

BC MEND MLARD Svartliden Closure measures

8 December 2021



Introduction

- Info of the Svartliden mine
- Future of the Svartliden site
- Surrounding environment
- Successive remediation works
- Planned closure measures

Info of the Svartliden mine

Dragon





Info of the Svartliden mine

STO



MA



Future of the Svartliden site



- Fäboliden mine
- 30 km SE from Svartliden
- Test mining 100 kton 2019-2020
- Environmental permit application submitted 2018. Main hearing in March 2022.





Surrounding environment

- Paubäcken creek
- Natura 2000 Protected
- Mainly due to Freshwater pearl mussel
- Proposal to make a Nature Reserve
- EQS must be met in all water sheds



ALT



Surrounding environment

Paubäcken creek

Water discharge during operation



Successive remediation works





• Waste rock slopes covered with glacial till



Successive remediation works



- TSF beach covered with waste rock and glacial till
- Precover for the engineered cover

Planned closure measures Short summary of actions

Remove buildings

Dragor

Mining

- Soil investigation, removal of contaminated masses, till cover, sow of gras and trees
- TSF Beach engineered cover (0,5 m sealing layer 1,5 m protective layer)
- Tailings < 1 m water, dredge to deeper area in TSF
- Dam between TSF and CWP dug of, joint lake
- Spillway to open pit, restore natural flow direction
- PAF cell waste rock, engineered cover (0,5 m sealing layer 1,5 m protective layer)
- Waste rock, protective cover 1 m till
- Water fill open pit, 10 m water cover to tailings







MAR









MA





No fill + 415 m.a.s.l + 430 m.a.s.l + 451 m.a.s.l



- Initial ABA tests
 - PAF waste rock >1% S
 - NAF waste rock <1% S



Separation of waste rock to PAF cell ~ 2 Mton PAF

- ~ 15 Mton NAF
- Updated Waste rock characterizations
 - Total metal levels
 - ABA
 - Leach test
 - Humidity cell tests

All waste rock potentially acid forming
NP/AP quotient < 3



- Separation NAF and PAF
 - NAF (~0,7 weight-% S) less acid producing then PAF (~2 weight-% S)
- Conclusion Separation has been successful
 - PAF more weathering prone (~2 weight-% S vs 0,7 weight-%)





- Leach water quality stable over time
- Low, stable sulphide oxidation rate ~770 mg/L SO₄





- Engineered cover on PAF
 - 0,5 m compacted glacial till <1 dm
 - 1,5 m non compacted glacial till
 - Several dry years continuously, 85 % soil saturation
 1,9 mol/m², year
 - Normal year, 90 % soil saturation \implies < 1 mol/m², year
- Protective cover on NAF
 - 1 m non compacted glacial till



Figur 2: Beräknat teoretiskt syreflux som en funktion av vattenmättnadsgraden (S).







- Modelled saturation of the protective cover
- Dry years and wet years

- Modelled saturation of the engineered cover
- Dry years and wet years



Figure 9: Computed saturation at mid portion of the single-layer non-compacted till cover configuration.



Conceptual model mass balance





- Effect of the engineered cover on PAF (ie: metal concentrations), has not been included in calculations. Due to not underestimate the risk of impact on the recipient
- Included reduction of mass flow. To 1/8 of today from PAF.



Metal concentration development in the open pit during operation to finished deposition at + 441 m.a.s.l (451 m.a.s.l. water)





• Water flow to North, towards Paubäcken. Natural flow direction

- Contribution of As, Pb, Cd and Cu most marginally from the waste rock dump
- Moderate contribution of Co, Ni, S and Zn in percent but low impact on the recipient
- Engineered cover of both PAF and NAF leads to negligible content change in the recipient vs engineered cover on only PAF

	Surcharge in Paubäcken – engineered cover PAF	Surcharge in Paubäcken – engineered cover PAF+NAF
	μg/L	μg/L
As	0,40	0,40
Pb	0,004	0,003
Cd	0,01	0,01
Со	0,23	0,08
Cu	0,05	0,04
Ni	1,02	0,32
S	133	100
Zn	2,2	0,7



- Engineered cover on both PAF and NAF

- Reduction of Total As ~ 0,01 ug/l.
- Reduction of Total Ni ~ 0,5 ug/l
- Reduction of Total Zn ~ 1,5 ug/l
- Total concentration>Bioavailable fraction
- Does not lead to any difference in status in recipient Paubäcken