TAILING BEACH IN EASTERN DESERT; EGYPT

AMD & Cyanide Contaminated Water Pit

Hassan Z. Harraz

hharraz2006@yahoo.com

Spring 2020

Overview of the Sukari Gold Project

- Located in Eastern Desert of Egypt
- Mined by the Pharaohs, the Romans and the British – exploration license granted to Centamin in 1995 and converted to mining license in 2005
- Sukari today is 100% owned by Pharaoh Gold Mines, a wholly owned subsidiary of Centamin Egypt
- Resource + 14Moz Au
- Open pit reserve 9Moz Au
- Resource and reserve growth open
- Initial open pit mine with underground development ongoing
- First quarter of production Q1 2010

Sukari Gold Mine; Eastern Desert-Egypt

Mineral extraction: from mining to metal

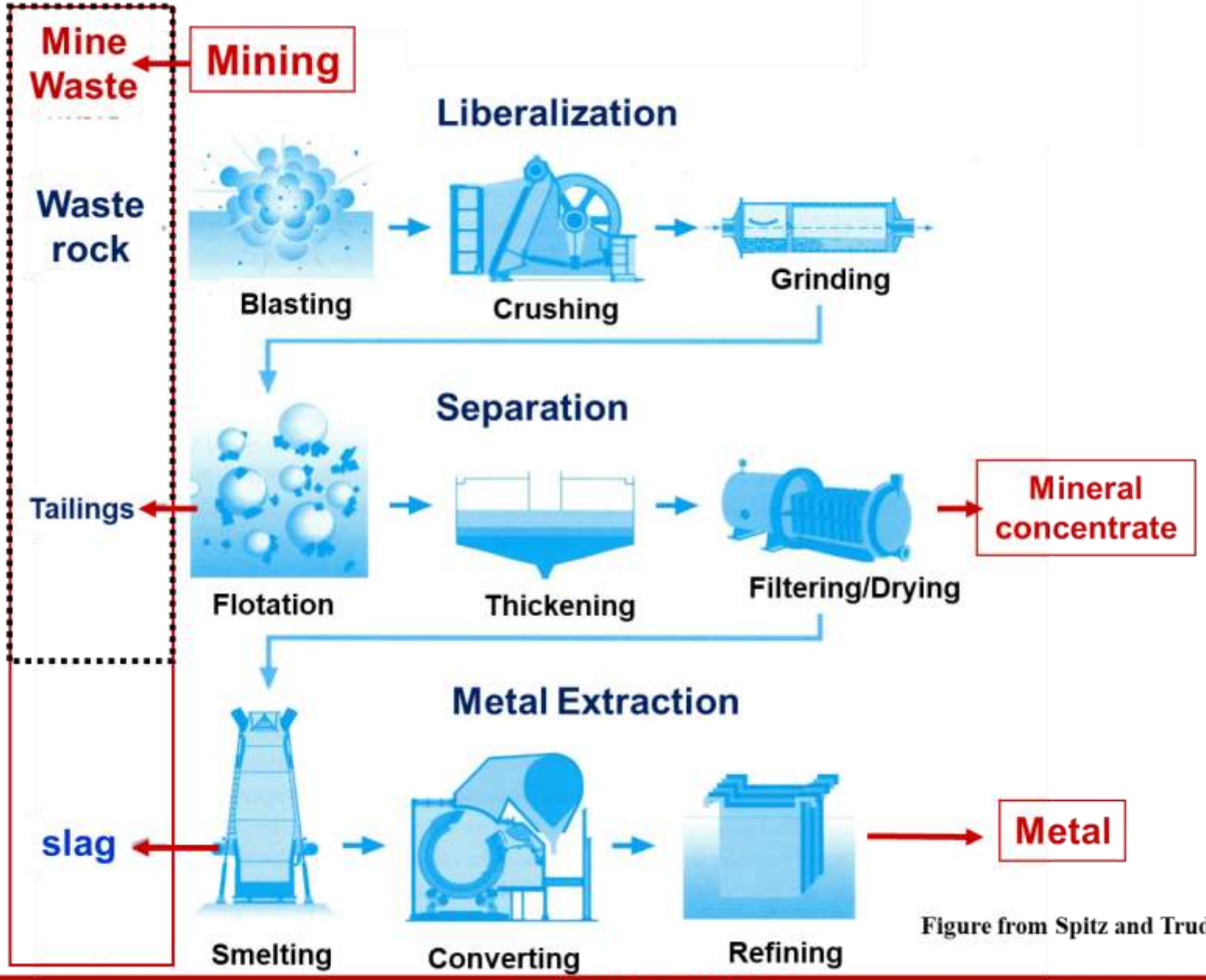


Figure from Spitz and Trudinger, 2009.

