Your ref: 999859517-10396
Our ref: 12644380

04 February 2024

Oceana Gold NZ Ltd
22 MacLaggan Street
Dunedin

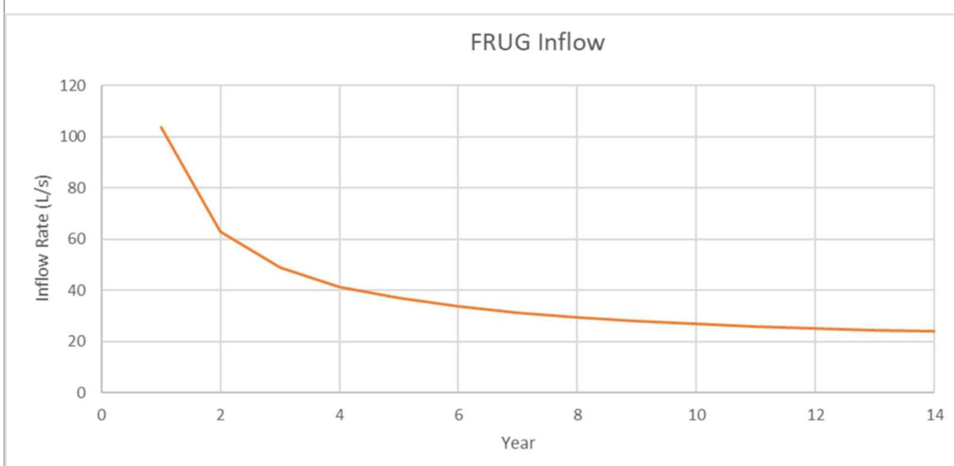
Response to Request for Further Information – Macraes Phase IV

To whom it may concern,

GHD provides this letter in response to Otago Regional Council's request for further information letter under Section 92(1) of the Resource Management Act for consent application number RM.24.184 (Dated 09 December 2024).

We provide our response to selected questions pertaining to GHDs work scope in *Table 1*.

Table 1 Response to RFI

Item	Question / Response
4.2	**What happens to model results if existing areas of high groundwater sulphate concentrations are used as initial concentrations in the model?**
	The groundwater model assumes that all structures are fully constructed, and sulphate concentrations are applied based on the full surface areas of the relevant mine elements at mine closure. The model is then run over a 400- year period. This simplified approach ignores earlier-built structures (i.e. waste rock stacks, tailings storage facilities and open pits) and any pre-existing seepage or transport before mine closure. Given the low rate of contaminant plume movement in groundwater, the small zone of influence modelled in the long-term scenario, and the timeframe modelled (400 years); the exclusion of existing groundwater conditions (from existing structures pre-closure) is unlikely to have a significant influence on modelled groundwater concentrations over the modelled period. Minor differences in sulphate concentrations relatively shortly (i.e. ~ 20 years) after mine closure are probable, however the modelled mass flux discharge is predicted to be relatively small in this timeframe and the staging of the inclusion of contaminant sources within the groundwater modelling process (which would add significant complexity into the groundwater model) was not considered necessary. Furthermore, mitigation measures (i.e. WRS rehabilitation, Passive Treatment Systems, Controlled Discharge and/or pumping) where present, are compared to the long term predicted contaminant flux, in which there would be little difference if the pre-existing elevated groundwater concentrations were taken into account.
4.3	**A transient model was run to compare modelled discharge rates from FRUG to measured rates. What were the findings of this model and how were they incorporated into current modelling?**
	Section 4.2.5 of the 'Macraes Phase IV. Stage 3 – Surface and Groundwater Assessment' describes this process. In summary: -Recorded discharges from FRUG have typically been between 12-14 L/sec (peak of 58 L/sec). -A drain boundary reflecting the dewatered FRUG workings was applied to the transient model. -The modelled inflow rates through this drain boundary area are as Figure 17 in the report (replicated below).  As the modelled inflow (ca. 23 L/sec from around year 12) is in general agreement with the measured dewatering rates, the model was judged to be a fair representation of actual conditions and a fair representation of groundwater movement in the area. It should be noted that the FRUG element within the groundwater model is represented by applying a drain boundary to an area that represents the extent and depth of the underground mine. The complex network of openings that comprises FRUG are not replicated within the groundwater model. As the purpose of the

	groundwater model is to represent site wide groundwater and contaminant movement, the simplistic representation utilised is considered appropriate.
4.6	**It seems that a uniform recharge rate of 29.2 mm/year has been applied across the GHD groundwater model. In the process of generating MWM (2024) BRWRS model, it was found that the recharge rate in the FWWRS was 74 mm/year. This will make a big difference to predicted loads for contaminants. What is the effect of this higher seepage rate through waste rock stacks on cumulative effects?**
	WRS infiltration rates are used in the surface water modelling during the mining phase and rates above 29.2 mm/yr are reflective of infiltration into the unrehabilitated waste rock dumps and are not reflective of recharge to groundwater (via the undisturbed/underlying schist). Seepage into the groundwater table underlying these structures is controlled by drainage features and the pre-WRS topography (which allow capture of seepage in collection sumps) as well as the low hydraulic conductivity of the in-situ schist material. The groundwater model applies a constant recharge of 29.2 mm/year across all surfaces as this value has generally provided the best calibration against observed groundwater levels. A short-term (relative to the model run time scale) increase in this value (i.e. associated with the unrehabilitated WRSs during the mining phase) is not expected to result in a significant increase in infiltration to the underlying shist, and hence, development of a more extensive or more concentrated groundwater plume, therefore short-term cumulative effects would be primarily observed as toe seeps from the WRS to silt ponds. In terms of the BRWRS, the modelling results provided (in GHD, 2024. Back Road WRS Assessment, Surface water quality modelling 9 October 2024) are for the closure and long-term phases only due to the uncertainty in timing for construction of the BRWRS. It is assumed (as with the original MPIV surface water assessment (in GHD, 2024. Macraes Phase IV, Stage 3 – Surface and Groundwater Assessment 26 March 2024) that infiltration rates into rehabilitated WRSs will revert to 29.2 mm/year reflective of the global infiltration rate once rehabilitation efforts are complete. During the mining phase, higher short term infiltration rates into the unrehabilitated WRSs are expected. In terms of answering the question 'What is the effect of this higher seepage rate through waste rock stacks on cumulative effects?'; we note, long term / post closure results will not change providing the WRSs are appropriately rehabilitated. During the mining phase, due to the higher infiltration rate of the operating WRS, a greater flux of contaminants is likely to be observed in toe seeps sourced from the BRWRS (as is currently observed in other active WRSs and as stated above, are taken into account in the Surface Water Modelling undertaken). These toe seeps are modelled as being directed towards silt ponds by the underlying topology, particularly for the higher concentration seep water from deeper sections of the WRSs. This increased flux (of contaminants) could be managed during the operational phase via alternative construction methodologies, staging of the construction of the BRWRS and/or appropriate surface water management (i.e. dilution from Camp Creek Dam or alternative source, detention in a sump and controlled release).
4.7	**Given the many assumptions and limitations within the groundwater and surface water models, what specific monitoring and analysis do you recommend to review validate the model outputs during mine operation and in what timeframes?**
	- Groundwater monitoring well installation within the modelled contaminant plume extent. This will aid in improving the understanding of contaminant mobilisation and transport within the underlying aquifer, assist in future model calibration and confirm the envelope of assessed effects. Appendix C illustrates the modelled contaminant plume in relation to the existing monitoring groundwater wells. Areas in which there is insufficient coverage (based on the modelled contaminant plume) are located down hydraulic gradient of the existing Frasers WRS and the proposed Frasers TSF, and to the south of Deepdell Creek in the vicinity of the proposed BRWRS. - Flow and water quality monitoring at locations targeting specific seepage discharges to better confirm site specific contributions and enable targeted mitigation. This should be undertaken at any existing discrete and cumulative seep locations. Toe construction of future WRSs should allow for seepage flows to be captured at discrete / cumulative locations for monitoring (i.e. a pipe capturing seepage flows that concentrate at WRS toes in valleys, prior to mixing with surface water runoff). Flow and water quality monitoring should commence as soon as reasonably practicable following WRS construction.

