4/13 DOUBLE ANCHOR TRENCH DETAIL
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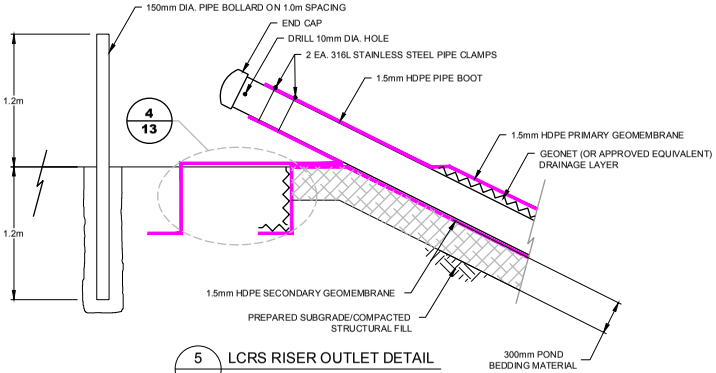

5/13 LCRS RISER OUTLET DETAIL
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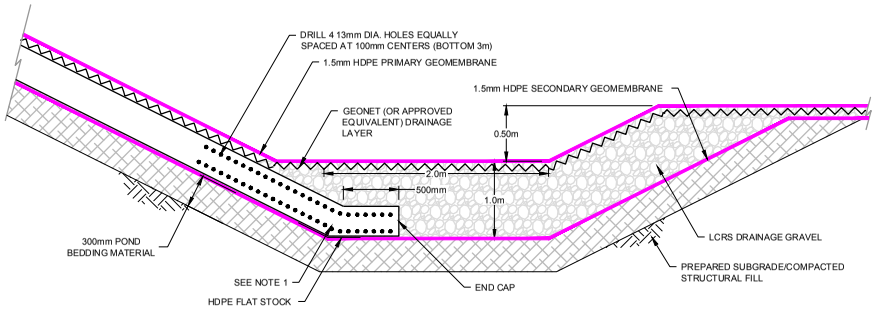

6/13 LCRS SUMP PLAN DETAIL
NOT TO SCALE

NOTE:
1. PIPE BEND TO BE FABRICATED TO MATCH SLOPE ANGLES.

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PRE-FEASIBILITY STUDY
HIMMETDEDE HEAP LEACH PROJECT

HEAP LEACH PAD

SOLUTION PONDS DETAILS

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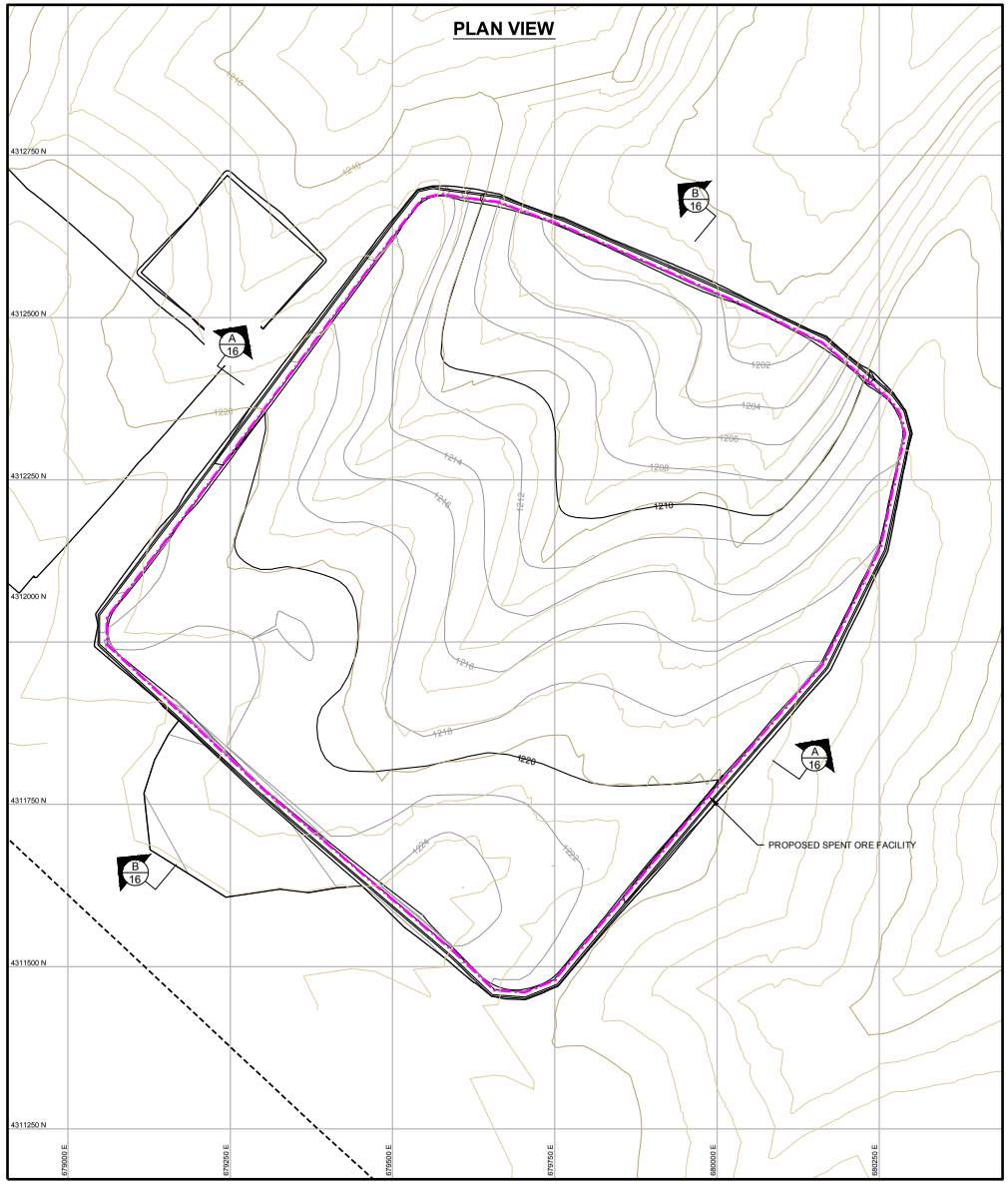
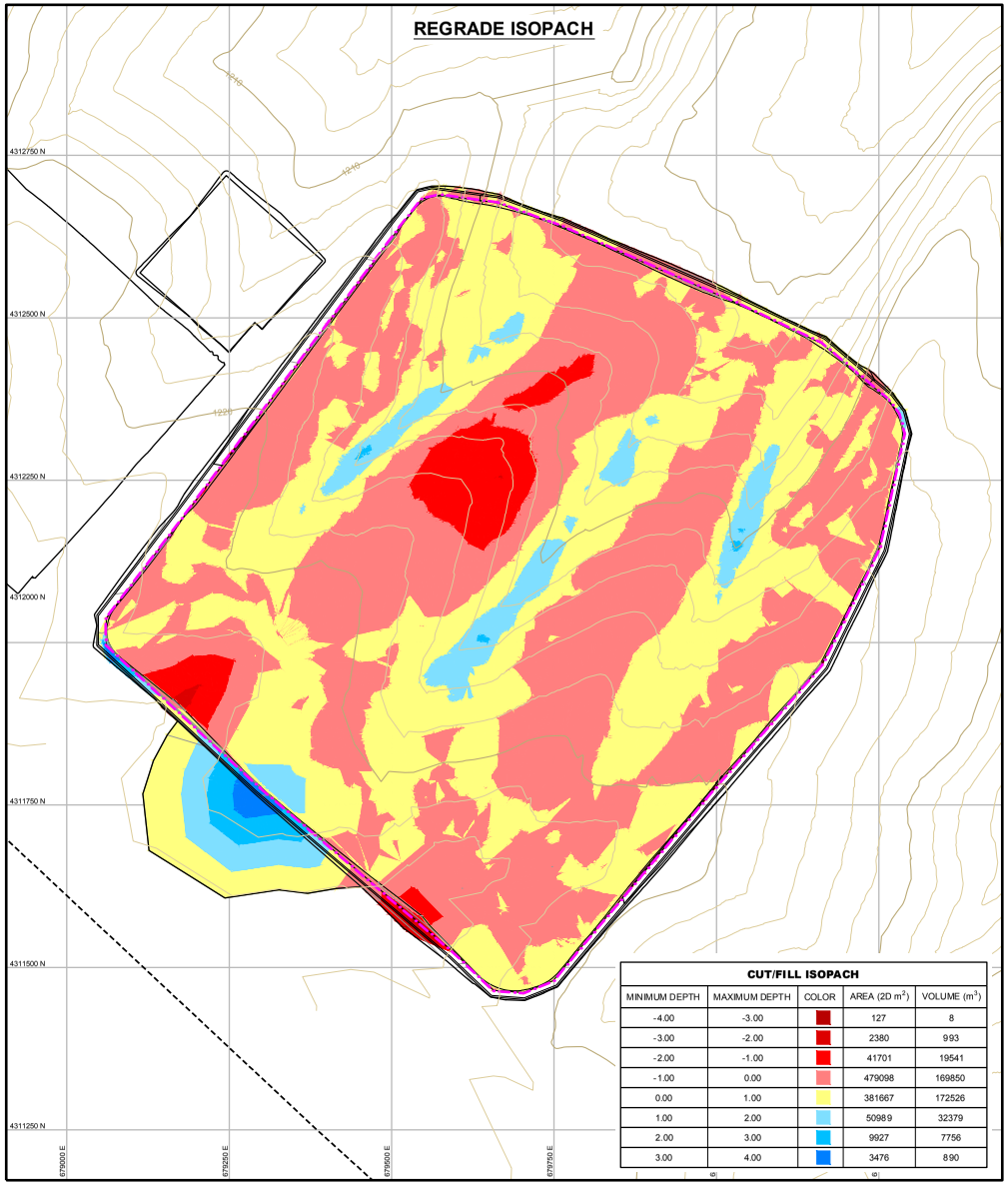
PLAN VIEW



REGRADE ISOPACH



CUT/FILL ISOPACH

MINIMUM DEPTH	MAXIMUM DEPTH	COLOR	AREA (2D m^2)	VOLUME (m^3)
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-3.00	-2.00		2380	993
-2.00	-1.00		41701	19541
-1.00	0.00		479098	169850
0.00	1.00		381667	172526
1.00	2.00		50989	32379
2.00	3.00		9927	7756
3.00	4.00		3476	890

LEGEND

- EXISTING GROUND CONTOURS (MAJOR/MINOR)
- PROPOSED HLP CONTOURS (MAJOR/MINOR)
- EXISTING HIGHWAY
- EXISTING POWER LINE

REFERENCES

1. EXISTING GROUND TOPOGRAPHY IS A COMPOSITE SURFACE OF DATA RECEIVED FROM CLIENT IN GIS FORMAT, AND DXF TOPOGRAPHY ISSUED FROM KOZA ON 06APR11.
2. EXISTING ROAD AND RAIL LINE DIGITIZED BY SRK FROM GENERAL COMMAND TOPOGRAPHIC MAPS PROVIDED BY KOZA.

0 40 80 120 160 200
Scale in Metres

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SRK JOB NO.: 216003

FILE NAME: 216003.Rev.C.Dwg.14.Proposed.SOF.Plan.2012-03-05.dwg

PRE-FEASIBILITY STUDY
HIMMETDEDE HEAP LEACH PROJECT

HEAP LEACH PAD

SPENT ORE FACILITY

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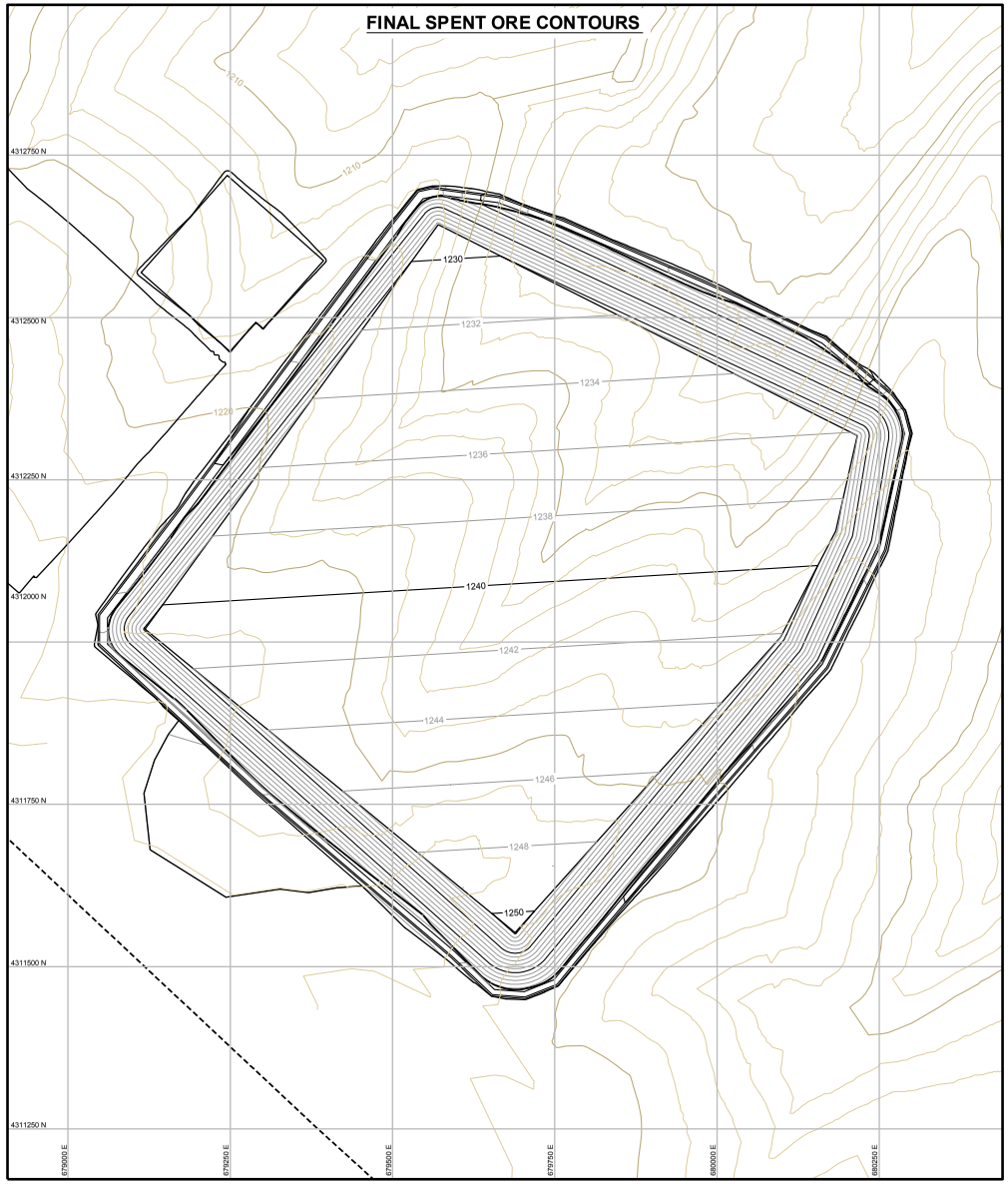
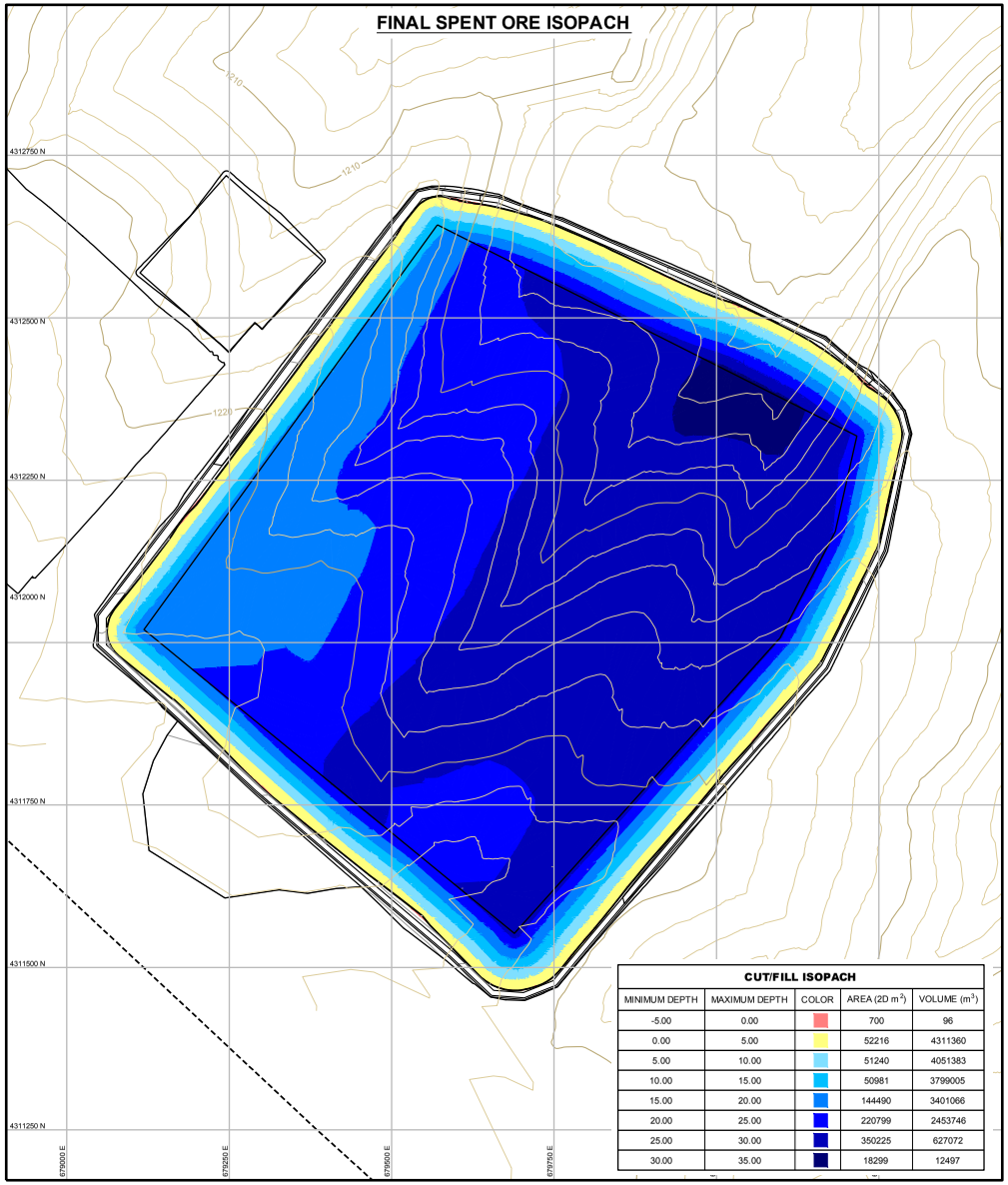
FINAL SPENT ORE CONTOURS



FINAL SPENT ORE ISOPACH



CUT/FILL ISOPACH

MINIMUM DEPTH	MAXIMUM DEPTH	COLOR	AREA (2D m^2)	VOLUME (m^3)
-5.00	0.00		700	96
0.00	5.00		52216	4311360
5.00	10.00		51240	4051383
10.00	15.00		50981	3799005
15.00	20.00		144490	3401066
20.00	25.00		220799	2453746
25.00	30.00		350225	627072
30.00	35.00		18299	12497

LEGEND

- EXISTING GROUND CONTOURS (MAJOR/MINOR)
- EXISTING GROUND CONTOURS (MAJOR/MINOR)
- EXISTING HIGHWAY
- EXISTING POWER LINE

REFERENCES

1. EXISTING GROUND TOPOGRAPHY IS A COMPOSITE SURFACE OF DATA RECEIVED FROM CLIENT IN GIS FORMAT, AND DXF TOPOGRAPHY ISSUED FROM KOZA ON 06APR11.
2. EXISTING ROAD AND RAIL LINE DIGITIZED BY SRK FROM GENERAL COMMAND TOPOGRAPHIC MAPS PROVIDED BY KOZA.

0 40 80 120 160 200
Scale in Metres

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SRK JOB NO.: 216003

FILE NAME: 216003.Rev.C.Dwg.15.Isopach.SOF.Plan.2012-03-05.dwg

PRE-FEASIBILITY STUDY
HIMMETDEDE HEAP LEACH PROJECT

HEAP LEACH PAD

SPENT ORE FACILITY ISOPACH AND FINAL CONTOURS

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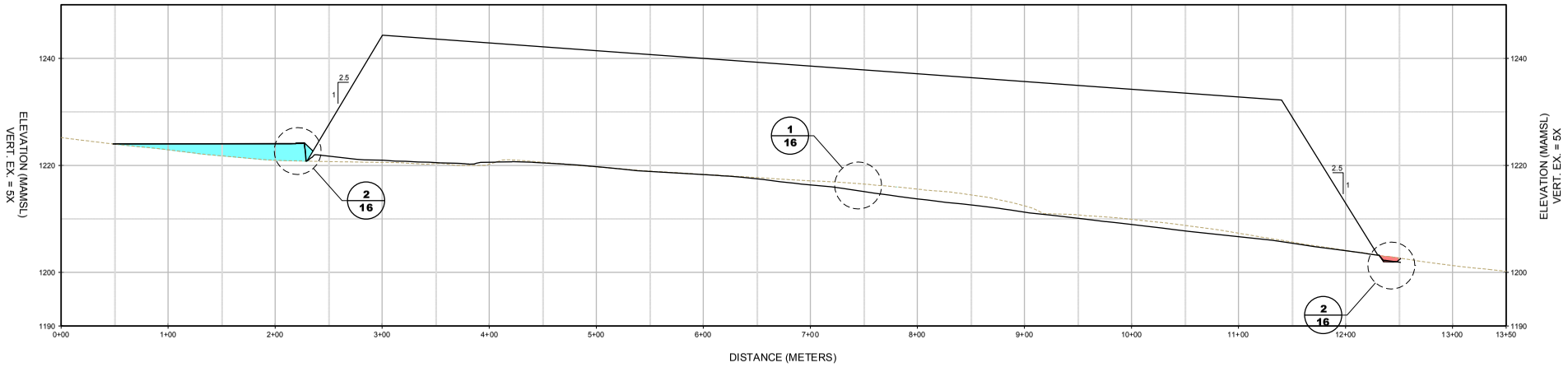
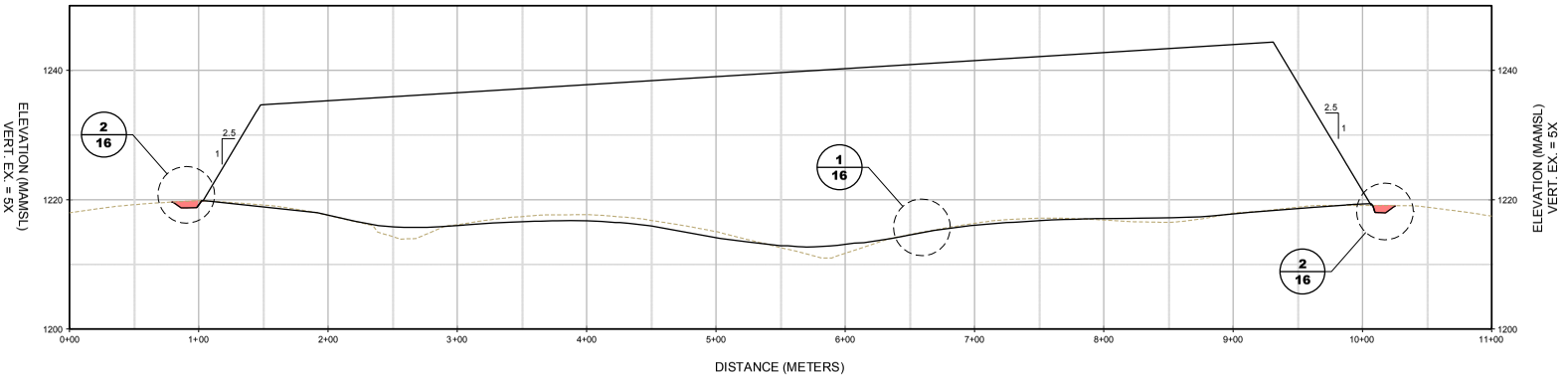
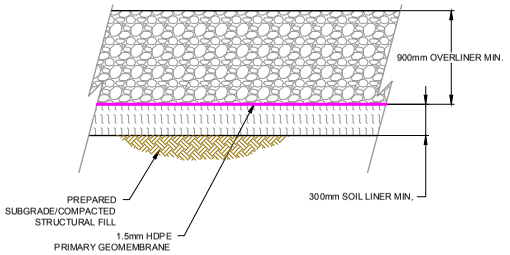


