dedect
Department:
Economic Development, Environment, Conservation and Tourism
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

AgriCentre Building
Cnr. Dr. James Moroka
&
Stadium Rd

Private Bag X2039
MMABATHO 2735
www.nwpg.gov.za

CHIEF DIRECTORATE: ENVIRONMENTAL SERVICES
DIRECTORATE: ENVIRONMENTAL QUALITY MANAGEMENT

Enquiries: Ouma Skosana
Tel: +27 (18) 389 5156
Email: oskosana@nwpg.gov.za
Fax: +27(18) 384 0104

DETAILS AND EXPERTISE OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	
NEAS Reference Number:	
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014

PROJECT TITLE

RBMR Acid Plant Relocation – Stormwater Management Plan

1. Details of Specialist

Type of Specialist:	Hydrologist		
Company Name:	SRK Consulting (Pty) Ltd		
Contact person:	Joyce Mathole		
Postal address:	P O Box 35290, Menlo Park		
Postal code:	0102	Cell:	0827410524
Telephone:	012 361 9821	Fax:	086 570 9575
E-mail:	jmathole@srk.co.za		
Professional affiliation(s) (if any)	Pr Sci Nat		

Project Consultant:	SRK Consulting (Pty) Ltd		
Contact person:	Ndomupei Masawi		
Postal address:	P O Box 35290, Menlo Park		
Postal code:	0102	Cell:	082 379 5716
Telephone:	012 361 9812	Fax:	012 361 9921
E-mail:	nmasawi@srk.co.za		

2. Expertise of the Specialist including Curriculum vItae (Appendix 6 (1)(a)(ii) of EIA Regulations, 2014)

- Geographic information Systems using ArcView GIS, Arc Map and AutoCAD;
- hydraulic and hydrological modelling of watercourses using HECRAS software and programs such as NWSRFS and other local programs developed in Department of Water Affairs and Forestry such as DT, OGEE for dams, SIDECHAN for side channels;
- Determination of Floodlines;
- Flood Hazard Assessments;
- Bridges, Culverts and Channel modelling;
- Water Resources Modelling using WRSM2000/Pitman Model;
- Surface Water Impact assessments
- Yield Model Analysis;
- Water Reconciliation Studies;
- Major and Miner Stormwater Management Planning using PCSWMM;
- Mine Stormwater Management.

3. Declaration by Specialist

I,---Joyce Mathole----------(Name of Specialist) of ----SRK Consulting (Pty) Ltd----------(name of company) declare that;

- I act as an independent specialist in this application.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant.
- there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant/ Environmental Assessment Practitioner appointed by applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- **all the particulars furnished by me in this form are true and correct; and**
- **I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of Section 48B(2) of the Act.**

SRK Consulting - Certified Electronic Signature
srk consulting
44277/Other
1385-2392-413-MATH
This signature has been printed digitally. The Author has given permission for its use for this document. The details are stored in the SRK Signature Database

SOUTH AFRICAN POLICE SERVICE
GARSFONTEIN
2021 -03- 26
MIC
SUID-AFRIKAANSE POLISIEDIENS

Signature of the specialist

SRK Consulting

Name of company (if applicable)

24 March 2021

Date

2139239-1.

Signature of the Commissioner of Oaths

2021-03-26.

Date

CONSTABLE.

Designation

Stormwater Management Plan for RBMR Proposed Acid Plant Relocation Site

Report Prepared for

Anglo Platinum Limited: Rustenburg Base Metals Refiners (RBMR)

Report Number 561608/SWMP

Report Prepared by

March 2021

Stormwater Management Plan for RBMR Proposed Acid Plant Relocation Site

Anglo Platinum Limited: Rustenburg Base Metals Refiners (RBMR)

SRK Consulting (South Africa) (Pty) Ltd.
SRK House,
265 Oxford Road,
Illovo,
South Africa

e-mail: johannesburg@srk.co.za
website: www.srk.co.za

Tel: +27 (0) 11 441 1111
Fax: +27 (0) 11 880 8086

SRK Project Number 561608

March 2021

Compiled by:

Joyce Mathole
Senior Water Scientist

Email: jmathole@srk.co.za

Peer Reviewed by:

Peter Shepherd
Partner

Authors:

J Mathole; P Shepherd

Executive Summary

Summary of principal objectives

Anglo Platinum Limited's Rustenburg Based Metals Refiners (RBMR) appointed SRK Consulting South Africa (Pty) Ltd (hereafter referred to as SRK) to develop a stormwater management plan which will form part of the Environmental Authorisation process for the proposed Acid Plant Relocation in accordance with requirements of Government Notice Regulation (GNR) 704 (Government Gazette 20118, 4 June 1999) of the Water Act (Act 36 of 1998) (NWA) that also meets the Anglo American Water Management Structures Standards and Technical Specifications Version 5 of May 2019 for the proposed Acid Plant Relocation site to ensure that stormwater at the proposed Relocated Acid Plant is managed responsibly in terms of the principles of the NWA and the National Environmental Management Act (Act 107 of 1998) (NEMA) as well as the relevant regulations and guidelines.

Key areas of concern are summarised as follow:

1. Acid Storage Tanks
2. Acid Offloading Bay
3. Acid Pumps
4. Truck Staging Area
5. Evaporation Pad under Construction

Outline of work programme

- A site visit was conducted on 14th July 2020 at the Anglo Platinum Ltd.'s Rustenburg Base Metals Refiners. The existing land cover, topography and the gradient relative to the nearby watercourses were noted;
- The existing stormwater management plan was retrieved from the SRK archives SRK Report 474221);
- The revised Acid Plant Layout Plan received from RBMR was used to identify stormwater management controls required to meet GN 704 requirements;
- A stormwater management plan report and drawings outlining elements required to meet the relevant regulations and recommendations to ensure stormwater is managed responsibly was prepared.

Conclusions, high priorities and action needed

The stormwater management plan provides an indication of the steps and processes required in order to meet the Regulation 704 criteria in terms of the National Water Act (Act No. 36 of 1998).

These steps and processes include the following:

a) Separation of clean and dirty water streams and the release and containment of each stream respectively.

b) The impact of Mean Annual Runoff (MAR on the local and quaternary catchment level

c) The potential impact on the infrastructure by the 1:100 year flood event

The following are key findings and recommendations following the development of stormwater management plan for the Acid Plant Relocation site:

- Proposed diversion berms and channels discussed in Section 7 of this report are required to separate clean and dirty water effectively. The stormwater trenches were sized to contain the 1:50 year flood in compliance with Reg 704.
- Clean surface runoff emanating from the area between the proposed loading bay and the desilting dewatering plant to be channelled into a clean natural trench which will report at the proposed oil trap. After oil separation, the clean water will be discharged to the clean natural environment and conveyed towards Klipfonteinspruit.
- A 1:50 year peak discharge of 3.126 m3/s is anticipated at the proposed oil trap from the Acid plant clean area.
- The stormwater channels and berms to be maintained regularly to ensure that no vegetation and silt obstruct the flow within the channels and along the berms.
- Stormwater channels to be lined if the velocity within the channels exceeds 2 m/s to prevent erosion within the channels.
- Culvert openings should be constructed at the positions where the proposed channels cross the access road. The culvert openings should be sized to capacities that can convey the channel flow as per the 1:50 year storm event without overtopping. The existing culvert currently conveying contaminated water from the existing Plant should be upgraded to accommodate the additional affected runoff coming from the Acid Plant.
- The proposed dirty water system to discharge dirty runoff collected from the area between the Chemical Tanks into the proposed dirty water channel running on the western side of the Chemical Tanks which further discharges into a proposed sump at the north western end of the Chemical Tanks foot print. A proposed sump at the chemical loading are will collect contaminated water due to activities occurring below the proposed loading area roof and this water will either be pumped directly into the CatchAll Tank or pumped into the dirty channel sump.
- Bunding walls to be constructed around Chemical Tanks to provide emergency containment in an event of tank failure, to prevent mixing of different acids around the tanks and to stop chemical leakage that could result in surface and groundwater contamination. A 1.5m^2 sump to be installed in each bund to temporarily store contaminated stormwater which will be pumped to CatchAll Tank. Contaminated stormwater collected in the CatchAll Tank will be pumped to the E&S for equalization where post equalization, the equalized stormwater will be recycled and reused by the mine.It is important to develop an efficient and effective pumping schedule to ensure that no spilling occurs from the temporary storages.
- All proposed stormwater storages/sumps should be maintained to prevent silt potentially reducing the capacities of the sumps.
- Stormwater discharge points forming part of the stormwater management plan discharging to the nearest watercourses/natural environment should be positioned outside of the 1:100 year floodlines.
- The proposed infrastructure within the Acid Plant is not affected by 1:100 year floodlines (Report No.474221 – SRK Consulting, April 2014).
- The Acid Plant Relocation site will marginally affect the MAR by 0.0006% at a quaternary scale.

- The hydrological data used in running PCSWMM model for the stormwater management planhas considered the latest survey from RBMR and latest conceptual layout plan of the proposed Acid Plant.