	- Continuous flow monitoring within the North Branch Waikouaiti River (NBWR), Deepdell Creek and Mare Burn below the mine site. - Continuous electrical conductivity monitoring in the North Branch Waikouaiti River, Deepdell Creek and Mare Burn catchments to better understand the current range and distribution of water quality parameters within these surface water bodies and catchments. - A control site for background water quality monitoring within the NBWR be investigated. It is recommended that these measures should be implemented as soon as practicable.
4.10	**It is difficult to have any certainty that the available groundwater data is representative as the catchments are not presented for all of the locations relative to monitoring bores and activities, and the screen elevations are not documented within any of the assessments. How representative is water quality data available for the model in terms of existing groundwater within each catchment? Can a conceptual model or GIS layers be provided that presents the available monitoring locations and screen elevations relative to activity elevations and catchments?**
	The screen information for groundwater monitoring wells (where known and where assumed) are provided in Appendix B with screen depths varying between shallow (surface) to deep (ca. 100 m) at various locations throughout and surrounding the site. The locations of these monitoring wells screened in the moderately weathered schist (layer 6 of the model – in which the maximum modelled extent of the groundwater sulphate plume is located) are depicted in Appendix C. Layer 6 incorporates the upper weathered schist layer, is approximately 50 metres thick and is present immediately below modelled layers 1-5 (which represent the top 1-10 m below the in-situ surface and mine impacted materials). The monitoring wells and screen intervals are positioned to intersect: – likely seepage pathways down gradient of site features, – adjacent receiving surface waters where groundwater could discharge to nearby surface waters – and/or are located surrounding the site to understand contaminant mobilisation both vertically and laterally within the groundwater system. The current bores and screen installations are considered suitably located and they cover varying groundwater depths down hydraulic gradient of most site structures where significant contaminant sources and potential mobilisation pathways are present and/or are anticipated. The existing groundwater monitoring wells are grouped generally into the following area/categories: ***Deepdell*** A series of monitoring wells (DDB01 -DDB06) either side of Deepdell Creek are installed between 17 m to 58 m below ground surface. No screen information on these monitoring wells is available, however it is assumed (based on the screen levels of the other monitoring wells) that they are screened at the base. These monitoring wells detect groundwater seepage from the Golden Point / Round Hill / MTI / SP11 area to the south and the Deepdell North and South mining areas to the North prior to discharge to Deepdell Creek. Furthermore, a cluster of monitoring wells are located down hydraulic gradient of the MTI and intersect groundwater in the inferred seepage pathway between ca. 7 and 17 m deep (GW18, GW19, GW20 and GW21) and 18 and 26 m deep (GW22, GW23, GW24 and GW25). ***North Branch Waikouaiti*** A series of monitoring wells (FDB01-FDB10) are located between the rim of Frasers Pit and the upper headwaters of the North Branch Waikouaiti River. These wells are screened between surface and 10 metres below ground level and intersect seepage pathways draining to the receiving surface water environment with the aim of detecting contaminant mobilisation from the Frasers Pit and backfill area. ***TTTSF*** Groundwater monitoring wells TT01 – TT15 are installed at the base of the TTTSF within the underlying bedrock at depths of between 12 to 25 metres below the surface. It is our understanding that they are installed with a 6m screen from the base. These monitoring wells intersect groundwater seepage from the TTTSF within the Tipperary Creek and Cranky Jim's Creek catchment areas. In addition to the above, selected groundwater monitoring wells are present at other locations throughout the site that are screened to intersect groundwater at varying levels within the groundwater table.