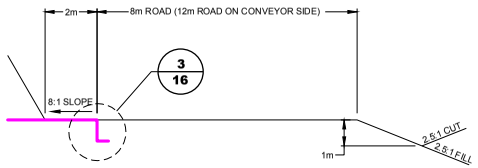
A 16 PROPOSED HEAP LEACH PAD CROSS SECTION
PER GRID



B 16 PROPOSED HEAP LEACH PAD CROSS SECTION
PER GRID



1 16 SPENT ORE FACILITY LINER DETAIL
NOT TO SCALE



2 16 SPENT ORE FACILITY LINER DETAIL
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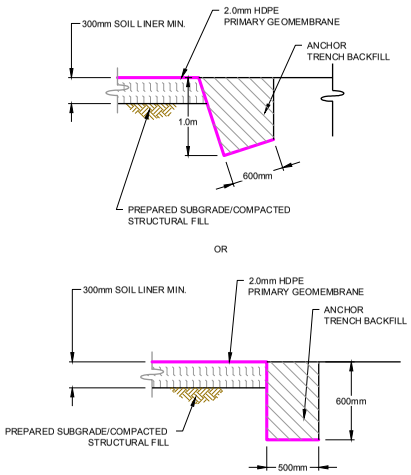

3 16 ANCHOR TRENCH DETAIL
NOT TO SCALE

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SRK JOB NO.: 216003

FILE NAME: 216003.Rev.C.Dwg.16.Proposed.SOF.Cross Sections.2012-03-05.dwg

PRE-FEASIBILITY STUDY
HIMMETDEDE HEAP LEACH PROJECT

HEAP LEACH PAD

PROPOSED SPENT ORE FACILITY CROSS SECTIONS

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MAR. 2012	TM	16	C

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Appendices

Appendix A: Design Criteria and Parameters

Item No.	Item	Value Description	Design Input	Source / Reference	Level of Confidence	Rev	Date	Comments
A - General								
A1	Latitude	38° 58' N	SRK	A	M	A	23May11	
A2	Longitude	35° 5' E	SRK	A	M	A	23May11	
A3	Coordinate System	UTM	SRK	A	M	A	23May11	
A4	Units	Metric	SRK	A	M	A	23May11	
A5	Ore Placement Start Date	01Oct12	SRK	A	M	A	23May11	
A6	Peak Ground Acceleration							
A7	Design Acceleration	2/3 PGA	SRK	A	M	A	23May11	
A8	Probabilistic Recurrent Period		SRK	A	M	A	23May11	
A9	Minimum Static FoS (Operations)	1.3	SRK	A	M	A	23May11	
A10	Minimum Static FoS (Closure)	1.5	SRK	A	M	A	23May11	
A11	Minimum Pseudo-Static FOS	1.1	SRK	A	M	A	23May11	
B - Process								
B1	**Dry Process Operating Schedule**							
B1.1	Operating shift schedule	7,200	SRK	A	M	A	23May11	
B1.2	Design utilization	20hr/d x 360d/yr	SRK	A	M	A	23May11	
B1.3	Dry Process Shift Schedule	2 x 10hr shifts per day	SRK	A	M	A	23May11	
B1.4	Ramp up Schedule	126 Days						
B1.5	Ore tpd	11,000 ktpd	SRK	A	M	A	18Dec11	
B1.6	Stacking Design Rate	750 t/hr	SRK	A	M	A	18Dec11	
B2	**Wet Process Operating Schedule**							

Item No.	Item	Value Description	Design Input	Source / Reference	Level of Confidence	Rev	Date	Comments
B2.1	Operating shift schedule	7,200	SRK	A	M	A	23May11	
B2.2	Design utilization	20hr/d x 360d/yr	SRK	A	M	A	23May11	
Ore								
C1	**Ore**							
C1.1	Maximum particle size	100% passing 9.5mm	SRK	A	M	A	23May11	
C1.2	Work index							
C1.3	Agglomeration	Yes	SRK	A	M	A	23May11	
C1.4	Amount of Lime Binder	1.75 kg/mt Ore	SRK	C	M	A	23May11	
C1.5	Amount of Cement Binder	1.50 kg/mt Ore	SRK	C	M	A	23May11	
C2	Ore Grade Design							
C3	Ore buffer storage – mined stockpile							
C4	Ore buffer storage – crushed stockpile							
C5	**Ore Density**							
C5.1	Ore bulk density(dry) - crushed ore on conveyor	1600kg/m3	SRK	A	M	A	23May11	
C5.2	Ore bulk density (dry)- average ore density as stacked on HLP.	1600kg/m3	SRK	A	M	A	23May11	
C5.3	Angle of repose	37degrees	SRK	A	M	A	23May11	
C6	**Water Content (gravimetric)**							
C6.1	As Delivered	3%	SRK	A	M	A	5Mar12	
C6.2	Leaching	18%	SRK	A	M	A	5Mar12	
C6.3	Draindown	12%	SRK	A	M	A	5Mar12	

Item No.	Item	Value Description	Design Input	Source / Reference	Level of Confidence	Rev	Date	Comments
C7	**Shear Strength**							
C7.1	Ore Shear Strength							
C7.2	Interface Shear Strength							
D – Heap Leach Pad								
D1	Lift height	4m	SRK	A	M	A	23May11	
D2	Surface area under leach	120,315 m^2	SRK	A	M	A	28Dec11	
D3	Number of cells (design) for ultimate configuration	10	SRK	A	M	A	28Dec11	
D4	Cell Width	60m	SRK	A	M	A	28Dec11	
D5	**Leaching Cycle**							
D5.1	Stacking	14 days	SRK	A	M	A	23May11	
D5.2	Irrigation	70 days	Koza	MT	M	A	23May11	
D5.3	Draindown	14 days	SRK	A	M	A	23May11	
D5.4	Unloading	14 days	SRK	A	M	A	23May11	
D5.5	Contingency	28 days	SRK	A	M	A	23May11	
D5.6	Total Cycle	140 days	SRK	A	M	A	23May11	
D6	Percent Recovery (Min.)							
D7	Primary Irrigation rate – $l/m^2/h$ (top / slopes)	10	SRK	A	M	A	23May11	
D8	Containment System	Composite liner system comprised of • 1200 mm Overliner • 2.0mm HDPE Geomembrane • 300 Soil Liner	SRK	A	M	A	23May11	
D9	Pad Type	On-Off	SRK	A	M	A	23May11	

DESIGN INPUT CODES

A = Assumed C = Calculated GT = Geotechnical Test work I = Industry Practice MT = Metallurgical Test work O = Owner
P = Published Information SRK = SRK Consulting

Item No.	Item	Value Description	Design Input	Source / Reference	Level of Confidence	Rev	Date	Comments
D10	Pad On loading System	Stacker	SRK	A	M	A	28Dec11	
D11	Pad Off-loading System	Loader / Belts	SRK	A	M	A	28Dec11	
D13	Maximum HLP Allowable Ground Contact Pressure							
E – Solution Ponds								
E1	PLS Flow nominal	1200 m^3/hr	SRK	C	M	A	28Dec11	
E2	**Pond Criteria**							
E2.1	No. of Ponds	1. Pregnant 2. Rinse 3. Storm	SRK	A	M	A	23May11	
E2.2	Pregnant Pond volume	Live storage Freeboard Delta Climatological Draindown Minimum intake pump depth (7,513 m^3)	SRK	A	M	A	23May11	
E2.3	Rinse Pond volume	Live storage Freeboard Delta Climatological Draindown Minimum intake pump depth (38,000 m^3)	SRK	A	M	A	23May11	
E2.4	Storm Pond volume	Freeboard Storm Event (27,000 m^3)	SRK	A	M	A	1Jan2012	
E2.5	Freeboard	500mm	SRK	A	M	A	23May11	
E2.6	Draindown (Rinse Pond)	24hours	SRK	A	M	A	23May11	

DESIGN INPUT CODES

A = Assumed C = Calculated GT = Geotechnical Test work I = Industry Practice MT = Metallurgical Test work O = Owner
P = Published Information SRK = SRK Consulting

Item No.	Item	Value Description	Design Input	Source / Reference	Level of Confidence	Rev	Date	Comments
E2.7	Draindown (Pregnant Pond)	6 Hours	SRK	A	M	A	23May11	
E2.8	Design Storm	100yr, 24 hour	SRK	A	M	A	23May11	
E2.9	Minimum intake pump depth	2m	SRK	A	M	A	23May11	
E3	Pregnant and Rinse Pond Containment	Double liner system comprised of • 1.5mm HDPE Geomembrane • Geonet • 1.5mm HDPE Geomembrane • 300 Compacted subgrade	SRK	A	M	A	23May11	
E3	Storm Pond Containment	Single liner system comprised of • 1.5mm HDPE Geomembrane • 300 Soil Liner	SRK	A	M	A	23May11	
F - Spent Ore								
F1	Containment	Composite liner system comprised of • Overliner • 1.5 mm HDPE Geomembrane • 300 Soil Liner	SRK	A	M	A	23May11	
G - Climate Data								
G1	Air temperature (°C)							
G2	**Minimum** Jan Feb Mar	 -6.9 -5.3 -1.5	SRK		M	A	23May11	**Climatological data from Kayseri weather station (about 40kms from HLP location)**

DESIGN INPUT CODES

A = Assumed C = Calculated GT = Geotechnical Test work I = Industry Practice MT = Metallurgical Test work O = Owner
P = Published Information SRK = SRK Consulting

Item No.	Item	Value Description	Design Input	Source / Reference	Level of Confidence	Rev	Date	Comments
	Apr	3.5						
	May	6.8						
	June	9.7						
	July	12.1						
	Aug	11.5						
	Sep	7.4						
	Oct	3.8						
	Nov	-1.1						
	Dec	-4.7						
	Yearly Minimum	**-6.9**						
G3	**Maximum**		SRK	C	M	A	23May11	**Climatological data from Kayseri weather station (about 40kms from HLP location)**
	Jan	3.8						
	Feb	5.7						
	Mar	11.5						
	Apr	17.6						
	May	22.1						
	June	26.7						
	July	30.5						
	Aug	30.6						
	Sep	26.5						
	Oct	20.2						
	Nov	12.2						
	Dec	5.8						
	Yearly Maximum	**30.6**						
G4	24 hr Storm for 100 yr return period	100mm	SRK	A	M	A	5Mar12	
G5	**Average Annual Evaporation**							
G6	From active leaching	1594 m^3 / cycle	SRK	C	M	A	1Feb12	
G7	From inactive leaching areas							

DESIGN INPUT CODES

A = Assumed C = Calculated GT = Geotechnical Test work I = Industry Practice MT = Metallurgical Test work O = Owner
P = Published Information SRK = SRK Consulting

Item No.	Item	Value Description	Design Input	Source / Reference	Level of Confidence	Rev	Date	Comments
G8	From ponds							
G9	**Monthly Average Precipitation**							
G10	Jan Feb Mar Apr May June July Aug Sep Oct Nov Dec **Annual Total**	31.7 33.0 41.1 56.3 57.4 36.0 13.1 6.5 11.4 33.3 38.2 39.4 **397.4**	SRK		M	A	23May11	**Climatological data from Kayseri weather station (about 40kms from HLP location)**
G11	**Monthly Average Evaporation**							
G12	Jan Feb Mar Apr May June July Aug Sep Oct Nov Dec **Annual Total**	0 0 0.6 58.0 124.5 172.0 216.5 201.6 140.4 68.9 1.7 0 **984.2**	SRK		M	A	23May11	**Climatological data from Kayseri weather station (about 40kms from HLP location)**

Item No.	Item	Value Description	Design Input	Source / Reference	Level of Confidence	Rev	Date	Comments
H - Mining								
H1	**Operating Schedule**							
H1.1	Hours per year	7,200 hr/yr	SRK		H	A	23May11	
H1.2	Operating shift schedule	20hr/d x 360d/yr	SRK		H	A	23May11	
H1.3	Mining shift schedule	2 x 10hr shifts per day	SRK		H	A	23May11	
H2	**Ore production rate**							
H2.1	Yr-1 Yr 1 Yr 2 Yr 3 Yr 4 Yr 5 Yr 6 Yr 7 Yr 8	0 4.0Mtpa / 11ktpd 4.0Mtpa / 11ktpd 4.0Mtpa / 11ktpd 4.0Mtpa / 11ktpd 4.0Mtpa / 11ktpd 4.0Mtpa / 11ktpd 4.0Mtpa / 11ktpd 1.2Mtpa / 11ktpd	O		H	B	08Aug11	
H2.2	Reserve	29.2Mt	O		H	A	23May11	

Appendix B: Phase I Geotechnical Report

PHASE-I

FACTUAL REPORT FOR SUBSURFACE INVESTIGATION FOR KOZA GOLD MINING PROJECT AT HIMMETDEDE, KAYSERİ

KOZA MINING AS

December 2011

476

CONTENTS

APPENDIXES

1.0 INTRODUCTION

This report represents the results of Phase-I work of Geological and Geotechnical subsurface investigation for the Koza Gold Mining AS's Project site at Himmetdede, Kayseri, in Turkey.

1.1 PURPOSE OF STUDY

The purpose of this study (Phase-I) is to determine the surface and subsurface ground conditions for planning the future drilling surveys at the project site and to obtain preliminary data about the physical properties of ground material. After the completion of drilling survey in Phase-II, the engineer will be provided with sufficient information for designing of most suitable and safe foundations for the gold mining operation complex which has been planned to set in the project site.

1.2 SCOPE OF STUDY

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The scope of study consists of the following items;

- Collecting information about previous studies done on the project site and maps related with the study area.
- Opening 35 numbers of Test Pits in order to determine the type, thickness, sequence, conditions and properties of the ground materials
- Taking representative bulk samples from the Test Pits for the laboratory works
- Carrying out the necessary laboratory tests on the bulk samples from Test Pits

1.3 GENERAL DESCRIPTION OF PROJECT AREA

The understudy project site is inside the boundary of Kayseri-province /Turkey. It is located to the north west of Kayseri Province (Figure-1). It is possible to arrive to the project site through Ankara-Kayseri Highway and the distance from Kayseri to project area is 50 km. Apart from the open pit region the site is relatively flat. At the open pit area where is in the north west of the site , the elevation rises up to 1259 meters from the sea level.

The main occupation of the population is sheep and cattle breeding and agriculture. Himmetdede and its adjoining areas have a continental climate; the temperature between day and night - summer and winter differs much. The nearest meteorological station is in Kayseri where 50 km east from Himmetdede.

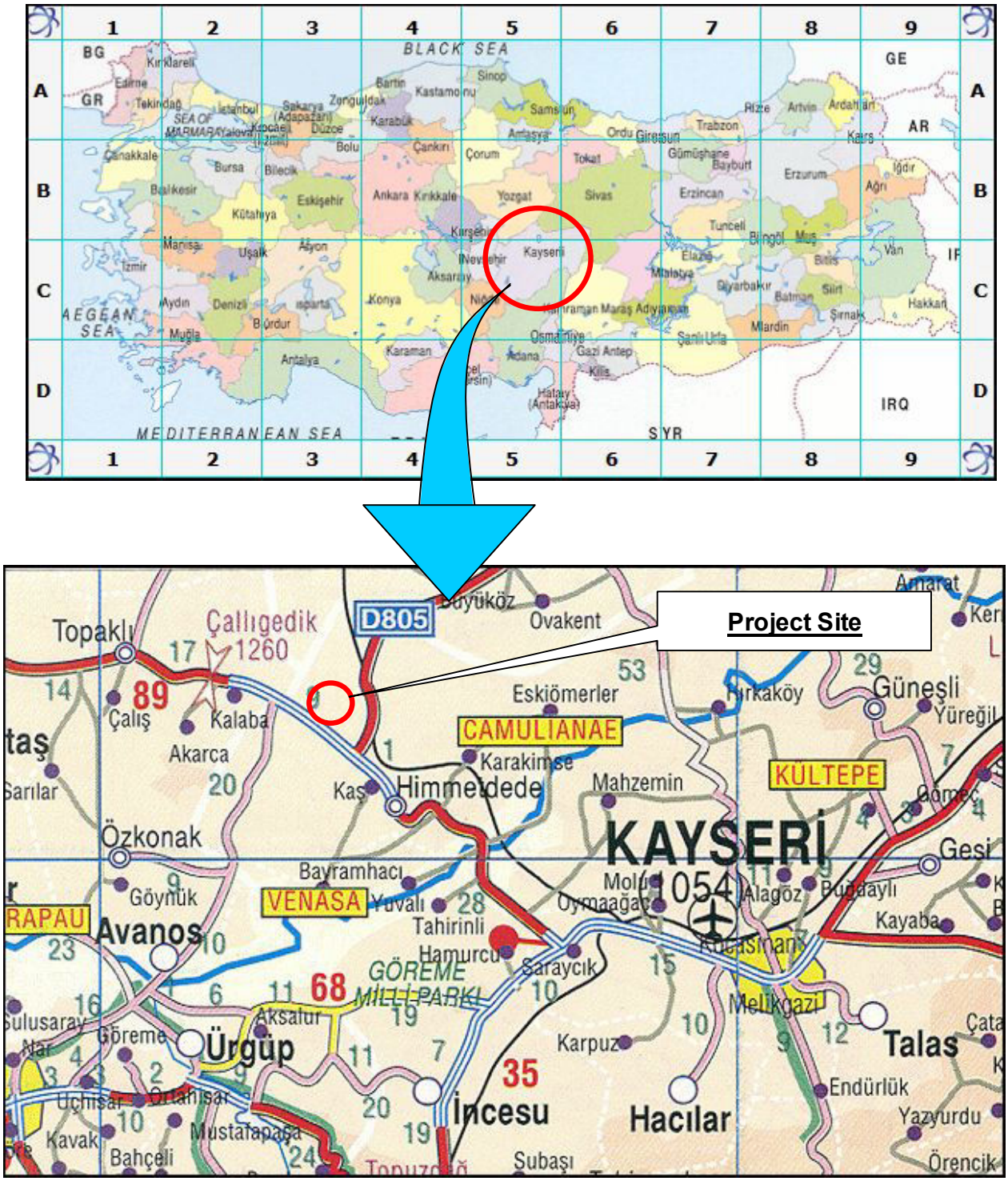


Figure-1: Location of Project Site

According to Meteorological records from Kayseri station;

Average temperature is; 10.4 °C

Average air pressure is; 892.3 hPa

Dominant wind direction is; towards south

Average wind speed is; 1.8 m/s

Average relative humidity is; 64 %

Average precipitation per year is; 397.1 mm

2.0 SITE INVESTIGATION

Based on the study scope mentioned earlier, between the dates of 17.10.2011 and 19.10.2011 the site visit was carried out for the visual inspection of the ground conditions and to open 35 numbers of test pits for collecting bulk samples for the laboratory works. After opening the test pits, sub ground conditions were investigated in detail and Test Pit logs were prepared considering the data obtained from the test pits. The list of the test pits are given in Table-1 together with their coordinates.

Test Pit No	North	East
TP-1	4313639	678120
TP-2	4313400	677910
TP-3	4313260	678137
TP-4	4313400	678376
TP-5	4313409	678068
TP-6	4313732	677336
TP-7	4313212	678729
TP-8	4313050	679138
TP-9	4313095	679352
TP-10	4313210	679072
TP-11	4313008	678277
TP-12	4312898	678045
TP-13	4312832	678002
TP-14	4312834	678235
TP-15	4312957	678505
TP-16	4312830	678338
TP-17	4312522	678654
TP-18	4312433	678896
TP-19	4312154	679139
TP-20	4312276	679369
TP-21	4312474	679196
TP-22	4312743	678947
TP-23	4312977	679695
TP-24	4312791	679554
TP-25	4312509	679710
TP-26	4312183	679681
TP-27	4311929	679481
TP-28	4311647	680029
TP-29	4312138	680162
TP-30 (*)	4312386	680374
TP-31	4312681	680204
TP-32	4312878	678471
TP-33	4312719	678715
TP-34	4312567	678497
TP-35	4313450	677373

(*) Cancelled

Table-1: List of the test pits

Also distribution of the test pit locations at the Project site is shown in Figure-2. Test Pit Logs and pictures of the Test Pits are given in Appendix-1

Figure-2; Test Pit locations

3.0 GEOLOGY of THE PROJECT SITE

The geological properties of the Project site is shown in Figure-2, together with layout sketch of mining process complex. In the site Lutetian and Neogene aged geological formations are found. These geological units are demonstrated on the satellite picture taken from Google Earth (Figure-3) .

3.1. LUTETIAN FORMATION

The hilly parts of the Himmeddede region consist of marbles and metamorphic rocks. Marbles are coarse- to fine-grained, crystalline and sometimes the presence of breccia zones is observed. The rocks are grey-white, pink or purple. The thickness of these marbles is about 20-30 cm but at places they are thicker and more massive. In some places marble levels are inter bedded with chlorite schistes.

3.2 NEOGENE FORMATIONS

This formation is composed of: a) Lacustrine limestone, b) tuffs, c) sandy, clayey, calcareous tuffs, Their aged is Upper Miocene.

a) Lacustrine Limestone; the lacustrine limestone which are generally flaggy (5-10 cm in thickness) or travertine in structure or passing from one to another laterally and vertically. These limestone layers overlie unconformably the marbles and crystalline schist levels.

b) Tuffs; tuffs are generally 1 m thick and homogeneous in structure. Towards west they contain clay or sandy clayey beds. The color of these tuffs is generally white, pink and rarely black. These tuffs are used as building material all over the area.

c) Sandy, clayey, calcareous tuffs; these heterogeneous lake deposits generally are seen at the east and northeast of Himmetdede. At the project site, calcareous tuffs were only seen in Test Pits 24, 28 and 29. Due to having limited separation at the project site, these calcareous tuffs were not shown in Figure-3.

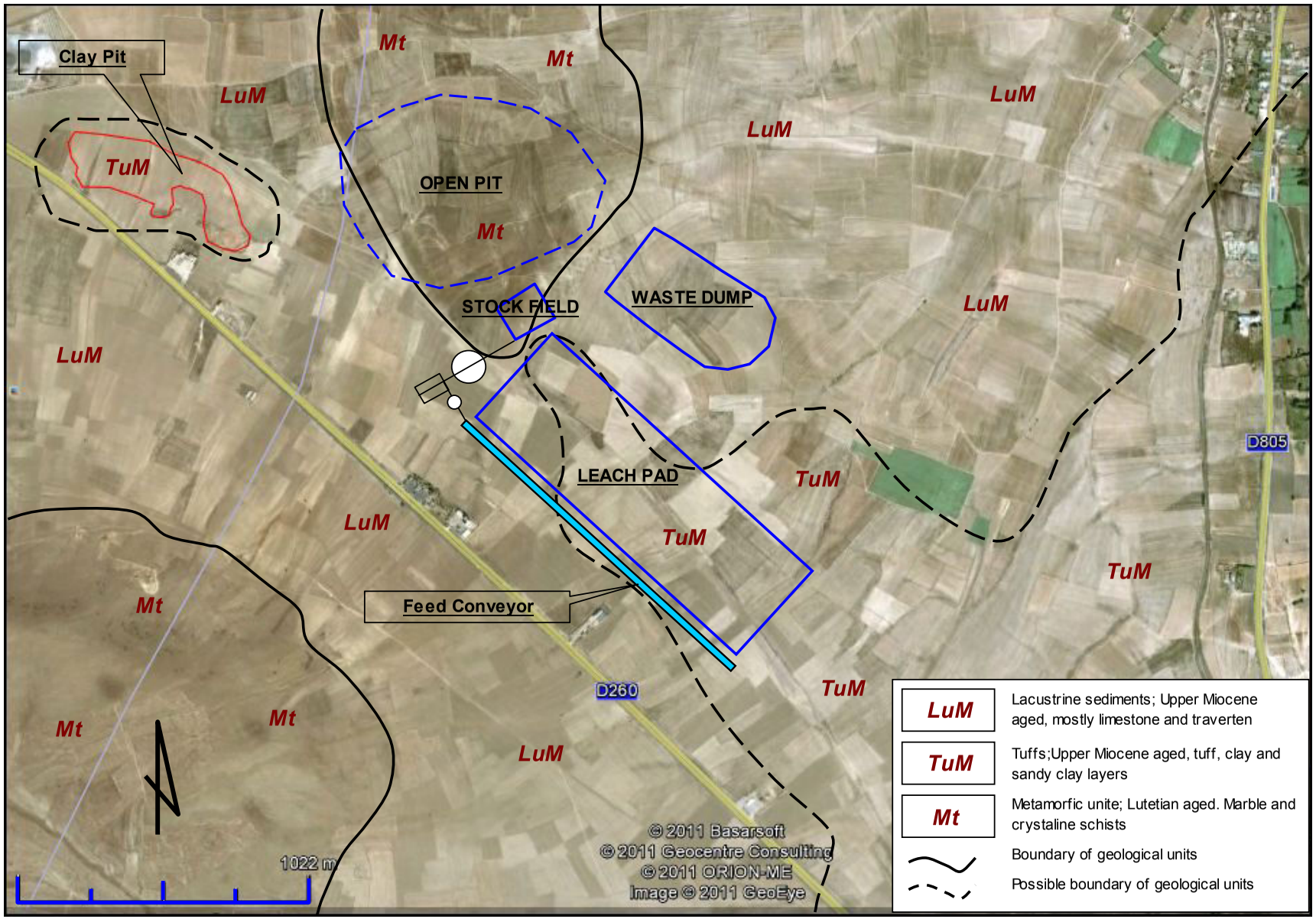


Figure-3; Geological Map of the Project Site

4. LABORATORY WORKS

During the test pit works total 30 numbers of bulk samples were collected. On these samples index property tests and soil classification tests were carried out in the Soil Laboratory of EFOL Geotechnical Services in Ankara/Turkey.

