



**Oyu Tolgoi LLC**

## **Oyu Tolgoi Dump and Stockpile Management Plan**

| Dump and Stockpile Management Plan |   |                 |
|------------------------------------|---|-----------------|
| Effective Date:<br>2013.01.01      | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

**EXECUTIVE SUMMARY**

This Oyu Tolgoi LLC (OT) Dump and Stockpile Management Plan provides a roadmap for the continuous management of geotechnical and environmental risks at the Oyu Tolgoi Waste Dump and Stockpiles, as required by Health, Safety and Environment (HSE) Performance Standard D3 – Management of Pit Slopes, Stockpiles and Waste Dumps. The DMP was developed following the D3 Work Cycle for Management of Pit Slopes, Stockpiles, Spoil and Waste Dumps.

The DMP identifies the critical areas where OT should focus to achieve safe and effective dump and stockpiles slopes.

Proactive mineral waste management will be important at Oyu Tolgoi to ensure that acid rock drainage risks are minimized, sensitive receiving environments such as the Umdai River are protected and to ensure the site can be successfully rehabilitated. Potentially acid forming (PAF) waste rock must be segregated and placed only in designated areas. Non-acid forming (NAF) waste rock must also be carefully managed because it is an important resource for use as general fill, in TSF embankment construction and as final cover materials. Table 1 lists the different geologic material types that must be separately handled and placed during mining, outlines their management requirements and uses.

**Table 1 - Materials Overview**

| Material Type                               | Classification Criteria   | Management Requirements and Uses   |
|---|---|--|
| Topsoil                                     | Fertile topsoil generally uppermost 30 cm except on stony hills where missing   | NAF - Transport to central topsoil repository for storage until used for rehabilitation.   |
| Residual Soils and Alluvial Sand and Gravel | Subsoils, aeolian sands and well sorted sand and gravel exposed at the surface in active or recently active alluvial channels such as the Umdai River   | NAF – Unrestricted use on and offsite as general fill. If texture is appropriate can be used as aggregate and for <b>Zone D</b> (sand and gravel filter) in TSF Embankment. Can also be managed as general NAF and co-disposed with NAF waste rock.  |
| Cretaceous Clay                             | Unconsolidated Cretaceous Clay  | NAF - Unrestricted use on and offsite as general fill. If texture is appropriate (1) can be used for <b>Zone A</b> (starter dam) or general fill in TSF Embankment ( <b>Zone F</b> ) and as a compacted clay liner in locations where the clay aquitard is missing. Not appropriate for use in drainage layers, covers or as a growth media because of low permeability, erodibility and high salinity. Should not be co-stored with NAF that may be used as covers. |
| Segregated Oxide Material (SOM)             | Weathered (oxide and transitional) bedrock with $\geq 0.25\%$ Cu  | PAF – Transport to the SOM dump/stockpile for storage until processed or closed in place with a NAF cover.   |
| Coarse NAF                                  | Weathered (oxide and transitional) bedrock with $< 0.25\%$ Cu and $< 0.2\%$ total sulfur. Fresh (un-oxidized) waste rock containing $< 0.8\%$ total sulfur. If sulfur unknown, all bedrock from Carboniferous and overturned block sediments (CS2&3; Da4) can be considered NAF as well as oxide rock with no visible | NAF – Unrestricted use as general onsite fill. Should not be transported offsite. Ideal for use in <b>Zone B1, Zone B2, Zone C</b> and <b>NAF basal layer</b> of the TSF embankment because minimal processing (screening) required to meet texture requirements (1). Oversize material can be used as riprap. Sand and fine gravel component could be used in <b>Zone D</b> . Excess material should be stored in a General   |

| <b>Dump and Stockpile Management Plan</b> |   |                 |
|---|---|-----------------|
| Effective Date:<br>2013.01.01             | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

| Material Type | Classification Criteria   | Management Requirements and Uses   |
|---------------|---|--|
|               | <p>sulfides.</p> <p>Must contain less than 5% fines (material passing 200 mesh) or be capable of being processed to contain less than 5% fines. Rock types which meet this texture requirement are not currently known.</p>   | <p>NAF waste rock dump for eventual use in final covers on waste rock, tailings and embankment surfaces.</p>   |
| General NAF   | <p>Weathered (oxide and transitional) bedrock with &lt;0.25% Cu and &lt;0.2% total sulfur. Fresh (un-oxidized) waste rock containing &lt;0.8% total sulfur. If sulfur unknown, all bedrock from Carboniferous and overturned block sediments (CS2&amp;3; Da4) can be considered NAF as well as oxide rock with no visible sulfides. Does not include Cretaceous Clay.</p> <p>No texture requirements but a well graded material with cobbles, sands and silt/clay is best for covers.</p> | <p>NAF – Unrestricted use as general onsite fill. Should not be transported offsite. Ideal for use in covers and as general fill. Can be used as fill in <b>Zone F</b> of the embankment. Might require significant costly washing and screening for use in Zones B1, B2, Zone C and NAF basal layer of the TSF embankment. Oversize material can be used as riprap. Sand and fine gravel component could be used in Zone D. Should be stored in a General NAF waste rock dump for eventual use in final covers on waste rock, tailings and embankment surfaces.</p> |
| PAF           | <p>Bedrock from all deposits except for Central Oyu and Wedge Zone containing <math>\geq 0.8\%</math> total sulfur if fresh and <math>\geq 0.2\%</math> sulfur if oxide or transitional; if sulfur unknown includes all bedrock other than from Carboniferous and overturned block sediments (Cs 2 &amp; 3; Da4)</p>  | <p>PAF – Can only be placed in 1) designated waste rock dumps; 2) TSF internal splitter dykes, or 3) <b>Zone F</b> embankment fill in the TSF. Must be capped with a NAF cover at closure.</p>   |
| Central PAF   | <p>Bedrock from the Central and Wedge Zone deposits containing <math>\geq 0.8\%</math> total sulfur if fresh and <math>\geq 0.2\%</math> sulfur if oxide or transitional; if sulfur unknown all Central and Wedge bedrock other than from Carboniferous and overturned block sediments (Cs 2 &amp; 3; Da4)</p>  | <p>PAF – Can only be placed in 1) designated waste rock dumps; and 2) TSF internal splitter dykes. Use as <b>Zone F</b> embankment fill in the TSF should be avoided if possible. Because of extremely high ARD potential should be preferentially encapsulated within general PAF in waste rock dumps within the zone of capture of the open pit. Must be capped with a NAF cover at closure.</p>   |
| Low Grade Ore | <p>Low grade ore designated by Net Smelter Return (NSR in \$/ton)</p>   | <p>PAF – Transport to the low grade ore stockpile for storage until processed through the concentrator or closed in place with a NAF cover. Central and SW LG ore must be stockpiled separately.</p>   |



| Dump and Stockpile Management Plan |   |                 |
|------------------------------------|---|-----------------|
| Effective Date:<br>2013.01.01      | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

| Material Type | Classification Criteria                | Management Requirements and Uses  |
|---------------|--|---|
| Ore           | Ore as designated by NSR in \$/ton     | PAF – Transported for immediate processing at Concentrator. ARD risk is low for short term (< 6 month) storage.   |
| Concentrate   | Copper Concentrate from Concentrator   | PAF – Strongly acid generating and extremely high metals content. Secure storage and transport required to avoid releases to the environment. Soils contaminated by releases should be reprocessed at concentrator or placed in industrial landfill.          |
| Tailings      | Ore processing waste from Concentrator | PAF with lesser NAF – Discharged into TSF interior. Should not be transported offsite. Should not be used as general onsite fill. If possible final interior surfaces should be capped with NAF tailings to reduce NAF waste rock cover thickness at closure. |

- Zone A** should be constructed with Cretaceous Clay containing >50% fines (50% passing a 200 mesh sieve). **Zone B1** should be constructed with fresh or oxide NAF waste rock containing <10% fines and with a maximum particle size of 75mm. **Zone B2** should be constructed with fresh or oxide NAF containing <5% fines and with a maximum particle size of 200 mm. **Zone C** and the **NAF Basal Layer** should be constructed with fresh or oxide NAF waste rock containing <5% fines and with a maximum particle size of less than 1 meter. **Zone D** should be constructed with Umdai Alluvium, Fresh NAF or Oxide NAF containing <5% fines and with a maximum particle size of 9.5mm.

Material should be transported and placed into appropriate waste rock dumps, stockpiles or directly at the TSF according to their geochemical and texture characteristics. All stockpiles and waste rock dumps must be constructed in lifts no greater than 30 meter in height, with the outer slopes stair-stepped so that the overall toe to crest slope does not exceed 2.5:1. Waste rock dumps and stockpiles may not exceed 90 meters in height.

All contact water from the open pit, waste rock dumps, stockpiles and TSFs must be retained on site and should ideally be discharged into the process water circuit or be put to other beneficial use. All PAF materials will need to be capped with NAF cover material when they are closed or during operations in order to protect runoff water quality, minimize infiltration, control wind erosion and allow vegetation establishment.

Placeholder cover designs are currently assumed to be at least ten meters of NAF over PAF slopes (thickness measured perpendicular to slope), 1.5 meters of NAF over flat PAF surfaces and 0.5 meters of NAF waste rock over NAF tailings. A materials segregation flow chart is presented in Appendix 1 and waste dump and stockpile design criteria are listed in Appendix 1.

