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INTEGRATED WATER AND WASTE MANAGEMENT PLAN FOR:

THE LAFARGE TSWANA LIMESTONE QUARRY ON A PORTION OF FARM DRIEFONTEIN 46 PORTION 0, FARM RONDEFONTEIN PORTION 0 AND FARM RIETSCHRAAL 58 PORTION 0, NORTH WEST PROVINCE IN WARD 17 WITHIN DITSOBOTLA LOCAL MUNICIPALITY, NGAKA MODIRI MOLEMA DISTRICT MUNICIPALITY, NORTHWEST PROVINCE

Reference No: WU23173

Prepared by:	On behalf of:	Prepared for:
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Report name	**INTEGRATED WATER AND WASTE MANAGEMENT PLAN (IWWMP) FOR THE LAFARGE TSWANA LIMESTONE QUARRY ON A PORTION OF FARM DRIEFONTEIN 46 PORTION 0, FARM RONDEFONTEIN PORTION 0 AND FARM RIETSCHRAAL 58 PORTION 0, NORTH WEST PROVINCE IN WARD 17 WITHIN DITSOBOTLA LOCAL MUNICIPALITY, NGAKA MODIRI MOLEMA DISTRICT MUNICIPALITY, NORTHWEST PROVINCE.**		
DMR File Ref. No.	**NW30/5/1/2/2/454MR**		
DWS WULA Ref. No.	**Reference No: WU23173**		
Submitted to	**Department of Water and Sanitation**		
Report writer	**Ms Nikita Van Schoor**	**Signature**	
Assistant Report writer and EAP	**Mr Solomon Fataki**	**Signature**	
Afzelia Environmental Consultants Reviewer and EAP Environmental Assessment Practitioner Number is 2019/1078	**Ms Deshni Naicker**	**Signature**	
External Reviewer – Greenmined Consultants Environmental Assessment Practitioner Number is 2021/4203	**Mrs Murchellin Saal**	**Signature**	
Lafarge Mining South Africa	**Mrs. Uneysa Taljard**	**Signature**	
Risk Assessment	**Mr. J. Alletson (JG Afrika (PTY) LTD)**		
Submission of IWWMP to DWS	**October 2022**		

ACRONYMS

DMR	Department of Minerals and Resources
DWAF	Department of Water Affair and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control officer
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
EPWP	Extended Public Works Programme
ERA	Environmental Risk Assessment
GN704	General Notice 704
I&AP	Interested and Affected Parties
IDP	Integrated Development Plan
IWRM	Integrated Water Resource Management
IWWMP	Integrated Water and Waste Management Plan
MAR	Mean Annual Runoff
MR	Mining Right
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
NGA	National Groundwater Archives
NWA	National Water Act
PES	Present Ecological State
PPP	Public Participation Process
RQO	Resource Quality Objectives
SASS5	South African Scoring System version 5
SQR	Sub Quaternary Reaches
SWMP	Storm water Management Plan
WMA	Water Management Area
WUA	Water Use Authorisation
WUAA	Water Use Authorisation Application
WWTW	Waste Water Treatment Works

EXECUTIVE SUMMARY

1. Summary of Principal Objectives

The purpose of this Integrated Water and Waste Management Plan (IWWMP) Report for Water Use Authorisation Application (WUAA) is to provide a planning framework in terms of the National Water Act, 1998 (Act 36 of 1998) (NWA) that will achieve site specific objectives related to the management and monitoring of activities during the operation of the Tswana Limestone Quarry, in accordance with the Integrated Water Resource Management (IWRM) principles. These objectives being to characterise the present status of the site, identify the sources of any potential impacts, and set appropriate and effective action plans for the control and monitoring of the activities during the quarry operation (project and site specific EMPr).

2. Activity Background

Afzelia Environmental Consultants (Pty) Ltd was appointed by Greenmined Environmental on behalf of Lafarge Industries South Africa (Pty) Ltd to conduct a Water Use Authorisation Application (WUAA) process and obtain separate authorisation for the existing Lafarge Tswana Limestone Quarry.

Lafarge South Africa (Pty) Ltd (Lafarge) operates a cement manufacturing facility at Lichtenburg, Northwest Province that includes the Tswana Limestone Quarry and a manufacturing plant.

The existing operation was authorised on the 13th August 2001 (File Reference No. RDNW(KL) 6/2/2/101)) by the Department of Minerals and Energy - Mineral Development (North West Region). Since then, the area has continuously been used for mining limestone that is used for cement production and packaging.

The Applicant (Lafarge) had applied for a conversion of an older mining right, which was granted on the 08th March 2013 (DMR Ref No: NW30/5/1/2/2/454MR) and is valid for a period of 30-years ending on the 07th March 2043. The Mining Right is attached as **Appendix 25** in the document Appendices section of the Integrated Water and Waste Management Plan (IWWMP).

The Tswana quarry has a current production capacity of 1 800 000 tons per annum (t/a) of limestone. The production rate at the Tswana quarry will need to be increased to 2 000 000 tons per annum (t/a) in order to achieve Lafarge's objective of increasing the production of cement at the Lichtenburg Plant.

Even though the Mining Right is valid till March 2043, the life of the mine can be longer. The entity will apply for a new mining right at that time should they wish to continue operating.

The operation of the Tswana Limestone Quarry will make use of water for dust suppression, stockpiles, storing rainwater in the quarry dam, and disposing of water from sewage into the dams. As such, a Water Use Authorisation Application (WUAA) is required in accordance with the National Water Act (NWA), 1998 (Act No. 36 of 1998) in terms of Section 21. This document forms part of the WUAA.

3. Project Description

The Tswana Limestone Quarry operations involve mining limestone rock from opencast pits using conventional drilling and blasting methods. The topsoil and overburden are removed by means of trucks and relocated to an area near the open pit. The mined limestone material is loaded onto haul trucks by excavators and transported to the primary crusher. Following the crushing process, the materials are transported to the Lafarge Cement Plant via railway.

The operational phase mining activities area is 10km X 14km consisting of the following:

- ✓ Blasting
- ✓ Excavating
- ✓ Crushing and production lines
- ✓ Stockpiling and transporting of material via rail

The infrastructure at the Tswana mining area entails:

- ✓ Railway line and siding
- ✓ Crushing Plant and production lines
- ✓ Workshops
- ✓ Office complex

The quarry has already been developed; therefore, the construction phase is not applicable. The increased production rates at the Tswana Limestone Quarry will not result in any real change to the existing situation other than:

- ✓ More frequent blasting activities,
- ✓ Increased rail traffic to Lichtenburg necessitating the rail bypass loop, and
- ✓ Increased number of operational days (5 to 6) and number of shifts of work (2 to 3).

4. The Need and Desirability for the Project

Northwest Province is a growing market surpassing national trends and, as such, demand for Lafarge's products in Northwest Province has already exceeded existing production capacity. The proposed expansion is therefore required to meet the growing product demand and ensure that provincial and national economic development is not hampered.

Additionally, the benefits associated with the mining operation as a whole are detailed in both the Lichtenburg Plant original EMPR and the EMPR amendment. In summary:

- ✓ Job retention - approximately 345 are employed on a permanent basis in addition to temporary and contract employment,
- ✓ Local economic benefits are derived as a result of wage income and increased demand for goods,
- ✓ Training is provided to employees resulting in an improvement of the local skills base,
- ✓ Support is given to the local and national economy by the purchase of goods and services,
- ✓ Lafarge will achieve profits from the increase in the production of cement resulting in increased tax revenues for the government,
- ✓ Lafarge will continue to support projects that will benefit the local community leading to improved living conditions and improvement of skills,
- ✓ Support to local municipality in terms of road repairs, road construction, upgrading of youth centres, town clean-up, water supply etc,
- ✓ Support to schools in terms of adopt a school, fundraising campaigns, sport activities, giving books to learners, waste recycling projects,
- ✓ Support to small enterprises- historically disadvantage communities, courier services, tent hiring, shirt printing, gardening services, maintenance contractors etc; and
- ✓ Initiation of historically disadvantaged communities business forum.