Table of Contents

Executive Summary 2
Disclaimer vii
List of Abbreviations viii
1 Introduction and Scope of Report 1
1.1 Project brief 1
1.2 Scope of Work 1
1.3 Background to Regulation 704 2
2 Program Objectives and Work Program 2
2.1 Program Objectives 2
2.2 Work Program 3
2.3 Project Team 3
2.4 Methodology 3
2.5 Study Area Description and Locality 4
3 Hydrology 7
3.2 Topography and Drainage 7
4 Climate 9
4.1 Precipitation 9
4.2 Evaporation 9
5 Background to Stormwater Management Plan 10
5.1 Sub-catchment Delineation 11
5.2 Peak Flows 14
6 Mean Annual Runoff 16
7 Stormwater Management Plan 16
7.1 Clean Water Management System 16
7.2 Dirty Water Management System 17
8 Conclusion and Action List 22
9 References 24

List of Tables

Table 2-1: Project team consultants and specialists 3
Table 4-1 Summary of closest rainfall stations 9
Table 4-2: 24-hour storm rainfall for various return periods in the Klipfontein catchment 9
Table 4-3: Average monthly evaporation (mm) 9
Table 5-1: Peak Flows for the 1:50 year and 1:100 year return periods 15
Table 6-1: Quaternary Catchment MAR Reduction 16
Table 7-1: Clean and Dirty Stormwater Channel Characteristics 18

List of Figures

Figure 2-1: Anglo Platinum Rustenburg Base Metals Refiners Locality 5
Figure 2-2: Project Locality relative to the Existing Infrastructure 6
Figure 3-1: RBMR Drainage Lines 8
Figure 5-1: Proposed Clean and Dirty Stormwater Management System 12
Figure 5-2: Sub catchments and Proposed Channels.....13
Figure 7-1: Dirty Stormwater System 19
Figure 7-2: Chemical Tanks Sub-catchments and Channels.....20
Figure 7-3: Clean Stormwater Management 21

Disclaimer

The opinions expressed in this Report have been based on the information supplied to SRK Consulting (South Africa) (Pty) Ltd (SRK) by Anglo Platinum Limited's Rustenburg Base Metal Refiners (RBMR). The opinions in this Report are provided in response to a specific request from RBMR to do so. SRK has exercised all due care in reviewing the supplied information. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of SRK's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this Report, about which SRK had no prior knowledge nor had the opportunity to evaluate.

List of Abbreviations

BPG	Best Practice Guideline
DMR	Department of Mineral Resources
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment
EMP	Environmental Management Program/Plan
EMPR	Environmental Management Program Report
IWWMP	Integrated Water and Waste Management Plan
MAR	Mean Annual Runoff
NEMA	National Environmental Management Act
NWA	National Water Act (Act 36 of 1998)
PCD	Pollution Control Dam
RBMR	Rustenburg Base Metals Refiners
SEF	Safety Evaluation Flood
SW	Stormwater
SWMP	Stormwater Management Plan
TSF	Tailings Storage Facility
WUL	Water Use Licence
WULA	Water Use Licence Application

1 Introduction and Scope of Report

1.1 Project brief

An emergency situation has occurred at the Anglo Platinum Limited's Rustenburg Base Metals Refiners that involves contamination of the centralized Bulk Chemical Storage Facility due to continuous Chemical Tanks leaks and loss of bund integrity that resulted in damage to the storage facility structures. A need was therefore identified to relocate the chemical storage facility to the eastern side of the existing RBMR Plant. SRK Consulting was appointed to develop a stormwater management plan based on the National Water Act no 36 of 1998, most specifically General Notice Regulation 704 (GN704) of the National Water Act (NWA) that also meets the Anglo American Water Management Structures Standards and Technical Specifications Version 5 of May 2019 for the proposed Acid Plant Relocation site.

1.2 Scope of Work

The Regulation 704 assessment includes considerations with regards to stormwater management within legislation, specifically in terms of the Regulations on Use of Water for Mining and Related Activities aimed at the Protection of Water Resources, GN 704.

The scope of work will include the following:

- Determination of catchment characteristics such as catchment boundaries, slopes, water bodies, drainage direction, etc;
- Delineation of clean and dirty water catchment areas;
- Determination of clean and dirty water areas storm peak flows and volumes for a 1:50 year and 1:100 year storm events;
- Determination of impact on the MAR;
- Placement and sizing of berms, stormwater channels and pollution control dams to divert clean water around dirty water areas as well as sizing and placement of dirty water containment infrastructure in line with GN 704 of the National Water Act (Act No. 36 of 1998);
- Development of a plan/map indicating water diversion berms and clean and dirty water conveyance structures
- A site layout plan indicating the stormwater management plan.,

Key stormwater management areas within the Proposed Acid Plant Relocation site are summarised as follow:

1. Acid Storage Tanks
2. Acid Offloading Bay
3. Acid Pumps
4. Truck Staging Area
5. Evaporation Pad under Construction

1.3 Background to Regulation 704

Section 26 (1) of the NWA provides for the development of regulations that:

- Require the use of incoming and discharging water from a water resource to be monitored, measured and recorded;
- Regulate or prohibit any activity in order to protect a water resource or in-stream or riparian habitat;
- Prescribe the outcome or effect that must be achieved through management practices for the treatment of waste, or any class of waste, before it is discharged or deposited into or allowed to enter a water resource.

GNR 704 was drawn up to address these issues in relation to mining activities. The impacts of mining operations must be managed according to several conditions as summarised in Appendix C. The principal conditions are:

- **Condition 4 describes the location of infrastructure and mining activities**. Any residue deposit, dam, reservoir, together with any associated structure must not be located within the 1 in 100-year floodline or within 100 m of any watercourse or borehole;
- **Condition 6 deals with capacity requirements of clean and dirty water systems**. Clean and dirty water systems must be kept separate and must be designed, constructed, maintained and operated such that these systems do not spill into each other more than once in 50 years; and
- **Condition 7 describes the measures which must be taken to protect water resources**. All dirty water or substances which cause or are likely to cause pollution of a water resource either through natural surface flow or by seepage must be contained.

As indicated above, Condition 6 of the Regulation requires containment of clean and dirty water systems, so they cannot spill into each other more than once in 50 years. To assist in planning and efficient design, this condition has been interpreted (Department of Water Affairs and Forestry) (DWAF) (now referred to as the Department of Water and Sanitation (DWS) Guidelines M6.1) as requiring the capacity for containment of the 1:50-year 24-hour storm event, over and above mean operating levels.

2 Program Objectives and Work Program

2.1 Program Objectives

The objective of this project is to perform a stormwater assessment against GNR 704 requirements and recommend a way forward for stormwater management at the Anglo's Rustenburg Base Metals Refinery RBMR. The SWMP based on Regulation 704 describes the measures that will be undertaken to manage stormwater related impacts within the proposed Acid Plant Relocation Area. The plan serves as a guideline for developing site specific practices and procedures which can be implemented. More specifically, the stormwater management plan presents a programme for routine monitoring of stormwater measures to protect water quality and to ensure compliance with Regulation 704.

The SWMP and Regulation 704 audit aims to:

1. Describe the catchments and surface flow patterns within the area of the project;
2. Identify stormwater controls required to meet Regulation 704;
3. Prioritise the implementation of the various stormwater measures; and
4. Provide a plan for ongoing stormwater management maintenance and implementation.

2.2 Work Program

- A site visit was conducted on 14th July2020 at the Anglo Platinum Ltd's Rustenburg Base Metals Refiners. The existing land cover, topography and the gradient relative to the nearby watercourses were noted;
- The existing stormwater management plan was retrieved from the SRK archives (SRK Report 474221);
- Proposed Conceptual Acid Plant Layout Plan received from RBMR was used to identify stormwater management controls required to meet GN 704 requirements;
- A stormwater management plan report and drawings outlining elements required to meet the relevant regulations and recommendations to ensure stormwater is managed responsibly was prepared.

2.3 Project Team

The project team consisted of the following consultants and specialists:

Table 2-1: Project team consultants and specialists

Name	Responsibility	Qualifications
Peter Shepherd	Principal Hydrologist	B Sc (Hons)
Ndomupei Masawi	Principal Environmental Scientist	MA Environmental Management
Mathole Joyce	Senior Hydrologist	B Sc (Hons)
Tshilidzi Netshitangani	Principal Hydrologist	MSc (Civil Engineering)

2.4 Methodology

The proposed stormwater management system was developed in terms of GN 704 of the NWA. The methodology is listed below. In order to achieve the objectives, set out in Section 2.1, the following activities were undertaken.

- Checked to ensure that no proposed infrastructure within the Relocated Acid Plant area is located within the 1 in 100-year floodline or within 100m of any watercourse or borehole based on previous floodlines undertaken in the area in 2014;
- Sized the proposed stormwater controls capacities to contain the catchment runoff from a 1:50 year storm event and diverted clean water away from dirty water sources;
- Dirty water from contaminated areas are discharged into dirty water containment storages;

Catchments were classified as clean or dirty areas in accordance with:

Clean Areas:

- **External catchments:** Open or undeveloped natural areas around the proposed Acid Plant Relocation site;
- Area between the Chemical Loading Bay and the Desilting Dewatering Plant

Dirty Areas:

- **Chemical Storage Area:** Contamination is anticipated within the Chemical Tanks storage area due to possible chemical leaks.
- **Chemical Loading Area:** stormwater contamination is expected within the chemical loading area due to possible chemical leaks during the loading process;

- **Evaporation Pad:** dirty water will be discharged into the evaporation pad and disposed of by evaporation.

