APPENDIX T

Groundwater Assessment

8.0 GROUNDWATER CONCEPTUAL MODEL

An initial groundwater conceptual model (Figure 35) was constructed based on the outcome of this investigation and the east-west cross section C' – C' provided by Exxaro. The Exxaro cross sections show a number of smaller, sympathetic faults associated with the two regional faults namely the Daarby and Eenzaamheid Faults. These smaller fault zones make the project area structurally complex and may contribute to the disappearance of portions of the coal measures in the area (Exxaro). The position of the cross sections is shown in Figure 36.

8.1 Aquifer Classification

Based on the drilling results, two aquifer systems are distinguished at Turfvlakte in the Karoo Supergroup namely (section 5.1.3.2):

- Top weathered aquifer system; with an average thickness of ~ 28 m. The average water level is about 24 mbgl which means that the weathered zone is saturated and water-bearing; and
- Fractured secondary aquifer system (~15 m thickness); below the weathered aquifer system and is characterised by secondary fractures resulting in preferential flow paths for the groundwater flow and possible contaminant migration.

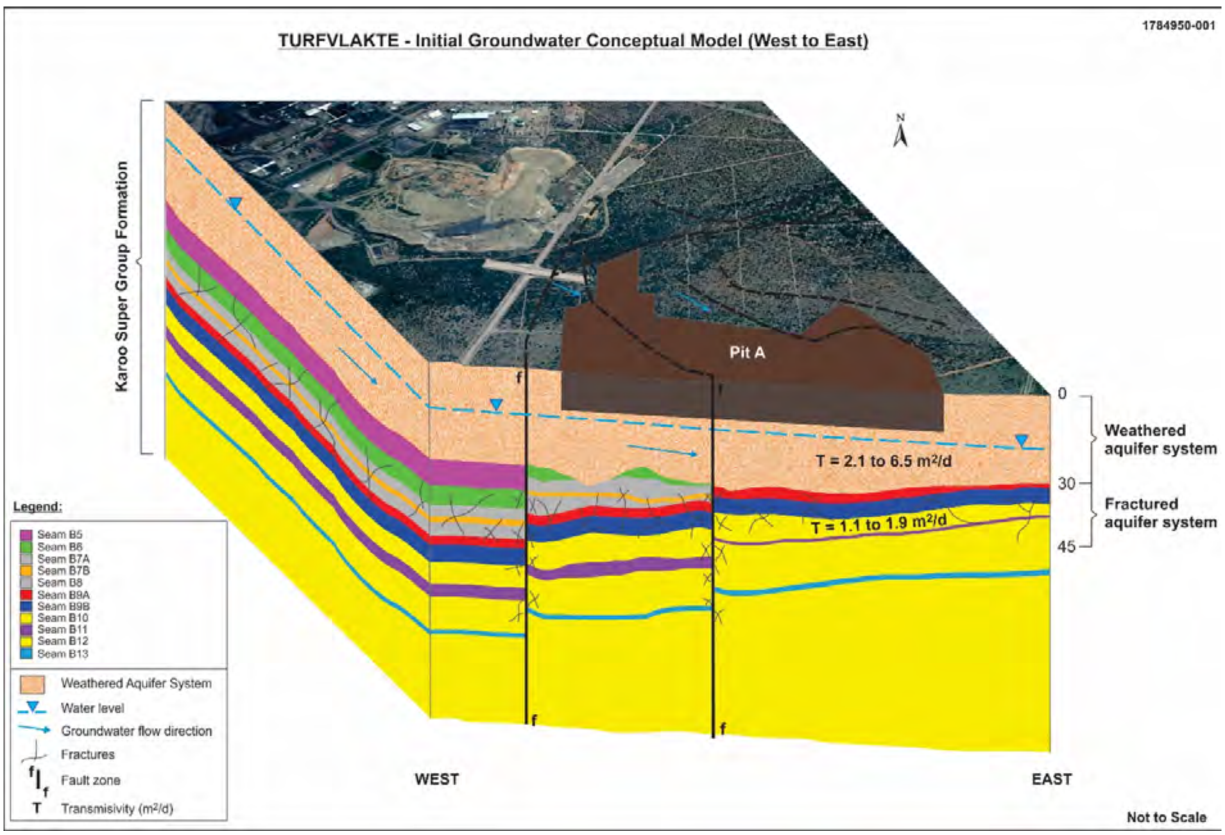

Figure 35: Initial Groundwater Conceptual Model

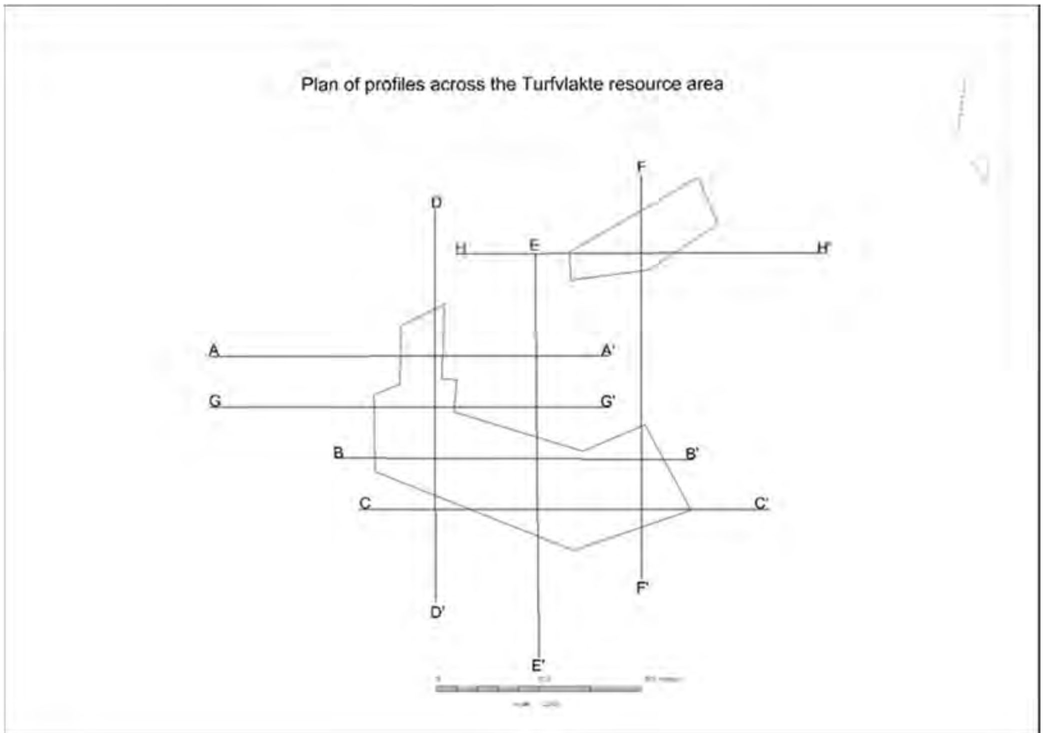

Figure 36: Positions of Cross Sections (Adapted from Exxaro)

9.0 GROUNDWATER MONITORING

9.1 Monitoring Objective

A groundwater monitoring programme at Turfvlakte needs to be implemented as part of the Grootegeluk Mine monitoring program, to understand the current baseline conditions, build up a time related database and to identify future impacts from mining operations on the groundwater systems. It is required for future rehabilitation purposes to determine the occurrence, source and extent of contamination such as Acid Rock Discharge (ARD), to verify decant predictions from groundwater modelling and to determine whether water treatment needs to be done as a part of rehabilitation (Golder 2017).

Any groundwater monitoring network design should be guided by a risk-based source-pathway-receptor principle. A groundwater monitoring network should contain monitoring positions which can assess the groundwater status at certain areas. Both the impact on water quality and water quantity should be catered for in the monitoring system. The boreholes in the network should cover the following:

- Source monitoring – monitoring close to possible contaminant sources;
- Plume (pathway) monitoring – monitoring along identified contamination plumes (if any);
- Impact (receptor) monitoring – monitoring at expected sensitive receptors; and
- Monitoring of the background water quality and levels.

9.2 Proposed Monitoring Programme

The 9 boreholes sampled during 2018 should be monitored as initial monitoring boreholes to be able to confirm the baseline conditions at Turfvlakte. The baseline monitoring must be conducted for a period of one year where after it must be re-evaluated. Additional monitoring boreholes may need to be installed and identified as mining activities progress and monitoring requirements change.

9.2.1 Groundwater Sampling and Water levels

Water quality sampling and water level measurements should be done on a quarterly basis during the baseline period to be able to identify trends over the rainy and dry season.

10.0 PHASE II IMPACT ASSESSMENT

10.1 Groundwater Numerical Model and Impact Assessment – GCS 2019

GCS Water and Environmental Consultants (Pty) Ltd (GCS) was appointed by Golder Associates Africa (Pty) Ltd to update the existing Grootegeluk groundwater flow and contaminant transport model conduct a as part of a hydrogeological assessment for the development of an open pit coal mine referred to as Turfvlakte.

The proposed Turfvlakte mining pits will be situated inside the current Exxaro Coal (Pty) Ltd - Grootegeluk mining rights area within the Lephalale district, Limpopo Province, South Africa. Grootegeluk Coal mine is situated approximately 20 km west of Lephalale. The proposed development of these additional opencast pits and associated infrastructure will be situated on the eastern portion of the Turfvlakte farm. Access routes, pipelines and power lines will run through remaining Grootegeluk Mining Rights area so as to link up to the existing mine infrastructure.

GCS completed a contaminant transport model update for the Grootegeluk Mine Complex in November 2018 (GCS Project No 17-1113).

10.1.1 Objective of the Model

The objective of the model is to simulate groundwater ingress into the mine and the migration of potential contaminant plumes. Scenario modelling is typically used to run future scenarios on varying changes in the natural environment or anthropogenic inputs. The potential scenarios to be simulated using the model include the following:

- Groundwater inflows and the extent of potential dewatering;
- Potential impact on surrounding groundwater users; and
- Potential contaminant plumes that may originate from the mining areas.

10.1.2 Model Confidence Level Classification

An Australian Guideline Class 1 model classification was pursued and was evaluated from a semi-quantitative assessment of the available data on which the model was based, the manner in which the model was calibrated and how the predictions were formulated. The level of confidence depended upon the available data for the conceptualisation, design and construction of the model.

Consideration was given to the spatial and temporal coverage of the available datasets in order to characterise the aquifer and the historic groundwater behaviour that was useful in model calibration. Factors that may affect the model confidence level during the calibration procedure were considered, and included the types and quality of data that was incorporated in the calibration, the degree to which the model was able to reproduce observations, and whether the model was able to represent present-day hydrogeological conditions. The time frame and level of stresses applied in the predictive models were consistent to that of the model calibration process.

10.1.3 Model Limitations and Exclusions

Groundwater flow models are inherently simplified mathematical representations of complex aquifer systems. The simplification limits the accuracy with which groundwater systems can be simulated in general. There are numerous sources of error and uncertainty in groundwater flow models.

Model error commonly stems from practical limitations of grid spacing, time discretisation, parameter structure, insufficient calibration data, and the effects of processes not simulated by the model. These factors, alongside unavoidable error in field observations and measurements, result in uncertainty in the model predictions. The complexities of fractured rock aquifers imply that the model can only be used as a guide to determine the order of magnitude of dewatering and contaminant transport. The interpretation of modelled results should be based on the assumptions the model was built on and actual results will vary as unknown aquifer conditions and parameters vary in the natural system.

10.1.4 Governing Equations

The numerical model used in this modelling study was based on the conceptual model developed from the findings of the desktop and the baseline investigations. The simulation model simulates groundwater flow based on a three-dimensional cell-centred grid and may be described by the following partial differential equation:

(1) $$\frac{\partial}{\partial x}(K_{xx}\frac{\partial h}{\partial x})+\frac{\partial}{\partial y}(K_{yy}\frac{\partial h}{\partial y})+\frac{\partial}{\partial z}(K_{zz}\frac{\partial h}{\partial z})\pm W = S_s\frac{\partial h}{\partial t}$$

where:

- Kxx, Kyy, and Kzz are values of hydraulic conductivity along the x, y, and z coordinate axes, which are assumed to be parallel to the major axes of hydraulic conductivity (L/T);
- h is the potentiometric head (L); and
- W is a volumetric flux per unit volume representing sources and/or sinks of water.

with:

- W < 0.0 for flow out of the ground-water system, and W>0.0 for flow in (T-1);
- Ss is the specific storage of the porous material (L-1); and
- t is time (T).

Equation 1, when combined with boundary and initial conditions, describes transient three-dimensional ground-water flow in a heterogeneous and anisotropic medium, provided that the principal axes of hydraulic conductivity are aligned with the coordinate directions (Harbaugh et al. 2000).

10.1.5 Model Software Package

The model was updated using GMS 10.3.8, a pre- and post-processing package. GMS uses the well-established MODFLOW-2005 (Harbaugh *et al.*, 2005) and MT3DMS (Zheng & Wang, 1999) numerical codes.

MODFLOW is a modular three-dimensional groundwater flow model developed by the United States Geological Survey (Harbaugh *et al*., 2000). MODFLOW uses 3D finite difference discretisation and flow codes to solve the governing equations of groundwater flow. MODFLOW NWT (Niswonger *et al*., 2011) was used in the simulation of the groundwater flow model. Both are widely used simulation codes and are well documented.

MT3DMS is a 3D model for the simulation of advection, dispersion, and chemical reactions of dissolved constituents in groundwater systems. MT3DMS uses a modular structure similar to the structure utilized by MODFLOW and is used in conjunction with MODFLOW in a two-step flow and transport simulation. Heads are computed by MODFLOW during the flow simulation and utilized by MT3DMS as the flow field for the transport portion of the simulation.

10.1.5.1 Boundary Conditions

Boundary conditions express the way in which the considered domain interacts with its environment. In other words, they express the conditions of known water flux, or known variables, such as the hydraulic head. Different boundary conditions result in different solutions, hence the importance of stating the correct boundary conditions. Boundary condition options in MODFLOW can be specified either as:

- Specified head or Dirichlet; or
- Specified flux or Neumann; or
- Mixed or Cauchy boundary conditions.

From the conceptual point of view, it was essential to meet two criteria to the maximum extent possible:

- The modelled area should be defined by natural geological and hydrogeological boundary conditions, i.e. the model domain should preferably encompass entire hydrogeological structures; and
- The mesh size of model grid has to correspond to the nature of the problem being addressed with the model.

The model domain (Figure 37) is irregularly shaped and defined by the following boundaries:

- On the north by the Limpopo River;
- On the east by the Mokolo River;
- Along the southeast by the A42J and A42H/A42G quaternary catchment boundaries; and
- The western model boundary is a no flow boundary.

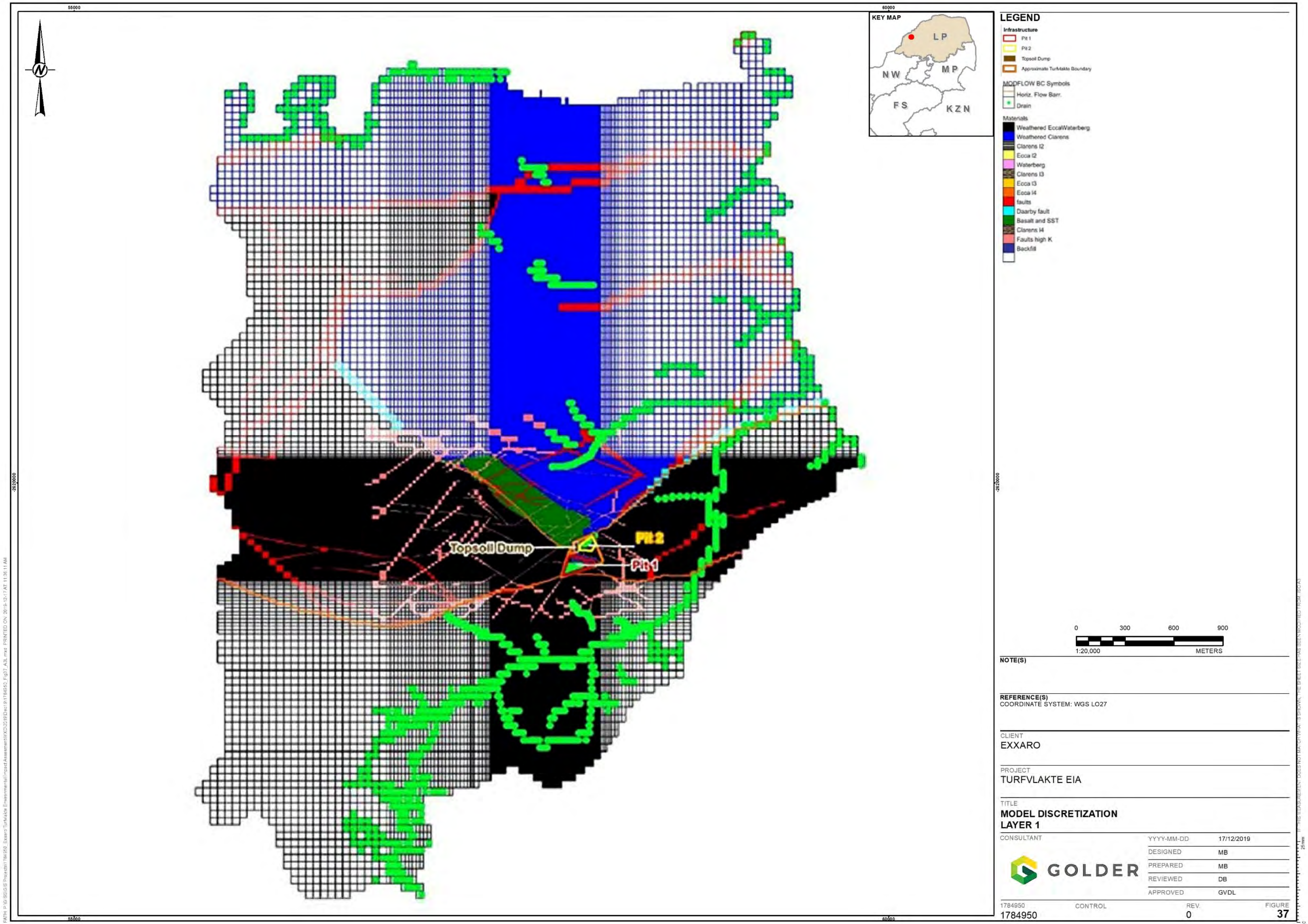

Figure 37: Model Discretization (layer 1)

10.1.6 Model Discretisation

The model grid was designed within the delineated model boundary. The high resolution grid areas overlay the mine and infrastructure; with a coarser grid on the far reaches of the model (Figure 37 to Figure 39) At the finest, the model grid is 40 m x 40 m, while the coarsest grid size at the outer limits of the model area is 500 m x 500 m. The aquifer distribution can also be seen in Figure 37 to Figure 39. A 3D cross section across the Letaba basalt aquifer can be seen in Figure 39. The actual varying thickness of the basalt was incorporated into the model.

A total of five layers were assigned to the model:

- Layer 1 (30 m in thickness): The upper weathered and fractured aquifers comprising of:
  - Clarens Formation weathered and fractured aquifer;
  - Waterberg and Ecca Group weathered and fractured aquifer; and
  - Letaba Formation basalt weathered and fractured aquifer.
- Layer 2 - 3 (25 m in thickness for layer 2 and 3): weathered and fractured aquifer comprising of:
  - Ecca Group fractured aquifer;
  - Clarens Formation fractured aquifer;
  - Letaba Formation fractured aquifer; and
  - Waterberg Group fractured aquifer.
- Layer 4 - 5 (30 m in thickness for layer 4 and 5): the fractured rock aquifers comprising of:
  - Ecca Group fractured aquifer;
  - Clarens Formation fractured aquifer;
  - Letaba Formation fractured aquifer; and
  - Waterberg Group fractured aquifer.

10.1.6.1 Layer Type

The shallow weathered aquifer (top of the model domain) is assigned as an unconfined layer. The weathered fractured aquifers (Layer 2 - 5) were assigned as being confined aquifers.

10.1.6.2 Starting groundwater levels

Groundwater levels recorded during the 2014 GCS and 2018 Golder hydrocensus were used as starting levels for the numerical model. The starting groundwater levels were extrapolated for the entire model area using the Bayesian interpolation method. This is regarded as realistic for the catchment areas away from the mine dewatering.

10.1.6.3 Rivers and non-perennial rivers

The Mokolo and Limpopo Rivers are perennial rivers that exists in the model area and was incorporated using the “drain” package. The required data was estimated, including, drain bottom (assumed to be 5 m below the surface elevation), hydraulic conductivity of the riverbed material (assumed to be 0.01 m^2/day/m).

