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Exxaro Coal Pty (Ltd) Grootegeluk Short-Term Stockpiles Amendment Project

Surface Water Assessment Report

Project Number:

EXX3666

Prepared for:

Exxaro Reductants Pty. Ltd

September 2016

Digby Wells & Associates (Pty) Ltd. Co. Reg. No. 1999/005985/07. Turnberry Office Park, 48 Grosvenor Road, Bryanston, 2191. Private Bag X10046, Randburg, 2125, South Africa
Tel: +27 11 789 9495, Fax: +27 11 789 9498, info@digbywells.com, www.digbywells.com

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Report Type:	**Surface Water Assessment Report**
Project Name:	**Exxaro Coal Pty (Ltd) Grootegeluk Short-Term Stockpiles Amendment Project**
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Name	**Responsibility**	**Signature**	**Date**
Zinhle Shongwe	Report compiler		2016-04-25
Chenai Makamure	Report Reviewer		2016-04-25
Lucas Smith	2nd Review		2016-04-25

EXECUTIVE SUMMARY

Digby Wells Environmental (hereafter Digby Wells) was appointed by Exxaro (Pty) Ltd (Exxaro), Grootegeluk Coal Mine (hereafter Grootegeluk) to amend the environmental authorisations for the Grootegeluk Infrastructure Expansion Project in 2014. The permitting documents were submitted to Limpopo Department of Economic Development, Environment and Tourism (LEDET) and Department of Mineral Resources (DMR).Exxaro were granted an Environmental Authorisation in October 2014 and August 2015.

The approved uses of the stockpile areas will need to be changed also to utilise the laydown Area, GG10B, and multiproduct stockyard footprints to stock excess Eskom-grade coal only (in the form of a compacted coal stockpile), for an approximate period of five years, until Medupi station is fully operational. These changes will also include the extension of the GG10B Stockyard footprint by approximately 12.8 hectares (ha) by including the current D8 rail loop area, which will be decommissioned with the construction of the new loadout area, also referred to as the extension area.

This report provides details in terms of the surface water assessment associated with the proposed extension of the GG10B Stockyard footprint within the internal area of the discontinued rail loop and the proposed stockpile areas (Laydown Area, GG10B, and Multiproduct Stockyard footprints), at the Grootegeluk Mine.

Grootegeluk is located approximately 20 kilometres (km) from Lephalale in Limpopo Province and is in a relatively dry area within the boundaries of quaternary catchments A42J, in the Limpopo Water Management Area (WMA01). The surrounding surface water resources are the Sandloop Spruit, the Mokolo River and the Limpopo River; however there are no streams within close proximity of the mine.

The objectives of the study were:

- To conduct an impact assessment that identifies impacts of the proposed stockpile footprints to surface water resources in the area; as well as to
- To identify gaps in the surface water monitoring programmes; and
- To propose mitigation measures or recommendations, if required.

The following were key findings of the surface water study:

- Potential surface water impacts that could result from the proposed project and its associated activities include:
  - Carbonaceous material reporting into water drains, resulting in poor water quality and siltation of eroded runoff leading to siltation of PCD and conveyance channels.
- There are no gaps within the monitoring programme.

The water quality indicates elevated levels of Sulphate, Calcium and Magnesium that exceed the water quality water use licence (WUL) limits.

As concluded in the previous water balance reports, the pit is the main source of water storage and account for 91% of the total excess water during the summer period.

The proposed storm water management plan should cover and capture runoff from the stockpiles are. The water should be captured in appropriate drains linking to the existing system.

The impact assessment is provided in this report, as well as the necessary mitigation measures to prevent and/or minimise the identified potential impacts.

The following is recommended:

- The top soil stockpiles cleared from the stockpile footprints should be well managed and vegetated to prevent erosion;
- There should be continuous monitoring of the capacity of the water drains so that they do not over flow; and
- The water monitoring currently in place should continue and management of impacts should be maintained.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 Introduction

Digby Wells Environmental (hereafter Digby Wells) was appointed by Exxaro Coal (Pty) Ltd to amend the environmental authorisations for the Grootegeluk Infrastructure Expansion Project; started in 2014. The permitting documents were submitted to Limpopo Department of Economic Development, Environment and Tourism (LEDET) and Exxaro were granted an Environmental Authorisation in October 2014.

The approved uses of the stockpile areas will need to be changed to also utilise the laydown Area, GG10B, and multiproduct stockyard footprints to stock excess Eskom-grade coal only (in the form of a compacted coal stockpile), for an approximate period of five years, until Medupi station is fully operational. These changes will also include the extension of the GG10B Stockyard footprint by approximately 12.8 hectares (ha) by including the current D8 rail loop area, which will be decommissioned with the construction of the new loadout area, also referred to as the extension area.

The proposed changes will require authorisation in terms of Regulation 31 of the National Environmental Management Act (NEMA), as well as a Section 21(g) Authorisation in terms of the National Water Act, 1998 (Act No 36 of 1998).

The Grootegeluk operations consist of open pit mining, several plants supplied by extensive stockpiles, tailing storage facilities and a discard dump. The site is operational and most of the proposed infrastructure will be in current mining / disturbed areas.

This report assesses the impacts of the proposed project activities on surface water resources. A detailed description of these areas was covered by Digby Wells' Surface Water Assessments and Conceptual Storm Water Management Plan (2014).

2 Project Description

Exxaro owns multiple mining operations, including Grootegeluk Coal Mine (hereafter Grootegeluk), which has been in operation since 1982 in the Limpopo Province. Grootegeluk is located approximately 20 km outside of Lephalale and is contracted to supply coal to Eskom's Matimba power station and the Medupi power station. Due to delays in the start-up of Medupi off-take of Eskom coal has slowed and Exxaro requires additional stockpiling space to accommodate the excess coal on site.

Exxaro applied to expand certain infrastructure within the mine boundary area, referred to as the Grootegeluk Coal Mine Infrastructure Expansion Project. Exxaro submitted Applications in terms of the National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) and Minerals and Petroleum Resources Development Act (MPRDA), 2002 (Act No. 28 of 2002) to include the following activities / expansions within the mine boundary:

- Expansion of the rail loop, load out stations and associated infrastructure;
- Expansion of the existing coal stockyard and stockpiles;
- Expansion of the fuel storage depot;

- Expansion of beneficiation plants and associated infrastructure;
- New road and conveyors to fines recovery area;
- New gate and hard park area; and
- Expansion of ancillary infrastructure and new 33 kV power line.

The aforementioned 2014 amendment was also associated with the expansion of the existing coal product stockpiles. The following stockpiles and stockyards were included in the applications and approved:

- GG 6/2 stockyard;
- GG 10 stockyards;
  - Conical Stock pile;
  - Stockyard A and
  - Stockyard B;
- Multi-product overflow stockyard

The Grootegeluk Coal Mine Infrastructure Expansion Project was authorised in terms of the NEMA and the Environmental Impact Assessment Regulations of 2010[1], (which have been repealed). The Limpopo Department of Economic Development, Environment and Tourism (LEDET), and the Record of Decision are dated 27 October 2014, with reference number 12/1/9/1-W89 (refer to Figure 2-1). The Department of Mineral Resources (DMR) Environmental Management Programme (EMP) Amendment approval was granted on the 28 August 2015.

