

Appendix N-2 - Hydrology and Flood Assessment Report - Rustler's Roost



Rustler's Roost Open-Cut Mine Redevelopment

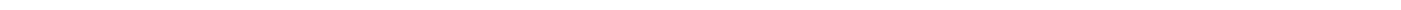
Catchment Hydrology & Flood Risk Assessment

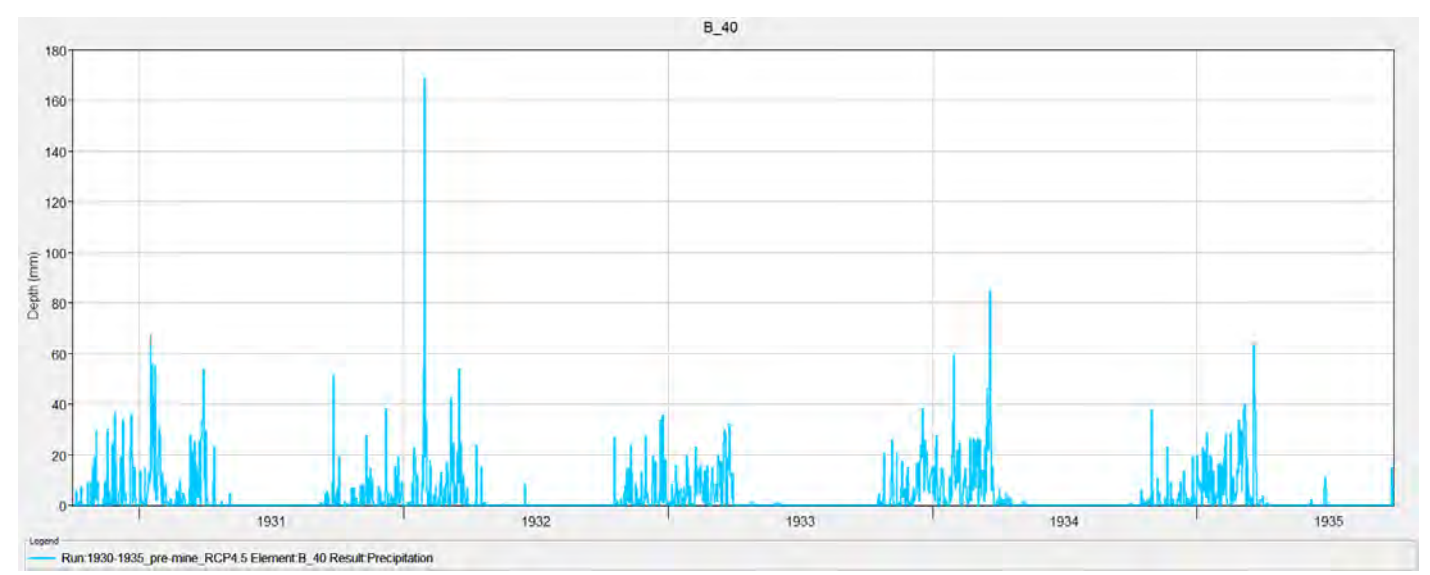
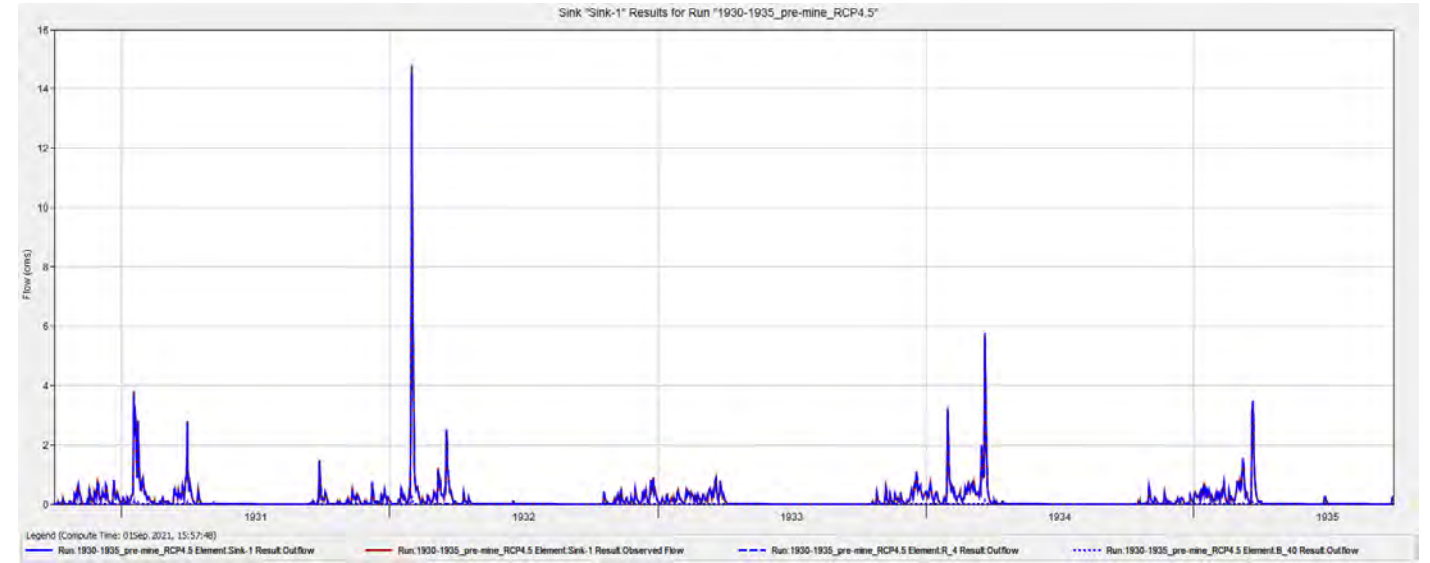
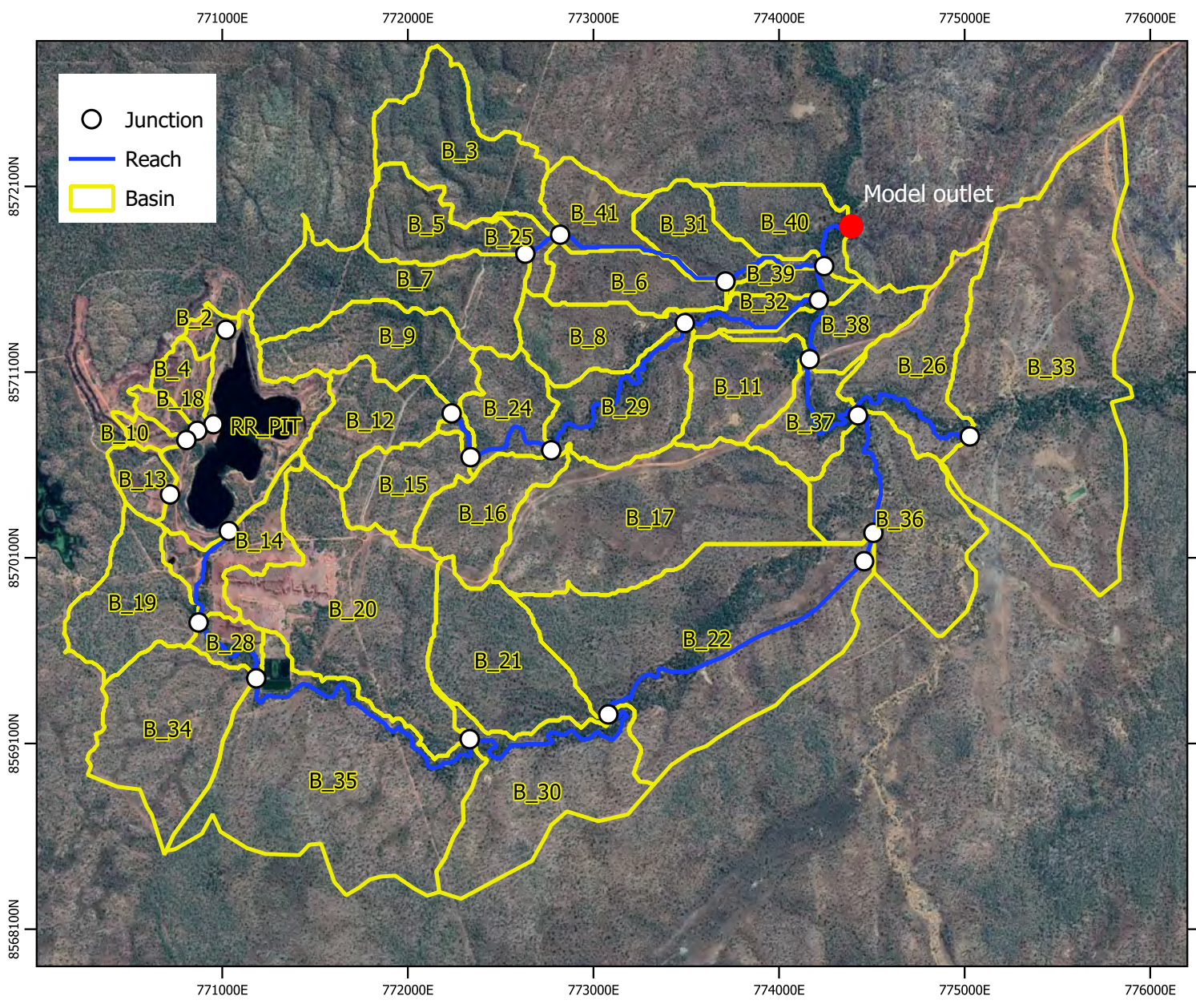
Volume 3 - Appendices