Dust

Commissioning of Mining Fleet / Plant Site Civils

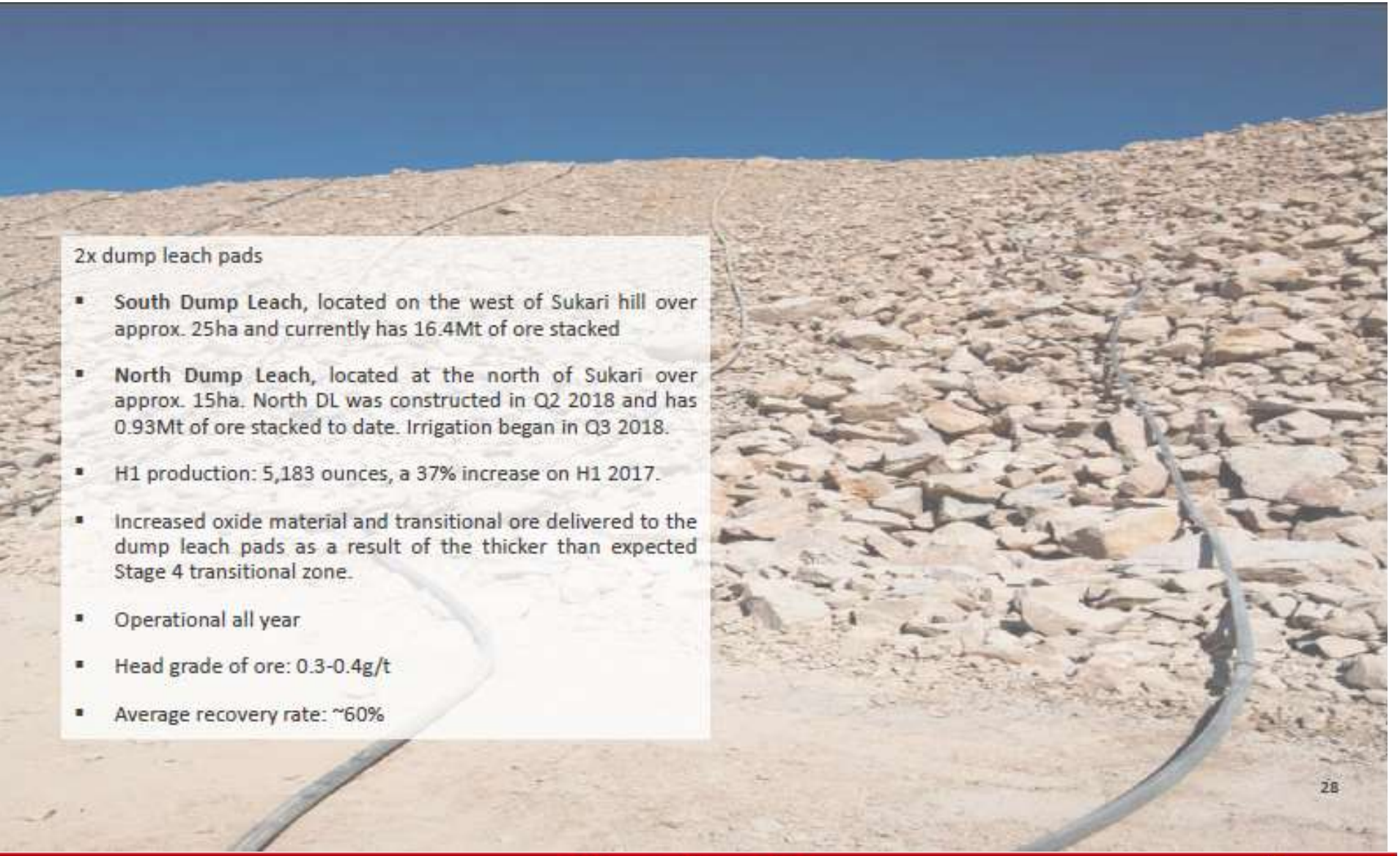
MINES WASTES

- *Mine wastes are problematic because they contain hazardous substances that can be (or are) released into the environment around the Sukari gold mine* – ***heavy metals, metalloids, acids, process chemicals*** – and therefore require treatment, secure disposal, and monitoring.
- ***Wastes are not only produced during mining, but also at mineral processing plants and smelter sites and include effluents, sludges, leached ore residues, slags, furnace dusts, filter cakes and smelting residues.***
- Mine wastes may be in the form of: ***solid waste, water waste, or gaseous waste***.
- **Environmental contamination and pollution** as a result of improper mining, smelting and waste disposal practices has occurred, ***and still occur*** at Sukari Gold Mine

WASTE-ROCK DISPOSAL (ROCK DUMPS)

- Waste-rock is always produced at an open pit mine at Sukari gold mine.
- "Waste-rock" is rock emerging from the mine that will not be processed further. It is either "***ore" that is below the cut-off grade***, or ***is simply the barren host-rock to the mineral deposit***.
- **Rock dumps** ***contain an wide variety of different rocks and minerals that is site specific*****,** depending on the nature of the ore deposit and the host-rock. Sulphide minerals (e.g.; pyrite; Galena; and Arsenopyrite…etc) are present in open pit and underground mining rocks, there is the potential for ***Acid Mine Drainage***.
  - ***Generally rock dumps are not sealed at their base***, and the risk of acid water incursion into the surface drainage system or subsurface aquifers is very high.
- Dumping must be managed because uncontrolled dumping can be dangerous.
  - ✓ Water flowing through a dump must also be controlled to maintain stability and prevent contaminating surface water or groundwater.
  - ✓ ***Rock dumps are also highly porous to water flow,*** and therefore increases significantly the risk of AMD production.
- The operation and management of a waste dump are affected by the mine plan, *i.e., the geometrical relationship between waste and ore in the mine and the strip ratio*.