Apart from the above mention tests, on the clay samples taken from the test pits 6, 11 and 35 standard compaction and permeability tests were also performed to understand the suitability of the clay materials as being the foundation layer of Leach Pad.

Summary sheets of the laboratory results are given in Appendix-2

APPENDIX-1

TEST PIT LOGS

and

TEST PIT PICTURES

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

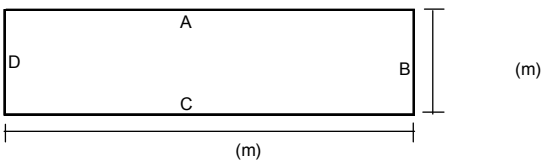
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-1	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	1,20
Tarih / Date	17.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.313.639
Makine / Machine	Hidromek 220LC		E	678.120

Derinlik / Depth (m)	Numune No / Sample No	Numune Derinliği / Depth of Sample (m)	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test: Cinsi / Type	Yerinde Deney / Insitu Test: Sonuç / Result (kg/cm²)	Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
0,30 m							TS	Top Soil
0,45 m								Light brown gravely silty sand
	S-1		D				SM	Yellowish brown colored highly weathered rock, soft rock, easy to dig by excavator
1,00 m								
1,20 m								Yellowish brown colored slightly weathered rock, hard to excavate by machine
2								
3								
4								
5								
6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-1

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

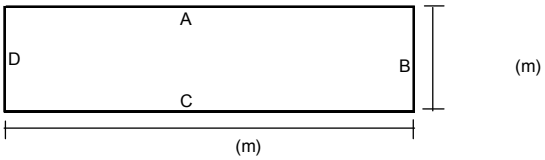
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-2	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	1,60
Tarih / Date	17.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.313.400
Makine / Machine	Hidromek 220LC		E	677.910

Derinlik / Depth (m)	Numune No / Sample No	Numune Derinliği / Depth of Sample (m)	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test: Cinsi / Type	Yerinde Deney / Insitu Test: Sonuç / Result (kg/cm²)	Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
-							TS	Top Soil
0,50 m								
- 1	S-1		D				ML	Yellowish brown colored clayey silty fine sand or low plastic silt, slightly wet, medium dense, Residual soil
1,40 m								Yellowish brown colored slightly weatherede rock, hard to excavate by machine
1,60 m								
- 2								
- 3								
- 4								
- 5								
- 6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-2

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

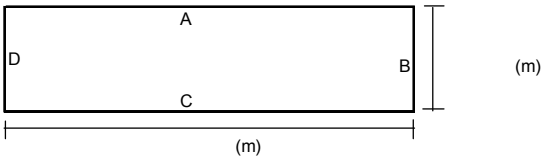
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-3	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	2,40
Tarih / Date	17.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.313.260
Makine / Machine	Hidromek 220LC		E	678.137

Derinlik / Depth (m)	Numune No / Sample No	Numune Derinliği / Depth of Sample (m)	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test: Cinsi / Type	Yerinde Deney / Insitu Test: Sonuç / Result (kg/cm²)	Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
-							TS	Top Soil
0,50 m								
- 1	S-1		D				ML	Darkish brown colored, clay or silt, dry to slightly wet, medium soft to soft, residual soil
1,50 m								
- 2	S-2		D				ML	Yellowish brown colored, highly weathered rock, partly oxidized, soft rock
2,40 m								
- 3								
- 4								
- 5								
- 6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION

D = Torba Numune / Bulk Sample

CP= Cep Penetrometre Ölçümü / Pocket Penetrometer

Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-3

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

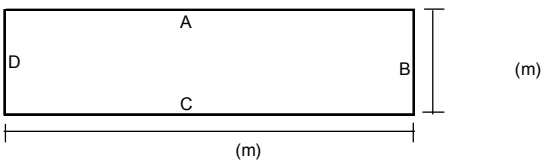
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-4	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	3,00
Tarih / Date	17.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.313.400
Makine / Machine	Hidromek 220LC		E	678.376

Derinlik / Depth (m)	Numune No / Sample No	Numune Derinliği / Depth of Sample (m)	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test: Cinsi / Type	Yerinde Deney / Insitu Test: Sonuç / Result (kg/cm²)	Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
-							TS	Top Soil
0,40 m								White colored carbonate layer, hard crust (Travertine)
0,60 m								
- 1	S-1		D				SM	Yellowish brown colored, highly weathered rock, soft rock, easy to excavate by machine
- 2								
3,00 m								
- 4								
- 5								
- 6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-4

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

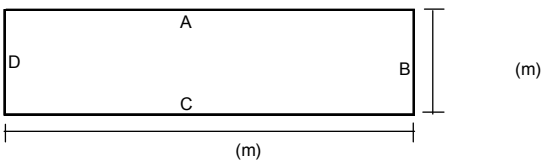
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	**TP-5**	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	1,55
Tarih / Date	17.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.313.409
Makine / Machine	Hidromek 220LC		E	678.068

Derinlik / Depth	Numune No / Sample No	Numune Derinliği / Depth of Sample	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test		Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
(m)		(m)		Cinsi / Type	Sonuç / Result (kg/cm^2)			
-							TS	
- 1	S-1						SM	
- 2								
- 3								
- 4								
- 5								
- 6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-5

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

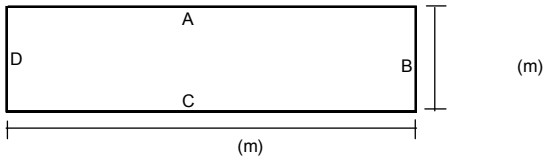
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-6	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	3,40
Tarih / Date	19.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.313.732
Makine / Machine	Hidromek 220LC		E	677.336

Derinlik / Depth (m)	Numune No / Sample No	Numune Derinliği / Depth of Sample (m)	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test: Cinsi / Type	Yerinde Deney / Insitu Test: Sonuç / Result (kg/cm²)	Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
1							TS	
2								
3	S-1		D				MH	
4								
5								
6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-6

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

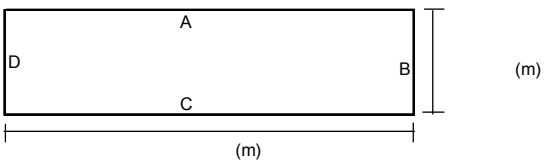
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-7	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	3,00
Tarih / Date	19.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.313.212
Makine / Machine	Hidromek 220LC		E	678.729

Derinlik / Depth	Numune No / Sample No	Numune Derinliği / Depth of Sample	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test		Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
(m)		(m)		Cinsi / Type	Sonuç / Result (kg/cm^2)			
-							TS	
-								
- 1								
-								
- 2	S-1		D				SM	
-								
-								
- 3								
-								
-								
- 4								
-								
-								
- 5								
-								
-								
- 6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-7

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

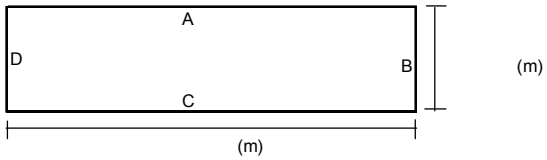
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	**TP-8**	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	2,00
Tarih / Date	19.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.313.050
Makine / Machine	Hidromek 220LC		E	679.138

Derinlik / Depth	Numune No / Sample No	Numune Derinliği / Depth of Sample	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test		Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
(m)		(m)		Cinsi / Type	Sonuç / Result (kg/cm^2)			
-							TS	
-								
- 1 -	S-1		D				GW-GM	
- 2 -								
- 3 -								
- 4 -								
- 5 -								
- 6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-8

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

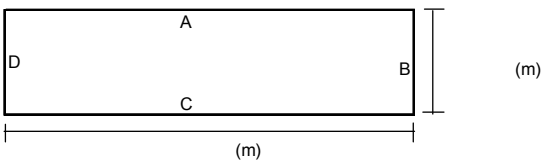
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-9	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	2,70
Tarih / Date	19.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.313.095
Makine / Machine	Hidromek 220LC		E	679.352

Derinlik / Depth (m)	Numune No / Sample No	Numune Derinliği / Depth of Sample (m)	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test: Cinsi / Type	Yerinde Deney / Insitu Test: Sonuç / Result (kg/cm^2)	Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
1	S-1		D				TS ML	
2								
3								
4								
5								
6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-9

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

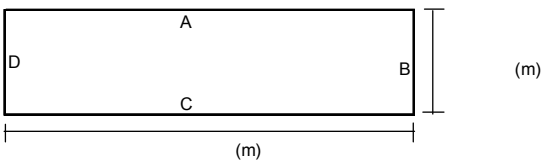
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-10	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	3,10
Tarih / Date	19.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.313.210
Makine / Machine	Hidromek 220LC		E	679.072

Derinlik / Depth (m)	Numune No / Sample No	Numune Derinliği / Depth of Sample (m)	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test: Cinsi / Type	Yerinde Deney / Insitu Test: Sonuç / Result (kg/cm²)	Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
0,40 m							TS	
1,40 m								
3,10 m								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-10

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

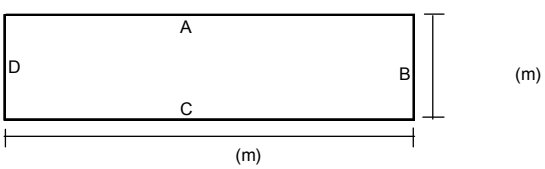
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-11	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	4,00
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	4,00
Tarih / Date	17.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.313.008
Makine / Machine	Hidromek 220LC		E	678.277

Derinlik / Depth (m)	Numune No / Sample No	Numune Derinliği / Depth of Sample (m)	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test: Cinsi / Type	Yerinde Deney / Insitu Test: Sonuç / Result (kg/cm²)	Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
-							TS	
1	S-1		D				CH	
2								
	S-2		D				MH	
3								
4								
5								
6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-11

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

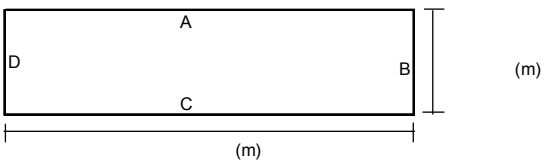
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-12	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	2,35
Tarih / Date	17.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.312.898
Makine / Machine	Hidromek 220LC		E	678.045

Derinlik / Depth	Numune No / Sample No	Numune Derinliği / Depth of Sample	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test		Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
(m)		(m)		Cinsi / Type	Sonuç / Result (kg/cm^2)			
-							TS	
- 1 - - 2	S-1		D				SM	
- 3 - - 4 - - 5 - - 6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-12

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

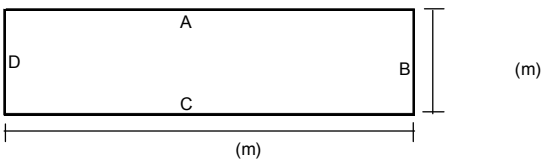
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-13	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	2,75
Tarih / Date	17.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.312.832
Makine / Machine	Hidromek 220LC		E	678.002

Derinlik / Depth (m)	Numune No / Sample No	Numune Derinliği / Depth of Sample (m)	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test: Cinsi / Type	Yerinde Deney / Insitu Test: Sonuç / Result (kg/cm²)	Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
-							TS	
- 1	S-1		D				SM	
- 2								
- 3								
- 4								
- 5								
- 6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-13

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

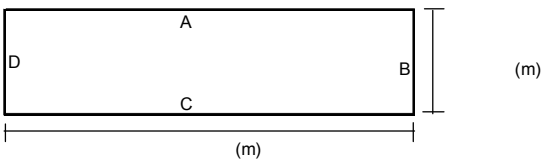
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-14	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	2,20
Tarih / Date	17.10ç2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.312.834
Makine / Machine	Hidromek 220LC		E	678.235

Derinlik / Depth (m)	Numune No / Sample No	Numune Derinliği / Depth of Sample (m)	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test: Cinsi / Type	Yerinde Deney / Insitu Test: Sonuç / Result (kg/cm²)	Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
1	S-1		D				TS / SM	
1,20 m								
2								
2,10 m								
3								
4								
5								
6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-14

	Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
	FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

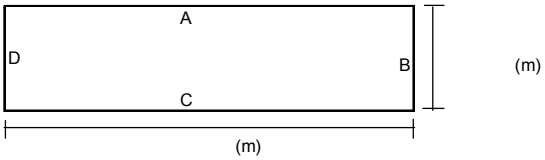
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-15	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	4,20
Tarih / Date	18.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.312.957
Makine / Machine	Hidromek 220LC		E	678.505

Derinlik / Depth	Numune No / Sample No	Numune Derinliği / Depth of Sample	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test		Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
(m)		(m)		Cinsi / Type	Sonuç / Result (kg/cm^2)			
0							TS	
1	S-1		D				SM	
2								
3	S-2		D				CH	
4								
5								
6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-15

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

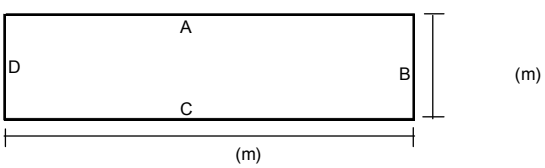
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-16	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	1,80
Tarih / Date	17.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.312.830
Makine / Machine	Hidromek 220LC		E	678.338

Derinlik / Depth	Numune No / Sample No	Numune Derinliği / Depth of Sample	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test		Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
(m)		(m)		Cinsi / Type	Sonuç / Result (kg/cm^2)			
- 1							TS	
- 2								
- 3								
- 4								
- 5								
- 6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-16

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

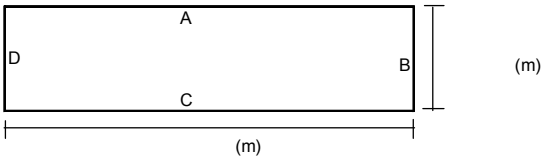
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-17	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	0,90
Tarih / Date	18.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.312.522
Makine / Machine	Hidromek 220LC		E	678.654

Derinlik / Depth	Numune No / Sample No	Numune Derinliği / Depth of Sample	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test		Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
(m)		(m)		Cinsi / Type	Sonuç / Result (kg/cm^2)			
-							TS	
- 1								
- 2								
- 3								
- 4								
- 5								
- 6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-17

	Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL	FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

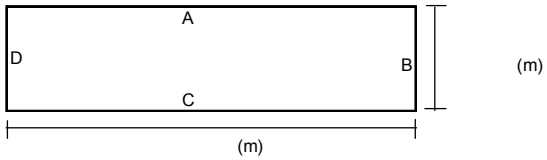
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-18	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	0,70
Tarih / Date	18.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.312.433
Makine / Machine	Hidromek 220LC		E	678.896

Derinlik / Depth (m)	Numune No / Sample No	Numune Derinliği / Depth of Sample (m)	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test: Cinsi / Type	Yerinde Deney / Insitu Test: Sonuç / Result (kg/cm²)	Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
0							TS	
1								
2								
3								
4								
5								
6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-18

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

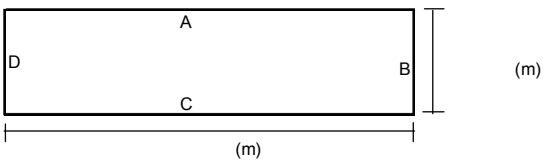
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-19	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	2,00
Tarih / Date	18.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.312.154
Makine / Machine	Hidromek 220LC		E	679.139

Derinlik / Depth	Numune No / Sample No	Numune Derinliği / Depth of Sample	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test		Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
(m)		(m)		Cinsi / Type	Sonuç / Result (kg/cm^2)			
0,40 m							TS	
1								
3								
4								
5								
6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-19

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

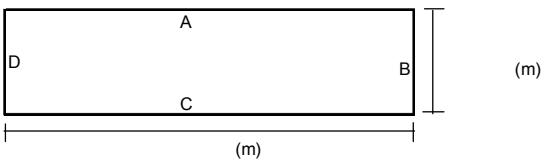
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	**TP-20**	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	0,90
Tarih / Date	18.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.312.276
Makine / Machine	Hidromek 220LC		E	679.369

Derinlik / Depth	Numune No / Sample No	Numune Derinliği / Depth of Sample	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test		Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
(m)		(m)		Cinsi / Type	Sonuç / Result (kg/cm^2)			
-							TS	
- 1								
- 2								
- 3								
- 4								
- 5								
- 6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-20

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

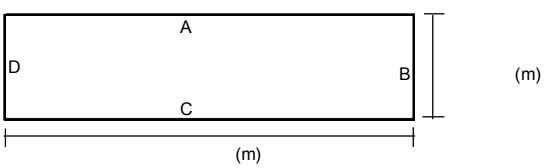
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	**TP-21**	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	2,10
Tarih / Date	18.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.312.474
Makine / Machine	Hidromek 220LC		E	679.196

Derinlik / Depth	Numune No / Sample No	Numune Derinliği / Depth of Sample	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test		Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
(m)		(m)		Cinsi / Type	Sonuç / Result (kg/cm^2)			
0,30 m							TS	
- 1	S-1		D				SM	
- 2								
- 3								
- 4								
- 5								
- 6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-21

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

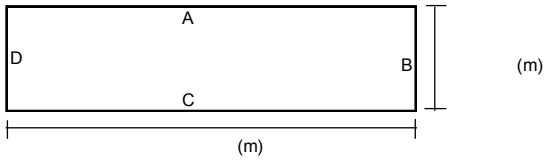
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-22	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	3,20
Tarih / Date	18.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.312.743
Makine / Machine	Hidromek 220LC		E	678.947

Derinlik / Depth (m)	Numune No / Sample No	Numune Derinliği / Depth of Sample (m)	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test: Cinsi / Type	Yerinde Deney / Insitu Test: Sonuç / Result (kg/cm²)	Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
1							TS	
2	S-1		D				MH	
			D				MH	
4								
5								
6								

Açıklama / Explanation:

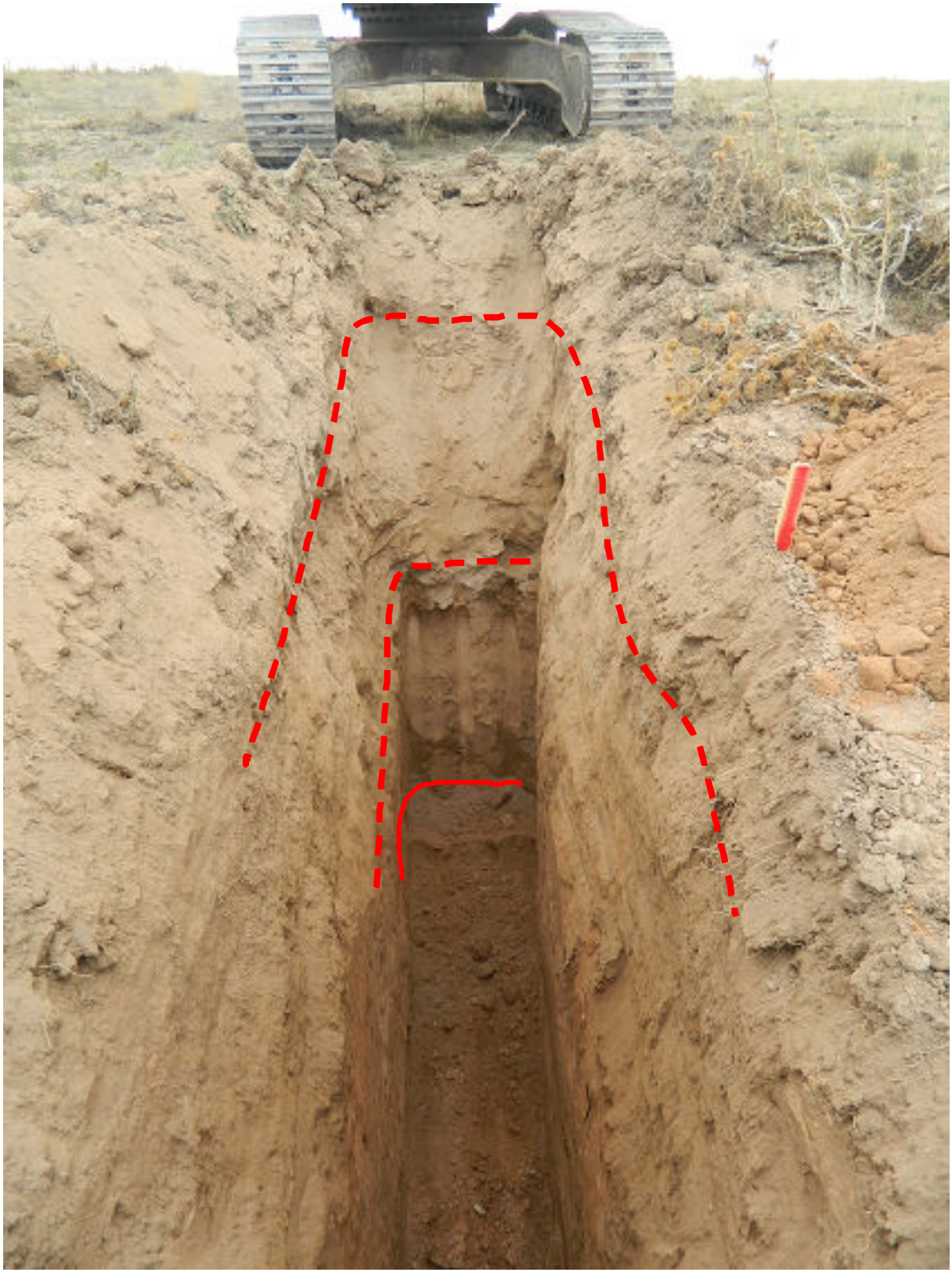
Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				



Test Pit-22

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

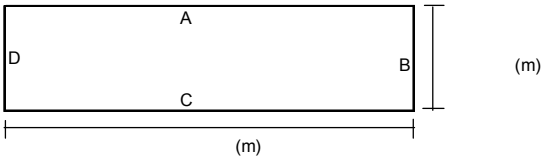
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	**TP-23**	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	4,40
Tarih / Date	19.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.312.977
Makine / Machine	Hidromek 220LC		E	679.695

Derinlik / Depth (m)	Numune No / Sample No	Numune Derinliği / Depth of Sample (m)	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test: Cinsi / Type	Yerinde Deney / Insitu Test: Sonuç / Result (kg/cm^2)	Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
1							TS	
2								
3								
4	S-1		D				CH	
5								
6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-23

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

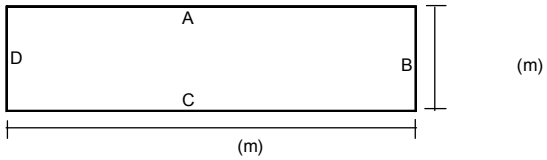
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-24	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	1,80
Tarih / Date	19.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.312.791
Makine / Machine	Hidromek 220LC		E	679.554

Derinlik / Depth	Numune No / Sample No	Numune Derinliği / Depth of Sample	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test		Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
(m)		(m)		Cinsi / Type	Sonuç / Result (kg/cm^2)			
1							TS	
	S-1		D				MH	
2								
3								
4								
5								
6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-24

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

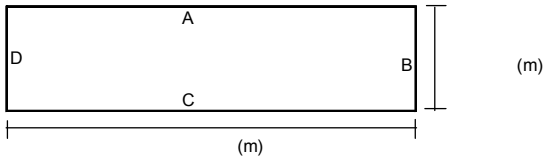
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-25	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	3,00
Tarih / Date	19.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.312.509
Makine / Machine	Hidromek 220LC		E	679.710

Derinlik / Depth (m)	Numune No / Sample No	Numune Derinliği / Depth of Sample (m)	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test: Cinsi / Type	Yerinde Deney / Insitu Test: Sonuç / Result (kg/cm²)	Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
-	S-1		D				TS	
							CL	
1	S-2		D				MH	
2								
3								
4								
5								
6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

No Picture for Test Pit-25

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

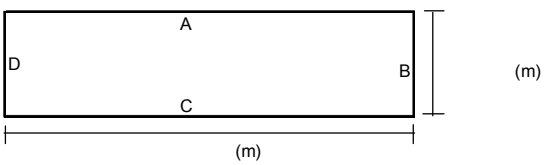
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-26	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	4,40
Tarih / Date	18.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.312.183
Makine / Machine	Hidromek 220LC		E	679.681