5. Water Use Applied For

Water use(s)	Watercourse	Purpose (Activity)	Volume (m^3/a) / Dimensions / Crossing distance	Co-ordinates	Property Description	Property Owner
Section 21(a)	Groundwater from Borehole 1	Water abstracted from the borehole to supply water to two Jojo tanks (Domestic and process water use) However, drinking water is bought and not used from the borehole.	25 769 m^3 /annum	26° 4'34.26"S 25°46'49.14"E	Land Parcel 46 of the Major Region IO	Department of Rural Development & Land Reform
Section 21 (b)	Quarry Sump 1 / Mine Pit Wetland (W1)	Captures stormwater runoff from the workshop, administrative buildings, and wash bay into the sump. Water used for dust suppression will be collected by a truck.	480 000m^3	26° 04' 28.64"S 25°48' 08.43"E	Land Parcel 46 of the Major Region IO	Department of Rural Development & Land Reform
Section 21 (g)	Tswana Quarry Sump 1	Limestone Stockpiles Storm water runoff from workshop, administrative buildings, and water from wash bay used as dust suppression at crushing plant and a long-haul road	24 528 m^3/annum (Dust suppression at crushers) 1 681 m^3/annum (Tankers dust suppression on roads)	26° 07' 99.20" S 25°80' 02.90" E	Land Parcel 46 of the Major Region IO	Department of Rural Development & Land Reform
Section 21 (g)	Tswana Quarry Sump 1	Tswana Quarry - Loading Tunnel, Limestone stockpile	8000/tons	26° 04' 80.70"S 25°47' 91.70"E	Land Parcel 46 of the Major Region IO	Department of Rural Development & Land Reform

Water use(s)	Watercourse	Purpose (Activity)	Volume (m^3/a) / Dimensions / Crossing distance	Co-ordinates	Property Description	Property Owner
Section 21(c)	Tswana Quarry (Polfonteinspruit.)	Discharging wastewater into the Polfonteinspruit.	700 000 m^3/ annum	26° 03' 11.94"S 25° 48' 13.09"E	Land Parcel 46 of the Major Region IO	Department of Rural Development & Land Reform
Section 21 (i)	Tswana Quarry (Polfonteinspruit)	Discharging wastewater into the Polfonteinspruit.	700 000 m^3/ annum	26° 03' 11.94"S 25° 48' 13.09"E	Land Parcel 46 of the Major Region IO	Department of Rural Development & Land Reform
Section 21 (f)	Tswana Quarry (Polfonteinspruit).	Discharging wastewater into the Polfonteinspruit.	700 000 m^3/ annum	26° 03' 11.94"S 25°48' 13.09"E	Land Parcel 46 of the Major Region IO	Department of Rural Development & Land Reform
Section 21 (j)	Tswana Quarry	Sump 1 Dust suppression along haul roads/crushing plant	1 681.66 m^3/year	26° 04' 20.53"S 25°48' 17.14"E	Land Parcel 46 of the Major Region IO	Department of Rural Development & Land Reform

6. Summary of Impacts of Activities on Water Resources

Operational Phase

- Changes in catchment water resources.
- Erosion and sedimentation.
- Increased impervious area (Hardened surfaces).
- Potential pollution on surface water and groundwater.
- Proliferation of alien invasive vegetation

Mitigation measures are provided in table 10.

7. Monitoring and Control

An independent Environmental Control Officer (ECO) must be appointed by the authorisation holder to ensure that the conditions as stipulated in the Water Use Authorisation (WUA) and the approved EMPr are adhered to.

The authorisation holder or Applicant is obliged to adhere to the requirements of Section 28 of the NEMA (Duty of Care and Remediation of Environmental Damage) which states that: "(1) *Every person who causes has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot be reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment*".

7.1. Surface Water Monitoring

The monitoring programme must be designed to enable the detection of potential negative impacts brought about by the Tswana Limestone Quarry mining development.

It is recommended that water sampling is undertaken in the vicinity of the site located to the east (downstream) of the quarry area for monitoring purposes. In addition to this, routine water quality monitoring must be completed within this sampling area at the specified GPS coordinates twice a year (April and October) during the operational phase.

A chemical analysis must be done on every sample and a report submitted monthly to the Department of Water and Sanitation.

7.1.1. Groundwater Monitoring

Sampling must be undertaken from at least 2 monitoring boreholes in the area. It is recommended that monitoring be carried out either on a quarterly or bi-annual basis. The water must be tested for pH, EC, TDS, macro nutrients and microbial organisms and hydrocarbon which may arise from the fuels and oil stored on site. The groundwater monitoring plan must be carried out as follows:

I. Groundwater samples must be collected bi-annually.
II. Groundwater samples must be tested for macro and micronutrients including microbial contamination.
III. If required, hydrocarbon analysis must be done. This may only be considered if a hydrocarbon contamination event on site has occurred.
IV. Depending on the level and/or type of contamination identified, remedial procedures by the hydrogeological consultant must be followed.
V. The water sampling must be carried out following strict protocol so that cross contamination or contamination of water does not occur during the sampling phase. Sterilised sample bottles must be used, and these can be obtained from the analytical laboratory.
VI. Depending on the professional carrying out the work, sampling methods may vary, but it is imperative that sterile equipment be used. It is suggested that basic parameters such as pH and EC be recorded in the field.

VII. The water sample(s) must be kept cool. In this regard, it is suggested that a cooler box with ice brick be used for this purpose. A sampling data sheet must be completed for each sample taken and kept as document control for the work carried out.
VIII. Water samples must be submitted to a SANAS accredited laboratory for testing. A groundwater monitoring report must be compiled in line with the DWS guidelines.
IX. A geophysical survey should be completed to determine the best positions for drilling of monitoring boreholes.
X. At least two monitoring boreholes must be drilled in the vicinity of the project site. Depending on the subsurface structures the area just northeast and southeast of the project site should be explored for the drilling of the monitoring boreholes.
XI. The monitoring boreholes should be yield tested in order to obtain the necessary aquifer parameters like transmissivity and hydraulic conductivity for input in the calibration of the numerical groundwater flow and transport model.
XII. A numerical groundwater flow and transport model must be compiled and calibrated in order to determine the potential risk for contamination of the aquifer.
XIII. The monitoring boreholes should never be utilised for abstraction purposes.

8. Risk Assessment

It is shown that the risks arising from possible spillage or leakage of hydrocarbons, and from loss of wetlands from future mining activities are both rated as "**Moderate**" before any mitigatory measures are taken. While the risks associated with hydrocarbons can be managed and be significantly reduced or even avoided, any losses due to future mining cannot be remediated to any great extent. Such losses must be accepted but the following must be considered:

- ✓ Loss of wetland as a result of mining. The area is being operated under an authorisation and so the excavations are a part of the operator's core business and must be accepted as being inevitable,
- ✓ Toxicity of the mined material. The extracted limestone is non-hazardous and so will not lead to contamination or pollution of the area and the Polfonteinspruit which flows from it,
- ✓ Recovery of wetland sites. The mine pits will in the future fill with water to some extent as has already happened with the existing worked-out pits. These areas will develop wetland habitat as has happened before,
- ✓ Status of the wetlands. The wetlands in the mining area are, with one possible exception, artificial. In the distant future it is possible that they will all cease to exist but no time scale for such change can be provided.

It is to be noted that, although there has been mining activity at the site for some 40 years, the mine only approached to within 100 m of the delineated Polfonteinspruit channel in 2016. However, there appears to be no visible impacts on the Polfonteinspruit as a result of the incursion. The risk associated with the mine activities to the Polfonteinspruit is considered to be **Low** Therefore, it is considered that, if the proposed mitigatory measures are applied, there are no new risks to the Polfonteinspruit system.

9. Watercourse Impact Report

An environmental audit regarding water management was required as part of the water use licence application for the Tswana Limestone Quarry.