Exxaro proposed a phased authorisation approach for the amendments that are being requested. Exxaro proposes to amend the existing Authorisation relevant to the Grootegeluk Mine Infrastructure Expansion Project (which included the expansion of the GG10 Stockyards and several other stockpile areas).

The purpose of these amendments is to allow Exxaro to legally stockpile Eskom-grade coal currently being mined from the upper coal benches at the Grootegeluk Mine. In summary the two phases included the following:

- Phase 1: Amendment of the GG10A stockyard for temporary use - The amendment of the GG10A stockyard area with the capacity of 400,000m^3 to include the alternative of a temporary 2 Mt compacted Power Station Coal Stockpile in the same footprint area.
- Phase 2: Amend the GG10B stockyard area - The amendment of the GG10B stockyard to include the additional area inside the loop not originally included. To also amend the use of the multi-product overflow stockpiles to stacking and loading

[1] Dated 18 June 2010

areas. The additional 1.1mil stockpiles area in the footprint of the original Coke and Co-gen area will need to be included as an additional area.

Further to what has been noted above regarding the requested amendment, Exxaro received approval from Department of Water Affairs (DWS) and DMR for Phase 1 of the project on the 5th May 2016 and 7th July 2016 respectively. This part of the project and associated specialist studies conducted is in support of the Phase 2 amendment that is being requested for in terms Section 31 of the 2014 NEMA Regulations applies as this is an amendment to an existing Environmental Authorisation. Thus the information contained within this specialist report is specific to the Phase 2 amendment process, however does make reference to Phase 1 with respect to the areas assessed.

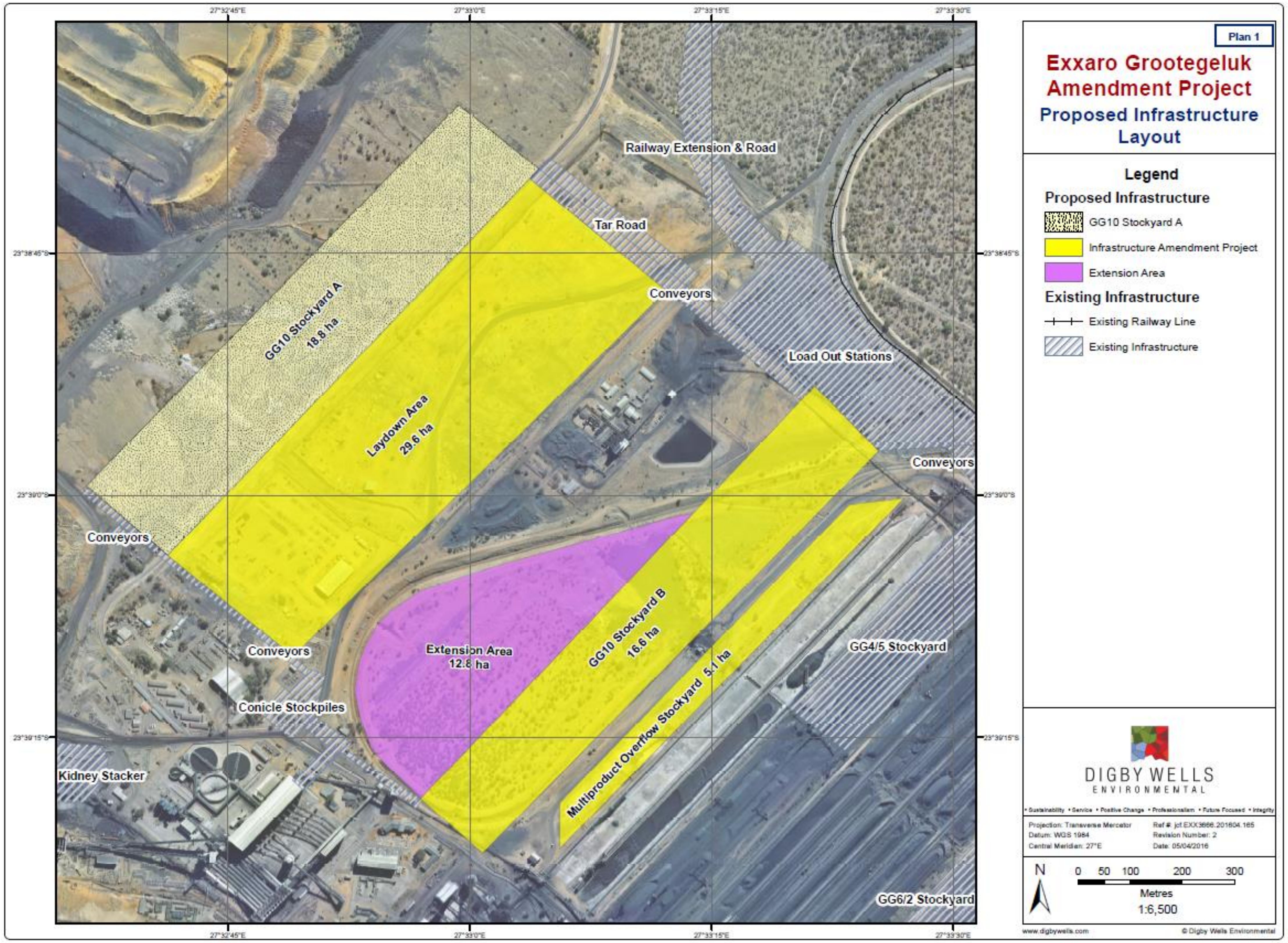

Figure 2-1 Site layout

3 Legislation

The identified impacts and proposed management and mitigation measures will also incorporate recommendations linked to the National Water Act (Act 36 of 1998) (NWA); more specifically Section 21(g) and the relevant regulations in the Regulations no. 704 (GN 704), as well as in the Department of Water and Sanitation's (DWS) Best Practice Guidelines (BPGs) series (DWA, 2008). The applicable guidelines:

- BPG G1: Storm Water Management;
- BPG G2: Water and Salt Balances;
- BPG G3: Water Monitoring Systems; and
- BPG G4: Impact Prediction.

4 Methodology and Terms of Reference

4.1 Terms of Reference

The following terms of reference were adopted as part of this surface water study:

- Identification of potential impacts to surface water resources as a result of the stockpiling activities;
- A gap analysis on the current water monitoring programme based on the new infrastructure location; and
- Recommendations for updates of the water monitoring programme in light of the associated activities, if required.

4.2 Methodology

The methodology followed for the surface water assessment to fulfil the terms of reference included a desktop review of available information from reports of previous work done for the Grootegeluk 2014 infrastructure Expansion (Digby Wells, 2014), and to incorporate it in for a site hydrology and catchment description. A summarised baseline hydrology description will inform the identification of sensitive receptors around the proposed stockpile footprints, as well as identification of potential impacts. The impacts of all proposed infrastructure on the surface water will also be determined and the mitigation measures that need to be implemented recommended.

The gaps identified in the monitoring plan and the recommendations for monitoring will be documented.

4.2.1 Impact Assessment

The surface water impacts are assessed based on the impact's magnitude, as well as the receiver's sensitivity, culminating in an impact significance which identifies the most important impacts that require management.

Based on international guidelines and South African legislation, the following criteria are taken into account when examining potentially significant impacts:

- Nature of impacts (direct/indirect, positive/ negative);
- Duration (short/medium/long-term, permanent(irreversible) / temporary (reversible), frequent/seldom);
- Extent (geographical area, size of affected population/habitat/species);
- Intensity (minimal, severe, replaceable/irreplaceable);
- Probability (high/medium/low probability); and
- Possibility to mitigate, avoid or offset significant adverse impacts.