September 2021



8 APPENDICES



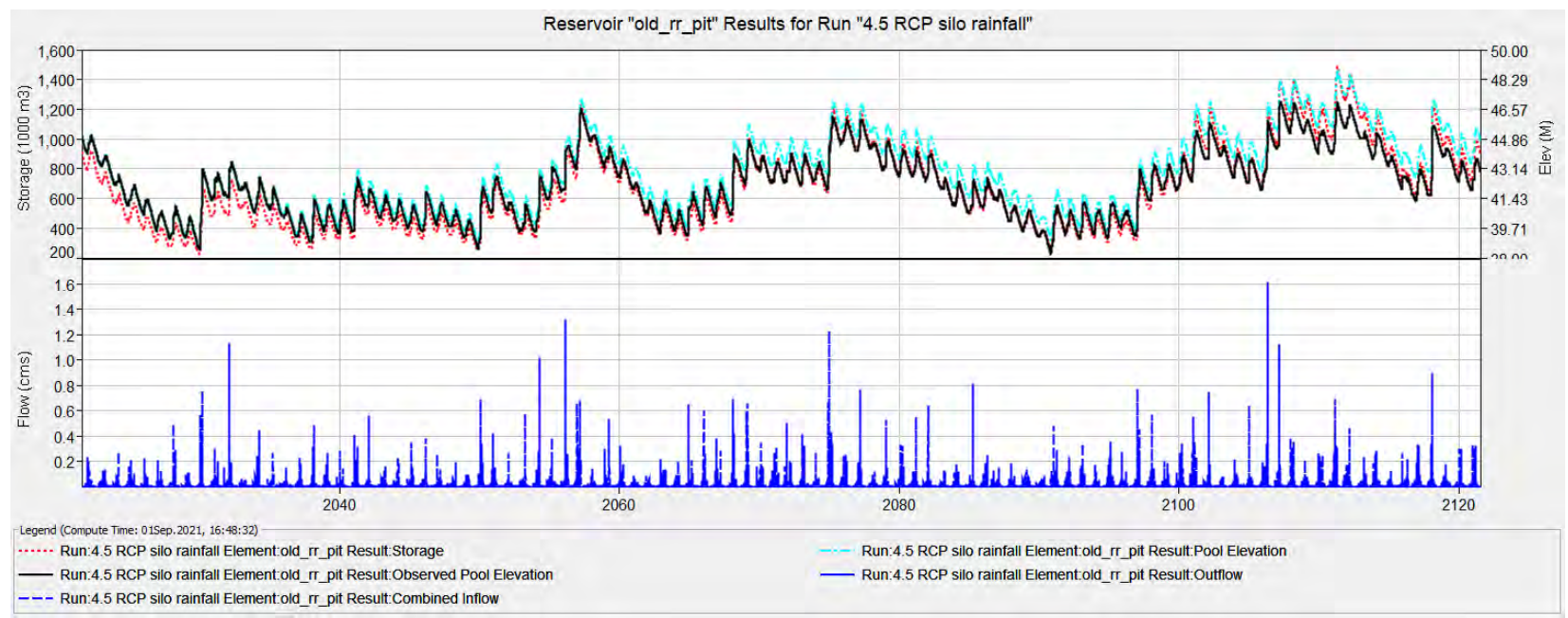


Above: The HEC-HMS model layout for the RRPA East model for its current condition in care and maintenance. This is the largest of the models required to assess changes in long term catchment hydrology due to mine expansion.

Above Right: A five year period between 1930 and 1935 used to calibrate the model to a runoff ratio. The fitted runoff ratio was 0.24 with CR = 1.5 mmh⁻¹.

Right Centre: The SILO rainfall for the period 1930 to 1935

Right: This shows the change in water surface elevation in Pit 1 during a simulated period for 2021 to 2121. There is no change to the site. The black line is water level based on the SILO rainfall for the past 100 years and the blue line is the water surface elevation using the SILO rainfall adjusted for the RCP 4.5 climate change model. The effect of climate change is clearly seen as the blue climate-affected line increases in elevation and separates from the baseline black line.

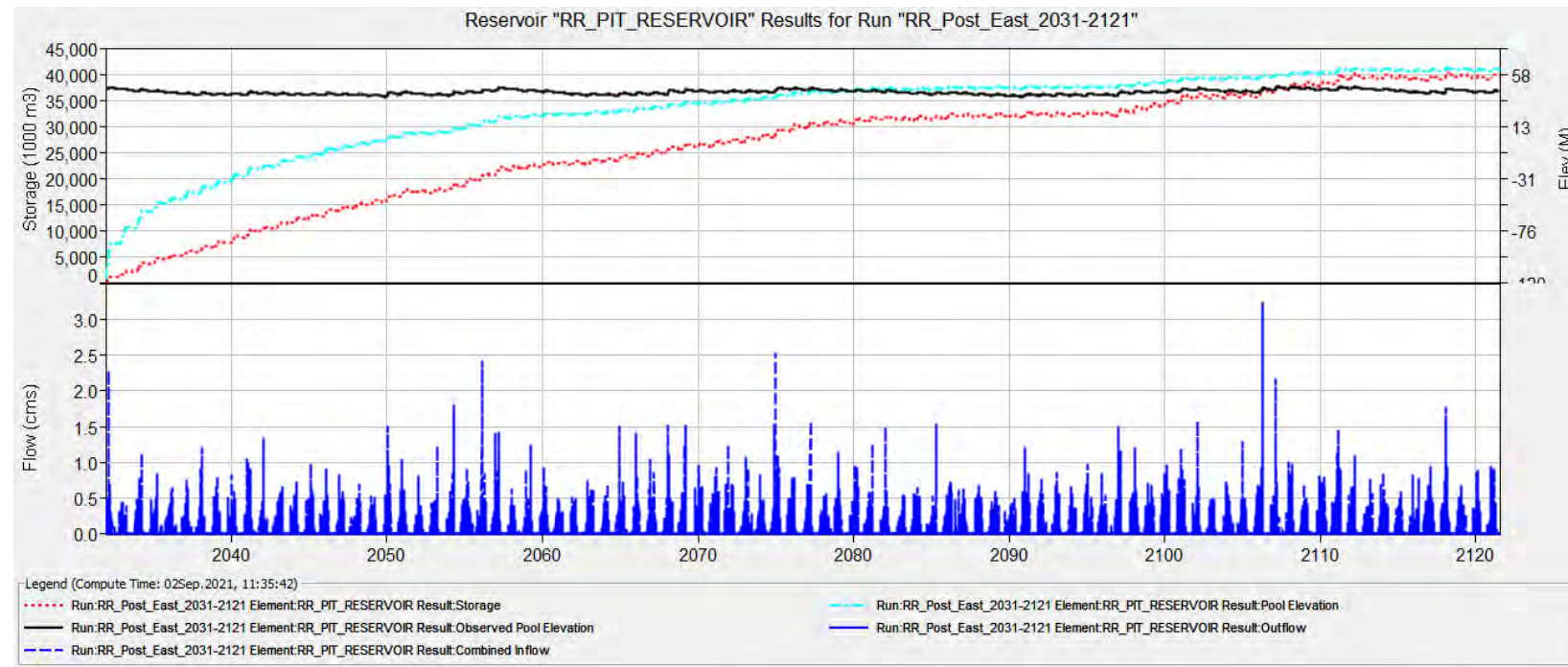
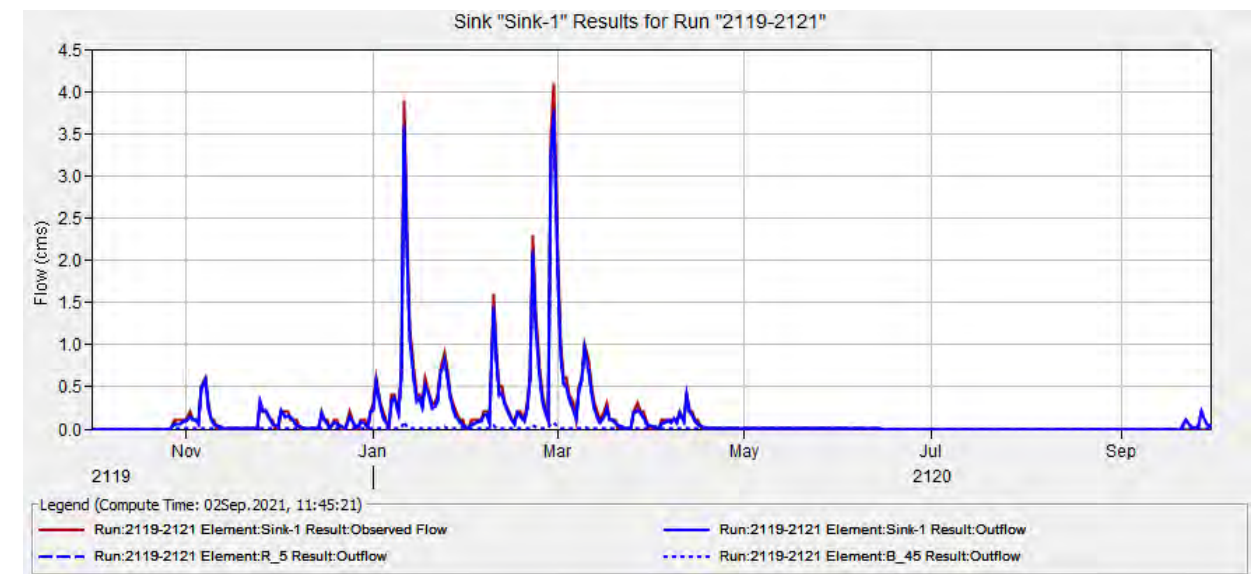
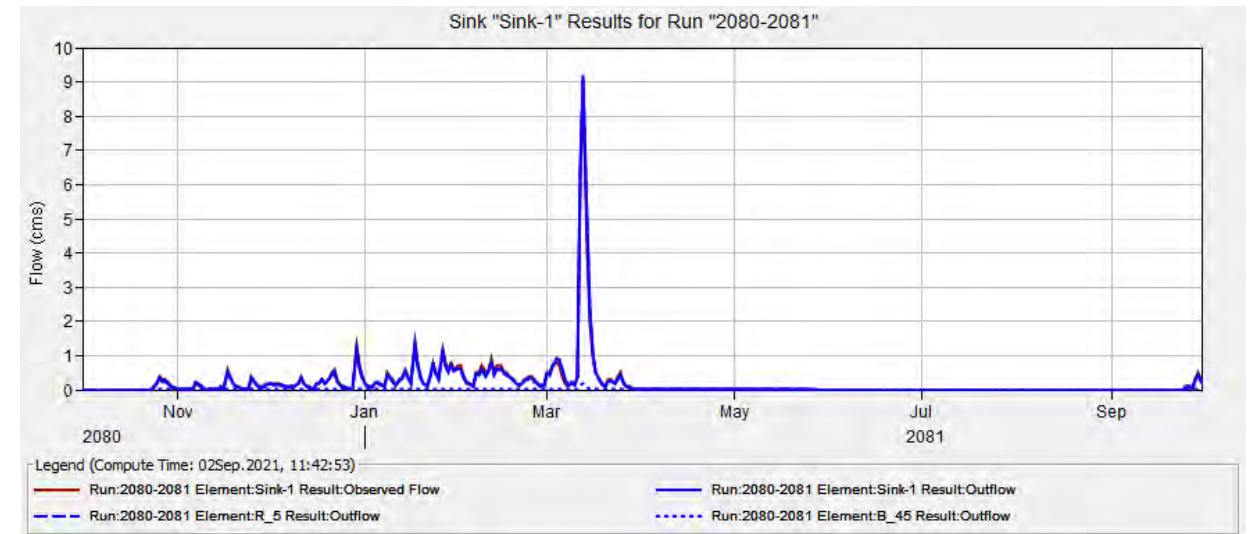
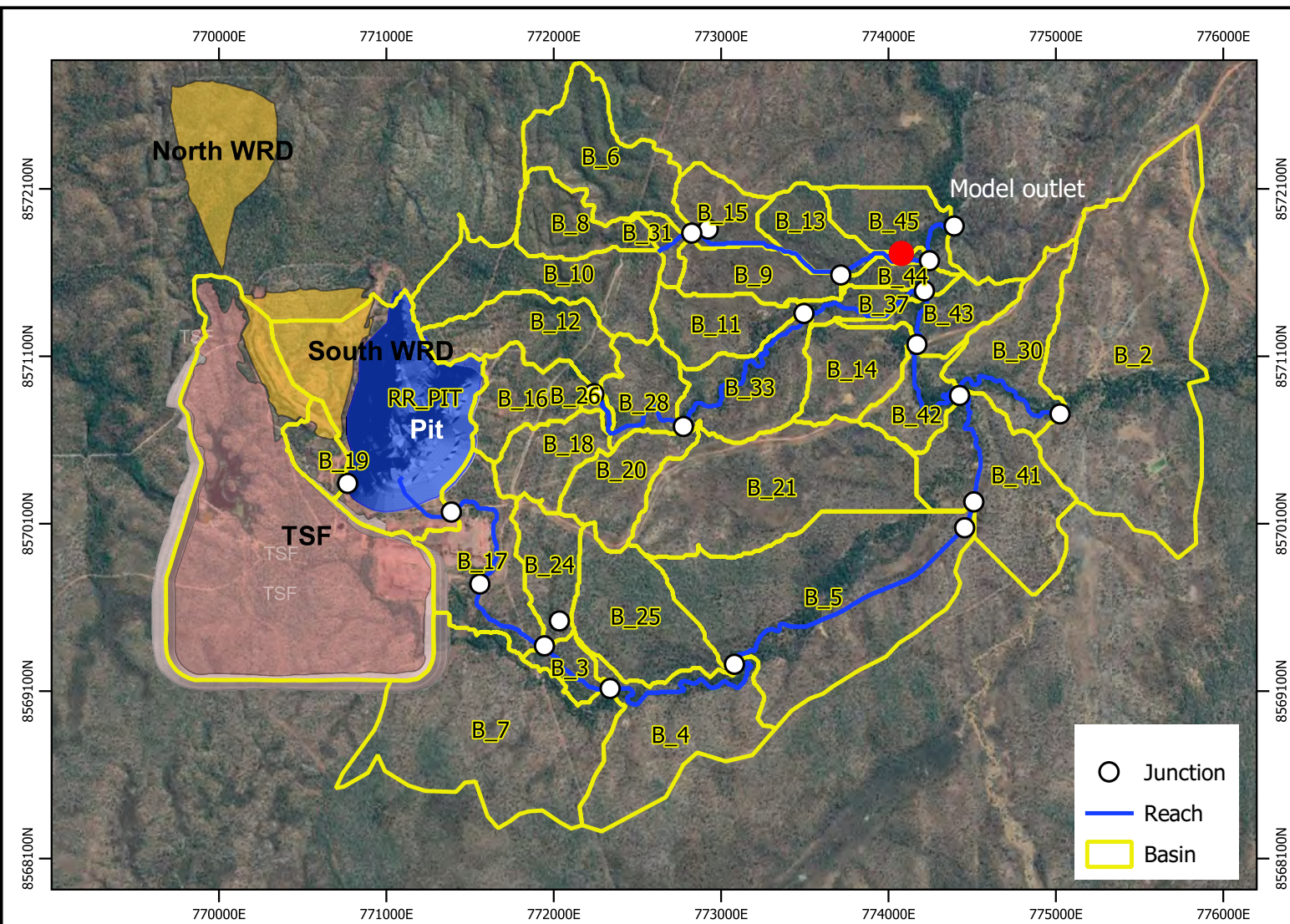