**Dump and Stockpile Management Plan**Effective Date:  
2013.01.01Document Number:  
OT-10-D3-PLN-0001-EVersion:  
1.1**CONTENTS PAGE**

|  |           |
|--|-----------|
| <b>EXECUTIVE SUMMARY</b>                                     | <b>2</b>  |
| <b>LIST OF FIGURES</b>                                       | <b>6</b>  |
| <b>LIST OF TABLES</b>  | <b>7</b>  |
| 1. INTRODUCTION  | 8         |
| 1.1 General Setting  | 8         |
| 1.2 Foundation Soils and Geology                             | 9         |
| 2. GEOTECHNICAL DESIGN CRITERIA                              | 10        |
| 3. TOPSOIL AND SUBSOIL MANAGEMENT                            | 10        |
| 4. WASTE ROCK AND STOCKPILE MANAGEMENT                       | 11        |
| 4.1 Material Segregation Criteria                            | 11        |
| 4.1.1 Interim Segregation Criteria                           | 12        |
| 4.2 Field Segregation Program                                | 12        |
| 4.3 Waste Rock and Stockpile Dump Design                     | 14        |
| 4.4 Waste Rock Dump and Stockpile Water Management           | 15        |
| 4.5 Waste Rock Dump and Stockpile Closure                    | 16        |
| 5. SEGREGATED OXIDE MATERIAL MANAGEMENT                      | 17        |
| 5.1 SOM Stockpile Construction                               | 17        |
| 5.2 SOM Stockpile Closure                                    | 18        |
| 6. ONGOING MANAGEMENT AND MONITORING                         | 18        |
| 6.1 Dump Plans   | 18        |
| 6.2 Geotechnical Monitoring and Verification                 | 18        |
| 6.3 Construction Verification and Recordkeeping              | 18        |
| 6.4 Surface and Groundwater Operational Monitoring           | 19        |
| 6.5 External Reviews   | 19        |
| 6.6 Training   | 19        |
| 6.7 Targets  | 20        |
| 6.8 Responsibilities   | 20        |
| 6.9 Document Control   | 21        |
| 7. GENERAL REFERENCES  | 22        |
| <b>APPENDIX 1 – MATERIAL SEGREGATION FLOWCHART</b>           | <b>23</b> |
| <b>APPENDIX 2 – WASTE DUMP AND STOCKPILE DESIGN CRITERIA</b> | <b>24</b> |
| <b>APPENDIX 3 – FOLDER STRUCTURE FOR TECHNICAL REPORTS</b>   | <b>25</b> |



| <b>Dump and Stockpile Management Plan</b> |   |                 |
|---|---|-----------------|
| Effective Date:<br>2013.01.01             | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

**LIST OF FIGURES**

Figure 1 - Approximate Location of Dumps, Stockpiles and TSF..... 9

Figure 2 - Example of a Concave Slope Design ..... 15

Figure 3- Surface water collection system around dumps ..... 15

Figure 4 - Surface water collection system around TSF– green lines show toe collection ditch, blue lines are the diversion ditches (after KCBL, drawing D-5002) ..... 16

Figure 5 - Organization of the DMP folders and data contained under the root directory ..... 21



| <b>Dump and Stockpile Management Plan</b> |   |                 |
|---|---|-----------------|
| Effective Date:<br>2013.01.01             | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

**LIST OF TABLES**

Table 1 - Materials Overview.....2

Table 2 - Subsoil Classification Summary (original Ref IDP08) ..... 10

Table 3 – Summary of Key Geotechnical and Hydrologic Design Criteria ..... 10

Table 4 - Summary of the Environmental Geochemical Characteristics of NAF and PAF Waste Rock12

Table 5 - Dump and Stockpile Material Specifications ..... 13

Table 6 - Geotechnical Gradation Limits (Tailings Embankment) ..... 13

Table 7 – Summary of Activities and Responsibilities .....20

Table 8 – Design Support Documents..... 26

Table 9 - Implementation Documents.....27

Table 10 - Verification Documents .....27



| <b>Dump and Stockpile Management Plan</b> |   |                 |
|---|---|-----------------|
| Effective Date:<br>2013.01.01             | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

## 1. INTRODUCTION

This plan provides an overview of the strategies, procedures and design requirements for the management of all overburden and waste rock at the Oyu Tolgoi mine. Successful implementation of this plan will control and minimize the acid rock drainage, geotechnical and rehabilitation risks associated with mineral waste. This plan fulfils the requirements of Rio Tinto's:

- D3 Standard – for a Dump Management Plan.

The plan is intended to provide a broad overview of the mineral waste management requirements and is supplemented by electronic folders containing detailed reports forming the technical backup to this document.

An estimated two billion tons of waste rock and 700 million tons of tailings will be generated during the first phase of mining at Oyu Tolgoi. The waste rock will be deposited in waste rock dumps immediately surrounding the open pit and will be used to construct the embankments for the tailings storage facility (TSF). The layout of these facilities is shown on Figure 1. Current rough estimates are that almost half of the waste rock will be non-acid forming (NAF) and about half will be potentially acid forming (PAF). The low grade ore stockpile, portions of the segregated oxide material (SOM) stockpile and portions of the tailings will also be PAF. A materials segregation flow chart is presented in Appendix 1 and waste dump and stockpile design criteria are listed in Appendix 2. Appendix 3 contains the folder organization containing the technical report backup for this Management Plan. Despite the arid climate, proactive ARD management will be important at the mine. NAF and PAF waste rock will need to be segregated and managed separately to minimize long term ARD impacts and liabilities.

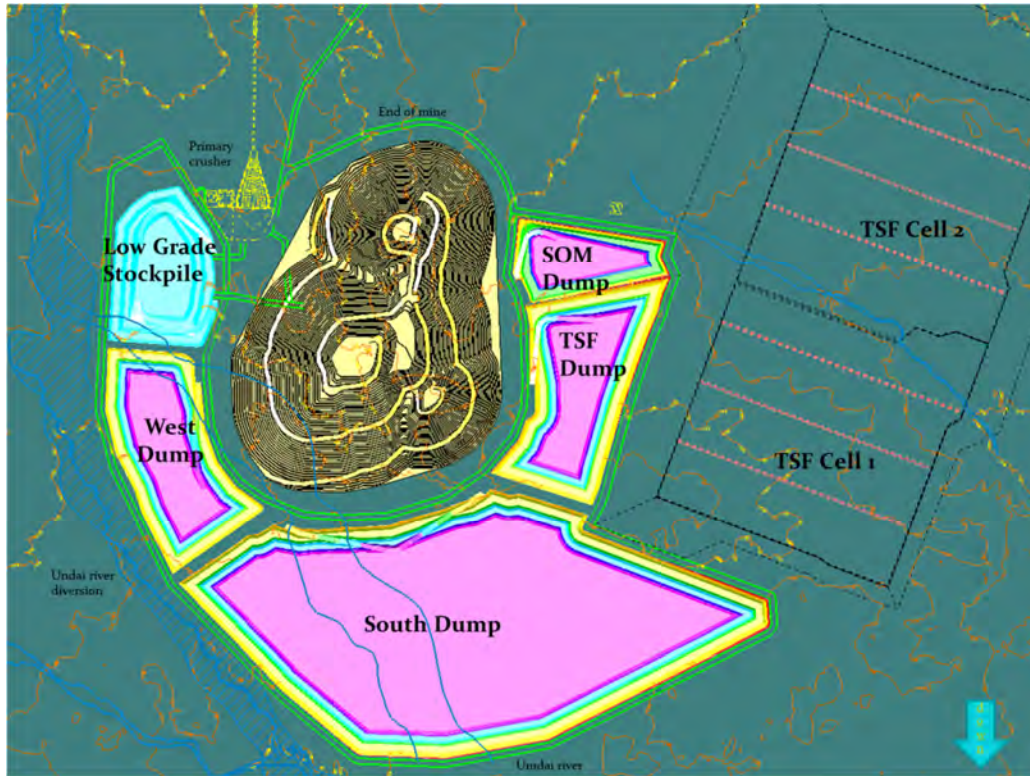
### 1.1 General Setting

The Oyu Tolgoi ore body is a high-grade, large-tonnage copper-gold porphyry deposit. The ore bodies are related to a series of late Devonian igneous rocks intruded into predominantly basaltic host rock. There are two distinct mineralized areas. The Southern Oyu deposits consisting of the Southwest, South, Central and Wedge zones will be mined by open pit methods. The North and South Hugo Dummett deposits will be mined by block cave methods.

The mineralized volcanics and intrusions typically contain one to five percent sulphide sulphur. Within the high sulphur Central zone, pyrite contents of greater than 10% are commonly observed. Much of this mineralized rock is prone to acid rock drainage (ARD) formation. There are also un-mineralized intrusive, volcanic and sedimentary rocks surrounding and overlying the porphyry copper deposits. The post-mineralization rocks (Sainshandhudag Formation), un-mineralized overturned block sequence in fault contact with the ore body (DA4) and portions of the oxidized cap typically have low sulphide sulphur contents and/or significant acid neutralization potential (ANC) and are not prone to ARD formation.



| <b>Dump and Stockpile Management Plan</b> |   |                 |
|---|---|-----------------|
| Effective Date:<br>2013.01.01             | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |



**Figure 1 - Approximate Location of Dumps, Stockpiles and TSF**

Oyu Tolgoi is located in the Gobi Desert and only receives about 65 mm of precipitation annually. Annual average evaporation rates are 36 times higher than precipitation and even during the wettest months mean evaporation is 15 times greater than precipitation. There are no perennial streams or rivers in the vicinity of Oyu Tolgoi. The most significant drainage feature is the ephemeral Umdai River which is located on the southwest margin of the proposed open pit but which will be diverted outside of the operational footprint. Although this river only flows periodically, the underlying alluvium hosts a small but locally significant aquifer. Water quality within the alluvial aquifer is good, with total dissolved solids concentrations of approximately 500 mg/L. The Umdai River channel is the most sensitive potential receiving environment near the mine and will need to be carefully protected from mineral waste and ARD impacts.