Derinlik / Depth (m)	Numune No / Sample No	Numune Derinliği / Depth of Sample (m)	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test: Cinsi / Type	Yerinde Deney / Insitu Test: Sonuç / Result (kg/cm^2)	Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
1	S-1		D				TS / CL	
2								
3	S-2		D				MH	
4								
5								
6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-26

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

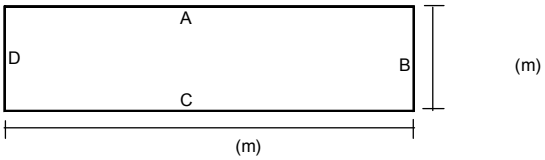
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-27	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	1,50
Tarih / Date	18.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.311.929
Makine / Machine	Hidromek 220LC		E	679.481

Derinlik / Depth	Numune No / Sample No	Numune Derinliği / Depth of Sample	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test		Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
(m)		(m)		Cinsi / Type	Sonuç / Result (kg/cm^2)			
1							TS	Top Soil
2								
3								
4								
5								
6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-27

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

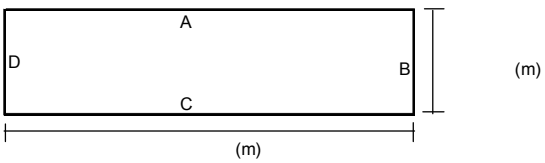
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-28	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	2,30
Tarih / Date	18.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.311.647
Makine / Machine	Hidromek 220LC		E	680.029

Derinlik / Depth	Numune No / Sample No	Numune Derinliği / Depth of Sample	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test		Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
(m)		(m)		Cinsi / Type	Sonuç / Result (kg/cm^2)			
0,45 m							TS	Top Soil
1								
2								
3								
4								
5								
6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

No Picture for Test Pit-28

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

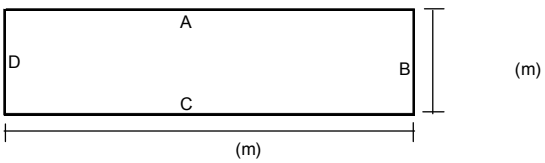
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-29	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	3,00
Tarih / Date	18.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.312.138
Makine / Machine	Hidromek 220LC		E	680.162

Derinlik / Depth (m)	Numune No / Sample No	Numune Derinliği / Depth of Sample (m)	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test: Cinsi / Type	Yerinde Deney / Insitu Test: Sonuç / Result (kg/cm^2)	Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
0,40 m							TS	Top Soil
1,00 m								White colored highly weathered rock (Tuff), cemented by washing calcium carbonated water, reasonably hard
3,00 m								Redish brown colored, silty clayey sand with few gravel, sligtly wet, loose to medium dense, residual soil

Açıklama / Explanation:

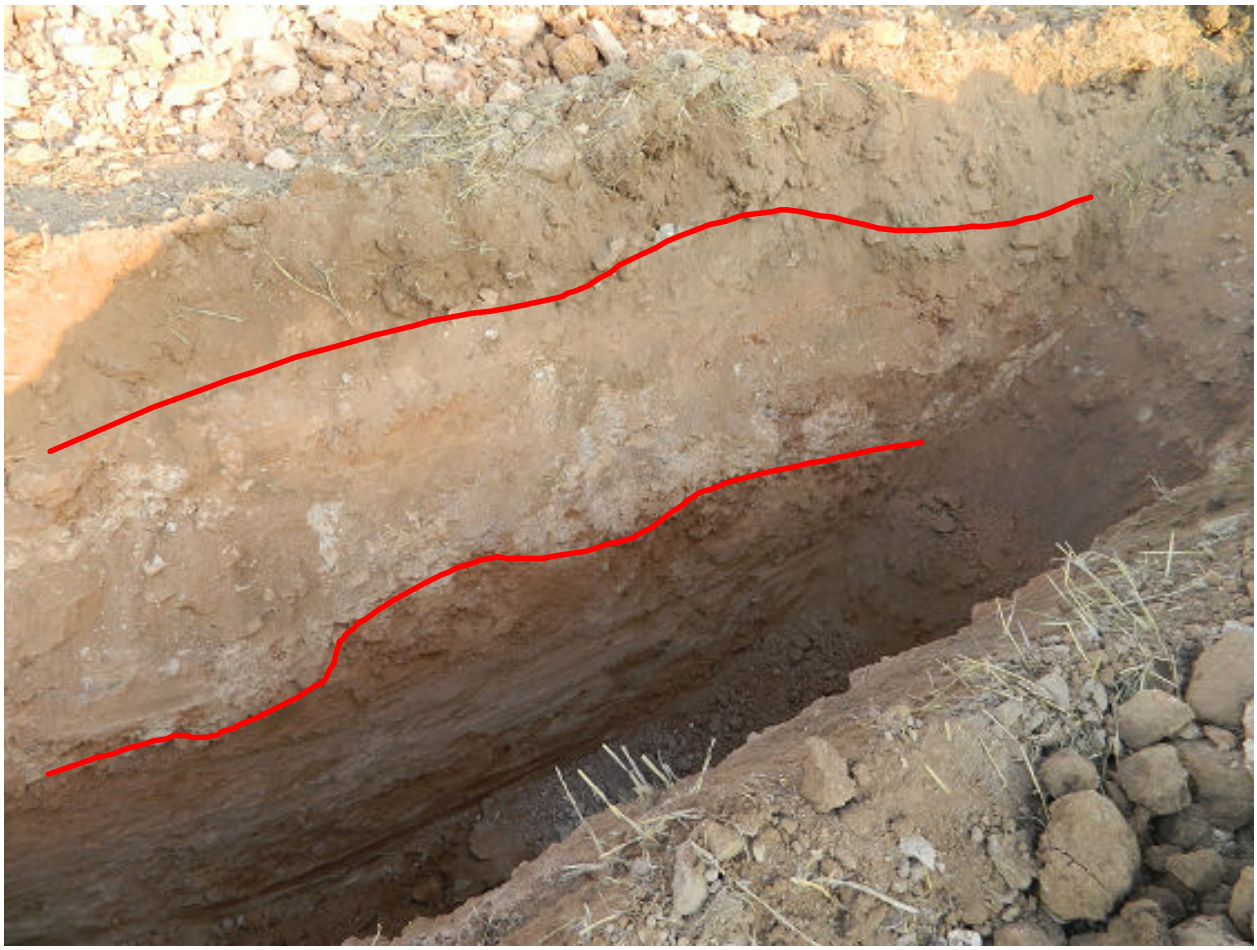
Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				



Test Pit-29

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

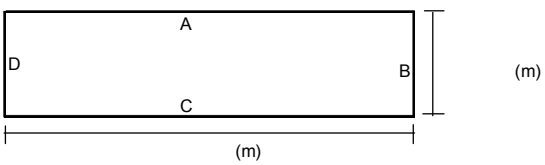
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-31	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	4,40
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	4,60
Tarih / Date	19.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.312.681
Makine / Machine	Hidromek 220LC		E	680.204

Derinlik / Depth (m)	Numune No / Sample No	Numune Derinliği / Depth of Sample (m)	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test: Cinsi / Type	Yerinde Deney / Insitu Test: Sonuç / Result (kg/cm²)	Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
-							TS	
- 1 - 2 - 3 - 4	S-1		D				CL	
- 5 - 6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-31

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

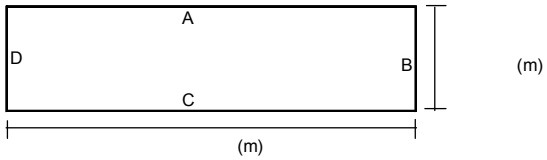
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-32	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	5,35
Tarih / Date	18.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.312.878
Makine / Machine	Hidromek 220LC		E	678.471

Derinlik / Depth (m)	Numune No / Sample No	Numune Derinliği / Depth of Sample (m)	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test: Cinsi / Type	Yerinde Deney / Insitu Test: Sonuç / Result (kg/cm²)	Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
-							TS	
- 1 - 2								
- 3 - 4 - 5								
- 6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-32

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

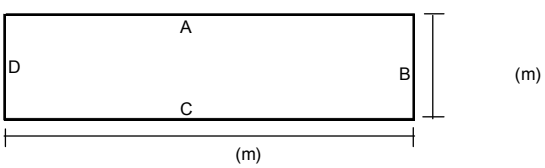
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-33	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	4,20
Tarih / Date	18.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.312.719
Makine / Machine	Hidromek 220LC		E	678.715

Derinlik / Depth	Numune No / Sample No	Numune Derinliği / Depth of Sample	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test		Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
(m)		(m)		Cinsi / Type	Sonuç / Result (kg/cm^2)			
-							TS	
- 1								
- 2								
- 3								
- 4								
- 5								
- 6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-33

	Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL	FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

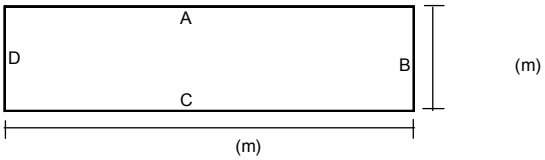
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-34	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	2,15
Tarih / Date	18.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.312.567
Makine / Machine	Hidromek 220LC		E	678.497

Derinlik / Depth	Numune No / Sample No	Numune Derinliği / Depth of Sample	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test		Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
(m)		(m)		Cinsi / Type	Sonuç / Result (kg/cm^2)			
- 1	S-1		D				TS	
- 2								
- 3								
- 4								
- 5								
- 6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-34

Uzman Ekip / Expert Team	İşveren / Client	Proje /Project
FUGRO SİAL YERBİLİMLERİ MÜŞAVİRLİK VE MÜHENDİSLİK LTD. ŞTİ.	Koza Madencilik	

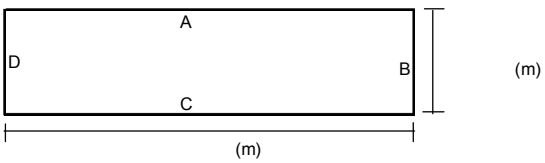
ARAŞTIRMA ÇUKURU LOGU / TEST PIT LOG

Çukur No / Test Pit No	TP-35	Sayfa No / Page No		1
Müteahhit / Contractor		YAS Derinliği / Ground water level	(m)	
Çukur Yeri / Pit Location		Çukur Derinliği / Depth of the Test Pit	(m)	4,50
Tarih / Date	19.10.2011	Kot / Elevation	(m)	
Kazı Metodu / Excavation Method	by Excavator	Koordinatlar / Coordinates	N	4.313.450
Makine / Machine	Hidromek 220LC		E	677.373

Derinlik / Depth (m)	Numune No / Sample No	Numune Derinliği / Depth of Sample (m)	Numune Türü / Type of Sample	Yerinde Deney / Insitu Test: Cinsi / Type	Yerinde Deney / Insitu Test: Sonuç / Result (kg/cm²)	Zemin Profili / Soil Profile	Zemin Cinsi / Soil Class	Zemin Tanımlaması / Description of the Soil
-							TS	
- 1	S-1	1,00	D				CH	
- 2		2,50						
- 3	S-2	3,00	D				CH	
- 4		4,50						
- 5								
- 6								

Açıklama / Explanation:

Üst Görünüm / Plan View: Azimut / Azimuth:



KISALTMALAR / ABBREVIATION
D = Torba Numune / Bulk Sample
CP= Cep Penetrometre Ölçümü / Pocket Penetrometer
Mühendis / Engineer

ZEMİN PARAMETRELERİ / SOIL PARAMETERS

İNCE DANELİ / FINE GRAINS		İRİ DANELİ / COARSE GRAINS		PLASTİSİTE / PLASTICITY	
N : 0 - 2	Ç.Yumuşak/Very Soft	N : 0 - 4	Çok Gevşek/Very Loose	PI : 1 - 5%	Çok Az / Trace of Plasticity
N : 3 - 4	Yumuşak / Soft	N :5 - 10	Gevşek / Loose	PI :5 - 10%	Az / Low Plastic
N : 5 - 8	Orta Katı / Medium	N :11 - 30	Orta Sıkı / Medium	PI :10 - 20%	Orta / Medium Plastic
N : 9 - 15	Katı / Stiff	N :31 - 50	Sıkı / Dense	PI :20 - 40%	Yüksek / High Plastic
N : 16 - 30	Çok Katı / Very Stiff	N :> 50	Çok Sıkı / Very Dense	PI :>40%	Çok Yüksek / Very High Plastic
N : > 30	Sert / Hard				

Test Pit-35

APPENDIX-2

LABORATORY RESULTS

EFOL JEOTEKNİK HİZMETLER TİCARET LİMİTED ŞTİ.
Özanadolu Sanayi Sitesi 677. Sok. No:36 Ostim/ANKARA
Tel: (0312) 394 03 61 Faks: (0312) 394 03 62

DENEYİ YAPTIRAN KURULUŞ :		YİBF NO:		TARİH
Sayfa : 1/1	Ek : sayfa deney sonucu	BAKANLIK RAPOR NO:		DENEY TARİHİ:

Proje Adı: HİMMETDEDE

DENEY SONUÇLARI ÖZET TABLOSU

Kuyu No /BH No	Örnek / Sample No	Derinlik / Depth	Elek Analizi / Sieve Analysis: Metot / Method	-#4	-#10	-#40	-#200	Cu	Cr	Atterberg Limit/At.Limits: Kurutma / Drying	LL	PL	PI	USCS: Birleştirilmiş Zemin Sınıfı / Unified Soil Classification System	Su Oranı / Water Cont.	Birim Ağırlık / Unit Weight: Doğal B.A. / Natural U.W.	Kuru B.A. / Dry U.W.	Üç eksenli / Triaxial Test: Deney Tipi	kg/cm²	Derece	Konsolidas./ Consolidation: Doğal Boşluk Oranı / Natural Void Ratio	Sonraki Boşluk Oranı / Void Ratio After Test	Özgül Ağırlık / Spesific Gravity	Hidrometri / Hydrometer: Metot / Method	% Ağırlık kaybı / % Weight Loss	-0,076	-0,002	PERMEABİLİTE / Permeability	Proktor / Proctor Test: Metot / Method	Maximum Kuru Bir.Ağ. / Max. Dry Unit Weight.	Optimum Su İçeriği / Optim. Water Content
				%	%	%	%				%	%	%	USCS	%	gr/cm³			c	Ø	e_n	e_f	gr/cm³			%	%	cm/sn(*10^{-7})		gr/cm³	%
TP-1	S-1	0,45-1,80	Yıkamalı Eleme / Wet Siewing	89	84	57	31			Etüvde Kurutma / Owen Drying	34	25	9	SM	13											30	13				
TP-2	S-1	0,50-1,40		92	88	75	52				40	29	11	ML	16											52	14				
TP-3	S-1	0,50-1,50		92	85	75	65				45	28	17	ML	16											65	26				
TP-3	S-2	1,50-2,40		62	56	46	36				42	27	15	ML	14											36	10				
TP-4	S-1	0,60-3,00		63	49	28	17				27	22	5	SM	7											17	4				
TP-5	S-1	0,40-1,55		70	56	37	27				31	24	7	SM	5											27	7				
TP-6	S-1	2,20-3,40		99	98	94	90				95	49	46	MH	45								2,54			90	40	1,08		1,040	52,7
TP-7	S-1	0,80-3,00		94	83	60	45				47	30	17	SM	24											45	8				
TP-8	S-1	0,80-2,00		48	36	22	10	108	2,4		30	27	3	GW-GM	7											10	3				
TP-9	S-1	0,40-1,40		99	97	83	60				36	25	11	ML	19											60	29				
TP-11	S-1	0,35-1,80		98	96	91	83				70	34	36	CH	32								2,46			83	42	1,87		1,218	39,3
TP-11	S-2	1,30-4,00		99	98	95	89				82	46	36	MH	33								2,44			89	40	1,52		1,137	42,7
TP-12	S-1	0,80-2,25		99	95	70	44				45	30	15	SM	25											44	10				
TP-13	S-1	0,60-2,65		82	66	42	29				47	28	19	SM	25											29	9				
TP-14	S-1	0,60-1,20		88	81	61	44				38	30	8	SM	20											44	9				

Laboratuvarımız Bayındırlık ve İskan Bakanlığı Yapı İşleri Genel Müdürlüğü tarafından verilen 11 numaralı 'Laboratuvar İzin Belgesi'ne sahiptir.

Yapılan deneylerde TS 1900-1 ve TS 1900-2 standartları kullanılmıştır
Laboratuvarımız örnek alımı ve taşınmasından kaynaklanabilecek hatalardan sorumlu değildir.
Bu deney sonuçları yalnızca test edilen örnek için geçerlidir
Bu deney sonuç tablosu Laboratuvarın izni olmadan kısmen kopyalanamaz, değiştirilemez.

EFOL JEOTEKNİK HİZMETLER
TİCARET LİMİTED ŞTİ.
Özanadolu Sanayi Sitesi 677. Sok. No:36 Ostim/ANKARA
Tel: (0312) 394 03 61 Faks: (0312) 394 03 62

DENEYİ YAPTIRAN KURULUŞ :				YİBF NO:				TARİH	
Sayfa : 1/1	Ek :	sayfa deney sonucu		BAKANLIK RAPOR NO:				DENEY TARİHİ:	

Proje Adı: HİMMETDEDE

DENEY SONUÇLARI ÖZET TABLOSU

Kuyu No /BH No	Örnek / Sample No	Derinlik / Depth	Elek Analizi / Sieve Analysis: Metot / Method	#4	#10	#40	#200	Cu	Cr	Atterberg Limit/At.Limits: Kurutma / Drying	LL	PL	PI	USCS: Birleştirilmiş Zemin Sınıfı / Unified Soil Classification System	Su Oranı / Water Cont.	Birim Ağırlık / Unit Weight: Doğal B.A. / Natural U.W.	Kuru B.A. / Dry U:W:	Üç eksenli / Triaxial Test: Deney Tipi	kg/cm²	Derece	Konsolidas./ Consolidation: Doğal Boşluk Oranı / Natural Void Ratio	Sonraki Boşluk Oranı / Void Ratio After Test	Özgül Ağırlık / Spesific Gravity	Hidrometri / Hydrometer: Metot / Method	% Ağırlık kaybı / % Weight Loss	-0,076	-0,002	PERMEABİLİTE / Permeability	Proktor / Proctor Test: Metot / Method	Maximum Kuru Bir.Ağ. / Max. Dry Unit Weight.	Optimum Su İçeriği / Optim. Water Content
				%	%	%	%				%	%	%	USCS	%	gr/cm³			c	Ø	e_n	e_f	gr/cm³			%	%	cm/sn(*10^{-7})		gr/cm³	%
TP-15	S-1	0,60-2,50	Yıkamalı Eleme / Wet Siewing	99	95	76	49			Etüvde Kurutma / Owen Drying	40	27	13	SM	25											49	10				
TP-15	S-2	2,50-4,20		98	97	92	84				53	29	24	CH	25											84	48				
TP-21	S-1	0,97-1,60		81	71	50	27				41	22	19	SM	23											27	11				
TP-22	S-1	1,50-3,00		95	92	84	73				52	32	20	MH	26											73	27				
TP-22	S-2	3,00-3,20		98	96	91	83				51	35	16	MH	26											83	33				
TP-23	S-1	3,30-3,40		100	100	98	95				56	28	28	CH	60											95	68				
TP-24	S-1	1,00-1,90		92	88	84	80				58	26	32	MH	20											80	37				
TP-25	S-1	0,30-0,80		89	83	70	58				45	25	20	CL	20											58	32				
TP-25	S-1	0,80-3,00		95	91	86	81				54	31	23	MH	25											80	35				
TP-26	S-1	0,30-1,50		96	91	80	65				33	22	11	CL	21											65	40				
TP-26	S-2	0,50-1,40		100	100	93	77				58	38	20	MH	36											76	37				
TP-31	S-1	0,40-4,40		99	97	83	65				45	17	28	CL	19											65	35				
TP-34	S-1	0,40-2,15		85	82	66	52				31	28	3	ML	8											52	17				
TP-35	S-1	1,00-2,50		100	98	93	88				63	28	35	CH	21								2,61			88	74	0,6		1,365	30,41
TP-35	S-2	3,00-4,50		98	95	90	84				64	30	34	CH	25								2,61			84	53	1,14		1,359	33,7

Laboratuvarımız Bayındırlık ve İskan Bakanlığı Yapı İşleri Genel Müdürlüğü tarafından verilen 11 numaralı 'Laboratuvar İzin Belgesi'ne sahiptir.

Yapılan deneylerde TS 1900-1 ve TS 1900-2 standartları kullanılmıştır
Laboratuvarımız örnek alımı ve taşınmasından kaynaklanabilecek hatalardan sorumlu değildir.
Bu deney sonuçları yalnızca test edilen örnek için geçerlidir

Appendix C: Water Balance Calculations

A water balance model was developed to evaluate the solution pond capacity, make-up water, and water management requirements for average monthly conditions using an Excel™ spreadsheet developed specifically for the Himmetdede On-Off Heap Leach Pad (OHLP) Project.

Deterministic analyses were performed for the 8-year mine life, corresponding to 190 cycles, with each cycle corresponding to a 14-day cell size for steady state conditions (not including ramp up or shut down). The Excel spreadsheet was used to simulate the pad loading (including ore loading, lined pad and pond areas), track inflows (such as wet-up of ore, rainfall, solution application, draindown, etc.) and outflows (such as pad and pond evaporation, etc.). A detailed discussion for each of the items considered in the water balance, along with a description of the calculation, is presented below.

The Solution Pond system was developed utilizing the following mass balance systems as described below and presented in Appendix C:

- Mass Balance 1 (OHLP Active Leaching Cells): Ore enters into the system from the mine where it is agglomerated and stacked on to the OHLP. Barren Solution enters Mass Balance 1 from the Process Plant, and is either used to wet the ore in the Agglomeration drum or is used to leach the ore. Pregnant solution is collected and reports to the Pregnant Pond, where gold is recovered and Barren Solution is re-introduced into the system. Mass Balance 1 is then used to size the Pregnant Pond;
- Mass Balance 2 (OHLP Rinsing Cells): At the end of leaching, ore from mass Balance 1 is rinsed with freshwater for 14 days to remove process solution. The Rinse Solution then reports to a Rinse Pond, where it is pumped to the Process Plant and introduced into Mass Balance 1 as makeup water. Mass Balance 2 is then used to size the Rinse Pond, and any excess Rinse solution that the Process Plant cannot accept must be treated and discharged; and
- The Storm Pond sizing is independent of the Mass Balances, and based on the design storm event depth, multiplied by the total OHLP and Pond areas.

The results of the water balance for the active leaching cells (Mass Balance 1) indicate that the system is a net user, or requires makeup water addition. However, the rinse cells (Mass Balance 2) are a net water producer, or generates excess water. SRK investigated combining the two systems, performing a combined mass balance between excess water created annually by the rinsing system against the amount of make-up water by altering the application rate of the freshwater rinse solution. The effect of this overall water balance calculated a maximum rinse application rate of 1.50 l/hr/m2 in order to achieve a net balance on an annual basis between Mass Balance 1 and Mass Balance 2. In other words, if the rinse application rate exceeds 1.50 l/hr/m2, then water treatment of the rinse solution will be required. If the application rate is less than this amount then make-up water will be required for the process plant.

The water balance was also used as a basis to size three external solution ponds (Rinse, Pregnant, and Stormwater Ponds), which are located downstream of the OHLP facility. The Pond capacity for each of the ponds was then calculated in 14-day increments considering the following variables:

- Maximum operating volume. The maximum operating depth was assumed to be approximately 5m for the Pregnant and Storm Ponds;
- Draindown. This represents an estimate of the maximum period of time that pond pumps may be without power, pumps be maintained or replacement pumps installed, and unable to recirculate solution;
- Variations in precipitation and evaporation. The changes in volume due to seasonal changes in precipitation and evaporation were considered;
- Design storm event. The runoff generated from the 100-year, 24-hour storm event was used as the design storm event and was assumed by SRK to be 100mm due to lack of design storm precipitation information for this part of Turkey; and

- Design storm event. The runoff generated from the 100-year, 24-hour storm event was used as the design storm event and was assumed by SRK to be 100mm due to lack of design storm precipitation information for this part of Turkey; and
- Freeboard. A minimum freeboard of 0.5m in the ponds.

In summary, the ponds have been sized considering they are at the maximum operating capacity, when there is either a loss in power such that the irrigation pumps are down or the pumps are being maintained or replaced and all of the ore is draining down at a rate of 10 L/hr/m^2 for a period of 6 hours (24 hours at a rate of 1.5 L/hr/m^2 for the rinse cells, and the 100-year, 24-hour storm event occurs at the same time.