Appendix A.1

Project
Rustler's Roost Open-Cut Mine Redevelopment -
Catchment Hydrology & Flood Risk

Title
HEC-HMS Model East Layout

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Date	Sheet No.		
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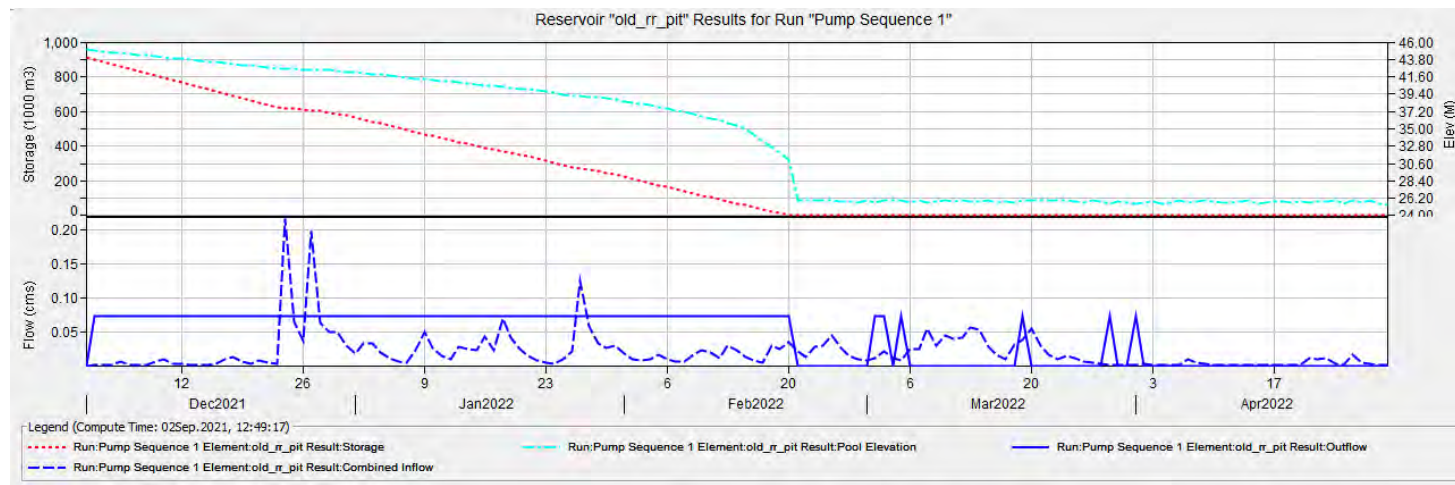
Above left: The HEC-HMS model layout for the RRPA East model post-expansion and mining. This is the largest of the models required to assess changes in long term catchment hydrology due to mine expansion.

Left: Pit water level after mining is completed' The blue line is the water elevation as the pit fills over several decades. The black line is the water level that would be in the pit if the expansion didn't occur. The pit is filled by direct rainfall and runoff from the southern WRD.

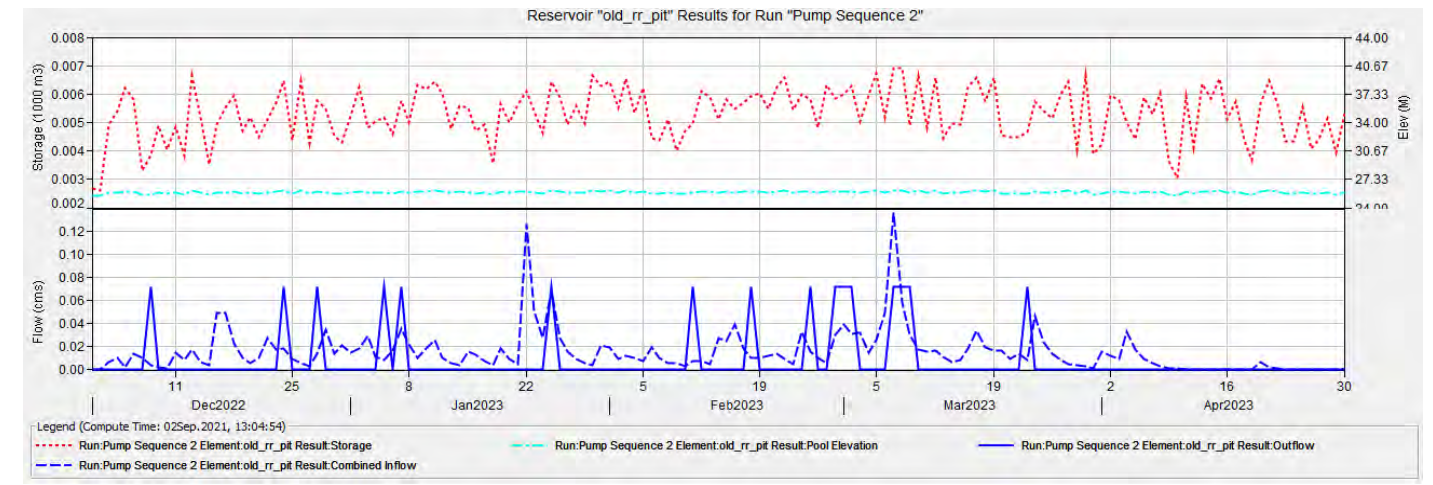
Above right: To assess how downstream flows were affected as the pit refilled simulations for 2080-2081 and 2119-2120 were conducted. The 2080-2081 simulation showed a similar shaped hydrograph with little difference to the pre expansion hydrograph at the catchment outlet.

Above: This is for the simulation 2119 - 2120 at the outlet. In this case the Qp values are less than pre-mine Qps but are still within environmental flow recommendations.

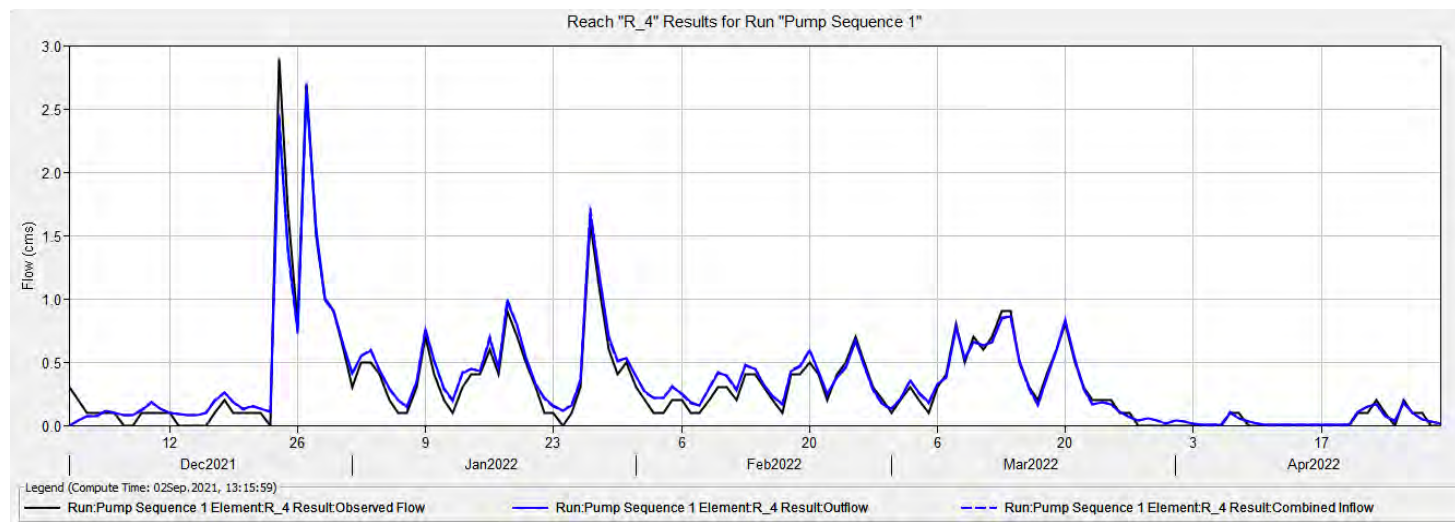
	Appendix A.2	Project Rustler's Roost Open-Cut Mine Redevelopment - Catchment Hydrology & Flood Risk	Title Rustler's Roost Post-Mining HEC-HMS Model	Designed	Drawn	Checked	Sheet size
				Date	Sheet No.		
							Sheet of