The ore bodies and mineral waste repositories are located on a flat plain with sparse desert vegetation consisting of short perennial shrubs and annual grasses and forbs. The area is underlain by weathered bedrock and portions are underlain by an unconsolidated stiff (Cretaceous) clay aquitard up to 30 meters thick (thickening to the north and east). Depth to groundwater in the area typically varies from five to 15 meters. The mine is not located near any major tectonic plate boundaries, but an active fault has been identified about 18 km from the site. The Maximum Credible Earthquake has been estimated as a magnitude 7.0 event with a return period of 2500 years.

## 1.2 Foundation Soils and Geology

Appendix 3 summarizes the information that is available regarding the soil and bedrock geologic conditions below the dumps. Since these are the “receiving” environment and can influence geotechnical stability, it is important that the substrate be properly characterized. In most cases, these investigations were completed for purposes other than assessment of dumps, such as utilization of the Umdai River gravels as borrow materials (Golder 2008), relocation of the Umdai River and previous investigations below alternative TSF footprints (KCBL 2007). The field data and investigations are however useful regarding the conditions below the footprint of the dumps. A general characterization of the subsurface conditions is presented in Table 2.

| <b>Dump and Stockpile Management Plan</b> |   |                 |
|---|---|-----------------|
| Effective Date:<br>2013.01.01             | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

**Table 2 - Subsoil Classification Summary (original Ref IDP08)**

| Origin                       | Description  | Plasticity     | Moisture                         | Consistency   |
|------------------------------|--|----------------|----------------------------------|---|
| Aeolian                      | SILT and SAND mixtures, trace clay, locally with gravel  | Non to low     | Dry                              | Stiff, medium dense, friable                            |
| Alluvium                     | SAND, gravelly, trace fines  | Non            | Slightly moist above water table | Medium dense, locally dense                             |
|                              | GRAVEL, sandy, trace fines   | Non            | Slightly moist above water table | Medium dense, locally dense                             |
| Colluvium                    | SAND, silty/clayey with gravel   | Non to low     | Slightly moist                   | Medium dense, locally dense                             |
|                              | CLAY, silty, with trace sand, typically trace or no gravel (typical stiff Cretaceous Clay)                             | Medium to HIGH | Slightly moist to wet            | Stiff to hard, Desiccated near surface, intact at depth |
| Weathered Bedrock (andesite) | Soil derived from in-situ rock weathering  | Non to low     | Slightly moist                   | Medium dense to dense, stiff to hard                    |
|                              | Rock weathered to soil properties, typically hard, low plasticity silt and clay with sand. Locally rock fabric evident | Low            | Slightly moist                   | Hard  |
| Bedrock                      | Predominantly igneous and metamorphic rocks. Strength varies from low to high. Rock often fractured                    | Non            | Dry to slightly moist            | Dense to very dense                                     |

## 2. GEOTECHNICAL DESIGN CRITERIA

Key geotechnical and hydrologic design criteria are summarized in the Table 3 and detailed in Appendix 2.

**Table 3 – Summary of Key Geotechnical and Hydrologic Design Criteria**

| Parameter                         | Value                                       | Reference  |
|-----------------------------------|---|--|
| Dump Geotechnical                 |   | As above   |
| Static Stability                  | FS > 1.3                                    | British Columbia Mine Waste Rock Research Committee, "Mined Rock and Overburden Piles," Operating and Monitoring Manual, Interim Guidelines, 1991. |
| Seismic Stability                 | FS > 1.0                                    |  |
| Dump Hydrology                    |   |  |
| Operations                        | 100 yr. 24 hr. duration precipitation event | KCB, Aug 2011, p 136.  |
| Umdai River Diversion and Closure | 1 in 1000 yr. flood event                   | SMEC 60% design drawings   |

## 3. TOPSOIL AND SUBSOIL MANAGEMENT

Before an area is disturbed by mining or construction of waste dumps, stockpiles, TSFs and other infrastructure, topsoil must be stripped and transported to a central topsoil repository. About 30 cm of topsoil should be stripped in all locations except for stony hills where very little topsoil is typically present.



| <b>Dump and Stockpile Management Plan</b> |   |                 |
|---|---|-----------------|
| Effective Date:<br>2013.01.01             | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

The maximum height / thickness of topsoil stockpiles will not exceed five meters and the preferred thickness is less than three meters. Topsoil should be placed in the stockpiles in a manner that minimizes vehicle compaction. Once long term stockpile surfaces are created they should be seeded with a native seed mix to minimize wind and water erosion. Under no circumstances will topsoil stockpiles be used for general construction fill or be covered by waste rock dumps, TSFs or other infrastructure.

At least 15 cm of topsoil or another suitable growth media will be placed on all reclaimed waste rock, TSF, stockpile and infrastructure surfaces during final rehabilitation. Topsoil balances should be periodically calculated to ensure sufficient topsoil is present to reclaim all disturbed surfaces which will be revegetated. In the event that insufficient topsoil or growth media is available, topsoil thickness may be reduced to 10 cm. Topsoil use may also be prioritized as follows in decreasing order of importance:

- Waste rock and TSF embankment slopes underlain by any PAF rock;
- Flat waste rock surfaces underlain by any PAF rock;
- Flat tailings surfaces underlain by any PAF tailings;
- Waste rock and embankment slopes only underlain by NAF rock;
- Flat waste rock and tailings surfaces only underlain by NAF material;
- Other disturbed surfaces.

Subsoil, aeolian sands and alluvial sand and gravel can be put to any use on or offsite. Fine or well graded materials can be used as general fill, but for sands and gravels the highest beneficial use is likely to be in Zone D of the TSF embankment which requires a well sorted fine gravel or well sorted sand (9.5 mm maximum with <5% passing 200 mesh) or for use in concrete. Oversize material can be crushed and used for roadway surfacing. Well sorted sands and gravels should be stockpiled for eventual beneficial use. The Umdai alluvium within the footprint of the waste rock dumps is likely to be the most significant source of clean sand and gravel on site. Subsoils, aeolian sands and alluvial material can also be managed as general NAF and as such can be considered for cover material.

**4. WASTE ROCK AND STOCKPILE MANAGEMENT**

Approximately two billion tons of waste rock may be generated during open pit mining from the Oyu ore deposits. About half of this material is predicted to be potentially acid forming (PAF) and must be carefully managed to avoid creating large environmental impacts and liabilities. Non-acid forming (NAF) waste rock and overburden is a valuable resource for the project for use in TSF embankment construction; cover layers over PAF material and as general fill. Overarching ARD control strategies for the waste rock dumps and stockpiles are: 1) segregation and separate handling of NAF and PAF material; 2) containment of any contact water within the operation footprint, and 3) construction of NAF waste rock store and release covers over final PAF waste rock surfaces. The planned locations of the waste rock dumps and stockpiles are shown on Figure 1. Sterilization drilling confirms the waste rock dump and stockpile footprints are not underlain by any mineral resources that could be developed by open pit or block cave mining methods.

**4.1 Material Segregation Criteria**

Waste rock, unconsolidated overburden and low grade ore will need to be segregated based upon copper content, total sulfur content and texture (Table 1 and Appendix 1). The segregation criteria for waste rock, overburden and stockpile materials are summarized in Table 1. The NAF/PAF cutoff criteria using total sulfur are based upon 213 drill hole samples which were analyzed by full acid/base accounting techniques (EGI, 2004), 22 leach columns, some of which have run in excess of seven years (EGI, 2011) and 24000 drill holes with total sulfur, carbon and metals data (EGI, 2008; Borden, 2011a; Borden 2011b; Jennings, 2011). The use of a 0.2% sulfur cutoff for oxide and 0.8% sulfur for fresh (un-oxidized) waste rock is a simple proxy for the ANC/MPA (acid neutralizing capacity/maximum potential acidity) cutoff ratio of 1.5 recommended by EGI (2004) and is much more accurate than the use of lithology alone to differentiate between NAF and PAF rock. The total sulfur cutoffs minimize the risk of ARD in NAF material but will also reduce potential impacts posed by sulfate-dominated salinity and contained metals such as arsenic, selenium and copper (Table 4).

| <b>Dump and Stockpile Management Plan</b> |   |                 |
|---|---|-----------------|
| Effective Date:<br>2013.01.01             | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

**Table 4 - Summary of the Environmental Geochemical Characteristics of NAF and PAF Waste Rock**

|                     | <b>NAF Oxide Waste Rock (&lt;0.2% S)(1)</b> | <b>PAF Oxide Waste Rock (≥0.2% S)</b> | <b>NAF Fresh Waste Rock (&lt;0.8% S)</b> | <b>PAF Fresh Waste Rock (≥0.8% S)</b> |
|---------------------|---|---------------------------------------|--|---------------------------------------|
| Mean S (%)          | 0.06  | 1.40                                  | 0.46                                     | 3.48                                  |
| Mean ANC/MPA        | 20 (2)                                      | 0.4                                   | 4.7 (2)                                  | 0.3                                   |
| ANC/MPA<1.5         | 27% (3)                                     | 86%                                   | 8% (3)                                   | 81%                                   |
| Mean As (mg/kg) (4) | 31  | 120                                   | 14                                       | 94                                    |
| Mean Cu (mg/kg)     | 1170  | 940                                   | 2180                                     | 2840                                  |
| Mean Se (mg/kg)     | 3.4   | 9.5                                   | 4.1                                      | 11.1                                  |

- Based on analysis of the 24000 sample database with oxide/transitional samples with less than 0.25% Cu and fresh samples with less than 0.6% Cu.
- A commonly accepted criteria is that acidification risk is minimal if there is at least twice as much ANC as MPA present in a rock mass (ANC/MPA>2) (Price, 2009).
- These samples might be prone to weak acidification
- Mean As and Se concentrations in NAF waste rock are at or below NRC guidelines for animal feed and are unlikely to pose a risk to wildlife or livestock. Copper is above guideline values but is unlikely to pose a risk because of elevated molybdenum and sulfur which can greatly ameliorate copper toxicity to mammals (NRC, 2005). No other elements are present at mean concentrations that would be expected to pose an ecological exposure risks (Borden, 2011a).