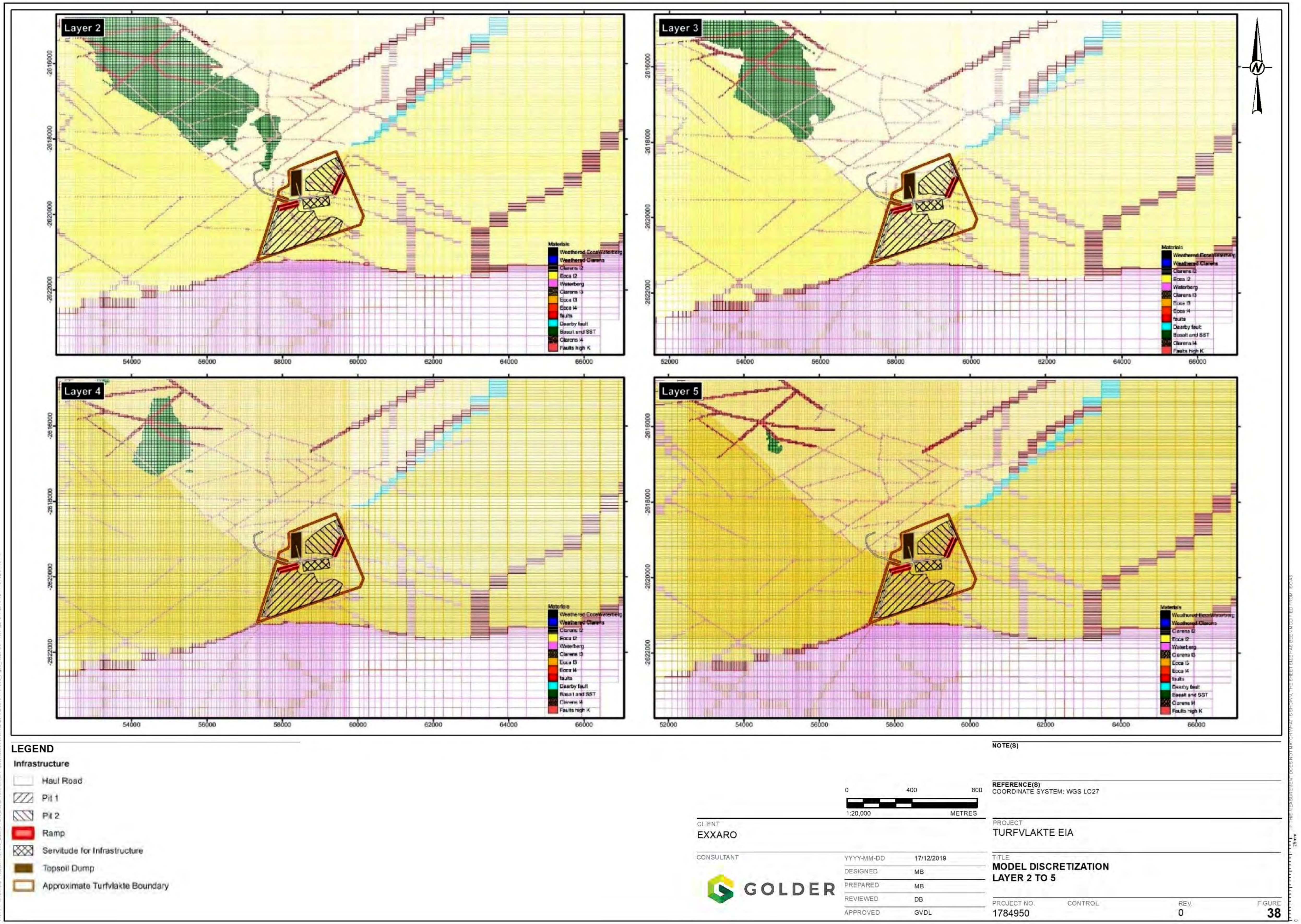

Figure 38: Model Discretization (layer 2 to 5)

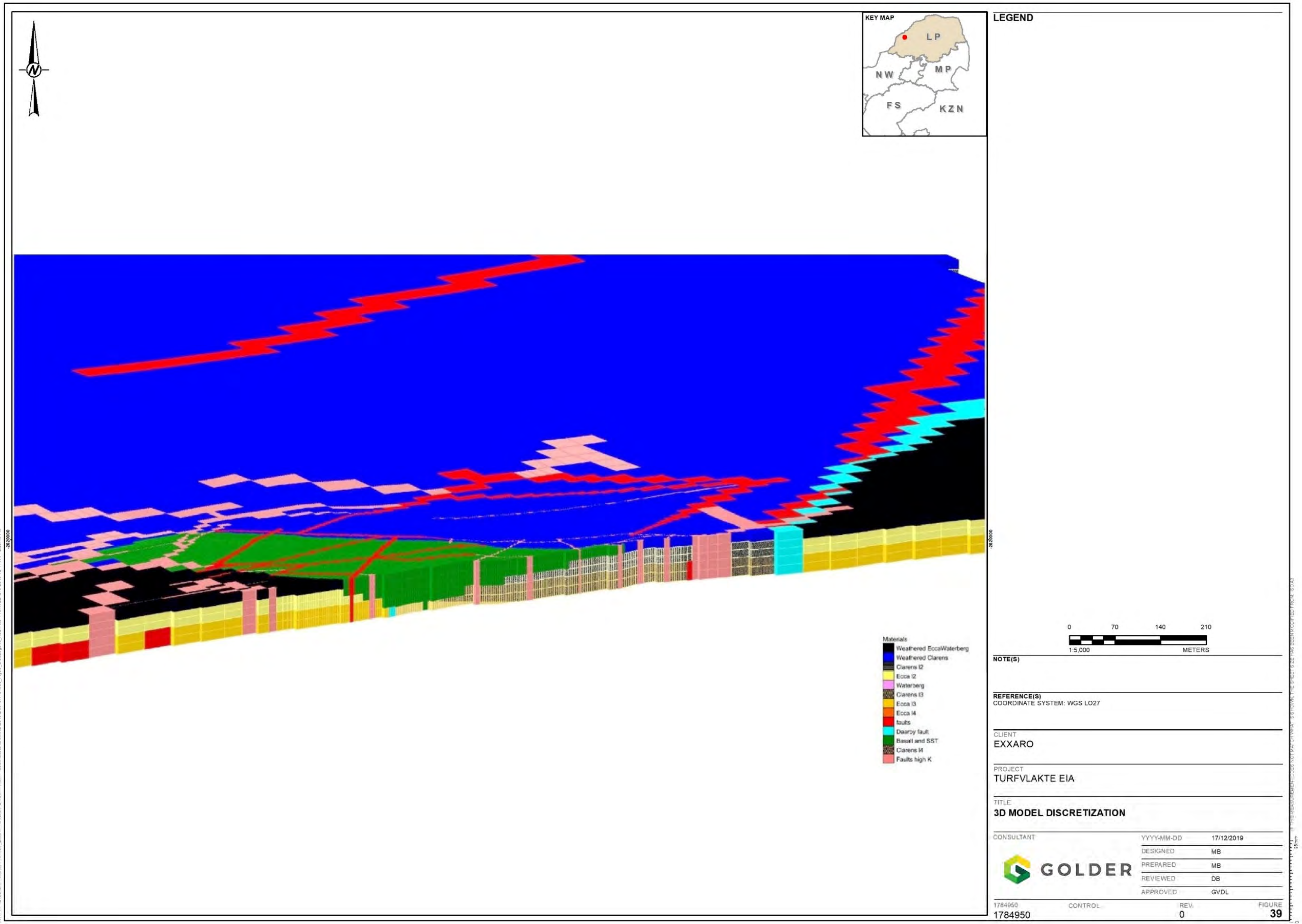

Figure 39: 3D Model Discretization

10.1.6.4 Mine dewatering

The proposed Turfvlakte pits were incorporated into the model using the “drain” function. The drain elevations were specified using the Turfvlakte_b11sf.dwg file as obtained from Golder Associates (Pty) Ltd. The 1.5 Mtpa preferred mining schedule and 3 Mtpa – Alternative mine schedule was sued for Turfvlakte.

10.1.6.5 Horizontal flow barriers

The Daarby and Eenzaamheid faults were found to be barriers to flow across the faults and were assigned as horizontal flow barriers (HFB) across all the layers. However, these faults also act as flow paths parallel to the faulting as discussed below.

10.1.6.6 Aquifer parameters

10.1.6.6.1 Recharge

Existing literature on the region show that recharge to the aquifers is estimated at between 0.2 and 1.2% of MAR (Vegter, 1995). A recharge of 0.7% was calculated by Golder based on 6 groundwater samples collected at Turfvlakte using the Chloride Ratio Method (see this report, section 7.0 above)). It can therefore be deduced that recharge in the area is generally low.

Numerical model calibration indicated a recharge value of 0.12% of the MAR over the Waterberg Group and Clarens Formations sandstone. Zero recharge was assigned to the Ecca Group west of the Daarby fault. The Letaba basalt Formation was assigned a 3% recharge.

10.1.6.6.2 Aquifer Transmissivity

The transmissivity values obtained from various aquifer tests conducted across Grootegeluk and Thabametsi and Turfvlakte. These transmissivities were applied to the model domain to simulate the regional groundwater flow system.

Analysis of aquifer test data of six boreholes drilled at Turfvlakte indicated a transmissivity of ~1.6 m^2/day for the weathered and fractured aquifer and 1.99 m^2/day for the fractured aquifer (see section 7.0 above)).

The hydraulic conductivities of each layer were thus derived from the transmissivity as shown in Table 17 below as correlates well with Golder aquifer tests, the Exxaro slug tests and previous aquifer testing conducted at Grootegeluk Mine.

The total transmissivity of the Letaba basalt, Clarens sandstone contact, and Ecca Group aquifer underlying the dump was calibrated as 9.2 m^2/day. The total transmissivity of the aquifers associated with the Ecca Group; Beaufort Group; Clarens, Elliot and Molteno Formations ranged from 2.1 to 3 m^2/day in the model.

Transmissivities of individual structures are elevated compared to the matrix transmissivity and was assigned a transmissivity of 12 m^2/day. The Daarby fault was assigned a transmissivity of 140 m^2/d in the model.

The Storativity values ranged from 0.01 for the Letaba basalt and Clarens sandstone. For the Ecca Group, Beaufort Group, Clarens, Elliot, Molteno Formations aquifer group a value of 0.001 was used.

Table 17: Model Hydraulic Conductivities and Storativity

Layer	Thickness (m)	Ecca Group, Beaufort Group, Clarens, Elliot, Molteno Formations			Letaba basalt, Clarens sandstone contact, and Ecca Group			Clarens sandstone and Ecca Group		
		Transmissivity (m^2/d)	Hydraulic conductivity (m/d)	Storativity	Transmissivity (m^2/d)	Hydraulic conductivity (m/d)	Storativity	Transmissivity (m^2/d)	Hydraulic conductivity (m/d)	Storativity
1	30	0.0-1.0	0.03	0.001	4.5	0.1	0.01	0.6	0.02	0.01
2	25	0.75	0.03	0.001	3.75	0.1	0.01	0.5	0.02	0.01
3	25	0.75	0.03	0.001	3.75	0.1	0.01	0.5	0.02	0.01
4	30	0.3	0.01	0.001	0.3	0.01	0.001	0.3	0.01	0.001
5	30	0.3	0.01	0.001	0.3	0.01	0.001	0.3	0.01	0.001
Minor faults and Eenzaamheid fault	N/A	12	0.09	1.00E-05	12	0.09	1.00E-05	12	0.09	1.00E-05
Daarby fault	N/A	140	1	1.00E-04	140	1	1.00E-04	140	1	1.00E-04

10.1.7 Model Calibration

As stated previously the model was calibrated in the steady and transient state using the manual calibration method where aquifer parameters are varied within realistic ranges until the model is able to reproduce the field specific conditions. A total of 207 groundwater levels, as obtained from the GCS and Golder hydrocensus surveys as well as the Grootegeluk monitoring database, were used to calibrate the model.

The ranges of aquifer parameter values, such as transmissivity and recharge (from rainfall), were derived from the data collected during the desktop study and the field work investigation.

The calibration error statistics are presented in Table 18. The root means square error (RMSE) for the transient model was ~10 and the residual mean ~0.89 m, the normalised root means square error (NRMSE) was 11%. This is acceptable considering the size of the modelled area, heterogeneity of the aquifers, number of observations and the complex stresses due to dewatering on the aquifers.

The simulated groundwater levels, compared to those measured in the field, are shown in Figure 40. A good fit of simulated and measured groundwater levels was obtained. The model is thus capable of reflecting the general trends in groundwater level due to the external stresses on the aquifer, including dewatering.

The average residual heads are all less than 20 m across the model area and less than 10 m around the dump area. The residuals were thus less than 10% of groundwater level differences over the modelled area, as prescribed in various modelling guidelines, i.e. Mandle (2002). The current calibrated flow contours are presented in Figure 41. The 2018 simulated groundwater levels (in metres below ground level) can be seen in Figure 42.

Table 18: Error Statistics

Summary Statistics for Calibration Targets	Value
Residual Mean	0.89
Absolute Residual Mean	8.5
Root Mean Squared Residual (RMSE)	9.89

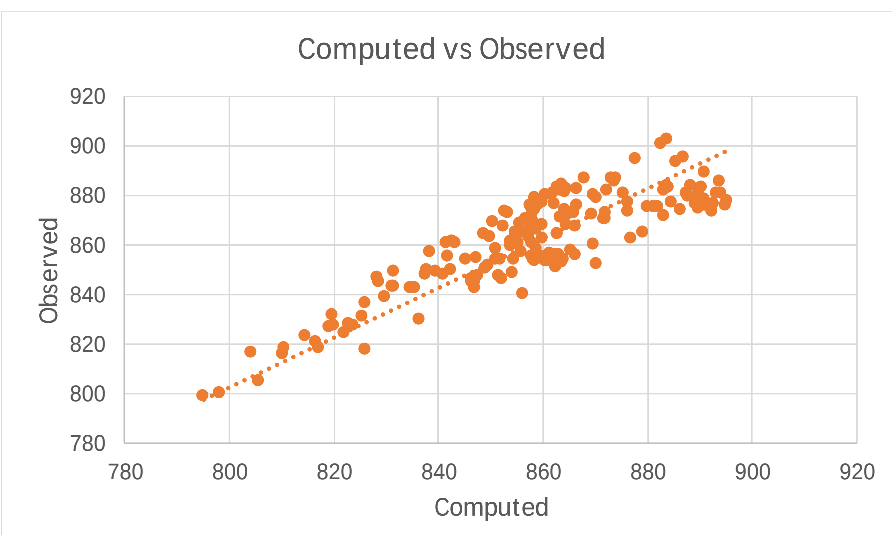

Figure 40: Calculated Versus Observed Groundwater Level

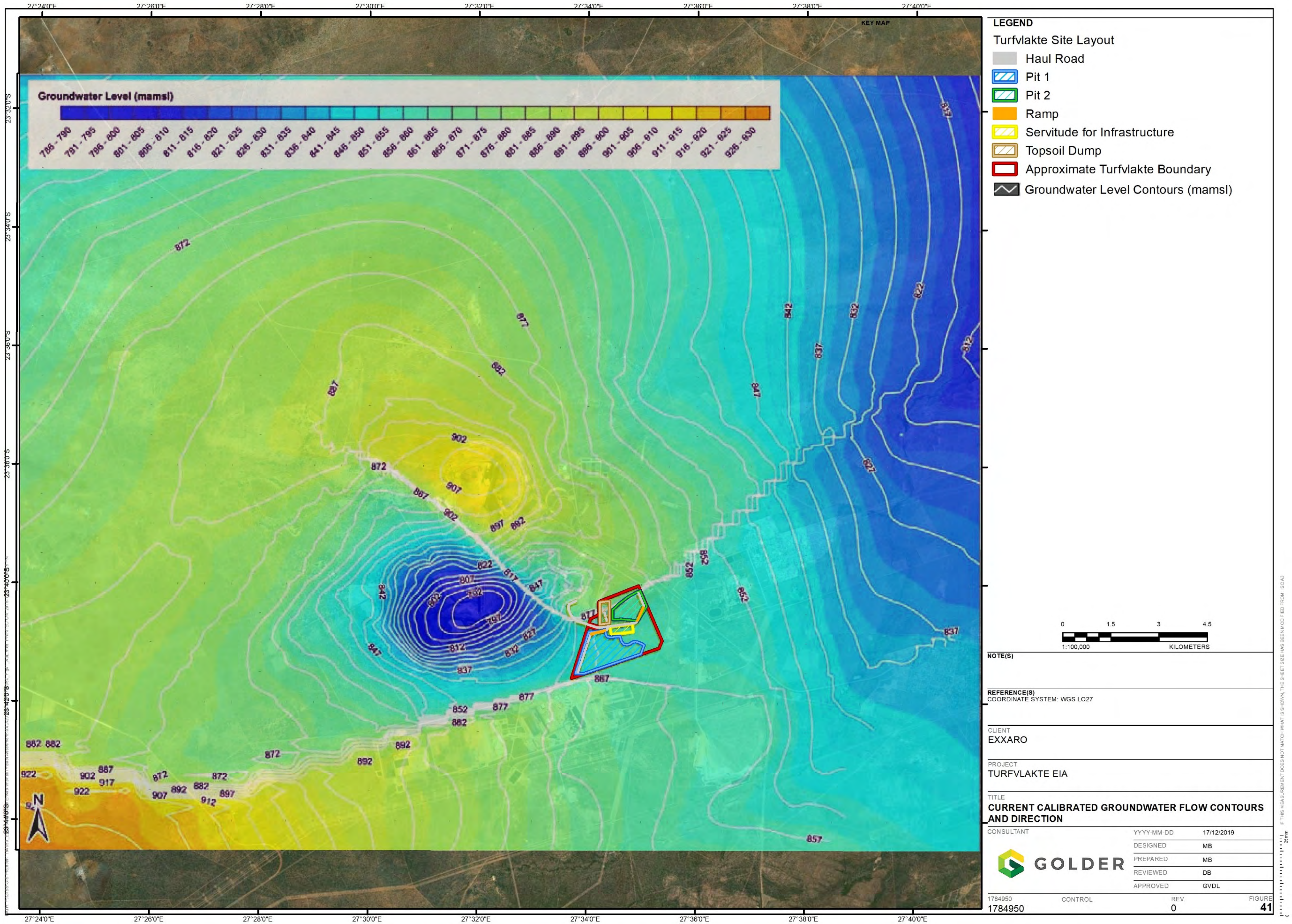

Figure 41: Numerical Model Calibrated Groundwater Flow (2019 Groundwater Elevations)

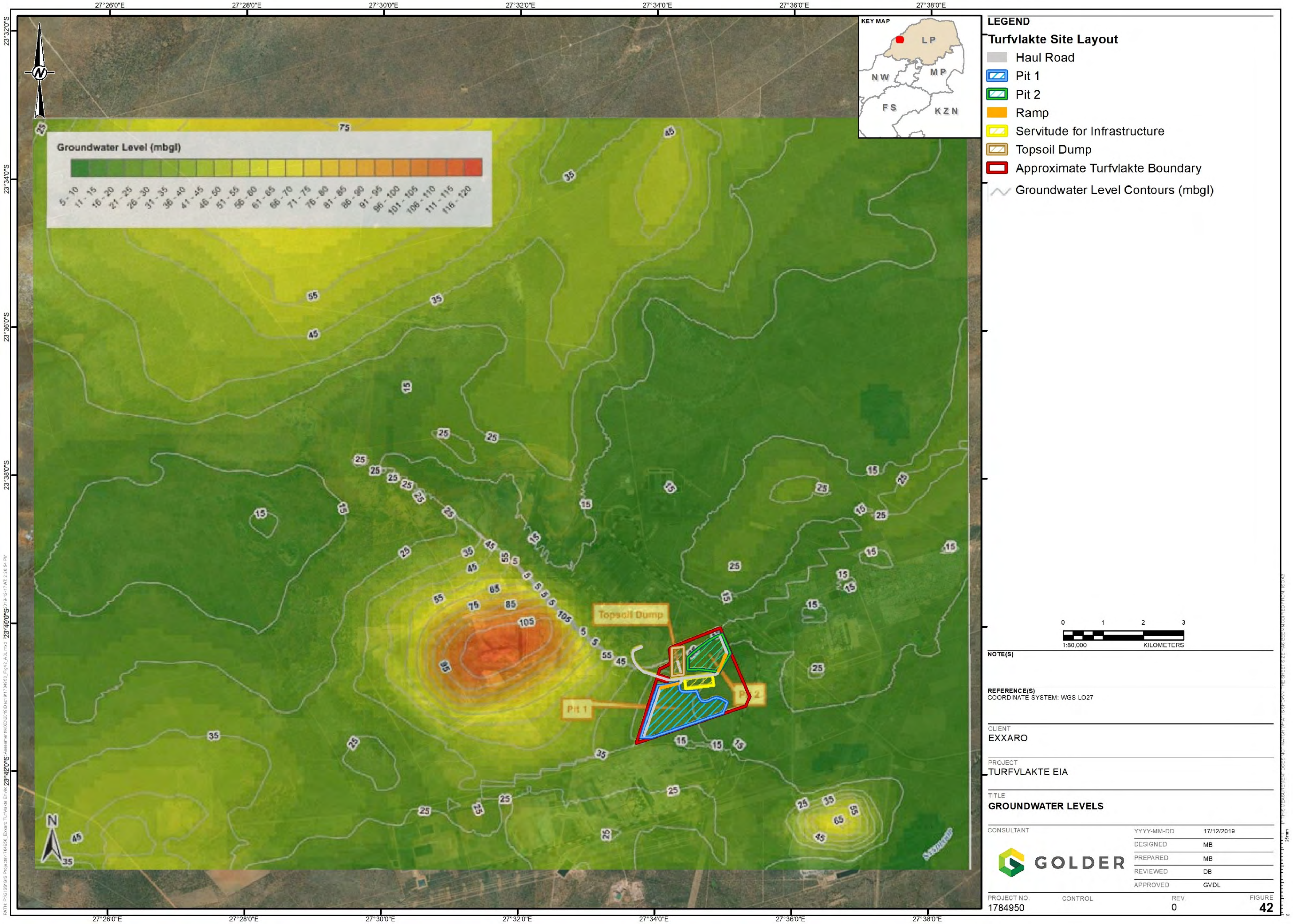

Figure 42: Simulated 2019 Groundwater Levels (metres below ground level)

10.1.8 Contaminant Transport Model

The calibrated groundwater flow model was used as a basis for developing the contaminant transport model. Total dissolved solids (TDS) was allocated as an input contaminant in the transport model. The model was based on the following assumptions:

- Contaminant movement will mostly take place as a result of advection. This assumption was based on the calculation of the Peclet number (Pe) for the aquifer which indicated that advection is the main flow mechanism; and
- Chemical reaction between rock and dissolved species were not taken into consideration during simulations. Therefore, a worst-case scenario was assumed.