The water balance model was used to calculate the following pond storage volumes:

- Pregnant Pond. The volume was determined considering each of the inflows and outflows and a six hour draindown period;
- Stormwater Pond. The volume was calculated by multiplying the 100-yr, 24-hr storm event rainfall depth by the total lined pad and design pond area. This pond will be maintained dry for most of the operational life except when there are large storms and/or excess flows are directed to it via spillways from the other ponds; and
- Rinse Pond. This volume was determined, considering each of the inflows and outflows and a 24 hour draindown period. The Rinse Pond volume was determined by assuming that the pond would contain all the excess flow from periods of high precipitation through the evaporation cycle where this solution would have an opportunity to evaporate naturally, creating a yearly net inflow water balance of zero.

The Rinse application rate was optimized at 1.5 L/hr/m^2 so that the Rinse Pond volume could be calculated for an annual net inflow water balance of zero. This application rate may need to be increased depending upon geochemistry testing results during the next design phase of the project.The calculated storage volume below freeboard levels (consisting of the maximum operating volume and draindown) along with design storage volumes required for each of the ponds are summarized below. The design storage volume also consists of the additional storage volume from the sloped bottom of each pond.

Table 1: OHLP Pond Sizing

Pond	Maximum Operating Volume including Precipitation Variation (m^3)	Irrigation Draindown* (m^3)	Calculated Storage Volume (m^3)	Design Storage Volume (m^3)
Pregnant	0	7,511	7,511	8,675
Rinse	5,407	225	5,632	38,000**
Stormwater	0	0	27,000	27,000***

*6 hours for pregnant solution draindown from 5 active leach cells and 24 hours for draindown from one active rinse cell.

**Design storage volume calculations based on the rinse pond holding the yearly rinse water balance without treatment or make-up requirements.

***Design storage volume calculations assumed no pond volume except for storm water overflow from pregnant and rinse ponds.

The design storage volume is typically slightly greater than the calculated storage volume required as the pond dimensions were usually rounded up to the nearest 0.5m increment, while maintaining an overall constant pond width.

A description of the line item components of the water balance model is presented below.

- *Column A – 14-Day Cycle* – Indicates the number of 4-Day cycles.
- *Column B – Start Date* – Indicates the predicted start date of each cycle in terms of month and day. This model assumes operations to begin October 1, 2012.
- *Column C – End Date* – Indicates the end date of a 14-day cycle.
- *Column D – Climatic Data, Precipitation per Cycle (mm)* – Presents the time weighted value of average monthly precipitation data over a 14-day cycle in millimeters. Monthly precipitation data per project design criteria (Appendix A).
- *Column E – Climatic Data, Evaporation per Cycle (mm)* – Presents the time weighted value of average monthly evaporation data over a 14-day cycle in millimeters. Monthly evaporation data per project design criteria (Appendix A).
- *Column F – Operation Data, Ore Production (tonnes)* – Calculates the weight of ore produced over a 14-day cycle at 11,000 tonnes per day.
- *Column G – Operation Data, Cumulative Ore Production (tonnes)* – Calculates the cumulative weight of ore produced over the life mining operations.
- *Column H – Variable, Loaded Ore Volume (m3)* – Calculates the volume of ore production over a 14-day cycle by dividing Ore Production (Column F) by the density of the ore (Input Sheet - reported in units of tonnes per m3).
- *Column I – Variable, Stacking Cell Area (m2)* – Calculates the area of the stacked ore on the pad by dividing the Loaded Ore Volume (Column H) by the lift height of the cell (Input Sheet – reported in units of m).
- *Column J – Variable, Irrigation Cell Areas (m2)* – Calculates the area under irrigation on the pad by multiplying the Stacking Cell Area (Column I) by the number of cells under leach (Maximum of 5).
- *Column K – Variable, Downdrain Cell Areas (m2)* – Calculates the area of cells under post leaching draindown. Fixed number beginning in cycle 7.
- *Column l – Variable, Rinse Cell Area (m2)* – Calculates the area of cells under rinse. Fixed number beginning in cycle 8.
- *Column M – Variable, Unloading Cell Area (m2)* – Calculates the area of cells being unloaded after the rinse cycle is completed. Fixed number beginning in cycle 9.
- *Column N – Variable, Contingency Cell Area (m2)* – Calculates the area of cells being used for contingency. Fixed number beginning in cycle 9.
- *Column 0 – Mass Balance 1, Inflows, Irrigation from Process Plant (m3/hr)* – Calculates the flow rate of process solution entering mass balance 1 from the process plant. Process solution

entering into mass balance 1 goes to the agglomeration process and the leach pad for leaching at a rate of 10 l/m2/hr applied over the area of a maximum of five active leaching cells. Number becomes fixed once process reaches steady state. Column O links directly to and equals Column AZ.

- *Column P – Mass Balance 1, Inflows, Solution Application (Volume) from Process Plant (m3)* – Calculates the flow of process solution entering mass balance 1 from the process plant in terms of volume per cycle. Calculated by multiplying the Irrigation from the Process Plant (Column O) by the number of days per cycle (14) and the number of hours per day (24).

- *Column Q – Mass Balance 1, Inflows, Initial Ore Water Inflow (m3)* – Calculates the amount of water incoming into mass balance 1 contained in the ore being delivered from the mine. Calculated by multiplying the Ore Production (Column F) by the Initial Water Content (Input Sheet – reported as a percentage).

- *Column R – Mass Balance 1, Inflows, Precipitation on Irrigation and Draindown Cell Areas (m3)* – Calculates the amount of precipitation falling onto the areas of the irrigation and draindown cells. Calculated by adding the Irrigation Cell Areas (Column J) and the Downdrain Cell Areas (Column K) together and multiplying the sum by the Precipitation per Cycle (Column D).

- *Column S – Mass Balance 1, Inflows, Precipitation on Stacking Cell Area (m3)* – Calculates the amount of precipitation falling onto the Stacking Cell. Calculated by multiplying the Stacking Cell Area (Column I) by the Precipitation per Cycle (Column D), dividing by 1000 to convert Column D mm to m, and multiplying by the Inactive Runoff Factor (Input Sheet).

- *Column T – Mass Balance 1, Inflows, Total Precipitation (m3)* – Calculates the total precipitation for mass balance one. Calculated by summing Precipitation on Irrigation & Draindown Cell Areas (Column R) and Precipitation on Stacking Cell Area (Column S).

- *Column U – Mass Balance 1, Inflows, Total Inflow (m3)* – Calculates the total inflow into mass balance 1. Calculated by summing Solution Application (Volume) from Process Plant (m3) (Column P), Initial Ore Water Inflow (Column Q), Precipitation on Irrigation & Draindown Cell Areas (Column R), and Precipitation on Stacking Cell Area (Column S).

- *Column V – Mass Balance 1, Outflows, Evaporation from Irrigation & Draindown Cell Area (m3)* – Calculates the evaporation from the irrigation and draindown cells. Calculated by summing Irrigation Cell Areas (Column J) and Downdrain Cell Areas (Column K), multiplying the sum by Evaporation per Cycle (Column E), dividing by 1000 to convert mm to m, and multiplying by the Solution Application Evaporation Factor (Input Sheet – reported as a fraction of applied solution that will evaporate from the ore).

- *Column W – Mass Balance 1, Outflows, Evaporation from Stacking Cell Area (m3)* – Calculates the evaporation from the stacking cell area. Calculated by multiplying the Stacking Cell Area (Column I) by the Evaporation per Cycle (Column E), dividing by 1000 to convert mm to m, and multiplying by the Solution Application Evaporation Factor (Input Sheet – reported as a fraction of applied solution that will evaporate from the ore).

- *Column X – Mass Balance 1, Outflows, Total Evaporation (m3)* – Calculates the total evaporation for mass balance 1. Calculated by summing the Evaporation from Irrigation & Draindown Cell Area (Column V) and Evaporation from Stacking Cell Areas (Column W).

- *Column Y – Mass Balance 1, Outflows, Ore Water Outflow (m3)* – Calculates the amount of water contained in the ore that transfers from the draindown cell in mass balance 1 to the rinse cell in mass balance 2. Calculated by multiplying the Ore Production (Column F) by the Residual Moisture Content (Input Sheet – reported as a percentage). Reaches steady state during cycle 7.

- *Column Z – Mass Balance 1, Outflows, Total Outflow (m3)* – Calculates the total outflow from mass balance 1. Calculated by summing Total Evaporation (Column X) and Ore Water Outflow (Column Y).

- *Column AA – Mass Balance 1, Outflows, Leached Solution to Pregnant Pond (m3)* – Calculates the amount of remaining water from mass balance 1 available to report to the process plant. Calculated by subtracting Total Outflows (Column Z) from Total Inflows (Column U).

- *Column AB – Mass Balance 2, Inflows, Freshwater Flow Rate Required (m3/hr)* – Calculates the flow rate required to rinse the spent ore. Calculated by multiplying the Rinse Application Rate (Input Sheet – reported as l/hr/m2) by the Rinse Cell Area (Column L). Reaches steady state during cycle 8, the first rinse cell cycle.

- *Column AC – Mass Balance 2, Inflows, Freshwater (Volume) Required (m3)* - Calculates the freshwater required to rinse the spent ore. Calculated by multiplying the Freshwater Flow Rate Required (Column AB) by the number of days per cycle (14) and the number of hours per day (24). Reaches steady state during cycle 8.

- *Column AD – Mass Balance 2, Inflows, Ore Water Inflow (m3)* – Calculates the amount of water in the ore coming in to mass balance 2. Calculated by multiplying Ore Production (Column F) by the Residual Moisture Content (Input Sheet – reported as a percentage).

- *Column AE – Mass Balance 2, Inflows, Precipitation on Rinse & Unloading Cell Areas (m3)* – Calculates the precipitation on the rinse and unloading cell areas. Calculated by summing the Rinse Cell Area (Column L) and the Unloading Cell Area (Column M), multiplying by the Precipitation per Cycle (Column D), dividing by 1000 to convert mm to m, and multiplying by the Inactive Runoff Factor (Input Sheet).

- *Column AF – Mass Balance 2, Inflows, Precipitation on Contingency Area (m3)* – Calculates the precipitation on the contingency cell area. Calculated by multiplying the Contingency Cell Area (Column N) by the Precipitation per Cycle (Column D) and dividing by 1000 to convert mm to m.

- *Column AG – Mass Balance 2, Inflows, Total Precipitation (m3)* – Calculates the total precipitation on mass balance 2. Calculated by summing Precipitation on Rinse & Unloading Areas (Column AE) and Precipitation on Contingency Area (Column AF).

- *Column AH – Mass Balance 2, Inflows, Total Inflows (m3)* – Calculates the total precipitation into mass balance 2. Calculated by summing Freshwater (Volume) Required (Column AC), Ore Water Inflow (Column AD), Precipitation on Rinse & Unloading Cell Areas (Column AE), and Precipitation on Contingency Area (Column AF).

- *Column AI – Mass Balance 2, Outflows, Evaporation on Rinse & Unloading Cell Areas (m3)* – Calculates the evaporation on the rinse and unloading cells in mass balance 2. Calculated by summing Rinse Cell Area (Column L) and the Unloading Cell Area (Column M), multiplying by the Evaporation per Cycle (Column E), dividing by 1000 to convert mm to m, and multiplying by the

Solution Application Evaporation factor (Input Sheet – reported as a the fraction of applied solution that will evaporate from the ore).

- *Column AJ – Mass Balance 2, Outflows, Ore Water Outflow (m3)* – Calculates the amount of water leaving mass balance 2 in the ore and going to the spent ore facility. Calculated by multiplying the Ore Production (Column F) by the Residual Moisture Content (Input Sheet – reported as a percentage). Reaches steady state during cycle 9.

- *Column AK – Mass Balance 2, Outflows, Total Outflow (m3)* – Calculates the total outflow of water from mass balance 2. Calculated by summing Evaporation on Rinse & Unloading Cell Areas (Column AI) and Ore Water Outflow (Column AJ).

- *Column AL – Mass Balance 2, Outflows, Rinse Solution to Rinse Pond (m3)* – Calculates the solution that reports to the rinse pond. Calculated by subtracting Total Outflow (Column AK) from Total Inflow (AH).

- *Column AM – Pregnant Pond, Inflows, Daily Solution Flowrate from Pad (m3/hr)* – Calculates the flow rate of solution from mass balance 1 to the pregnant pond. Calculated by dividing the volume of Leached Solution to Pregnant Pond (Column AA) by the number of days per cycle (14) and the number of hours per day (24).

- *Column AN – Pregnant Pond, Inflows, Pond Precipitation (m3/hr)* – Calculates the flow rate of precipitation into the pregnant pond. Calculated by multiplying Precipitation per Cycle (Column D) by the Pregnant Pond Top Area (Input Sheet – reported as m2), dividing by 1000 to convert mm to m, dividing by number of days per cycle (14), and dividing by number of hours per day (24).

- *Column AO – Pregnant Pond, Inflows, Total Inflow (m3/hr)* – Calculates the total inflow into the pregnant pond. Calculated by summing Daily Solution Flow Rate from Pad (Column AM) and Pond Precipitation (Column AN).

- *Column AP – Pregnant Pond, Outflows, Pond Evaporation (m3/hr)* – Calculates the flow rate of evaporation from the pregnant pond. Calculated by multiplying Evaporation per Cycle (Column E) by the Pregnant Pond Top Area (Input Sheet – reported as m2), dividing by 1000 to convert mm to m, dividing by number of days per cycle (14), and dividing by number of hours per day (24).

- *Column AQ – Pregnant Pond, Outflows, Total Outflow (m3/hr)* – Calculates the total outflow from evaporation from the pregnant pond. Calculated as the Pond Evaporation (Column AP)

- *Column AR – Pregnant Pond, Operating Pond Volume for 2-m head (m3)* – Calculates the volume in the pregnant pond necessary to maintain 2m of head to prevent pump cavitation. Calculated by the larger of the two numbers Pregnant Pond Volume 2m Head (Input Sheet – reported as m3) and Daily Pond Storage (Column AS).

- *Column AS – Pregnant Pond, Daily Pond Storage (m3)* – Calculates the necessary pregnant pond storage to contain the required draindown volume from mass balance 1. Calculated by multiplying the Pregnant Pond Draindown Capacity (Input Sheet – reported as hours) by the Net Inflow to Process Plant (Column AT).

- *Column AT – Pregnant Pond, Net Inflow to Process Plant (m3/hr)* – Calculates the flow rate of solution into the process plant from the pregnant pond. Calculated by subtracting the Total Outflow (Column AQ) from the Total Inflow (Column AO).

- *Column AU – Process Plant, Inflows, Pregnant Pond (m3/hr)* – Calculates the flow rate into the process plant from the pregnant pond. Calculated as the sum of Net Inflow to Process Plant (Column AT).

- *Column AV – Process Plant, Inflows, Rinse Pond (m3/hr)* – Calculates the inflow rate that the process plant can accept from the rinse pond to maintain a zero net inflow in the process plant. Calculated as the sum of To Process Plant (Column BF).

- *Column AW – Process Plant, Inflows, Total Inflow (m3/hr)* – Calculates the total inflow rate to the process plant. Calculated by summing Pregnant Pond (Column AU) and Rinse Pond (Column AV).

- *Column AX – Process Plant, Outflows, To Agglomerator (m3/hr)* – Calculates the flow rate of solution necessary to send to the agglomerator to increase the incoming ore from the mine from initial water content to the reported agglomerator water content. Calculated by subtracting the Initial Water Content (Input Sheet – reported as a percentage) from the Agglomeration with Freshwater (Input Sheet – reported as a percentage), multiplying by the Ore Production (Column F), dividing by the number of days per cycle (14), and dividing by the number of hours per day (24). Reaches steady state during cycle 1.

- *Column AY – Process Plant, Outflows, To Leach Cells (m3/hr)* – Calculates the amount of solution flow rate required for application to the leaching cells. Calculated by multiplying the Irrigation Cell Areas (Column J) by the Solution Application Rate (Input Sheet – reported as l/hr/m2) and divided by 1000 to convert l to m3. Reaches steady state during cycle 6.

- *Column AZ – Process Plant, Outflows, Total Outflow (m3/hr)* – Calculates the total outflow rate from the process plant to mass balance 1. Calculated by summing To Agglomerator (Column AX) and To Leach Cells (Column AY).

- *Column BA – Process Plant, Net Inflow (m3/hr)* – Verifies the net inflow rate to the process plant assuming a net inflow of zero. Calculated by subtracting Total Outflow (Column AZ) from Total Inflow (Column AW).

- *Column BB – Rinse Pond, Inflows, Rinse Solution Inflow (m3/hr)* – Calculates the flow rate into the rinse pond from mass balance 2. Calculated by multiplying Rinse Solution to Rinse Pond (Column AL), divided by number of days per cycle (14), and divided by number of hours per day (24).

- *Column BC – Rinse Pond, Inflows, Pond Precipitation (m3/hr)* – Calculates the flow rate of precipitation into the rinse pond. Calculated by multiplying the Precipitation per Cycle (Column D) by the Rinse Pond (Input Sheet – reported as m2), divided by 1000 to convert mm to m, divided by number of days per cycle (14), and divided by number of hours per day (24).

- *Column BD – Rinse Pond, Inflows, Total inflows (m3/hr)* – Calculates the total inflow into the rinse pond. Calculated by summing the Rinse Solution Inflow (Column BB) and Pond Precipitation (Column BC).

- *Column BE – Rinse Pond, Outflows, Pond Evaporation (m3/hr)* – Calculates the evaporation flow rate from the rinse pond. Calculated by multiplying the Evaporation per Cycle (Column E) by the Rinse Pond Area(Input Sheet – reported as m2), divided by 1000 to convert mm to m, divided by number of days per cycle (14), and number of hours per day (24).

- *Column BF – Rinse Pond, Outflows, To Process Plant (m3/hr)* – Calculates the flow rate of solution that the process plant can accept from the rinse pond assuming a net flow rate in the process plant. Calculated by subtracting Pregnant Pond (Column AU) from Total Outflow (Column AZ).

- *Column BG – Rinse Pond, Outflows, Total Outflow (m3/hr)* – Calculates the total outflow rate from the rinse pond. Calculated by summing Pond Evaporation (Column BE) and To Process Plant (BF).

- *Column BH – Rinse Pond, Net Inflow (m3/hr)* – Calculates the total inflow rate of the rinse pond. This inflow rate indicates the amount of water that must be added for makeup purposes or treatment if excess. Calculated by subtracting Total Outflow (Column BG) from Total Inflow (Column BD).

- *Column BI – Rinse Pond, Operating Pond Volume for 2m Head (m3)* – Calculates the minimum volume required to maintain 2m of pond depth to avoid cavitation. Calculated by taking either the Rinse Pond Volume 2m Head (Input Sheet – reported as m3) or Daily Pond Storage (Column BJ) amount, whichever is larger.

- *Column BJ – Rinse Pond, Daily Pond Storage (m3)* – Calculates the amount of required storage to hold the drain down event based on a specified hourly input. Calculated by multiplying the Net Inflow (Column BH) by the Rinse Draindown Pond Storage Capacity (Input Sheet – reported in hours).

- *Column BK – Rinse Pond, Make-Up Volume (m3/hr)* – Calculates the amount of makeup water addition that must occur to keep the system at equilibrium based on the water balance. Calculated by subtracting Total Inflow (Column BD) from To Process Plant (Column BF) if To Process Plant amount is larger than Total Inflow.

- *Column BL – Rinse Pond, Excess Pond Volume (m3/hr)* – Calculates the amount of water treatment that must occur to keep the system at equilibrium based on the water balance. Calculated by summing Net Inflow (Column BH) if Total Outflow (Column BG) is greater than zero.

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Table 1: Input Variables and Constants

Solution Appication	Quantity	Units		
Solution Application Rate:	10	l/hr/m^2	***Model assumes all agglomeration water comes from Barren Pond	
Rinse Application Rate:	1.505	l/hr/m^2	1.54 l/hr/m2 is Equalized Rate w/ approx 37,000 m3 wash pond	
Cell Size:	14	days		
Stacking:	14	days	1 cell	
Irrigation	70	days	5 cells	
Downdrain Option A:	14	days	1 cell	Freshwater Applied in Mass Balance 2
Downdrain Option B	0	Days	0 cell	Freshwater Applied in Mass Balance 1
Rinse:	14	days	1 cell	
Unloading:	14	days	1 cell	
Contingency:	14	days	1 cell	
Subtotal:	**140**	**days**	**10 cells**	
Cycle Rate:	14	days/cycle		
Start Date:	10/1/2012	mm/dd/yyyy		
Solution Application Evaporation Factor:	25.0%			
Pregant Pond Draindown Capacity:	6	hours		
Barren Pond Draindown Capacity:	0	hours		
Rinse Downdrain Pond Storage Capacity:	24	hours		

Areas	Quantity	Units
Total Lined Area:	250,000	m^2
No. of Cells:	10	
Cell Area:	25,000	m^2
Active Leach Area:	120,313	m^2
Pregnant Pond:	2,500	m^2
Barren Pond:	2,500	m^2
Rinse Pond:	16,732	m^2
Storm Pond:	9,600	m^2
Total Lined Pond Area:	31,332	m^2
Inactive Runoff Factor:	1.00	
Pregnant Pond Volume 2m Head:	82.70	
Rinse Pond Volume 2m Head:	26.20	
Barren Pond Volume 2m Head:		

Ore Production	Quantity	Units
Ore Production rate:	11,000	tonnes/day
Heap Average Stacked Unit Weight:	1.6	tonnes/m^3
Design Life:	10.0	years
Initial Water Content:	3%	(by weight)
Agglomeration with Freshwater:	9%	(by weight)
Leaching Water Content:	18.0%	(by weight)
Residual Moisture Content:	12.0%	(by weight)
Lift height:	4.00	m
No. of Lifts:	1	

Table 2: Climate Data

Precipitation and Evaporation

Month	Precipitation Average Monthly (mm)	Evaporation Average Monthly (mm)
January	31.7	0
February	33	0
March	41.1	1
April	56.3	58
May	57.4	125
June	36	172
July	13.1	217
August	6.5	202
September	11.4	140
October	33.3	69
November	38.2	2
December	39.4	0
Average Annual	397.4	984.2

