Site Characterization throughout the Tailings Facility Life Cycle

2018 TAILINGS AND MINE WASTE CONFERENCE

M. Malgesini, L. Aubone – Golder
R. Hunsaker, W. Boyd – Goldcorp / Minera Peñasquito

October 1, 2018
Introduction 01
Minera Peñasquito Overview 02
Tailings Facility Life Cycle 03
Site Characterization by Phase 04
Minera Peñasquito Tailings Facility Overview

CASE STUDY – SITE CHARACTERIZATION FOR TSF LIFE CYCLE

- Zacatecas State, Mexico
- Open pit mine producing gold, silver, lead, and zinc since 2010
- Mill Capacity 130,000 tpd
Minera Peñasquito Tailings Facility Overview

CASE STUDY – SITE CHARACTERIZATION FOR TSF LIFE CYCLE

Tailings Facility
- 80 m high
- 11 km long
- Centerline raise, cyclone sand/rockfill dam

LOM
- 150 m high
- 807 Mt
Tailings Facility Life Cycle Site Characterization

CASE STUDY – SITE CHARACTERIZATION FOR TSF LIFE CYCLE

1. Planning
2. Design
3. Construction
4. Operations
5. Closure

CHANGE

Plan
Operate
Design
Construct
Initial Planning and Concept Phase

CASE STUDY – SITE CHARACTERIZATION FOR TSF LIFE CYCLE

Initial geologic reconnaissance and field investigation program:

- Geologic features
- Bedrock type and depth
- Soil profiles
- Material Properties
- Groundwater levels
- Borrow Materials

2004
Preliminary Design Phase

CASE STUDY – SITE CHARACTERIZATION FOR TSF LIFE CYCLE
Preliminary Design Phase

CASE STUDY – SITE CHARACTERIZATION FOR TSF LIFE CYCLE
Detailed Design Phase

CASE STUDY – SITE CHARACTERIZATION FOR TSF LIFE CYCLE

- Earth Fill Starter Dam
- Composite lined impoundment
- Cyclone sand dam centerline raise with east expansion
Design and Construction Phase – Adapting to Change

CASE STUDY – SITE CHARACTERIZATION FOR TSF LIFE CYCLE

Original Design Basis:
• Mill throughput = 50,000 tpd
• TSF Capacity = 200-300 Mt
• 2 Year Starter Facility
• 3H: 1V Cyclone Sand Dam
• HDPE lined starter facility

Adapting to Change:
• Mill throughput = 130,000 tpd
• TSF Capacity = 807 Mt
• 1 Year Starter Facility
• 3H: 1V Cyclone Sand Dam
• Property Boundary Constraints on Expansion
• 95% Recovery of Cyclone Sand Required for Construction
Design/Construct/Operations Phase – Adapting to Change

CASE STUDY – SITE CHARACTERIZATION FOR TSF LIFE CYCLE

- Starter Dam
- Initial Operations
- Temporary Buttress
- Continue Rockfill Decision
- Buttress Requirements
- Centerline Raise Plan
Operations Phase – Instrumentation and Monitoring

CASE STUDY – SITE CHARACTERIZATION FOR TSF LIFE CYCLE

<table>
<thead>
<tr>
<th>Formation</th>
<th>Instrumentation</th>
<th>Instrumentation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Piezometer</td>
<td>Inclinometer</td>
</tr>
<tr>
<td>Foundation</td>
<td>66</td>
<td>4</td>
</tr>
<tr>
<td>Rock Fill</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>Cycloned Sand</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Beach</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Tailings</td>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>

- 2018-GBH-01
- 2018-GBH-02
- 2018-GBH-03
- 2018-GBH-04
- 2018-GBH-05
- 2018-GBH-06
- 2018-GBH-07
- 2018-GBH-08
- 2018-GBH-09
- 2018-GBH-10
- 2018-GBH-11
- 7+200 Beach Piezometers
- 4+200 Beach Piezometers
- 3+200 Beach Piezometers
- 5+450 Beach Piezometers
- 6+050 Beach Piezometers
- 6+095 Test Fill Location

- 4+915 Test Fill Location
- 6+095 Test Fill Location
Operations Phase – Instrumentation and Monitoring

CASE STUDY – SITE CHARACTERIZATION FOR TSF LIFE CYCLE

Telemetry Device

Instrumentation
- Piezometers
- Inclinometers

Cloud Data System

Real-time Monitoring Dashboard

Internet Connected Device
Future Phases and Closure

CASE STUDY – SITE CHARACTERIZATION FOR TSF LIFE CYCLE

• Assessments expansion and alternative tailings management technologies

• Ongoing site characterization work to assess Landform Closure Design Concepts
Thank you.