2.5 Study Area Description and Locality

Anglo Platinum Limited's Rustenburg Base Metals Refiners forms part of Anglo Platinum Limited's smelting and refining complex for separating and recovering Platinum Group Metals (PGMs). High quality Nickel, Copper cathode, Cobalt sulphate and Sodium sulphate are produced at the RBMR plant and package for distribution to customers globally. RBMR situated on the western limb of the Bushveld complex within the jurisdiction of Rustenburg Local Municipality in the North West Province, a medium sized province relative to the other provinces in the country characterized by high levels of poverty, high unemployment and low levels of literacy. The nearest towns relative to RBMR include Rustenburg situated 8 km on the north-west, Kanana at ±12 km to the north, Marikana at 21 km on the eastern side and Mooinooi at 23.5 km on the south-east. The N4 National Road from east to west passes RBMR at ±5.5 km on the south western side.

A chemical storage facility (Acid Plant) situated within the existing plant is to be decommissioned and relocated due to contamination occurring within the current storage facility as a result of chemical leaks from the chemical storage tanks that resulted in damage to structures within the Acid Plant and destruction of the storage facility foundations. The project locality is shown on **Figure 2-1**. The location of the proposed Acid Plant Relocation site relative to the existing infrastructure is indicated on **Figure 2-2**.

New infrastructure to be constructed at the proposed site, includes;

- The bunded acid storage tanks and their designated pumps,
- The acid offloading bays,
- The weigh bridge and inspection platform,
- Access road,
- The truck staging area.

Klipfonteinspruit River (a tributary of Hex River) flows across the mine boundary on the northern side of RBMR in the north westerly direction and confluences with Hex River at ±5.8 km north-west of RBMR.

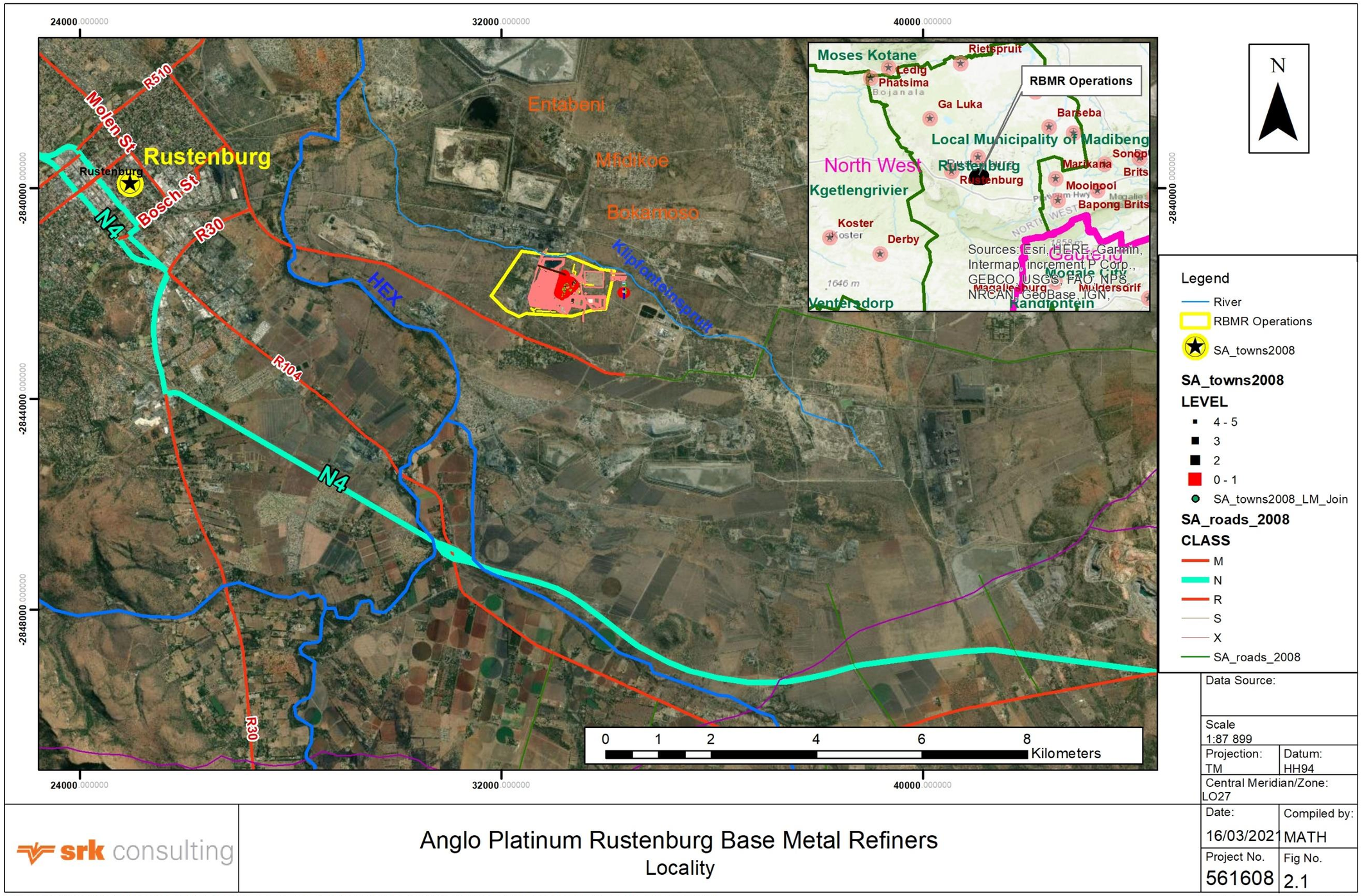

Figure 2-1: Anglo Platinum Rustenburg Base Metals Refiners Locality

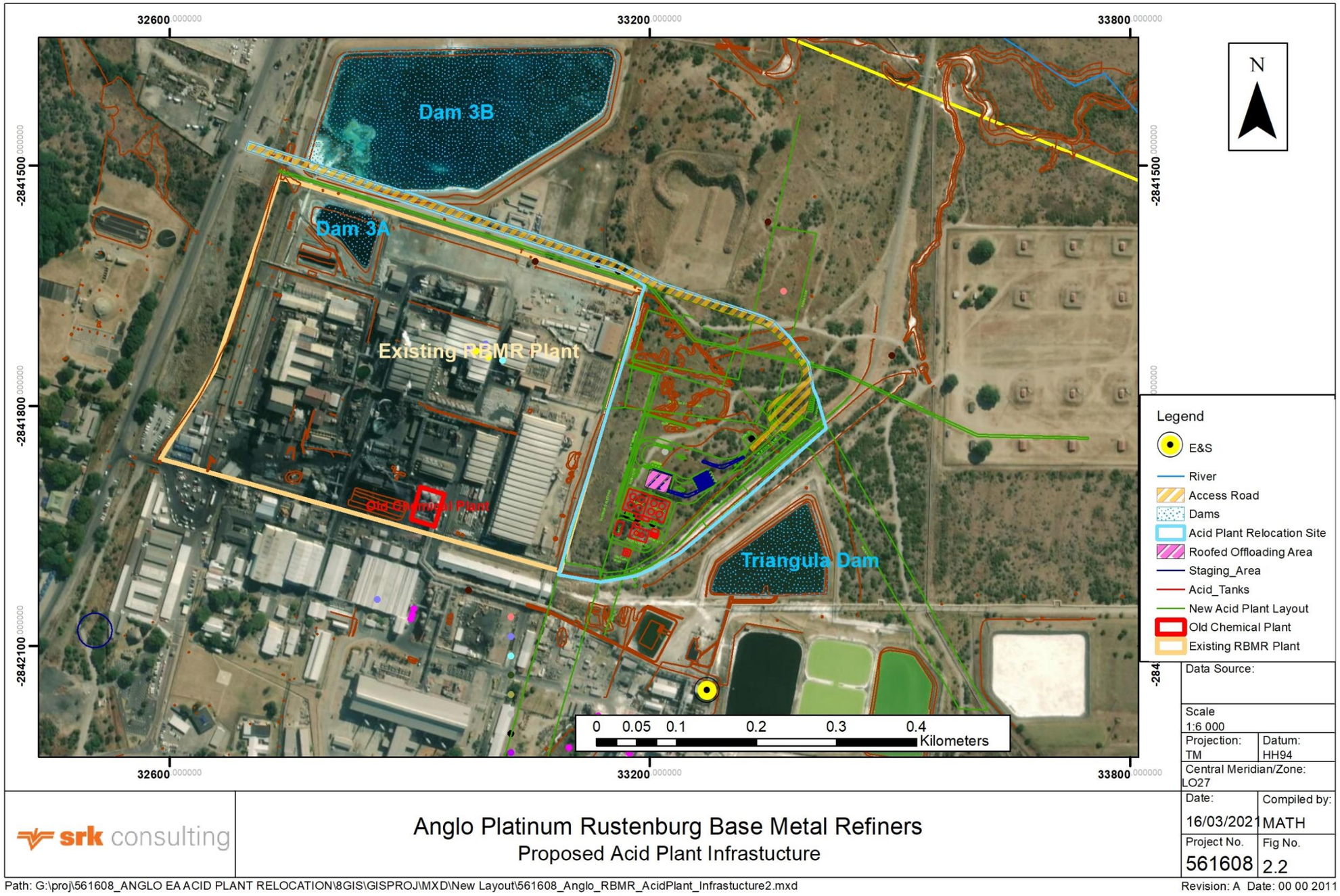

Figure 2-2: Project Locality relative to the Existing Infrastructure

3 Hydrology

3.1 Current Hydrological Conditions

Anglo Platinum Limited Rustenburg Base Metal Refiners is situated within the Crocodile West and Marico WMA in the North West Province. The Acid Plant Relocation project forms part of the existing RBMR Plant and will be constructed on the eastern side of the existing plant. The project area is situated within quaternary catchment A22H. Rustenburg District within which RBMR is situated is a semi-tropical region with reasonably high summer and winter daytime temperatures. The average summer temperatures range from 13 to 30 °C, while average winter temperatures range from 2 to 24 °C. Summers are warm to hot with moist conditions and winters are cool with dry conditions. The region is classed under the calm category as wind speeds are relatively low, frost is minimal during the winter seasons, the area is fog free and hailstorms are a rare occurrence.