Storm Events

100-yr, 24-hr	100	mm

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14-Day Cycle	Start Date	End Date	Climatic Data		Operation Data		Variable							Mass Balance 1							
														Inflows							
			Precip. per Cycle	Evap. per Cycle	Ore Prod.	Cum. Ore Prod.	Loaded Ore Vol.	Stacking Cell Area	Irrigation Cell Areas	Downdrain Cell Areas	Rinse Cell Area	Unloading Cell Area	Contingency Cell Area	Irrigation from Process Plant	Solution Application (Vol.) from Process Plant	Initial Ore Water Inflow	Precip. on Irrigation & Draindown Cell Areas	Precip.on Stacking Cell Area	Total Precip	Total Inflow	Evap. from Irrigation & Draindown Cell Area
			(mm)	(mm)	(tonnes)	(tonnes)	(m^3)	(m^2)	(m^2)	(m^2)	(m^2)	(m^2)	(m^2)	(m^3/hr)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)
1	1-Oct	14-Oct	15.04	31.1	154,000	154,000	96,250	24,063	0	0	0	0	216,563	27.5	9,240	4,620	0	362	362	14,222	0
2	15-Oct	28-Oct	15.04	31.1	154,000	308,000	96,250	24,063	24,063	0	0	0	192,500	268	90,090	4,620	362	362	724	95,434	187
3	29-Oct	11-Nov	17.23	7.3	154,000	462,000	96,250	24,063	48,125	0	0	0	168,438	509	170,940	4,620	829	415	1,244	176,804	88
4	12-Nov	25-Nov	17.83	0.8	154,000	616,000	96,250	24,063	72,188	0	0	0	144,375	749	251,790	4,620	1,287	429	1,716	258,126	14
5	26-Nov	9-Dec	17.81	0.3	154,000	770,000	96,250	24,063	96,250	0	0	0	120,313	990	332,640	4,620	1,714	428	2,142	339,402	7
6	10-Dec	23-Dec	17.79	0.0	154,000	924,000	96,250	24,063	120,313	0	0	0	96,250	1,231	413,490	4,620	2,141	428	2,569	420,679	0
7	24-Dec	6-Jan	16.30	0.0	154,000	1,078,000	96,250	24,063	120,313	24,063	0	0	72,188	1,231	413,490	4,620	2,354	392	2,746	420,856	0
8	7-Jan	20-Jan	14.32	0.0	154,000	1,232,000	96,250	24,063	120,313	24,063	24,063	0	48,125	1,231	413,490	4,620	2,067	344	2,411	420,521	0
9	21-Jan	3-Feb	14.78	0.0	154,000	1,386,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	2,134	356	2,490	420,600	0
10	4-Feb	17-Feb	16.50	0.0	154,000	1,540,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	2,382	397	2,779	420,889	0
11	18-Feb	3-Mar	16.94	0.1	154,000	1,694,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	2,446	408	2,854	420,964	2
12	4-Mar	17-Mar	18.56	0.3	154,000	1,848,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	2,680	447	3,126	421,236	10
13	18-Mar	31-Mar	18.56	0.3	154,000	2,002,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	2,680	447	3,126	421,236	10
14	1-Apr	14-Apr	26.27	27.1	154,000	2,156,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	3,793	632	4,425	422,535	977
15	15-Apr	28-Apr	26.27	27.1	154,000	2,310,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	3,793	632	4,425	422,535	977
16	29-Apr	12-May	25.97	52.1	154,000	2,464,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	3,750	625	4,375	422,485	1,879
17	13-May	26-May	25.92	56.2	154,000	2,618,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	3,743	624	4,366	422,476	2,029
18	27-May	9-Jun	20.06	71.7	154,000	2,772,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	2,896	483	3,379	421,489	2,587
19	10-Jun	23-Jun	16.80	80.3	154,000	2,926,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	2,426	404	2,830	420,940	2,897
20	24-Jun	7-Jul	11.36	89.0	154,000	3,080,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	1,640	273	1,913	420,023	3,213
21	8-Jul	21-Jul	5.92	97.8	154,000	3,234,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	854	142	996	419,106	3,529
22	22-Jul	4-Aug	5.06	95.9	154,000	3,388,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	731	122	853	418,963	3,460
23	5-Aug	18-Aug	2.94	91.0	154,000	3,542,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	424	71	494	418,604	3,286
24	19-Aug	1-Sep	3.11	89.2	154,000	3,696,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	448	75	523	418,633	3,220
25	2-Sep	15-Sep	5.32	65.5	154,000	3,850,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	768	128	896	419,006	2,365
26	16-Sep	29-Sep	5.32	65.5	154,000	4,004,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	768	128	896	419,006	2,365
27	30-Sep	13-Oct	14.34	33.6	154,000	4,158,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	2,071	345	2,416	420,526	1,212
28	14-Oct	27-Oct	15.04	31.1	154,000	4,312,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	2,171	362	2,533	420,643	1,123
29	28-Oct	10-Nov	17.03	9.5	154,000	4,466,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	2,459	410	2,869	420,979	341
30	11-Nov	24-Nov	17.83	0.8	154,000	4,620,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	2,574	429	3,003	421,113	29
31	25-Nov	8-Dec	17.81	0.3	154,000	4,774,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	2,571	428	2,999	421,109	12
32	9-Dec	22-Dec	17.79	0.0	154,000	4,928,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	2,569	428	2,997	421,107	0
33	23-Dec	5-Jan	16.55	0.0	154,000	5,082,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	2,390	398	2,788	420,898	0
34	6-Jan	19-Jan	14.32	0.0	154,000	5,236,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	2,067	344	2,411	420,521	0
35	20-Jan	2-Feb	14.63	0.0	154,000	5,390,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	2,112	352	2,464	420,574	0
36	3-Feb	16-Feb	16.50	0.0	154,000	5,544,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	2,382	397	2,779	420,889	0
37	17-Feb	2-Mar	16.79	0.0	154,000	5,698,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	2,425	404	2,829	420,939	1
38	3-Mar	16-Mar	18.56	0.3	154,000	5,852,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	2,680	447	3,126	421,236	10
39	17-Mar	30-Mar	18.56	0.3	154,000	6,006,000	96,250	24,063	120,313	24,063	24,063	24,063	24,063	1,231	413,490	4,620	2,680	447	3,126	421,236	10

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14-Day Cycle	Start Date	End Date	Mass Balance 2																				
			Climatic Data		Operation Data		Outflows					Inflows								Outflows			
			Precip. per Cycle	Evap. per Cycle	Ore Prod.	Cum. Ore Prod.	Evap. from Stacking Cell Area	Total Evap	Ore Water Outflow	Total Outflow	Leached Solution to Pregnant Pond	Freshwater Flow Rate Required	Freshwater (Vol.) Required	Ore Water Inflow	Precip. on Rinse & Unloading Cell Areas	Precip. on Contingency Area	Total Precip	Total Inflow	Evap. on Rinse & Unloading Cell Areas	Ore Water Outflow	Total Outflow	Rinse Solution to Rinse Pond
			(mm)	(mm)	(tonnes)	(tonnes)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3/hr)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)
1	1-Oct	14-Oct	15.04	31.1	154,000	154,000	187	187	0	187	14,035	0	0	0	0	3,257	3,257	3,257	0	0	0	3,257
2	15-Oct	28-Oct	15.04	31.1	154,000	308,000	187	374	0	374	95,059	0	0	0	0	2,895	2,895	2,895	0	0	0	2,895
3	29-Oct	11-Nov	17.23	7.3	154,000	462,000	44	132	0	132	176,672	0	0	0	0	2,902	2,902	2,902	0	0	0	2,902
4	12-Nov	25-Nov	17.83	0.8	154,000	616,000	5	19	0	19	258,107	0	0	0	0	2,574	2,574	2,574	0	0	0	2,574
5	26-Nov	9-Dec	17.81	0.3	154,000	770,000	2	9	0	9	339,394	0	0	0	0	2,142	2,142	2,142	0	0	0	2,142
6	10-Dec	23-Dec	17.79	0.0	154,000	924,000	0	0	0	0	420,679	0	0	0	0	1,713	1,713	1,713	0	0	0	1,713
7	24-Dec	6-Jan	16.30	0.0	154,000	1,078,000	0	0	18,480	18,480	402,376	0	0	0	0	1,177	1,177	1,177	0	0	0	1,177
8	7-Jan	20-Jan	14.32	0.0	154,000	1,232,000	0	0	18,480	18,480	402,041	36	12,168	18,480	344	689	1,033	31,681	0	0	0	31,681
9	21-Jan	3-Feb	14.78	0.0	154,000	1,386,000	0	0	18,480	18,480	402,120	36	12,168	18,480	711	356	1,067	31,715	0	18,480	18,480	13,235
10	4-Feb	17-Feb	16.50	0.0	154,000	1,540,000	0	0	18,480	18,480	402,409	36	12,168	18,480	794	397	1,191	31,839	0	18,480	18,480	13,359
11	18-Feb	3-Mar	16.94	0.1	154,000	1,694,000	0	2	18,480	18,482	402,481	36	12,168	18,480	815	408	1,223	31,871	1	18,480	18,481	13,390
12	4-Mar	17-Mar	18.56	0.3	154,000	1,848,000	2	11	18,480	18,491	402,745	36	12,168	18,480	893	447	1,340	31,988	3	18,480	18,483	13,505
13	18-Mar	31-Mar	18.56	0.3	154,000	2,002,000	2	11	18,480	18,491	402,745	36	12,168	18,480	893	447	1,340	31,988	3	18,480	18,483	13,505
14	1-Apr	14-Apr	26.27	27.1	154,000	2,156,000	163	1,140	18,480	19,620	402,916	36	12,168	18,480	1,264	632	1,897	32,545	326	18,480	18,806	13,739
15	15-Apr	28-Apr	26.27	27.1	154,000	2,310,000	163	1,140	18,480	19,620	402,916	36	12,168	18,480	1,264	632	1,897	32,545	326	18,480	18,806	13,739
16	29-Apr	12-May	25.97	52.1	154,000	2,464,000	313	2,192	18,480	20,672	401,813	36	12,168	18,480	1,250	625	1,875	32,523	626	18,480	19,106	13,416
17	13-May	26-May	25.92	56.2	154,000	2,618,000	338	2,368	18,480	20,848	401,629	36	12,168	18,480	1,248	624	1,871	32,519	676	18,480	19,156	13,363
18	27-May	9-Jun	20.06	71.7	154,000	2,772,000	431	3,018	18,480	21,498	399,990	36	12,168	18,480	965	483	1,448	32,096	862	18,480	19,342	12,753
19	10-Jun	23-Jun	16.80	80.3	154,000	2,926,000	483	3,380	18,480	21,860	399,080	36	12,168	18,480	809	404	1,213	31,861	966	18,480	19,446	12,415
20	24-Jun	7-Jul	11.36	89.0	154,000	3,080,000	536	3,749	18,480	22,229	397,795	36	12,168	18,480	547	273	820	31,468	1,071	18,480	19,551	11,917
21	8-Jul	21-Jul	5.92	97.8	154,000	3,234,000	588	4,117	18,480	22,597	396,509	36	12,168	18,480	285	142	427	31,075	1,176	18,480	19,656	11,419
22	22-Jul	4-Aug	5.06	95.9	154,000	3,388,000	577	4,036	18,480	22,516	396,447	36	12,168	18,480	244	122	366	31,014	1,153	18,480	19,633	11,380
23	5-Aug	18-Aug	2.94	91.0	154,000	3,542,000	548	3,834	18,480	22,314	396,291	36	12,168	18,480	141	71	212	30,860	1,095	18,480	19,575	11,284
24	19-Aug	1-Sep	3.11	89.2	154,000	3,696,000	537	3,757	18,480	22,237	396,396	36	12,168	18,480	149	75	224	30,872	1,073	18,480	19,553	11,319
25	2-Sep	15-Sep	5.32	65.5	154,000	3,850,000	394	2,759	18,480	21,239	397,767	36	12,168	18,480	256	128	384	31,032	788	18,480	19,268	11,764
26	16-Sep	29-Sep	5.32	65.5	154,000	4,004,000	394	2,759	18,480	21,239	397,767	36	12,168	18,480	256	128	384	31,032	788	18,480	19,268	11,764
27	30-Sep	13-Oct	14.34	33.6	154,000	4,158,000	202	1,414	18,480	19,894	400,632	36	12,168	18,480	690	345	1,035	31,683	404	18,480	18,884	12,799
28	14-Oct	27-Oct	15.04	31.1	154,000	4,312,000	187	1,310	18,480	19,790	400,853	36	12,168	18,480	724	362	1,086	31,734	374	18,480	18,854	12,879
29	28-Oct	10-Nov	17.03	9.5	154,000	4,466,000	57	398	18,480	18,878	402,100	36	12,168	18,480	820	410	1,229	31,877	114	18,480	18,594	13,284
30	11-Nov	24-Nov	17.83	0.8	154,000	4,620,000	5	33	18,480	18,513	402,599	36	12,168	18,480	858	429	1,287	31,935	10	18,480	18,490	13,445
31	25-Nov	8-Dec	17.81	0.3	154,000	4,774,000	2	14	18,480	18,494	402,615	36	12,168	18,480	857	428	1,285	31,933	4	18,480	18,484	13,449
32	9-Dec	22-Dec	17.79	0.0	154,000	4,928,000	0	0	18,480	18,480	402,627	36	12,168	18,480	856	428	1,284	31,932	0	18,480	18,480	13,452
33	23-Dec	5-Jan	16.55	0.0	154,000	5,082,000	0	0	18,480	18,480	402,418	36	12,168	18,480	797	398	1,195	31,843	0	18,480	18,480	13,363
34	6-Jan	19-Jan	14.32	0.0	154,000	5,236,000	0	0	18,480	18,480	402,041	36	12,168	18,480	689	344	1,033	31,681	0	18,480	18,480	13,201
35	20-Jan	2-Feb	14.63	0.0	154,000	5,390,000	0	0	18,480	18,480	402,094	36	12,168	18,480	704	352	1,056	31,704	0	18,480	18,480	13,224
36	3-Feb	16-Feb	16.50	0.0	154,000	5,544,000	0	0	18,480	18,480	402,409	36	12,168	18,480	794	397	1,191	31,839	0	18,480	18,480	13,359
37	17-Feb	2-Mar	16.79	0.0	154,000	5,698,000	0	2	18,480	18,482	402,457	36	12,168	18,480	808	404	1,212	31,860	0	18,480	18,480	13,380
38	3-Mar	16-Mar	18.56	0.3	154,000	5,852,000	2	11	18,480	18,491	402,745	36	12,168	18,480	893	447	1,340	31,988	3	18,480	18,483	13,505
39	17-Mar	30-Mar	18.56	0.3	154,000	6,006,000	2	11	18,480	18,491	402,745	36	12,168	18,480	893	447	1,340	31,988	3	18,480	18,483	13,505

14-Day Cycle	Start Date	End Date	Climatic Data		Operation Data		Pregnant Pond								Process Plant										
							Inflows			Outflows					Inflows			Outflows					Inflows			
			Precip. per Cycle	Evap. per Cycle	Ore Prod.	Cum. Ore Prod.	Daily Solution Flowrate from Pad	Pond Precip.	Total Inflow	Pond Evap.	Total Outflow	Operating Pond Vol. for 2-m head	Daily Pond Storage	Net Inflow to Process Plant	Pregnant Pond	Rinse Pond	Total Inflow	To Aggl.	To Leach Cells	Total Outflow	Net Inflow	Rinse Solution Inflow	Pond Precip.	Total Inflow	Pond Evap.
			(mm)	(mm)	(tonnes)	(tonnes)	(m^3/hr)	(m^3/hr)	(m^3/hr)	(m^3/hr)	(m^3/hr)	(m^3)	(m^3)	(m^3/hr)	(m^3/hr)	(m^3/hr)	(m^3/hr)	(m^3/hr)	(m^3/hr)	(m^3/hr)	(m^3/hr)	(m^3/hr)	(m^3/hr)	(m^3/hr)	(m^3/hr)	(m^3/hr)
1	1-Oct	14-Oct	15.04	31.1	154,000	154,000	41.8	0.11	42	0.2	0.2	249.9	250	42	42	-14	27.5	27.5	0	27.5	0	10	0.7	10	1.5
2	15-Oct	28-Oct	15.04	31.1	154,000	308,000	282.9	0.11	283	0.2	0.2	1696.8	1,697	283	283	-15	268.1	27.5	241	268.1	0	9	0.7	9	1.5
3	29-Oct	11-Nov	17.23	7.3	154,000	462,000	525.8	0.13	526	0.1	0.1	3155.3	3,155	526	526	-17	508.8	27.5	481	508.8	0	9	0.9	9	0.4
4	12-Nov	25-Nov	17.83	0.8	154,000	616,000	768.2	0.13	768	0.0	0.0	4609.8	4,610	768	768	-19	749.4	27.5	722	749.4	0	8	0.9	9	0.0
5	26-Nov	9-Dec	17.81	0.3	154,000	770,000	1,010.1	0.13	1,010	0.0	0.0	6061.4	6,061	1,010	1,010	-20	990.0	27.5	963	990.0	0	6	0.9	7	0.0
6	10-Dec	23-Dec	17.79	0.0	154,000	924,000	1,252.0	0.13	1,252	0.0	0.0	7512.9	7,513	1,252	1,252	-22	1,230.6	27.5	1203	1,230.6	0	5	0.9	6	0.0
7	24-Dec	6-Jan	16.30	0.0	154,000	1,078,000	1,197.5	0.12	1,198	0.0	0.0	7186.0	7,186	1,198	1,198	33	1,230.6	27.5	1203	1,230.6	0	4	0.8	4	0.0
8	7-Jan	20-Jan	14.32	0.0	154,000	1,232,000	1,196.6	0.11	1,197	0.0	0.0	7179.9	7,180	1,197	1,197	34	1,230.6	27.5	1203	1,230.6	0	94	0.7	95	0.0
9	21-Jan	3-Feb	14.78	0.0	154,000	1,386,000	1,196.8	0.11	1,197	0.0	0.0	7181.4	7,181	1,197	1,197	34	1,230.6	27.5	1203	1,230.6	0	39	0.7	40	0.0
10	4-Feb	17-Feb	16.50	0.0	154,000	1,540,000	1,197.6	0.12	1,198	0.0	0.0	7186.6	7,187	1,198	1,198	33	1,230.6	27.5	1203	1,230.6	0	40	0.8	41	0.0
11	18-Feb	3-Mar	16.94	0.1	154,000	1,694,000	1,197.9	0.13	1,198	0.0	0.0	7187.9	7,188	1,198	1,198	33	1,230.6	27.5	1203	1,230.6	0	40	0.8	41	0.0
12	4-Mar	17-Mar	18.56	0.3	154,000	1,848,000	1,198.6	0.14	1,199	0.0	0.0	7192.7	7,193	1,199	1,199	32	1,230.6	27.5	1203	1,230.6	0	40	0.9	41	0.0
13	18-Mar	31-Mar	18.56	0.3	154,000	2,002,000	1,198.6	0.14	1,199	0.0	0.0	7192.7	7,193	1,199	1,199	32	1,230.6	27.5	1203	1,230.6	0	40	0.9	41	0.0
14	1-Apr	14-Apr	26.27	27.1	154,000	2,156,000	1,199.15	0.20	1,199	0.2	0.2	7194.9	7,195	1,199	1,199	31	1,230.6	27.5	1203	1,230.6	0	41	1.3	42	1.3
15	15-Apr	28-Apr	26.27	27.1	154,000	2,310,000	1,199.2	0.20	1,199	0.2	0.2	7194.9	7,195	1,199	1,199	31	1,230.6	27.5	1203	1,230.6	0	41	1.3	42	1.3
16	29-Apr	12-May	25.97	52.1	154,000	2,464,000	1,195.9	0.19	1,196	0.4	0.4	7174.1	7,174	1,196	1,196	35	1,230.6	27.5	1203	1,230.6	0	40	1.3	41	2.6
17	13-May	26-May	25.92	56.2	154,000	2,618,000	1,195.3	0.19	1,196	0.4	0.4	7170.6	7,171	1,195	1,195	36	1,230.6	27.5	1203	1,230.6	0	40	1.3	41	2.8
18	27-May	9-Jun	20.06	71.7	154,000	2,772,000	1,190.4	0.15	1,191	0.5	0.5	7140.4	7,140	1,190	1,190	41	1,230.6	27.5	1203	1,230.6	0	38	1.0	39	3.6
19	10-Jun	23-Jun	16.80	80.3	154,000	2,926,000	1,187.7	0.13	1,188	0.6	0.6	7123.6	7,124	1,187	1,187	43	1,230.6	27.5	1203	1,230.6	0	37	0.8	38	4.0
20	24-Jun	7-Jul	11.36	89.0	154,000	3,080,000	1,183.9	0.08	1,184	0.7	0.7	7100.0	7,100	1,183	1,183	47	1,230.6	27.5	1203	1,230.6	0	35	0.6	36	4.4
21	8-Jul	21-Jul	5.92	97.8	154,000	3,234,000	1,180.1	0.04	1,180	0.7	0.7	7076.4	7,076	1,179	1,179	51	1,230.6	27.5	1203	1,230.6	0	34	0.3	34	4.9
22	22-Jul	4-Aug	5.06	95.9	154,000	3,388,000	1,179.9	0.04	1,180	0.7	0.7	7075.4	7,075	1,179	1,179	51	1,230.6	27.5	1203	1,230.6	0	34	0.3	34	4.8
23	5-Aug	18-Aug	2.94	91.0	154,000	3,542,000	1,179.4	0.02	1,179	0.7	0.7	7072.7	7,073	1,179	1,179	52	1,230.6	27.5	1203	1,230.6	0	34	0.1	34	4.5
24	19-Aug	1-Sep	3.11	89.2	154,000	3,696,000	1,179.8	0.02	1,180	0.7	0.7	7074.7	7,075	1,179	1,179	52	1,230.6	27.5	1203	1,230.6	0	34	0.2	34	4.4
25	2-Sep	15-Sep	5.32	65.5	154,000	3,850,000	1,183.8	0.04	1,184	0.5	0.5	7100.3	7,100	1,183	1,183	47	1,230.6	27.5	1203	1,230.6	0	35	0.3	35	3.3
26	16-Sep	29-Sep	5.32	65.5	154,000	4,004,000	1,183.8	0.04	1,184	0.5	0.5	7100.3	7,100	1,183	1,183	47	1,230.6	27.5	1203	1,230.6	0	35	0.3	35	3.3
27	30-Sep	13-Oct	14.34	33.6	154,000	4,158,000	1,192.4	0.11	1,192	0.2	0.2	7153.3	7,153	1,192	1,192	38	1,230.6	27.5	1203	1,230.6	0	38	0.7	39	1.7
28	14-Oct	27-Oct	15.04	31.1	154,000	4,312,000	1,193.0	0.11	1,193	0.2	0.2	7157.4	7,157	1,193	1,193	38	1,230.6	27.5	1203	1,230.6	0	38	0.7	39	1.5
29	28-Oct	10-Nov	17.03	9.5	154,000	4,466,000	1,196.7	0.13	1,197	0.1	0.1	7180.7	7,181	1,197	1,197	34	1,230.6	27.5	1203	1,230.6	0	40	0.8	40	0.5
30	11-Nov	24-Nov	17.83	0.8	154,000	4,620,000	1,198.2	0.13	1,198	0.0	0.0	7190.0	7,190	1,198	1,198	32	1,230.6	27.5	1203	1,230.6	0	40	0.9	41	0.0
31	25-Nov	8-Dec	17.81	0.3	154,000	4,774,000	1,198.3	0.13	1,198	0.0	0.0	7190.3	7,190	1,198	1,198	32	1,230.6	27.5	1203	1,230.6	0	40	0.9	41	0.0
32	9-Dec	22-Dec	17.79	0.0	154,000	4,928,000	1,198.3	0.13	1,198	0.0	0.0	7190.6	7,191	1,198	1,198	32	1,230.6	27.5	1203	1,230.6	0	40	0.9	41	0.0
33	23-Dec	5-Jan	16.55	0.0	154,000	5,082,000	1,197.7	0.12	1,198	0.0	0.0	7186.8	7,187	1,198	1,198	33	1,230.6	27.5	1203	1,230.6	0	40	0.8	41	0.0
34	6-Jan	19-Jan	14.32	0.0	154,000	5,236,000	1,196.6	0.11	1,197	0.0	0.0	7179.9	7,180	1,197	1,197	34	1,230.6	27.5	1203	1,230.6	0	39	0.7	40	0.0
35	20-Jan	2-Feb	14.63	0.0	154,000	5,390,000	1,196.7	0.11	1,197	0.0	0.0	7180.9	7,181	1,197	1,197	34	1,230.6	27.5	1203	1,230.6	0	39	0.7	40	0.0
36	3-Feb	16-Feb	16.50	0.0	154,000	5,544,000	1,197.6	0.12	1,198	0.0	0.0	7186.6	7,187	1,198	1,198	33	1,230.6	27.5	1203	1,230.6	0	40	0.8	41	0.0
37	17-Feb	2-Mar	16.79	0.0	154,000	5,698,000	1,197.8	0.12	1,198	0.0	0.0	7187.5	7,187	1,198	1,198	33	1,230.6	27.5	1203	1,230.6	0	40	0.8	41	0.0
38	3-Mar	16-Mar	18.56	0.3	154,000	5,852,000	1,198.6	0.14	1,199	0.0	0.0	7192.7	7,193	1,199	1,199	32	1,230.6	27.5	1203	1,230.6	0	40	0.9	41	0.0
39	17-Mar	30-Mar	18.56	0.3	154,000	6,006,000	1,198.6	0.14	1,199	0.0	0.0	7192.7	7,193	1,199	1,199	32	1,230.6	27.5	1203	1,230.6	0	40	0.9	41	0.0