Dump Leach



2x dump leach pads

- **South Dump Leach**, located on the west of Sukari hill over approx. 25ha and currently has 16.4Mt of ore stacked
- **North Dump Leach**, located at the north of Sukari over approx. 15ha. North DL was constructed in Q2 2018 and has 0.93Mt of ore stacked to date. Irrigation began in Q3 2018.
- H1 production: 5,183 ounces, a 37% increase on H1 2017.
- Increased oxide material and transitional ore delivered to the dump leach pads as a result of the thicker than expected Stage 4 transitional zone.
- Operational all year
- Head grade of ore: 0.3-0.4g/t
- Average recovery rate: ~60%

28

WASTE WATER

- Waste water *consists* of liquid wastes from processing:
  - flotation reagents, SX/EW solvents
  - acids or cyanide used in leaching
  - water
- Waste water *from* a mine may contain:
  - ammonia from explosives
  - contaminated groundwater

- Something has to be done about waste water. The best strategy is to minimize the production of waste water but this usually leads to higher costs. It could be contained, as in behind a dam, but this is difficult and risky. ***Usually it is treated and reused or discharged to the environment***.

i) Sulphidic mine wastes:

- **Sulphidic mine wastes:** ***Sulphide wastes are the biggest problem on mines because of potential for generating Acid Mine Waters (AMW). Pyrite is the major concern.***

- ***Sulphide minerals occur abundantly in Sukari Gold Mine***

- ***Sulphide minerals may be exposed (just about) everywhere in mines:***
  - Tailings dams
  - Waste rock dumps and coal spoil (overburden) heaps
  - Heap leach piles
  - Run-of-mine and low-grade ore stockpiles
  - Waste repository embankments
  - Open-pit floors and faces
  - Underground workings
  - Haulroads and road cuts

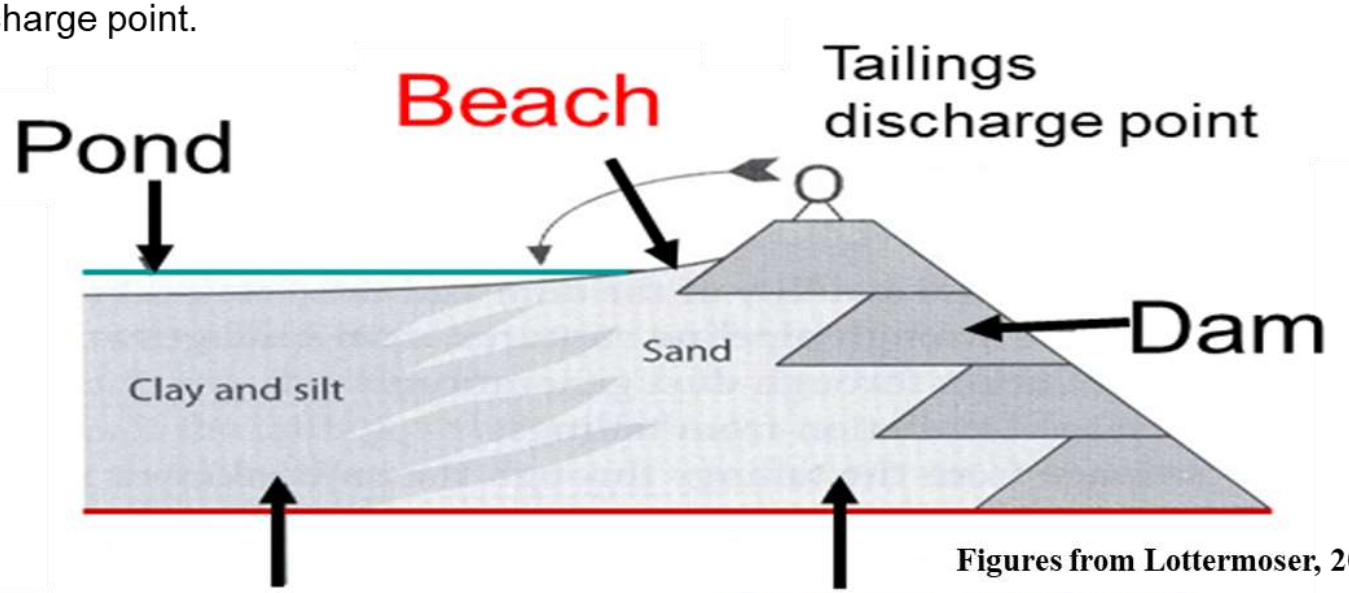
ii) Acid Mine Waters:

"*Acid mine drainage*" (AMD) refers to a particular process whereby ***low pH mine water is formed from the oxidation of sulphide minerals***. It provides one of the most significant hydrological impacts of mining. AMD is particularly prevalent in both metallic mineral and coal mines.

Some authors refer to "*Acid rock drainage*" (ARD), "*Acid sulphate waters*" (ASW); and also "*Acidic ground water*" (AG) when referring to impacted ground-water specifically.

Fundamental Constructed Elements of a Tailings Dam

Solid tailings become segregated in the tailings dam, based on their grain-size and distance from the discharge point.



Figures from Lottermoser, 2007.

Fine-grained sediments settle further from the discharge point, and are significantly less permeable (porous).

These sediments have lower shear strength.

Coarse-grained sediments settle closest to the discharge point, and are significantly more permeable – they drain more easily.