The Carboniferous Sainshandhudug Formation is a post-mineralization sedimentary and basaltic unit. A limited number of samples from units CS2 and CS3 indicate that mean sulfur concentrations are only 0.27%, mean ANC/MPA is 12 and no samples have an ANC/MPA ratio below 1.5. In the absence of sulfur data, Units CS2 and CS3 can always be assumed to be NAF. However, Unit CS1 has not been sampled sufficiently to confirm that it is always NAF. About 260 samples collected from the overturned block sequence (DA4) indicate that it is also consistently NAF with mean sulfur of 0.08%, mean ANC/MPA of 51 and only 2% of samples with an ANC/MPA ratio of below 1.5. Mean arsenic, copper and selenium concentrations are below NRC guideline values in both the Carboniferous units and in DA4.

#### 4.1.1 Interim Segregation Criteria

Until the geochemical block model is developed, or in areas where no data are available, the following segregation criteria should be used for the open pit: a) all oxide bedrock without visible sulfides is considered NAF and with any visible sulfides is considered PAF; b) any Cretaceous Clay and rock from Units CS2, CS3 and DA4 is considered NAF; c) fresh (unweathered) rock from any other geologic unit is considered PAF. All rock in the Shaft 1 development rock stockpile is considered PAF and should be processed through the concentrator during startup along with Shaft 1 development rock used as fill in the Shaft 1 laydown area. Any material from Shaft 2 mined from less than 880 meters below ground surface can be considered NAF and any material from deeper than 880 meters should be considered PAF.

NAF rock should be further subdivided between General NAF and Course NAF based on lithology and oxidation. Until additional grain size distribution data are available fresh NAF from DA1B, DA2, CS3 and any fresh NAF intrusive rock (Qmd, Ba, Rhy, BiGd, HbBiAnd, OT-Qmd) should be considered course NAF and should be transported to the TSF dump for eventual use in construction of Zones B1, B2, C and the NAF basal layer. This course NAF classification will eventually need to be refined based upon field observation and textural analysis of different NAF waste rock types after blasting, loading and transport.

#### 4.2 Field Segregation Program

Open pit materials will be identified and segregated in the field according to the following procedures:

- Once an updated geologic and total sulfur block model is available it will be used to identify blocks of General NAF, PAF, Cretaceous Clay, SOM, Ore and Low Grade Ore based on the criteria outlined in Table 1. As coarse NAF is characterized and identified it may also need to be identified



| <b>Dump and Stockpile Management Plan</b> |   |                 |
|---|---|-----------------|
| Effective Date:<br>2013.01.01             | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

in the model. The model and, if needed, the segregation criteria, will be periodically updated as new total sulfur, lithologic, textural and total carbon data become available. Material types should be entered into modular mining system so that dig blocks can be identified.

- Visual logging of blast holes to confirm model predictions and dig block designations. Sampling of waste rock blast patterns for real time sulfur and carbon analysis at an onsite lab in areas where designation is uncertain, to fill in sulfur block model data gaps and/or for model QA/QC.
- Dig blocks flagged in the field to designate material types and to identify contacts between various material types.
- Dig block designations entered into modular mining system to allow tracking of material.
- Open Pit Operations Department ensures that each material is transported and placed in the proper location (Table 5).
- Perform periodic inspections and sampling of embankment construction materials, waste rock dumps and stockpiles to ensure appropriate material is being delivered.
- Perform periodic reconciliations between geologic block models and actual field designations. Update the block models as needed.

During shaft sinking a cutoff elevation will be selected for each shaft separating NAF rock above and PAF rock below based on geology and total sulfur concentrations. All assumed NAF rock from above the cutoff elevation should be placed in a temporary stockpile near the head of the shaft; and all assumed PAF rock from below the cutoff should be placed in a separate temporary PAF stockpile. This rock will then be transported to a permanent waste rock dump, TSF location and/or stockpile to be processed through the mill.

Material should be transported and placed into appropriate waste rock dumps and stockpiles according to the following geochemical and texture characteristics:

**Table 5 - Dump and Stockpile Material Specifications**

| Location                    | Material Specifications   |
|-----------------------------|---|
| SO M Dump                   | Oxide/Transitional rock with >0.25% Copper  |
| TSF Dump – Clay(1)          | Cretaceous Clay with >50% fines (passing 200 mesh)  |
| TSF Dump – Waste Rock(1)(2) | Coarse NAF Waste Rock with <5% fines or capable of being easily processed to contain <5% fines (passing 200 mesh) |
| West Dump                   | Any NAF Waste Rock; No PAF or Cretaceous Clay   |
| South Dump – Interior       | Any PAF waste rock; Excess Cretaceous Clay; Central Oyu PAF preferred   |
| South Dump – Exterior       | Any PAF waste rock; Excess Cretaceous Clay; Avoid Central Oyu PAF if possible                                     |
| Low Grade Stockpile         | Low grade ore as identified by net smelter return.  |

- Materials used for TSF construction should be direct hauled to the embankment whenever possible.
- NAF waste rock with <5% fines should be used as the feed material for Zones B1, B2, C and the basal PAF layer. If low fines rock is not available then material will need to be processed to attain the desired texture.

**Table 6 - Geotechnical Gradation Limits (Tailings Embankment)**

| PARTICLE Size |                      | % Finer by Weight  |              |
|---------------|----------------------|--------------------|--------------|
| US Std Sieve  | Approximate Size, mm | Zone A Fill (clay) | General Fill |
| 3             | 75                   |                    | 100          |
| 0.75          | 19                   | 100                | 85-100       |
| # 4           | 4.75                 | 90-100             |              |
| #10           | 2                    | 80-100             | 50-100       |
| #40           | 0.4                  | 60-100             | 25-85        |
| #200          | 0.075                | 40-92              | 0-65         |



| <b>Dump and Stockpile Management Plan</b> |   |                 |
|---|---|-----------------|
| Effective Date:<br>2013.01.01             | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

|                          |         |     |
|--------------------------|---------|-----|
| 0.002                    | 10-60   | <35 |
| Other (atterberg limits) | PI > 20 |     |

### 4.3 Waste Rock and Stockpile Dump Design

Before any waste rock or stockpile material is placed on a new surface, the topsoil must first be stripped (Section 5.0) and any alluvial sand and gravel should be removed. Removal of the Umdai River alluvium from the inactive channel is particularly important because this material may be used for Zone D of the TSF embankment. If alluvium is removed from the Umdai channel, it must be replaced with a NAF waste rock drainage blanket to reestablish the original topography before any PAF waste rock is placed. The NAF drainage blanket must be at least three meters thick within the old Umdai channel. No waste rock may be placed in the Umdai River channel until the Umdai Diversion dam has been completed. The diversion structure will move the active Umdai channel to the west of all planned waste rock dumps and stockpiles. The diversion design is able to accommodate at least a 1 in 1000 year Umdai River flood event. A portion of the Umdai alluvial aquifer and the Bor-Ovoo Spring will be covered by the waste rock dumps. However, the diversion is designed to maintain down gradient alluvial flow and to replace the spring which is an important source of water for domestic animals and wildlife (SMEC, 2011). In order to prevent post-closure capture of the Umdai River by the open pit, the West (NAF) dump must be extended completely across the inactive channel between the diversion and the pit.

Waste rock dumps, low grade stockpiles and the SOM dump may not exceed 90 meters in height to minimize aesthetic impacts. Dump and stockpile benches must not exceed 30 meters in height. Final outer slopes of waste dumps, low grade stockpiles and the SOM dump should be stair-stepped so that the overall toe to crest slope does not exceed 22 degrees (2.5:1 H:V). If concave slopes are planned as final landforms the bench widths may be varied so that the lower slope can be recontoured to 18 degrees or lower. However, the upper slopes must not exceed 26 degrees (2:1) after recontouring and the overall slope must never exceed 2.5:1 after recontouring (Figure 2). This outer slope design will minimize the amount of material that must be moved during recontouring and also ensures geotechnical stability during operation and after closure. A three meter thick NAF basal layer must be placed below any PAF rock placed in the inactive Umdai alluvial river channel below the diversion (arrow points to NAF material on Figure 3). However, no NAF basal layer is required for PAF waste rock dumps outside of the historic Umdai Channel.