Movement of contaminant particles takes advection, dispersion and also flux sources into account. Longitudinal dispersion was taken as 50 m. The source concentrations were provided to GCS by Golder Associates (Pty) Ltd. The post closure TDS source terms can be seen in Figure 43. The following assumptions were made by Golder regarding the pit source terms:

- Recharge assumed to be 4%, porosity 30%;
- Volumes of pit and backfill obtained from mass balance calculations;
- Salts will be added to pit water from backfill, wall rock and groundwater;
- Groundwater inflow quality assumed to be average of 2018 baseline data for boreholes in Turfvlakte farm (TDS 1220 - 7060 mg/L; average= 4165 mg/L);
- It was assumed that there will be no flow from one pit to another;
- It was assumed that the discard in coal seams would contribute to salts to the pit. The proportion was estimated from the mass balance calculations;
- Salts from coal were not included due to absence of TDS loading data;
- Blast fracture and affected zone was assumed to be 15 m for all units. However, a portion of overburden will be free dug; and
- Effects of evaporation on water quality was not considered.

These seepage rates and concentrations were used as input into the numerical flow and contaminant transport model. The model outputs were for 50- and 100-years post closure (see Figure 43).

Due to the assumptions made and limited calibration data available, the results from the contaminant transport model were considered to represent a first approximation of the impact on groundwater quality. Due to the nature of the simulations, the estimated concentrations will reflect expected conditions within an order of magnitude.

The detailed geochemical assessment and geochemical model used to develop the pit source-terms are presented in the geochemistry specialist report (*1784950-325695-10*) which is also annexed to this report (APPENDIX D).

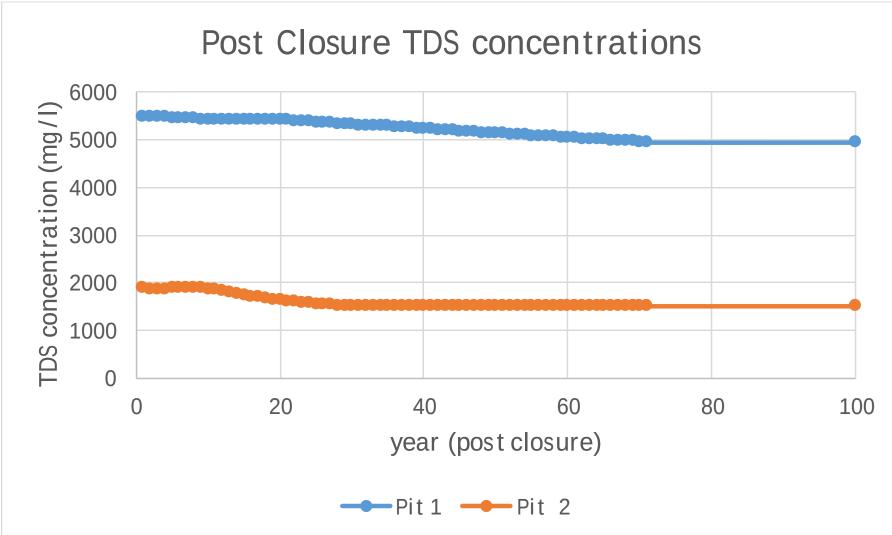

Figure 43: TDS concentrations in Pit 1 and Pit 2 post closure – transport model source term

10.2 GROUNDWATER IMPACTS

The impacts discussed below only pertain to the proposed Turfvlakte project and excluded impacts associated with Grootegeluk Mine.

10.2.1 Environmental Impact Significance Rating Methodology

To ensure uniformity, the assessment of potential impacts has been addressed in a standard manner so that a wide range of impacts are comparable. The methodology utilised is from the South African Department of Environmental Affairs and Tourism guideline document on EIA Regulations (April 1998). The following descriptive value-added evaluation method will be used to determine the significance of the impacts.

10.2.1.1 Extent (spatial scale)

Extent is an indication of the physical and spatial scale of the impact (Table 19).

Consideration to be given to:

- Access to resources;
- Amenity;
- Threats to lifestyles, traditions and values; and
- Cumulative impacts, including possible changes to land uses around the site.

Table 19: Extent Scale

Low (1)	Low/Medium (2)	Medium (3)	Medium/High (4)	High (5)
Impact is localised within the site boundary: Site only	Impact is beyond the site boundary: Local	Impacts felt within adjacent biophysical and social environments: Regional	Impact widespread far beyond site boundary: Regional	Impact extend National or over international boundaries

10.2.1.2 Duration

Duration refers to the time frame over which the impact is expected to occur, measured in relation to the lifetime of the proposed project (Table 20).

Consideration to be given to:

- Cost-benefit economical and socially (e.g. long- or short-term costs/benefits).

Table 20: Duration Scale

Low (1)	Low/Medium (2)	Medium (3)	Medium/High (4)	High (5)
Immediate mitigating measures, immediate progress	Impact is quickly reversible, short term impacts (0 - 5 years)	Reversible over time; medium term (5 - 15 years)	Impact is long-term	Long term; beyond closure; permanent; irreplaceable or irretrievable commitment of resources

10.2.1.3 Intensity of Magnitude / Severity

Intensity refers to the degree or magnitude to which the impact alters the functioning of an element of the environment. The magnitude of alteration can either be positive or negative, as were also taken into consideration during the assessment of severity (Table 21).

Consideration to be given to:

- Cost-benefit economically and socially (e.g. high net cost = substantial deterioration); and
- Impacts on future management (e.g. easy/practical to manage with change or recommendation).

Table 21: Intensity Scale

Type of criteria	Negative				
	H-(10)	M/H-(8)	M-(6)	M/L-(4)	L-(2)
Qualitative	Very high deterioration, high quantity of deaths, injury of illness/total loss of habitat, total alteration of ecological processes, extinction of rare species.	Substantial deterioration, death, illness or injury, loss of habitat/diversity or resource, severe alteration or disturbance of important processes.	Moderate deterioration, discomfort, partial loss of habitat/ biodiversity or resource, moderate alteration.	Low deterioration, slight noticeable alteration in habitat and biodiversity. Little loss in species numbers.	Minor deterioration, nuisance or irritation, minor change in species/ habitat/diversity or resource, no or very little quality deterioration.

10.2.1.4 Probability of Occurrence

Probability describes the likelihood of the impacts occurring. This determination is based on previous experience with similar projects and/or based on professional judgment (Table 22.

Table 22: Probability of Occurrence Scale

Low (1)	Medium/Low (2)	Medium (3)	Medium/High (4)	High (5)
Improbable; low likelihood; seldom. No known risk or vulnerability to natural or induced hazards.	Likely to occur from time to time. Low risk or vulnerability to natural or induced hazards.	Possible, distinct possibility, frequent. Low to medium risk or vulnerability to natural or induced hazards.	Probable if mitigating measures are not implemented. Medium risk of vulnerability to natural or induced hazards.	Definite (regardless of preventative measures), highly likely, continuous. High risk or vulnerability to natural or induced hazards.

10.2.1.5 Significance

Significance is determined through a synthesis of the above impact characteristics and is an indication of the overall importance of the impact. The significance of the impact "without mitigation:" is the prime determinant of the nature and degree of mitigation required. For this assessment, the significance of the risk without prescribed mitigation actions was measured.

The significance of the identified impacts on components of the affected environment were determined as significance points (SP) = (magnitude + duration + spatial scale) x probability. The maximum value per aspect is 100 SP. Environmental effects were rated as high, moderate or low significance, based on the following:

- more than 60 significance points indicated high (H) environmental significance;
- between 30 and 60 significance points indicted moderate (M) environmental significance; and
- less than 30 significance points indicated low (L) environmental significance.

10.2.2 Construction Phase

During construction of the new activities at Turfvlakte minimal additional impacts on the groundwater system is expected. The main activities that could impact on groundwater in this phase include constructing and clearing of footprint areas for construction. Table 23 below lists the groundwater impacts expected during this phase, the impacts are expected to have a low significance rating.

Table 23: Impacts on groundwater during Construction Phase

Activity	Potential Impact	Aspects Affected	Phase	Magnitude	Duration	Scale	Probability	Significance	Significance Without Mitigation	Magnitude	Duration	Scale	Probability	Significance	Significance with Mitigation	Detailed Mitigation Measures
Footprint Clearance / Construction	Clearing topsoil for footprint areas can increase infiltration rates of water to the groundwater system and increase aquifer vulnerability	Groundwater contamination	Construction Phase	4	3	1	3	24	Low	4	3	1	3	24	Low	- Mitigation is not possible. No users are currently likely to be affected. - Groundwater monitoring should be used to confirm that the affected area remains within that predicted.
Waste / hydrocarbon Handling	Handling of waste and transport of building material can cause various types of spills (hydrocarbons) which can infiltrate and contaminate the groundwater system.	Soil contamination	Construction Phase	4	2	1	3	21	Low	2	3	1	2	12	Low	- All vehicles and machinery shall be kept in good working order and inspected on a regular basis for possible leaks and shall be repaired as soon as possible if required; - Repairs shall be carried out in a dedicated repair area only, unless in-situ repair is necessary as a result of a breakdown; - Drip trays shall at all times be placed under vehicles that require in-situ repairs; - Drip trays shall be emptied into designated containers only and the contents disposed of at a licenced hazardous material disposal facility; - Accidental spills (concrete, chemicals, process water, hydrocarbons, waste) need to be reported immediately so that effective remediation and clean-up strategies and procedures can be implemented; - Soil that is contaminated by fuel or oil spills, for example, from vehicles, will be collected to be treated at a pre-determined and dedicated location, or will be treated in situ, using sand, soil or cold coal-ash as absorption medium.

10.2.3 Operational Phase

10.2.3.1 Groundwater Quantity (Groundwater level drawdown)

The mine floor elevation is below the general groundwater level thus causing groundwater inflows into the two proposed open pit mining areas from the surrounding aquifers during operations. The mining areas will have to be actively dewatered to ensure a safe working environment. Pumping water that seeps into the mine areas will cause dewatering of the surrounding aquifers and an associated decrease in groundwater level within the zone of influence of the dewatering cone.

The zone of influence of the dewatering cone depends on several factors including the depth of mining below the regional groundwater level, recharge from rainfall to the aquifers, the size of the mining area, and the aquifer transmissivity amongst others. The 3-D numerical groundwater flow model was used to simulate the development of the drawdown cone over time in the study area. The latest mining schedules (at the time of investigation) also taken in consideration when calculating the drawdown, mining to seam B11sf (Bench 11) was proposed.

During the operational phase, it is expected that the main impact on the groundwater environment will be dewatering of the surrounding aquifer. In order to interpret the changing cone of groundwater depression as mining progresses, scenario modelling has been carried out, the simulated drawdown for 1.5 Mtpa preferred mining schedule is illustrated in Figure 44, while the 3 Mtpa alterative mining schedule can be seen in Figure 45.

The impact of groundwater drawdown due to the Grootegeluk pit has been excluded, in order to assess the Turfvlakte impact in isolation. When assessing the 1.5 Mtpa preferred mining on Turfvlakte the extent of drawdown could reach ~1400 m to the east of the two open pits and ~1600 m to the west (which would merge with the Grootegeluk pit drawdown cone).

For the 3 Mtpa alterative mining schedule, the extent of drawdown could reach ~1100 m to the east of the two open pits and ~950 m to the west (which would merge with the Grootegeluk pit drawdown cone). The reduced impacted of the 3 Mtpa alterative mining schedule is due to the quicker mining progression and shorter mining period.

The impact on groundwater levels do not extend across the Daarby Fault to the north or the Eenzaamheid Fault to the south, as seen in Figure 44 and Figure 45.

No privately-owned boreholes were located in proximity to the proposed project (as identified by the baseline study - this report, section 7.0 above). Therefore, it is not expected that the dewatering activities associated with the Turfvlakte mining will impact negatively on existing privately-owned boreholes nor on groundwater users off-site.

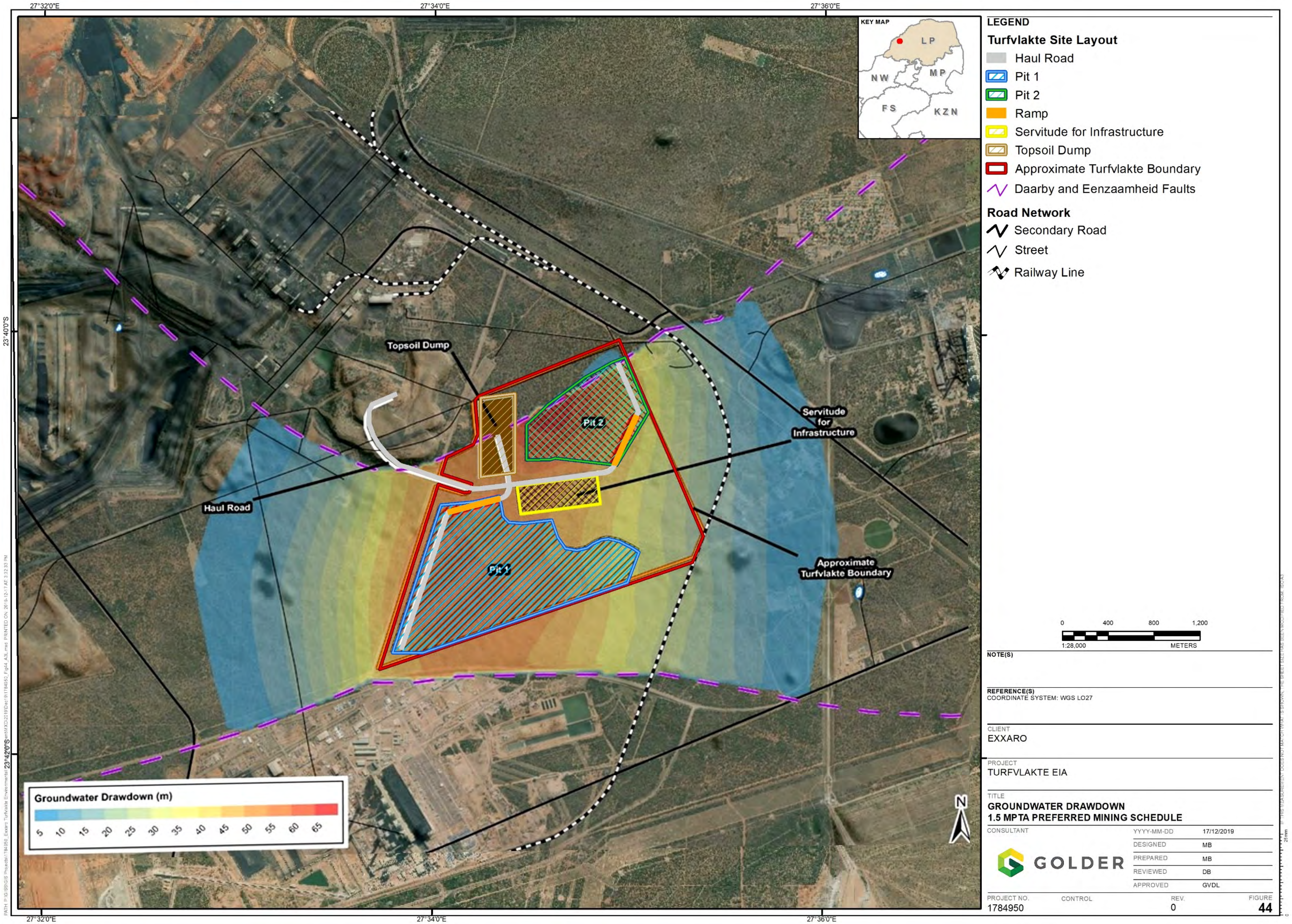

Figure 44: Groundwater Drawdown in year 16 (1.5 Mtpa Preferred Mining Schedule)

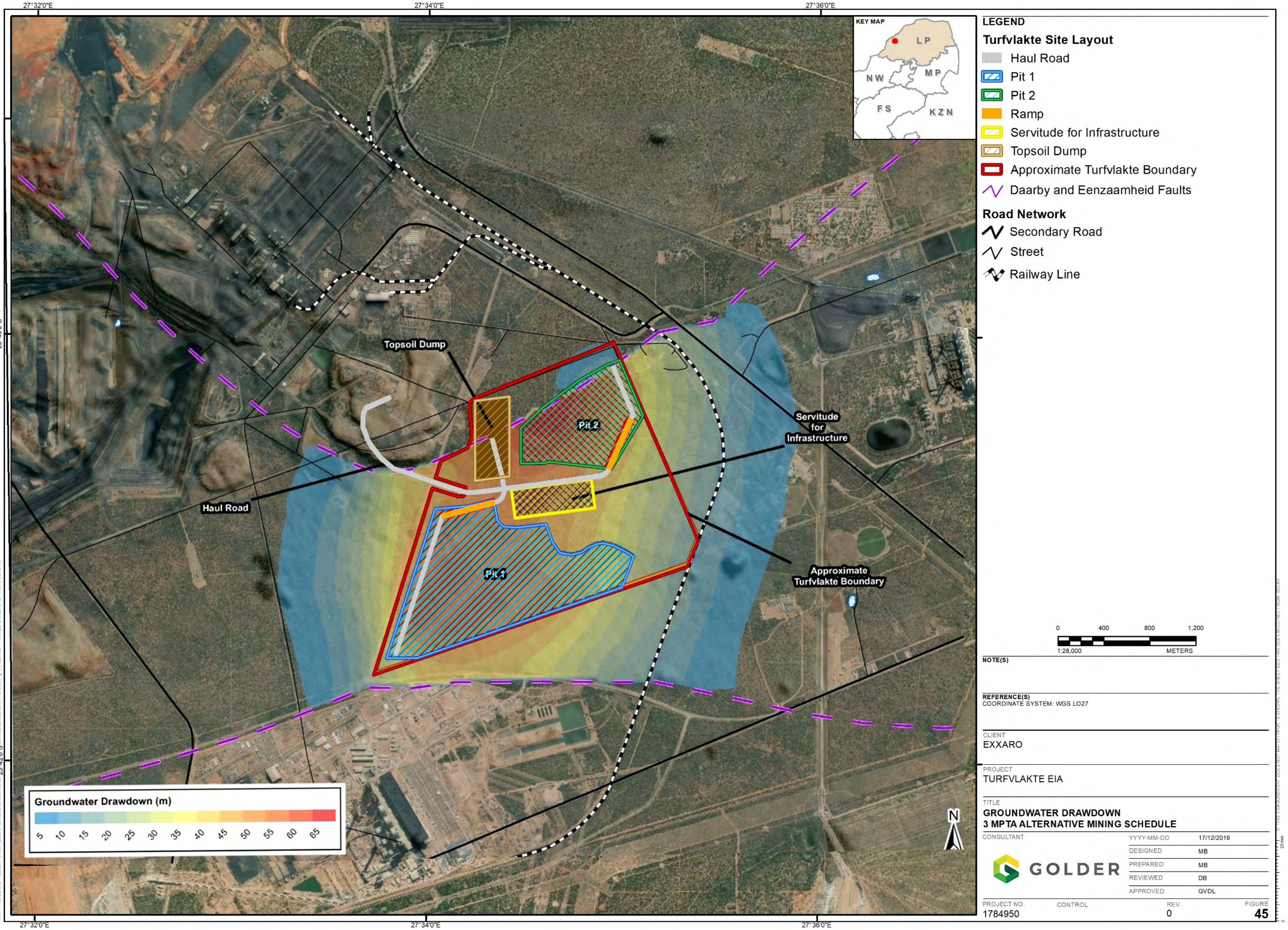

Figure 45: Groundwater Drawdown in year 7 (3 Mtpa alterative mining schedule)

10.2.4 Mine Inflow Volumes

It was possible to calculate the inflow into the opencasts for each mining cut from the numerical model. The computed inflow into each open pit at Turfvlakte was calculated as shown below in Figure 46 for the 1.5 Mtpa preferred mining schedule and in Figure 47 for the 3 Mtpa – Alternative mine schedule.

10.2.4.1 1.5 Mtpa -Preferred schedule

The 1.5 Mtpa preferred mining schedule entails the mining of Pit 1 from year 1 to year 11. The simulated groundwater inflow into open pit 1 between fluctuate between ~580 m^3/d and ~290 m^3/d (Figure 46). The pit floor depths in Pit 1 range from 46 mbgl in the north part to 77 mbgl in the southern/central part.

In Pit 2 located north east of Pit 1, mining also commences in year 12 and ceases in year 16. Mining depths range from ~39 mbgl in the south eastern part of the pit and deepens to 120 mbgl in the north-western part of the proposed pit. The simulated groundwater inflows ranged between ~270 and 380 m^3/d as seen in Figure 46.

10.2.4.2 3 Mtpa -Alternative schedule

The 3 Mtpa alterative mining schedule entails the mining of both pits at the same time, i.e. from year 1 to year 7. The simulated groundwater inflow into open pit 1 between fluctuate between ~590 m^3/d and ~300 m^3/d (Figure 47).

In Pit 2, where mining occurs concurrently with Pit 1 but only from year 1 to year 4. The simulated groundwater inflows ranged between ~640 and 440 m^3/d (Figure 47).

It is also important to view these volumes for the water make of the mine in relation to natural evaporation. Evaporation will take place over the total area of the open pits and could reduce the actual seepage volume.

It must be noted that these calculations have been performed using simplifying assumptions for homogeneous aquifer conditions. In reality groundwater inflows could deviate substantially from this. The inflows represent the correct order of magnitude, and the most likely range of inflow variation based on the uncertainties of the model.