The assessment focused on compliance with legal requirements and the site's own systems and procedures, as well as on impacts with regards to watercourse characteristics namely surface flow, interflow, groundwater flow, water quality, geomorphology, habitat and biota. Site visits and document reviewing was conducted and information from recently conducted specialist studies were used to reach conclusions.

According to the Watercourse Impact Audit Report (October 2022), Lafarge will need to commence implementation of the recommendations of the specialist studies and closing of the findings identified during the audit, so long as

legal authorisation for implementation of the recommendations of the specialist studies and closing of the findings identified during the audit do not require authorisation

10. Conclusion and Recommendations

Based on the information analysed in this report and supporting specialist studies, it is considered that there could be some concerns with the proposed mining operation from a hydrogeological perspective. Risks are generally assessed as moderate to low and with appropriate mitigation, potential impacts on surface and ground water resources are likely to be negligible. Thus, the quarry operation may continue, provided that the recommendations provided in this report, wetland report, geohydrological report, geotechnical report and SWMP are adhered to. It is recommended that ongoing groundwater and surface water monitoring be carried out to identify any impact that may arise during the operational phase.

The operation of the mine has resulted in the creation of a number of artificial wetlands in an area that was previously almost entirely dry which have been classified as being Depression Wetlands. However, as further areas within the mining right area are opened up for mineral extraction many of these wetlands may be lost or will be changed from their present state into mine pit wetlands.

The Polfonteinspruit, which flows by the northern end of the mining right area, is severely degraded as a result of the channel having been used for agricultural or pastoral purposes in the past and ongoing excavation activities. The areas affected in this way are large and further impacts come from overgrazing of the area by livestock.

The mine would have little effect on the Polfonteinspruit despite being within 100 m of the delineated boundary in some places, provided that the edge of the mining operation footprint be stabilized and grassed, and that it is not closer than 100 m from the delineated edge of the Polfonteinspruit.

Mitigation measures recommended in this IWWMP report and all specialist studies including rehabilitation plans to manage potentially significant impacts to surface and groundwater resources during the operation phase have been incorporated into an Environmental Management Programme (EMPr) for the proposed development. The successful implementation of these management objectives would be best achieved through enforcement and monitoring for compliance by an independent qualified/trained Environmental Control Officer (ECO).

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

APPENDIX	1:	Certified copy of ID of applicant	Phase 1
APPENDIX	2:	Copy of property's title deed where water use occurs	Phase 1
APPENDIX	3:	Lease Agreements	Not Applicable
APPENDIX	4:	Copy of Property Zoning Documents where water use occurs	Not Applicable
APPENDIX	5:	Clearance letter from the Department of Rural Development and Land Reform indicating that the property where the water uses are taking place are not under land claims	Phase 3 -Public Participation Report
APPENDIX	6:	Proof of BBEEE Status (not required for Government)	Phase 3
APPENDIX	7:	**License application forms:** ▪ Licensing Application for Water Use Licence (DW755) ▪ Registration as a user (DW 758) ▪ Property on which water use occurs (DW 901) ▪ Property owner (DW902) **Water uses forms** ▪ DW760 - Section 21 (a) of the NWA, Taking water from a water resource. ▪ DW762 - Section 21 (b) of the NWA, Storing Water. ▪ DW763 – Section 21(c) of the NWA, Impeding or diverting the flow of water in a watercourse. ▪ DW768 – Section 21 (i) of the NWA, Altering the bed, banks, course, or characteristics of a watercourse. ▪ DW766 - Section 21(f) of the NWA, Waste Discharge Related Water Use. ▪ DW767 – Section 21 (g) Disposing of waste in a manner which detrimentally impact on a water resource. **Water uses supplementary forms**	Phase 3

		▪ DW775/781 – Supplementary water use information section 21(c) and (i) water uses. ▪ DW784 - Supplementary water use information section 21(a) water uses. ▪ DW779/805/905 – Supplementary water use information section 21(g) water use.	
APPENDIX	8:	Topographic Map	Phase 3
APPENDIX	9:	Master Layout Plan	Phase 3
APPENDIX	10:	Alternatives	Not Applicable
APPENDIX	11:	EIA /BAR	Not Applicable
APPENDIX	12:	ROD	Not Applicable
APPENDIX	13:	EMPr	Phase 3
APPENDIX	14:	Wetland Assessment	Phase 3
APPENDIX	15:	Floodline Assessment	Phase 3
APPENDIX	16:	Aquatic Assessment	Not Applicable
APPENDIX	17:	Geohydrological Studies	Phase 3
APPENDIX	18:	Hydrological Studies	Phase 3
APPENDIX	19:	Water Balance	Phase 3
APPENDIX	20:	Stormwater Management Plan:	Phase 3
APPENDIX	21:	Civil Design Report (Lichtenburg Lafarge Cement Plant and Tswana Quarry Stormwater Infrastructure and Pollution Control Dams Preliminary Design Report).	Phase 3
APPENDIX	22:	Monitoring programme for surface and groundwater and Watercourse Impact Audit Report	Phase 3
APPENDIX	23:	Public Participation	Phase 3
APPENDIX	24:	Financial Provision and Bank Guarantee Document	Phase 3
APPENDIX	25:	Mining Rights	Phase 3
APPENDIX	26:	Exemption from GN 704	Not Applicable

1. INTRODUCTION

1.1 Activity Background

Afzelia Environmental Consultants (Pty) Ltd was appointed by Greenmined Environmental on behalf of Lafarge Industries South Africa (Pty) Ltd to conduct a Water Use Authorisation Application (WUAA) process and obtain separate authorisation for the existing Lafarge Tswana Limestone Quarry.

Lafarge South Africa (Pty) Ltd (Lafarge) operates a cement manufacturing facility at Lichtenburg, Northwest Province that includes the Tswana Limestone Quarry and a manufacturing plant.

The existing operation was authorised on the 13th August 2001 (File Reference No. RDNW(KL) 6/2/2/101)) by the Department of Minerals and Energy - Mineral Development (North West Region). Since then, the area has continuously been used for mining limestone that is used for cement production and packaging.

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The Tswana quarry has a current production capacity of 1 800 000 tons per annum (t/a) of limestone. The production rate at the Tswana quarry will need to be increased to 2 000 000 tons per annum (t/a) in order to achieve Lafarge's objective of increasing the production of cement at the Lichtenburg Plant.

Even though the Mining Right is valid till March 2043, the life of the mine can be longer. The entity will apply for a new mining right at that time should they wish to continue operating.

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1.2 Purpose of the Integrated Water and Waste Management Plan (IWWMP)

The purpose of this IWWMP is to provide a planning framework in terms of the NWA, 1998 (Act 36 of 1998) that will achieve site specific objectives related to the management and monitoring of activities during the construction and operation of the existing Lafarge Tswana Limestone Quarry, in accordance with the Integrated Water Resource Management (IWRM) principles.

These objectives being:

- To characterise the present status of the site,
- To identify any potential impact sources,
- To set appropriate and effective action plans for the control and monitoring of activities during construction and operation (project and site-specific Environmental Management Programme (EMPr),
- To provide all the relevant information to enable the Department of Water and Sanitation (DWS) to make an informed decision regarding the authorisation of this water use in accordance with the NWA, 1998 (Act 36 of 1998).

1.3 Contact Details of the Water User

The contact details of the water user are indicated in **Table 1** below:

Table 1: Contact details of the water user.