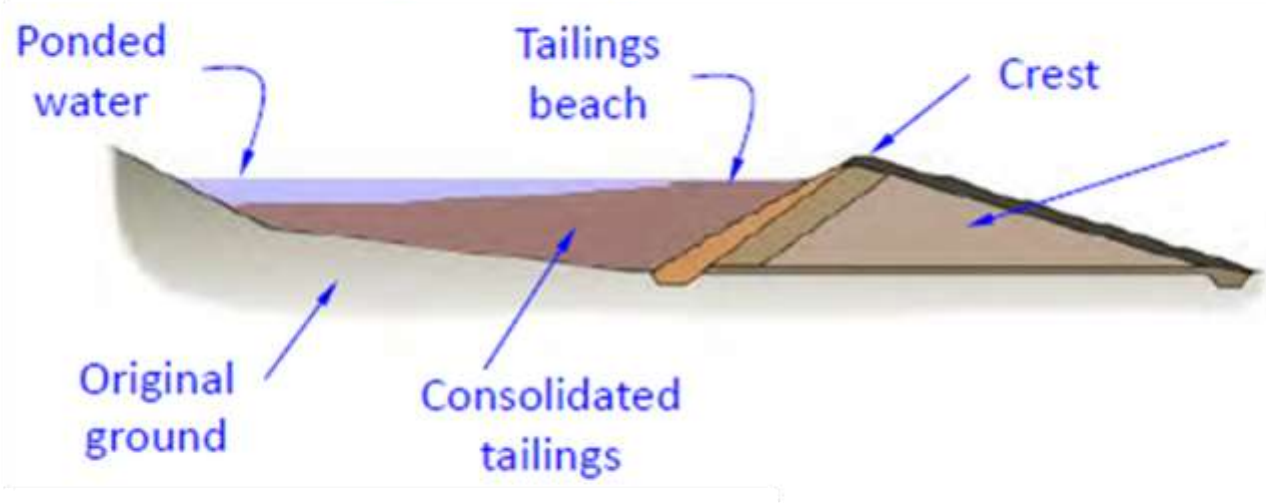
These sediments have higher shear strength.

Example

Thickened tailings deposited into pit pond

Waste rock end-dumped into pit

Wet Tailings Deposition



www.newmont.com

Water Balance of a Tailings Dams

- Tailings dams remain wet during their entire operational life, and only start drying out after decommissioning.

- Contamination-plumes below tailings dams are normally much reduced compared to rock-dumps, due to the low porosity of tailings materials and the low permeability of the liner at the base of the tailings dams.