The nearest perennial river to the Acid Plant Relocation site is the Hex River flowing at ±2.5 km on the west of the RBMR. Surface runoff originating from RBMR and surrounding areas is drained into a non-perennial Klipfonteinspruit River which starts on the south-eastern side of RBMR flowing in the north westerly direction discharging runoff into the Hex River.

The natural bushveld vegetation falling mainly within the Savanna Biome and the Marikana Thornveld unit is found within the Rustenburg Local Municipality within which the proposed Acid Plant Relocation site is located.

3.2 Topography and Drainage

Surface contours show general drainage lines for RBMR moving from southeast towards the northwest discharging surface runoff first into Klipfonteinspruit and later into the Hex River. Drainage lines within RBMR Plant boundary have been modified by mining activities such as mine dumps, access roads, haul roads, surface water impoundments and other mining infrastructure. Hex River flowing in the northerly direction drains into Bospoort Dam situated ±12 km north of RBMR.

Topography at the RBMR is generally flat with gentle slopes towards Klipfonteinspruit River. A maximum elevation difference of 29 m is observed from the mine boundary on the south-east to the runoff discharge point into Klipfonteinspruit. The natural topography of the existing plant has also been modified by mining activities. General topography and drainage lines for RBMR are shown on **Figure 3-1**.

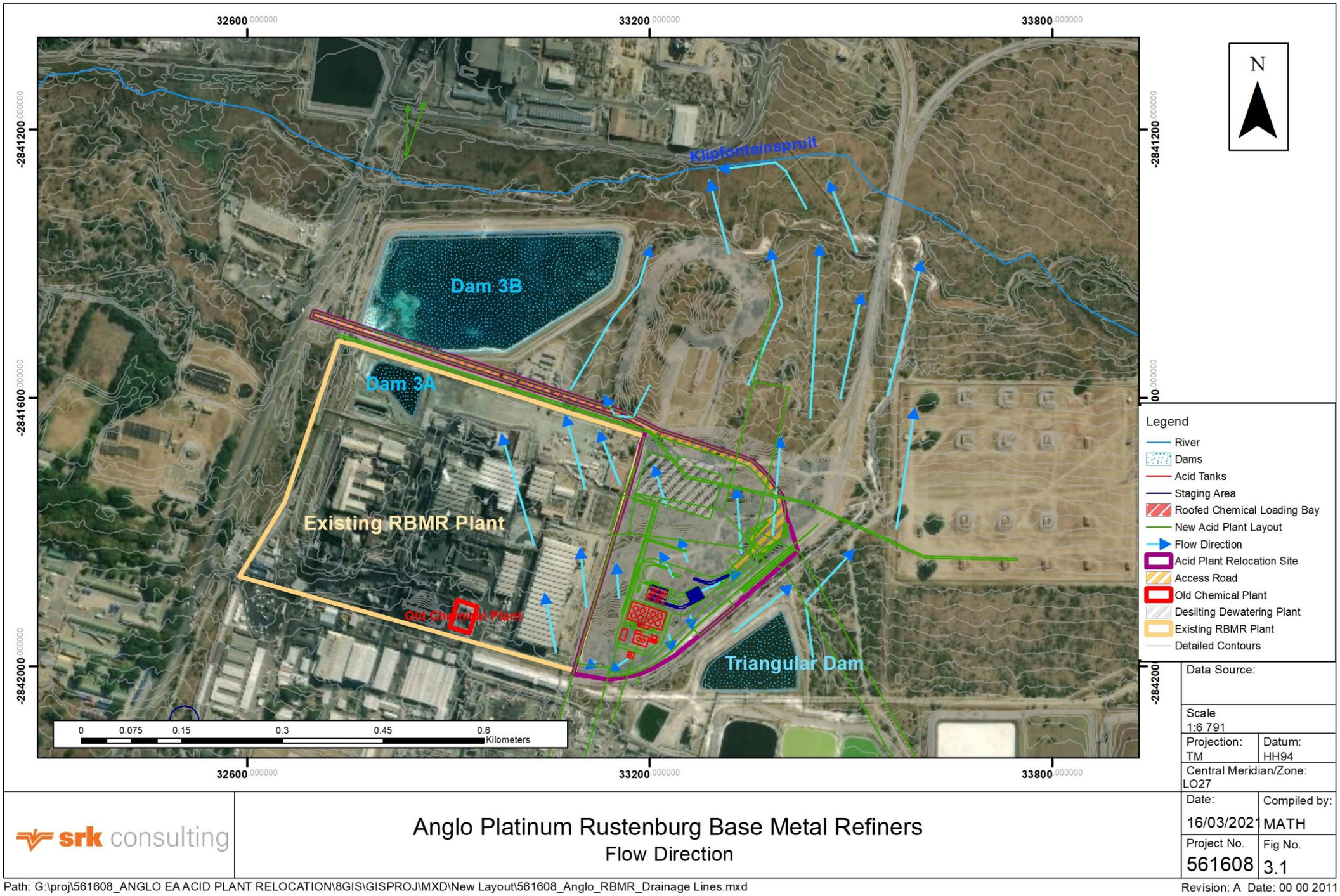

Figure 3-1: **RBMR Drainage Lines**

4 Climate

The climate is generally warm and temperate. The surrounding area has very warm summers and mild winters. Precipitation in the Rustenburg area occurs mainly as a result of thunderstorms and heavy showers in summer (from October to April). Mean Annual Precipitation (MAP) ranges between 600 mm and 800 mm and mainly occurs as summer thunderstorms.

Average temperatures during summer range from 13 to 30 °C, while in winter, average temperatures range from 2 to 24 °C. Summers are warm to hot with moist conditions and winters are cool with dry conditions.

4.1 Precipitation

The project area falls within quaternary catchments A22H. Rainfall, in the form of storm event intensity, is required for site hydrology calculations. Five rainfall stations falling within a 7km radius from RBMR indicate a mean annual precipitation of 651mm. Details of the five rainfall station is given in **Table 4-1**.

Table 4-1 Summary of closest rainfall stations

Name	SAWS Number	Record (Years)	Latitude		Longitude		MAP (mm)	Altitude (mamsl)
			(°)	(')	(°)	(')		
Klipfontein	0511672_W	71	25	41	27	21	633	1173
Rustenburg-AGR	0511523_A	41	25	43	27	18	639	1141
Kroondal	0511523_W	33	25	43	27	18	639	1141
Kroondal	0511554_W	40	25	43	27	18	639	1141
Waterkloof	0511524_W	82	25	44	27	17	684	1161

The Adamson (1981) rainfall data used for peak flow determination for various return periods used was obtained SRK Report No.474221 which was also used in previous water control designs. An updated design rainfall report undertaken by JC Smithers and RE Schulze (2000) indicated lower storm rainfall depths for rainfall stations in **Table 4-1**.

Adamson and Schultze rainfall depths for stations within the Klipfontein catchment are shown in Table 4-2.

Table 4-2: 24-hour storm rainfall for various return periods in the Klipfontein catchment

Source	1:2yr	1:5yr	1:10yr	1:20yr	1:50yr	1:100yr	1:200yr
Adamson	59	84	104	125	158	185	216
Schmidt and Schulze	*58*	74	90	105	125	143	161

4.2 Evaporation

The S-pan, A-pan and Lake evaporation are given in **Table 4-3**. The Mean Annual S-pan Evaporation (MAE) for the surrounding area is 1700 mm/annum.

Table 4-3: Average monthly evaporation (mm)

Month	S-pan	A-pan	Lake
January	181.9	222.6	152.8
February	151.8	190.1	133.6
March	147.2	185.2	129.5

April	116.1	151.6	102.2
May	98.8	132.9	86.0
June	81.3	114.0	69.1
July	90.1	123.5	74.8
August	119.3	155.1	96.6
September	159.8	198.7	129.4
October	185.6	226.6	150.3
November	176.3	216.5	144.6
December	191.8	233.2	159.2
Annual Total	**1700**	**2150**	**1428**

5 Background to Stormwater Management Plan

Anglo Platinum Rustenburg Base Metals Refiners requested SRK Consulting to develop a stormwater management plan associated with the activities at their proposed Acid Plant Relocation site. The SWMP is based on the National Water Act no 36 of 1998, most specifically General Notice Regulation 704 (GN704) of the National Water Act (NWA) which provides range of Best Practice Guidelines (BPGs) for the mining sector with each BPG having particular application to different aspects of the mining process and to different components of the water management system at a mine. BPG G1 (DWAF, 2006) provides four primary principles that need to be applied in the development and implementation of a Storm Water Management Plan (SWMP).

The four principles are as follows:

- Clean water must be kept clean and be routed to a natural watercourse by a system separate from the dirty water system while preventing or minimising the risk of spillage of clean water into dirty water systems. This will limit the reduction in water flow to the receiving water environment/catchment (loss of water to the catchment) and thus increase the water available in the water resource to other users;
- Dirty water must be collected and contained in a system separate from the clean water system and the risk of spillage or seepage into clean water systems must be minimised. The containment of dirty or polluted water will minimize the impact on the surrounding water environment;
- The Stormwater Management Plan must be sustainable over the life cycle of the site and over different hydrological cycles and must incorporate principles of risk management. Portions of the SWMP, such as those associated with waste management facilities, may have to remain after site closure since management is required until such time that the impact is considered negligible and the risk no longer exist;
- The statutory requirements of various regulatory agencies and the interests of stakeholders must be considered and incorporated.