Applicant	Lafarge Industries South Africa (Pty) Ltd				
Contact person	Uneysa Taljard				
Physical address	1 Manana Road, Industrial Site, Lichtenburg, 2740				
Postal address	P.O. Box 188, Lichtenburg 2740				
Email	uneysa.taljard@lafargeholcim.com	**Fax**		**Tel**	018 633 3011

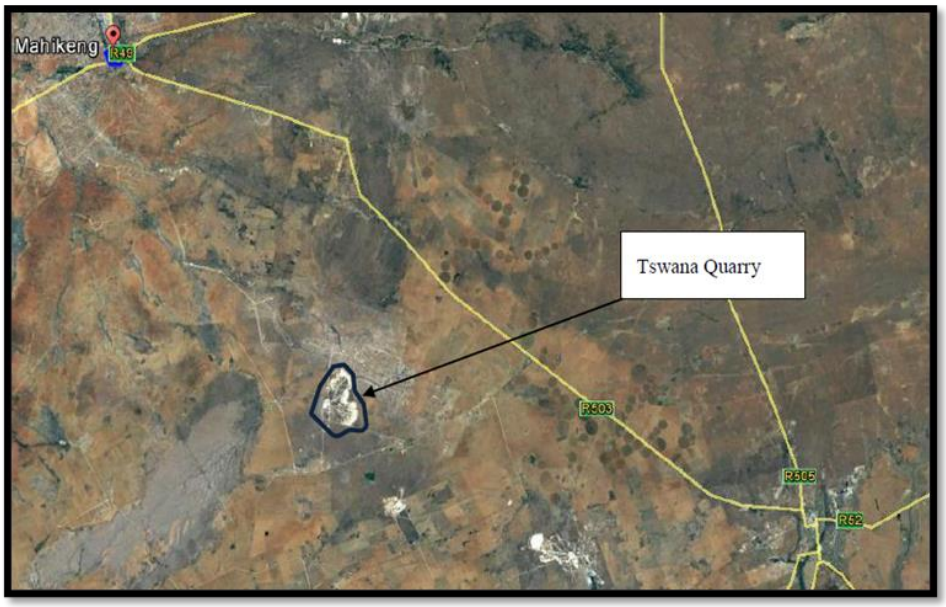
1.4 Location of the Proposed Development

The Lafarge Tswana Limestone Quarry operation is situated in Ward 17 within Ditsobotla Local Municipality, Ngaka Modiri Molema District Municipality which is part of the Northwest Province. The Lafarge Tswana Limestone Quarry is located about 45km from Lichtenburg near the settlement of Bodibe and approximately 37 Km west of the cement factory in Lichtenburg. There is rail line that is used to transport the crushed limestone to the cement plant. The Tswana Limestone Quarry is connected to the R503 via secondary roads. Refer to **Figure 1** Locality Aerial Map and **Figure 2** Topographical Map. The Maps are attached as **Appendix 8** in the document Appendices section for Integrated Water and Waste Management Plan (IWWMP).

The Geographic co-ordinates of the Lafarge Tswana Limestone Quarry are shown in **Table 2** below:

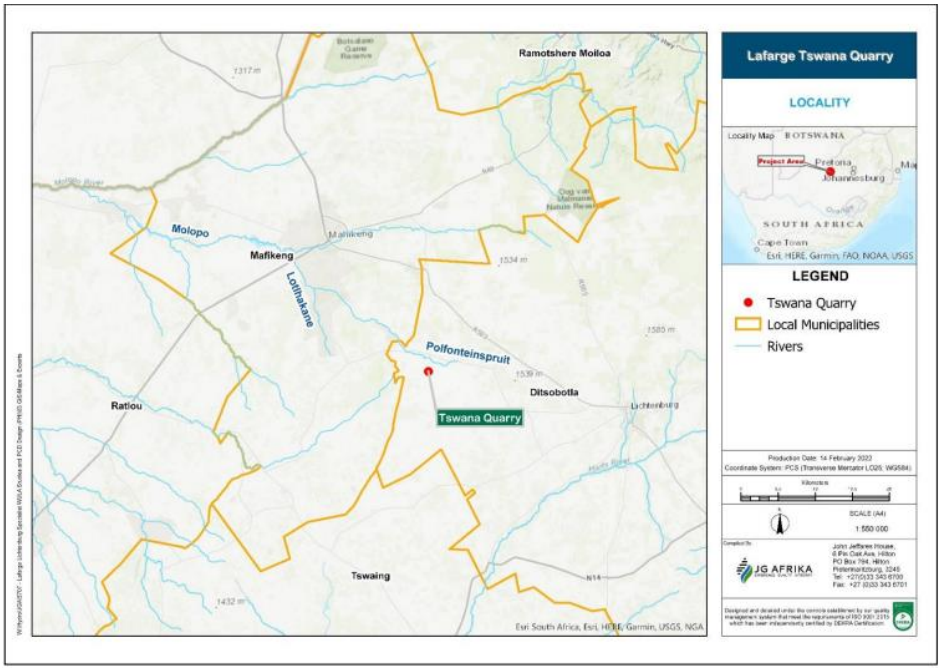
Table 2: GPS Coordinates of the site.

Latitude /Longitude	Degrees	Minutes	Seconds
South	29	45	29.68
East	30	48	17.31



(Source: Tswana quarry geohydrological report)

Figure 1: Locality Aerial map showing boundaries of Lafarge Tswana Limestone Quarry



(Source: Tswana quarry Wetland report compiled by JG Afrika, 2022)

Figure 2: Topographic map of the Lafarge Tswana Limestone Quarry

1.5 Property Description

The Tswana Limestone Quarry is located on the land held in trust by the State for the Bodibe tribe. The Department of Rural Development & Land Reform acts as custodian and royalties from the quarry accrue to the State. The property details, including the extent of the Lafarge Tswana Limestone Quarry, is reflected in **Table 3** below:

Table 3: Property associated with the Lafarge Tswana Limestone Quarry

Property description	Title Deed number	Owner
Farm Driefontein 46 Portion 0 (Remaining Extent), Northern West Province	T1007/1887BP	Department of Rural Development & Land Reform
Farm Rietschraal 58 Portion 0, North West Province	T5235/1999	Department of Rural Development & Land Reform
Farm Rondefontein 47 Portion 0, North West Province	T2/1976BP	Department of Rural Development & Land Reform

2. CONCEPTUALISATION OF ACTIVITY

2.1 Project Description

The Tswana Limestone Quarry operations involve mining limestone rock from opencast pits using conventional drilling and blasting methods. The topsoil and overburden are removed by means of trucks and relocated to an area near the open pit. The mined limestone material is loaded onto haul trucks by excavators and transported to the primary crusher. Following the crushing process, the materials are transported to the Lafarge Cement Plant via railway.

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- ✓ Blasting
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- ✓ Stockpiling and transporting of material via rail

The infrastructure at the Tswana mining area entails:

- ✓ Railway line and siding
- ✓ Crushing Plant and production lines
- ✓ Workshops
- ✓ Office complex

Refer to the Master Layout Plan in **Figure 3** on page 5 and attached as **Appendix 9.**

The quarry has already been developed; therefore, the construction phase is not applicable. The increased production rates at the Tswana Limestone Quarry will not result in any real change to the existing situation other than:

- ✓ More frequent blasting activities,
- ✓ Increased rail traffic to Lichtenburg necessitating the rail bypass loop, and
- ✓ Increased number of operational days (5 to 6) and number of shifts of work (2 to 3).

2.2 The Need and Desirability for the Project

Northwest Province is a growing market surpassing national trends and, as such, demand for Lafarge's products in Northwest Province has already exceeded existing production capacity. The proposed expansion is therefore required to meet the growing product demand and ensure that provincial and national economic development is not hampered.

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- ✓ Support is given to the local and national economy by the purchase of goods and services,
- ✓ Lafarge will achieve profits from the increase in the production of cement resulting in increased tax revenues for the government,
- ✓ Lafarge will continue to support projects that will benefit the local community leading to improved living conditions and improvement of skills,
- ✓ Support to local municipality in terms of road repairs, road construction, upgrading of youth centres, town clean-up, water supply etc.,
- ✓ Support to schools in terms of adopt a school, fundraising campaigns, sport activities, giving books to learners, waste recycling projects,
- ✓ Support to small enterprises- historically disadvantage communities, courier services, tent hiring, shirt printing, gardening services, maintenance contractors etc; and
- ✓ Initiation of historically disadvantaged communities business forum.