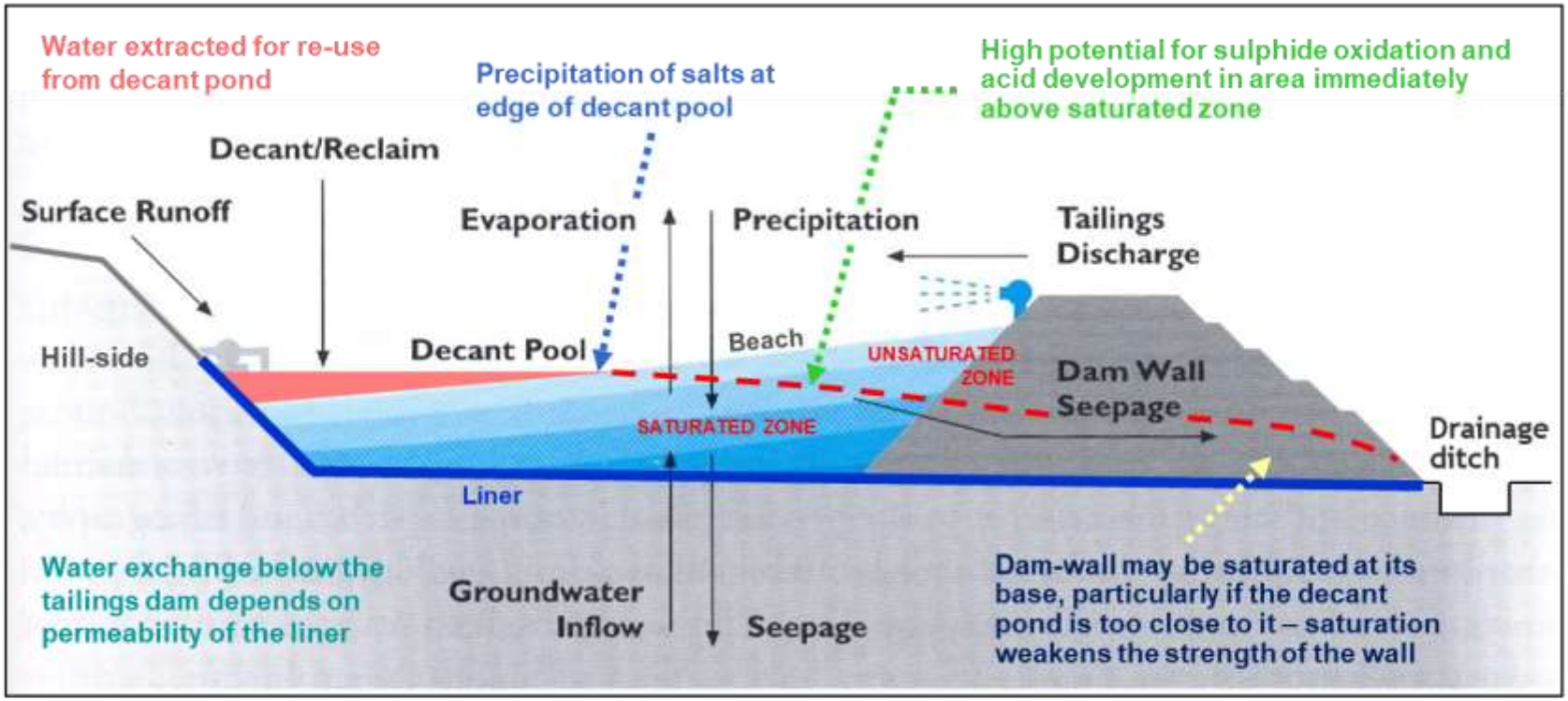
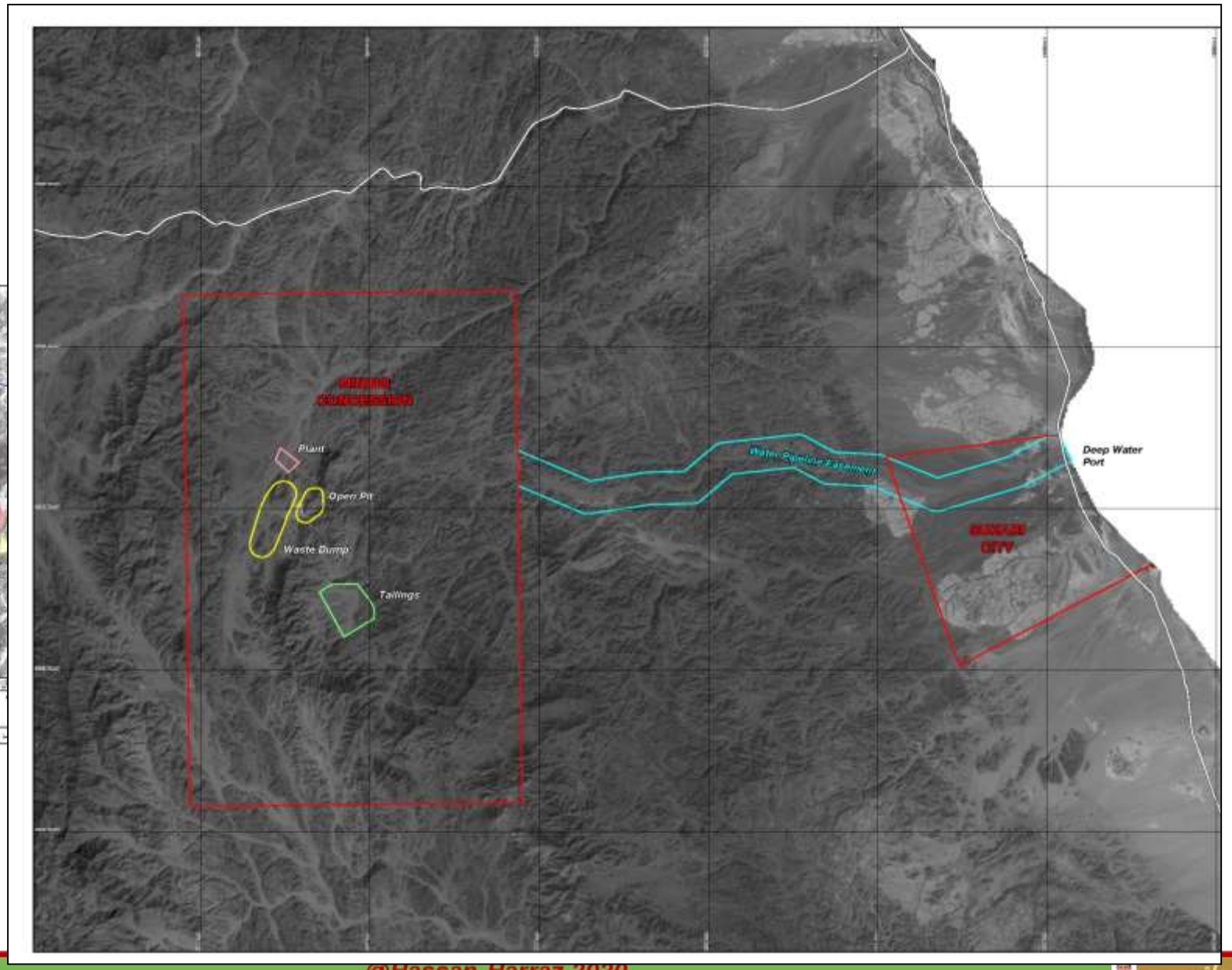
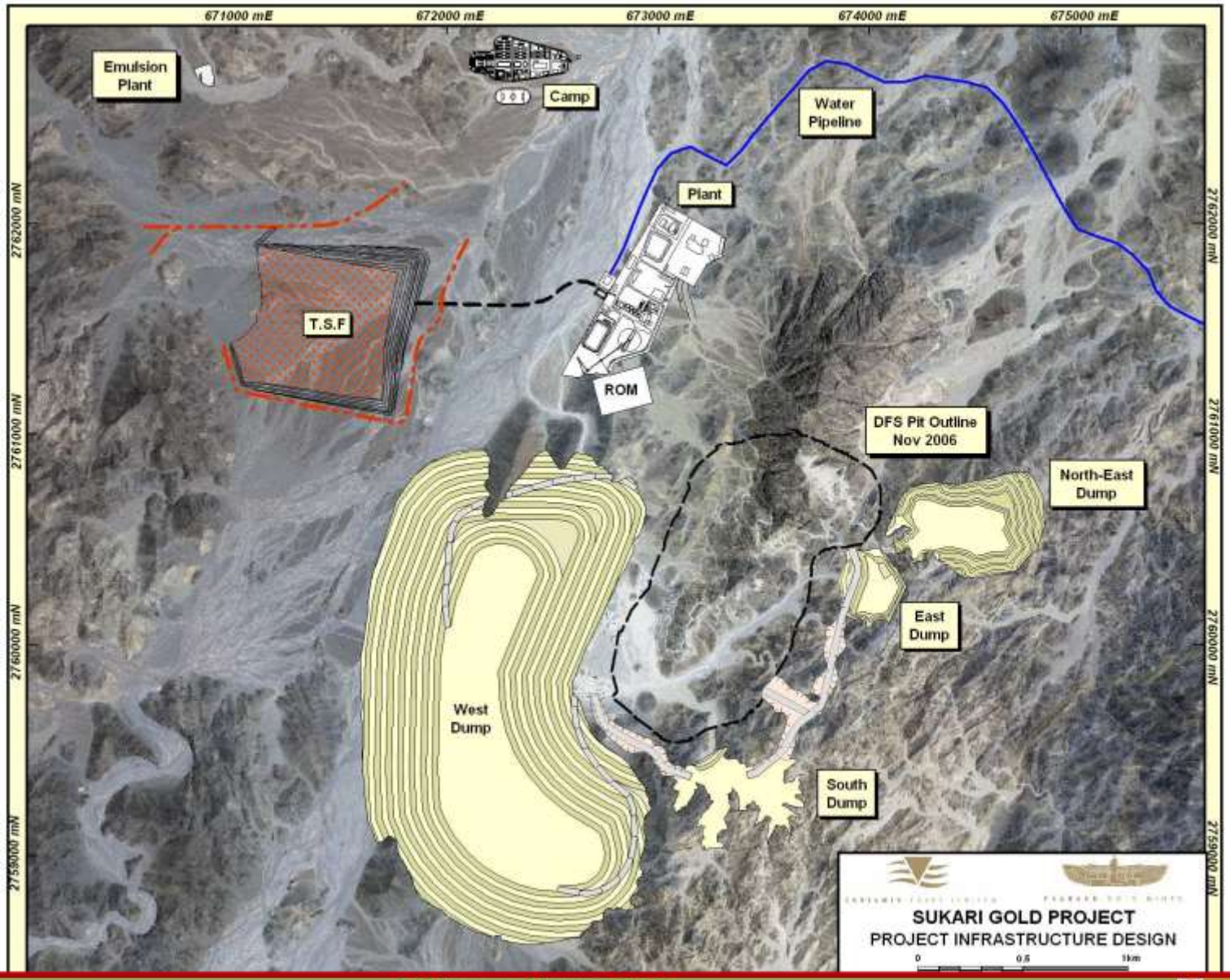