A Stormwater Management Plan structure was developed based on these Best Practice Guidelines G1 (DWA, 2006).

Stormwater Management Plans for Anglo Platinum mines need to meet the Anglo American Water Management Structures Standards and Technical Specifications outlined in the Mineral Residue Facilities and Water Management Structures: Standard and Technical Specifications, Version 5 of May 2019.

5.1 Sub-catchment Delineation

Sub-catchments within the Acid Plant Relocation area were delineated and classified as either clean or dirty based on the planned activities within the Acid Plant Relocation site. External catchments that could potentially contribute runoff into the Acid Plant Relocation area will be diverted around the proposed site to discharge clean runoff towards Klipfonteinspruit River Delineation of contaminated (dirty) and clean runoff receiving sub-catchment areas was accomplished based on latest detailed contour survey supplied by Anglo Platinum RBMR while the catchments outside the acid plant boundary were delineated using the 0.5m contours obtained from SRK Consulting projects, 520889 and 474221 taking into account the backdrop google images. The disturbed areas include the Chemical Tanks area, the acid pumps and the area below the chemical loading bay roof. Stormwater controls separating clean water from contaminated water, diverting clean water around dirty areas and collecting dirty water emanating from contaminated sub-catchments will have an effect of reducing the surface water runoff draining into the natural environment downstream. The proposed clean and dirty water management system is shown in **Figure 5-1**. The contaminated sub-catchments due to the relocated Chemical Tanks, clean water sub-catchments, channels conveying the clean and contaminated surface runoff are shown in **Figure 5-2**.

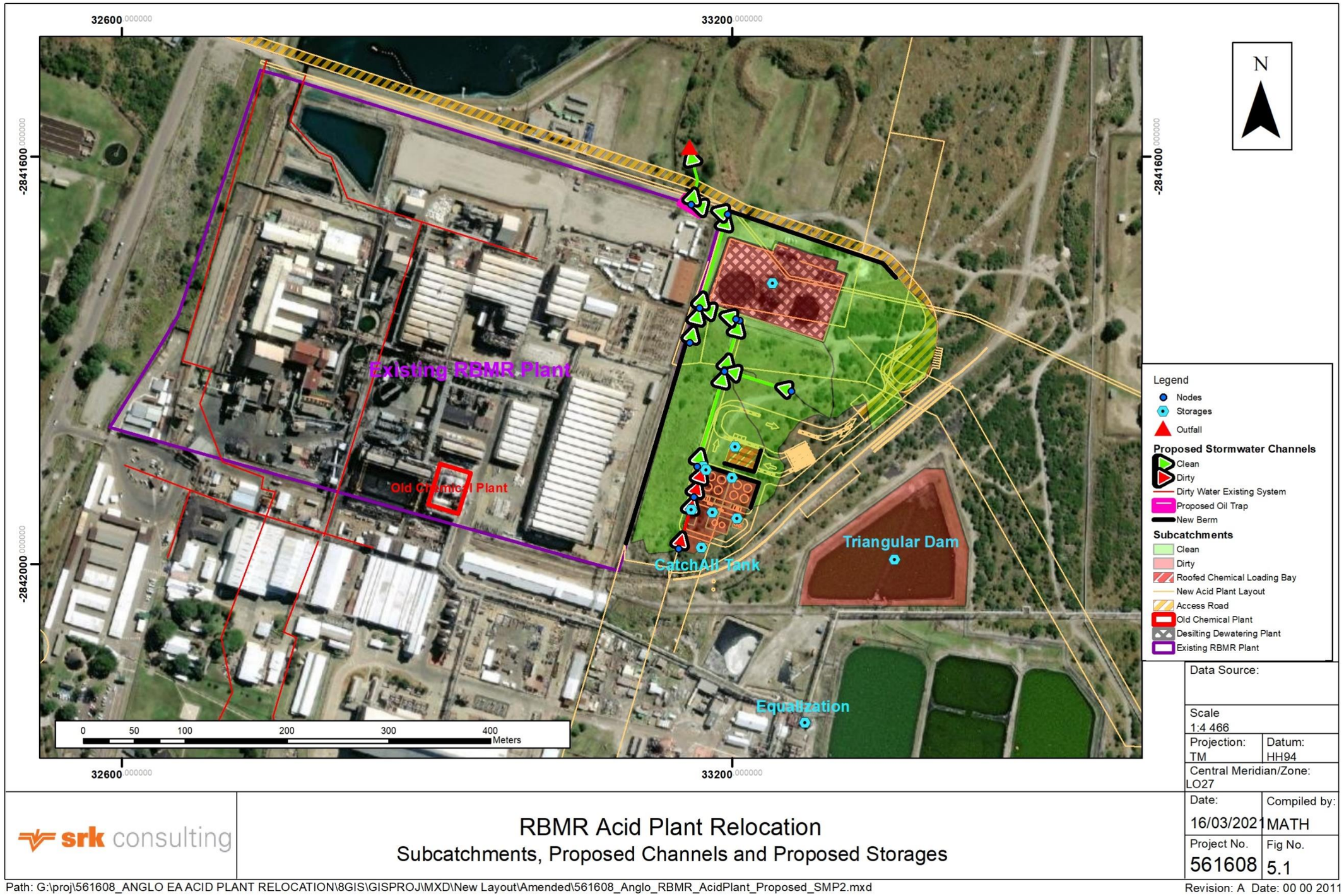

Figure 5-1: Proposed Clean and Dirty Stormwater Management System

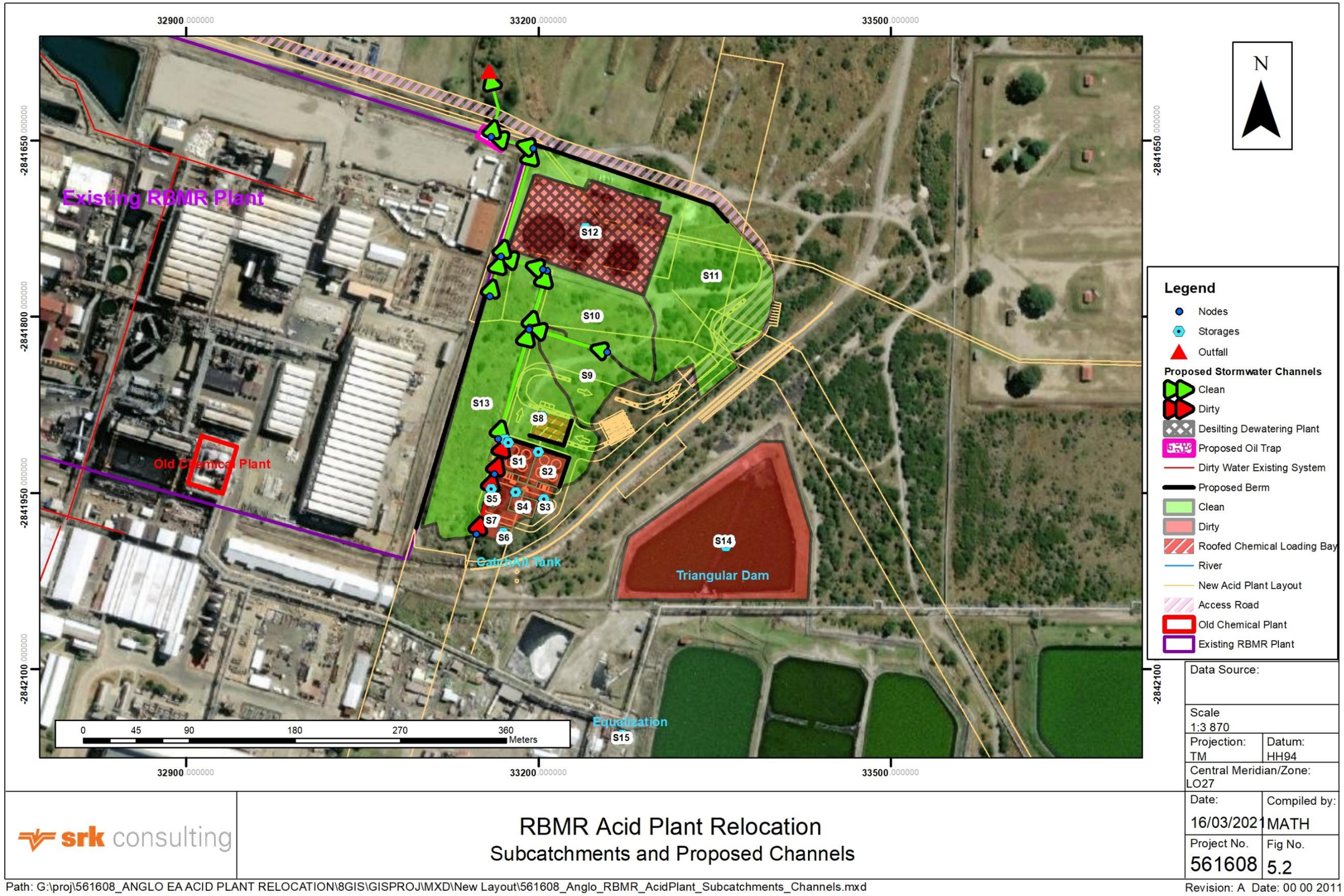

Figure 5-2: Sub catchments and Proposed Channels

The hydraulic characteristics of each delineated clean and dirty water sub-catchment can be seen in **Table 5-1**. These catchment characteristics were subsequently used to calculate the peak storm flows emanating from each sub-catchment.