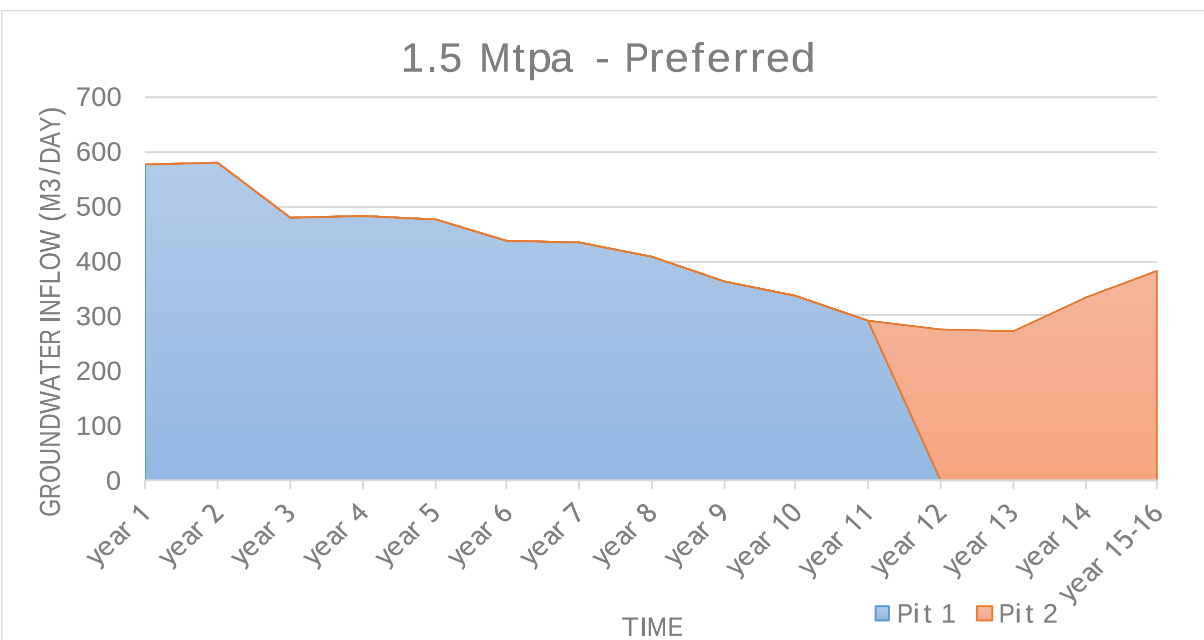

Figure 46: Simulated Groundwater Inflows into the proposed Pit 1 and 2 open pits 1.5 Mtpa – Preferred option

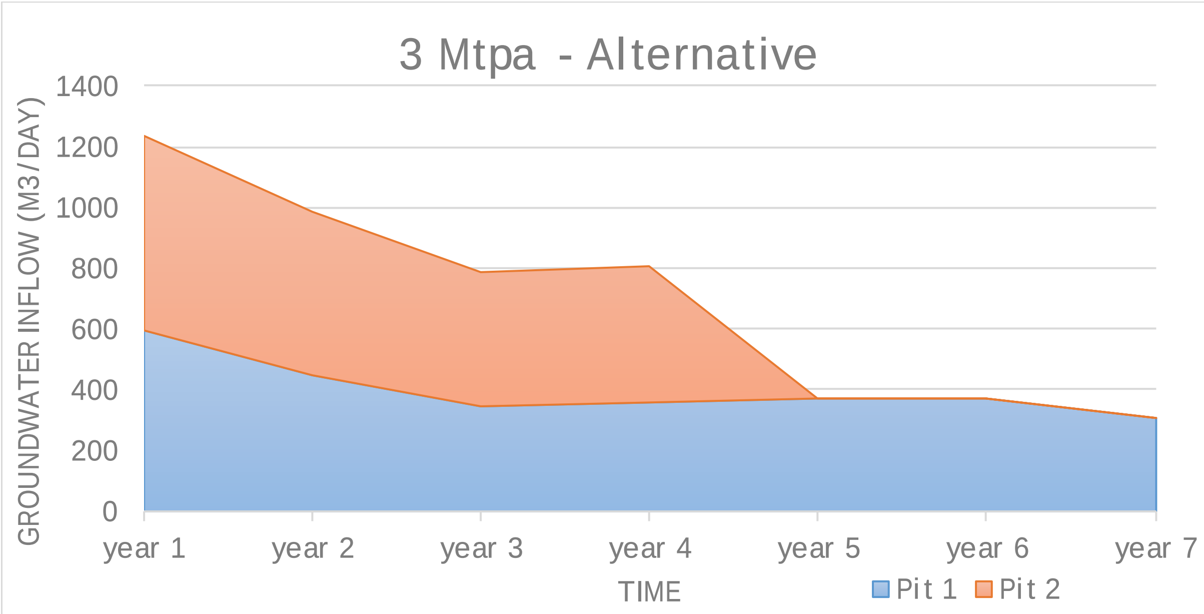

Figure 47: Simulated Groundwater Inflows into the proposed Pit 1 and 2 open pits 3 Mtpa – Alternative option

10.2.5 Groundwater Quality (contamination of the surrounding aquifers)

The life of mine for the proposed mining at Turfvlakte is planned until 2035 for 1.5 Mtpa preferred mining schedule and 2027 for the 3 Mtpa alterative option. This allows sufficient time for chemical reactions to take place in the mined-out areas and other potential pollution sources to produce ARD conditions. There will also be leaching of hard and soft overburden deposited onto Dump 6 (but not carbonaceous interburden which could produce ARD)

Groundwater flow directions south of the Daarby fault will be directed towards the mining areas due to the mine dewatering. Therefore, contamination will be contained within the mining area, and little contamination will be able to migrate away from the mining area.

Contamination from the mining areas is generally contained within the mining areas. The baseline study (this report, section 7.0 above) found that is the groundwater quality of the boreholes located in the middle of Turfvlakte and WBR46 are of poor quality. The environmental impact significance is expected to be low can be seen in Table 24 below.

Table 24: Impact on groundwater during Operational Phase

ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	Magnitude	Duration	Scale	Probability	Significance	Significance without Mitigation	Magnitude	Duration	Scale	Probability	Significance	Significance with Mitigation	Detailed Mitigation Measures
Open pit mining	Open pit mining will result in groundwater inflows into the workings which need to be pumped out for mine safety and the resultant dewatering (water level decrease) of the groundwater system in the immediate vicinity of the workings.	Groundwater quantity	Operational	4	2	1	5	35	Moderate	4	2	1	4	28	Low	- Keeping the workings dry is necessary for mining and mitigation is not possible. No users are currently likely to be affected. - Groundwater monitoring should be used to confirm that the affected area remains within that predicted.
Open pit mining	Exposure of geological strata in the open pit areas will result in a deuteriation in quality of groundwater flowing into the open pit and the pit water, due to the ARD formation in some strata, and the leaching of various major trace elements from all strata.	Groundwater contamination	Operational	4	3	1	5	40	Moderate	4	3	1	2	16	Low	- Disturbing geological strata is a result of mining. Pits need to be kept as dry as possible to reduce contact time of water and oxygen with exposed rock and therefore keep contamination to a minimum. - Mine water must be contained and/or re-used
Mineral residue handling and disposal at Dump 6	Dumping of overburden material will result in the contaminated seepage with ARD and other material leached from the overburden	Groundwater contamination	Operational	4	4	1	5	45	Moderate	2	3	1	4	24	Low	- ARD producing strata are excluded from placement on Dump 6, meaning that the resulting seepage quality is likely to be not substantially changed. - Dump 6 will ultimately be capped and closed.

10.2.6 Decommissioning Phase

During this phase it is assumed that active mining has stopped, and the open pits will be backfilled using the available material. Based on information provided by Golder, a final void will be left in both Pit 1 and Pit 2.

All the surface contaminant sources (infrastructure and dams) has been decommissioned and no longer acts as a source. No additional impacts on the groundwater of the study area other than the impacts discussed above are expected during the decommissioning phase of the project.

10.2.7 Post Closure Phase

In the post closure phase, the open pits were deemed to be partly backfilled and vegetated, with final voids in Pit 1 and Pit 2. A flow gradient exists towards both pits after closure due to the rehabilitated pits and final voids acting as a sink.

Table 26 also lists the groundwater impacts expected during this phase. Water and oxygen will react with the backfilled material and as a result ARD will peak during this phase. The environmental impact significance is expected to be low.

10.2.7.1 Groundwater Quality

Once the mining has ceased, ARD and leaching of trace elements is still likely to occur within the backfilled pits due to the contact of water and oxygen through natural process including rainfall and groundwater seepage. Once the ARD forming material is however saturated, the formation of ARD is reduced. The partially backfilled Pit 1 and Pit 2 likely to act as a contaminant sink post closure (i.e. contaminants could migrate toward pit post closure) and therefore no significant migration of the contaminants from the 2 partially backfilled pits is expected. The contaminants are generally confined to the pits post closure as can be seen in the Figure 48 and Figure 49 (50 year and 100 years post closure respectively).

No privately-owned boreholes located in the fractured Karoo aquifer is likely to be impacted based on the impact simulations.

The results must be viewed with caution as a layered homogeneous aquifer has been assumed. Heterogeneities in the aquifer are unknown and the effect of this cannot be predicted. Furthermore, no chemical interaction with the minerals in the surrounding bedrock has been assumed. As there may be some interaction and retardation of the plume, it is likely that this prediction will represent a worst-case scenario.

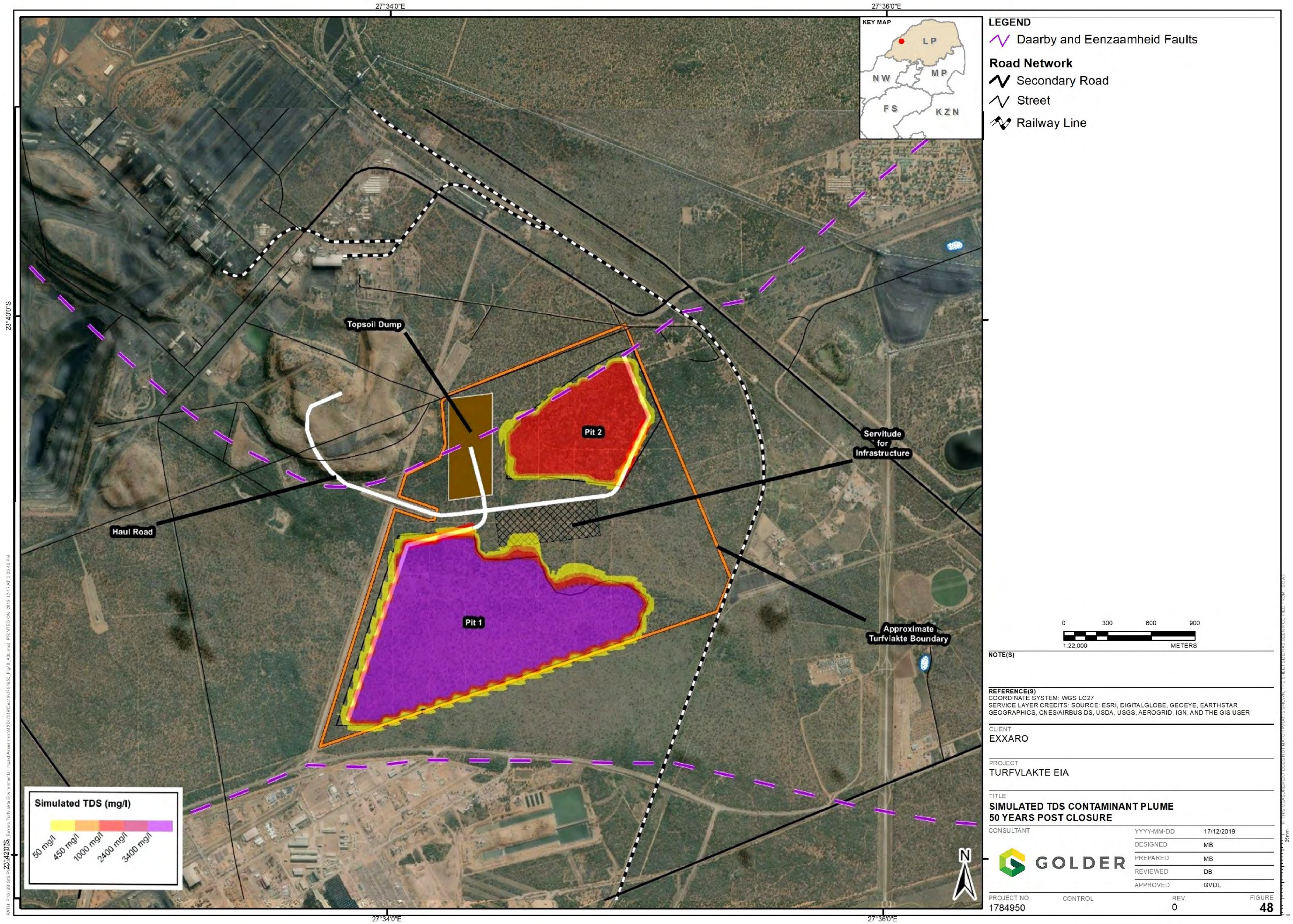

Figure 48: Simulated TDS Contaminant Plume – 50 years post closure

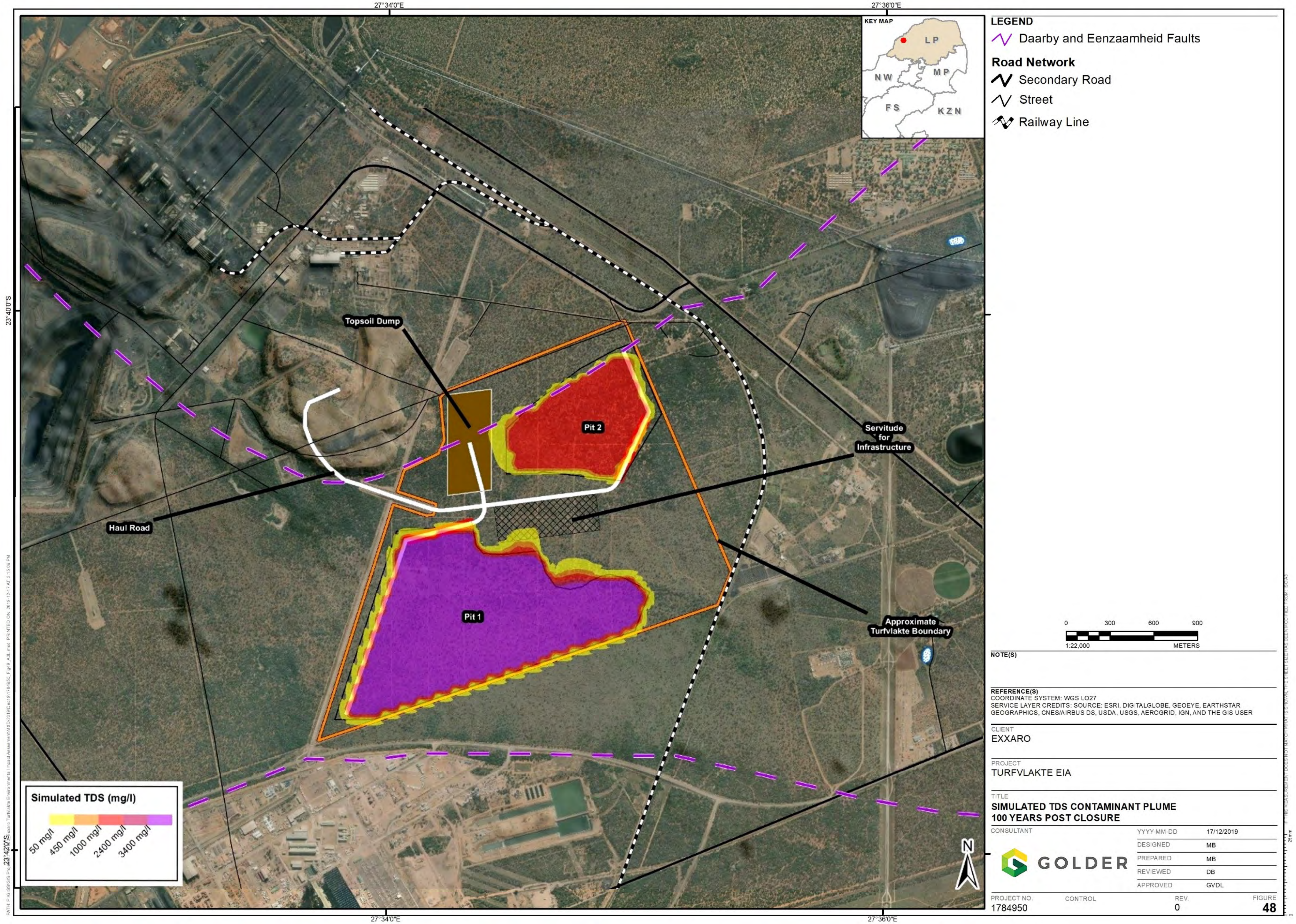

Figure 49: Simulated TDS Contaminant Plume – 100 years post closure

10.2.8 Mine Water Level Recovery

Pit 1 and Pit 2 is planned to be partially backfilled due to a material deficit resulting in final void. Based on a mineral residue mass balance by Golder it was found that the void in Pit 1 would be 51% of the pit volume, while at Pit 2 the void would be 70% for the 1.5 Mtpa preferred mining schedule and 82% for the 3 Mtpa – Alternative mine schedule. The large void space is attributed to half of the mine waste being deposited on Dump 6 and within the Grootegeluk pit.

Decanting/surface discharge occurs when the mine water level in the rehabilitated and backfilled workings rebounds to a level above the topographic elevation, resulting in mine water discharging onto surface. Surface decanting refers to direct discharge of mine water to surface through backfilled material, voids, shafts, adits and other direct paths. Decant take place at the lowest topographic level that intersects the flow path and/or open pit. Given the climatic and topographical environment at Turfvlakte as well as the future presence of a final voids in Pit 1 and Pit 2; decant or surface discharge from the open pits are unlikely. As summary of the re-watering/time to fill can be seen in Table 25. The expected significance of the impact is high as seen in Table 26.

It is recommended that boreholes are drilled into the backfilled pit to determine the inflow rates as the pit water levels rebound.

Table 25: Summary of the estimated mine water recovery/re-watering of pits

General information			
	Units	**Pit 1**	**Pit 2**
Surface area	m^2	1 199 722	428 733
Average Pre-mining groundwater elevation	mamsl	867	867
Total potential saturated backfill volume	m^3	54 176 352	25 846 536
Backfilled % based on Golder Mass Balance		100%-51% = 49%	100% - 70% = 30%
Saturated backfill volume accounting for mass balance	m^3	26 546 412	7 753 961
Mean annual rainfall	m/a	0.435	0.435
Saturated Backfilled void volume			
20% Porosity	m^3	5 309 282	1 550 792
30% Porosity	m^3	7 963 924	2 326 188
50% Porosity	m^3	13 273 206	3 876 980
Pit re-watering rate			
4% Recharge + GW inflow	m^3/y	112 125	80 460
8% Recharge + GW inflow	m^3/y	133 000	87 920
10% Recharge + GW inflow	m^3/y	143 438	91 650

General information			
Time to fill to pre-mining groundwater elevation			
Most probable scenario **(30% porosity and 4% Recharge)**	**Years**	**71**	**29**

Table 26: Impacts on groundwater Post Closure Phase

Activity	Potential impact	Aspects affected	Phase	Magnitude	Duration	Scale	Probability	Significance	Significance without mitigation	Magnitude	Duration	Scale	Probability	Significance	Significance with mitigation	Detailed mitigation measures
Partially backfilled open pit with final void	Exposure of geological strata and backfill material will result in the contamination of the pit water with ARD and other material leached from the backfill	Groundwater quantity	Post Closure	4	4	1	4	36	Moderate	4	4	1	2	18	Low	- Groundwater levels in the partially backfilled pits will recover to levels determined by evaporation from the final void . - The pits will act as sinks, preventing contaminants from migrating away from the pits. - All mined areas should be flooded as soon as possible to bar oxygen from reacting with remaining pyrite. - Groundwater monitoring should be done to establish a database of plume movement trends, to aid eventual mine closure. - The drilling of boreholes into mining areas is recommended so that recovery of water in mining areas can be monitored. - The absence of groundwater users should be assessed bi-annually.

10.3 GROUNDWATER MANAGEMENT PLAN

10.3.1 Construction Phase

10.3.1.1 Actions

- Prevent dirty water runoff from leaving the general mining area;
- Minimise dirty footprints;
- A credible company should remove used oil from the workshops for legal off-site disposal;
- A sufficient supply of absorbent fibre should be kept at the site to contain accidental spills; and
- Groundwater monitoring boreholes should be installed to comply with the design requirements of a groundwater monitoring system.

10.3.2 Operational Phase

Restrict the impact of contaminated groundwater to the mining area and mitigate the impact on groundwater levels in the catchment.

10.3.2.1 Actions

The following actions (if possible) should be aligned with mine rehabilitation strategy and health and safety regulations:

- Soft overburden and weathered rock must be placed at the top of the backfill in order to minimize oxygen diffusion into the pit;
- The mined-out sections of the pit must be backfilled, compacted and rehabilitated with a soil layer and vegetation through a concurrent rehabilitation programme;
- Static groundwater levels should be monitored to ensure that any deviation of the groundwater flow from the idealised predictions is detected in time for intervention to be undertaken;
- The numerical model should be updated annually by using the measured water ingress and water levels to re-calibrate and refine the impact predictive scenario;
- The monitoring results must be interpreted by a qualified hydrogeologist and network audited annually for performance and compliance with license conditions;
- The rehabilitated part of open pit should be free draining away from the pit to reduce drainage into the pit and final void, if this is possible in terms of the mass balance and landform design;
- Sewage effluent emanating from latrines or ablution blocks should be treated to acceptable levels before discharge into the environment;
- Boreholes should be drilled into the backfilled part of the open pit so that the rate of flooding and water level recovery and quality could be established. Stage curves should made which would aid in the management of closure phase; and
- It is recommended that the geochemical assessment is updated regularly during the life of the mine in order to calibrate and validate its results and to construct an effective closure plan. The geochemical model should be updated to assess the effectiveness of potential mitigation measures.