5.1	**Please confirm that the only mitigation assumed for the Deepdell Creek in Appendix F to the application and Annexure 4 of the S92 response is flow augmentation from the Camp Creek Dam? Figures 40 and similar in Appendix F refer to mitigation + flow augmentation. However, based on Section 5.11.2 of Appendix F, the listed mitigations and the water balance model schematic, the flow augmentation is the entirety of the mitigation.**
	The scenario includes Camp Creek dilution as the primary additional mitigation method for the Deepdell Creek catchment. There are other mitigating features within the Deepdell Creek catchment that are existing commitments and not new to this consent application. The following measures are included in the modelling undertaken and presented: • the continued collection of underdrain seepage waters from the MTI and SP11 tailings facilities, • re-establishment of ground cover on exposed surfaces, • the backfilled Golden Point Pit, and Northern Gully WRSs within the Battery Creek and Maori Tommy Silt Ponds (these silt ponds will be retained post closure such that during dry periods there is some level of evaporation from the ponds, reducing the volume of seepage waters discharging to the receiving environment and limiting overflows during low flow periods). • long-term control of the historic Golden Point Adit, by concrete plugging or a similar sealing method to effectively control groundwater flows from the Golden Point Pit void to Deepdell Creek. The scenario naming convention ("Mitigation + Flow Augmentation") aligns with the same model runs and scenarios applied in the North Branch Waikouaiti River outputs where additional mitigation measures were represented.
5.3	**In relation to Appendix D of Annexure 4 of the S92 response please provide:** **a. Versions of Table 9-11 without the selected mitigations applied.** **b. An indication of the extent to which the current proposal contributes to increased 'closure' and 'long term' contaminant concentrations in the absence of mitigations (i.e., are predicted concentrations different from what would be expected with just the implementation of existing consents?).** **c. Comment on whether the proportional change between the modelled 'mining' concentrations and the 'closure' and 'long-term' concentrations can be applied to the measured current state to provide a better indication of concentrations during those phases for those contaminants where the modelled 'mining' concentrations do not adequately reflect measured current state data.** **For example, the 'long term' modelled maximum copper concentrations at NB03 are 2.0 times higher than the modelled maximum 'mining' concentration. Applying the proportional difference between those values to the measured current maximum of 0.005 mg/L results in a long-term maximum concentration of 0.01 mg/L, twice as high as what is predicted by the model.** **The reason for this is request is that under 5.2 of Annexure 4 of the S92 response it is stated that "*'current' data can be considered to have a comparable basis to the 'mining phase' data*". However, there are cases where the measured current concentration far exceeds the equivalent modelled 'mining' concentration presented in Appendix D (e.g. maximum copper concentrations), suggesting the modelled concentrations may be underestimating the adverse effects of the proposal.**
	a. These are provided in Appendix A (Tables 2-4). These results include the collection of seepage within Murphys silt pond and the return pumping of this water to Frasers Pit during the mining phase (as this mitigation is currently in place). Table 6 presents the percentage change (in predicted contaminant concentrations) between the MPIV non mitigation scenario versus a mitigated scenario. In general, the mitigation scenario shows significant improvement in the water quality predictions with large percentage reductions modelled for most contaminants of concern. b. Additional contaminant flux discharging to the Waikouaiti River North Branch (NBWR) from the proposed Macraes PhIV development is modelled to be sourced from the components listed below. The extent to which these components contribute to increased contaminant concentrations has been assessed by removing the MPIV specific components within the MPIV model run. Results of this pre MPIV scenario for NB03 are provided in Appendix A (Table 5) which is a direct comparison to the no- mitigated MPIV scenario for NB03 provided in Appendix A (Table 4).

Table 6 presents the percentage change (in predicted contaminant concentration) between the MPIV non mitigated scenario versus the pre MPIV non-mitigated scenario. In general, MPIV results in a decrease in contaminant concentrations during the mining phase relative to a pre MPIV scenario. This is primarily associated with the dewatering of the Golden Bar Pit and the removal of the Golden Bar Pit Lake spill water in the MPIV scenario. Relative increases in modelled sulphate, Nitrate-N, Arsenic, Lead and Zinc are then noted in the closure and long-term phases.

The observed changes are a result of:

- The associated Golden Bar WRS extension proposed for Golden Bar Stage 2 Pit extension is modelled to provide additional contaminant flux to the Clydesdale Creek which flows via the Murphys Creek to the NBWR.
- Overflow from the Golden Bar Pit Lake into Golden Bar Creek provides additional contaminant flux in the post closure period. The predicted sulphate concentrations within Golden Bar Pit are expected to increase from the current Stage 1 development (~ 270 mg/L) to ~ 370 mg/L during the Stage 2 development.
- FRIM pit lake water levels above 487 m RL will potentially result in increased seepage through to Murphys Silt Pond (as a result of pit water seeping through the Frasers South WRS). A similar effect will also likely occur in the already consented Frasers Pit Lake however the loading from the consented and/or the proposed MPIV pit lake through this pathway has not been quantified to date. Water (and mass loading) draining along this pathway is assumed to be captured in the Murphys Silt Pond and is pumped back to FRIM during the mining phase. Post closure, it is proposed the silt pond will be converted to a sump with controlled discharge during elevated flows. Additional loading to Murphys Creek will be captured within this sump (after treatment in the passive treatment system) which will have the ability to pump or cart water back to Frasers Pit if necessary. Therefore no net effect on discharge volumes and/or contaminant flux through this pathway to the receiving environment is modelled.

c. No, that is not a valid approach. Please refer to the response to the last part of this question below for context.

The mitigated mining scenario data (as per Appendix D of Annexure 4 of the S92 response) can be considered to have a comparable basis to current data in ‘some cases’ but they are not the same due to:

- The actual sample numbers are limited so the statistical spread of current data is generally not as wide as the modelled data.
- The ‘current’ statistics presented are significantly influenced by lower detection limits for some constituents.
- The operation of Murphys Creek Silt Pond and return pumping of seepage to Frasers Pit is considered constant in the modelling run but it is understood that there have been periods of this not being effectively operating. The current dataset (May 2020 – May 2024) is a reflection of this.
- The current dataset does not include any (apart from the Murphys Creek Silt Pond) of the mitigation measures applied to the modelling run presented.

The unmitigated mining scenario (presented in Appendix A) is considered more comparable with actual data, however differences are still present due to:

- The actual sample numbers are limited so the statistical spread of current data is generally not as wide as the modelled data.
- The ‘current’ statistics presented are significantly influenced by lower detection limits for some constituents.
- The operation of Murphy’s Creek Silt Pond and return pumping of seepage to Frasers Pit is considered constant in the modelling run but it is understood that there have been significant periods of this not been operational. The current dataset (May 2020 – May 2024) is a reflection of this.

Modelled results for NB03 are considered more accurate compared to MC02 and NBWRRF. During calibration (of the WBM), a greater focus was placed on NB03 due to the greater availability of water quality data, the more stringent compliance limits applicable to NB03, and the lower reliance on discrepancies in the smaller upper natural and mine impacted catchment areas within the headwaters of the NBWR.