srk consulting

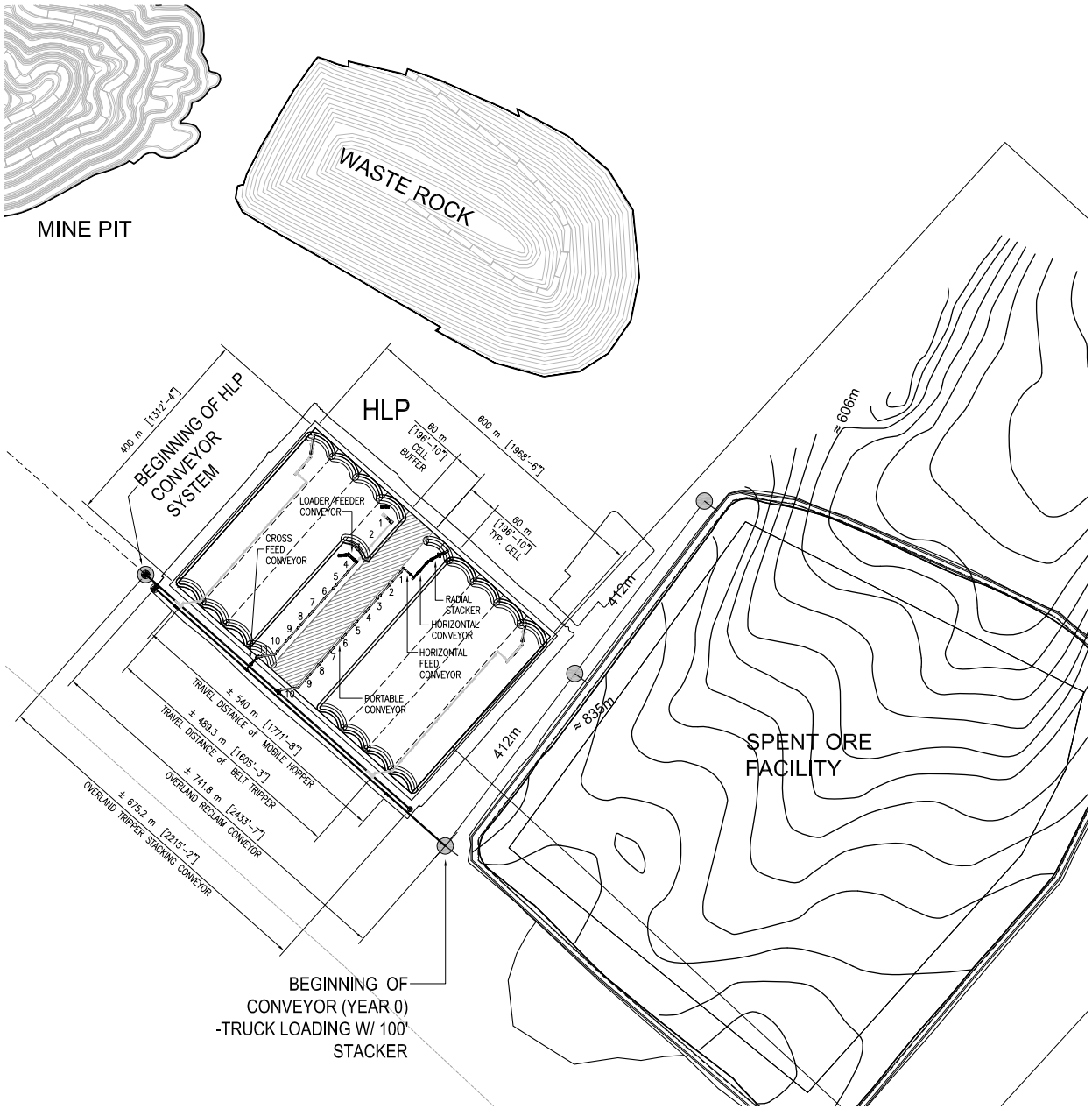
14-Day Cycle	Start Date	End Date	Climatic Data		Operation Data		Rinse Pond						
							Outflows		Net Inflow	Operating Pond Vol. for 2-m head	Daily Pond Storage	Make-Up Volume	Excess Pond Volume
			Precip. per Cycle	Evap. per Cycle	Ore Prod.	Cum. Ore Prod.	To Process Plant	Total Outflow					
			(mm)	(mm)	(tonnes)	(tonnes)	(m^3/hr)	(m^3/hr)	(m^3/hr)	(m^3)	(m^3)	(m^3/hr)	(m^3/hr)
1	1-Oct	14-Oct	15.04	31.1	154,000	154,000	(14)	-13	23	553.0	553.0	0	0
2	15-Oct	28-Oct	15.04	31.1	154,000	308,000	(15)	-13	22	539.7	540	0	0
3	29-Oct	11-Nov	17.23	7.3	154,000	462,000	(17)	-17	26	630.4	630	0	0
4	12-Nov	25-Nov	17.83	0.8	154,000	616,000	(19)	-19	27	658.4	658	0	0
5	26-Nov	9-Dec	17.81	0.3	154,000	770,000	(20)	-20	27	659.5	659	0	0
6	10-Dec	23-Dec	17.79	0.0	154,000	924,000	(22)	-22	28	660.3	660	0	0
7	24-Dec	6-Jan	16.30	0.0	154,000	1,078,000	33	33	0	26.2	0	29	0
8	7-Jan	20-Jan	14.32	0.0	154,000	1,232,000	34	34	61	1465	1465	0	61
9	21-Jan	3-Feb	14.78	0.0	154,000	1,386,000	34	34	6	153.5	154	0	6
10	4-Feb	17-Feb	16.50	0.0	154,000	1,540,000	33	33	8	185.4	185	0	8
11	18-Feb	3-Mar	16.94	0.1	154,000	1,694,000	33	33	8	193.3	193	0	8
12	4-Mar	17-Mar	18.56	0.3	154,000	1,848,000	32	32	9	222.2	222	0	9
13	18-Mar	31-Mar	18.56	0.3	154,000	2,002,000	32	32	9	222.2	222	0	9
14	1-Apr	14-Apr	26.27	27.1	154,000	2,156,000	31	33	9	224.9	225	0	9
15	15-Apr	28-Apr	26.27	27.1	154,000	2,310,000	31	33	9	224.9	225	0	9
16	29-Apr	12-May	25.97	52.1	154,000	2,464,000	35	38	4	88.4	88	0	4
17	13-May	26-May	25.92	56.2	154,000	2,618,000	36	38	3	65.6	66	0	3
18	27-May	9-Jun	20.06	71.7	154,000	2,772,000	41	41	0	26.2	0	2	0
19	10-Jun	23-Jun	16.80	80.3	154,000	2,926,000	43	43	0	26.2	0	6	0
20	24-Jun	7-Jul	11.36	89.0	154,000	3,080,000	47	47	0	26.2	0	11	0
21	8-Jul	21-Jul	5.92	97.8	154,000	3,234,000	51	51	0	26.2	0	17	0
22	22-Jul	4-Aug	5.06	95.9	154,000	3,388,000	51	51	0	26.2	0	17	0
23	5-Aug	18-Aug	2.94	91.0	154,000	3,542,000	52	52	0	26.2	0	18	0
24	19-Aug	1-Sep	3.11	89.2	154,000	3,696,000	52	52	0	26.2	0	18	0
25	2-Sep	15-Sep	5.32	65.5	154,000	3,850,000	47	47	0	26.2	0	12	0
26	16-Sep	29-Sep	5.32	65.5	154,000	4,004,000	47	47	0	26.2	0	12	0
27	30-Sep	13-Oct	14.34	33.6	154,000	4,158,000	38	40	0	26.2	0	0	0
28	14-Oct	27-Oct	15.04	31.1	154,000	4,312,000	38	39	0	26.2	0	0	0
29	28-Oct	10-Nov	17.03	9.5	154,000	4,466,000	34	34	6	145.7	146	0	6
30	11-Nov	24-Nov	17.83	0.8	154,000	4,620,000	32	32	9	205.9	206	0	9
31	25-Nov	8-Dec	17.81	0.3	154,000	4,774,000	32	32	9	207.9	208	0	9
32	9-Dec	22-Dec	17.79	0.0	154,000	4,928,000	32	32	9	209.4	209	0	9
33	23-Dec	5-Jan	16.55	0.0	154,000	5,082,000	33	33	8	186.4	186	0	8
34	6-Jan	19-Jan	14.32	0.0	154,000	5,236,000	34	34	6	144.9	145	0	6
35	20-Jan	2-Feb	14.63	0.0	154,000	5,390,000	34	34	6	150.7	151	0	6
36	3-Feb	16-Feb	16.50	0.0	154,000	5,544,000	33	33	8	185.4	185	0	8
37	17-Feb	2-Mar	16.79	0.0	154,000	5,698,000	33	33	8	190.7	191	0	8
38	3-Mar	16-Mar	18.56	0.3	154,000	5,852,000	32	32	9	222.2	222	0	9
39	17-Mar	30-Mar	18.56	0.3	154,000	6,006,000	32	32	9	222.2	222	0	9

Appendix D: Stacking and Reclaiming Vendor Information


CONVENTIONAL STACKER
HORIZONTAL CONVEYOR
HORIZONTAL
FEED CONVEYOR
GRASSHOPPER
RAIL TRIPPER
OVERLAND CONVEYOR

KOZA ON-OFF PAD PROJECT

HEAP LEACH SYSTEM



DESIGN CRITERIA

DESIGN:	750 TPH
MOISTURE CONTENT	
MATERIAL DENSITY	: 1.6 MT/Cu.MTR (100 LBS/Cu. ft.)
CRUSH SIZE	: – 12mm (1/2 in)
ADVANCE RATE:	4.894 FT/HOUR

32" SYSTEM

OPERATION	: 19 HRS / DAY
LIFT HEIGHT	: 4 METERS
ULTIMATE HEIGHT	: 1 LIFT
CELL (TYP. WIDTH)	: 60 M

STACKING

CONV. No.	QTY	DESCRIPTION	hp	REMARKS
CV-01	1	NOT USED		
CV-02	1	.914 M x ± 675 M OVERLAND TRIPPER STACKING CONVEYOR (36" x ± 2,215'-0")	600	
CV-03	1	.914 M x 7.62 M TRIPPER DISCHARGE CONVEYOR (36" x ± 25'-0")	30	RAIL MOUNTED
CV-04	10	.914 M x 35 M STD. PORTABLE CONVEYOR (36" x 115'-0")	40	
CV-05	–	NOT USED		
CV-06	1	.914 M x 27.5 M HORIZONTAL FEED CONVEYOR (36" x 90'-0")	60	
CV-07	1	.914 M x 42.6 M HORIZONTAL CONVEYOR (36" x 140'-0")	60	
CV-08	1	.914 M x 36.5 M – 42.6 M RADIAL TELESCOPING STACKER (36" x 120'-0" TO 140'-0")	100	

RECLAIM

CONV. No.	QTY	DESCRIPTION	hp	REMARKS
RCV-01	1	.914 M x ± 742 M OVERLAND RECLAIM CONVEYOR (36" x ± 2,438'-0")	600	
RCV-03	11	.914 M x 35 M STD. PORTABLE CONVEYOR (36" x 115'-0")	40	
RCV-04	1	.914 M x 27.5 M CROSS FEED CONVEYOR (36" x 90'-0")	75	USE TO "CROSS-OVER" THE OVERLAND TRIPPER CONVEYOR
RCV-05	1	.914 M x 27.5 M LOADER FEEDER CONVEYOR (36" x 90'-0")	60	
MH-01	1	MOBILE HOPPER		RAIL MOUNTED
MFC-01	1	FRONT END LOADER		BY OTHERS

2425 TOTAL CONNECTED HP

ZONE	REV	DATE	BY	APPROVED	REVISION\DESCRIPTION
	A	28OCT2011	dna	GMB	ISSUED FOR INFORMATION

Document Control

PROJECT NAME: KOZA ON-OFF PAD PROJECT

EQUIPMENT NO. | TNT JOB NO. | P.O. NO.

TERRA NOVA Technologies, Inc.
10770 Rockvill Street
Santee, California 92071
Phone (619) 596-7400
Fax (619) 596-7402

THIRD ANGLE PROJECTION

DIMENSIONS IN [ ] ARE MILLIMETERS

DRAWN BY	dna	DATE 04.JAN.2012
CHECKED BY	GMB	DATE JAN.2012
DESIGN APPROVED		DATE
STRUCTURAL APPROVED		DATE
PROJ. MGR/ENGR APPROVED		DATE
CLIENT APPROVED		DATE

DRAWING TITLE: HEAP LEACH LAYOUT ON-OFF PAD

EQUIPMENT NAME

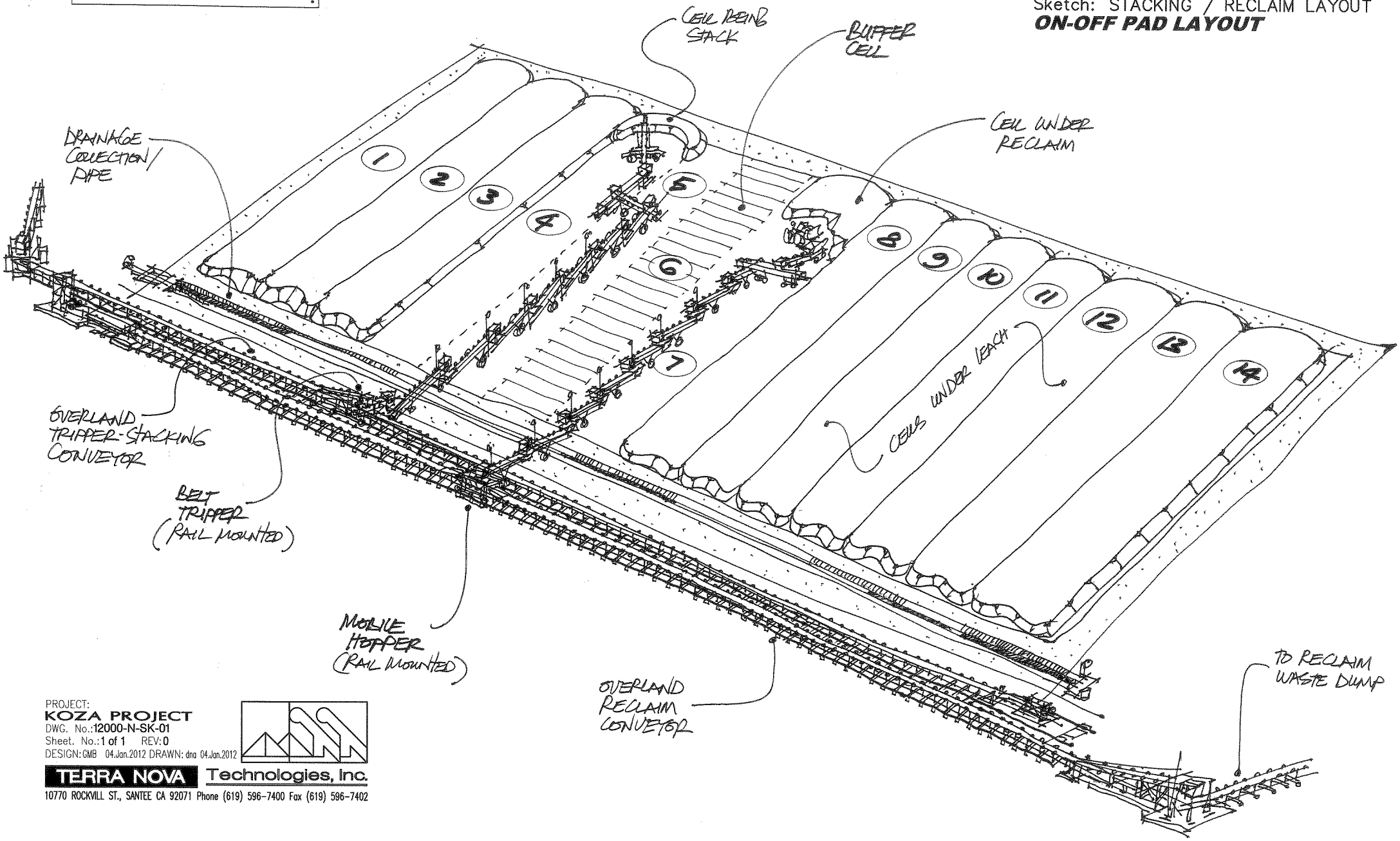
SCALE	DWG NO.		SHEET NO.	REV
1:4000 M	12-XXX-N-100	D	1 OF 1	A

CONFIDENTIAL
Proprietary Design
Terra Nova Technologies, inc.

KOZA PROJECT

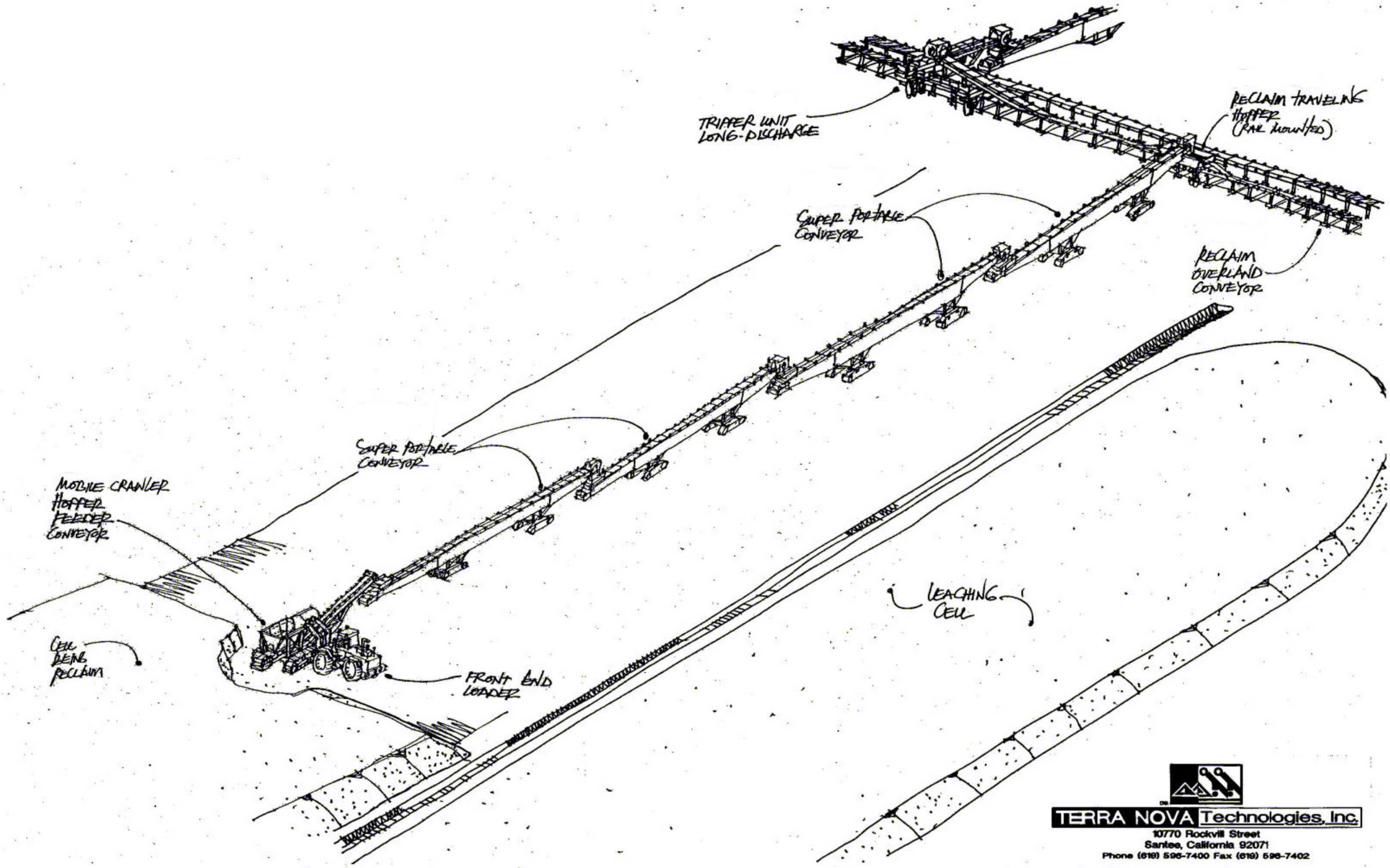
Sketch: STACKING / RECLAIM LAYOUT

ON-OFF PAD LAYOUT



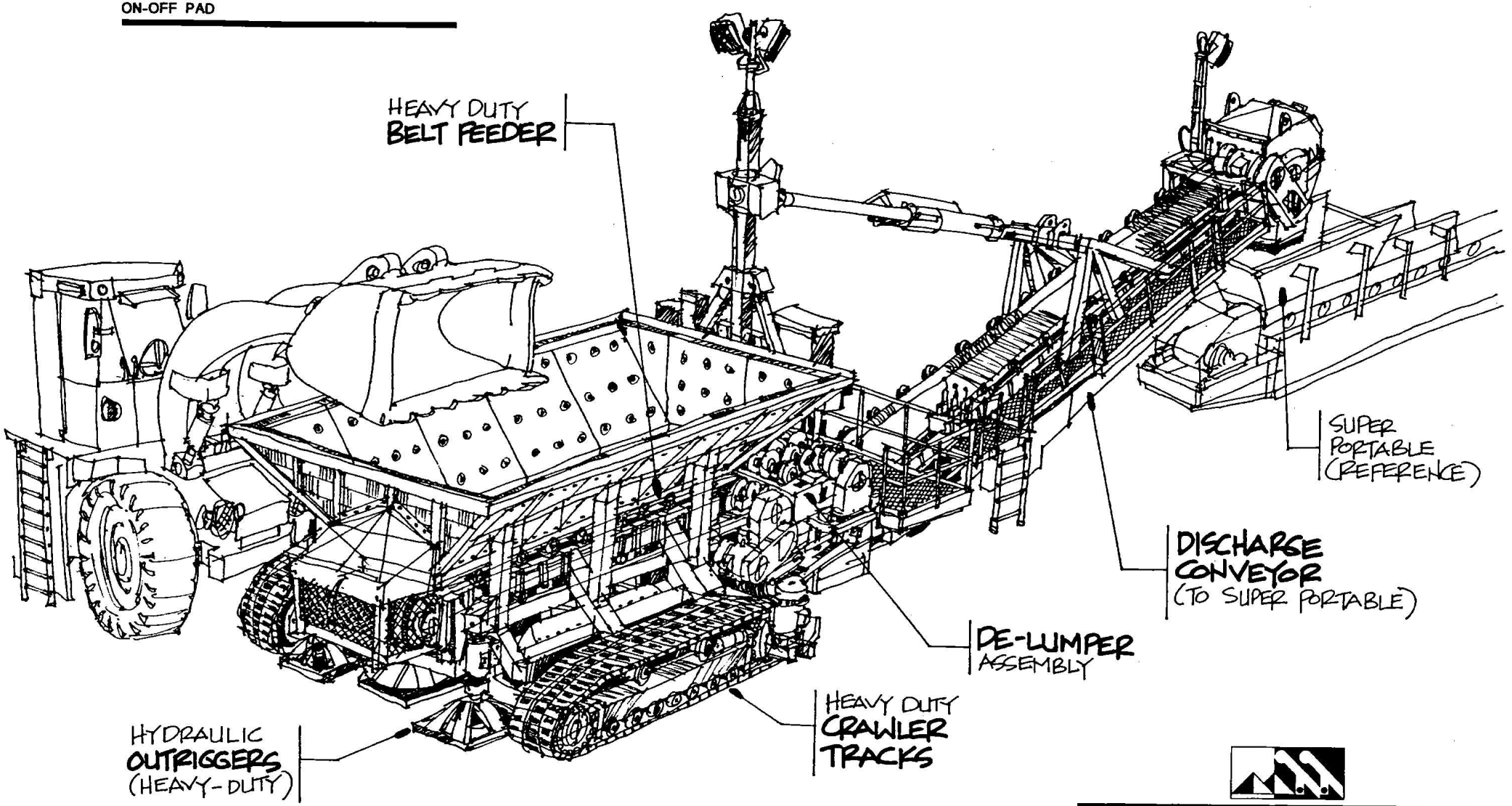
PROJECT:
KOZA PROJECT
DWG. No.:12000-N-SK-01
Sheet. No.:1 of 1 REV:0
DESIGN:GMB 04.Jan.2012 DRAWN: dna 04.Jan.2012

TERRA NOVA Technologies, Inc.
10770 ROCKVILL ST., SANTEE CA 92071 Phone (619) 596-7400 Fax (619) 596-7402



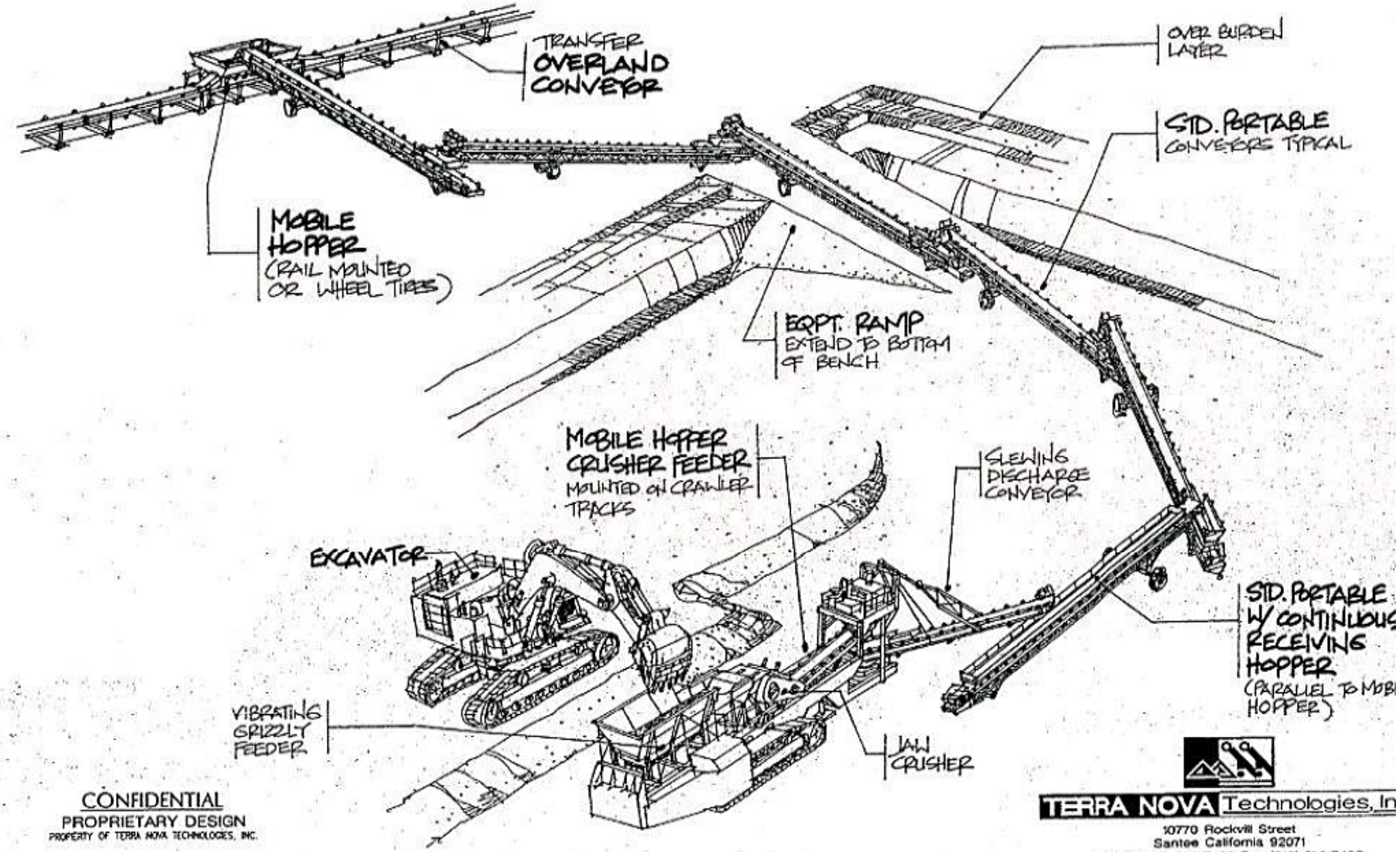
TERRA NOVA Technologies, Inc.
10770 Rockvill Street
Santee, California 92071
Phone (619) 596-7400 Fax (619) 596-7402

MANTOVERDE UPGRADE
NEW STACKING SYSTEM
ON-OFF PAD



MOBILE RIPIOS
RECLAIM HOPPER / FEEDER

TERRA NOVA Technologies, Inc.
10770 Rockvill Street
Santee, California 92071
Phone (619) 596-7400 Fax (619) 596-7402



CONFIDENTIAL
PROPRIETARY DESIGN
PROPERTY OF TERRA NOVA TECHNOLOGIES, INC.