10.3.3 Post Closure

The following objectives are envisaged for the closure phase:

- Negotiate and obtain groundwater closure objectives approved by the relevant authorities during the Decommissioning Phase of the project, based on the results of the monitoring information obtained during the construction and operational phases of the project, and through verification of the numerical model constructed for the project;
- Continue with the groundwater quality and groundwater level monitoring after mining ceases in order to establish post-closure groundwater level and quality trends. The monitoring information must be used to update, verify, and recalibrate the predictive tools used during the study to increase the confidence in the closure objectives and management plans; and
- Negotiate mine closure with the authorities based on the results of the groundwater monitoring undertaken, after the two four-year post-closure monitoring periods.

10.3.3.1 Actions

- Use the results of the monitoring programme to confirm/validate the predicted impacts on groundwater availability and quality after closure;
- Update existing predictive tools to verify long-term impacts on groundwater, if required;
- Present the results to the authorities on an annual basis to determine compliance with the closure objectives set during the Decommissioning Phase;
- Reduce recharge, this would entail a soil cover for the backfilled part of the open pit;
- Implement as many closure measures during the operational phase, while conducting appropriate monitoring programmes to demonstrate actual performance of the various management actions during the life of mine;
- All mined areas should be flooded as soon as possible to decrease oxygen reacting with remaining pyrite;
- The final backfilled open pit topography should be engineered such that runoff is directed away from the final void areas, if possible; and
- Audit the monitoring network annually.

11.0 CONCLUSIONS

The following conclusions are made from the baseline groundwater investigation (Phase I):

- The investigation area is characterised by the igneous and sedimentary rocks of the Karoo Supergroup. Turfvlakte Project Area is located on the Waterberg Coalfield and includes all the major units of the Karoo Supergroup, comprising from surface of the Stormberg Group, Beaufort Group, Ecca Group and the Dwyka Group forming the basement;
- Two aquifer systems are distinguished at Turfvlakte in the Karoo Supergroup namely:
  - Top weathered aquifer; and
  - Fractured secondary aquifer.
- The local groundwater flow direction is south-east towards the Mokolo River;
- The groundwater quality of the investigation area is mainly represented by poor (Class 3) to unacceptable drinking water quality (Class 4);

- The following constituents of the groundwater samples exceed the DWAF (1996), Agriculture use target water quality range limit EC, TDS, Na, Cl, F, Mn, Fe, Zn, N and SO_4 concentrations; and
- The baseline water quality at Turfvlakte is represented by boreholes TESPES 68 (Class 1) and TESPES 47 (Class 1) which are un-impacted by mining activities and are representative of calcium magnesium bicarbonate type of water (Ca, Mg)$(HCO_3)_2$.

The following conclusions are made from the Impact Assessment (Phase II):

- Numerical groundwater flow and contaminant transport modelling was used to quantify the likely construction, operational and post closure phase impacts of the proposed Turfvlakte project. The scenarios that were simulated include:
  - Groundwater inflows and the extent of potential dewatering;
  - Potential impact on surrounding groundwater users; and
  - Potential contaminant plumes that may originate from the mining areas.

Construction Phase

- During construction of the new activities at Turfvlakte minimal additional impacts on the groundwater system is expected. The main activities that could impact on groundwater in this phase include constructing and clearing of footprint areas for construction. The impacts are expected to have a low significance rating.

Operational Phase

- Groundwater Quantity:
  - The mine floor elevation is below the general groundwater level thus causing groundwater inflows into the two proposed open pit mining areas from the surrounding aquifers during operations. The mining areas will have to be actively dewatered to ensure a safe working environment. Pumping water that seeps into the mine areas will cause dewatering of the surrounding aquifers and an associated decrease in groundwater level within the zone of influence of the dewatering cone;
  - When assessing the 1.5 Mtpa preferred mining on Turfvlakte the extent of drawdown could reach ~1400 m to the east of the two open pits and ~1600 m to the west (so the Turfvlakte dewatering cone would merge with the Grootegeluk pit drawdown cone);
  - For the 3 Mtpa alterative mining schedule, the extent of drawdown could reach ~1100 m to the east of the two open pits and ~950 m to the west (so the Turfvlakte dewatering cone would merge with the Grootegeluk pit drawdown cone). The reduced impacted of the 3 Mtpa alterative mining schedule is due to the quicker mining progression and shorter mining period; and
  - The impact on groundwater levels do not extend across the Daarby Fault to the north or the Eenzaamheid Fault to the south. No privately-owned boreholes were located in proximity to the proposed project (2018 hydrocensus). Therefore, it is not expected that the dewatering activities associated with the Turfvlakte mining will impact negatively on existing privately-owned boreholes.
- Mine inflow volumes:
  - The 1.5 Mtpa preferred mining schedule entails the mining of Pit 1 from year 1 to year 11. The simulated groundwater inflow into open pit 1 fluctuate between ~580 m^3/d and ~290 m^3/d. The pit

floor depths in Pit 1 range from 46 mbgl in the north part to 77 mbgl in the southern/central part. In Pit 2 located north east of Pit 1, mining also commences in year 12 and ceases in year 16.

Mining depths range from ~39 mbgl in the south eastern part of the pit and deepens to 120 mbgl in the north-western part of the proposed pit. The simulated groundwater inflows ranged between ~270 and 380 m^3/d;

- The 3 Mtpa alterative mining schedule entails the mining of both pits at the same time, i.e. from year 1 to year 7. The simulated groundwater inflow into open pit 1 fluctuate between ~590 m^3/d and ~300 m^3/d. In Pit 2, where mining occurs concurrently with Pit 1 but only from year 1 to year 4. The simulated groundwater inflows ranged between ~640 and 440 m^3/d; and
- It is also important to view these volumes for the water make of the mine in relation to natural evaporation. Evaporation will take place over the total area of the open pits and could reduce the actual seepage volume.

- Groundwater Quality:
  - Groundwater flow directions south of the Daarby fault will be directed towards the mining areas due to the mine dewatering. Therefore, contamination will be contained within the mining area, and little contamination will be able to migrate away from the mining area; and
  - Contamination from the mining areas is generally contained within the mining areas. The baseline study found that is the groundwater quality of the boreholes located in the middle of Turfvlakte and WBR46 are likely to be impacted from existing mining activities. The environmental impact significance is expected to be low.
- Post Closure Phase:
  - In the post closure phase, the open pit is deemed to be partly backfilled and vegetated, with final voids in Pit 1 and Pit 2. A flow gradient exists towards both pits after closure due to the rehabilitated pits and final voids acting as a sink. The environmental impact significance is expected to be low. Once the mining has ceased, ARD and leaching of trace elements is still likely to occur within the backfilled pits due to the contact of water and oxygen through natural process including rainfall and groundwater seepage. Once the ARD forming material is however saturated, the formation of ARD is reduced. The partially backfilled Pit 1 and Pit 2 likely to act as a contaminant sink post closure (i.e. contaminants could migrate toward pit post closure) and therefore no significant migration of the contaminants from the 2 partially backfilled pits is expected. The contaminants are generally confined to the pits post closure. No privately-owned boreholes are likely to be impacted based on the impact simulations; and
  - Given the climatic and topographical environment at Turfvlakte as well as the future presence of a final voids in Pit 1 and Pit 2; decant or surface discharge from the open pits are unlikely.

12.0 RECOMMENDATIONS

The following groundwater recommendations are made:

- The 9 boreholes sampled during 2018 to be monitored as initial monitoring boreholes to monitor baseline/background conditions at Turfvlakte as part of the Grootegeluk existing groundwater monitoring plan;
- The sampling and water level monitoring is to be done on a quarterly basis during the baseline period for one year when it should be re-evaluated;

- Monitoring boreholes to be drilled into the backfilled pit to determine the inflow rates as the pit water levels rebound. Drilling of monitoring boreholes to be aligned with mine health and safety regulations;
- A pit lake feasibility study should be conducted to determine the optimal size of the final void to ensure minimal post closure impacts. In addition, the geochemical assessment should be updated based on the likely final void/pit lake dimensions;
- Consideration should be given to separate handling of calcrete in the soft overburden so that this material, which is high in neutralisation potential as confirmed by kinetics of the soft overburden, can be used in covers for the backfilled pits, and the base of the final void of Pit 1;
- During trial mining or grade control drilling, samples of different lithologies in the hard overburden should be subjected to further acid-base accounting tests to confirm whether they should be precautionarily considered to be potentially acid-generating; and
- The numerical flow and contaminant transport model and the geochemical model should be updated every 2 years with the latest monitoring, analyses, and structural data.

13.0 REFERENCES

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- 1:4 000 000 Groundwater Resources map of RSA – Sheet 2 (WRC.DWAF 1995).
- 1: 500 000 Hydrogeological Map Series of RSA (1996).

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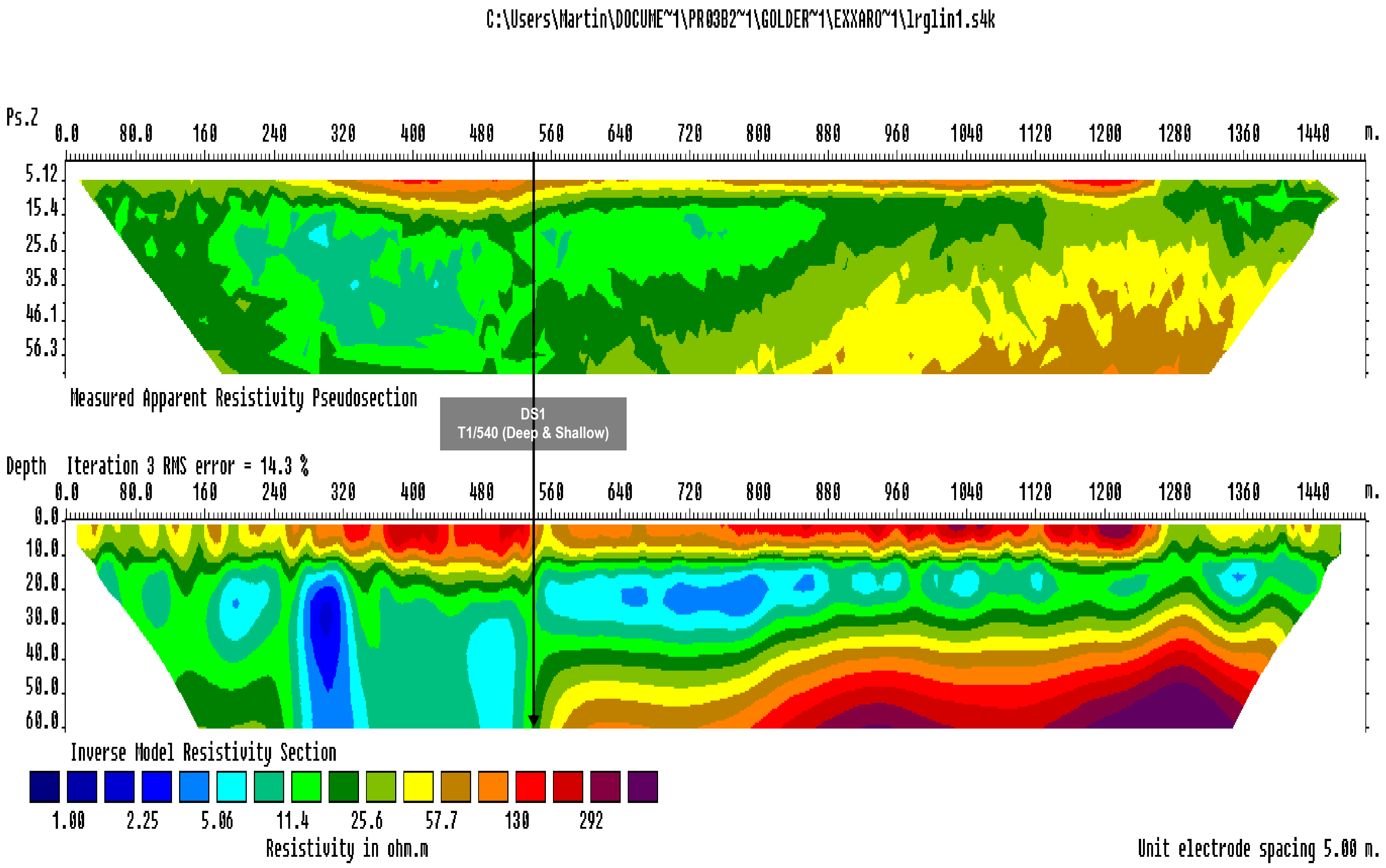
APPENDIX A

Geophysical Traverses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5.12
15.4
25.6
35.8
46.1
56.3
Measured Apparent Resistivity Pseudosection
DS1
T1/540 (Deep & Shallow)
Depth
Iteration 3 RMS error = 14.3 %
0.0 80.0 160 240 320 400 480 560 640 720 800 880 960 1040 1120 1200 1280 1360 1440 m.
0.0
10.0
20.0
30.0
40.0
50.0
60.0
Inverse Model Resistivity Section
1.00 2.25 5.06 11.4 25.6 57.7 130 292
Resistivity in ohm.m
Unit electrode spacing 5.00 m.

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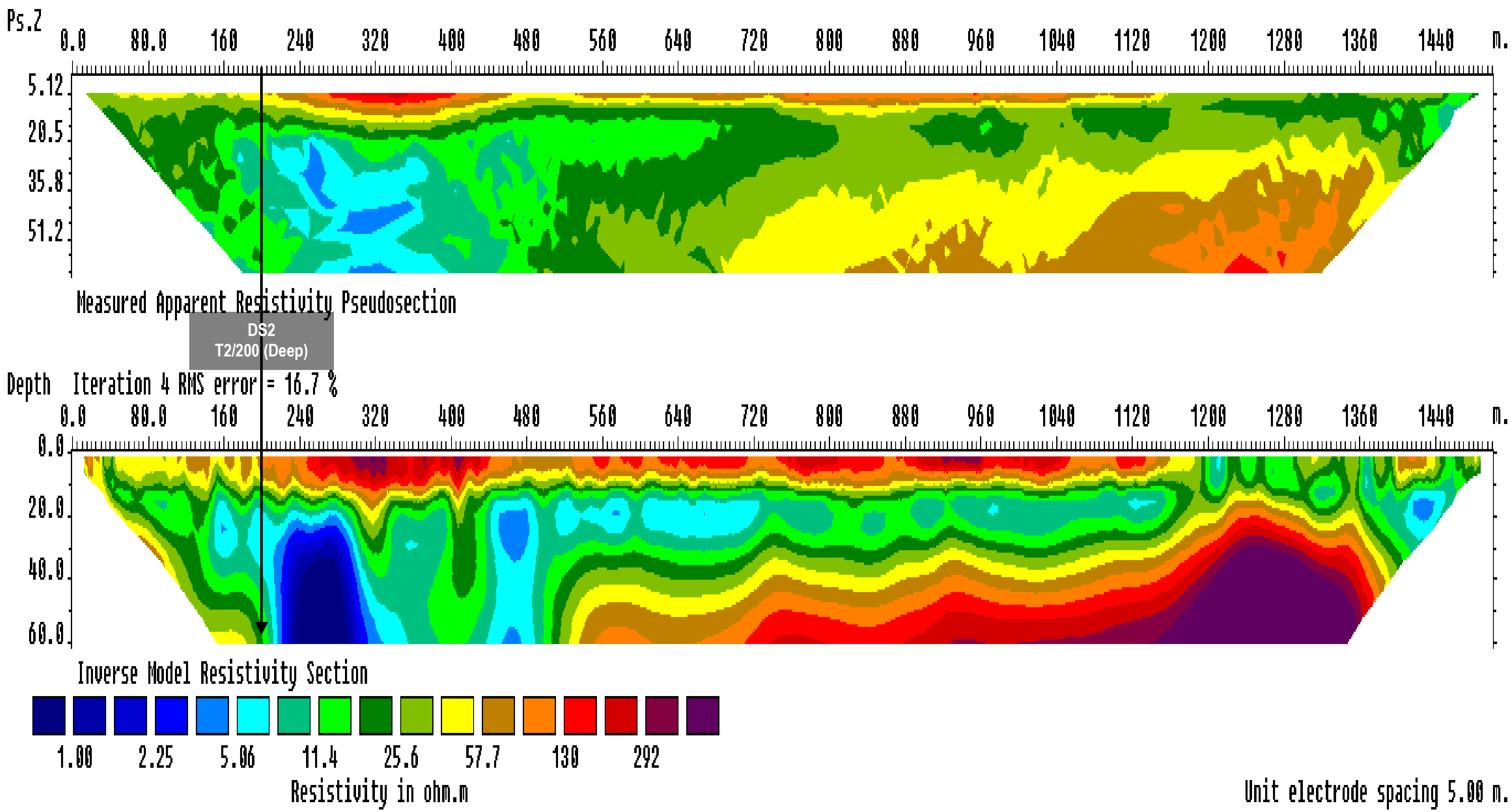