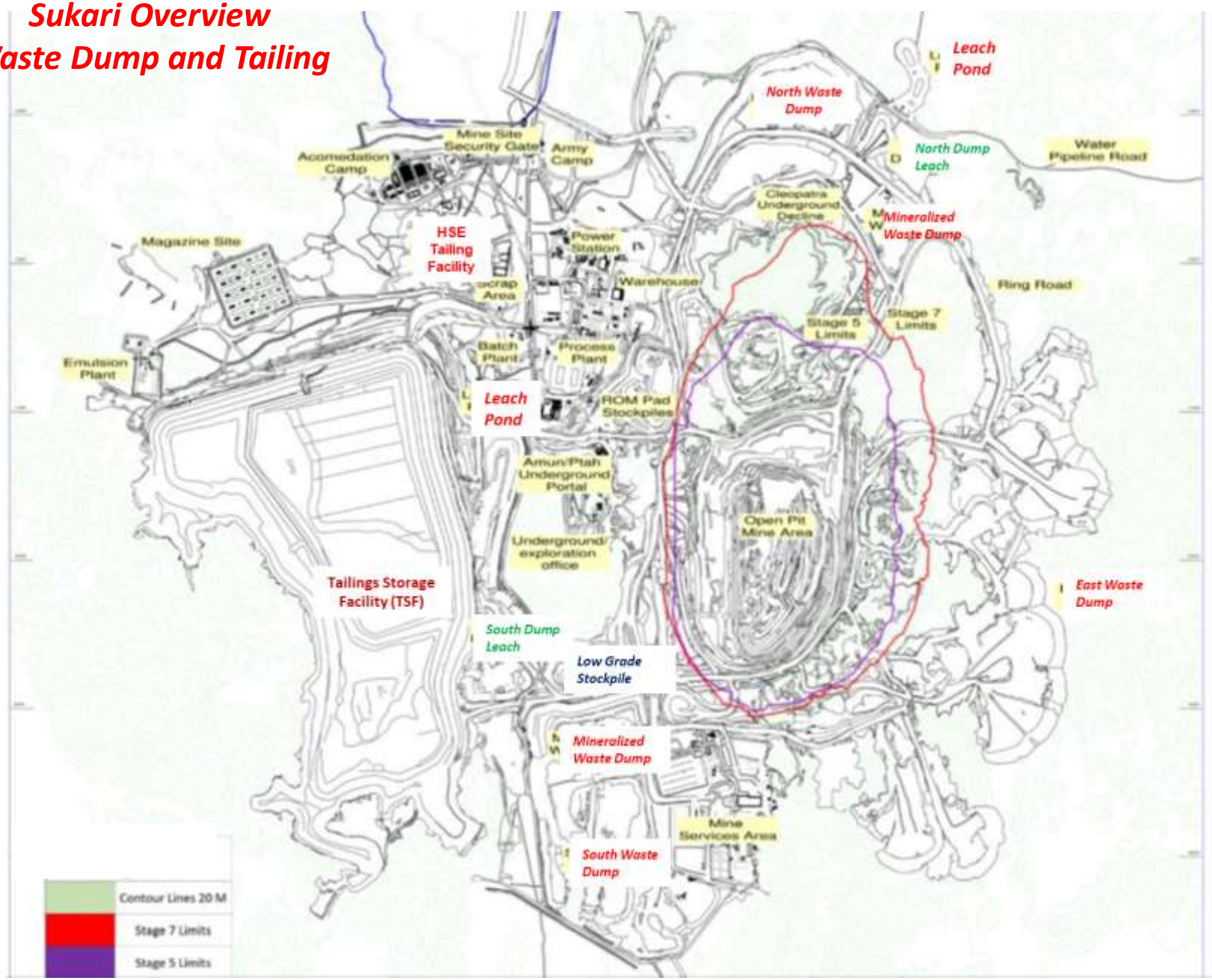
Figure modified from Spitz and Trudinger, 2009.