Details of the impact assessment methodology used to determine the significance of physical, bio-physical and socio-economic impacts are provided below.

The significance rating process follows the established impact/risk assessment formula:

Significance = Consequence x Probability x Nature

Where

Consequence = Intensity + Extent + Duration

And

Probability = Likelihood of an impact occurring

And

Nature = Positive (+1) or negative (-1) impact

Note: In the formula for calculating consequence, the type of impact is multiplied by +1 for positive impacts and -1 for negative impacts.

The matrix calculates the rating out of 147, whereby Intensity, Extent, Duration and Probability are each rated out of seven as indicated in Table 4-1. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts.

Impacts are rated prior to mitigation and again after consideration of the mitigation measure proposed in this Report. The significance of an impact is then determined and categorised into one of eight categories, as indicated in Table 4-2, which is extracted from Table 4-1. The description of the significance ratings is discussed in Table 4-3.

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, i.e. there may already be certain types of mitigation measures included in the design (for example due to legal requirements). If the potential impact is still considered too high, additional mitigation measures are proposed.

Table 4-1: Impact Assessment Parameter Ratings

RATING	INTENSITY/ REPLACEABILITY		EXTENT	DURATION/REVERSIBILITY	PROBABILITY
	Negative impacts	Positive impacts			
7	Irreplaceable damage to highly valued items of great natural or social significance or complete breakdown of natural and / or social order.	Noticeable, on-going natural and / or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the project.	Definite: There are sound scientific reasons to expect that the impact will definitely occur. >80% probability.
6	Irreplaceable damage to highly valued items of natural or social significance or breakdown of natural and / or social order.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond project life: The impact will remain for some time after the life of the project and is potentially irreversible even with management.	Almost certain / Highly probable: It is most likely that the impact will occur. <80% probability.
5	Very serious widespread natural and / or social baseline changes. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	Province/ Region Will affect the entire province or region.	Project Life (>15 years): The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Likely: The impact may occur. <65% probability.

RATING	INTENSITY/ REPLACEABILITY		EXTENT	DURATION/REVERSIBILITY	PROBABILITY
	Negative impacts	Positive impacts			
4	On-going serious natural and / or social issues. Significant changes to structures / items of natural or social significance.	Average to intense natural and / or social benefits to some elements of the baseline.	Municipal Area Will affect the whole municipal area.	Long term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. <50% probability.
3	On-going natural and / or social issues. Discernible changes to natural or social baseline.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local extending only as far as the development site area.	Medium term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. <25% probability.
2	Minor natural and / or social impacts which are mostly replaceable. Very little change to the baseline.	Low positive impacts experience by a small percentage of the baseline.	Limited Limited to the site and its immediate surroundings.	Short term: Less than 1 year and is reversible.	Rare / improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. <10% probability.
1	Minimal natural and / or social impacts, low-level replaceable damage with no change to the baseline.	Some low-level natural and / or social benefits felt by a very small percentage of the baseline.	Very limited Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly unlikely / None: Expected never to happen. <1% probability.

Table 4-2: Probability/Consequence Matrix

Probability	Significance																																					
7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	-21	**-20**	**-19**	**-18**	**-17**	**-16**	**-15**	**-14**	**-13**	**-12**	**-11**	**-10**	**-9**	**-8**	**-7**	**-6**	**-5**	**-4**	**-3**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**

Consequence

Table 4-3: Significance Rating Description

Score	Description	Rating
109 to 147	A very beneficial impact that may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change	Substantial (positive)
73 to 108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and / or social) environment	Major (positive)
36 to 72	An positive impact. These impacts will usually result in positive medium to long-term effect on the natural and / or social environment	Minor (positive)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and / or social environment	Negligible (positive)
-3 to -35	An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and / or social environment	Negligible (negative)
-36 to -72	A minor negative impact requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and / or social environment	Minor (negative)
-73 to -108	A moderate negative impact may prevent the implementation of the project. These impacts would be considered as constituting a major and usually a long-term change to the (natural and / or social) environment and result in severe changes.	Major (negative)
-109 to -147	A major negative impact may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	Substantial (negative)

5 Baseline Summary

This section provides a summarised hydrological baseline description. It includes a description of the water management areas (WMAs), rivers and drainage, and climate (rainfall and evaporation).

5.1 Regional Hydrology

South Africa is divided into 19 Water Management Areas (WMA) (National Water Resource Strategy, 2004), managed by their own water boards. Each of the WMAs is made up of quaternary catchments which relate to the drainage regions of South Africa, ranging from A to X (excluding O). These drainage regions are subdivided into four known divisions based on size. For example, the letter A represents the primary drainage catchment; A2 for example will represent the secondary catchment; A21 represents the tertiary catchment and A21D would represent the quaternary catchment which is the lowest subdivision in the WR2005 manual. Each of the quaternary catchments has associated surface water attributes.

Grootegeluk is situated in the Limpopo Water Management Area (WMA01); in the A42J quaternary catchment. A summary of the surface water attributes associated with the A42J quaternary catchment is shown in Table 5-1, where:

- MAE refers to the Mean Annual Evaporation;
- MAR refers to Mean Annual Runoff; and
- MAP being the Mean Annual Precipitation.

In this quaternary catchment, the Mokolo River forms the major drainage system. Other surface water resources within proximity to the Grootegeluk Project are the Sandloop Spruit and the Limpopo River.

Table 5-1: Summary of the Surface Water Attributes for the Affected Quaternary Catchments (WRC, 2005)

Quaternary Catchment	Area (km^2)	Rainfall Zone	MAP (mm)	MAR (mm)	MAR $*10^6 m^3$	Evaporation Zone	MAE (mm)	% MAR/ MAP
A42J	1812	A4E	428	3.21	5.81	1D	1949	0.7

The A42J quaternary catchment has a net area of 1,812 km^2 and has an MAR of 5.81 million cubic meters (10^6 m^3). Runoff emanating from this area drains into the Limpopo River, bordering the northern part of this region.

5.2 Climate

Grootegeluk lies in the summer rainfall region with warm summers and moderate, dry winters. The area is characterized by summer rainfall with an average rainfall of approximately 466 mm per annum; falling mainly between November and April (Golder, 2009).

Temperatures vary between a minimum of 11°C and a maximum of 40°C during the summer and a minimum of 0°C and a maximum of 28°C during the winter.

The regional rainfall and evaporation is detailed below.

5.2.1 Rainfall

The area has a semi-arid climate with a MAP (obtained from the WR2005 manual) for quaternary catchment A42J of 428 mm, as indicated in Table 5-2. Most of the rainfall occurs in April (78.2 mm) and the lowest occurs in October (1.9 mm).

Table 5-2: Summary of Rainfall Data extracted from the WR2005

Month	MAP (mm)
January	30.6
February	60.2
March	73.7
April	78.2
May	74.3
June	55.6
July	30.0
August	9.8
September	3.7
October	1.9
November	2.3
December	7.8
MAP	**428**

5.2.2 Evaporation

Monthly evaporation data was obtained from the WR2005 manual (WR2005, 2009). The evaporation obtained is based on Symons pan evaporation measurements and needs to be converted to lake evaporation. This is due to the Symons pan being located below the ground surface and painted black which results in the temperature in the water being higher than that of a natural open water body. The Symons pan figure is then multiplied by a lake evaporation factor[2] to obtain the adopted lake evaporation which presents the monthly evaporation rates of a natural open water body.