Limitations Statement

This report: has been prepared by GHD for Oceana Gold NZ Ltd and may only be used and relied on by Oceana Gold NZ Ltd for the purpose agreed between GHD and Oceana Gold NZ Ltd.

GHD otherwise disclaims responsibility to any person other than Oceana Gold NZ Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Oceana Gold NZ Ltd and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.
Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

Project name	Macraes PhIV Post Lodgement						
Document title	Response to Request for Further Information – Macraes Phase IV | Section 92 Responses – Surface and Ground Water						
Project number	12644380						
File name	12644380-GHD-LET-REVB_MPIV Post Lodgement S92 Responses.docx						
Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S4	Rev0	Jeff Tuck / Dora Avanidou	Tim Mulliner		Tim Mulliner		04/02/2025
[Status code]							
[Status code]							
[Status code]							
[Status code]							

GHD Limited
Contact: Jeff Tuck, Water Engineer | GHD
138 Victoria Street, Level 3
Christchurch Central, Canterbury 8013, New Zealand
T +64 3 378 0900 | **F** +64 3 377 8575 | **E** chcmail@ghd.com | **ghd.com**

Appendices

Appendix A

NBWR Water Quality Results

Table 2 Predicted Water Quality Statistics for NBWRRF (No Mitigation)

Constituent	Statistic	Phase (g/m^3)			Current (May 2020 - May 2024)
		Mining	Closure	Long Term	
Sulphate	Median	260	140	160	112
	95th %	1240	820	790	508
	Maximum	3150	2110	2030	880
Nitrate-N	Median	0.61	0.4	0.42	0.00
	95th %	2.5	1.7	1.6	0.13
	Maximum	6	4.1	3.9	0.53
Ammoniacal-N	Median	0.015	0.013	0.013	0.01
	95th %	0.033	0.025	0.024	0.03
	Maximum	0.071	0.049	0.048	0.23
Arsenic	Median	0.0028	0.0028	0.0027	0.002
	95th %	0.0034	0.0034	0.0034	0.008
	Maximum	0.0046	0.005	0.0052	0.199
Copper	Median	0.0013	0.0012	0.0012	0.0005
	95th %	0.0026	0.002	0.002	0.0011
	Maximum	0.005	0.0037	0.0036	0.0050
Iron	Median	0.18	0.19	0.19	0.21
	95th %	0.23	0.24	0.23	0.50
	Maximum	0.25	0.25	0.26	1.01
Lead	Median	0.00018	0.00017	0.00017	0.0001
	95th %	0.00026	0.00022	0.00022	0.0001
	Maximum	0.00044	0.00034	0.00033	0.0010
Zinc	Median	0.0027	0.0021	0.0022	0.001
	95th %	0.0074	0.0054	0.0052	0.004
	Maximum	0.017	0.012	0.011	0.010

Table 3 Predicted Water Quality Statistics for MC02 (No Mitigation)

Constituent	Statistic	Phase (g/m³)			Current (May 2020 - May 2024)
		Mining	Closure	Long Term	
Sulphate	Median	59	60	72	186
	95th %	190	190	230	1236
	Maximum	420	480	450	1320
Nitrate-N	Median	0.35	0.36	0.39	0.31
	95th %	0.91	0.93	0.97	0.96
	Maximum	1.9	2.2	1.8	1.24
Ammoniacal-N	Median	0.014	0.012	0.013	0.01
	95th %	0.022	0.021	0.023	0.02
	Maximum	0.035	0.042	0.038	0.10
Arsenic	Median	0.0027	0.0027	0.0049	0.002
	95th %	0.003	0.003	0.014	0.005
	Maximum	0.0038	0.004	0.026	0.010
Copper	Median	0.0010	0.0010	0.0010	0.0006
	95th %	0.0011	0.0011	0.0011	0.0042
	Maximum	0.0012	0.0012	0.0012	0.0350
Iron	Median	0.19	0.19	0.19	0.11
	95th %	0.22	0.22	0.22	0.23
	Maximum	0.23	0.24	0.24	0.24
Lead	Median	0.00016	0.00016	0.00017	0.0001
	95th %	0.00019	0.0002	0.0002	0.0008
	Maximum	0.00026	0.00026	0.00025	0.0016
Zinc	Median	0.0021	0.0021	0.0022	0.001
	95th %	0.0037	0.0038	0.004	0.005
	Maximum	0.0068	0.0074	0.0067	0.010

Table 4 Predicted Water Quality Statistics for NB03 (No Mitigation)

Constituent	Statistic	Phase (g/m³)			Current (May 2020 - May 2024)
		Mining	Closure	Long Term	
Sulphate	Median	93	130	150	73
	95th %	460	760	750	280
	Maximum	1720	2090	2120	340
Nitrate-N	Median	0.29	0.38	0.4	0.00
	95th %	0.94	1.5	1.5	0.19
	Maximum	3.2	4.0	4.0	0.78
Ammoniacal-N	Median	0.012	0.011	0.011	0.01
	95th %	0.02	0.015	0.015	0.02
	Maximum	0.046	0.026	0.024	0.04
Arsenic	Median	0.0029	0.0027	0.0039	0.002
	95th %	0.0089	0.003	0.0081	0.009
	Maximum	0.028	0.0039	0.018	0.012
Copper	Median	0.0011	0.0011	0.0011	0.0005
	95th %	0.0015	0.0015	0.0015	0.0012
	Maximum	0.003	0.0024	0.0023	0.0050
Iron	Median	0.19	0.19	0.19	0.09
	95th %	0.21	0.22	0.21	0.23
	Maximum	0.23	0.24	0.24	0.30
Lead	Median	0.00016	0.00017	0.00016	0.0001
	95th %	0.0002	0.00022	0.00022	0.0001
	Maximum	0.00032	0.00035	0.00034	0.0010
Zinc	Median	0.002	0.0021	0.0022	0.001
	95th %	0.0043	0.0052	0.0052	0.003
	Maximum	0.011	0.012	0.012	0.010

Table 5 ***Predicted Water Quality Statistics for NB03 (No Mitigation) Pre MPIV Modelled Scenario***