Sukari Tailings Storage Facilities" (TSF)




671000 mE
672000 mE
673000 mE
674000 mE
675000 mE
2762000 mN
2761000 mN
2760000 mN
2759000 mN
Emulsion Plant
Camp
Water Pipeline
Plant
T.S.F
ROM
DFS Pit Outline Nov 2006
North-East Dump
East Dump
West Dump
South Dump
SUKARI GOLD PROJECT
PROJECT INFRASTRUCTURE DESIGN
0
0.5
1km

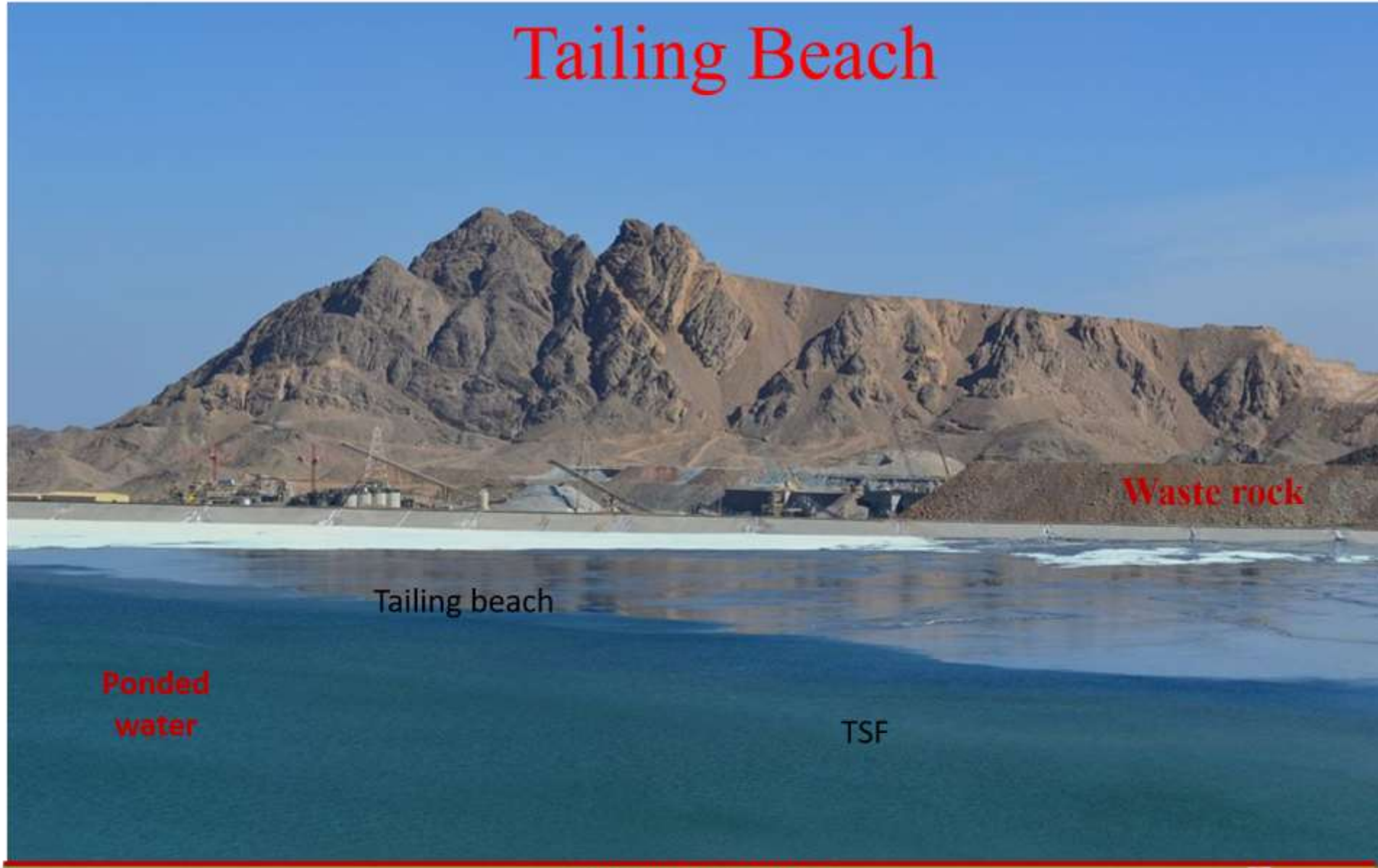
Sukari Overview
Waste Dump and Tailing



Sukari Tailings Storage Facilities" (TSF)