Table 5-3 is a summary of the evaporation data for the A42J quaternary catchment (from WR2005).

Table 5-3: Summary of Evaporation Data

Months	Symons Pan Evaporation (mm)	Lake Evaporation Factor	Lake Evaporation (mm)
January	226.1	0.8	183.1
February	210.1	0.8	172.3
March	210.1	0.8	174.4
April	208.9	0.8	175.5
May	174.2	0.9	153.3
June	164.7	0.9	144.9
July	129.2	0.9	113.7
August	109.7	0.9	95.5
September	90.6	0.9	77.0
October	101.9	0.8	84.6
November	137.0	0.8	111.0
December	186.3	0.8	150.9
Total	**1949**	**10.11**	**1636**

The evaporation rates presented in

Table 5-3 show that the highest evaporation of 183.1 mm was recorded in January and the monthly minimum (77.0 mm) occurs in September.

5.3 Local Drainage

The area is relatively dry with no streams or rivers within a 10 kilometer (km) radius. The nearest water courses are the Sandloop Spruit, located just over 10 km from site and the Limpopo River at almost 30 km towards the north.

The mine is located on relatively flat ground with no streams or defined drainage lines within the site.

[2] Evaporation factor obtained from WR2005

The onsite runoff and stockpiles seepage are managed through a number of existing secondary storm water trenches which drain towards the main storm water drains. The water collected is pumped back for reuse as part of the process water circuit or allowed to flow to the Bosbok Dam. Any impacts on surface water are anticipated to impact the storm water management system rather than the natural water courses.

5.4 Water Quality

As the nearest permanent surface water resource in the vicinity of Grootegeluk, the Mokolo River, is situated approximately 20 kilometres away, the only surface water monitoring taking place is in the storm water and process water storage facilities. The locations of these are detailed in Figure 5-1

Water quality has been monitored at the Grootegeluk for a number of years, and records on water quality from 2010 until 2016.The water quality results available were benchmarked against and the water use licence (WUL) limits. The box and whisker plots of these three parameters of concern are depicted in Figure 5-2, Figure 5-3 and Figure 5-4.

The water quality indicates elevated levels of Sulphate, Calcium and Magnesium that exceed the WUL limits for most of the sites. The following sites; Control sample tap water (CTL), Pool Workshop Dam (PWD) and Voëltjie Dam (VTJ) overall depict cleaner water quality with records falling within the WUL limits for all parameters

Surface water is reused on site with no water released to the environment, but released in to pit sumps, dams and trenches. Water quality impacts could be anticipated in groundwater resources rather than surface water resources.