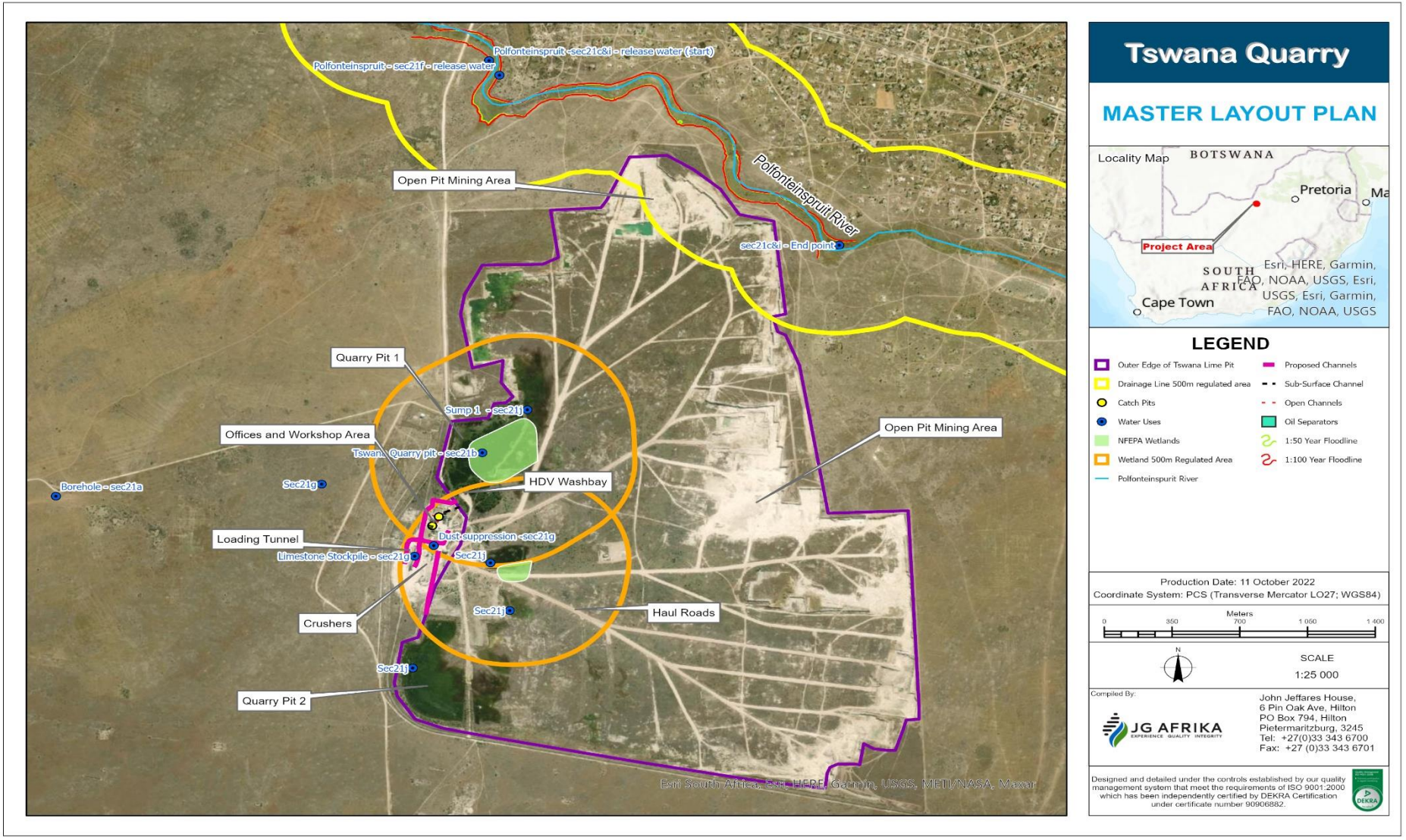


Figure 3: Master Layout Plan of Tswana Limestone Quarry (JG Afrika, October 2022)

3. INFORMATION ON ASSESSMENT FACTORS (PRESENT ENVIRONMENTAL SITUATION)

3.1 Climate and Rainfall

The Tswana Limestone Quarry lies within an arid to temperate climatic region (Köppen-Geiger Climate Classification Maps, 2018). Rainfall occurs mostly during the summer. The climate category can be described as dry and hot during the summer months and cold during the winter months. As flow measurements are limited in the lease area, the mean annual runoff (MAR) was determined using the assumption that the rainfall-runoff response of most of the catchment is the same as that of the regional rainfall-runoff response as determined in the WR90 project (Midgley, Pitman and Middleton, 1994). Catchment areas and the mean annual runoff (MAR) for Lichtenburg up and downstream of affected areas are shown in **Table 4,** and the summary of climatic statistics in **Table 5** below.

Table 4: Natural MAR (from WR90, Midgley, Pitman and Middleton, 1994).

Site Name	Area (km^2)	MAR (mill m^3)
Tswana Quarry area	98.8	0.909

Table 5: Summary of climatic statistics

Average annual rainfall	600 mm
Rainfall season	November to March
Month of highest rainfall	January
Month of lowest rainfall	August
Maximum temperature	33˚C in January
Minimum temperature	0˚C -3˚C in July
Sunshine duration	90% in July, 65-80% in summer months
Maximum average monthly evaporation	9.9 mm in October and December
Minimum average monthly evaporation	3.5 mm in June
Wind description	Light to moderate from the north-eastern sector
Maximum 24 hr rainfall	99 mm in March
24 hr maximum in 1:50 year return period	104.5 mm in December
24 hr maximum in 1:100-year return period	120.2 mm in December
Extreme weather events	These have included hail (1-3 occurrences per year), frost (31 to 60 days per year) and snow in the past

It is evident that most of the rainfall falls over the summer period (September to March), with a total rainfall depth over these seven months equating to 509.4 mm. It is also noted that low rainfall values are recorded over the winter months (April to August), during which a total of 91.5 mm of rainfall falls on average. The wettest recorded year over the 1950 to 2000 period was 1 099.2 mm in 1967.

The monthly distribution of average daily maximum temperatures shows that the maximum temperatures range from 18.9°C in June to 28.7°C in January. The region is the coldest during the month of June when the temperature drops to -0.4°C on average.

The annual potential evaporation rate for the area is 1 952 mm and the highest evaporation rates occur during the hotter summer months of September to March.

3.2 Topography, Soil and Geology

The topography of the area is generally flat and gently undulating. The Tswana Limestone Quarry lies in an area which has generally low topography. The valley within which it is located slopes toward the Polfonteinspruit and the linear gradient down the length of the mine is approximately 0.1% (JG Afrika, Wetland Assessment, 2022).

Soil depth at the Tswana Limestone Quarry is limited to approximately 300 mm over the limestone deposit. Agricultural potential is very low in this area. It was found that examination of the soil characteristics for typical wetland indicators is confusing for two reasons. The first of these is that no traces of the mottling, typically

associated with hydromorphic (redoximorphic) soils, could be found. This is partly thought to be a consequence of the mining that has been undertaken (JG Afrika, Wetland Assessment, 2022).

The second reason for the lack of mottling in the soils may be a natural characteristic of the region. The auger holes produced a heavy dark grey to black organic (not peat) and clay-rich soil. Since the region where the quarry is located is strongly dolomitic in terms of its geology, modifications to the generic approach of identifying wetlands may be necessary (JG Afrika, Wetland Assessment, 2022).

3.3 Vegetation (terrestrial and riparian)

The natural vegetation in the area is Carltonville Dolomite Grassland. (Type Gh 15). Due to the mining activities, the vegetation on the site is severely transformed but some indigenous terrestrial plant species were found within the 500 m radius around the mine (JG Afrika, Wetland Assessment, 2022).

Tswana Limestone Quarry site falls within Acocks veld type "Dry Cymbopogon-Themeda Veld". A common feature of this Grassveld is the absence of a clearly dominant grass species, except in small patches. Some of the areas are still open for grazing and for this reason the most palatable grass species have been heavily grazed. In general, the most visible common grass species are: *Eragrostis echinochloidea; Aristida adscensionis; Aristidia congesta; Cymbopogon plurinodis; Cynodon dactylon; Eragrostis lehmanniana; Eragrostis superba; Stipagrostis uniplumis; Fingerhutia Africana; Heteropogon contortus; Themeda trianda; Triraphis andropogonoides;* and *Hyparrhenia hirta*. Trees are sparsely distributed but these may have been utilised for firewood or for other purposes by the local communities.