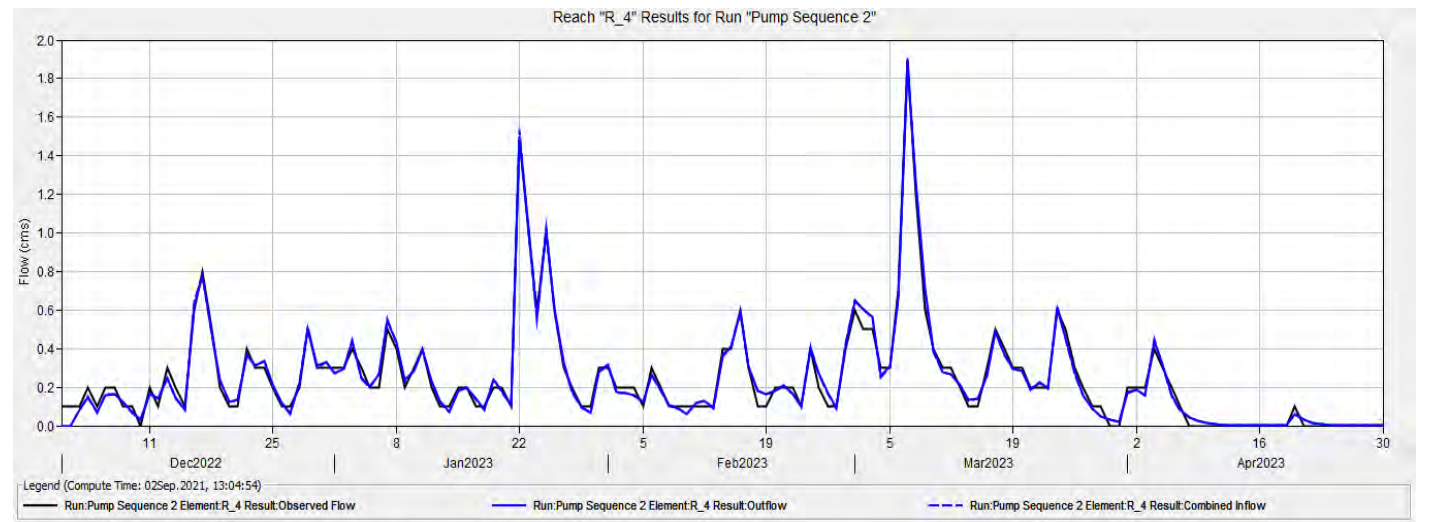
Above: Dewatering the RRPA pit prior to mine expansion. This is the first pump sequence from 1/12/2021 - 30/4/2022. The pump rate in this catchment is 72.5 L/s.



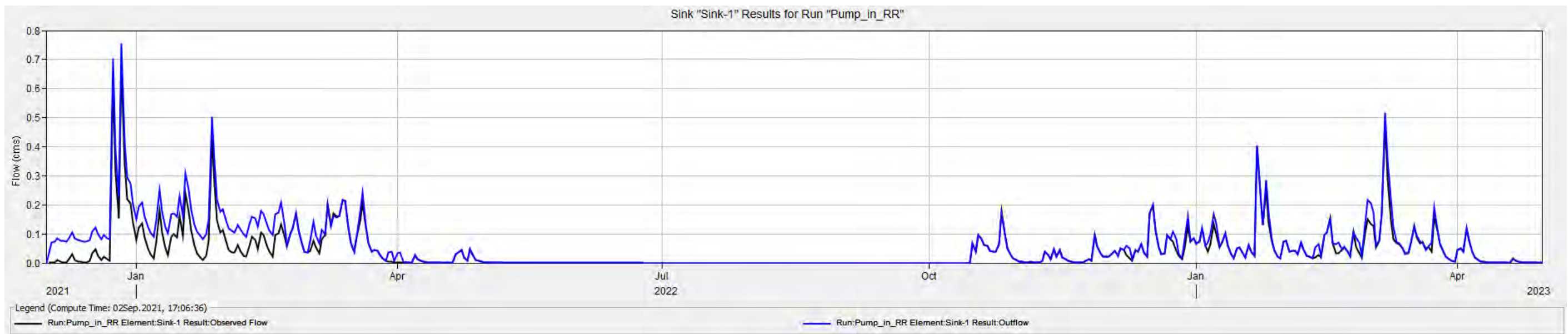
Above: This is the second phase of pumping from 1/12/2022 - 30/4/2023. The water level in the pit is at a minimum from the start with the pump occasionally turning on as water level rises. The pump rate is 72.5 L/s.



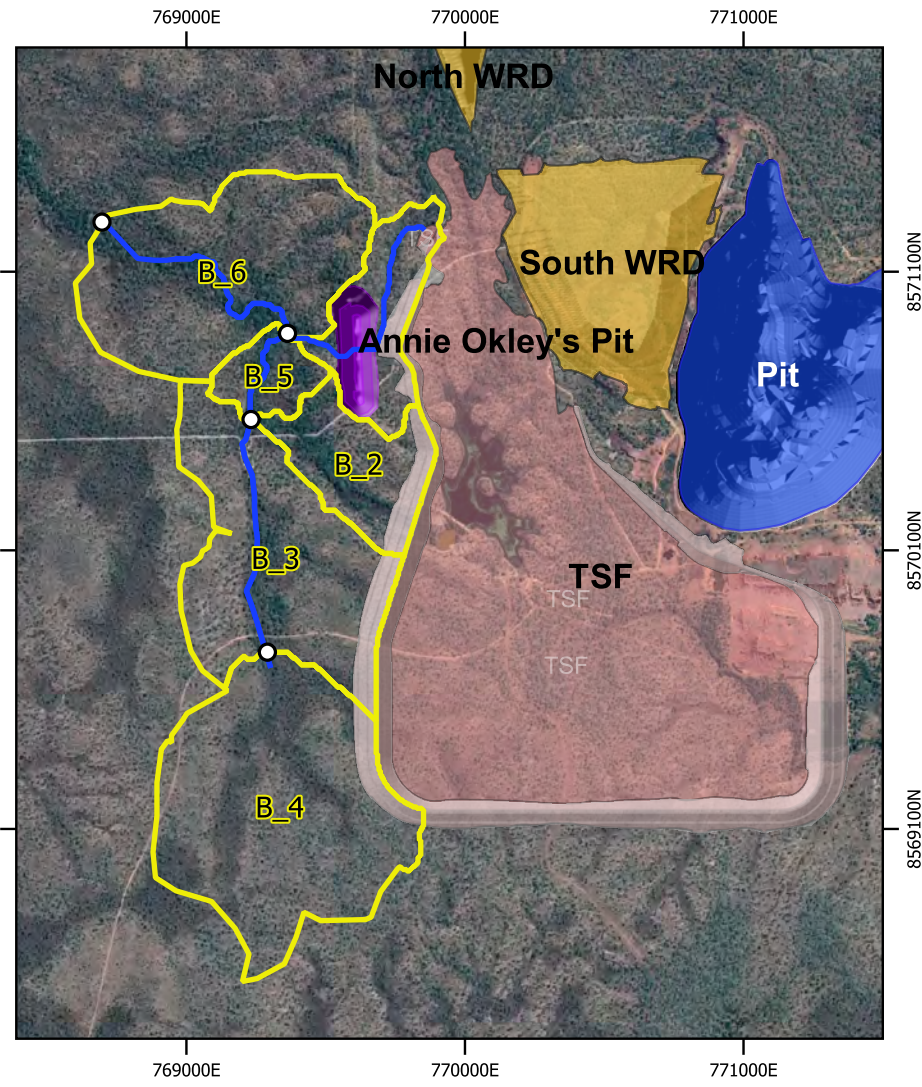
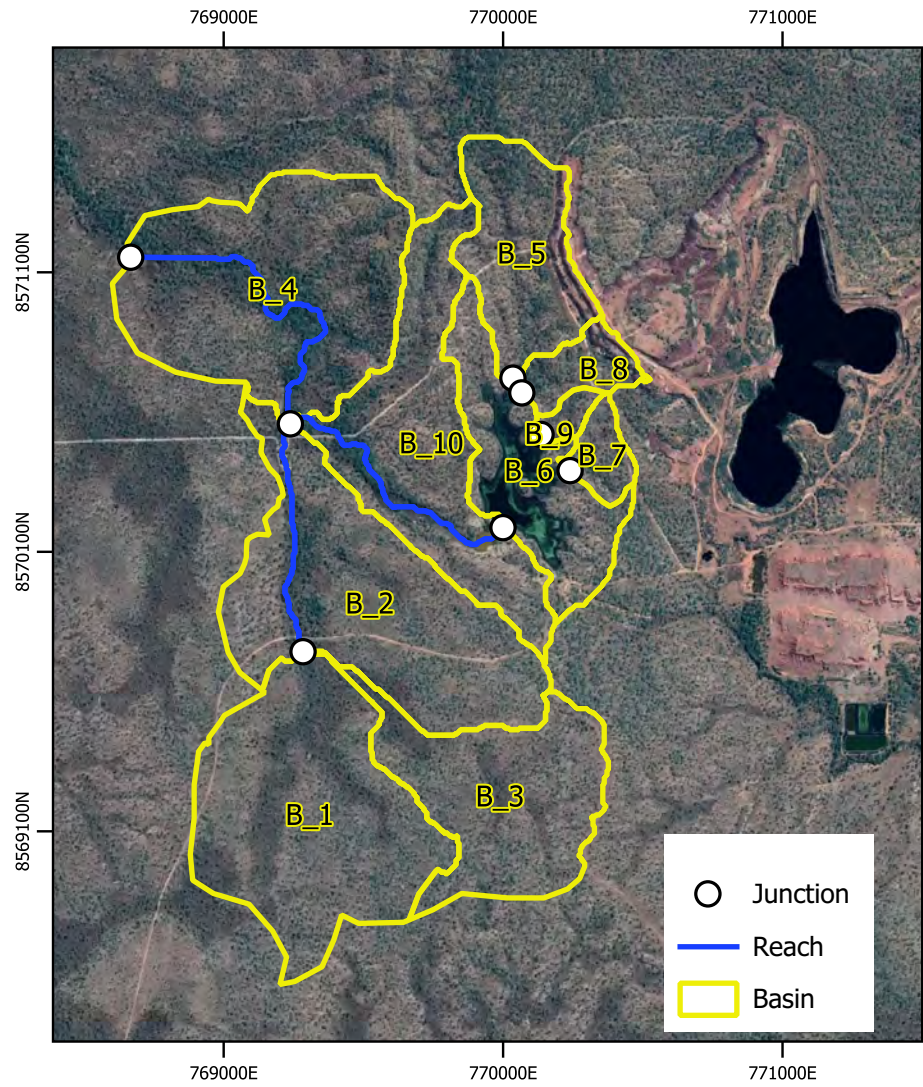
Above: Flow at the outlet of the catchment see Appendix A.1. The blue line is the pump discharge and the black is observed flow. The blue line is the simulated flow for the pre-mine condition with the RCP 4.5 climate change model applied. At the start of the hydrograph, the flat blue line is the pump discharge on the simulated flow. Further on in the record the pump sequence is slightly higher.