5.2 Peak Flows

An important factor considered during the modelling process, is the catchment land-use as this is a defining parameter in the estimation of the percentage impervious area and hence contributes to the runoff potential of an area. Land-use data was estimated from the topographical maps, site layout plan and google earth images. Catchment characteristics used in determining the peak flows and volumes and the diverted clean and dirty water runoff peak flows from the Relocated Acid Plant area are shown in **Tables 5-1**. The Peak Flows were calculated for a 1.50 year and 1:100 year return periods. Stormwater management infrastructure should be sized to have sufficient capacity to contain without spilling the 1:50 year peak storm flows.

PCSWMM Model, version 7.3.3095 was used to determine the peak flow rates and volumes based on various input parameters (Sub-catchment characteristics, 1:50 year and 1:100 year rainfall events, etc). The PCSWMM is a dynamic rainfall-runoff simulation model used for single event or long-term simulation of runoff quantity. EPA SWMM 5.1.015 was the selected engine for the model.

Table 5-1: Peak Flows for the 1:50 year and 1:100 year return periods

Catchment Name	Catchment Category	Area (ha)	Width (m)	%Slope	Flow Length (m)	1:50 year Precipitation (mm)	1:100 year Precipitation (mm)	1:50 Year		1:100 Year	
								Runoff Volume (ML)	Peak Runoff (m^3/s)	Runoff Volume (ML)	Peak Runoff (m^3/s)
S12	Dirty	0.892	146	2.9	61	158	185	1.33	0.80	1.57	0.94
S7	Dirty	0.173	23	20.5	74	158	185	0.26	0.16	0.30	0.18
S11	Clean	1.554	56	5.8	278	158	185	2.28	1.14	2.70	1.37
S1	Dirty	0.076	23	12.1	33	158	185	0.12	0.07	0.14	0.08
S3	Dirty	0.009	13	4.5	7	158	185	0.01	0.01	0.02	0.01
S4	Dirty	0.036	20	28.3	18	158	185	0.06	0.03	0.07	0.04
S6	Dirty	0.007	15	10.7	5	158	185	0.01	0.01	0.01	0.01
S5	Dirty	0.014	11	34.9	12	158	185	0.02	0.01	0.02	0.01
S14	Dirty	1.581	316	1.8	50	158	185	2.48	1.44	2.90	1.69
S15	Dirty	0.008	16	1.9	5	158	185	0.01	0.01	0.01	0.01
S2	Dirty	0.077	26	3.4	30	158	185	0.12	0.07	0.14	0.08
S13	Clean	1.041	47	4.9	222	158	185	1.53	0.79	1.81	0.94
S8	Clean	0.510	40	7.5	128	158	185	0.75	0.44	0.89	0.52
S10	Clean	0.625	47	7.1	134	158	185	0.92	0.53	1.09	0.63
S9	Clean	0.347	27	11.3	128	158	185	0.51	0.30	0.60	0.36

6 Mean Annual Runoff

The effects of proposed activities on the catchment Mean Annual Runoff (MAR) within which the Acid Plant Relocation site is located, will be a marginal reduction in MAR for the regional catchment due to dirty water conveyance and containment. In order to determine the maximum loss in MAR for the new Acid Plant, the plant footprint area (including the mine infrastructure area) was used. The results for the localised investigation are shown in **Table 6-1**. The captured localised dirty water at the Relocated Acid Plant will result in a 0.0006% of MAR reduction of quaternary catchment A22H.

Table 6-1: Quaternary Catchment MAR Reduction

Catchment	Total Acid Plant Area (km^2)	A22H MAR contributing rainfall (mm)	A22H Quaternary Catchment Area (km^2)	Dirty water area (km^2)	MAR from dirty water (m^3)	Loss of MAR (%)
Acid Plant	0.084	16.7	658	0.003928	65.79	0.0006%

7 Stormwater Management Plan

PCSWMM model was used as the flood analysis model. PCSWMM is a dynamic rainfall-runoff simulation model used for single event or long-term simulation of runoff quantity. This model was set up for the site and used to size the conveyance channels and dirty water storage structures for separation and diversion of clean and dirty stormwater runoff.

Stormwater management measures are recommended in this section to ensure separation of clean surface runoff and contaminated water emanating from the proposed Acid Plant activities. These recommended measures will ensure adequate stormwater drainage and runoff containment during the 1:50 year peak storm flows.

7.1 Clean Water Management System

A large portion of the proposed Acid Plant Relocation site is considered clean with the exception of the proposed desilting-dewatering plant area, the area occupied by the Chemical Tanks and the chemical loading area. A roofed loading bay is recommended to ensure that no contamination of the downstream clean sub-catchments from loading bay activities occurs. Contamination is not anticipated from the Staging area and access road as localized spill kits will be available by the weighbridge for clean-up of oil spills. An oil trap is however recommended to ensure that any accidental oil spills not captured by the spill kits are separated and removed from the clean water to be discharged to the clean natural environment.

Clean natural stormwater channels currently exist between the proposed Chemical Tanks area and the proposed Desilting-Dewatering plant area. These clean channels require upgrades to ensure that they can contain without spilling, a 1:50 year storm event. Clean stormwater runoff from the roofed loading bay area and from the area surrounding the Desilting-Dewatering Plant (Sub-catchments S8, S9, S10 and S11) will be conveyed by the existing upgraded clean water trench and routed first towards the proposed oil trap indicated on **Figure 7-3** which will separate the oil from the clean stormwater before releasing to the natural environment.

A peak discharge of 3.126 m^3/s is anticipated at the proposed oil trap raising. The oil trap should be large enough to accommodate this peak flow. A berm should be considered on the western and southern boundary of the loading bay to divert clean stormwater away from the loading bay activities occurring under the loading bay roof. Clean storm water emanating from the area on the west of the

proposed Chemical Tanks (Sub-catchment S13) will be conveyed along the proposed berm on the western boundary of the Acid Plant relocation site into a clean channel that links to the upgraded existing clean channel reporting at the oil trap. Culverts that can handle a 1:50 year storm event are required to convey the clean stormwater across the access road towards the environment. A berm running along the southern side of the proposed access road is required to ensure clean stormwater from the clean catchment does not flow over the access road but rooted towards the clean water channel on the western side. Sufficient clean water diversion either by berms or Chemical Tanks bunds is required such that no clean stormwater enters the Chemical Tanks area from the western side. The proposed clean water management measures are indicated on **Figure 7-1**. The proposed clean water diversion channel characteristics required to comply with GN 704 are given in **Tables 7-1**.

It must be noted that a volume of 7320 m^3 will be anticipated from the Acid Plant clean water sub-catchments ones Desilting-Dewatering activities have been completed and the plant rehabilitated. A peak discharge of 3.91 m^3/s will report at the proposed oil trap before diversion to the clean conveyance system.

7.2 Dirty Water Management System

The area surrounding the acid tank bunds (Sub-catchment S7) is labelled dirty due to the high risk of spillage and acid leaks from the Chemical Tanks. Contaminated stormwater runoff from this area will be collected into a dirty water channel on the west of the Chemical Tanks and discharged into a sump on the north western end of the Chemical Tanks area. The Chemical Tanks should be bunded to contain emergency spillages in case of acid tank failure. Contaminated stormwater collected into the sumps situated within each acid tank bund (Sub-catchments S1, S2, S3, S4 & S5) shown on **Figure 7-2** and from the dirty channel sump will be collected into sumps and pumped into the Catchall Tank where it will be pumped further into the E&S for equalization. Contaminated water due to activities occurring below the roof of the chemical loading bay should also be collected in a sump and discharged either in the dirty water channel sump or should be pumped directly into the Catchall tank. From the E&S, the collected dirty stormwater will be recycled and reused for mining activities. A Peak discharge of 0.47 m^3/s is anticipated from the E&S. The dirty water drains were sized to contain a 1:50 year peak flow. The desilting-dewatering plant storage (within Sub-catchment S12) should be sized to contain 1:50 year volume (1040 m^3) emanating just from the Desilting-Dewatering Plant area into the storage dam at this location without any spillage. This volume does not include the volume of water transferred from external sources (e.g. Dam 3B) into the Desilting-Dewatering storage dam/s.

The proposed dirty water diversion channel characteristics required to comply with GN 704 are also given in **Tables 7-1**.