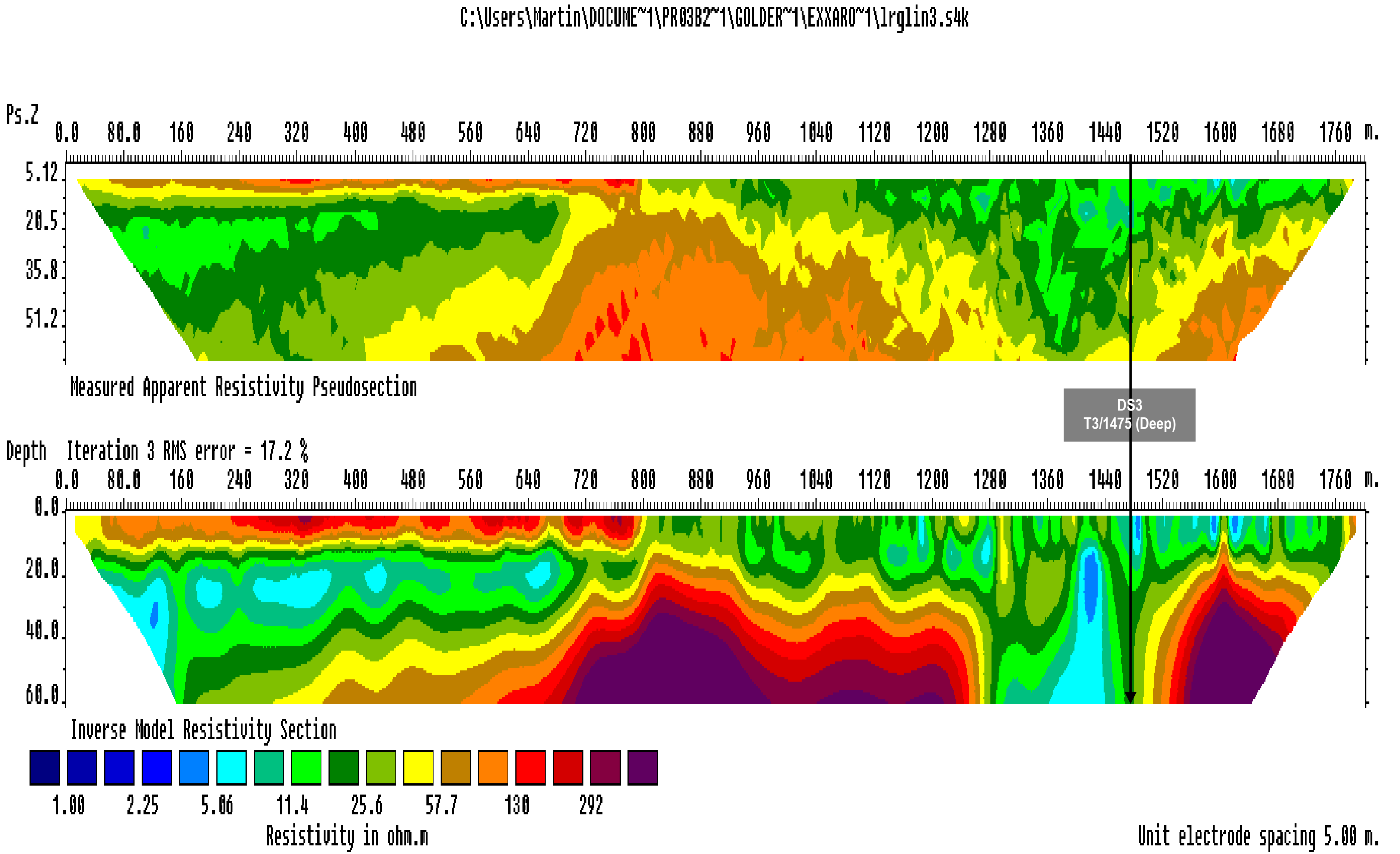
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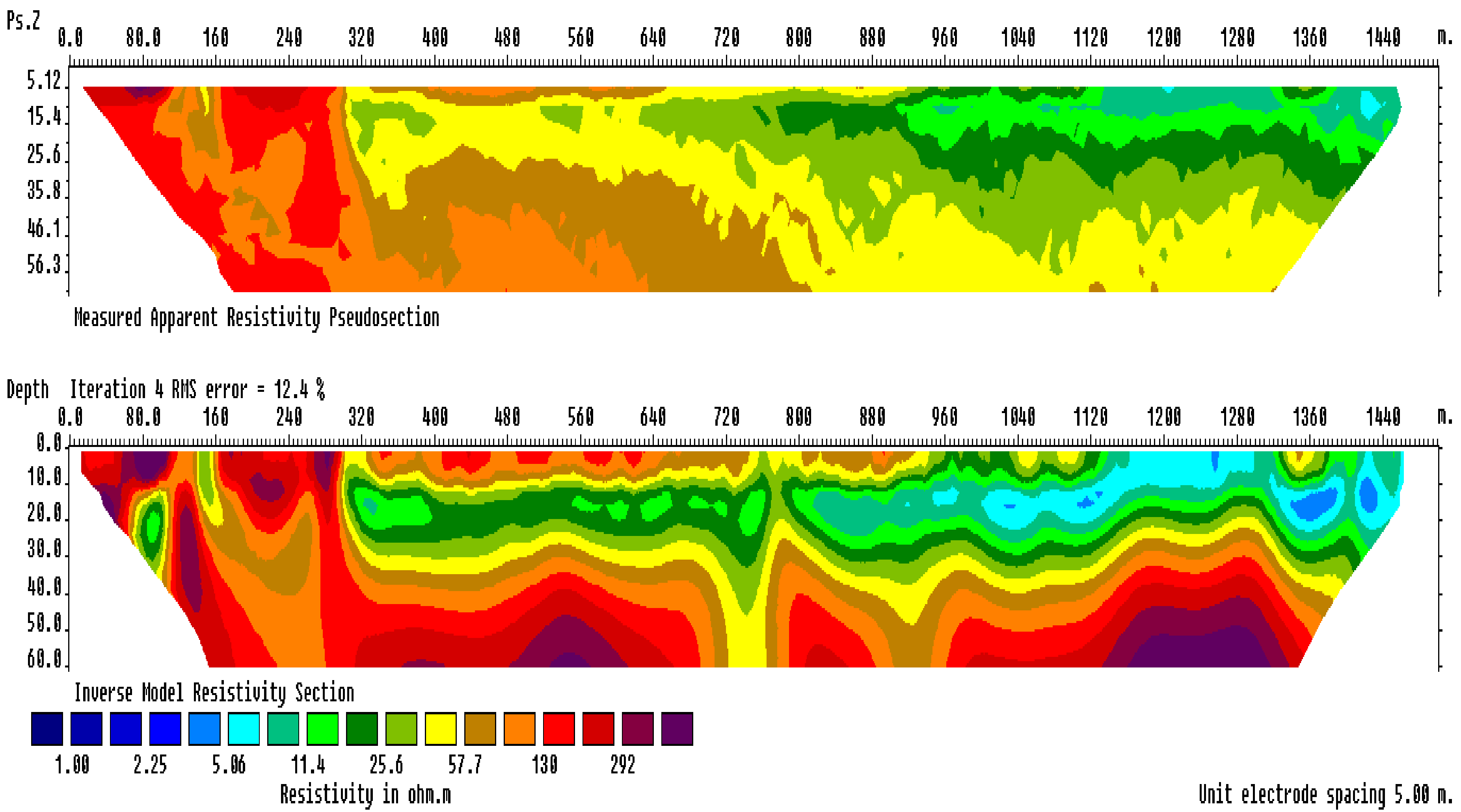
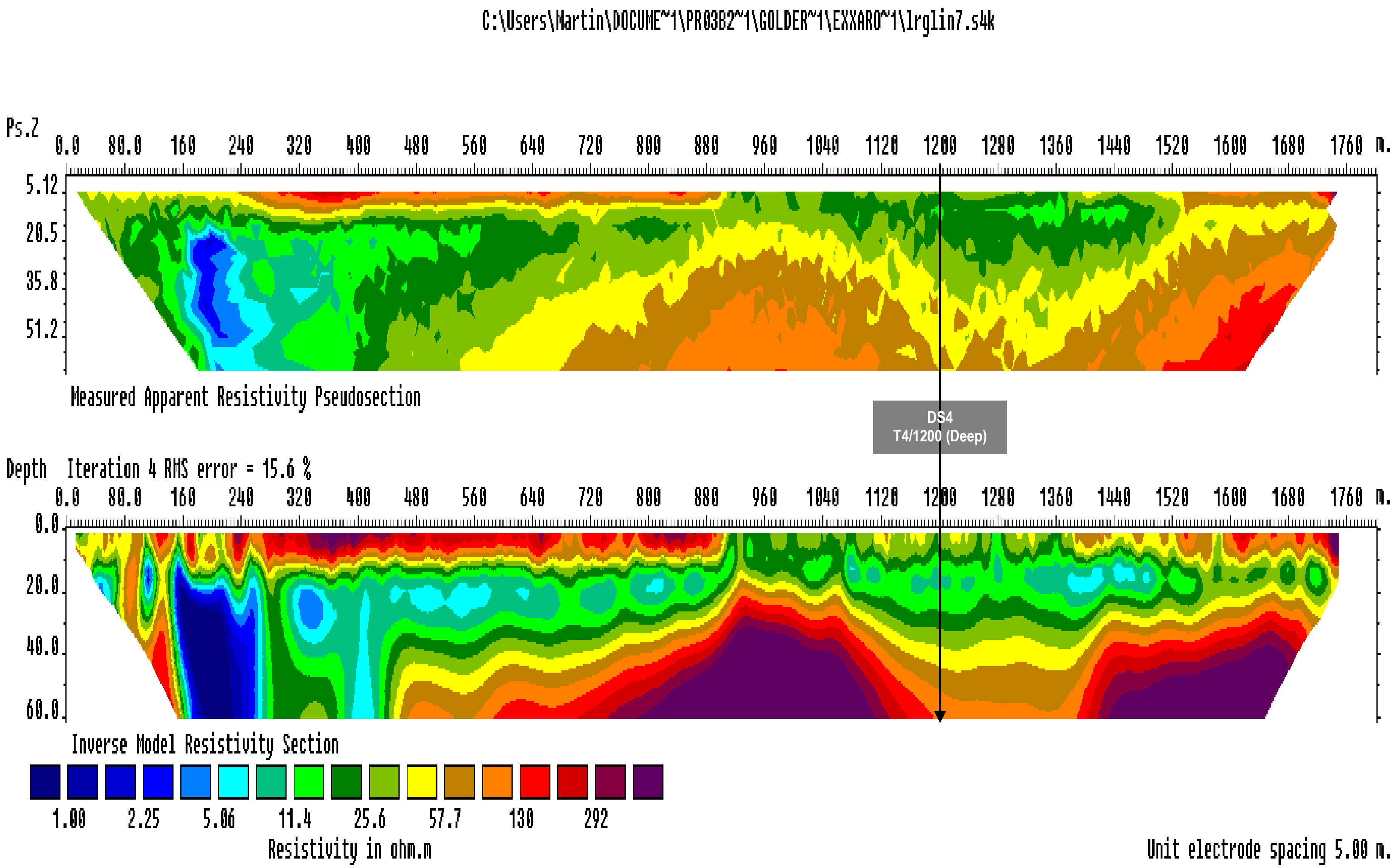
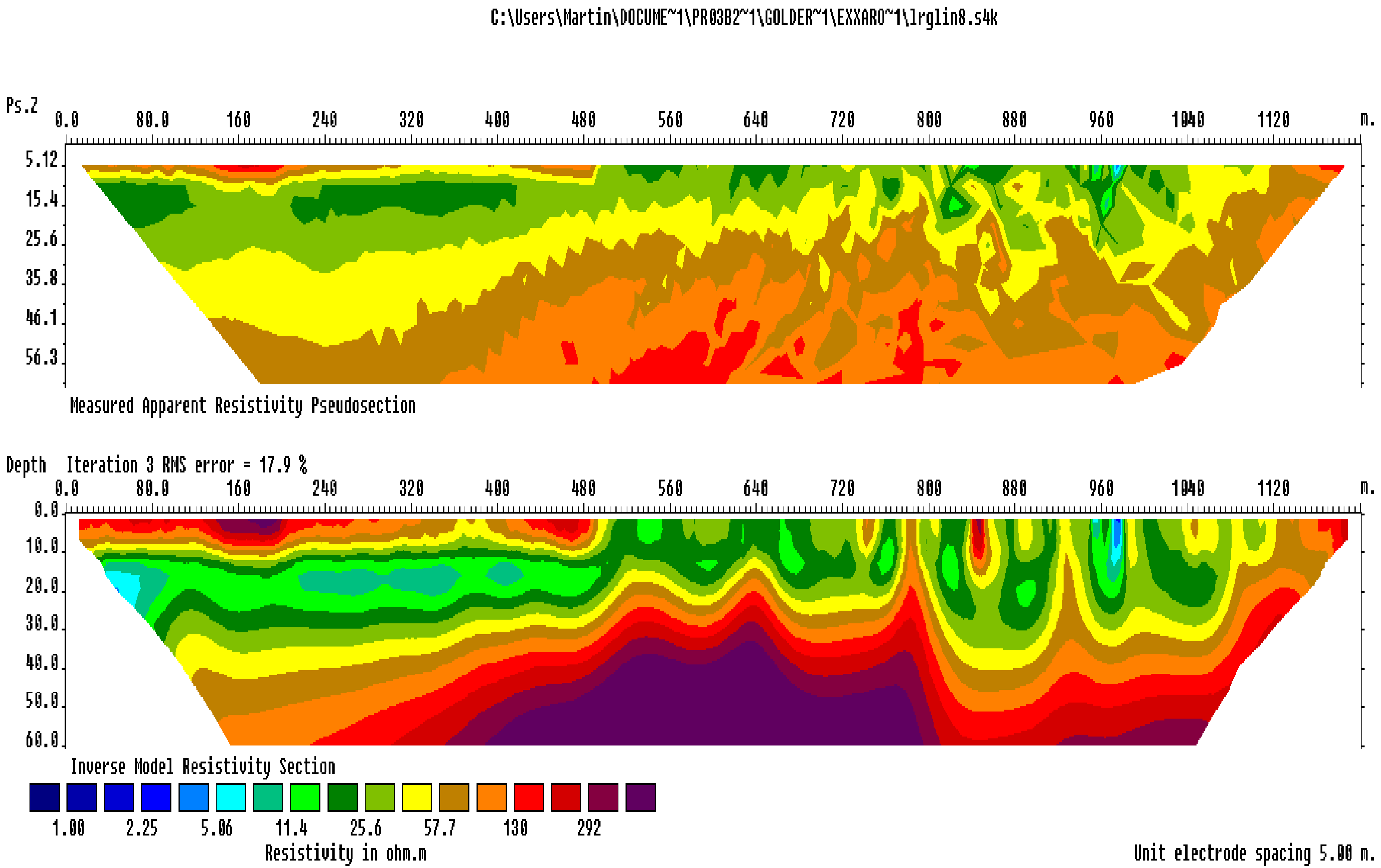
Ps.Z
0.0 80.0 160 240 320 400 480 560 640 720 800 880 960 1040 1120 1200 1280 1360 1440 1520 1600 1680 1760 m.
5.12
20.5
35.8
51.2
Measured Apparent Resistivity Pseudosection
DS3
T3/1475 (Deep)
Depth Iteration 3 RMS error = 17.2 %
0.0 80.0 160 240 320 400 480 560 640 720 800 880 960 1040 1120 1200 1280 1360 1440 1520 1600 1680 1760 m.
0.0
20.0
40.0
60.0
Inverse Model Resistivity Section
1.00 2.25 5.06 11.4 25.6 57.7 130 292
Resistivity in ohm.m
Unit electrode spacing 5.00 m.

C:\Users\Martin\DOCUME~1\PR03B2~1\GOLDER~1\EXXARO~1\lrglin6.s4k




C:\Users\Martin\DOCUME~1\PR03B2~1\GOLDER~1\EXXARO~1\lrglin7.s4k
Ps.Z
0.0 80.0 160 240 320 400 480 560 640 720 800 880 960 1040 1120 1200 1280 1360 1440 1520 1600 1680 1760 m.
5.12
20.5
35.8
51.2
Measured Apparent Resistivity Pseudosection
DS4
T4/1200 (Deep)
Depth Iteration 4 RMS error = 15.6 %
0.0 80.0 160 240 320 400 480 560 640 720 800 880 960 1040 1120 1200 1280 1360 1440 1520 1600 1680 1760 m.
0.0
20.0
40.0
60.0
Inverse Model Resistivity Section
1.00 2.25 5.06 11.4 25.6 57.7 130 292
Resistivity in ohm.m
Unit electrode spacing 5.00 m.



C:\Users\Martin\DOCUME~1\PR03B2~1\GOLDER~1\EXXARO~1\lrglin8.s4k
Ps.Z
0.0
80.0
160
240
320
400
480
560
640
720
800
880
960
1040
1120
m.
5.12
15.4
25.6
35.8
46.1
56.3
Measured Apparent Resistivity Pseudosection
Depth
Iteration 3 RMS error = 17.9 %
0.0
10.0
20.0
30.0
40.0
50.0
60.0
Inverse Model Resistivity Section
1.00
2.25
5.06
11.4
25.6
57.7
130
292
Resistivity in ohm.m
Unit electrode spacing 5.00 m.

APPENDIX B

Hydrocensus Analytical Results

analytical services

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FINAL CERTIFICATE OF ANALYSIS	
Report Date	2018-02-06
Date Required	2018-02-08
Contract No	
Order/Ref No	1784950 Turfvlakte

Testing Laboratory T0184

1784950 Turfvlakte

Notes
The results relate specifically to the items tested.
The report shall not be reproduced except in full, without the written approval of the laboratory.
1 SANAS accredited analysis included in the SANAS Schedule of Accreditation for this laboratory.
2 Not SANAS accredited analysis and not included in the SANAS schedule of accreditation for this laboratory.
3 Outsourced not performed by this laboratory.

Request ID: 20183 **Sample ID:** 545805 **Received:** 2018-01-29 **Matrix:** Water **Page:** 1 / 14
Sample Number: TESPES 34/20-01-2018 **Revision Number:** 0

Method: [2]UIS-CP-KBY-T007(Calculated Carbonate and Bicarbonate Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]Bicarbonate Alkalinity	349	mg/l CaCO3	[2]Carbonate Alkalinity	<0.6	mg/l CaCO3

Method: [1]UIS-EA-T001(pH) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]pH	6.8		[2]pH Temperature	25	Deg C

Method: [1]UIS-EA-T001(Electrical Conductivity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Tot Cond @25C	358	mSm	[1]Total Conductivity	358	mS/m	[2]TC Temperature	21.9	Deg C

Method: [2]UIS-CP-T001(Calculated Total Dissolved Solids from EC) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]TDS by EC*6.5	2330	mg/l	[2]TDS by EC*7	2510	mg/l

Method: [1]UIS-EA-T005(Total Dissolved Solids) **Completed:** 2018-02-06

Parameter	Value	Unit
[1]Total Dissolved Solids at 180C	2890	mg/l

Method: [2]UIS-CP-T004(Calculated Hardness) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ca Hardness	807	mg/l CaCO3	[2]Mg Hardness	610	mg/l CaCO3	[2]Total Hardness	1420	mg/l CaCO3

Method: [2]UIS-CP-T003(Calculated Total Dissolved Solids by Summation) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]TDS by Summation	1090	mg/l

Method: [1]UIS-EA-T001(P and Total (M) Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]P Alkalinity	<0.6	mg/l CaCO3	[1]Total (M) Alkalinity	349	mg/l CaCO3

Method: [1]UIS-AC-T007(Disolved Elements in Water by ICP-OES) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Ca	323	mg/l	[1]K	10.9	mg/l	[1]Mg	148	mg/l
[1]Na	391	mg/l						

Method: [1]UIS-EA-T034(Anions by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Fluoride F	0.551	mg/l	[1]Chloride Cl	607	mg/l	[2]Nitrite NO2	<0.001	mg/l
[2]Nitrite NO2 as N	<0.001	mg/l	[1]Sulphate SO4	867	mg/l			

Method: [2]UIS-CP-T005(Ion Balance Error Gallery) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Sum of Cations	45.8	me/l	[2]Sum of Anions	41	me/l	[2]Ion Error Balance	5.47	%

Method: [1]UIS-EA-T008(Anions by Ion Chromatography) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]NO3	1.91	mg/l	[2]NO3 as N	0.43	mg/l

Method: [2]UIS-AC-T100(Trace elements in liquids by ICP-MS) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ag	<0.001	mg/l	[2]Al	<0.001	mg/l	[2]As	0.003	mg/l
[2]Au	<0.001	mg/l	[2]B	0.321	mg/l	[2]Ba	0.047	mg/l
[2]Be	<0.001	mg/l	[2]Bi	<0.001	mg/l	[2]Cd	<0.0001	mg/l
[2]Co	0.07	mg/l	[2]Cr	<0.001	mg/l	[2]Cu	0.027	mg/l
[2]Fe	<0.01	mg/l	[2]Hg	<0.0001	mg/l	[2]Li	0.156	mg/l
[2]Mn	0.679	mg/l	[2]Mo	0.008	mg/l	[2]Ni	0.876	mg/l
[2]Pb	0.001	mg/l	[2]Sb	0.001	mg/l	[2]Se	0.001	mg/l
[2]Sn	<0.001	mg/l	[2]Sr	0.795	mg/l	[2]Ti	0.475	mg/l
[2]U	<0.0001	mg/l	[2]V	0.011	mg/l	[2]Zn	0.251	mg/l

Method: [2]UIS-CP-T012(Ammonium calculated photometry) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]NH4+ calculated	2.96	mg/l

Method: [1]UIS-EA-T050(Ammonia by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]Ammonia as N	2.31	mg/l	[1]Ammonia as NH3	2.81	mg/l

Request ID: 20183 **Sample ID:** 545806 **Received:** 2018-01-29 **Matrix:** Water **Page:** 2 / 14
Sample Number: TESPES 63/18-01-2018 **Revision Number:** 0

Method: [2]UIS-CP-KBY-T007(Calculated Carbonate and Bicarbonate Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]Bicarbonate Alkalinity	372	mg/l CaCO3	[2]Carbonate Alkalinity	<0.6	mg/l CaCO3

Method: [1]UIS-EA-T001(pH) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]pH	6.86		[2]pH Temperature	25	Deg C

Method: [1]UIS-EA-T001(Electrical Conductivity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Tot Cond @25C	766	mSm	[1]Total Conductivity	766	mS/m	[2]TC Temperature	21.8	Deg C

Method: [2]UIS-CP-T001(Calculated Total Dissolved Solids from EC) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]TDS by EC*6.5	4980	mg/l	[2]TDS by EC*7	5360	mg/l

Method: [2]UIS-CP-T004(Calculated Hardness) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ca Hardness	1720	mg/l CaCO3	[2]Mg Hardness	1260	mg/l CaCO3	[2]Total Hardness	2990	mg/l CaCO3

Method: [1]UIS-EA-T005(Total Dissolved Solids) **Completed:** 2018-02-06

Parameter	Value	Unit
[1]Total Dissolved Solids at 180C	5390	mg/l

Method: [2]UIS-CP-T003(Calculated Total Dissolved Solids by Summation) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]TDS by Summation	1800	mg/l

Method: [1]UIS-EA-T001(P and Total (M) Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]P Alkalinity	<0.6	mg/l CaCO3	[1]Total (M) Alkalinity	372	mg/l CaCO3

Method: [1]UIS-AC-T007(Disolved Elements in Water by ICP-OES) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Ca	691	mg/l	[1]K	36.4	mg/l	[1]Mg	306	mg/l
[1]Na	537	mg/l						

Method: [1]UIS-EA-T034(Anions by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Fluoride F	0.511	mg/l	[1]Chloride Cl	1100	mg/l	[2]Nitrite NO2	<0.001	mg/l

Parameter	Value	Unit	Parameter	Value	Unit
[2]Nitrite NO2 as N	<0.001	mg/l	[1]Sulphate SO4	1930	mg/l

Method: [2]UIS-CP-T005(Ion Balance Error Gallery) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Sum of Cations	84.2	me/l	[2]Sum of Anions	77.4	me/l	[2]Ion Error Balance	4.17	%

Method: [1]UIS-EA-T008(Anions by Ion Chromatography) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]NO3	2.6	mg/l	[2]NO3 as N	0.59	mg/l

Method: [2]UIS-AC-T100(Trace elements in liquids by ICP-MS) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ag	<0.001	mg/l	[2]Al	<0.001	mg/l	[2]As	0.008	mg/l
[2]Au	<0.001	mg/l	[2]B	0.407	mg/l	[2]Ba	0.101	mg/l
[2]Be	<0.001	mg/l	[2]Bi	<0.001	mg/l	[2]Cd	<0.0001	mg/l
[2]Co	0.137	mg/l	[2]Cr	<0.001	mg/l	[2]Cu	0.039	mg/l
[2]Fe	<0.01	mg/l	[2]Hg	<0.0001	mg/l	[2]Li	0.253	mg/l
[2]Mn	0.988	mg/l	[2]Mo	0.014	mg/l	[2]Ni	1.74	mg/l
[2]Pb	<0.001	mg/l	[2]Sb	0.001	mg/l	[2]Se	0.001	mg/l
[2]Sn	<0.001	mg/l	[2]Sr	2.23	mg/l	[2]Ti	0.317	mg/l
[2]U	0.001	mg/l	[2]V	0.018	mg/l	[2]Zn	0.149	mg/l

Method: [2]UIS-CP-T012(Ammonium calculated photometry) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]NH4+ calculated	5.29	mg/l

Method: [1]UIS-EA-T050(Ammonia by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]Ammonia as N	4.13	mg/l	[1]Ammonia as NH3	5.02	mg/l

Request ID: 20183 **Sample ID:** 545807 **Received:** 2018-01-29 **Matrix:** Water **Page:** 3 / 14
Sample Number: TESPES 61/21-01-2018 **Revision Number:** 0

Method: [2]UIS-CP-KBY-T007(Calculated Carbonate and Bicarbonate Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]Bicarbonate Alkalinity	90.3	mg/l CaCO3	[2]Carbonate Alkalinity	<0.6	mg/l CaCO3

Method: [1]UIS-EA-T001(pH) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]pH	5.81		[2]pH Temperature	25	Deg C

Method: [1]UIS-EA-T001(Electrical Conductivity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Tot Cond @25C	516	mSm	[1]Total Conductivity	516	mS/m	[2]TC Temperature	21.8	Deg C

Method: [2]UIS-CP-T001(Calculated Total Dissolved Solids from EC) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]TDS by EC*6.5	3360	mg/l	[2]TDS by EC*7	3610	mg/l

Method: [2]UIS-CP-T004(Calculated Hardness) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ca Hardness	1340	mg/l CaCO3	[2]Mg Hardness	652	mg/l CaCO3	[2]Total Hardness	1990	mg/l CaCO3

Method: [1]UIS-EA-T005(Total Dissolved Solids) **Completed:** 2018-02-06

Parameter	Value	Unit
[1]Total Dissolved Solids at 180C	3620	mg/l

Method: [2]UIS-CP-T003(Calculated Total Dissolved Solids by Summation) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]TDS by Summation	1160	mg/l