Above: For the second phase there is little difference between the pump-driven hydrograph and the pre-mine hydrograph.



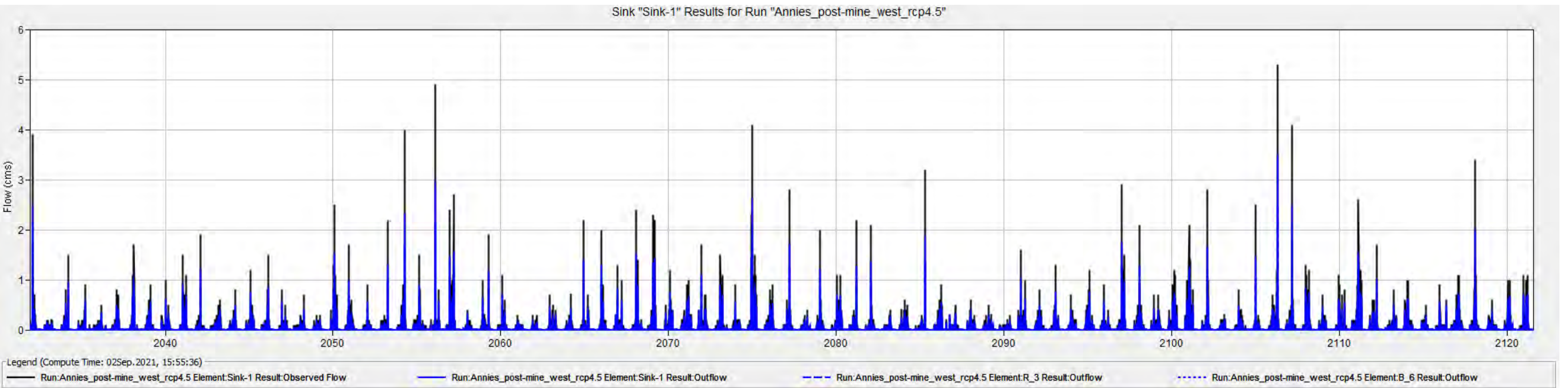
Above: The effects of the pit dewatering on Annie's Dam catchment. The increased flows during the first phase in 2021-2022 is clearly seen superimposed on the simulated baseline discharge. The increased Q_p at the catchment outlet is considerably less than the baseline maximum Q_p of $5.3 \text{ m}^3\text{s}^{-1}$. The pump rate is 72.5 L/s.

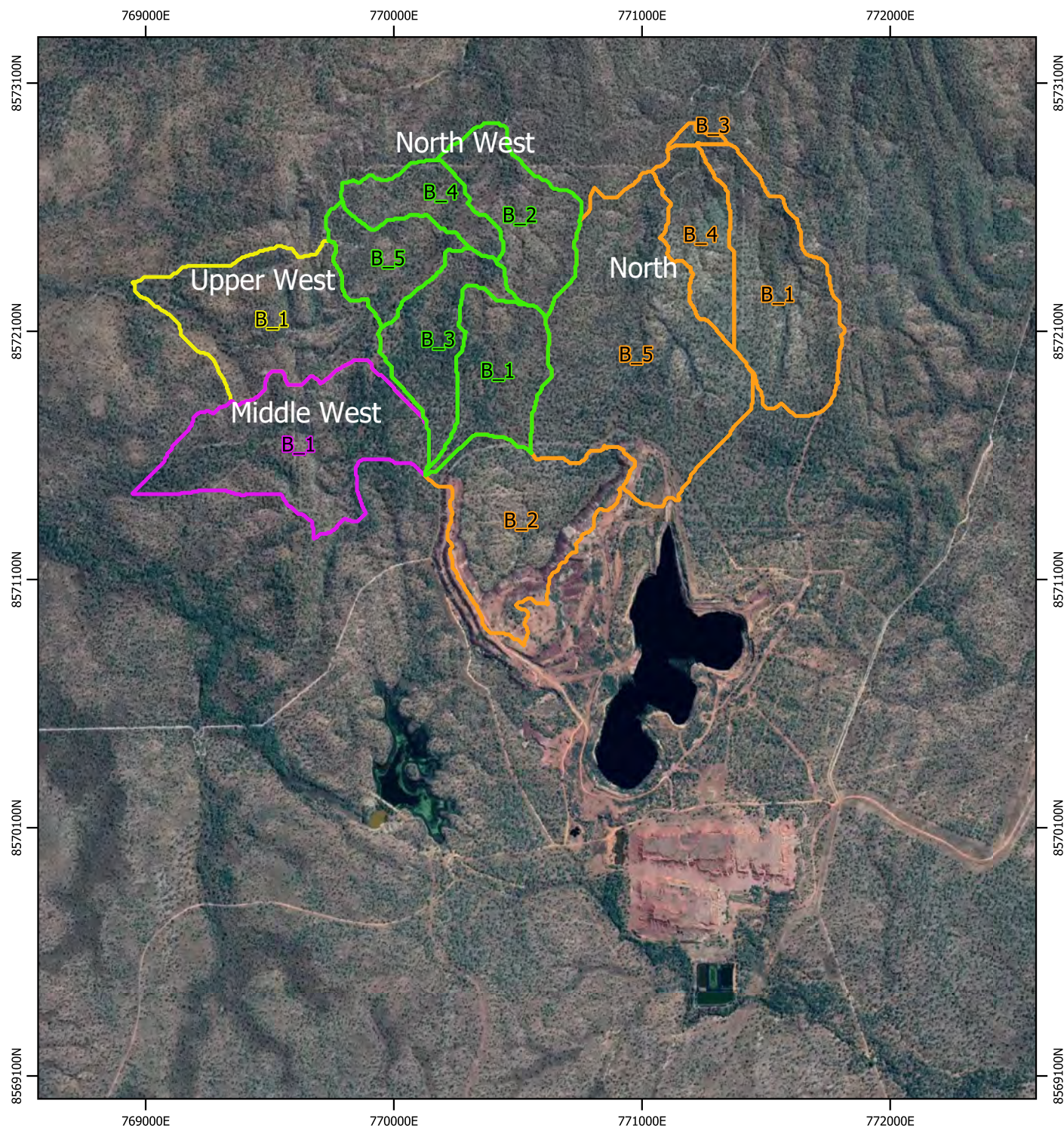


Far left: Annie's Dam catchment pre-expansion of Rustler's Roost mine.

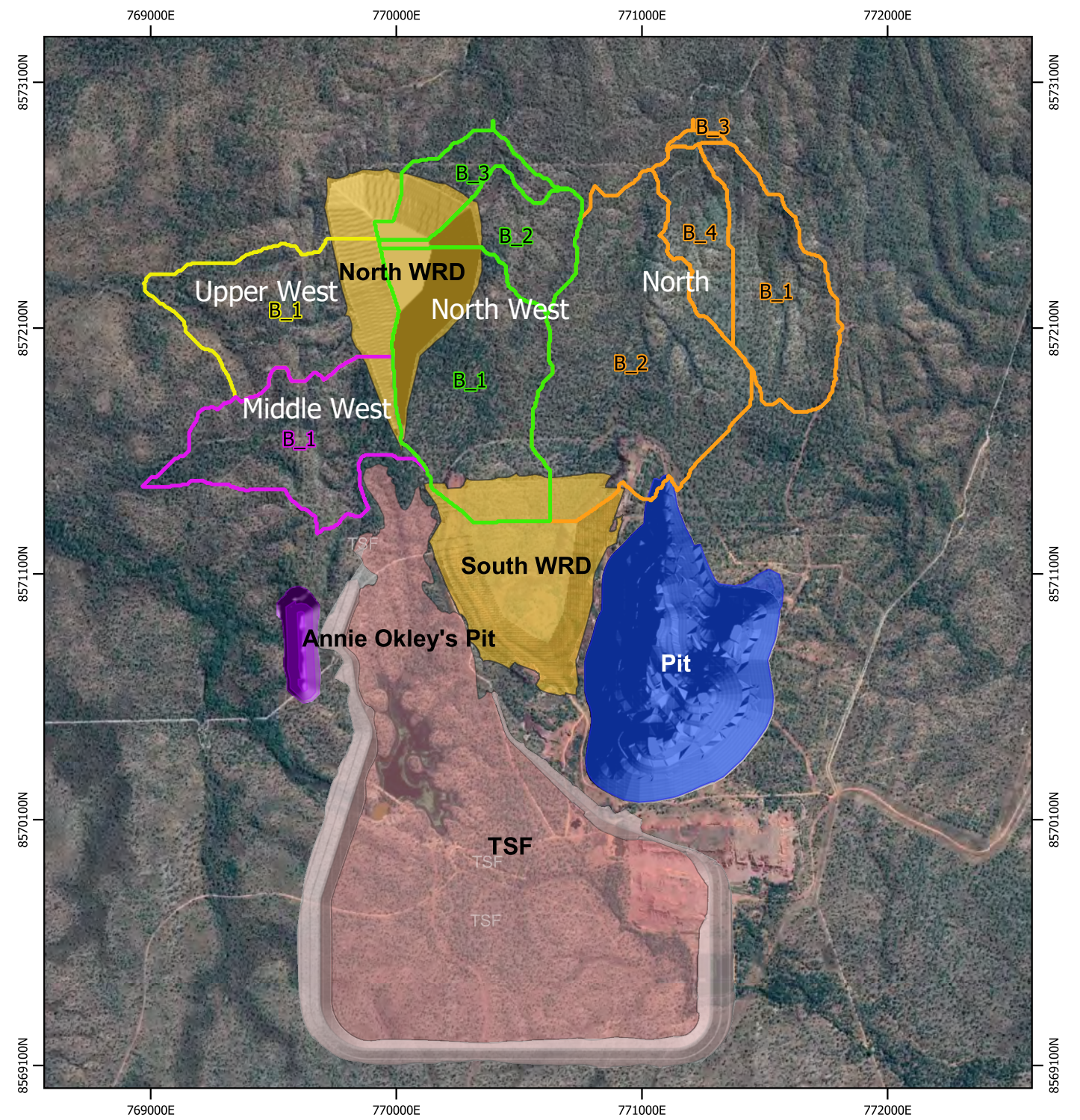
Left: Annie's Dam catchment post operations. Approximately 50% of the catchment is consumed by the proposed tailing storage facility. Total discharges at the outlet of the model domain are reduced by 38%. However, this catchment is at the top of the large Adelaide River catchment and the losses seem considerable because of the small size of the model domain.