Constituent	Statistic	Phase (g/m³)			Current (May 2020 - May 2024)
		Mining	Closure	Long Term	
Sulphate	Median	110	130	140	73
	95th %	630	730	730	280
	Maximum	1880	2070	2120	340
Nitrate-N	Median	0.33	0.37	0.39	0.00
	95th %	1.3	1.5	1.5	0.19
	Maximum	3.6	4.0	4.1	0.78
Ammoniacal-N	Median	0.011	0.011	0.011	0.01
	95th %	0.018	0.015	0.015	0.02
	Maximum	0.043	0.027	0.024	0.04
Arsenic	Median	0.0033	0.0033	0.0034	0.002
	95th %	0.0077	0.0069	0.0075	0.009
	Maximum	0.023	0.037	0.026	0.012
Copper	Median	0.0011	0.0011	0.0011	0.0005
	95th %	0.0016	0.0015	0.0015	0.0012
	Maximum	0.0033	0.0024	0.0022	0.0050
Iron	Median	0.19	0.19	0.19	0.09
	95th %	0.21	0.22	0.22	0.23
	Maximum	0.23	0.24	0.24	0.30
Lead	Median	0.00016	0.00016	0.00016	0.0001
	95th %	0.00021	0.00021	0.00021	0.0001
	Maximum	0.00033	0.00033	0.00033	0.0010
Zinc	Median	0.0021	0.002	0.0021	0.001
	95th %	0.0047	0.0048	0.0048	0.003
	Maximum	0.012	0.011	0.011	0.010

Table 6 Predicted Water Quality Statistics for NB03 (Difference (%) between MPIV Modelled Scenarios and Pre MPIV Scenarios)

Constituent	Statistic	MPIV Mitigated vs MPIV Non-Mitigated			MPIV Non Mitigation vs Pre MPIV		
		Mining	Closure	Long Term	Mining	Closure	Long Term
Sulphate	Median	-80%	-8%	-20%	-15%	0%	7%
	95th %	-85%	-75%	-75%	-27%	4%	3%
	Maximum	-85%	-85%	-84%	-9%	1%	0%
Nitrate-N	Median	-41%	11%	5%	-12%	3%	3%
	95th %	-71%	-59%	-59%	-28%	0%	0%
	Maximum	-78%	-76%	-76%	-11%	0%	-2%
Ammoniacal-N	Median	-8%	0%	0%	9%	0%	0%
	95th %	-25%	-20%	-20%	11%	0%	0%
	Maximum	-30%	-42%	-33%	7%	-4%	0%
Arsenic	Median	0%	-4%	0%	-12%	-18%	15%
	95th %	9%	-3%	2%	16%	-57%	8%
	Maximum	7%	15%	-6%	22%	-89%	-31%
Copper	Median	-9%	45%	55%	0%	0%	0%
	95th %	-20%	127%	133%	-6%	0%	0%
	Maximum	-20%	100%	109%	-9%	0%	5%
Iron	Median	0%	0%	0%	0%	0%	0%
	95th %	0%	0%	5%	0%	0%	-5%
	Maximum	0%	0%	0%	0%	0%	0%
Lead	Median	-6%	-6%	0%	0%	6%	0%
	95th %	-15%	-18%	-18%	-5%	5%	5%
	Maximum	-41%	-40%	-38%	-3%	6%	3%
Zinc	Median	-20%	5%	5%	-5%	5%	5%
	95th %	-58%	-44%	-42%	-9%	8%	8%
	Maximum	-75%	-67%	-65%	-8%	9%	9%
Table Notes:		A negative value shows an improvement in water quality in the proposed mitigation measures relative to no mitigation.			A negative value shows an improvement in water quality in the proposed MPIV scenario relative to the existing current pre MPIV scenario (both without mitigation measures applied).		