Table 7-1: Clean and Dirty Stormwater Channel Characteristics

Name	Channel Category	Channel Length (m)	Cross Section	Height (m)	Bottom Width (m)	Left Slope (m/m)	Right Slope (m/m)	BARRELS	Channel Slope (m/m)	Maximum Flow (m^3/s)	Maximum Velocity (m/s)
Dirty Channels											
C1	Dirty	53.1	RECT_OPEN	0.45	0.30	0	0	1	0.04523	0.000	0.00
C2	Dirty	31.1	RECT_OPEN	0.45	0.30	0	0	1	0.05655	0.000	0.00
Clean Channels											
C6	Clean	51.4	TRAPEZOIDAL	0.45	0.45	2	2	1	0.01788	0.721	2.85
C7	Clean	7.5	TRAPEZOIDAL	0.45	0.45	2	2	1	0.00556	0.723	2.34
C8	Clean	35.1	TRAPEZOIDAL	0.45	0.45	2	2	1	0.00589	0.730	2.39
C10	Clean	96.9	TRAPEZOIDAL	0.45	0.75	2	2	1	0.02365	2.008	3.77
C9	Clean	36.2	TRAPEZOIDAL	0.45	0.30	2	2	1	0.00155	0.809	2.14
C11	Clean	39.2	TRAPEZOIDAL	0.75	0.75	2	2	1	0.01229	3.104	3.67
C5	Clean	69.0	TRAPEZOIDAL	0.45	0.30	2	2	1	0.01470	0.000	0.00
C3	Clean	116.8	TRAPEZOIDAL	0.45	0.45	2	2	1	0.01680	0.000	0.00
C4	Clean	0.1	TRAPEZOIDAL	0.45	0.45	2	2	1	0.01493	0.427	2.13