Sufficient space must be left beyond the toe of the lowest angle of repose bench so that the slope can be extended to meet the final desired slope angle without impacting other infrastructure such as roads or sensitive areas such as the Umdai River floodplain. A 30 meter high bench will generally require a minimum 32 meter toe buffer to allow recontouring to a 3:1 slope and a minimum 24 meter buffer for a 2.5:1 slope. To protect the seepage collection systems and roads around the TSF, an 80 meter buffer is required between the TSF toe and the dump toe. Berms may also need to be built between critical infrastructure and active waste rock dumps to protect against rockfall impacts during dumping.

| <b>Dump and Stockpile Management Plan</b> |   |                 |
|---|---|-----------------|
| Effective Date:<br>2013.01.01             | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

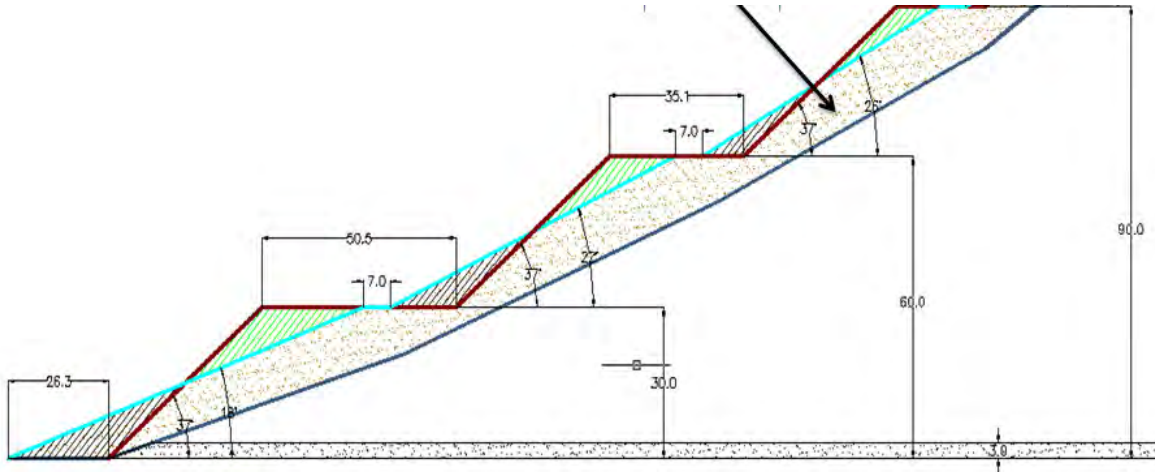


Figure 2 - Example of a Concave Slope Design

#### 4.4 Waste Rock Dump and Stockpile Water Management

No toe seepage is anticipated from the waste rock dumps because of the extremely arid climate and very low infiltration rates. However, any precipitation or runoff water which contacts the waste rock dumps or stockpiles must be retained on site. Most water will be directed to the TSF toe collection ditches and pond (Figures 3 and 4).

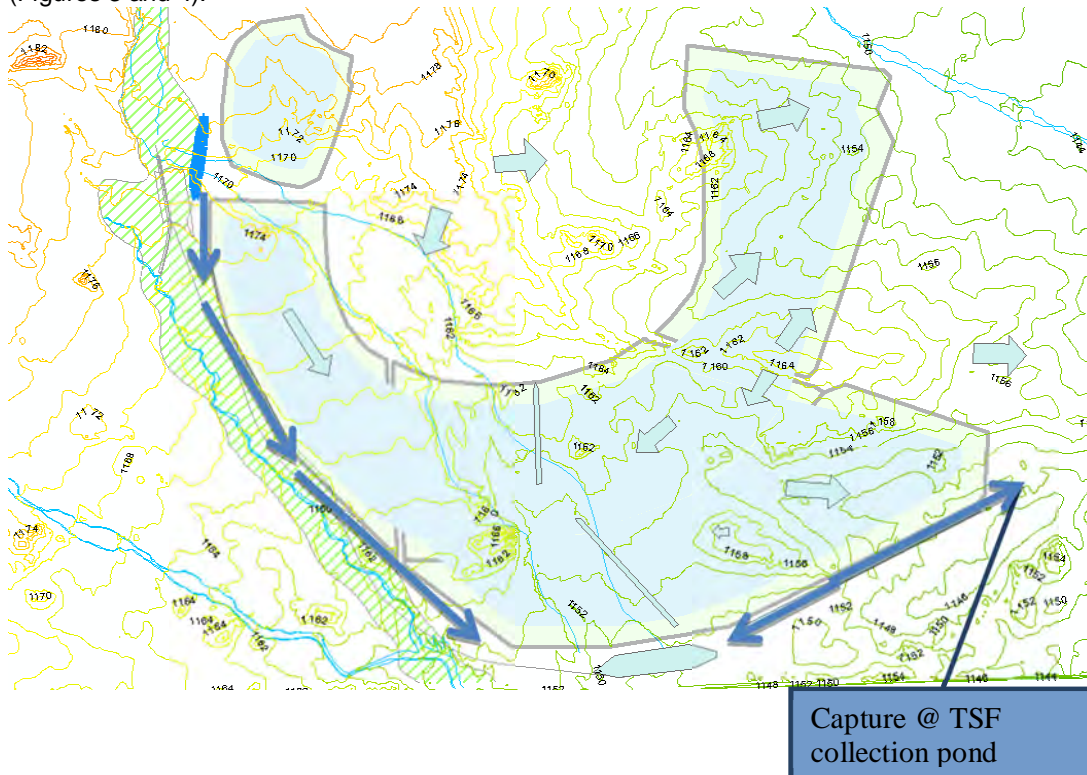


Figure 3- Surface water collection system around dumps  
Surface water management around the TSF is shown on Figure 4.

| <b>Dump and Stockpile Management Plan</b> |   |                 |
|---|---|-----------------|
| Effective Date:<br>2013.01.01             | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

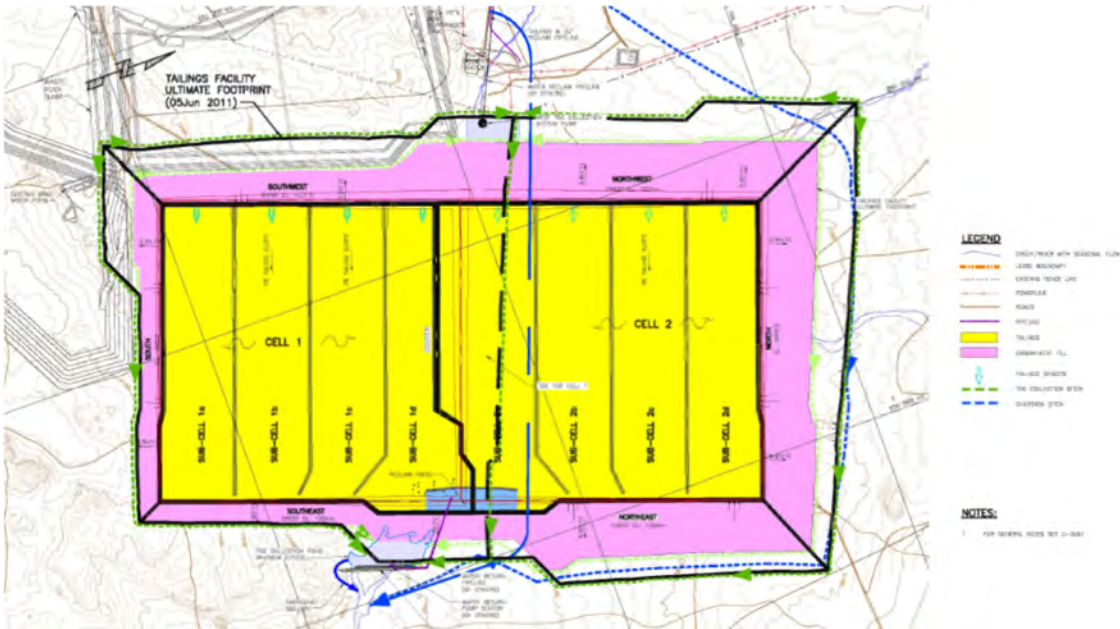


Figure 4 - Surface water collection system around TSF– green lines show toe collection ditch, blue lines are the diversion ditches (after KCBL, drawing D-5002)

The water will either be used in the process circuit, put to other beneficial uses such as road watering or will be allowed to evaporate. In many areas small perimeter berms, elevated perimeter road beds or natural topography will be sufficient to ensure that contact water will be retained within the operational footprint. However, an impermeable impoundment must be built across the inactive Umdai River channel on the southern (down gradient) side of the South Waste Rock Dump (see Figure 3). Waste rock placed in the South Dump before the diversion has been completed will not need a NAF perimeter berm as long as the dump toe does not cross the Umdai drainage divide and the existing topography thus ensures runoff containment. Where needed, toe collection ditches will be constructed around the dumps and stockpiles to direct water to either the South Dump impoundment, to the TSF seepage collection system or to another storage and/or collection point. These impoundments will be capable of holding all runoff from a one in one hundred year storm event. If any surface water must be discharged, it must first be tested to ensure that it meets the more stringent values for either the Mongolian General Standard for “Treated Waste Water to be discharged to the Environment” (MNS 4943:2011) or World Health Organization Drinking Water Guidelines.

Waste rock dumps and stockpiles will be protected from contact with one in 1000 year Umdai River flood events by appropriately engineered structures such as the Umdai River Diversion Dam, the elevated Concentrator road grade and additional NAF berms if needed.

#### 4.5 Waste Rock Dump and Stockpile Closure

All waste rock dumps and stockpiles left in place at closure must be recontoured into safe and stable landforms which tie into the surrounding topography. Final recontoured dump and stockpile slopes will not exceed 22 degrees (2.5:1 H:V) overall and no slope segments will ever exceed 26 degrees (2:1). If concave slopes are constructed they may vary from 18 degrees (3:1) or less at the base, through a maximum of 2:1 near the top and with an overall slope of 2.5:1 or less (Figure 2).

Any waste rock dump or stockpile containing PAF rock, or mixed PAF and NAF rock, will need to be capped with a NAF waste rock cover. Plans should be implemented to test conceptual cover designs during operations. The cover can be constructed of General NAF waste rock or other NAF geologic materials excavated for the purpose. However to support plant growth, to act as an efficient store and release cover and to be resistant to erosion, the cover material should ideally be a well graded silty sandy gravel or similar. The texture of the cover materials used can be variable but it should ideally contain at least 30% gravel and cobbles, and at least 30% sand, silt and clay (<2 mm). Flat PAF surfaces should have a cover



**Dump and Stockpile Management Plan**Effective Date:  
2013.01.01Document Number:  
OT-10-D3-PLN-0001-EVersion:  
1.1

composed of at least 1.5 meters of NAF material and 15 cm of topsoil/growth media. PAF slopes should have a NAF cover that is at least 10 meters thick (measured perpendicular to slope) and 15 cm of topsoil/growth media. All surfaces will be seeded and/or planted with native plants after topsoil placement. Note that these requirements should be considered preliminary placeholder cover designs. They may be modified based upon the results of field trials or if required because of materials balances. For example, if it is determined that there is a deficiency of appropriate NAF material, the NAF covers for outer slopes could locally be reduced to 5 meters thickness. Conversely if field trials indicate a thicker cover is needed to support the desired climax native vegetation then thicker covers may be required.