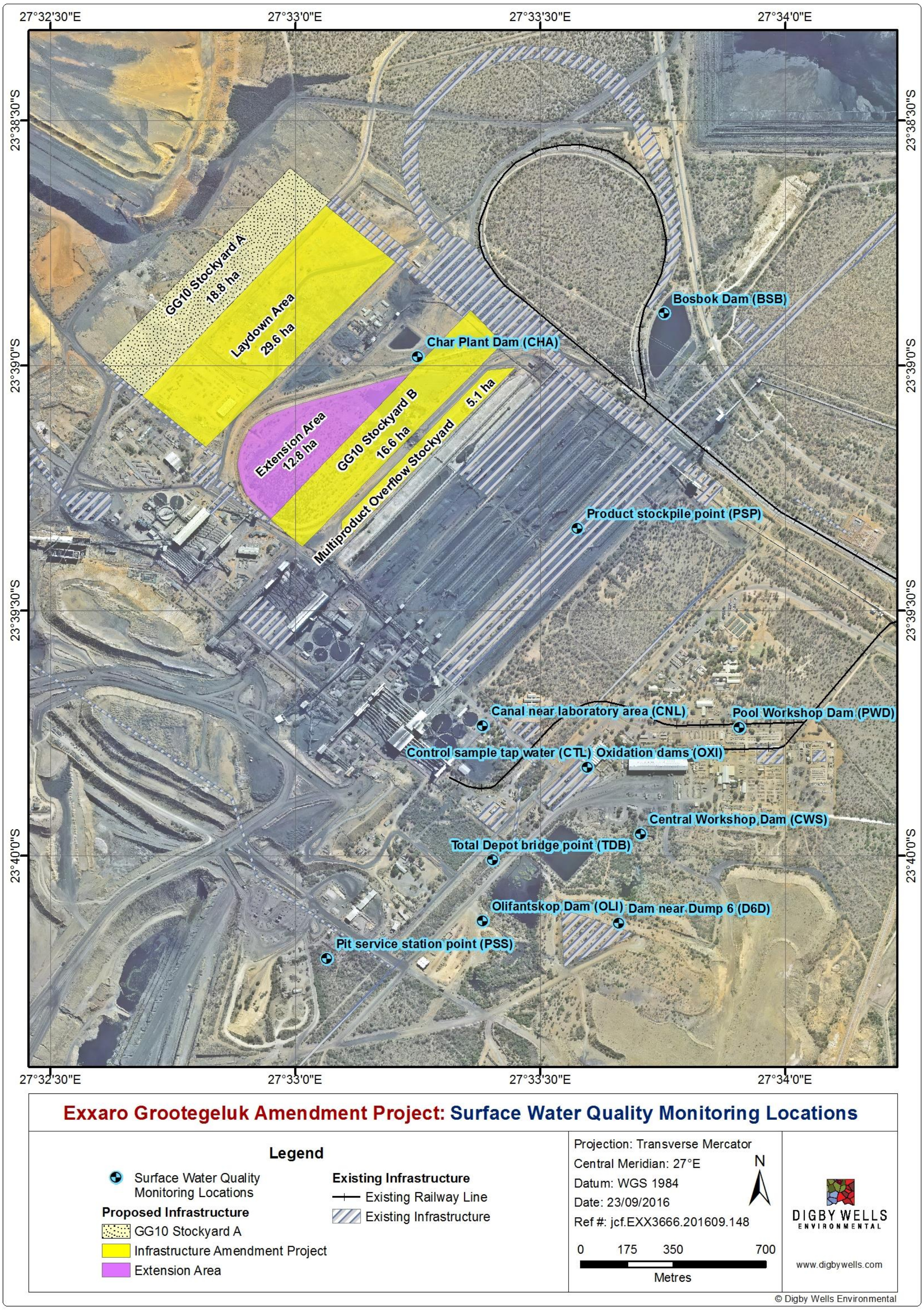

Figure 5-1: Current surface water quality monitoring locations

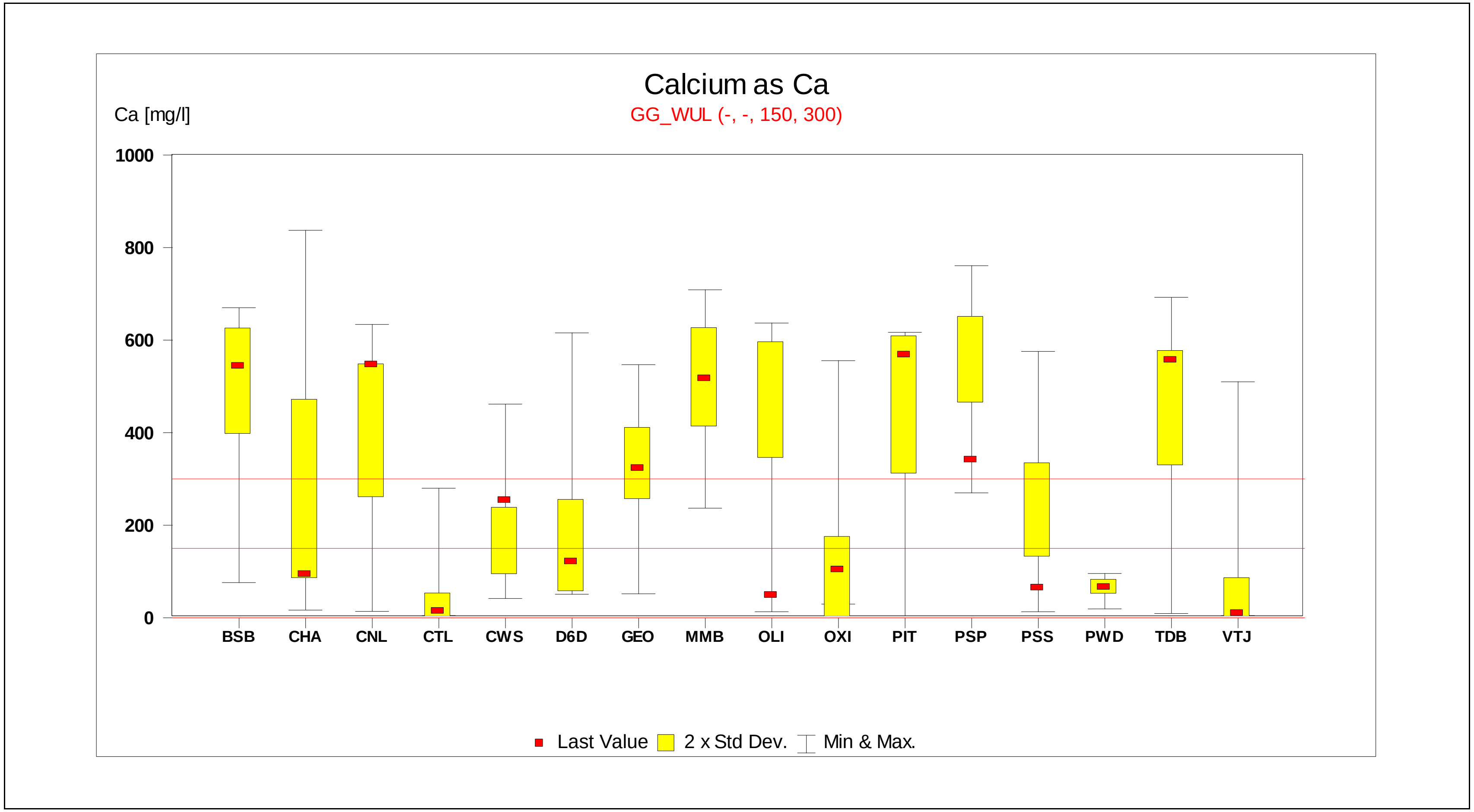

Figure 5-2: Summary of Calcium levels from the surface water samples

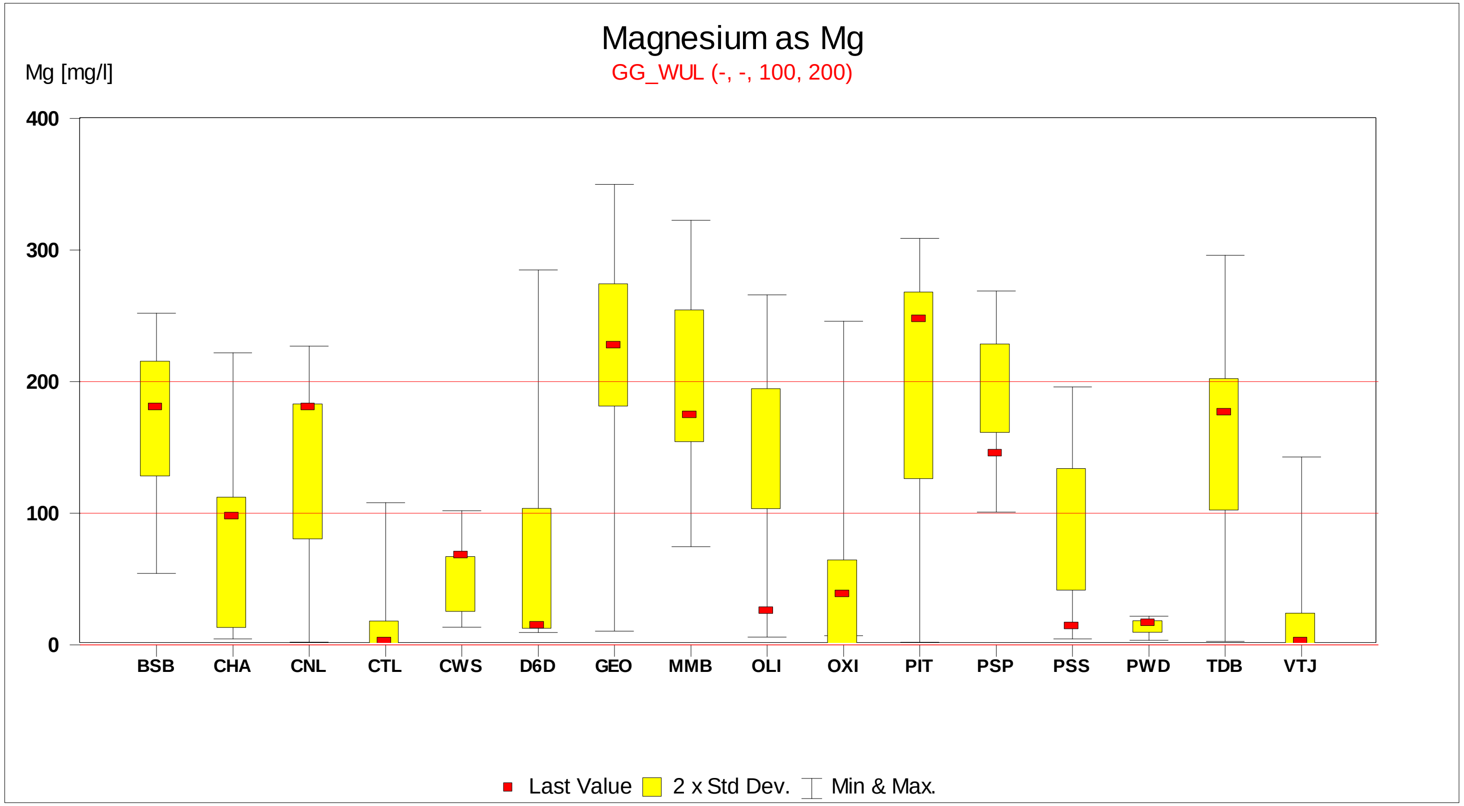

Figure 5-3: Summary of Magnesium levels from the surface water samples

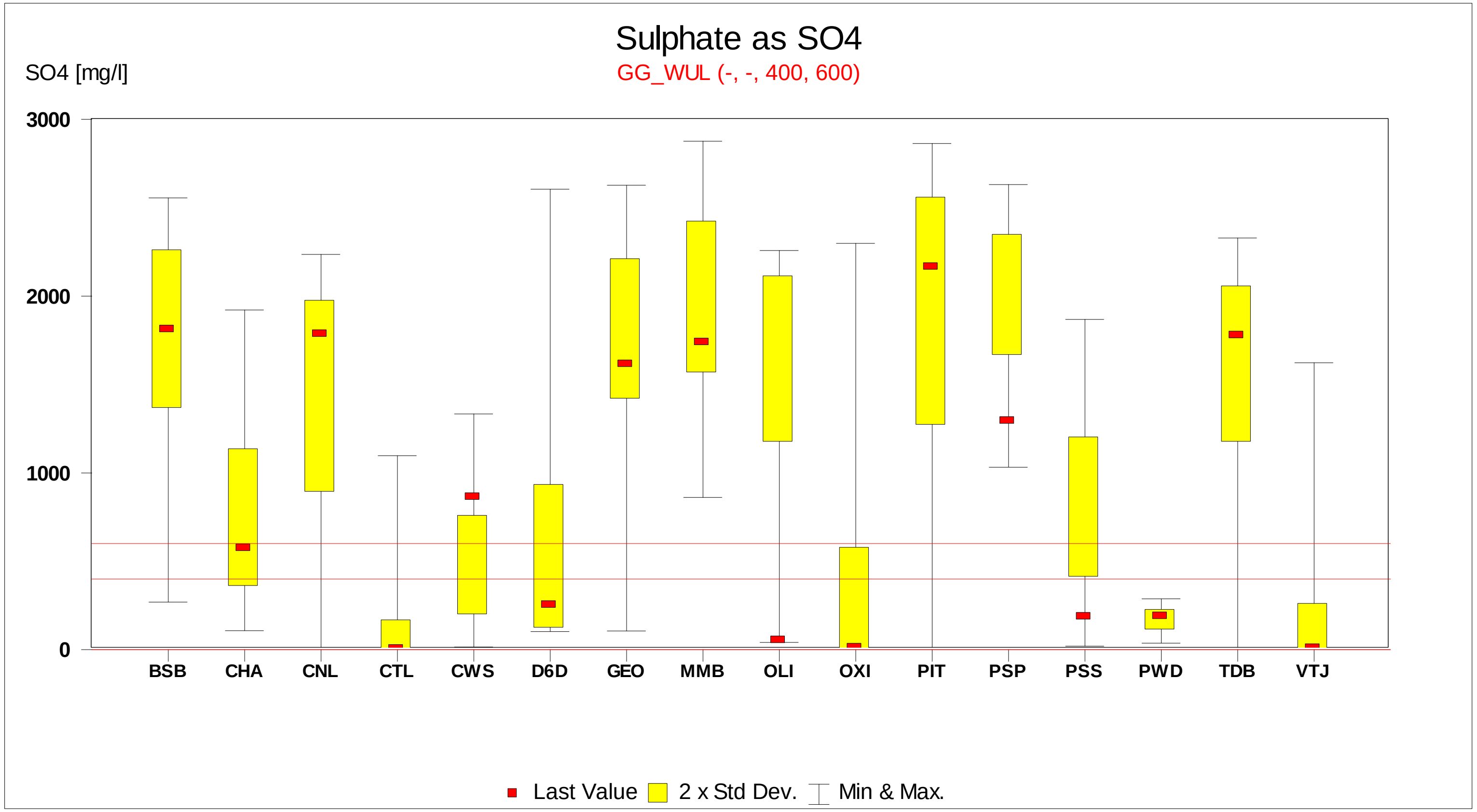

Figure 5-4: Summary of Sulphate levels from the surface water samples

6 Water Balance Summary

Sustainable water resource management forms part of the mine's integrated water management principles and involves the development of an integrated approach of water accounting that more accurately reflects the reality of water use on the mine.

Water accounting uses a water balance approach to quantify the amount of water entering a system (through precipitation and groundwater flows) and the amount leaving a system (through evaporation, surface water flows, sewage, product water loss and groundwater flows).

Water balance studies have been carried out in 2014 (Digby Wels, 2014) with an update on the addition of runoff from GG4/5, GG6/2, GG10, Multiproduct overflow Stockyards, Conicle and Buffer Stockpiles. In 2015, Exaro developed a water balance (Exxaro, 2015) which incorporated the new Waste Water Treatment Plant (WWTP) was incorporated; and the pit outfall channel replaced the WP Slimes Pits.

To ensure adequate storage during summer conditions the water balance were also determined for the six months summer and six months winter conditions. The summer period were taken from October to March with winter period from April to September.

The calculated water balance results adopted from the prior mentioned reports are summarised in Table 6-1.

Table 6-1: Summary of Water Balance Calculation Model Results