Method: [1]UIS-EA-T001(P and Total (M) Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]P Alkalinity	<0.6	mg/l CaCO3	[1]Total (M) Alkalinity	90.3	mg/l CaCO3

Method: [1]UIS-AC-T007(Disolved Elements in Water by ICP-OES) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Ca	536	mg/l	[1]K	61.5	mg/l	[1]Mg	158	mg/l
[1]Na	345	mg/l						

Method: [1]UIS-EA-T034(Anions by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Fluoride F	0.768	mg/l	[1]Chloride Cl	302	mg/l	[2]Nitrite NO2	0.052	mg/l
[2]Nitrite NO2 as N	0.016	mg/l	[1]Sulphate SO4	1930	mg/l			

Method: [2]UIS-CP-T005(Ion Balance Error Gallery) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Sum of Cations	56.8	me/l	[2]Sum of Anions	50.2	me/l	[2]Ion Error Balance	6.09	%

Method: [1]UIS-EA-T008(Anions by Ion Chromatography) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]NO3	0.98	mg/l	[2]NO3 as N	<0.3	mg/l

Method: [2]UIS-AC-T100(Trace elements in liquids by ICP-MS) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ag	<0.001	mg/l	[2]Al	0.386	mg/l	[2]As	0.003	mg/l
[2]Au	<0.001	mg/l	[2]B	0.654	mg/l	[2]Ba	0.052	mg/l
[2]Be	0.01	mg/l	[2]Bi	<0.001	mg/l	[2]Cd	0.001	mg/l
[2]Co	0.179	mg/l	[2]Cr	<0.001	mg/l	[2]Cu	0.025	mg/l
[2]Fe	0.128	mg/l	[2]Hg	<0.0001	mg/l	[2]Li	0.494	mg/l
[2]Mn	2.06	mg/l	[2]Mo	0.007	mg/l	[2]Ni	1.21	mg/l
[2]Pb	0.004	mg/l	[2]Sb	<0.001	mg/l	[2]Se	0.004	mg/l
[2]Sn	<0.001	mg/l	[2]Sr	2.1	mg/l	[2]Ti	0.296	mg/l
[2]U	0.001	mg/l	[2]V	0.005	mg/l	[2]Zn	1.03	mg/l

Method: [2]UIS-CP-T012(Ammonium calculated photometry) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]NH4+ calculated	0.543	mg/l

Method: [1]UIS-EA-T050(Ammonia by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]Ammonia as N	0.422	mg/l	[1]Ammonia as NH3	0.513	mg/l

Method: [2]UIS-CP-KBY-T007(Calculated Carbonate and Bicarbonate Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]Bicarbonate Alkalinity	273	mg/l CaCO3	[2]Carbonate Alkalinity	<0.6	mg/l CaCO3

Method: [1]UIS-EA-T001(pH) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]pH	6.69		[2]pH Temperature	25	Deg C

Method: [1]UIS-EA-T001(Electrical Conductivity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Tot Cond @25C	89.9	mSm	[1]Total Conductivity	89.9	mS/m	[2]TC Temperature	22.2	Deg C

Method: [2]UIS-CP-T001(Calculated Total Dissolved Solids from EC) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]TDS by EC*6.5	584	mg/l	[2]TDS by EC*7	629	mg/l

Method: [2]UIS-CP-T004(Calculated Hardness) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ca Hardness	250	mg/l CaCO3	[2]Mg Hardness	147	mg/l CaCO3	[2]Total Hardness	396	mg/l CaCO3

Method: [1]UIS-EA-T005(Total Dissolved Solids) **Completed:** 2018-02-06

Parameter	Value	Unit
[1]Total Dissolved Solids at 180C	618	mg/l

Method: [2]UIS-CP-T003(Calculated Total Dissolved Solids by Summation) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]TDS by Summation	364	mg/l

Method: [1]UIS-EA-T001(P and Total (M) Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]P Alkalinity	<0.6	mg/l CaCO3	[1]Total (M) Alkalinity	273	mg/l CaCO3

Method: [1]UIS-AC-T007(Disolved Elements in Water by ICP-OES) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Ca	100	mg/l	[1]K	3.92	mg/l	[1]Mg	35.6	mg/l
[1]Na	60.9	mg/l						

Method: [1]UIS-EA-T034(Anions by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Fluoride F	0.21	mg/l	[1]Chloride Cl	68.4	mg/l	[2]Nitrate NO3	<0.13	mg/l
[1]Nitrate NO3 as N	<0.13	mg/l	[2]Nitrite NO2	0.011	mg/l	[2]Nitrite NO2 as N	0.003	mg/l
[1]Sulphate SO4	138	mg/l						

Method: [2]UIS-CP-T005(Ion Balance Error Gallery) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Sum of Cations	10.7	me/l	[2]Sum of Anions	9.37	me/l	[2]Ion Error Balance	6.78	%

Method: [2]UIS-AC-T100(Trace elements in liquids by ICP-MS) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ag	<0.001	mg/l	[2]Al	0.005	mg/l	[2]As	0.002	mg/l
[2]Au	<0.001	mg/l	[2]B	0.12	mg/l	[2]Ba	0.158	mg/l
[2]Be	<0.001	mg/l	[2]Bi	<0.001	mg/l	[2]Cd	<0.0001	mg/l
[2]Co	0.023	mg/l	[2]Cr	<0.001	mg/l	[2]Cu	0.007	mg/l
[2]Fe	<0.01	mg/l	[2]Hg	<0.0001	mg/l	[2]Li	0.033	mg/l
[2]Mn	0.298	mg/l	[2]Mo	0.004	mg/l	[2]Ni	0.232	mg/l
[2]Pb	<0.001	mg/l	[2]Sb	<0.001	mg/l	[2]Se	0.001	mg/l
[2]Sn	<0.001	mg/l	[2]Sr	0.417	mg/l	[2]Ti	0.171	mg/l
[2]U	0.006	mg/l	[2]V	0.002	mg/l	[2]Zn	0.56	mg/l

Method: [2]UIS-CP-T012(Ammonium calculated photometry) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]NH4+ calculated	0.846	mg/l

Method: [1]UIS-EA-T050(Ammonia by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]Ammonia as N	0.659	mg/l	[1]Ammonia as NH3	0.801	mg/l

Request ID: 20183 **Sample ID:** 545809 **Received:** 2018-01-29 **Matrix:** Water
Sample Number: TESPES 26/22-01-2018 **Revision Number:** 0

Method: [2]UIS-CP-KBY-T007(Calculated Carbonate and Bicarbonate Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]Bicarbonate Alkalinity	350	mg/l CaCO3	[2]Carbonate Alkalinity	<0.6	mg/l CaCO3

Method: [1]UIS-EA-T001(pH) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]pH	6.43		[2]pH Temperature	25	Deg C

Method: [1]UIS-EA-T001(Electrical Conductivity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Tot Cond @25C	454	mSm	[1]Total Conductivity	454	mS/m	[2]TC Temperature	22.1	Deg C

Method: [2]UIS-CP-T001(Calculated Total Dissolved Solids from EC) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]TDS by EC*6.5	2950	mg/l	[2]TDS by EC*7	3180	mg/l

Method: [1]UIS-EA-T005(Total Dissolved Solids) **Completed:** 2018-02-06

Parameter	Value	Unit
[1]Total Dissolved Solids at 180C	3670	mg/l

Method: [2]UIS-CP-T004(Calculated Hardness) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ca Hardness	973	mg/l CaCO3	[2]Mg Hardness	824	mg/l CaCO3	[2]Total Hardness	1800	mg/l CaCO3

Method: [2]UIS-CP-T003(Calculated Total Dissolved Solids by Summation) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]TDS by Summation	1330	mg/l

Method: [1]UIS-EA-T001(P and Total (M) Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]P Alkalinity	<0.6	mg/l CaCO3	[1]Total (M) Alkalinity	350	mg/l CaCO3

Method: [1]UIS-AC-T007(Disolved Elements in Water by ICP-OES) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Ca	390	mg/l	[1]K	20.4	mg/l	[1]Mg	200	mg/l
[1]Na	504	mg/l						

Method: [1]UIS-EA-T034(Anions by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Fluoride F	0.391	mg/l	[1]Chloride Cl	900	mg/l	[2]Nitrite NO2	0.043	mg/l
[2]Nitrite NO2 as N	0.013	mg/l	[1]Sulphate SO4	1070	mg/l			

Method: [2]UIS-CP-T005(Ion Balance Error Gallery) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Sum of Cations	58.6	me/l	[2]Sum of Anions	53.4	me/l	[2]Ion Error Balance	4.59	%

Method: [1]UIS-EA-T008(Anions by Ion Chromatography) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]NO3	2.81	mg/l	[2]NO3 as N	0.63	mg/l

Method: [2]UIS-AC-T100(Trace elements in liquids by ICP-MS) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ag	<0.001	mg/l	[2]Al	<0.001	mg/l	[2]As	0.005	mg/l
[2]Au	<0.001	mg/l	[2]B	0.574	mg/l	[2]Ba	0.057	mg/l
[2]Be	<0.001	mg/l	[2]Bi	<0.001	mg/l	[2]Cd	<0.0001	mg/l
[2]Co	0.075	mg/l	[2]Cr	<0.001	mg/l	[2]Cu	0.035	mg/l
[2]Fe	<0.01	mg/l	[2]Hg	<0.0001	mg/l	[2]Li	0.181	mg/l
[2]Mn	1.13	mg/l	[2]Mo	0.041	mg/l	[2]Ni	0.915	mg/l
[2]Pb	0.001	mg/l	[2]Sb	0.001	mg/l	[2]Se	0.002	mg/l
[2]Sn	<0.001	mg/l	[2]Sr	1.94	mg/l	[2]Ti	0.399	mg/l
[2]U	0.034	mg/l	[2]V	0.017	mg/l	[2]Zn	0.371	mg/l

Method: [2]UIS-CP-T012(Ammonium calculated photometry) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]NH4+ calculated	1.75	mg/l

Method: [1]UIS-EA-T050(Ammonia by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]Ammonia as N	1.37	mg/l	[1]Ammonia as NH3	1.66	mg/l

Method: [2]UIS-CP-KBY-T007(Calculated Carbonate and Bicarbonate Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]Bicarbonate Alkalinity	352	mg/l CaCO3	[2]Carbonate Alkalinity	<0.6	mg/l CaCO3

Method: [1]UIS-EA-T001(pH) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]pH	6.77		[2]pH Temperature	25	Deg C

Method: [1]UIS-EA-T001(Electrical Conductivity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Tot Cond @25C	358	mSm	[1]Total Conductivity	358	mS/m	[2]TC Temperature	22.1	Deg C

Method: [2]UIS-CP-T001(Calculated Total Dissolved Solids from EC) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]TDS by EC*6.5	2330	mg/l	[2]TDS by EC*7	2510	mg/l

Method: [2]UIS-CP-T004(Calculated Hardness) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ca Hardness	815	mg/l CaCO3	[2]Mg Hardness	605	mg/l CaCO3	[2]Total Hardness	1420	mg/l CaCO3

Method: [1]UIS-EA-T005(Total Dissolved Solids) **Completed:** 2018-02-06

Parameter	Value	Unit
[1]Total Dissolved Solids at 180C	2900	mg/l

Method: [2]UIS-CP-T003(Calculated Total Dissolved Solids by Summation) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]TDS by Summation	1090	mg/l

Method: [1]UIS-EA-T001(P and Total (M) Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]P Alkalinity	<0.6	mg/l CaCO3	[1]Total (M) Alkalinity	352	mg/l CaCO3

Method: [1]UIS-AC-T007(Disolved Elements in Water by ICP-OES) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Ca	327	mg/l	[1]K	10.8	mg/l	[1]Mg	147	mg/l
[1]Na	388	mg/l						

Method: [1]UIS-EA-T034(Anions by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Fluoride F	0.522	mg/l	[1]Chloride Cl	605	mg/l	[2]Nitrite NO2	<0.001	mg/l
[2]Nitrite NO2 as N	<0.001	mg/l	[1]Sulphate SO4	851	mg/l			

Method: [2]UIS-CP-T005(Ion Balance Error Gallery) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Sum of Cations	45.7	me/l	[2]Sum of Anions	40.7	me/l	[2]Ion Error Balance	5.77	%

Method: [1]UIS-EA-T008(Anions by Ion Chromatography) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]NO3	1.94	mg/l	[2]NO3 as N	0.44	mg/l

Method: [2]UIS-AC-T100(Trace elements in liquids by ICP-MS) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ag	<0.001	mg/l	[2]Al	<0.001	mg/l	[2]As	0.002	mg/l

²Au	<0.001	mg/l	²B	0.308	mg/l	²Ba	0.044	mg/l
²Be	<0.001	mg/l	²Bi	<0.001	mg/l	²Cd	<0.0001	mg/l
²Co	0.062	mg/l	²Cr	<0.001	mg/l	²Cu	0.03	mg/l
²Fe	<0.01	mg/l	²Hg	<0.0001	mg/l	²Li	0.137	mg/l
²Mn	0.665	mg/l	²Mo	0.008	mg/l	²Ni	0.799	mg/l
²Pb	<0.001	mg/l	²Sb	0.001	mg/l	²Se	0.001	mg/l
²Sn	<0.001	mg/l	²Sr	0.785	mg/l	²Ti	0.401	mg/l
²U	<0.0001	mg/l	²V	0.01	mg/l	²Zn	0.205	mg/l

Method: ²UIS-CP-T012(Ammonium calculated photometry) **Completed:** 2018-02-06

Parameter	Value	Unit
²NH4+ calculated	2.93	mg/l

Method: ¹UIS-EA-T050(Ammonia by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
¹Ammonia as N	2.29	mg/l	¹Ammonia as NH3	2.78	mg/l

Method: ²UIS-CP-KBY-T007(Calculated Carbonate and Bicarbonate Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
²Bicarbonate Alkalinity	374	mg/l CaCO3	²Carbonate Alkalinity	<0.6	mg/l CaCO3

Method: ¹UIS-EA-T001(pH) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
¹pH	6.84		²pH Temperature	25	Deg C

Method: ¹UIS-EA-T001(Electrical Conductivity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
¹Tot Cond @25C	770	mSm	¹Total Conductivity	770	mS/m	²TC Temperature	21.6	Deg C

Method: ²UIS-CP-T001(Calculated Total Dissolved Solids from EC) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
²TDS by EC*6.5	5010	mg/l	²TDS by EC*7	5390	mg/l

Method: ²UIS-CP-T004(Calculated Hardness) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
²Ca Hardness	1730	mg/l CaCO3	²Mg Hardness	1230	mg/l CaCO3	²Total Hardness	2960	mg/l CaCO3

Method: ¹UIS-EA-T005(Total Dissolved Solids) **Completed:** 2018-02-06

Parameter	Value	Unit
¹Total Dissolved Solids at 180C	5180	mg/l

Method: ²UIS-CP-T003(Calculated Total Dissolved Solids by Summation) **Completed:** 2018-02-06

Parameter	Value	Unit
²TDS by Summation	1770	mg/l

Method: ¹UIS-EA-T001(P and Total (M) Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
¹P Alkalinity	<0.6	mg/l CaCO3	¹Total (M) Alkalinity	374	mg/l CaCO3

Method: ¹UIS-AC-T007(Disolved Elements in Water by ICP-OES) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
¹Ca	695	mg/l	¹K	34.1	mg/l	¹Mg	299	mg/l
¹Na	512	mg/l						

Method: ¹UIS-EA-T034(Anions by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
¹Fluoride F	0.485	mg/l	¹Chloride Cl	1080	mg/l	²Nitrite NO2	<0.001	mg/l
²Nitrite NO2 as N	<0.001	mg/l	¹Sulphate SO4	1900	mg/l			

Method: ²UIS-CP-T005(Ion Balance Error Gallery) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
²Sum of Cations	82.6	me/l	²Sum of Anions	76.1	me/l	²Ion Error Balance	4.07	%

Method: ¹UIS-EA-T008(Anions by Ion Chromatography) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
¹NO3	2.58	mg/l	²NO3 as N	0.58	mg/l

Method: ²UIS-AC-T100(Trace elements in liquids by ICP-MS) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
²Ag	<0.001	mg/l	²Al	<0.001	mg/l	²As	0.006	mg/l
²Au	<0.001	mg/l	²B	0.398	mg/l	²Ba	0.095	mg/l
²Be	<0.001	mg/l	²Bi	<0.001	mg/l	²Cd	<0.0001	mg/l
²Co	0.11	mg/l	²Cr	<0.001	mg/l	²Cu	0.045	mg/l
²Fe	<0.01	mg/l	²Hg	<0.0001	mg/l	²Li	0.219	mg/l

[2]Mn	0.991	mg/l	[2]Mo	0.014	mg/l	[2]Ni	1.45	mg/l
[2]Pb	<0.001	mg/l	[2]Sb	0.001	mg/l	[2]Se	0.001	mg/l
[2]Sn	<0.001	mg/l	[2]Sr	2.17	mg/l	[2]Ti	0.259	mg/l
[2]U	0.001	mg/l	[2]V	0.018	mg/l	[2]Zn	0.147	mg/l

Method: [2]UIS-CP-T012(Ammonium calculated photometry) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]NH4+ calculated	5.28	mg/l

Method: [1]UIS-EA-T050(Ammonia by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]Ammonia as N	4.12	mg/l	[1]Ammonia as NH3	5.01	mg/l

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Method: [2]UIS-CP-KBY-T007(Calculated Carbonate and Bicarbonate Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]Bicarbonate Alkalinity	374	mg/l CaCO3	[2]Carbonate Alkalinity	<0.6	mg/l CaCO3

Method: [1]UIS-EA-T001(pH) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]pH	6.57		[2]pH Temperature	25	Deg C

Method: [1]UIS-EA-T001(Electrical Conductivity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Tot Cond @25C	163	mSm	[1]Total Conductivity	163	mS/m	[2]TC Temperature	21.8	Deg C

Method: [2]UIS-CP-T001(Calculated Total Dissolved Solids from EC) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]TDS by EC*6.5	1060	mg/l	[2]TDS by EC*7	1140	mg/l

Method: [2]UIS-CP-T004(Calculated Hardness) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ca Hardness	331	mg/l CaCO3	[2]Mg Hardness	328	mg/l CaCO3	[2]Total Hardness	658	mg/l CaCO3

Method: [1]UIS-EA-T005(Total Dissolved Solids) **Completed:** 2018-02-06

Parameter	Value	Unit
[1]Total Dissolved Solids at 180C	1220	mg/l

Method: [2]UIS-CP-T003(Calculated Total Dissolved Solids by Summation) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]TDS by Summation	619	mg/l

Method: [1]UIS-EA-T001(P and Total (M) Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]P Alkalinity	<0.6	mg/l CaCO3	[1]Total (M) Alkalinity	374	mg/l CaCO3

Method: [1]UIS-AC-T007(Disolved Elements in Water by ICP-OES) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Ca	132	mg/l	[1]K	4.43	mg/l	[1]Mg	79.6	mg/l
[1]Na	168	mg/l						

Method: [1]UIS-EA-T034(Anions by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Fluoride F	0.602	mg/l	[1]Chloride Cl	153	mg/l	[2]Nitrite NO2	0.104	mg/l
[2]Nitrite NO2 as N	0.032	mg/l	[1]Sulphate SO4	326	mg/l			

Method: [2]UIS-CP-T005(Ion Balance Error Gallery) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Sum of Cations	20.7	me/l	[2]Sum of Anions	17.4	me/l	[2]Ion Error Balance	8.77	%

Method: [1]UIS-EA-T008(Anions by Ion Chromatography) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]NO3	9.8	mg/l	[2]NO3 as N	2.21	mg/l

Method: [2]UIS-AC-T100(Trace elements in liquids by ICP-MS) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ag	<0.001	mg/l	[2]Al	0.02	mg/l	[2]As	0.001	mg/l
[2]Au	<0.001	mg/l	[2]B	0.335	mg/l	[2]Ba	0.084	mg/l
[2]Be	<0.001	mg/l	[2]Bi	<0.001	mg/l	[2]Cd	<0.0001	mg/l
[2]Co	0.028	mg/l	[2]Cr	<0.001	mg/l	[2]Cu	0.017	mg/l
[2]Fe	<0.01	mg/l	[2]Hg	<0.0001	mg/l	[2]Li	0.098	mg/l
[2]Mn	0.206	mg/l	[2]Mo	0.008	mg/l	[2]Ni	0.304	mg/l
[2]Pb	<0.001	mg/l	[2]Sb	<0.001	mg/l	[2]Se	0.001	mg/l
[2]Sn	<0.001	mg/l	[2]Sr	0.56	mg/l	[2]Ti	0.475	mg/l
[2]U	0.092	mg/l	[2]V	0.015	mg/l	[2]Zn	0.339	mg/l

Method: [2]UIS-CP-T012(Ammonium calculated photometry) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]NH4+ calculated	0.162	mg/l

Method: [1]UIS-EA-T050(Ammonia by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]Ammonia as N	0.126	mg/l	[1]Ammonia as NH3	0.153	mg/l

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Method: [2]UIS-CP-KBY-T007(Calculated Carbonate and Bicarbonate Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]Bicarbonate Alkalinity	476	mg/l CaCO3	[2]Carbonate Alkalinity	<0.6	mg/l CaCO3

Method: [1]UIS-EA-T001(pH) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]pH	6.75		[2]pH Temperature	25	Deg C

Method: [1]UIS-EA-T001(Electrical Conductivity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Tot Cond @25C	1010	mSm	[1]Total Conductivity	1010	mS/m	[2]TC Temperature	21.7	Deg C

Method: [2]UIS-CP-T001(Calculated Total Dissolved Solids from EC) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]TDS by EC*6.5	6540	mg/l	[2]TDS by EC*7	7040	mg/l