The region within which the mine is situated has experienced a prolonged period of wetter than average rainfall, therefore much of the vegetation in the mined area now has characteristics of a hygrophilous grassland, which blends into wetland in many places (JG Afrika, Wetland Assessment, 2022).

It was, however, noted that such conditions are not permanent as plants such as *Hyparrhenia tamba* (Thatch Grass), *Gomphocarpus fruticosus* (Cotton Milkweed), and *Searsia lancea* (Karee), which are not commonly found in waterlogged conditions, were also present. Plants found in more natural conditions in the 500 m radius around the mining right area are listed in the below **Table 6**: Plant species observed in mined areas (JG Afrika, Wetland Assessment, 2022).

Table 6: Plant species observed in mined areas.

Water Dependence	Scientific Name	Common Name
Wetland Facultative	*Andropogon eucomus*	Snowflake Grass
	Eragrostis gummiflua	Gum Grass
	Imperata cylindrica	Cottonwool Grass
	Melinis repens	Natal redtop Grass
	Paspalum scrobiculatum	Ditch grass
Wetland Obligate	*Typha capensis*	Bullrush
	Phragmites australis	Common Reed
	Elionurus muticus	Lemon Grass
	Leersia hexandra	Wild Rice Grass
	Persicaria Spp.	Knot weeds

3.4 Catchment Characteristics and Watercourses (surface)

3.4.1 Water Management Area

The study area forms part of the Crocodile (West) and Marico water management area (WMA) and falls within the D41A quaternary drainage system known as the Polfonteinspruit catchment area as shown in **Table 7** below.

The Tswana Limestone Quarry is located just beneath the 1500 m contour line to the west of the upper reaches of the drainage basins of the Harts River and Molopo River. The plateau to the north, east and south forms the main watershed between the drainage basins of these rivers and the drainage basins of the rivers running northwards

(towards Groot Marico) and southwards (towards the Taaibosspruit). The Polfonteinspruit River flows adjacent to the northern boundary of the Tswana Limestone Quarry and drains into the Lotlhakane tributary which eventually drains into the Molopo River. (JG Afrika, Wetland Assessment, 2022).

Table 7: Catchment Characteristics

Quaternary Catchment	River System	Wetland Type	Condition Rating	Water Management Area	Bioregion
D41A	Molopo - Orange	Artificial Depressions	Category Z/1	Crocodile (West) and Marico	Dry Highveld Grassland

3.4.2 Wetland Assessment

A Wetland Assessment was undertaken by the JG Afrika (Pty) Ltd in March 2022 as a component of the environmental and WUA processes. The full report has been included in **Appendix 14**. The main findings of this Wetland Assessment report have been summarised below:

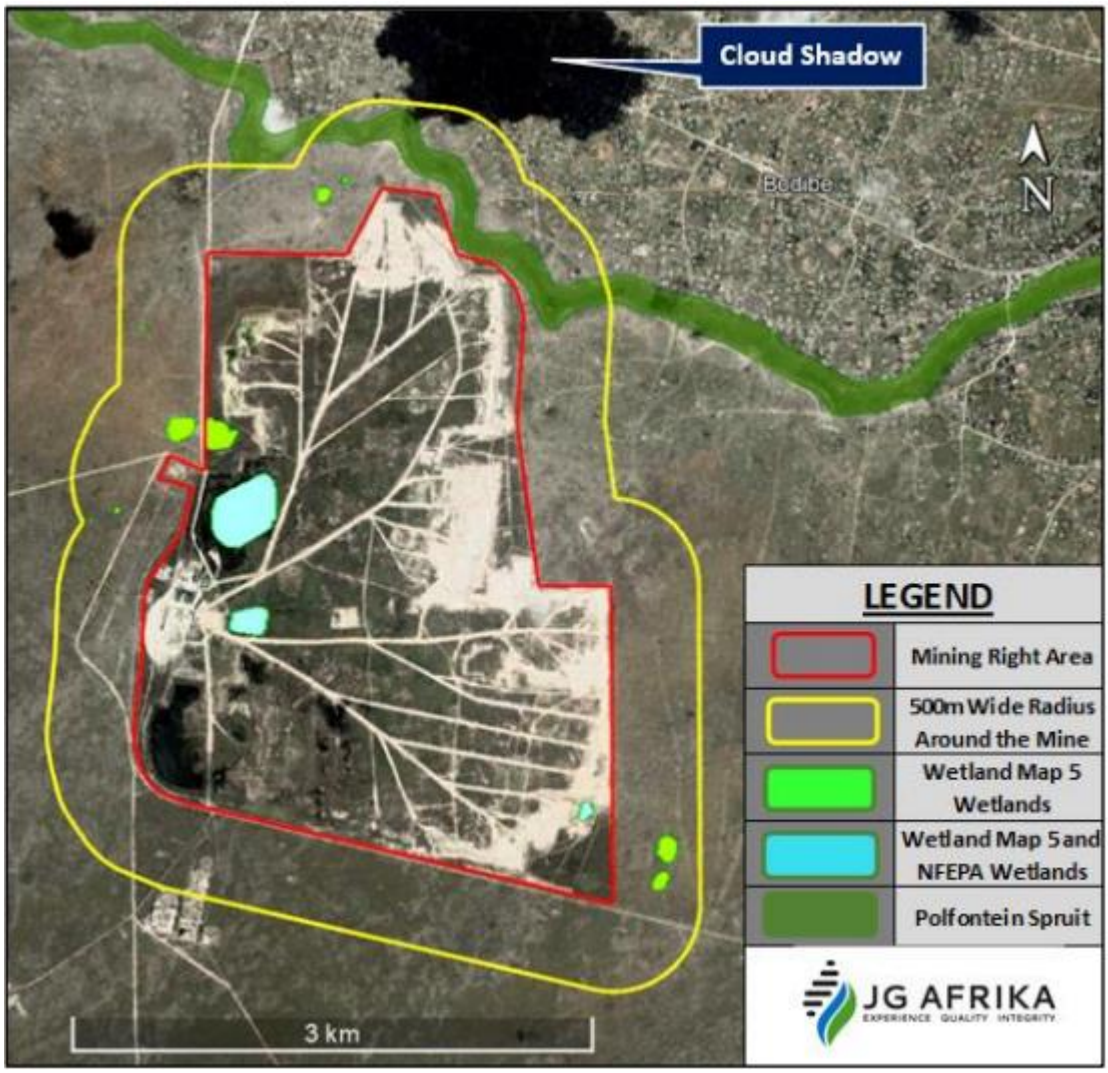
The study areas for each of the wetland sites are included in the relevant sections covering each site. However, for all of the sites the definition of the Regulated Area of a wetland or watercourse was taken into consideration. Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) for Water Uses as defined in Section 21(c) and (i)", Notice 509 of 2016, specifies that the "regulated area of a watercourse" is to mean:

- ✓ *The outer edge of the 1 in 100-year flood line and / or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam,*
- ✓ *In the absence of a determined 1 in 100-year flood line or riparian area, the area within 100m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench, or*
- ✓ *A 500m radius from the delineated boundary (extent) of any wetland or pan.*

While the above criteria are considered, the actual wetland study area was taken to be the 500 m radius around the mine since it also captured a length of the Polfonteinspruit River. The wetlands in the vicinity of Tswana Quarry Mine, as shown in **Figure 4** below, are all Wetland Map 5 listed but three, all within the mining right area, are also National Freshwater Ecosystem Priority Areas (NFEPA) listed.

Examination of the terrain within the mining right area revealed that much of it had, at some time in the past, been mined down to a level where the pit base was a short distance below the natural ground surface. As a result, the water table, which is naturally shallow, has co-incidentally been exposed in many places. Following the heavy rains that had fallen in the time prior to the site inspection, every deeper mine pit was at least partially filled with water and extensive areas of flat ground outside the mine pits were water-logged (JG Afrika, Wetland Assessment, 2022).