Appendix B

Groundwater Bore Screen Information

Table 7 Groundwater Bore Screen Information

GIS ID	NZTM East	NZTM North	Bore Depth (mBGL)	Screen Top (mBGL)	Screen Bottom (mBGL)	Screen Info	2024 Environmental Monitoring Site (Yes if Description Given)	2024 Land Owner
Control Bore RC	-	-	20	14	20	Assumed	-	-
CP03	1395180.3	4977277.99	-	-	-	-	Surrounding GW	OGNZL
CP04	1395003.81	4976789.73	-	-	-	-	Surrounding GW	OGNZL
DDB01	1397101.15	4975935.42	24	18	24	Assumed	Surrounding GW	OGNZL
DDB02	1397632.55	4976038.45	25	19	25	Assumed	-	-
DDB03	1397073.41	4975143.12	17	11	17	Assumed	Surrounding GW	OGNZL
DDB04	1398153.19	4975565.69	58	52	58	Assumed	Surrounding GW	OGNZL
DDB05	1397660.94	4974934.06	57	51	57	Actual	Surrounding GW	OGNZL
DDB06	1397788.82	4975041.9	45	39	45	Actual	Surrounding GW	OGNZL
FDB01	-	-	10	4	10	Assumed	-	-
FDB02	1400094.26	4969937.66	10	4	10	Assumed	Surrounding GW	OGNZL
FDB03	1399197.51	4970837.99	10	4	10	Assumed	Surrounding GW	OGNZL
FDB04	1399300.83	4970933.02	5	1	5	Assumed	Surrounding GW	OGNZL
FDB05	1399407.79	4971024.61	5	1	5	Assumed	Surrounding GW	OGNZL
FDB06	1399568.8	4971202.7	5	1	5	Assumed	Surrounding GW	OGNZL
FDB07	1399729.81	4971380.78	10	4	10	Assumed	Surrounding GW	OGNZL
FDB08	1399915.24	4971570.19	5	1	5	Assumed	Surrounding GW	OGNZL
FDB09	-	-	10	4	10	Assumed	-	-
FDB10	1400003.38	4971696.63	21	15	21	Assumed	Surrounding GW	OGNZL
FDB11	1400091.7	4969944.29	21	15	21	Assumed	Surrounding GW	OGNZL
FDB13	1401908.04	4969779.32	27	21	27	Assumed	Surrounding GW	OGNZL
FE02	1402665.33	4973508.84	-	-	-	-	Surrounding GW	OGNZL
FE03	1402447.99	4971996.46	-	-	-	-	Surrounding GW	OGNZL
Golden Point Adit	1398664.86	4974900.72	-	-	-	-	Detection Bores	DoC Historic Reserve
GP01	1398507.53	4974482.89	33	27	33	Assumed	Compliance Bores	OGNZL
GW1	1399485.36	4972477.56	22.7	16.7	22.7	Actual	Surrounding GW	OGNZL (Mat O'Connell lease)
GW18	1398033.92	4974333.22	16.6	10.6	16.6	Actual	Compliance Bores	OGNZL
GW19	1398030.88	4974329.01	14.9	8.9	14.9	Actual	Compliance Bores	OGNZL
GW2	1398302.26	4972525.65	20.1	12.1	20.1	Actual	Surrounding GW	Road Reserve or Craig and Erin Howard
GW20	1398026.36	4974323.57	13.5	7.5	13.5	Actual	Compliance Bores	OGNZL
GW21	1398020.51	4974317.88	16	10	16	Actual	Compliance Bores	OGNZL
GW22	1398032.76	4974334.32	26	23	26	Actual	Compliance Bores	OGNZL
GW23	1398030.4	4974329.83	26	23	26	Actual	Compliance Bores	OGNZL
GW24	1398024.95	4974324.59	24	21	24	Actual	Compliance Bores	OGNZL
GW25	1398018.4	4974319.58	26	23	26	Actual	Compliance Bores	OGNZL
GW3	1397819.06	4973213.24	24.9	18.9	24.9	Actual	Compliance Bores	OGNZL
GW30	1398072.4	4973380.92	26	23	26	Actual	Detection Bores	OGNZL
GW31	1398079.14	4973376.72	38	35	38	Actual	Detection Bores	OGNZL
GW32	1398173.26	4973046.87	24	21	24	Actual	Detection Bores	OGNZL
GW33	1398174.04	4973039.43	34	31	34	Actual	Detection Bores	OGNZL
GW38	1398018.98	4972897.4	20.5	17.5	20.5	Actual	Compliance Bores	OGNZL
GW4	1397690.24	4973729.61	20	14	20	Assumed	Surrounding GW	OGNZL
GW43	1398272.1	4974223.68	38	32	38	Actual	Detection Bores	OGNZL
GW46	1398199.23	4974095.81	21	15	21	Assumed	Detection Bores	OGNZL
GW47	1398195.3	4974091.61	21	15	21	Assumed	Detection Bores	OGNZL
GW48	1398192.2	4974086.94	21	15	21	Assumed	Detection Bores	OGNZL
GW49	1398188.88	4974082.65	21	15	21	Assumed	Detection Bores	OGNZL
GW5	-	-	18.5	12.5	18.5	Assumed	-	-
GW50	1398189.19	4974070.85	19	13	19	Assumed	Detection Bores	OGNZL
GW51	1398173.71	4974074.99	21	15	21	Assumed	Detection Bores	OGNZL
GW52	1398144.8	4974094.12	32	26	32	Assumed	Detection Bores	OGNZL
GW53	1398085.75	4974031.29	39	33	39	Actual	Detection Bores	OGNZL
MMCL_HB	1399337.58	4971606.21	10	14	10	Assumed	Surrounding GW	OGNZL
P1	1399298.26	4972484.46	14.4	8.4	14.4	Actual	Compliance Bores	OGNZL (Mat O'Connell lease)
RCH2585	1407027.92	4968253.24	71.2	65.2	71.2	Actual	Surrounding GW	OGNZL
RCH2613	1406457.9	4968376.21	81.3	75.3	81.3	Actual	Surrounding GW	OGNZL
RCH2775	1406841.16	4968564.63	87	81	87	Actual	Surrounding GW	OGNZL
RCH3004	1404012.95	4969720.75	-	24	30	Actual	Surrounding GW	OGNZL
SPB01	-	-	10	4	10	Assumed	-	-
SPB02	-	-	14	14	20	Assumed	-	-
SPMW1	1398509.32	4974744.25	86	80	86	Assumed	Detection Bores	DoC Historic Reserve
SPMW10	1399745.95	4974248.02	86	80	86	Assumed	-	-
SPMW11	1398976.15	4974090.06	62.4	56.4	62.4	Assumed	Detection Bores	OGNZL
SPMW12	1399838.6	4974747.71	86	80	86	Assumed	Detection Bores	OGNZL
SPMW2	1399817.25	4974775.72	52	46	52	Actual	Detection Bores	OGNZL
SPMW3	1400175.97	4972925.62	100	94	100	Assumed	-	-
SPMW4	1400352.87	4973404.85	49.5	43.5	49.5	Assumed	-	-
SPMW5	1398716.39	4974920.14	20	14	20	Assumed	Detection Bores	DoC Historic Reserve
SPMW6	1398946.85	4975142.73	20	14	20	Assumed	Compliance Bores	DoC Historic Reserve
SPMW7	1398826.57	4975022.44	20	14	20	Assumed	Compliance Bores	DoC Historic Reserve
SPMW8	1398516.6	4974737.39	18.5	12.5	18.5	Actual	Compliance Bores	DoC Historic Reserve
TT01	1403912.93	4973751.86	12	6	12	Actual	Compliance Bores	OGNZL
TT02	1403895.18	4973763.39	13	7	13	Actual	Compliance Bores	OGNZL
TT03	1403772.6	4974968.19	26.7	20.7	26.7	Actual	Compliance Bores	OGNZL
TT04	1403824.83	4974927.83	21	15	21	Actual	Compliance Bores	OGNZL
TT05	1402964.5	4974845.24	24.5	18.5	24.5	Actual	Detection Bores	OGNZL
TT06	1403249.33	4974724.2	24.5	18.5	24.5	Actual	Detection Bores	OGNZL
TT07	1403478.38	4974502.13	21	15	21	Actual	Detection Bores	OGNZL
TT08	1403632.35	4973931.55	19.2	13.2	19.2	Actual	Detection Bores	OGNZL
TT09	1403686.12	4974025.16	21.2	15.2	21.2	Actual	Detection Bores	OGNZL
TT10	1403769.83	4973875.34	10	4	10	Assumed	Detection Bores	OGNZL
TT11	1403710.98	4973895.88	14.8	8.8	14.8	Actual	Detection Bores	OGNZL
TT12	1403663.12	4973800.75	15	3.5	9.5	Actual	Detection Bores	OGNZL
TT13	1403529.13	4973407.94	24.6	18.6	24.6	Actual	Detection Bores	OGNZL
TT14	1403498.33	4973373.76	13.2	7.2	13.2	Actual	Detection Bores	OGNZL
TT15	1403163.12	4973151.23	17.4	11.4	17.4	Assumed	Detection Bores	OGNZL
Vickery_HB	1398584.57	4971470.8	25	19	25	Assumed	Surrounding GW	Jon Parkins