Waste rock dumps which only contain NAF material, or which are already overlain by a sufficient thickness of NAF will only need an additional 15 cm of topsoil/growth media before being seeded and/or planted with native plants.

The toe of final, recontoured dump slopes must be armored with NAF riprap of greater than 0.5 meters diameter if the slope extends into the one in 1000 year Umdai River flood plain.

Once the NAF covers are installed and revegetated, it is anticipated that runoff water quality will be good enough to allow it to discharge to the environment without additional management. After consistently good runoff water quality is confirmed for a rehabilitated waste rock dump, water collection systems in that area may be removed so clean runoff is directed offsite. No post-closure toe seepage is anticipated from the waste rock dumps because of the extremely arid climate.

## 5. SEGREGATED OXIDE MATERIAL MANAGEMENT

Segregated oxide material (SOM) is currently defined as oxide rock containing more than 0.25% total copper. This classification may be adjusted in the future as SOM volumes, copper distribution and leachability are better defined. This material cannot be economically processed through the concentrator to recover the copper, but may be amenable to copper leaching sometime in the future (Oyu Tolgoi, 2011). The material should be segregated and stockpiled separately. If for some reason it cannot be placed in the SOM stockpile, it may be co-disposed with PAF waste rock. SOM contains much higher copper, arsenic and selenium concentrations than NAF waste rock, has abundant sulfides and may be prone to ARD formation. As such all SOM material should be considered PAF.

### 5.1 SOM Stockpile Construction

The SOM stockpile is located on the northeast side of the open pit. At a minimum the foundation of the stockpile area must be prepared in the following manner:

- Removal of all soils, alluvial sand lenses and aeolian sands so that only Cretaceous Clay with >50% fines (passing 200 mesh) is exposed at the surface.
- Surveying of the exposed Cretaceous Clay surface to ensure that it slopes 0.5 to 2 degrees away from the open pit and towards a potential central collection point in the northeast corner of the SOM footprint.
- Capping of the Industrial waste storage pit (within the planned SOM footprint) with at least 1.5 meters of compacted Cretaceous Clay. The storage pit only contains benign waste which is predominantly composed of concrete and fly ash.
- Incidental haul truck compaction of the clay surface.

This minimum foundation preparation is not sufficient to allow future in-place dump leaching of the SOM stockpile. SOM would need to be picked up and moved to an engineered heap leach pad if it were to be leached in the future. If in-place dump leaching of the SOM stockpile is planned the following additional surface preparation requirements would need to be completed:

- Engineered regrading of the Cretaceous Clay surface so that the entire stockpile footprint slopes downward to a collection point on the northeast corner of the stockpile area. The collection point must be located so that it does not interfere with construction or operation of the tailing storage facilities, open pit or the TSF dump. All regraded surfaces must have slopes between 0.5% and 2%.
- The regraded Cretaceous Clay surface must be compacted so that a maximum saturated hydraulic conductivity of  $10^{-6}$  cm/second is attained. Full quality assurance/quality control will need to be implemented and documented during compaction to demonstrate that the target hydraulic



| <b>Dump and Stockpile Management Plan</b> |   |                 |
|---|---|-----------------|
| Effective Date:<br>2013.01.01             | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

conductivity has been met across the footprint. This information will be needed if an in-place leach circuit ever needs to be permitted.

Composite liners<sup>1</sup> are generally required for heap leach operations but the proposed additional foundation preparation is protective of groundwater quality because 1) the entire footprint area is underlain by a thick, low permeability Cretaceous Clay aquitard; 2) the SOM stockpile is clearly within the perpetual zone of capture of the fully excavated open pit; and 3) drain down will be rapid once active leaching is stopped because of the extremely arid climate. There are no known heap leach liner requirements mandated by Mongolian law or regulation. However, if heap leaching is ever planned, it will first need to be permitted with the Mongolian government. If a more robust liner system is required in the future, the SOM material would need to be transported to a new leach pad.

**5.2 SOM Stockpile Closure**

There are four possible management scenarios for the SOM material: 1) the material is never leached, 2) the material is leached in place, 3) the material is moved to a new leach pad and leached or 4) the material is processed through the concentrator. In all cases other than processing, the SOM material should be treated as PAF waste rock and should be closed in the same manner as a PAF waste rock dump (Section 6.5). Closure would need to include recontouring to maximum slope angles of 2:1, overall slope angles of 2.5:1 and capping with NAF waste rock and topsoil.

**6. ONGOING MANAGEMENT AND MONITORING**

The geotechnical and geochemical behavior of the waste rock dumps, stockpiles and TSFs will be managed and monitored throughout operation and into closure. The technical basis for the dump management is contained in Appendix 3. Conditions that are not anticipated under the design assumptions, unexpected or out of compliance conditions will be investigated and response plans developed as needed.

**6.1 Dump Plans**

The mine planning department will develop short and long range dump management plans. Plans will be checked by geotechnical and environmental personnel for compliance with the management plans. Designs will be modified as needed to meet the design criteria provided in Appendices 1 and 2.

**6.2 Geotechnical Monitoring and Verification**

TSF embankments, waste rock dumps and stockpiles will be visually inspected on a regular basis to identify unacceptable lateral displacement, settlement or erosion during construction and operation. Significant process water management infrastructure will be inspected at least daily. Instrumentation will also be installed and maintained in the TSF embankment to monitor pore water pressure and displacement including vibrating wire piezometers, inclinometers, survey monuments and settlement plates.

**6.3 Construction Verification and Recordkeeping**

Quality assurance and quality control inspections and sampling will be periodically performed to ensure that the TSF embankment and waste rock dumps are being constructed in accordance with all design specifications. Verification may include QA/QC on materials placement, compaction, grain size distribution and geochemistry.

In order to comply with the E8 standard and annual Rio Tinto reporting requirements, an inventory must be maintained which details 1) the annual and cumulative tonnage of NAF and PAF waste generated; 2) the location and tonnage held in NAF and PAF repositories and 3) as built descriptions of the waste disposal facilities.

<sup>1</sup> A composite liner generally consists of a synthetic liner (such as HDPE) overlying a natural liner, such as compacted Cretaceous clay.

| <b>Dump and Stockpile Management Plan</b> |   |                 |
|---|---|-----------------|
| Effective Date:<br>2013.01.01             | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

#### **6.4 Surface and Groundwater Operational Monitoring**

Operational surface and groundwater monitoring for potential mineral waste and ARD impacts will be focused on the process circuit, storm water catchment ponds and groundwater surrounding the TSFs and waste rock dumps. In addition to this sampling within the operational footprint, numerous surface and groundwater monitoring points will continue to be sampled outside the operational footprint.

Regular operational surface water sampling will occur at the following locations and frequencies:

- TSF Toe Ditch Seepage (Quarterly)
- TSF Decant Pond (Quarterly)
- Block Cave dewatering (Semi-annually)
- Open Pit Collection Sump (Semi-annually or when water present if less frequent)
- Impoundment below South PAF waste rock dump (Semi-annually or when water present if less frequent)
- Runoff from NAF, low grade ore and SOM stockpiles and dumps (Annually or when water present if less frequent).

Operational groundwater monitoring bores will be located immediately down gradient of potential sources of contamination such as the TSF, waste rock dumps and long term stockpiles. Particular attention will be given to the monitoring of possible groundwater flow paths connecting the mineral waste storage facilities with the Umdai River alluvial aquifer. Action levels for these wells should be set at the mean plus two standard deviations from background conditions. For existing monitoring bores which have sufficient data, the mean and standard deviation should be calculated based on the existing data set. New monitoring bores should be sampled on a quarterly basis for three years after installation, after which a mean plus two standard deviations should be calculated. If an established action level for any parameter is exceeded this will trigger an investigation into the probable cause of the exceedence. If needed a source control and/or remediation plan may also need to be developed to prevent further degradation of groundwater quality. For example, if monitoring wells indicate significant saline seepage from the TSF migrating towards the Umdai River, then extraction wells may need to be installed to contain the plume and return the water to the process circuit.

All operational surface and groundwater samples should be analyzed for the following parameters initially:

- pH and Conductivity
- Total Dissolved Solids
- Alkalinity or Acidity
- Major ions (sulfate, chloride, calcium, magnesium, sodium, potassium)
- Dissolved Metals (Ag, Al, As, Cd, Cr, Cu, Fe, Hg, Mo, Mn, Ni, Pb, Se, Ti, V, Zn).

Specific dissolved metals may eventually be dropped from the analyte list if they are not elevated in the operational surface water sampling sites above the Mongolian General Standard for "Treated Waste Water to be Discharged to the Environment" (MNS 4943:2011) or World Health Organization Drinking Water Guidelines.

#### **6.5 External Reviews**

Independent, external expert geotechnical reviews of the tailings impoundment, waste rock dumps and stockpiles must be conducted every two years. Independent, external expert geochemical reviews of the mineral waste storage facilities, open pit, block caves and contact water management systems should occur every four years. This integrated Mineral Waste, ARD and Dump Management Plan should be updated at least once every four years in response to review findings, and more frequently if justified by significant changes in operating conditions and field procedures.