Inflows	m^3 / month	Outflows	m^3 / month	Notes; Source
Slimes dam complex - Rainfall	8 000	Slimes dam complex- Evaporation	21 100	Exxaro, 2015
	3 200	Seepage Slimes Dam Complex	3 000	Exxaro, 2015
Concrete dam -Rainfall	10	Concrete dam - Evaporatioon	40	Exxaro, 2015
Mamba dam -Rainfall	500	Mamba dam- Evap	1 900	Exxaro, 2015
Bosbok dam -Rainfall	2 000	Bosbok dam Evaporation	9 000	Exxaro, 2015
	800	Seepage Bosbok dam	180	Exxaro, 2015
Beneficiation Plants, offices & workshops - Rainfall	10 100	Plant, offices & workshops evaporation	34 900	Exxaro, 2015
Boreholes Abstraction	70 000	Losses of Water in Waste	128 000	Exxaro, 2015
Zeeland (potable water) Abstraction	28 900			Exxaro, 2015
Raw water (Mokolo dam) Abstraction	283 800			Exxaro, 2015
Reductants -Rainfall	400	Reductants Evaporation	1 640	Exxaro, 2015
	1 980	Product Losses	122 000	Exxaro, 2015

Inflows	m^3 / month	Outflows	m^3 / month	Notes; Source
Buffer dam - Rainfall	900	Buffer dam- Evaporation	900	Exxaro, 2015
Oliphantskop dam - Rainfall	900	Oliphantskop dam- Evap	3 800	Exxaro, 2015
		Oliphantskop dam seepage	2 430	Exxaro, 2015
Bench 11 sump - Rainfall	2 100	Bench 11 sump Evap	9 200	Exxaro, 2015
	1 600	Dust suppression	108 730	Exxaro, 2015
Bench 13 sump - Rainfall	3 800	Bench 13 sump Evap	17 800	Exxaro, 2015
	95 000			
Voeltjie dam - Rainfall	60	Voeltjie dam Evap	300	Exxaro, 2015
	400	Voeltjie dam-seepage	160	Exxaro, 2015
Stockpiles - rainfall	26 766	Stockpiles - Evap	10 706	Digby Wells, 2014
		Stockpiles - Water in Product	3 774	Digby Wells, 2014
		Stockpiles - Seepage	3 150	Digby Wells, 2014

As concluded in the previous water balance (Exxaro; 2015), based on the summer and winter evaluation the pit is the main source of water storage and account for 91% of the total excess water during the summer period.