Appendix C

Groundwater Bores in Relation to Modelled Sulphate Plume

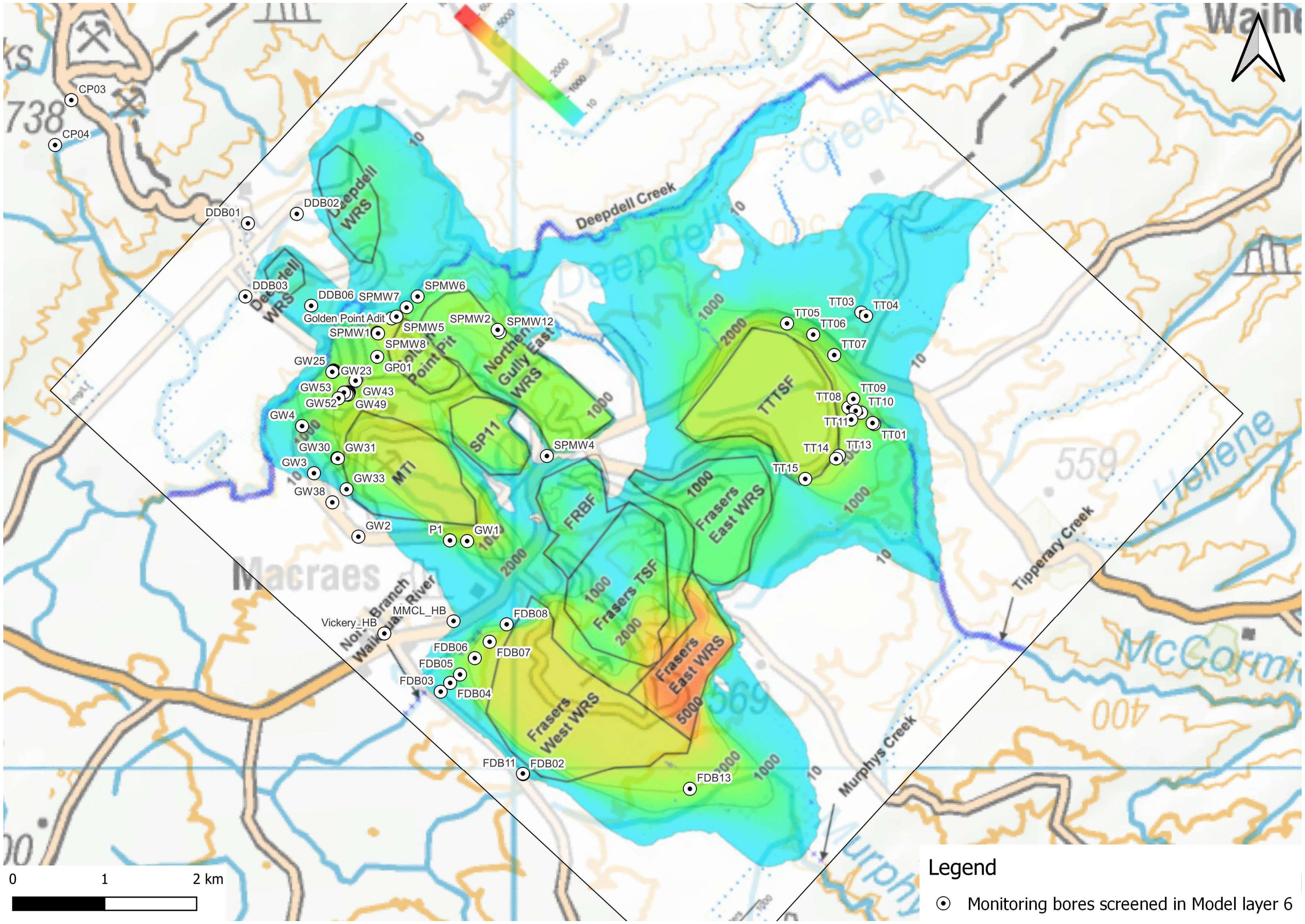


Figure 1 Modelled Sulphate Groundwater Plume (layer 6 of the model) @400 years relative to existing monitoring wells screened within the modelled plume (Overview)