Below: A post-mining simulation showing the reduction in annual Qp at the outlet of the model domain resulting from a large portion of the catchment being consumed by the TSF. The black trace is the pre-mining and the blue trace post-mining.

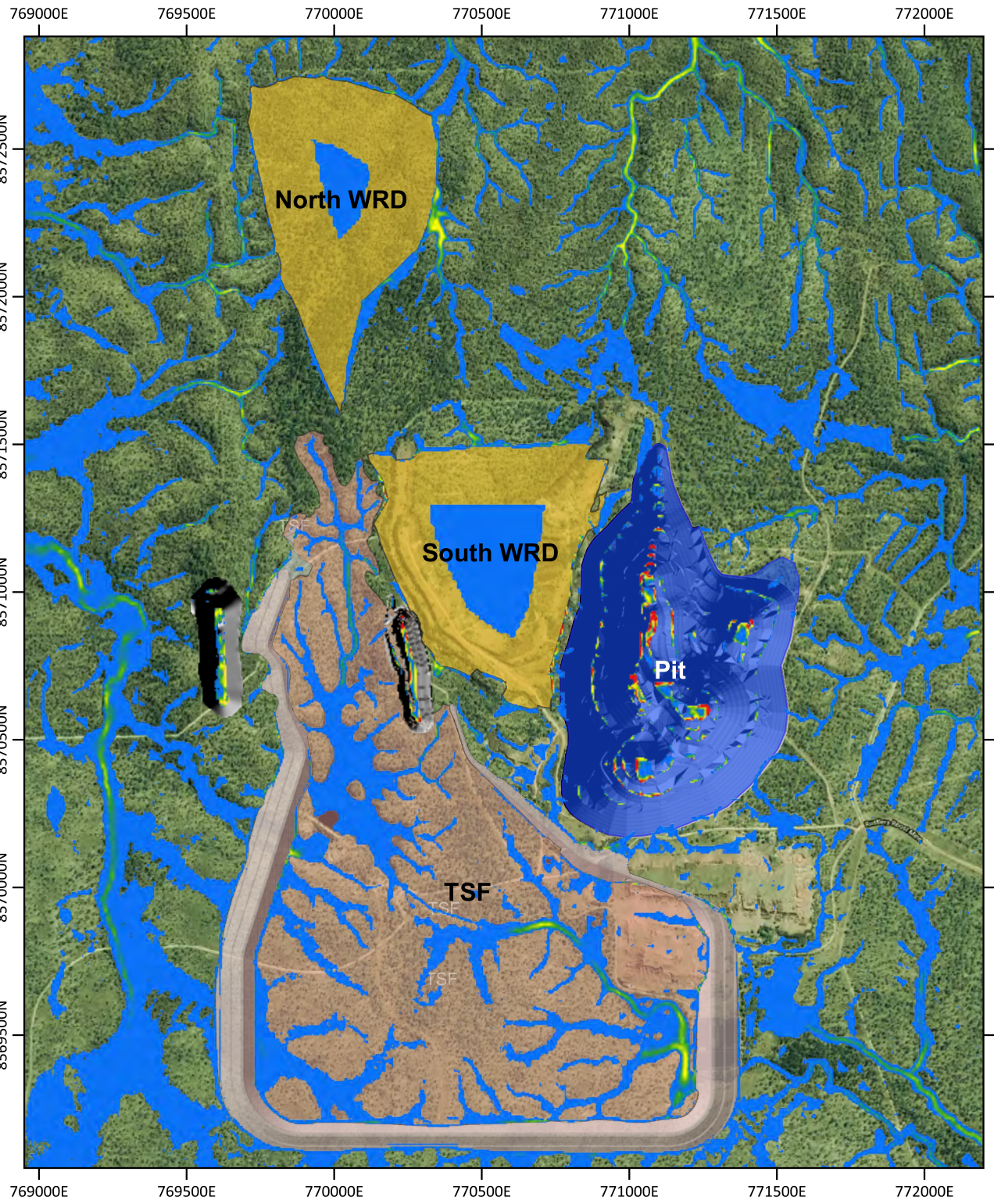




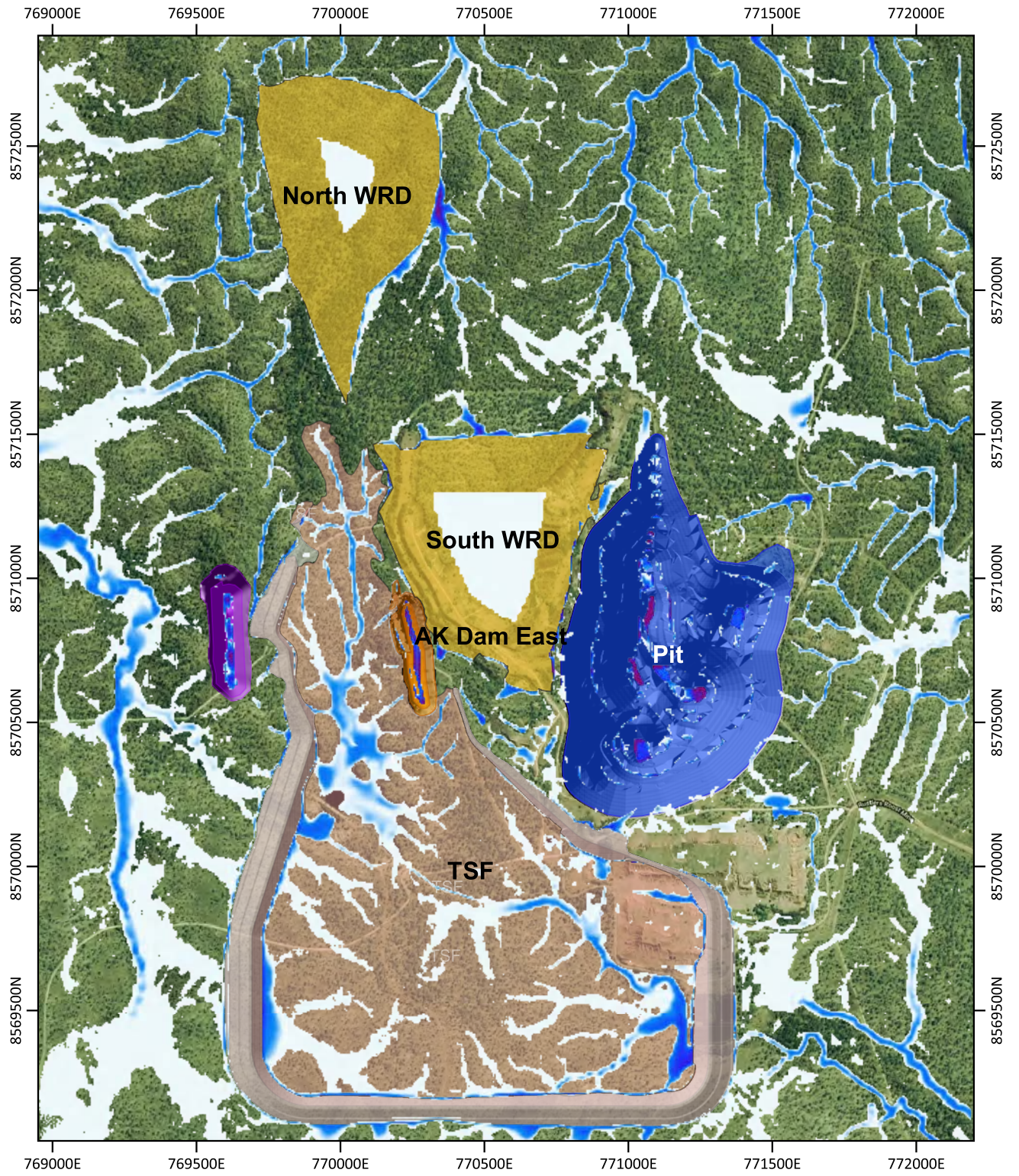
Pre-mining



Post-mining



Above. 20% AEP flood hazard.



Above. 20% AEP flood inundation.

Legend

Proposed Infrastructure

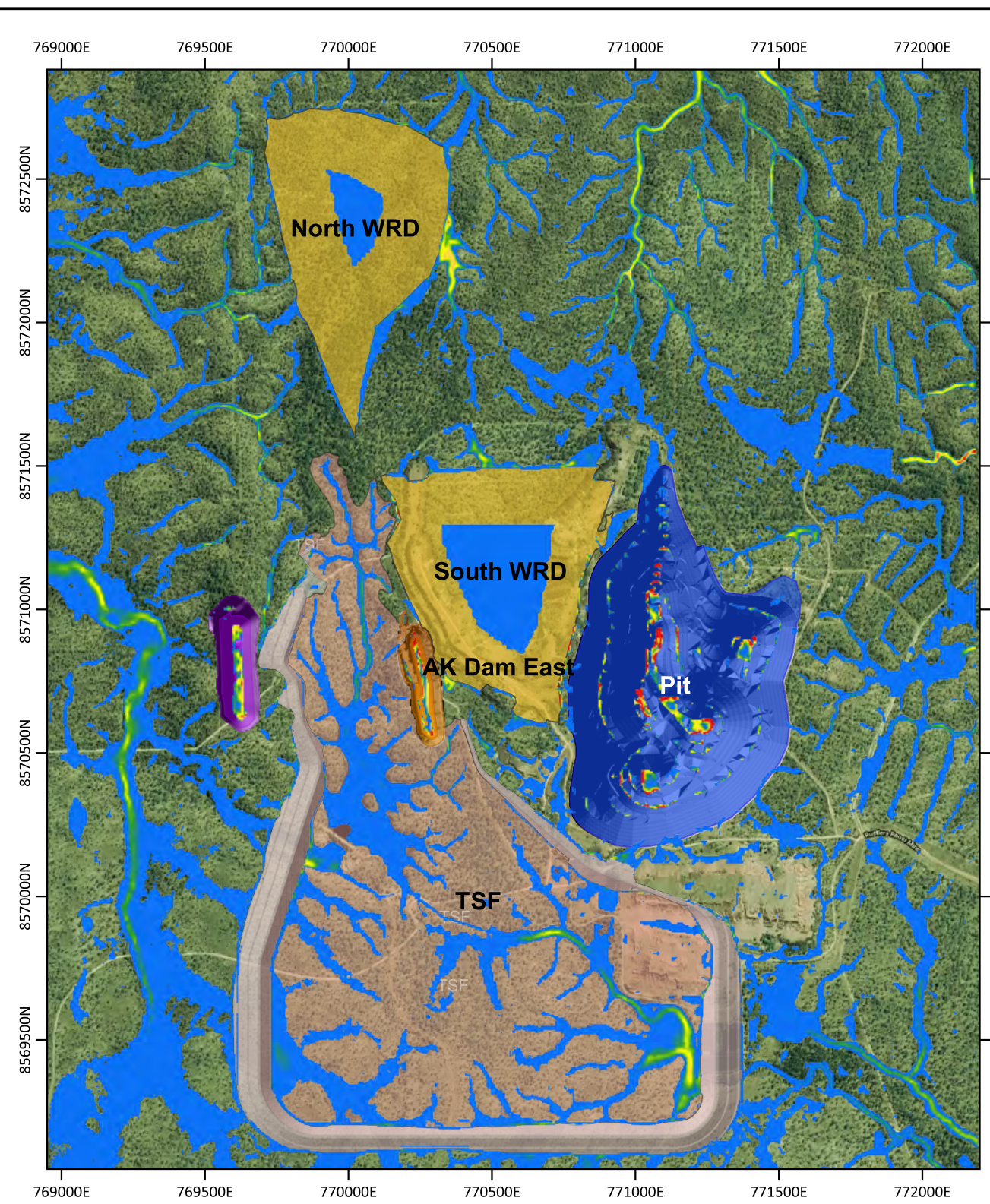
- WRD
- Annie Okley Pit
- AK Dam East
- Pit 1 final
- Proposed Tailing Storage Facility