#### **6.6 Training**

New employee training must provide a broad overview of the ARD and mineral waste issues and management strategies being employed by the operation. Personnel responsible for implementation of this

| <b>Dump and Stockpile Management Plan</b> |   |                 |
|---|---|-----------------|
| Effective Date:<br>2013.01.01             | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

plan must also receive training to ensure they are aware of all pertinent responsibilities, and design and management requirements.

### 6.7 Targets

The target for the remainder of the construction phase and the first three years of operation will be the successful implementation of this mineral waste and ARD management plan. Success in fulfilling this goal will be measured by the findings of the independent, external geotechnical and geochemical reviews which will be scheduled in approximately 2015 (Section 10.5).

### 6.8 Responsibilities

Responsibilities for implementing the different components of this plan are listed in Table 7. Implementation of the plan will require coordination between the geology, surface mining, earthmoving, tailings operations, and geotechnical and environment departments. Ideally these complex interactions should be coordinated via a mineral waste management committee which meets on a quarterly basis. Each responsible department should nominate one representative to attend committee meetings and ensure recommended actions are carried out.

**Table 7 – Summary of Activities and Responsibilities**

| <b>Activity (2012)</b>   | <b>Primary Responsibility</b>                   |
|--|---|
| Identify coarse NAF rock types which can be used in embankment construction for Zones B1, B2, C, D and NAF basal layer with minimal processing. If consistently coarse rock is not available, then design a processing plant to create material with the required texture characteristics. | Geology/Tailings Operation                      |
| Refinement of mine plans and predictions of NAF/PAF etc. materials balances based on geologic and sulfur block models  | Surface Mining                                  |
| Develop and maintain a mineral waste/ARD training package on relevant aspects of this plan for all groups involved in mineral waste management   | Environment                                     |
| Coordinate the formation and operation of the site based mineral waste management committee  | Environment                                     |
| <b>Ongoing Activities</b>  |   |
| Collection of carbon and sulfur data from pilot and drill holes  | Geology   |
| Development and periodic updating of the geologic and sulfur block model   | Geology   |
| Visual logging and sampling of blast holes   | Geology   |
| Designation of dig blocks as NAF, PAF, SOM etc.  | Geology   |
| Annual reconciliation between block models and dig block designations  | Geology   |
| Selection of NAF/PAF cutoff elevations during shaft development  | Geology   |
| Final waste rock dump locations and designs  | Surface Mining                                  |
| Dig blocks entered into modular mining system and tracked  | Surface Mining                                  |
| Waste rock dump closure plan designs   | Surface Mining                                  |
| Strip topsoil and transport to the Central topsoil repository  | Earthmoving                                     |
| Ensure designated dig blocks are transported to their appropriate location   | Earthmoving                                     |
| Ensure tailings embankment constructed according to design   | Earthmoving transitioning to Tailings Operation |
| Final waste rock recontouring and capping  | Earthmoving                                     |
| Final embankment and TSF interior capping  | Tailings Operation                              |
| Tailings-specific water management   | Tailings Operation                              |
| Tailings dust management   | Tailings Operation                              |

| Dump and Stockpile Management Plan |   |                 |
|------------------------------------|---|-----------------|
| Effective Date:<br>2013.01.01      | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

|  |                         |
|--|-------------------------|
| Geotechnical Monitoring and Verification   | Geotechnical Department |
| Arrange two-yearly external geotechnical review  | Geotechnical Department |
| Surface and groundwater monitoring and data interpretation   | Environment             |
| Site wide water management and coordination  | Environment             |
| Periodic inspection and oversight of the mineral waste/ARD program and updating of the management plan | Environment             |
| Monitor topsoil stockpiles to ensure they are constructed and maintained according to plan             | Environment             |

### 6.9 Document Control

This management plan is intended to be a summary document. Detailed documents supporting this Management Plan are summarized in Appendix 3 and found in the following folder structure. The organization of the documents into appendices will permit additional information to be incorporated into this management plan without major re-write of the document.

The D3 standard requires that each business unit maintain an “organized set of documents” as part of the dump management plan. Appendix 3 contains the locations where relevant information regarding a given design element or operational aspect is contained.

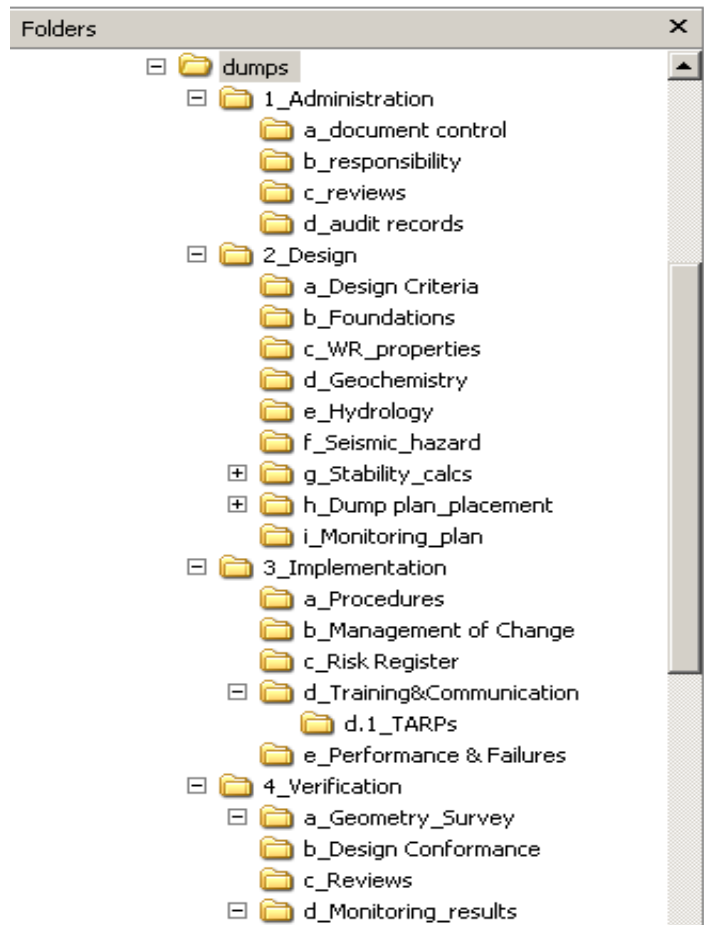


Figure 5 - Organization of the DMP folders and data contained under the root directory



| <b>Dump and Stockpile Management Plan</b> |   |                 |
|---|---|-----------------|
| Effective Date:<br>2013.01.01             | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

**7. GENERAL REFERNCE**

Following are general references. Specific project related references are provided in Appendix 3.  
 Krauskopf, K.B. and Bird, D.K., 1995, Introduction to Geochemistry, McGraw-Hill, Inc.  
 National Resource Council (USA), 2005, Mineral Tolerance of Animals, Second Revised Edition, The National Academies Press, Washington, D.C.  
 Oyu Tolgoi LLC, 2011, Technical Committee Position Paper – The Potential for Copper Heap Leaching at Oyu Tolgoi, 22 February, 2011.  
 Price, W. A., 2009, Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials, Mine Environment Neutral Drainage Report 1.20.1.  
 TSF Design  
 Klohn Crippen Berger, 2011, Oyu Tolgoi Project Tailings Storage Facility 2010 Feasibility Study Update, August 2011.

**8 DOCUMENT CONTROL**

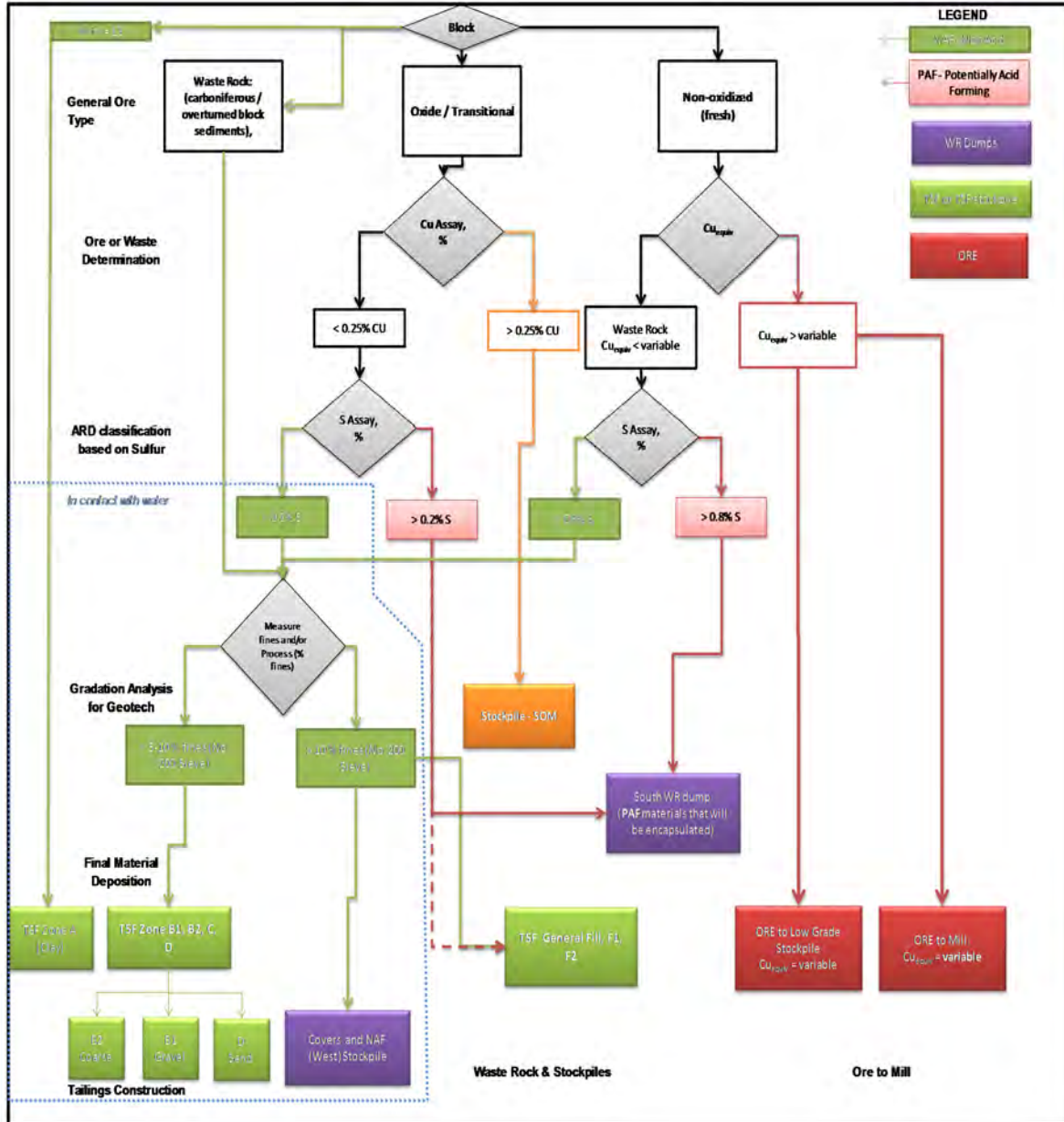
|                    |  |    |  |
|--------------------|--|----|--|
| File Name          | OT-10-D3-PLN-0001-E-Dump and Stockpile Management Plan |    |  |
| Description        | Dump and Stockpile Management Plan                     |    |  |
| Original Author(s) | Raimundo Almenara                                      |    |  |
| Creation Date      | 2013.02.20   |    |  |
| Approved By        | Andrew Miller  |    |  |
| Approval Date      | 2013.02.20   |    |  |
| Change Number      | Record   | ## |  |