Method: [2]UIS-CP-T004(Calculated Hardness) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ca Hardness	1900	mg/l CaCO3	[2]Mg Hardness	2050	mg/l CaCO3	[2]Total Hardness	3950	mg/l CaCO3

Method: [1]UIS-EA-T005(Total Dissolved Solids) **Completed:** 2018-02-06

Parameter	Value	Unit
[1]Total Dissolved Solids at 180C	7060	mg/l

Method: [2]UIS-CP-T003(Calculated Total Dissolved Solids by Summation) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]TDS by Summation	2370	mg/l

Method: [1]UIS-EA-T001(P and Total (M) Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]P Alkalinity	<0.6	mg/l CaCO3	[1]Total (M) Alkalinity	476	mg/l CaCO3

Method: [1]UIS-AC-T007(Disolved Elements in Water by ICP-OES) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Ca	761	mg/l	[1]K	87.6	mg/l	[1]Mg	497	mg/l
[1]Na	731	mg/l						

Method: [1]UIS-EA-T034(Anions by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Chloride Cl	1690	mg/l	[2]Nitrite NO2	<0.001	mg/l	[2]Nitrite NO2 as N	<0.001	mg/l
[1]Sulphate SO4	2450	mg/l						

Method: [2]UIS-CP-T005(Ion Balance Error Gallery) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Sum of Cations	116	me/l	[2]Sum of Anions	107	me/l	[2]Ion Error Balance	4.28	%

Method: [1]UIS-EA-T008(Anions by Ion Chromatography) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]F	1.12	mg/l	[1]NO3	5.05	mg/l	[2]NO3 as N	1.14	mg/l

Method: [2]UIS-AC-T100(Trace elements in liquids by ICP-MS) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ag	0.001	mg/l	[2]Al	<0.001	mg/l	[2]As	0.013	mg/l
[2]Au	<0.001	mg/l	[2]B	1.33	mg/l	[2]Ba	0.042	mg/l
[2]Be	<0.001	mg/l	[2]Bi	<0.001	mg/l	[2]Cd	<0.0001	mg/l
[2]Co	0.142	mg/l	[2]Cr	<0.001	mg/l	[2]Cu	0.071	mg/l
[2]Fe	77.6	mg/l	[2]Hg	<0.0001	mg/l	[2]Li	0.254	mg/l
[2]Mn	1.2	mg/l	[2]Mo	0.028	mg/l	[2]Ni	1.82	mg/l
[2]Pb	<0.001	mg/l	[2]Sb	0.001	mg/l	[2]Se	0.003	mg/l
[2]Sn	<0.001	mg/l	[2]Sr	5.24	mg/l	[2]Ti	0.497	mg/l
[2]U	0.023	mg/l	[2]V	0.029	mg/l	[2]Zn	0.047	mg/l

Method: [2]UIS-CP-T012(Ammonium calculated photometry) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]NH4+ calculated	3.8	mg/l

Method: [1]UIS-EA-T050(Ammonia by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]Ammonia as N	2.96	mg/l	[1]Ammonia as NH3	3.6	mg/l

Method: [2]UIS-CP-KBY-T007(Calculated Carbonate and Bicarbonate Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]Bicarbonate Alkalinity	127	mg/l CaCO3	[2]Carbonate Alkalinity	<0.6	mg/l CaCO3

Method: [1]UIS-EA-T001(pH) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]pH	6.68		[2]pH Temperature	25	Deg C

Method: [1]UIS-EA-T001(Electrical Conductivity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Tot Cond @25C	705	mSm	[1]Total Conductivity	705	mS/m	[2]TC Temperature	21.7	Deg C

Method: [2]UIS-CP-T001(Calculated Total Dissolved Solids from EC) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]TDS by EC*6.5	4580	mg/l	[2]TDS by EC*7	4940	mg/l

Method: [1]UIS-EA-T005(Total Dissolved Solids) **Completed:** 2018-02-06

Parameter	Value	Unit
[1]Total Dissolved Solids at 180C	5580	mg/l

Method: [2]UIS-CP-T004(Calculated Hardness) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ca Hardness	1430	mg/l CaCO3	[2]Mg Hardness	1730	mg/l CaCO3	[2]Total Hardness	3160	mg/l CaCO3

Method: [2]UIS-CP-T003(Calculated Total Dissolved Solids by Summation) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]TDS by Summation	1560	mg/l

Method: [1]UIS-EA-T001(P and Total (M) Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]P Alkalinity	<0.6	mg/l CaCO3	[1]Total (M) Alkalinity	127	mg/l CaCO3

Method: [1]UIS-AC-T007(Disolved Elements in Water by ICP-OES) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Ca	574	mg/l	[1]K	43.7	mg/l	[1]Mg	419	mg/l
[1]Na	438	mg/l						

Method: [1]UIS-EA-T034(Anions by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Chloride Cl	2320	mg/l	[2]Nitrite NO2	<0.001	mg/l	[2]Nitrite NO2 as N	<0.001	mg/l
[1]Sulphate SO4	559	mg/l						

Method: [2]UIS-CP-T005(Ion Balance Error Gallery) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Sum of Cations	84.1	me/l	[2]Sum of Anions	79.3	me/l	[2]Ion Error Balance	2.97	%

Method: [1]UIS-EA-T008(Anions by Ion Chromatography) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]F	0.65	mg/l	[1]NO3	7.64	mg/l	[2]NO3 as N	1.73	mg/l

Method: [2]UIS-AC-T100(Trace elements in liquids by ICP-MS) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ag	0.001	mg/l	[2]Al	<0.001	mg/l	[2]As	0.013	mg/l
[2]Au	<0.001	mg/l	[2]B	0.275	mg/l	[2]Ba	0.223	mg/l
[2]Be	<0.001	mg/l	[2]Bi	<0.001	mg/l	[2]Cd	<0.0001	mg/l
[2]Co	0.125	mg/l	[2]Cr	<0.001	mg/l	[2]Cu	0.045	mg/l
[2]Fe	14	mg/l	[2]Hg	<0.0001	mg/l	[2]Li	0.179	mg/l
[2]Mn	1.14	mg/l	[2]Mo	0.031	mg/l	[2]Ni	1.51	mg/l
[2]Pb	<0.001	mg/l	[2]Sb	0.001	mg/l	[2]Se	0.003	mg/l
[2]Sn	<0.001	mg/l	[2]Sr	5.21	mg/l	[2]Ti	0.22	mg/l
[2]U	0.02	mg/l	[2]V	0.043	mg/l	[2]Zn	0.015	mg/l

Method: [2]UIS-CP-T012(Ammonium calculated photometry) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]NH4+ calculated	0.501	mg/l

Method: [1]UIS-EA-T050(Ammonia by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]Ammonia as N	0.39	mg/l	[1]Ammonia as NH3	0.474	mg/l

Method: [2]UIS-CP-KBY-T007(Calculated Carbonate and Bicarbonate Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]Bicarbonate Alkalinity	644	mg/l CaCO3	[2]Carbonate Alkalinity	<0.6	mg/l CaCO3

Method: [1]UIS-EA-T001(pH) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]pH	6.82		[2]pH Temperature	25	Deg C

Method: [1]UIS-EA-T001(Electrical Conductivity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Tot Cond @25C	757	mSm	[1]Total Conductivity	757	mS/m	[2]TC Temperature	21.8	Deg C

Method: [2]UIS-CP-T001(Calculated Total Dissolved Solids from EC) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]TDS by EC*6.5	4920	mg/l	[2]TDS by EC*7	5300	mg/l

Method: [2]UIS-CP-T004(Calculated Hardness) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ca Hardness	812	mg/l CaCO3	[2]Mg Hardness	1170	mg/l CaCO3	[2]Total Hardness	1980	mg/l CaCO3

Method: [1]UIS-EA-T005(Total Dissolved Solids) **Completed:** 2018-02-06

Parameter	Value	Unit
[1]Total Dissolved Solids at 180C	5630	mg/l

Method: [2]UIS-CP-T003(Calculated Total Dissolved Solids by Summation) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]TDS by Summation	2250	mg/l

Method: [1]UIS-EA-T001(P and Total (M) Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]P Alkalinity	<0.6	mg/l CaCO3	[1]Total (M) Alkalinity	644	mg/l CaCO3

Method: [1]UIS-AC-T007(Disolved Elements in Water by ICP-OES) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Ca	325	mg/l	[1]K	150	mg/l	[1]Mg	285	mg/l
[1]Na	1100	mg/l						

Method: [1]UIS-EA-T034(Anions by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Fluoride F	3.65	mg/l	[1]Chloride Cl	1910	mg/l	[2]Nitrate NO3	90.6	mg/l
[1]Nitrate NO3 as N	20.4	mg/l	[2]Nitrite NO2	0.029	mg/l	[2]Nitrite NO2 as N	0.009	mg/l
[1]Sulphate SO4	800	mg/l						

Method: [2]UIS-CP-T005(Ion Balance Error Gallery) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Sum of Cations	91.8	me/l	[2]Sum of Anions	82.9	me/l	[2]Ion Error Balance	5.12	%

Method: [2]UIS-AC-T100(Trace elements in liquids by ICP-MS) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ag	0.001	mg/l	[2]Al	0.009	mg/l	[2]As	0.008	mg/l
[2]Au	0.001	mg/l	[2]B	1.82	mg/l	[2]Ba	0.065	mg/l
[2]Be	<0.001	mg/l	[2]Bi	<0.001	mg/l	[2]Cd	<0.0001	mg/l
[2]Co	0.065	mg/l	[2]Cr	<0.001	mg/l	[2]Cu	0.132	mg/l
[2]Fe	<0.01	mg/l	[2]Hg	<0.0001	mg/l	[2]Li	0.396	mg/l
[2]Mn	0.316	mg/l	[2]Mo	0.03	mg/l	[2]Ni	0.819	mg/l
[2]Pb	<0.001	mg/l	[2]Sb	0.001	mg/l	[2]Se	0.164	mg/l
[2]Sn	<0.001	mg/l	[2]Sr	6.28	mg/l	[2]Ti	0.609	mg/l
[2]U	1.227	mg/l	[2]V	0.042	mg/l	[2]Zn	0.016	mg/l

Method: [2]UIS-CP-T012(Ammonium calculated photometry) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]NH4+ calculated	<0.001	mg/l

Method: [1]UIS-EA-T050(Ammonia by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]Ammonia as N	<0.001	mg/l	[1]Ammonia as NH3	<0.001	mg/l

Method: [2]UIS-CP-KBY-T007(Calculated Carbonate and Bicarbonate Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]Bicarbonate Alkalinity	351	mg/l CaCO3	[2]Carbonate Alkalinity	<0.6	mg/l CaCO3

Method: [1]UIS-EA-T001(pH) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]pH	7.1		[2]pH Temperature	25	Deg C

Method: [1]UIS-EA-T001(Electrical Conductivity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Tot Cond @25C	309	mSm	[1]Total Conductivity	309	mS/m	[2]TC Temperature	21.9	Deg C

Method: [2]UIS-CP-T001(Calculated Total Dissolved Solids from EC) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]TDS by EC*6.5	2010	mg/l	[2]TDS by EC*7	2160	mg/l

Method: [2]UIS-CP-T004(Calculated Hardness) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ca Hardness	345	mg/l CaCO3	[2]Mg Hardness	395	mg/l CaCO3	[2]Total Hardness	739	mg/l CaCO3

Method: [1]UIS-EA-T005(Total Dissolved Solids) **Completed:** 2018-02-06

Parameter	Value	Unit
[1]Total Dissolved Solids at 180C	2050	mg/l

Method: [2]UIS-CP-T003(Calculated Total Dissolved Solids by Summation) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]TDS by Summation	895	mg/l

Method: [1]UIS-EA-T001(P and Total (M) Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]P Alkalinity	<0.6	mg/l CaCO3	[1]Total (M) Alkalinity	351	mg/l CaCO3

Method: [1]UIS-AC-T007(Disolved Elements in Water by ICP-OES) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Ca	138	mg/l	[1]K	31.1	mg/l	[1]Mg	95.9	mg/l
[1]Na	418	mg/l						

Method: [1]UIS-EA-T034(Anions by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Fluoride F	3.34	mg/l	[1]Chloride Cl	691	mg/l	[2]Nitrite NO2	0.044	mg/l
[2]Nitrite NO2 as N	0.013	mg/l	[1]Sulphate SO4	276	mg/l			

Method: [2]UIS-CP-T005(Ion Balance Error Gallery) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Sum of Cations	34	me/l	[2]Sum of Anions	31.3	me/l	[2]Ion Error Balance	4.14	%

Method: [1]UIS-EA-T008(Anions by Ion Chromatography) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]NO3	2.37	mg/l	[2]NO3 as N	0.54	mg/l

Method: [2]UIS-AC-T100(Trace elements in liquids by ICP-MS) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ag	<0.001	mg/l	[2]Al	<0.001	mg/l	[2]As	0.006	mg/l
[2]Au	<0.001	mg/l	[2]B	1.3	mg/l	[2]Ba	0.046	mg/l
[2]Be	<0.001	mg/l	[2]Bi	<0.001	mg/l	[2]Cd	<0.0001	mg/l
[2]Co	0.029	mg/l	[2]Cr	<0.001	mg/l	[2]Cu	0.14	mg/l
[2]Fe	<0.01	mg/l	[2]Hg	<0.0001	mg/l	[2]Li	0.426	mg/l
[2]Mn	0.448	mg/l	[2]Mo	0.014	mg/l	[2]Ni	0.345	mg/l
[2]Pb	<0.001	mg/l	[2]Sb	<0.001	mg/l	[2]Se	0.001	mg/l
[2]Sn	<0.001	mg/l	[2]Sr	1.11	mg/l	[2]Ti	0.227	mg/l
[2]U	0.007	mg/l	[2]V	0.013	mg/l	[2]Zn	0.006	mg/l

Method: [2]UIS-CP-T012(Ammonium calculated photometry) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]NH4+ calculated	<0.001	mg/l

Method: [1]UIS-EA-T050(Ammonia by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]Ammonia as N	<0.001	mg/l	[1]Ammonia as NH3	<0.001	mg/l

Request ID: 20183 **Sample ID:** 545817 **Received:** 2018-01-29 **Matrix:** Water **Page:** 12 / 14
Sample Number: WBR 01/19-01-2018 **Revision Number:** 0

Method: [2]UIS-CP-KBY-T007(Calculated Carbonate and Bicarbonate Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]Bicarbonate Alkalinity	189	mg/l CaCO3	[2]Carbonate Alkalinity	<0.6	mg/l CaCO3

Method: [1]UIS-EA-T001(pH) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]pH	7.44		[2]pH Temperature	25	Deg C

Method: [1]UIS-EA-T001(Electrical Conductivity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Tot Cond @25C	42.1	mSm	[1]Total Conductivity	42.1	mS/m	[2]TC Temperature	21.8	Deg C

Method: [2]UIS-CP-T001(Calculated Total Dissolved Solids from EC) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]TDS by EC*6.5	273	mg/l	[2]TDS by EC*7	294	mg/l

Method: [2]UIS-CP-T004(Calculated Hardness) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ca Hardness	87.3	mg/l CaCO3	[2]Mg Hardness	75.6	mg/l CaCO3	[2]Total Hardness	163	mg/l CaCO3

Method: [1]UIS-EA-T005(Total Dissolved Solids) **Completed:** 2018-02-06

Parameter	Value	Unit
[1]Total Dissolved Solids at 180C	302	mg/l

Method: [2]UIS-CP-T003(Calculated Total Dissolved Solids by Summation) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]TDS by Summation	207	mg/l

Method: [1]UIS-EA-T001(P and Total (M) Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]P Alkalinity	<0.6	mg/l CaCO3	[1]Total (M) Alkalinity	189	mg/l CaCO3

Method: [1]UIS-AC-T007(Disolved Elements in Water by ICP-OES) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Ca	35	mg/l	[1]K	2.33	mg/l	[1]Mg	18.4	mg/l
[1]Na	37.2	mg/l						

Method: [1]UIS-EA-T034(Anions by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Fluoride F	0.211	mg/l	[1]Chloride Cl	25.2	mg/l	[2]Nitrate NO3	9.8	mg/l
[1]Nitrate NO3 as N	2.21	mg/l	[2]Nitrite NO2	0.001	mg/l	[2]Nitrite NO2 as N	<0.001	mg/l
[1]Sulphate SO4	2.11	mg/l						

Method: [2]UIS-CP-T005(Ion Balance Error Gallery) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Sum of Cations	4.95	me/l	[2]Sum of Anions	4.08	me/l	[2]Ion Error Balance	9.66	%

Method: [2]UIS-AC-T100(Trace elements in liquids by ICP-MS) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ag	<0.001	mg/l	[2]Al	<0.001	mg/l	[2]As	0.001	mg/l
[2]Au	<0.001	mg/l	[2]B	0.075	mg/l	[2]Ba	0.111	mg/l
[2]Be	<0.001	mg/l	[2]Bi	<0.001	mg/l	[2]Cd	<0.0001	mg/l
[2]Co	0.006	mg/l	[2]Cr	0.001	mg/l	[2]Cu	0.044	mg/l
[2]Fe	<0.01	mg/l	[2]Hg	<0.0001	mg/l	[2]Li	0.011	mg/l
[2]Mn	0.002	mg/l	[2]Mo	0.001	mg/l	[2]Ni	0.079	mg/l
[2]Pb	<0.001	mg/l	[2]Sb	<0.001	mg/l	[2]Se	0.001	mg/l
[2]Sn	<0.001	mg/l	[2]Sr	0.215	mg/l	[2]Ti	0.538	mg/l
[2]U	0.002	mg/l	[2]V	0.03	mg/l	[2]Zn	0.008	mg/l

Method: [2]UIS-CP-T012(Ammonium calculated photometry) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]NH4+ calculated	<0.001	mg/l

Method: [1]UIS-EA-T050(Ammonia by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]Ammonia as N	<0.001	mg/l	[1]Ammonia as NH3	<0.001	mg/l

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Sample Number: TESPES 47/19-01-2018 **Revision Number:** 0

Method: [2]UIS-CP-KBY-T007(Calculated Carbonate and Bicarbonate Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]Bicarbonate Alkalinity	361	mg/l CaCO3	[2]Carbonate Alkalinity	<0.6	mg/l CaCO3

Method: [1]UIS-EA-T001(pH) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit

[1]pH	7.09		[2]pH Temperature	25	Deg C

Method: [1]UIS-EA-T001(Electrical Conductivity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Tot Cond @25C	114	mSm	[1]Total Conductivity	114	mS/m	[2]TC Temperature	21.8	Deg C

Method: [2]UIS-CP-T001(Calculated Total Dissolved Solids from EC) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[2]TDS by EC*6.5	739	mg/l	[2]TDS by EC*7	796	mg/l

Method: [2]UIS-CP-T004(Calculated Hardness) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ca Hardness	254	mg/l CaCO3	[2]Mg Hardness	227	mg/l CaCO3	[2]Total Hardness	481	mg/l CaCO3

Method: [1]UIS-EA-T005(Total Dissolved Solids) **Completed:** 2018-02-06

Parameter	Value	Unit
[1]Total Dissolved Solids at 180C	770	mg/l

Method: [2]UIS-CP-T003(Calculated Total Dissolved Solids by Summation) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]TDS by Summation	477	mg/l

Method: [1]UIS-EA-T001(P and Total (M) Alkalinity) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]P Alkalinity	<0.6	mg/l CaCO3	[1]Total (M) Alkalinity	361	mg/l CaCO3

Method: [1]UIS-AC-T007(Disolved Elements in Water by ICP-OES) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Ca	102	mg/l	[1]K	3.24	mg/l	[1]Mg	55.1	mg/l
[1]Na	100	mg/l						

Method: [1]UIS-EA-T034(Anions by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[1]Fluoride F	0.714	mg/l	[1]Chloride Cl	113	mg/l	[2]Nitrite NO2	<0.001	mg/l
[2]Nitrite NO2 as N	<0.001	mg/l	[1]Sulphate SO4	137	mg/l			

Method: [2]UIS-CP-T005(Ion Balance Error Gallery) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Sum of Cations	14.1	me/l	[2]Sum of Anions	12.1	me/l	[2]Ion Error Balance	7.75	%

Method: [1]UIS-EA-T008(Anions by Ion Chromatography) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]NO3	0.44	mg/l	[2]NO3 as N	<0.3	mg/l

Method: [2]UIS-AC-T100(Trace elements in liquids by ICP-MS) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit	Parameter	Value	Unit
[2]Ag	<0.001	mg/l	[2]Al	<0.001	mg/l	[2]As	<0.001	mg/l
[2]Au	<0.001	mg/l	[2]B	0.17	mg/l	[2]Ba	0.073	mg/l
[2]Be	<0.001	mg/l	[2]Bi	<0.001	mg/l	[2]Cd	<0.0001	mg/l
[2]Co	0.021	mg/l	[2]Cr	<0.001	mg/l	[2]Cu	0.041	mg/l
[2]Fe	<0.01	mg/l	[2]Hg	<0.0001	mg/l	[2]Li	0.039	mg/l
[2]Mn	0.235	mg/l	[2]Mo	0.004	mg/l	[2]Ni	0.254	mg/l
[2]Pb	<0.001	mg/l	[2]Sb	<0.001	mg/l	[2]Se	<0.001	mg/l
[2]Sn	<0.001	mg/l	[2]Sr	0.475	mg/l	[2]Ti	0.392	mg/l
[2]U	0.014	mg/l	[2]V	0.002	mg/l	[2]Zn	0.002	mg/l

Method: [2]UIS-CP-T012(Ammonium calculated photometry) **Completed:** 2018-02-06

Parameter	Value	Unit
[2]NH4+ calculated	<0.001	mg/l

Method: [1]UIS-EA-T050(Ammonia by Photometry) **Completed:** 2018-02-06

Parameter	Value	Unit	Parameter	Value	Unit
[1]Ammonia as N	<0.001	mg/l	[1]Ammonia as NH3	<0.001	mg/l

Premie Naidoo

AUTHORISED SIGNATORY

APPENDIX C

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