The issue relating to the difficulty in delineating wetlands is that there were originally very few wetlands in the area, other than those directly associated with the Polfonteinspruit. Because of the difficulty in determining the edges of wetlands, areas of wetland are mapped based on both the Wetland Map 5 sites and on direct field observations. In order to make the delineation as meaningful as possible, the sites are grouped into two categories and candidate sites are examined more closely (JG Afrika, Wetland Assessment, 2022). These categories are defined as follows:



(Source: Tswana quarry Wetland report compiled by JG Afrika, 2022)

Figure 4: Wetlands in the Tswana Limestone Quarry study area

Mine Pit Wetlands. Mine pit wetlands are those which have developed in mine pits, and which have a well-developed wetland vegetation assemblage, consisting of both wetland obligate and facultative species (Refer to **Photo 1** below). Included in the mine pit wetlands is the original southern wetland, seen in **Figure 4** above but which has now been significantly enlarged and modified.

(Source: Tswana quarry Wetland report compiled by JG Afrika, 2022)

Photo 1: View of a mine pit wetland

Shallow Depression Wetlands. Shallow depression wetlands are wetlands which are apparent at scattered places within the mining right area. It is evident that all these wetlands will be artificial in that they are a result of the mining and other soil disturbance and removal that have taken place. Although wet at the time of the site visit, they will tend to be seasonal or even ephemeral and so usually either lack wetland obligate plants or have only the faster growing species.

(Source: Tswana quarry Wetland report compiled by JG Afrika, 2022)

Photo 2: View of depression wetlands

It must be noted that the separation of the two wetland types is not absolute since the wetlands are highly dynamic in terms of their extent and properties. Shallow areas that have been mined can appear to be mine pit wetlands but lack the necessary inundation period to develop true wetland vegetation. The classification of such sites was then sometimes based on examination of Google Earth images from several different times to see if the site dries out or not (JG Afrika, Wetland Assessment, 2022).

As indicated above, two palustrine wetland types, which are Mine Pit wetlands and Depression Wetlands, are recognised. Both types are artificial as they most closely fit the definition of a Depression Wetland. Water levels in the mine pits will be closely associated with the ground water table with rainfall and surface flows only making up some of the volume. Rainfall is of considerable importance to these wetlands as the depth of the water table will be driven by it (JG Afrika, Wetland Assessment, 2022). Details of the delineated three wetlands subjected to assessment are shown on **Table 8** below and **Figure 5**.

Table 8: Details of the delineated three wetlands

Site	Area (Ha)	Wetland Type	Land use
W1	11.2	Pit	Mining Area
W2	3.1	Depression	Mining Area
W3	0.98	Depression	Unmined Area

The WET-Ecoservices model indicates that the levels of ecosystem service delivery from the three wetlands are generally "**Intermediate" to "Low**". Even the higher scores obtained for services such as "Flood Attenuation", "Sediment Trapping" and "Erosion Control" are misleading since the figures are based on the vegetation cover in the sites but are meaningless as the sites generally have no inflows or outflows that leave the area. Wetland W3 does offer some benefit in the form of "Natural Resources" (provision of grazing for livestock) which the others do not offer (JG Afrika, Wetland Assessment, 2022).

It is noted that the three sites can vary considerably between wet and dry years and so their ecological state will also vary accordingly. Therefore, they are rated to have a variable PES ranking. At times their functionality would suggest a **PES Category A system,** however the application of this score to an artificial wetland may be questionable (JG Afrika, Wetland Assessment, 2022).

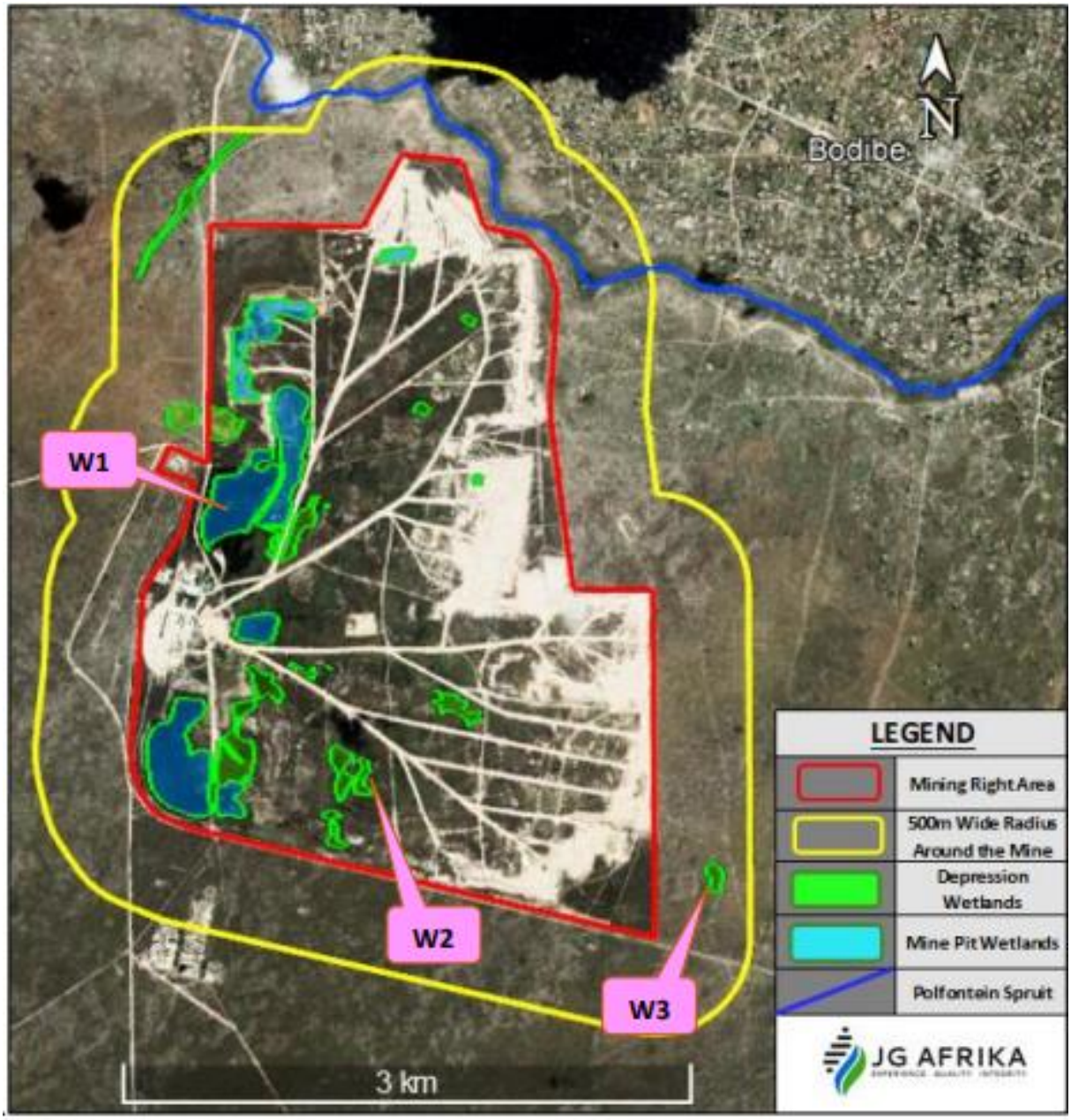


Figure 5: Tswana Limestone Quarry Wetlands Map

- ✓ W1 PES Category B with Potential PES Range of B – C
- ✓ W2 PES Category B with Potential PES Range of B – D
- ✓ W3 PES Category A with Potential PES Range of A – C

It is believed that the sites have **Moderately Low to Intermediate** Ecological Importance as they are able to support aquatic biodiversity in a region which is very dry at times. Site W1 is able to function as a refuge at times when other systems are completely dry on the surface, and so act as a source of recolonisation for times of wetter conditions (JG Afrika, Wetland Assessment, 2022).