| Risk Ranking | Assessment Date | Risk Assessor | Review Schedule | Next Review Date |
|--------------|-----------------|---------------|-----------------|------------------|
| Medium       | 2013.02.20      | Andrew Miller | 2 yearly        | 2015.02.20       |

| Version | Revision Date | Author(s)         | Approved By       | Revision Notes  |
|---------|---------------|-------------------|-------------------|---|
| 1.0     | 2013.02.20    | Trijanto Poespito | Andrew Miller     | First release   |
| 1.1     | 2013.03.28    | Togtuur N         | D'Alterio Mahoney | Reviewed format per Control Document Guideline. No changes to content |

| Dump and Stockpile Management Plan |   |                 |
|------------------------------------|---|-----------------|
| Effective Date:<br>2013.01.01      | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

Appendix 1 – Material Segregation Flowchart





| <b>Dump and Stockpile Management Plan</b> |   |                 |
|---|---|-----------------|
| Effective Date:<br>2013.01.01             | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

**Appendix 2 – Waste Dump Stability Analysis**





| <b>Dump and Stockpile Management Plan</b> |   |                 |
|---|---|-----------------|
| Effective Date:<br>2013.01.01             | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

**Appendix 3 – Technical Reports**

| <b>Dump and Stockpile Management Plan</b> |   |                 |
|---|---|-----------------|
| Effective Date:<br>2013.01.01             | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

**Table 8 – Design Support Documents**

| Appendix              | Capsule Summary / Document List   |
|-----------------------|---|
| A                     | Geotech Stability Report  |
| Design Criteria       | Link to folder  |
| B                     | Folder contains reports and data regarding the foundation soil and geologic conditions underlying the dumps. Much information was obtained during site investigations for the TSF impoundment by Knight Piesold (KP) and subsequently by Klohn Crippen Berger (KCB). Investigations regarding the Umdai Gravel as a borrow source were completed by Golder Associates (Golder) and OT geology completed test pit investigations where data was lacking. The available data were compiled into an ArcGIS (MapInfo) database containing the maps from original investigations which were superimposed on published surface and subsurface geology maps.   |
| Foundation Conditions | <p>The foundation area below the proposed WR dumps has been investigated by a number of investigators. In chronological order, these include:</p> <ul style="list-style-type: none"> <li>• Knight Piesold (2004) who completed a large number of shallow investigations across the site to define the basic surface soil conditions. This resulted in a surficial soils map that reflects the shallow soil. The map provides a high level overview of soils covering the site and has the broadest coverage, but has been updated by others where more specific investigations were performed.</li> <li>• KCBL (2007) who completed a number of test pits, geophysical investigations and borings for a TSF facility to the east of the planned pit. Following final location of the TSF, some of these 2007 investigations now overlap with the eastern dumps where the TSF materials may be temporarily stored if not hauled directly to the TSF.</li> <li>• Golder (2008) who completed investigations for both the Umdai River diversion and along the present Umdai River alluvium, which will underlie a large portion of the WR dumps to the south and southwest of the pit. This study focused on identifying potential borrow materials for infrastructure construction, however, the majority of the test pits encountered plastic Quaternary clay and/or Andesite bedrock (some test pits terminated in alluvial deposits). Golder also completed observations regarding the box cut, which has exposed sedimentary deposits.</li> </ul> |
| C                     | Summarizes the available investigations, logs, test work and data regarding the waste rock dump materials. This appendix also contains the waste rock material delivery schedules generated by the mine plan and separates NAF (Non Acid Forming) from PAF (Potentially Acid Forming) materials by material type and geochemistry characteristic.   |
| D                     | Summarizes geochemical conditions in reports by EGI and others and addresses the acid rock drainage (ARD) issues that may arise with dump development.  |
| Geochemistry          | <ul style="list-style-type: none"> <li>• Borden, R., 2011a, Environmental Geochemistry of the Ten Meter Composite Database, Internal Memo dated 16 March, 2011.</li> <li>• Borden, R., 2011b, Environmental Geochemistry of the 24,000 Sample Geochemical Database – Supplemental Assessment, Internal Memo dated 27 March, 2011.</li> <li>• Borden, R. 2011c, Environmental Geochemistry of the 24,000 Sample Geochemical Database – Tailings Assessment, Internal Memo dated 29 April, 2011.</li> <li>• Environmental Geochemistry International, 2004, Assessment of Geochemical Data for the Turquoise Hill Project, Document Number 8550/641.</li> <li>• Environmental Geochemistry International, 2008, Oyu Tolgoi Project Acid Rock Drainage Review and Recommended Investigation Programme, Document Number 8550/808.</li> <li>• Environmental Geochemistry International, 2011, Update of Leach Column Test Results for Waste Rock from the Oyu Tolgoi Project, Document Number 8550/976.</li> <li>• Jennings, K., 2011, Lithological Considerations for NAF/PAF Classification, Internal Memo dated 17 March, 2011.</li> </ul>  |
| E                     | Contains studies relating to the relocation of the Umdai River and general hydrology and climate studies of the mine as they may apply to the dumps.  |



| <b>Dump and Stockpile Management Plan</b> |   |                 |
|---|---|-----------------|
| Effective Date:<br>2013.01.01             | Document Number:<br>OT-10-D3-PLN-0001-E | Version:<br>1.1 |

|                                      |  |
|--------------------------------------|--|
| Hydrology                            | <ul style="list-style-type: none"> <li>SMEC, 2011, Oyu Tolgoi Project: River Diversion Detailed Engineering; 60% Design Report.</li> </ul>   |
| F<br>Seismic<br>Hazard               | <p>Contains a report prepared by Klohn Crippen Berger Ltd, summarizing the seismic hazard for the tailings storage facility (TSF), reports by RCAG concerning overall seismic hazard and contains seismic hazard information applicable to the dump closure condition.</p> <ul style="list-style-type: none"> <li>KCB, Appendix XII, Updated 2011 Seismic Hazard Assessment, Oct 26, 2010.</li> <li>RCAG, Seismic Hazard Assessment Oyu Tolgoi Site, March 2005.</li> <li>[Note: Knight Piesold report should not be used.]</li> </ul> |
| G<br>Stability                       | <p>Contains feasibility level static and pseudo static stability analysis of critical sections developed along the dumps. The analyses are based on generalized conditions developed along the dumps and are intended to identify areas where further investigations are warranted.</p>  |
| H<br>Dump<br>Progression &<br>Design | STP Monthly Pick-up  |
|                                      | Link to folder   |
| I<br>Monitoring<br>Program           | The dumps will require a geotechnical inspection.  |
|                                      | Link to the document   |

**Table 9 - Implementation Documents**

|   |  |
|---|--|
| A<br>Procedures                         | Inspection Form                                      |
|   | Link to the document                                 |
| B<br>Management<br>of Change<br>Records | Link to the document                                 |
|   |  |
| C<br>Risk Register                      | See SMP Risk Register 2012.                          |
|   | Link to the document                                 |
| D<br>Training &<br>Compliance           | See SMP Geotechnical Slope and Dump Hazard Awareness |
|   | Link to the document                                 |
| E<br>Performance<br>&/or<br>Failures    | Failure Report WD and Quarry                         |
|   | Link to the document                                 |

**Table 10 - Verification Documents**

|                            |                      |
|----------------------------|----------------------|
| A<br>Geometry<br>Surveys   | STP Monthly Pick-up  |
|                            | Link to folder       |
| B<br>Design<br>Conformance | STP Monthly Pick-up  |
|                            | Link to folder       |
| C<br>Reviews               | External Audit       |
|                            | Link to the document |
| D<br>Monitoring<br>Results | Geotech Inspection   |
|                            | Link to the document |