7 Storm Water Management Plan

An existing Storm Water Management Plan (SWMP) is in place for Grootegeluk Coal Mine and was upgraded to accommodate the infrastructure associated with the Grootegeluk Coal Mine Extension Project which in turn will be in favour of the current proposed Short-Term Stockpiles Amendment Project. The existing SWMP is delineated in 2014 (Digby Wells, 2014) and the proposed infrastructure falls within the proposed SWMP. It is with this presumption that in this study a SWMP was not part of the scope.

In terms of the SWMP, it is recommended that the stockyard design must ensure the efficient collection and handling of dirty water and prevent pollution of clean water resources through the use of berms and the appropriate channels designed for the Stockyards.

The SWMP delineated in 2014 is depicted with the proposed infrastructure as depicted in Figure 7-1.

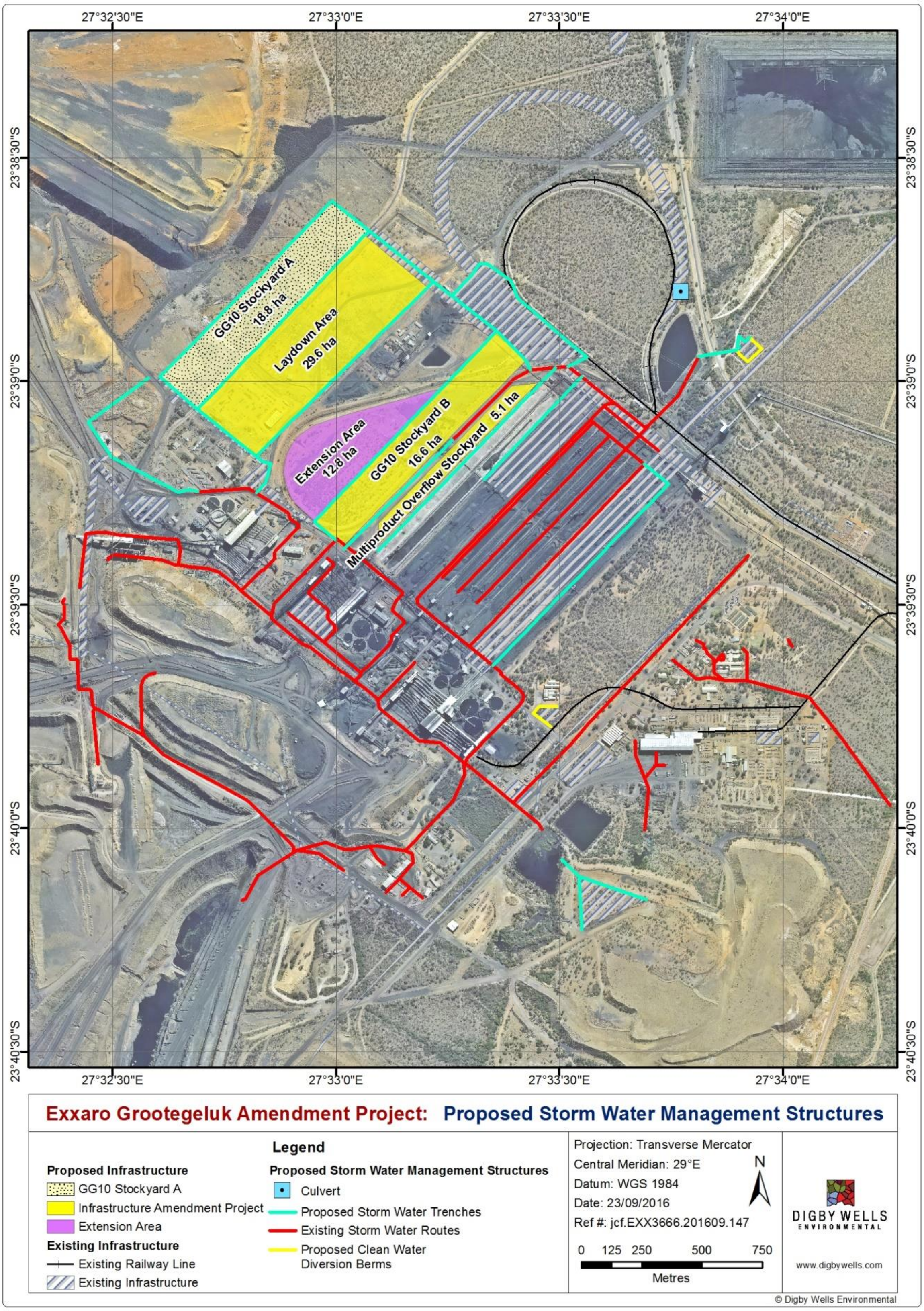

Figure 7-1: Proposed Storm Water Management Plan from Digby Wells, 2014

8 Impact Assessment

Based on the baseline data, Grootegeluk Coal Mine is located in a low rainfall and high evaporation area as indicated by the rainfall and evaporation records (Section 5.2). The area is relatively dry with no nearby stream or rivers within a 10 km radius. The nearest rivers are the Sandloop Spruit, located just over 10 km from site and the Limpopo River at almost 30 km away. The absence of rivers in the immediate vicinity implies contaminated runoff from the site is anticipated to have minimal regional surface water impacts.

Based on the current management and storm water infrastructure the impacts are anticipated to have very low significance due to availability of infrastructure and that activities will be in already disturbed areas with existing mitigation.

8.1 Project Activities Assessed

This section details the assessments of surface water impacts that will potentially arise from the following activities:

- The construction and operation of stockpiles (the Laydown Area, GG10B, and Multiproduct Stockyard footprints) to stock excess Eskom-grade coal, for an approximate period of five years; and
- The extension of the GG10B Stockyard footprint by approximately 12.8 ha by including the internal area of the discontinued rail loop.

8.2 Potential Impacts of Infrastructure

The following impacts are anticipated:

- Runoff contamination by eroded sediments emanating from the clearing of the stockpile footprints and the extension area; and
- Runoff contamination by coal fines and seepage from operational stockpiles. However, this report to the storm water drains hence should be managed there. This implies that the impacts will be minimal as long as the storm water management system is operational and well managed.

8.3 Site Clearing Impacts

8.3.1 Impact Description: Runoff Contamination from Eroded Sediments

Clearing or removal of vegetation from the proposed footprint and stockpiling of the topsoil leaves the soils prone to erosion during heavy rainfall events, and as a result runoff from these areas which will be high in suspended solids will cause an increase in turbidity in storm water management systems.

The runoff will not report to the natural water courses and the downstream receptors as they are far; however, it could report into the storm water management system and result in siltation. Siltation reduces the capacity of the water conveyance and storage infrastructure.

8.3.2 Management/ Mitigation Measures

The following mitigation measures are recommended:

- Clearing of vegetation must be limited to the stockpile footprint;
- The removed topsoil must be vegetated as soon as possible to prevent sediment erosion;
- All silted runoff emanating should be collected in trenches and passed through silt traps before discharge to containment facility e.g. PCD's; and
- The routine cleaning of storm water drains and containment dams is essential as part of a storm water management system maintenance.

8.3.3 Impact Ratings

This impact is rated in Table 8-1.