Flood Inundation (m)

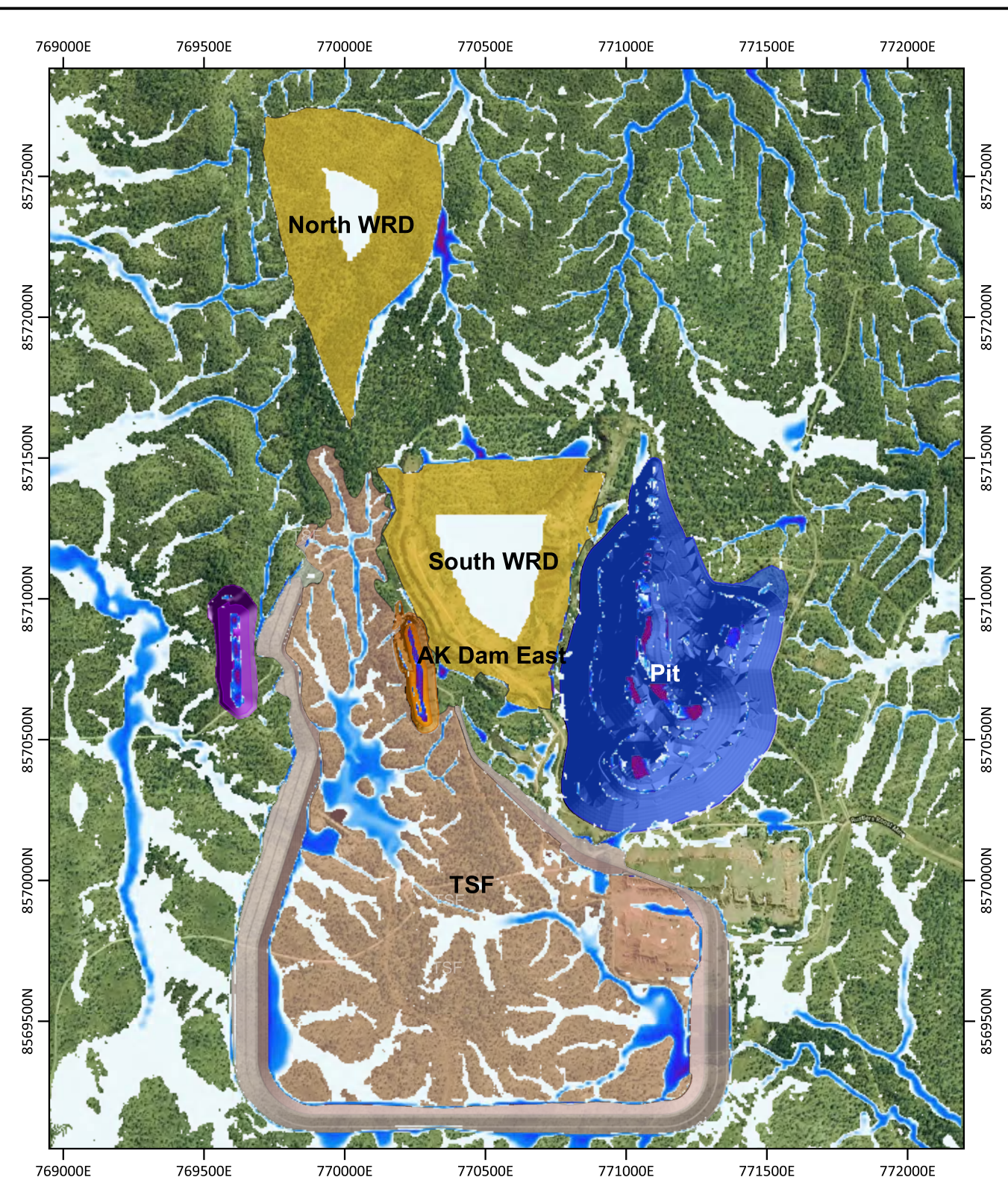
- 0.2
- 0.5
- 1.12
- 1.96
- 3

Flood Hazard (m^2s^{-1})

- <math><0.2</math>
- 0.2-0.5
- 0.5-1
- 1.0-2.0
- >2.0



Above. 1% AEP flood hazard.



Above. 1% AEP flood inundation.

Legend

Proposed Infrastructure

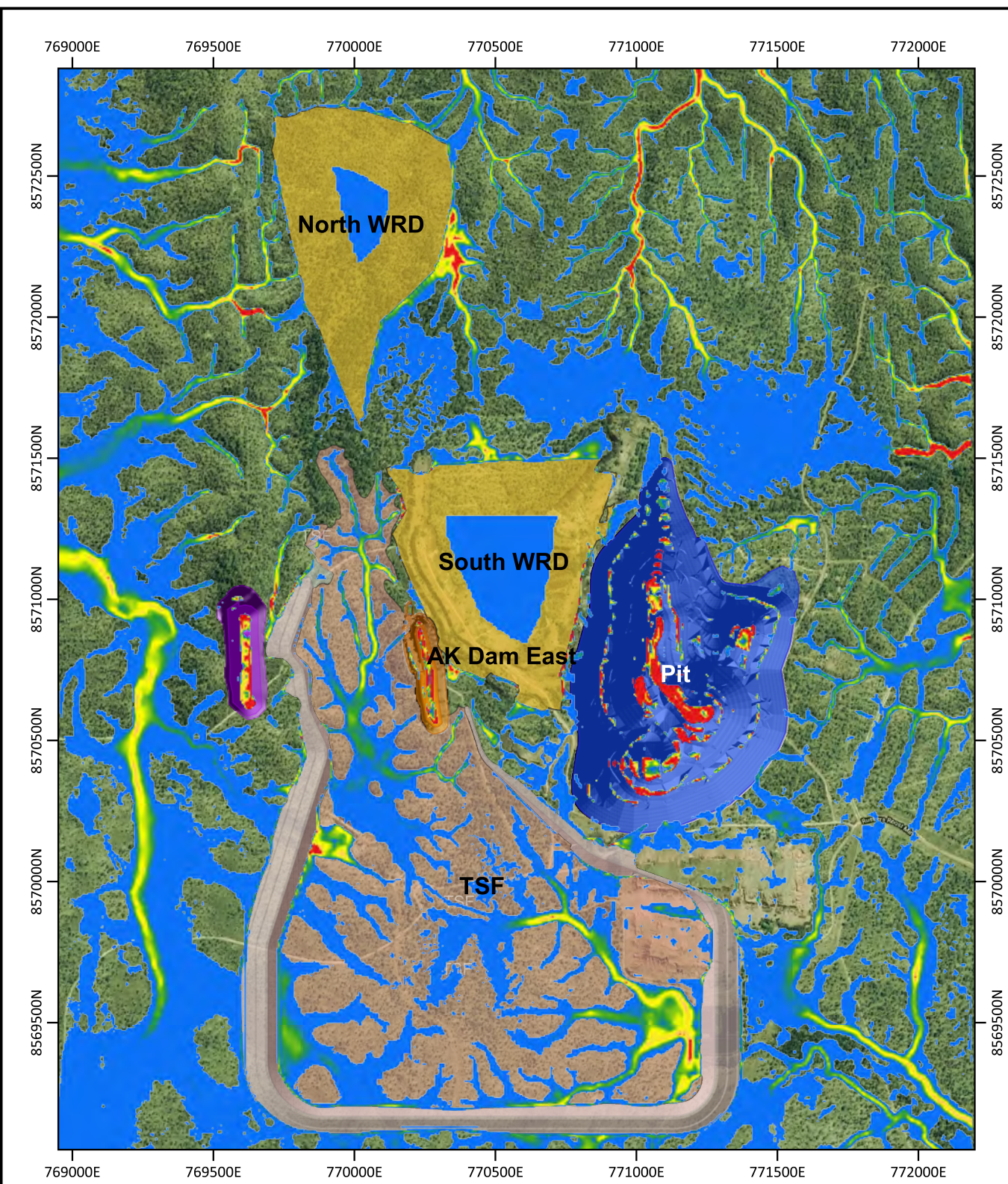
- WRD
- Annie Okley Pit
- AK Dam East
- Pit 1 final
- Proposed Tailing Storage Facility

Flood Inundation (m)