TERRA NOVA Technologies, In
10770 Rockvill Street
Santee California 92071
Phone (619) 596-7400 Fax (619) 596-7402

Appendix E: Capital and Operating Cost Estimate

Appendix E-1:Unit Cost Summary

Table E-1: Unit Cost Summary

Item No.	Item	Unit Cost	Units	Contingency
100	**Site Preparation**			
110	Mobilization and Demobilization	10%	ls	40%
120	Clear and Grub	$3,500	ha	40%
130	Topsoil Removal and Stockpiling	$1.50	m^3	40%
200	**Earthworks**			
210	HLP Overexcavation	$3.00	m^3	40%
211	SOF Overexcavation	$3.00	m^3	40%
220	HLP Compacted Fill: Regrading	$1.50	m^3	40%
221	SOF Compacted Fill: Regrading	$1.50	m^3	40%
230	HLP Subgrade Preparation	$0.25	m^2	40%
231	SOF Subgrade Preparation	$0.25	m^2	40%
240	HLP Soil Liner	$5.00	m^3	40%
241	SOF Soil Liner	$6.00	m^3	40%
250	HLP Single Anchor Trench	$2.50	lm	40%
251	SOF Single Anchor Trench	$2.50	lm	40%
255	HLP Double Anchor Trench	$6.00	lm	40%
260	HLP Blasting	$3.00	m^3	40%
261	SOF Blasting	$3.00	m^3	40%
270	N/A			40%
271	N/A			40%
300	**Geosynthetics**			
310	HLP 2.0mm HDPE Geomembrane	$6.20	m^2	35%
320	HLP 1.5mm HDPE Geomembrane	$4.95	m^2	35%
321	SOF 1.5mm HDPE Geomembrane	$4.95	m^2	35%
325	HLP 1.5mm HDPE Geomembrane (Double) and Drain Net	$6.19	m^2	35%
400	**Overliner**			
410	HLP Overliner	$15.00	m^3	40%
411	SOF Overliner	$16.00	m^3	40%
500	**Piping**			
510	Drainage Piping	$1.15	m^2	35%
600	**Diversion Channel**			
610	N/A	$0.00	m^2	40%
700	**Miscellaneous Mechanical Equipment**			
710	Fixed Conveyor	$2,900	lm	30%
720	Rail tripper	$655,000	LS	30%
730	Mobile Stacking Conveyor w/ tripper	$5,700,000	LS	30%
740	Bucket wheel	$3,000,000	LS	30%
750	Mobile Reclaim Conveyor w/ hopper	$5,200,000	LS	30%
760	Rail Hopper	$343,000	LS	30%
761	Mobile Conveyor Hopper	$1,300,000	LS	30%
765	Grasshopper	$148,000	LS	30%
766	Horizontal Feed Conveyor	$244,000	LS	30%
767	Horizontal Conveyor	$694,000	LS	30%
770	Conventional Stacker	$774,000	LS	30%
771	Radial Stacker	$465,000	LS	30%
780	20 t Truck	$375,000	EA	30%
781	958 Loader	$730,000	EA	30%
782	12M Grader	$320,000	EA	30%
783	$20m^3$ Water truck	$275,000	EA	30%
784	D7 Dozer	$570,000	EA	30%
790	Overland Conveyor	$2,350	LM	30%
800	**Closure**			
810	Mobilization and Demobilization	10%	ls	40%
820	Regrading	$0.50	m^2	40%
830	Rock Armour Placement	$13.50	m^3	40%
840	Topsoil Placement	$1.80	m^3	40%
841	Structure Removal Conveyors	$40	m	40%
842	General Labor Crew	$1,200		40%
900	**Construction and Engineering**			
910	Engineering	2%	ls	25%
920	CM	5%	ls	25%
930	Owner Costs	5%	ls	25%
1000	**OPEX**			
1010	Stacker / Conveyor / Reclaimer OPEX	$0.55	per tonne	
1011	Overland Conveyor	$0.09	per t-km	
1012	Grasshoppers and Stacker	$0.24	per tonne	
1013	Loader	$0.12	per tonne	
1014	Truck and Loader	$0.85	per tonne	
1020	Truck and Grasshopper OPEX	$1.02	per tonne	
1030	Electrical Power	$0.07	per kw-hr	
1040	Fuel	$2.10	per litre	
1050	Grasshopper / Stacker OPEX	$0.53	per tonne	

Appendix E-2:On-Off HLP Capital Cost Estimate

Himmetdede Gold HLP Project
Table E-2: On Off HLP PFS Cost Estimate With Grasshoppers, Loader and Conveyors
Quantity Summary

Item No.	Item	Units	Contingency	Subtotal	Year -2 Quantity	Year -1 Quantity	Year 1 Quantity	Year 2 Quantity	Year 3 Quantity	Year 4 Quantity	Year 5 Quantity	Year 6 Quantity	Year 7 Quantity	Year 8 Quantity
100	**Site Preparation**													
110	Mobilization and Demobilization	ls		1		1								
120	Clear and Grub	ha		136		136								
130	Topsoil Removal and Stockpiling	m^3		408,428		408,428								
200	**Earthworks**													
210	HLP Overexcavation	m^3		11,770		11,770								
211	SOF Overexcavation	m^3		10,678		10,678								
220	HLP Compacted Fill: Regrading	m^3		235,396		235,396								
221	SOF Compacted Fill: Regrading	m^3		213,552		213,552								
230	HLP Subgrade Preparation	m^2		302,652		302,652								
231	SOF Subgrade Preparation	m^2		906,117		906,117								
240	HLP Soil Liner	m^3		90,796		90,796								
241	SOF Soil Liner	m^3		271,835		271,835								
250	HLP Single Anchor Trench	m		2,559		2,559								
251	SOF Single Anchor Trench	m		3,623		3,623								
255	HLP Double Anchor Trench	m		752		752								
260	HLP Blasting	m^3		122,700		122,700								
261	SOF Blasting	m^3		-		-								
270	N/A			-										
271	N/A			-										
300	**Geosynthetics**													
310	HLP 2.0mm HDPE Geomembrane	m^2		273,564		273,564								
320	HLP 1.5mm HDPE Geomembrane	m^2		10,004		10,004								
321	SOF 1.5mm HDPE Geomembrane	m^2		906,117		906,117								
325	HLP 1.5mm HDPE Geomembrane (Double) and Drain Net	m^2		19,084		19,084								
400	**Overliner**													
410	HLP Overliner	m^3		574,484		328,277		82,069		82,069		82,069		
411	SOF Overliner	m^3		815,505		815,505								
500	**Piping**													
510	Drainage Piping	m^2		273,564		273,564								
600	**Diversion Channel**													
610	N/A	m^2		-										
700	**Miscellaneous Mechanical Equipment**													
710	Fixed Conveyor	lm		1,390		1,390								
720	Rail tripper	ls		1		1								
730	Mobile Stacking Conveyor w/ tripper	ls		-		-								
740	Bucket wheel	ls		-		-								
750	Mobile Reclaim Conveyor w/ hopper	ls		-		-								
760	Rail Hopper	ls		1		1								
761	Mobile Conveyor Hopper	ls		1		1								
765	Grasshopper	ls		21		21								
766	Horizontal Feed Conveyor	ls		1		1								
767	Horizontal Conveyor	ls		1		1								
770	Conventional Stacker	ls		1		1								
771	Radial Stacker	ls		1		1								
780	20 t Truck	ea		2		2								
781	958 Loader	ea		2		2								
782	12M Grader	ea		1		1								
783	20m3 Water truck	ea		1		1								
784	D7 Dozer	ea		2		2								
790	Overland Conveyor	lm		945		517			428					
800	**Closure**													
810	Mobilization and Demobilization	ls		1										1
820	Regrading	m^2		1,276,025										1,276,025
830	Rock Armour Placement	m^3		132,036										132,036
840	Topsoil Placement	m^3		303,586										303,586
841	Structure Removal Conveyors	m		2,335										2,335
842	General Labor Crew	day		100										100
900	**Construction and Engineering**													
910	Engineering	ls		1		1								
920	CM	ls		1		1								
930	Owner Costs	ls		1		1								

Himmetdede Gold HLP Project
Table E-2: On Off HLP PFS Cost Estimate With Grasshoppers, Loader and Conveyors
Cost Summary

Item No.	Item	Units	Unit Cost					Year -2 Cost	Year -1 Cost	Year 1 Cost	Year 2 Cost	Year 3 Cost	Year 4 Cost	Year 5 Cost	Year 6 Cost	Year 7 Cost	Year 8 Cost
100	**Site Preparation**						**$ 4,320,736**	$ -	**$ 3,951,425**	$ -	**$ 123,104**	$ -	**$ 123,104**	$ -	**$ 123,104**	$ -	$ -
110	Mobilization and Demobilization	ls		10%	40%	$ 1,292,838	$ 3,232,094	$ -	$ 2,862,782.87	$ -	$ 123,103.80	$ -	$ 123,103.80	$ -	$ 123,103.80	$ -	$ -
120	Clear and Grub	ha	$ 3,500.00		40%	$ 190,400	$ 476,000	$ -	$ 476,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
130	Topsoil Removal and Stockpiling	ha	$ 2		40%	$ 245,057	$ 612,642	$ -	$ 612,642	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
200	**Earthworks**						**$ 3,516,015**	$ -	**$ 3,516,015**	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
210	HLP Overexcavation	m^3	$ 3.00		40%	$ 14,124	$ 35,310	$ -	$ 35,310	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
211	SOF Overexcavation	m^3	$ 3.00		40%	$ 12,814	$ 32,034	$ -	$ 32,034	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
220	HLP Compacted Fill: Regrading	m^3	$ 1.50		40%	$ 141,238	$ 353,094	$ -	$ 353,094	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
221	SOF Compacted Fill: Regrading	m^3	$ 1.50		40%	$ 128,131	$ 320,328	$ -	$ 320,328	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
230	HLP Subgrade Preparation	m^2	$ 0.25		40%	$ 30,265	$ 75,663	$ -	$ 75,663	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
231	SOF Subgrade Preparation	m^2	$ 0.25		40%	$ 90,612	$ 226,529	$ -	$ 226,529	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
240	HLP Soil Liner	m^3	$ 5.00		40%	$ 181,592	$ 453,980	$ -	$ 453,980	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
241	SOF Soil Liner	m^3	$ 6.00		40%	$ 652,404	$ 1,631,010	$ -	$ 1,631,010	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
250	HLP Single Anchor Trench	m	$ 2.50		40%	$ 2,559	$ 6,398	$ -	$ 6,398	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
251	SOF Single Anchor Trench	m	$ 2.50		40%	$ 3,623	$ 9,058	$ -	$ 9,058	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
255	HLP Double Anchor Trench	m	$ 6.00		40%	$ 1,805	$ 4,512	$ -	$ 4,512	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
260	HLP Blasting	m^3	$ 3.00		40%	$ 147,240	$ 368,100	$ -	$ 368,100	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
261	SOF Blasting	m^3	$ 3.00		40%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
270	N/A		$ -		40%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
271	N/A		$ -		40%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
300	**Geosynthetics**						**$ 6,348,978**	$ -	**$ 6,348,978**	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
310	HLP 2.0mm HDPE Geomembrane	m^2	$ 6.20		35%	$ 593,634	$ 1,696,097	$ -	$ 1,696,097	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
320	HLP 1.5mm HDPE Geomembrane	m^2	$ 4.95		35%	$ 17,332	$ 49,520	$ -	$ 49,520	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
321	SOF 1.5mm HDPE Geomembrane	m^2	$ 4.95		35%	$ 1,569,848	$ 4,485,279	$ -	$ 4,485,279	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
325	HLP 1.5mm HDPE Geomembrane (Double) and Drain Net	m^2	$ 6.19		35%	$ 41,329	$ 118,082	$ -	$ 118,082	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
400	**Overliner**						**$ 21,665,351**	$ -	**$ 17,972,237**	$ -	**$ 1,231,038**	$ -	**$ 1,231,038**	$ -	**$ 1,231,038**	$ -	$ -
410	HLP Overliner	m^3	$ 15.00		40%	$ 3,446,906	$ 8,617,266	$ -	$ 4,924,152	$ -	$ 1,231,038	$ -	$ 1,231,038	$ -	$ 1,231,038	$ -	$ -
411	SOF Overliner	m^3	$ 16.00		40%	$ 5,219,234	$ 13,048,085	$ -	$ 13,048,085	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
500	**Piping**						**$ 314,599**	$ -	**$ 314,599**	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
510	Drainage Piping	m^2	$ 1.15		35%	$ 110,110	$ 314,599	$ -	$ 314,599	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
600	**Diversion Channel**						**$ -**	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
610	N/A	m^2	$ -		40%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
700	**Miscellaneous Mechanical Equipment**						**$ 17,779,750**	$ -	**$ 16,773,950**	$ -	$ -	**$ 1,005,800**	$ -	$ -	$ -	$ -	$ -
710	Fixed Conveyor	lm	$ 2,900		30%	$ 1,209,300	$ 4,031,000	$ -	$ 4,031,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
720	Rail tripper	ls	$ 655,000		30%	$ 196,500	$ 655,000	$ -	$ 655,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
730	Mobile Stacking Conveyor w/ tripper	ls	$ 5,700,000		30%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
740	Bucket wheel	ls	$ 3,000,000		30%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
750	Mobile Reclaim Conveyor w/ hopper	ls	$ 5,200,000		30%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
760	Rail Hopper	ls	$ 343,000		30%	$ 102,900	$ 343,000	$ -	$ 343,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
761	Mobile Conveyor Hopper	ls	$ 1,300,000		30%	$ 390,000	$ 1,300,000	$ -	$ 1,300,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
765	Grasshopper	ls	$ 148,000		30%	$ 932,400	$ 3,108,000	$ -	$ 3,108,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
766	Horizontal Feed Conveyor	ls	$ 244,000		30%	$ 73,200	$ 244,000	$ -	$ 244,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
767	Horizontal Conveyor	ls	$ 694,000		30%	$ 208,200	$ 694,000	$ -	$ 694,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
770	Conventional Stacker	ls	$ 774,000		30%	$ 232,200	$ 774,000	$ -	$ 774,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
771	Radial Stacker	ls	$ 465,000		30%	$ 139,500	$ 465,000	$ -	$ 465,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
780	20 t Truck	ea	$ 375,000		30%	$ 225,000	$ 750,000	$ -	$ 750,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
781	958 Loader	ea	$ 730,000		30%	$ 438,000	$ 1,460,000	$ -	$ 1,460,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
782	12M Grader	ea	$ 320,000		30%	$ 96,000	$ 320,000	$ -	$ 320,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
783	20m3 Water truck	ea	$ 275,000		30%	$ 82,500	$ 275,000	$ -	$ 275,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
784	D7 Dozer	ea	$ 570,000		30%	$ 342,000	$ 1,140,000	$ -	$ 1,140,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
790	Overland Conveyor	lm	$ 2,350		30%	$ 666,225	$ 2,220,750	$ -	$ 1,214,950	$ -	$ -	$ 1,005,800	$ -	$ -	$ -	$ -	$ -
800	**Closure**						**$ 3,366,389**	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	**$ 3,366,389**
810	Mobilization and Demobilization	ls		10%	40%	$ 122,414	$ 306,035	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 306,035
820	Regrading	m^2	$ 0.50		40%	$ 255,205	$ 638,013	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 638,013
830	Rock Armour Placement	m^3	$ 13.50		40%	$ 712,994	$ 1,782,486	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,782,486
840	Topsoil Placement	m^3	$ 1.80		40%	$ 218,582	$ 546,455	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 546,455
841	Structure Removal Conveyors	m	$ 40.00		40%	$ 37,360	$ 93,400	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 93,400
842	General Labor Crew	day	$ 1,200.00		40%	$ 48,000	$ 120,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 120,000
900	**Construction and Engineering**						**$ 6,877,418**	$ -	**$ 5,865,264**	$ -	**$ 162,497**	**$ 120,696**	**$ 162,497**	$ -	**$ 162,497**	$ -	**$ 403,967**
910	Engineering	ls		2%	25%	$ 286,559	$ 1,146,236	$ -	$ 977,544	$ -	$ 27,083	$ 20,116	$ 27,083	$ -	$ 27,083	$ -	$ 67,328
920	CM	ls		5%	25%	$ 716,398	$ 2,865,591	$ -	$ 2,443,860	$ -	$ 67,707	$ 50,290	$ 67,707	$ -	$ 67,707	$ -	$ 168,319
930	Owner Costs	ls		5%	25%	$ 716,398	$ 2,865,591	$ -	$ 2,443,860	$ -	$ 67,707	$ 50,290	$ 67,707	$ -	$ 67,707	$ -	$ 168,319
	Sub Total						**$ 64,189,236**	$ -	**$ 54,742,468**	$ -	**$ 1,516,639**	**$ 1,126,496**	**$ 1,516,639**	$ -	**$ 1,516,639**	$ -	**$ 3,770,355**
	Contingency	%				35%	$ 22,580,928	$ -	$ 19,006,624	$ -	$ 582,281	$ 331,914	$ 582,281	$ -	$ 582,281	$ -	$ 1,495,547
	Annual Tonnage	tpa					$ 29,200,000			4,000,000	4,000,000	4,000,000	4,000,000	4,000,000	4,000,000	4,000,000	1,200,000
	OPEX Total		**$ 1.60**				**$ 46,767,368**			$ 6,289,618	$ 6,289,618	$ 6,450,591	$ 6,450,591	$ 6,450,591	$ 6,450,591	$ 6,450,591	$ 1,935,177
	OPEX (Ore Stacking)		**$ 0.37**				**$ 10,707,467**										
1011	Overland Conveyor	per t-km	$ 0.09				$ 3,816,354			$ 522,788	$ 522,788	$ 522,788	$ 522,788	$ 522,788	$ 522,788	$ 522,788	$ 156,836
1012	Grasshoppers and Stacker	per tonne	$ 0.24				$ 6,891,112			$ 943,988	$ 943,988	$ 943,988	$ 943,988	$ 943,988	$ 943,988	$ 943,988	$ 283,196
	OPEX (Spent Ore Removal)		**$ 1.23**				**$ 36,059,902**										
1013	Loader		$ 0.12				$ 3,535,855			$ 484,364	$ 484,364	$ 484,364	$ 484,364	$ 484,364	$ 484,364	$ 484,364	$ 145,309
1012	Grasshoppers and Stacker		$ 0.24				$ 6,891,112			$ 943,988	$ 943,988	$ 943,988	$ 943,988	$ 943,988	$ 943,988	$ 943,988	$ 283,196
1011	Overland Conveyor		$ 0.09				$ 853,160			$ -	$ -	$ 160,974	$ 160,974	$ 160,974	$ 160,974	$ 160,974	$ 48,292
1014	Truck and Loader		$ 0.85				$ 24,779,774			$ 3,394,490	$ 3,394,490	$ 3,394,490	$ 3,394,490	$ 3,394,490	$ 3,394,490	$ 3,394,490	$ 1,018,347
	Total Cost						**$ 133,537,532**	$ -	**$ 73,749,092**	**$ 6,289,618**	**$ 8,388,537**	**$ 7,909,001**	**$ 8,549,511**	**$ 6,450,591**	**$ 8,549,511**	**$ 6,450,591**	**$ 7,201,080**

Appendix E-3:OPEX Supporting Calculations

Operating equipment cost estimate is as follows:

Fixed CV	$	0.044	per tonne				750		
Rail tripper	$	0.014	per tonne						
MSC w/ tripper	$	0.093	per tonne						
Bucket wheel	$	0.143	per tonne						
MRC w/ hopper	$	0.071	per tonne						
Rail hopper	$	0.014	per tonne						
1000m Fixed CV	$	0.044	per tonne				640		
Subtotal System	$	0.423	per tonne						
							1390		
OPEX (Grasshopper)									
			n						
Maintenance (parts, mechanical, tires, lube, etc.)	$	2.240		10.5	$	23.52			per hr
Labor (repair)	$	0.090		10.5	$	0.95			per hr
Repair Crew (4 persons)	$	15.000		1	$	15.00			per hr
Subtotal System	$	17.330			**$**	**39.47**			per hr
		kw	n		kwh				
Electrical Load		20	23		460	**$**	**32.20**		per hour
Sub total per hour	$	71.67							
Operating hours per day		18							hrs
	$	1,289.97							per day
Grasshopper Cost (8 units)	$	0.129							per tonne
Grasshopper Cost (29 units)	$	0.468							per tonne
Overland conveyor OPEX		Overhaul	Maintenance		Lube		For 400 ft belt at 600 tph		
		3.22	2.33		1.33		6.88		
						$	56.42		per hour km at 600 tph
		0.0940	$/t-km						
Overland belt lengths									
App1- On off									
App2 Grasshopper		0							
Grasshopper and Stacker Cost	**$**	**0.24**							
App2 Grasshopper									
Sub total App1	$	0.552							
Overland	$	-							
TOTAL App1	**$**	**0.552**	All Conveyors						
Grasshoppers	$	0.129	Grasshoppers only						
Feed belt	$	0.044							
TOTAL App2	**$**	**0.173**	Add to truck haulage costs						
Grasshoppers (29 units)	$	0.468	Grasshoppers only						
Feed belt	$	0.058							
TOTAL App3	**$**	**0.526**	Grasshopper OPEX						

Appendix F: Liner Leakage Rate

srk consulting

Flow Rate through Composite Liner
h=0.3m

Equation: $Q = 0.21 * a^{0.1} * h^{0.9} * k_s^{0.74}$

(Assume "good' contact conditions)

Input:

a = 1 cm^2 → a = 1.00E-04 m^2

h = 0.3 m

ks = 1.00E-06 cm/s → ks = 1.00E-08 m/s

n = 1

Output:

Q = 3.40E-08 m^3/acre/s

Q = 0.78 gal/acre/day

Q = 0.73 l/ha/day

Calculation:

Area = 24,063 m^2
24.1 ha

Q = 17 l/day per cell

Descriptions:

Q	leakage rate through a hole in the geomembrane component (m^3/s)
a	area of a circular hole in geomembrane (m^2)
h	liquid head on top of the geomembrane (m)
k_s	hydraulic conductivity of the soil in the composite liner (m/s)
n	number of holes per acre

Conversions:

1	m^3	264.2	gal
1	day	86400	sec
1	acre	4047	m^2