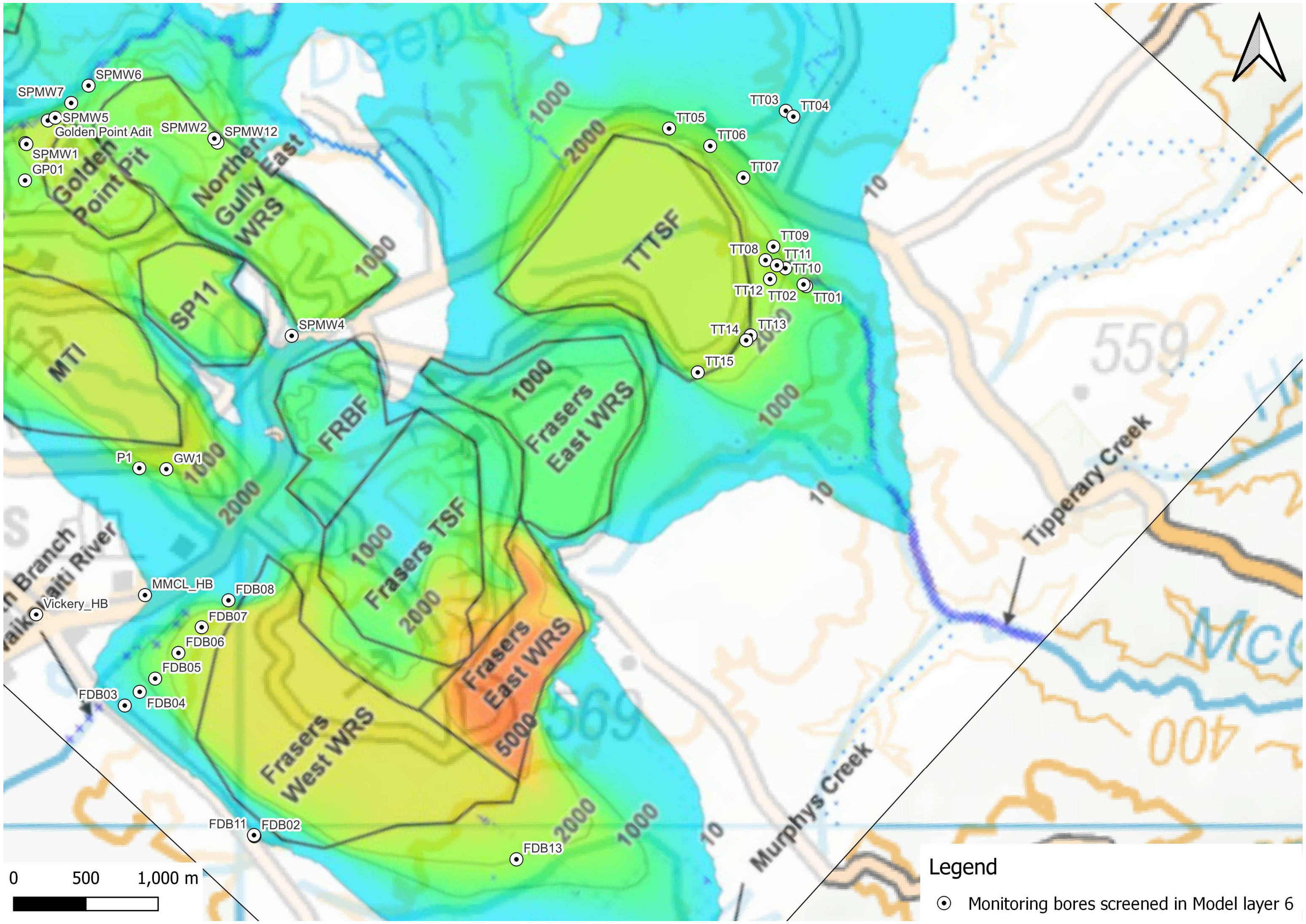


Figure 2 ***Modelled Sulphate Groundwater Plume (layer 6 of the model) @400 years relative to existing monitoring wells screened within the modelled plume (Close up of Frasers and TTTSF Area)***

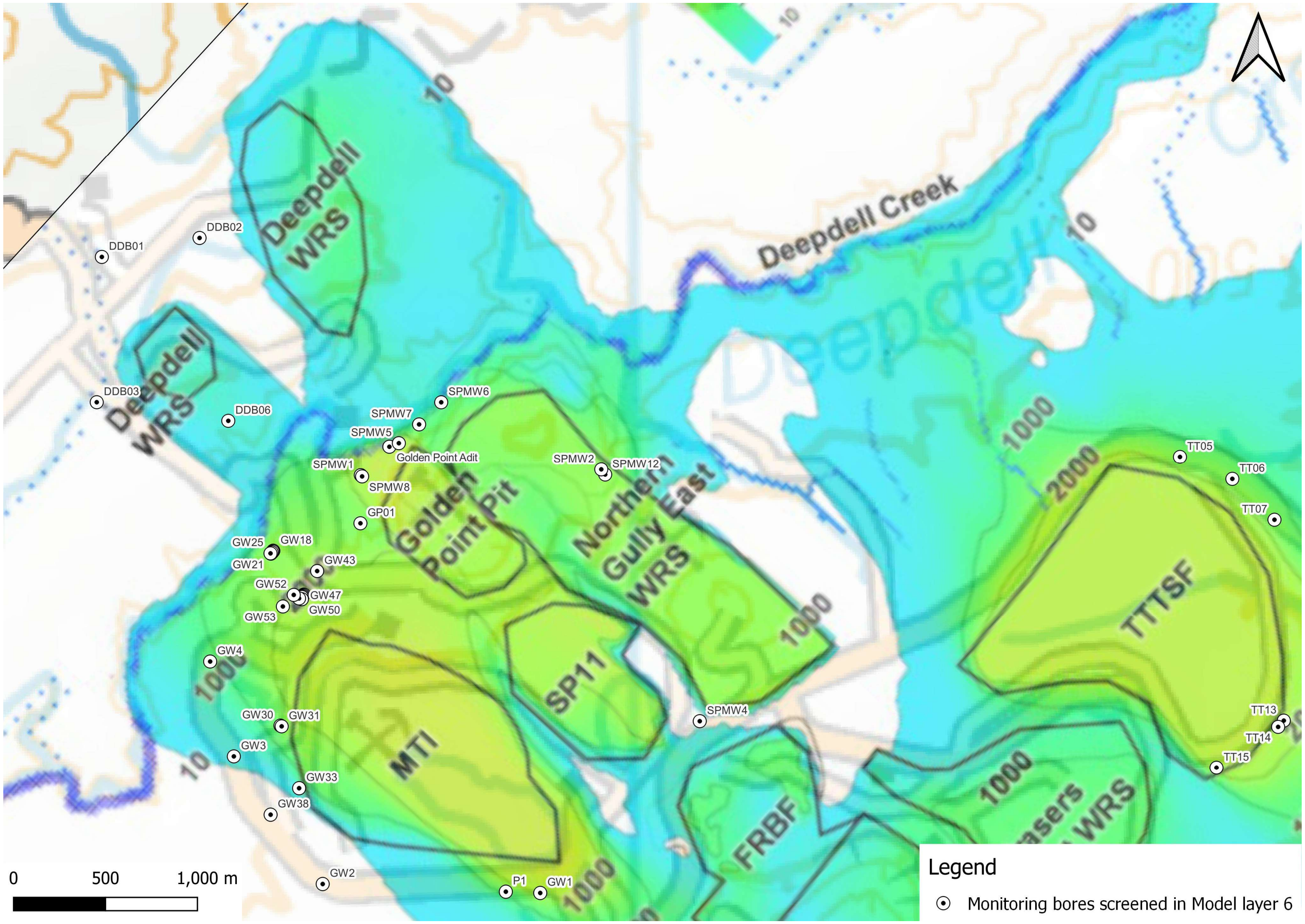


Figure 3 Modelled Sulphate Groundwater Plume (layer 6 of the model) @400 years relative to existing monitoring wells screened within the modelled plume (Close up of Deepdell Area)