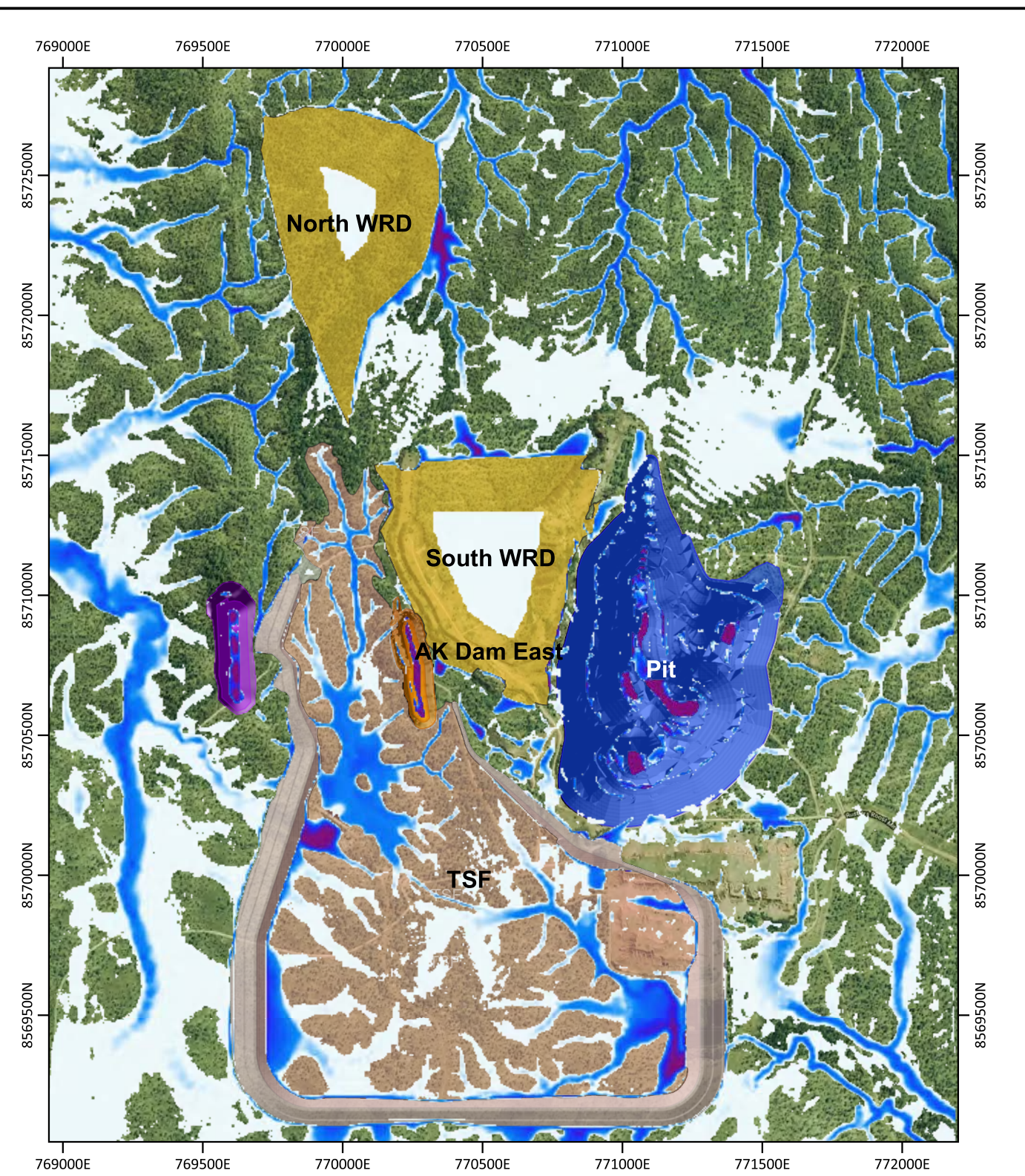
- 0.2
- 0.5
- 1.12
- 1.96
- 3

Flood Hazard (m^2s^{-1})

- <math><0.2</math>
- 0.2-0.5
- 0.5-1
- 1.0-2.0
- >2.0



Above. 0.1% AEP flood hazard.



Above. 0.1% AEP flood inundation.

Legend

Proposed Infrastructure

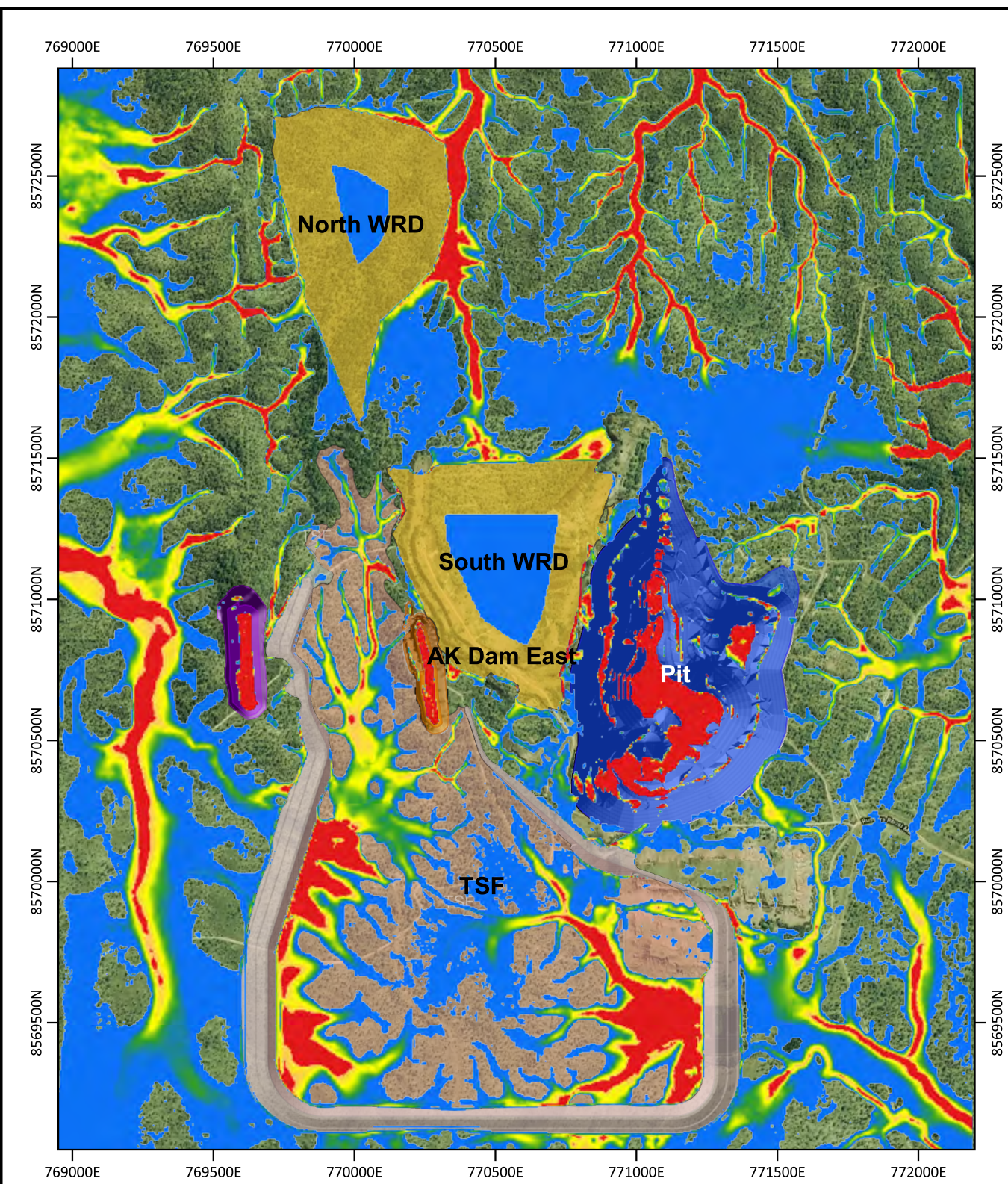
- WRD
- Annie Okley Pit
- AK Dam East
- Pit 1 final
- Proposed Tailing Storage Facility

Flood Inundation (m)

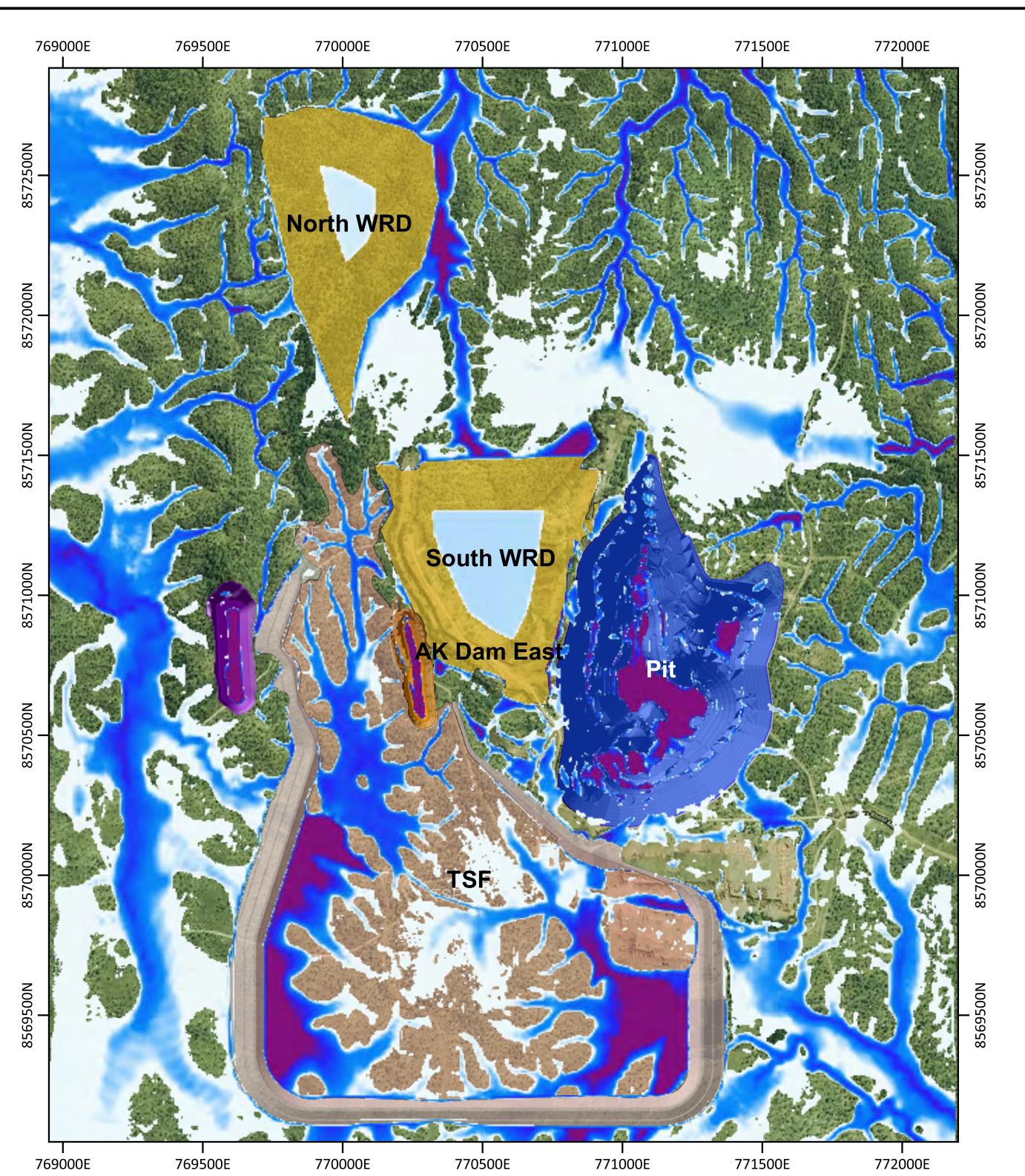
- 0.2
- 0.5
- 1.12
- 1.96
- 3

Flood Hazard (m^2s^{-1})

- <math><0.2</math>
- 0.2-0.5
- 0.5-1
- 1.0-2.0
- >2.0



Above. PMP flood hazard.



Above. PMP flood inundation.

Legend

Proposed Infrastructure

- WRD
- Annie Okley Pit
- AK Dam East
- Pit 1 final
- Proposed Tailing Storage Facility

Flood Inundation (m)

- 0.2
- 0.5
- 1.12
- 1.96
- 3

Flood Hazard (m^2s^{-1})

- <0.2
- 0.2-0.5
- 0.5-1
- 1.0-2.0
- >2.0