Sukari Tailings Storage Facilities" (TSF)

View of Sukari Pit Disposal Tailings



Sukari Tailing Disposal Pit


General view of Sukari mine site
TSF
Waste

Seepage flow to surface water and groundwater

Seepage to surface water and groundwater may lead to surface water and groundwater contamination in the short- medium- and long-term. The facility needs to be adequately located and designed and the relevant seepage control measures need to be in place according to the characteristics of the managed tailings in order to minimize contamination of surface and groundwater.

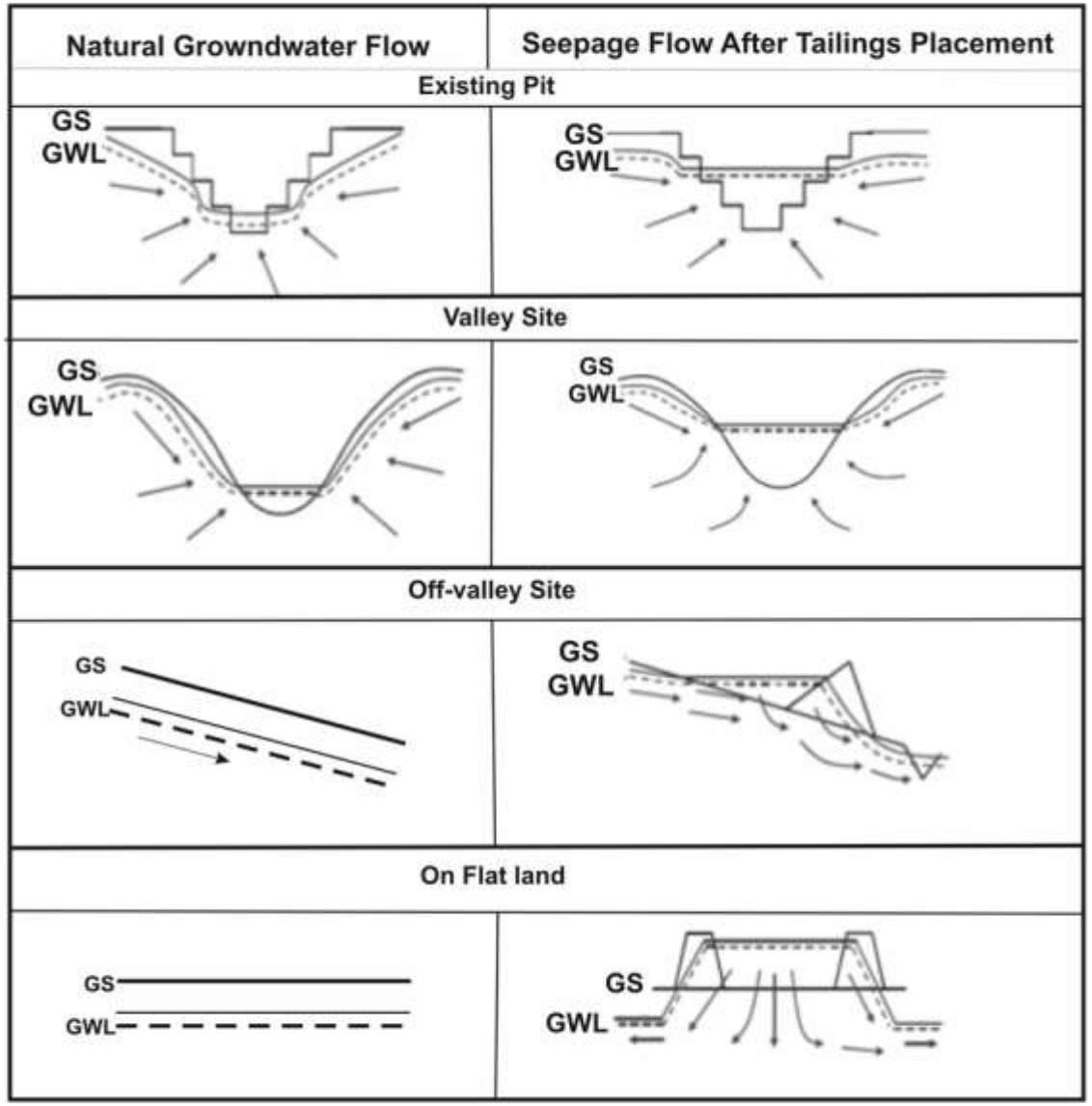


Figure illustrates schematic seepage flow scenarios for different types of tailings facilities.

Follow me on Social Media

LIKE ME ON Facebook

http://facebook.com/hzharraz

connect me on LinkedIn

https://www.linkedin.com/in/hassan-harraz-3172b235

slideshare
Present Yourself

http://www.slideshare.net/hzharraz