Table 8-1: Siltation of runoff

<table>
<tr><th colspan="4">IMPACT DESCRIPTION: Siltation of runoff leading to siltation of storage dams and conveyance channels</th></tr>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td colspan="4">Pre-Mitigation</td></tr>
<tr><td>Duration</td><td>Short term: Less than 1 year (2)</td><td>Equal to the duration of the construction phase which will be a short period</td><td rowspan="4">Negligible (negative) (35)</td></tr>
<tr><td>Extent</td><td>Limited (2)</td><td>The impacts will be limited to the nearby conveyance channels and the immediate containment facility</td></tr>
<tr><td>Intensity x type of impact</td><td>Minor- negative (3)</td><td>This will have impacts on the capacity of the storm water if it occurs over long enough time to cause accumulation</td></tr>
<tr><td>Probability</td><td>Likely (5)</td><td>Without appropriate mitigation there will definitely be erosion</td></tr>
<tr><td colspan="4">Mitigation/ Management actions</td></tr>
<tr><td colspan="4">▪ Clearing of vegetation must be limited to the project site and the cleared area should not be left exposed for too long to the elements of erosion.
▪ The removed topsoil must be vegetated as soon as possible to prevent sediment erosion.
▪ A storm water management system should include a silt trap and undergo regular cleaning.</td></tr>
<tr><td colspan="4">Post-Mitigation</td></tr>
<tr><td>Duration</td><td>Short term: Less than 1</td><td>Equal to the duration of the construction phase which will be a short period</td><td>Negligible (negative)</td></tr>
</table>

	year (2)		(15)
Extent	Limited (1)	Minimal impacts to conveyance channels and the immediate containment facility	
Intensity x type of impact	Negative (2)	Impacts experience within the stockyards	
Probability	Probable (3)	Necessary mitigations will reduce the erosion probability significantly	

8.4 Water Drain Contamination

8.4.1 Impact Description: Increased Water Contamination from Carbonaceous Material

Contaminated runoff emanating from the coal fines and stockyards has the potential to contaminate water in the storm drains and potentially silt up the drains.

This impact can reduce the potential of the water being reused in the system. The clogged drains and water holding dams will reduce their water holding capacity and pose greater risk of overflowing into clean system in extreme rainfall events.

However, this can be prevented and/or reduced if the following recommended measures are implemented.

8.4.2 Management / Mitigation Measures

These impacts can be prevented and/or reduced by implementing the following measures:

- Ensure that the plant's storm water drains are regularly cleaned as per management schedule. Cleaned systems will ensure that impacts are retained within a controlled environment with no potential impacts to clean storm water drainage systems;
- The stockyards should be operated within capacity to ensure that coal does not spill into the water management drains and result in siltation;
- Storm water management channels should be extended to include the GG10 Stockyard A & B extension Areas; and
- Water will be channelled to the pit or Bosbok dam for reuse I the beneficiation process.

8.4.3 Impact Ratings

This impact is rated in Table 8-2.

Table 8-2: Water Drains Contamination

IMPACT DESCRIPTION: Contaminated Runoff reporting into water drains resulting in siltation and poor water quality.			
Dimension	**Rating**	**Motivation**	**Significance**
Pre-Mitigation			
Duration	Medium term: (3).	The project will last for 5 years and the impact can occur over the project life	Negligible (negative) (16)
Extent	Limited (3)	Limited to the site and its immediate surroundings	
Intensity	Minor - negative (2)	If runoff is not diverted over long periods it could completely clog the drains and result in overflow that will contaminate groundwater	
Probability	Improbable (2)	The impact may occur, but only in extreme rainfall events	
Mitigation/ Management actions			
▪ The stockyards should be operated within capacity to ensure that coal does not spill into the water management drains and result in siltation. ▪ Ensure that the plant's storm water drains are regularly cleaned as per management schedule on site.			
Post-Mitigation			
Duration	Immediate (1)	Impact can occur over the project life	Negligible - negative (3)
Extent	Very limited (1)	Limited to specific isolated parts of the site	
Intensity	Low Level - negative (1)	Replaceable damage with no change to the baseline	
Probability	Highly unlikely (1)	The possibility of the impact materialising is expected never to happen as water resources are far away	

9 Surface Water Monitoring

9.1 Water Quality

There are no gaps within the current surface water monitoring programme and should be maintained as is (Table 9-1). Since there are no surface water streams, monitoring occurs at process water dams, storm water collection dams and conveyances and drinking water reservoirs and taps. The current monitoring can be maintained and supported with requirements of a salt and water balance.

Table 9-1: Surface Water Quality Monitoring Locations

Surface water quality monitoring points		Latitude	Longitude
BSB	Bosbok Dam	-23.647603	27.562937
CHA	Char Return Water Dam	-23.648672	27.553878
CNL	Canal near new Laboratory	-23.661922	27.556982
CTL	Control Sample	-23.662453	27.56065
CWS	Central Workshop Separator	-23.665615	27.56201
CWSS	Central Workshop Separator Inflow	-23.665615	27.56201
D6D	Dam next to 6 Dump	-23.667833	27.561315
GEO	Geohydrological Cut Off Trench	-23.634272	27.574703
MMB	Mamba Dam	-23.636472	27.572763
OLI	Olifantskop Dam	-23.667365	27.558415
OXI	Oxidation Dams	-23.675848	27.559458
PIT	Pit Water - Bench 11	-23.67746	27.546118
PIT S13	Pit Sump Bench 13	-23.676987	27.529012
PSP	Product Stockpile Point	-23.655307	27.559277
PSS	Pit Service Station	-23.669233	27.551575
PWDS	Pool Workshop Dam with New Separator	-23.661663	27.565022
TDB	Total Depot Bridge	-23.66587	27.556817
VTJ	Voeltjie Dam	-23.679272	27.558818
WWTW	Waste Water Treatment Works	-23.670322	27.554469

The storm water management plan needs to be monitored for aspects such as its efficiency, as well as de-silting so that it remains effective. These can be performed on monthly check and de-silting carried out when necessary.

9.2 Water Quantity

The water balance needs to be updated from time to time as specified in WULA conditions. It is therefore important that volumes related to water make and water use, are recorded throughout the Life of Mine. The water volumes that should be considered in the operation of stockyards include, but not limited to:

- Seepage collected in drains;
- Dust suppression volumes; and
- Product moisture content.

In the event of any technology changes, through monitoring, some changes in the water balance will therefore be documented and assist in the water management on the mine.

10 Conclusions and Recommendations

Grootegeluk is located in a relatively dry area, in quaternary catchment A21J with an MAP of 428 mm and no natural water courses flowing in the vicinity, except the on-site water management drains.

The water quality indicates elevated levels of Sulphate, Calcium and Magnesium that exceed the water quality water use licence (WUL) limits.

As concluded in the previous water balance (Exxaro; 2015), based on the summer and winter evaluation the pit is the main source of water storage and account for 91% of the total excess water during the summer period.

The surface water impact assessment indicated that the identified potential impacts were minor and could be mitigated to a negligible level. Water monitoring should continue as is currently in place and management of contaminated storm water from stockpiles should be maintained.

With all the mitigation and management measures in place, this project will not pose any threat into the natural surface water resources and should therefore go ahead.

11 References

DIGBY WELLS, 2014. Surface Water Report. Surface Water Assessments and Conceptual Storm Water Management Plan: Grootegeluk Mine.

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WATER RESEARCH COMMISSION (WRC), 2005. Water Resources of South Africa 2005 (WR2005), WRC Report No.: K5/1491).