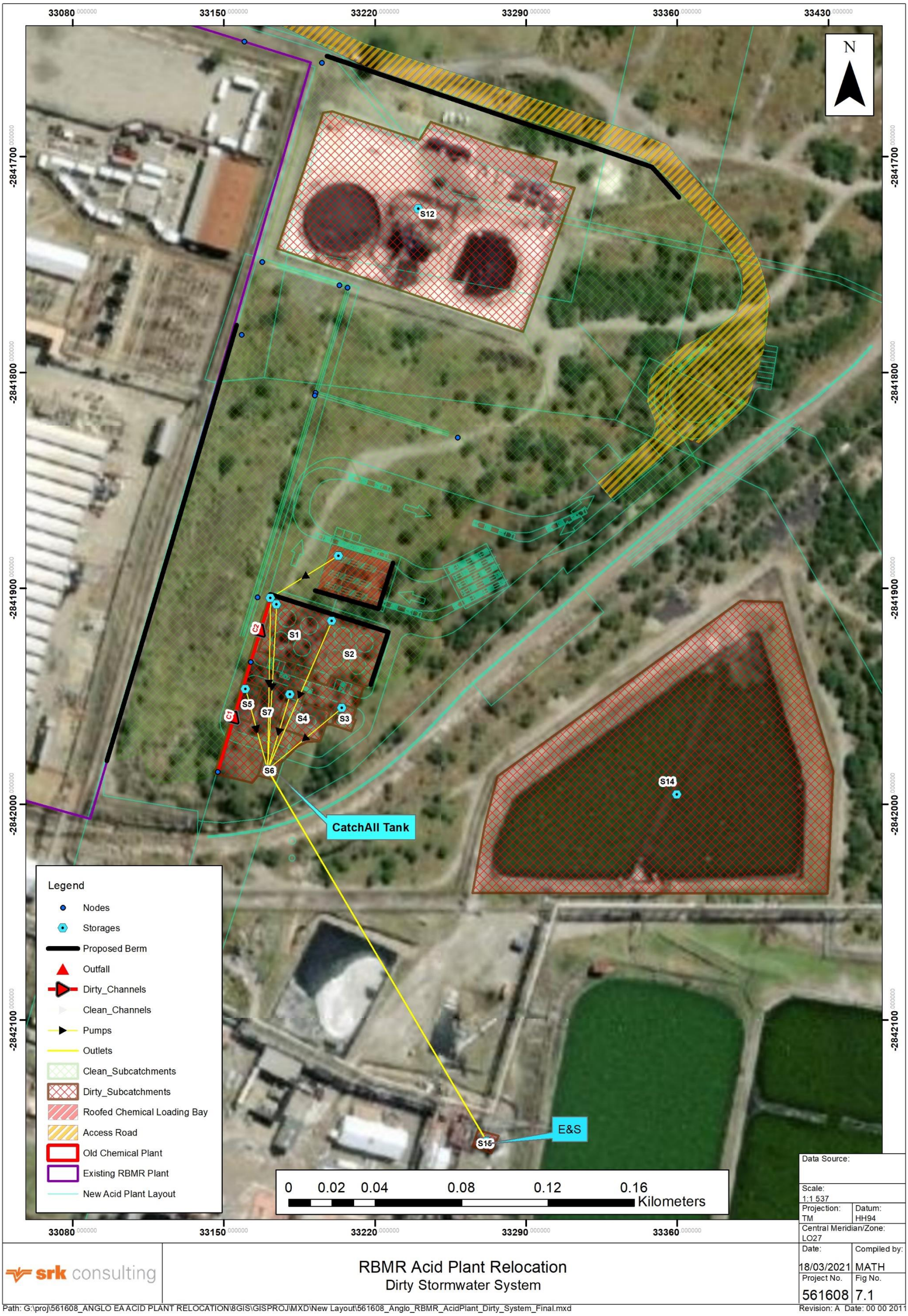

Figure 7-1: Dirty Stormwater System

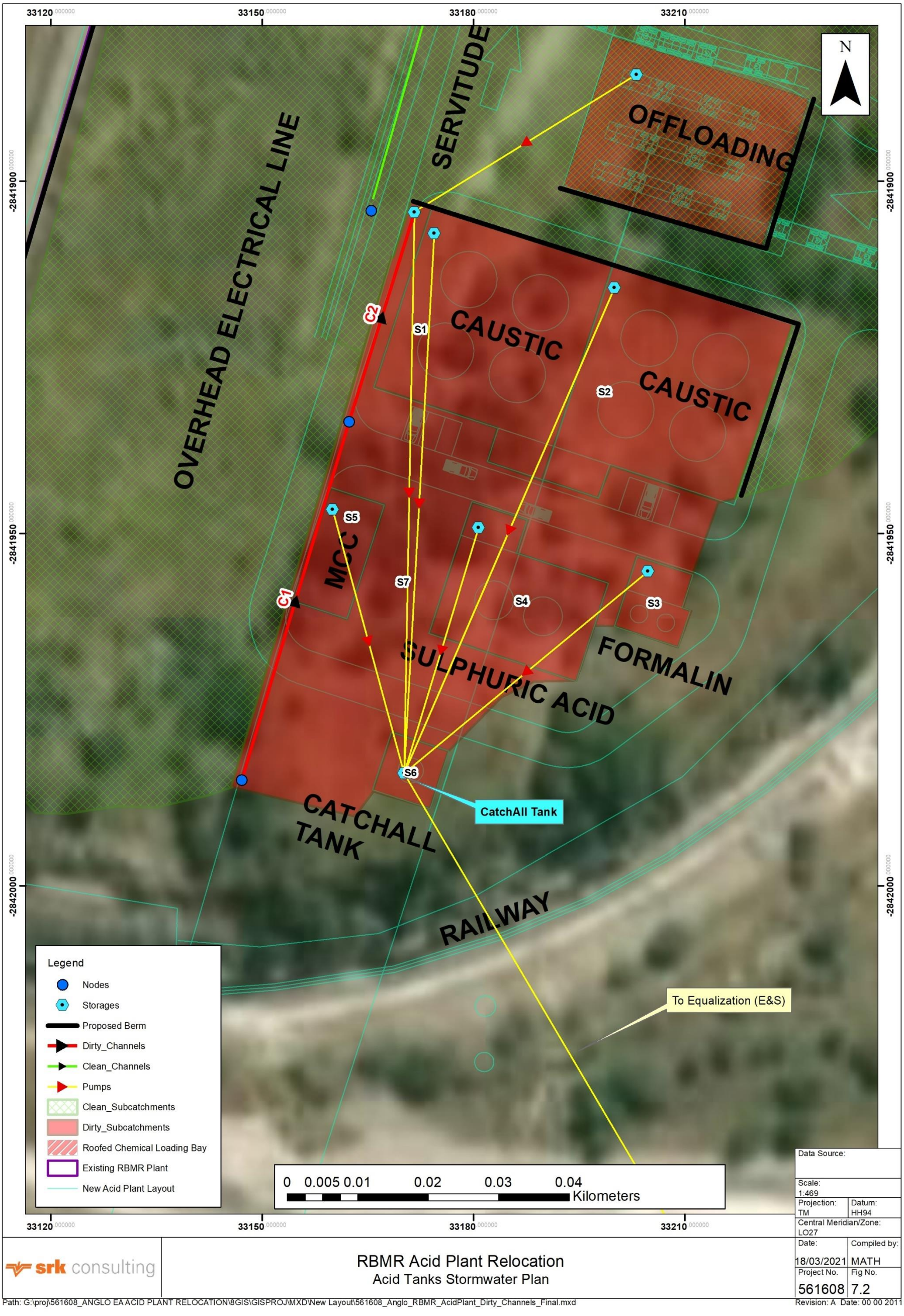

Figure 7-2: Chemical Tanks Sub-catchments and Channels

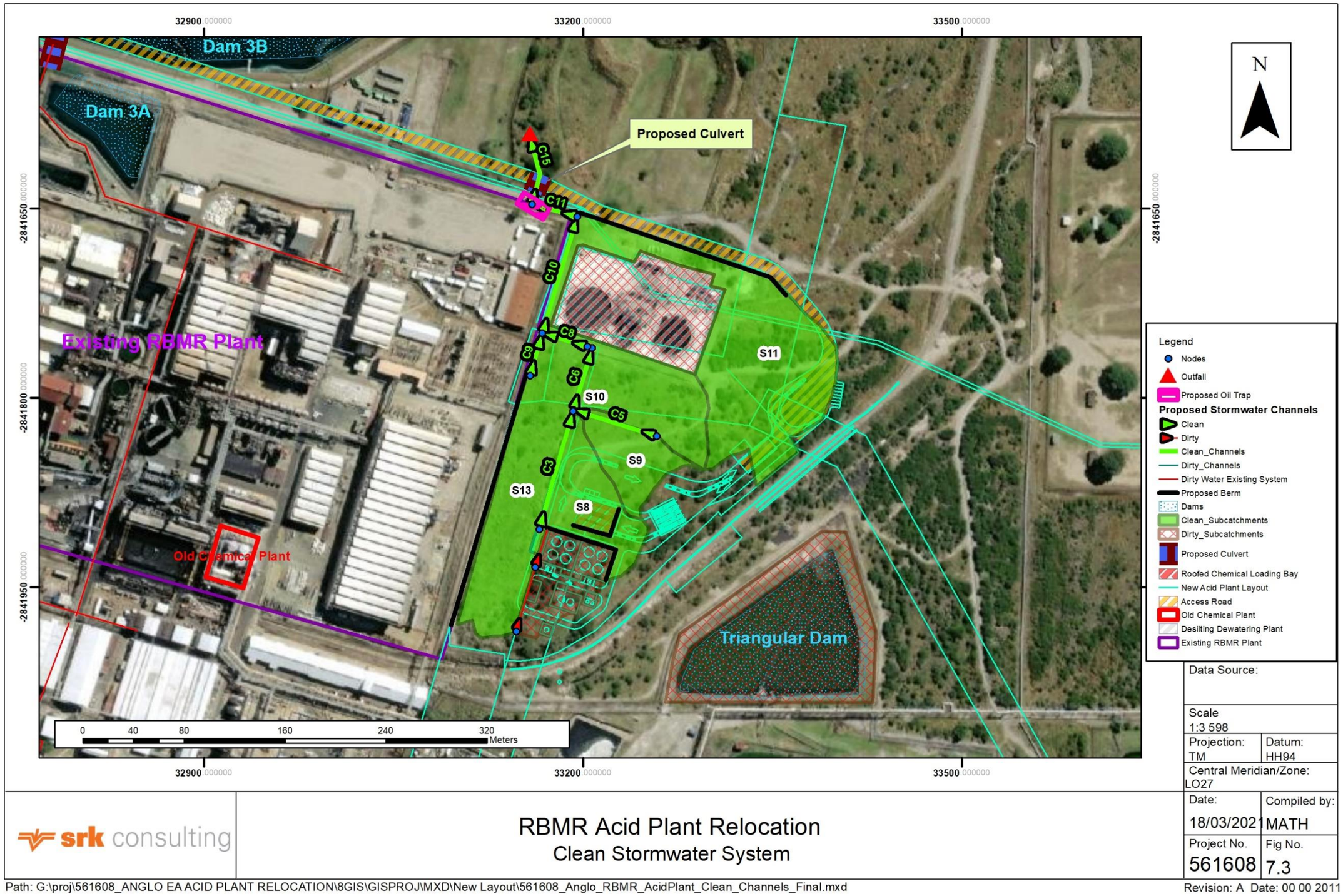

Figure 7-3: Clean Stormwater Management

8 Conclusion and Action List

The stormwater management plan provides an indication of the steps and processes required in order to meet the Regulation 704 criteria in terms of the National Water Act (Act No. 36 of 1998).

These steps and processes include the following:

d) Separation of clean and dirty water streams and the release and containment of each stream respectively.

e) The impact of Mean Annual Runoff (MAR on the local and quaternary catchment level

f) The potential impact on the infrastructure by the 1:100 year flood event

The following are key findings and recommendations following the development of stormwatermanagement plan for the Acid Plant Relocation site:

- Proposed diversion berms and channels discussed in Section 7 of this report are required to separate clean and dirty water effectively. The stormwater trenches were sized to contain the1:50 year flood in compliance with Reg 704.
- Clean surface runoff emanating from the area between the proposed loading bay and the desilting dewatering plant to be channelled into a clean natural trench which will report at theproposed oil trap. After oil separation, the clean water will be discharged to the clean natural environment and conveyed towards Klipfonteinspruit.
- A 1:50 year peak discharge of 3.126 m3/s is anticipated at the proposed oil trap from the Acid plant clean area.
- The stormwater channels and berms to be maintained regularly to ensure that no vegetation and silt obstruct the flow within the channels and along the berms.
- Stormwater channels to be lined if the velocity within the channels exceeds 2 m/s to prevent erosion within the channels.
- Culvert openings should be constructed at the positions where the proposed channels cross the access road. The culvert openings should be sized to capacities that can convey the channel flow as per the 1:50 year storm event without overtopping. The existing culvert currently conveying contaminated water from the existing Plant should be upgraded to accommodate the additional affected runoff coming from the Acid Plant.
- The proposed dirty water system to discharge dirty runoff collected from the area between theChemical Tanks into the proposed dirty water channel running on the western side of the Chemical Tanks which further discharges into a proposed sump at the north western end of the Chemical Tanks foot print. A proposed sump at the chemical loading are will collect contaminated water due to activities occurring below the proposed loading area roof and this water will either be pumped directly into the CatchAll Tank or pumped into the dirty channel sump.
- Bunding walls to be constructed around Chemical Tanks to provide emergency containment in an event of tank failure, to prevent mixing of different acids around the tanks and to stop chemical leakage that could result in surface and groundwater contamination. A 1.5m^2 sump to be installed in each bund to temporarily store contaminated stormwater which will be pumped to CatchAll Tank. Contaminated stormwater collected in the CatchAll Tank will be pumped to the E&S for equalization where post equalization, the equalized stormwater will be recycled and reused by the mine.It is important to develop an efficient and effective

pumping schedule to ensure that no spilling occurs from the temporary storages.

- All proposed stormwater storages/sumps should be maintained to prevent silt potentially reducing the capacities of the sumps.
- Stormwater discharge points forming part of the stormwater management plan discharging tothe nearest watercourses/natural environment should be positioned outside of the 1:100 yearfloodlines.
- The proposed infrastructure within the Acid Plant is not affected by 1:100 year floodlines (Report No.474221 – SRK Consulting, April 2014).
- The Acid Plant Relocation site will marginally affect the MAR by 0.0006% at a quaternary scale.
- The hydrological data used in running PCSWMM model for the stormwater management planhas considered the latest survey from RBMR and latest conceptual layout plan of the proposed Acid Plant.

Prepared by

SRK Consulting - Certified Electronic Signature

srk consulting

561608/44276/Report

5588-4450-2429-MATH

This signature has been printed digitally. The Author has given permission for its use for this document. The details are stored in the SRK Signature Database

Joyce Mathole

Senior Consultant

Reviewed by

SRK Consulting - Certified Electronic Signature

srk consulting

561608/44272/Report

6690-4427-9936-SHEP-19/03/2021

This signature has been printed digitally. The Author has given permission for its use for this document. The details are stored in the SRK Signature Database

Peter Shepherd

Partner

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

9 References

Dent, M.C., Lynch, S.D. and Schulze, R.E. (1989). Mapping mean annual and other rainfall statistics over southern Africa. Water Research Commission, Pretoria. Report 109/1/89.

Department: Water Affairs and Forestry (2006), Best Practice Guideline No. A4: Pollution control dams. Pretoria.

Department of Water Affairs and Forestry, (2006), Best Practice Guideline No. G1: Storm Water Management. Pretoria.

DWAF (1996) South African Water Quality Guidelines, Volumes 2, 5 and 7, Department of Water Affairs and Forestry, Pretoria.

Hamlin, M.J., 1983. The significance of rainfall in the study of hydrological processes at basin scale. Journal of Hydrology, 65, 73-94.

Midley DC, Pitman, WV and Middleton, BJ (1981) Surface water resources of South Africa Volumes I to VI. Hydrological Research unit Report Nos 8/81 to 13/81, University of Witwatersrand, Johannesburg.

Midley DC, Pitman, WV and Middleton, BJ (1994) Surface water resources of South Africa 1990 Water Research Commission Report Nos. WRC 298/1/94 to 298/6.2/94, Pretoria;

Pitman WC (1973). A mathematical model for generating monthly river flow from the Hydrometeological data in South Africa. Hydrological Research Unit Report No. 2/73, University of the Witwatersrand , Johannesburg;

Schulze, R.E., 1995. Hydrology and Agrohydrology. A theory text to accompany the ACRU 3.00 Agrohydrological Modelling System. Water Research Commission, Pretoria. Report TT69/95;

Schulze, R.E., 1995. Hydrology and Agrohydrology. A practical text to accompany the ACRU 3.00 Agrohydrological Modelling System. Water Research Commission, Pretoria. Report TT70/95;

Schulze, R.E., 1997. South African Atlas of Agrohydrology and Climatology, Water Research Commission Report. School of Bio Resources Engineering and Environmental Hydrology;

Smithers JC and Schulze RE (2000), Long duration design rainfall estimates for South Africa, WRC Report No. 811/1/00; and

SRK Report Distribution Record

Report No.	561608/SWMP
Copy No.	1

Name/Title	Company	Copy	Date	Authorised by
Verona Buitenbag	Anglo Platinum Ltd.'s RBMR	3	March 2021	P J Shepherd
Pretoria Library	SRK Consulting	1	March 2021	P J Shepherd
Joyce Mathole	SRK Consulting	1	March 2021	P J Shepherd
Peter Shepherd	SRK Consulting	1	March 2021	P J Shepherd
SRK Server	SRK Consulting	1	March 2021	P J Shepherd

Approval Signature:

This report is protected by copyright vested in SRK (SA) (Pty) Ltd. It may not be reproduced or transmitted in any form or by any means whatsoever to any person without the written permission of the copyright holder, SRK.