It is unlikely that provision of buffers would be of any benefit to the wetlands within the mine area. There are no incoming or outgoing watercourses and so the wetlands are all endorheic. The wetland areas outside of the mine are on community land used for grazing of livestock. It is not possible to provide buffers in such areas, however, should any form of developed land use ever take place there, then buffers should be developed as may be appropriate at the time (JG Afrika, Wetland Assessment, 2022).

The 500 m radius around the mining right area includes a section of the Polfonteinspruit. The Polfonteinspruit flows past the Tswana Limestone Quarry in a southeast to northwest direction. The source is located some 7.5 km upstream of the mine and the stream eventually joins the Molopo River some 45 km away near Mafikeng (JG Afrika, Wetland Assessment, 2022).

It is therefore thought that, in its natural state, the Polfonteinspruit in the study area was an Unchanneled Valley Bottom with some lateral flow inputs from either side but has now become a Channelled Valley Bottom (CVB) and is classified as such in Wetland Map 5. The same conditions exist for considerable distances both upstream and downstream of the site and so the study area may be considered to be representative of a longer section of the Polfonteinspruit (JG Afrika, Wetland Assessment, 2022).

The Polfonteinspruit has been severely impacted upon by human activities. It is apparent that the channel is far from natural as almost its entire length has been either used for agriculture in the past or has been deeply pitted. It is assumed that the pits were excavated for the purpose of providing surface water for livestock, but it is also clear that excavation for extraction of material for block making is still being done, although not on a large scale (JG Afrika, Wetland Assessment, 2022).

The Polfonteinspruit is the only watercourse in the area which has permanent or semi-permanent water even if only very little. A tributary channel flows in from the north and enters the main channel opposite the mine. It is now almost obliterated in the built-up area of Bodibe. The linear gradient of the channel down the study section is approximately 0.5% (JG Afrika, Wetland Assessment, 2022). Further details are shown in **Table 9** below.

Table 9: Characteristics of the Polfonteinspruit

Quaternary Catchment	River System	Wetland Type	Wetland Map 5 Condition Rating	Water Management Area	Bioregion
D41A	Molopo - Orange	Channelled Valley Bottom	D/E/F	Crocodile (West) and Marico	Dry Highveld Grassland

The results indicate that the Polfonteinspruit has **Moderately High** ecosystem service delivery capability in relation to the following Stream flow regulation:

- ✓ Sediment trapping,
- ✓ Phosphate assimilation,
- ✓ Nitrate assimilation,
- ✓ Toxicant assimilation,
- ✓ Biodiversity maintenance,
- ✓ Food for livestock, and
- ✓ Cultivated foods (JG Afrika, Wetland Assessment, 2022).

Delivery levels are **Moderately Low** for the following:

- ✓ Flood attenuation,
- ✓ Erosion control, and
- ✓ Carbon storage (JG Afrika, Wetland Assessment, 2022).

The lack of functionality in those services for the above three services is attributed to the general degradation of the system as a result of past agricultural activity and the present grazing by livestock. These factors are suppressing the wetland vegetation and so surface roughness is reduced and organic matter is removed.

Delivery levels are Low for the following:

- ✓ Tourism and Recreation,

- ✓ Education and Research; and
- ✓ Cultural and Spiritual (JG Afrika, Wetland Assessment, 2022).

The probable explanation for the above lies with the general remoteness of the site and its location on a small tributary watercourse. Only a single HGM is recognised although a very small lateral wetland enters the channel near its lower end (JG Afrika, Wetland Assessment, 2022).

The overall PES Category for the Polfonteinspruit Score is **Category E**. The result of the PES modelling is similar to that listed in Wetland Map 5. There are no red listed species data, and a search of the Animal Demography Unit Virtual Museum indicated no species of concern. The findings that the site was of an Intermediate EIS were not unexpected, since it has been subject to numerous impacts in the past. Adequate protection from ongoing impacts could raise the score substantially.

It is to be noted that, although there has been mining activity at the site for some 40 years, the mine only approached to within 100 m of the delineated channel in 2016. However, as noted in the section above, there appear to be no visible impacts on the wetland as a result of the incursion. Therefore, it is considered that, if the proposed mitigatory measures are applied, there are no new risks to the Polfonteinspruit system.

It is recommended that the mining right area, if ever to be enlarged, approach no closer than 100 m from the delineated edge of the wetland and so this distance is recommended as a general buffer for the site. The purpose of the buffer strip is to ensure that the mine does not have any further effect on the Polfonteinspruit, which is already impacted upon by various agricultural and pastoral activities originating from the Bodibe Community.

3.4.3 Surface Water Hydrology

JG Afrika (Pty) Ltd were appointed by Lafarge Industries South Africa (Pty) Ltd to undertake a Baseline Hydrology and Impact Assessment for the Lafarge Tswana Limestone Quarry, located in the Northwest Province. The full report is attached as **Appendix 18** and summarised below.

Based on Department of Water and Sanitation (DWS) river coverages and 5 m contours, the Polfonteinspruit flows alongside the northern boundary of the Tswana Limestone Quarry and flows into the Lotlhakane tributary which drains into the Molopo River. The Molopo River is located approximately 42 km downstream of the project site. Tswana Limestone Quarry Catchment: Water flows into the quarry dam that lies north of the dam (JG Afrika , Hydrological assessment, 2022).

The catchment area of the Polfonteinspruit within the vicinity of the Tswana Limestone Quarry, is approximately 33 km^2. For the purposes of this study, this is considered the local catchment area. Quaternary Catchment D41A (considered as the regional catchment for the purposes of this study), within which the quarry is located, has a catchment area of 4 322 km² and a Mean Annual Runoff (MAR) of 5.03 million cubic meters (MCM). Details of the Quaternary Catchment D41A, including its associated MAR volume and MAR depth are provided in **Table 9** above (JG Afrika , Hydrological assessment, 2022).

The following potential hydrological impacts were identified to be associated with the Tswana Limestone Quarry and, therefore, included as part of this impact assessment:

- ✓ Changes in catchment water resources due to an Increase in impervious areas, abstractions, and limiting flow to the downstream environment,
- ✓ Changes in catchment water quality due to erosion from disturbed open ground; and discharge of waste or contaminated water (Hydrocarbon spills, pit dewatering and sewage spills), and
- ✓ Changes in catchment flood hydrology due to an Increase in impervious areas, and altering the bed, banks, course, or characteristics of a watercourse (JG Afrika , Hydrological assessment, 2022).

3.4.3.1 Changes in Catchment Water Resources

A hydrological analysis of the local (Polfonteinspruit adjacent to the quarry) and regional (D41A quaternary catchment) catchments hydrology was undertaken to determine the potential impact of the quarry on the local and regional hydrology. an analysis of the licensed water abstractions downstream of the quarry, within the D41A Quaternary Catchment was undertaken using the 2022 DWS Water Authorisation and Registration Management System (WARMS) database. The database indicated that there were seven licenced water users which mostly included water users for water supply services, located downstream of the study area, between the quarry and the Molopo River (JG Afrika , Hydrological assessment, 2022).

Based on the respective catchment areas and information provided in the WR2012 study, the MAR of the local catchment (i.e., which includes the Polfonteinspruit catchment area), in the vicinity of the quarry equates to 0.04 MCM (million cubic meters), and the MAR of the regional catchment (D41A) equates to 5.03 MCM. This is based on an average runoff depth of 1.16 mm/annum for the respective catchments. In order to determine the anticipated impact of the quarry on the catchment water resources (volume of water), the catchment area of the overall quarry site was compared to the local and regional catchment areas (JG Afrika , Hydrological assessment, 2022).

Based on this, the quarry site, with an area of approximately 7.62 km^2, comprises approximately 15.76 % of the local catchment area and approximately 0.18 % of the regional quaternary catchment area (D41A). The resulting impact on local and regional catchment resources is 15.76 % and 0.18 %, respectively. Based on this, the anticipated impact of the quarry on the local and regional catchment water resources (from a water volume perspective), as a result of a limiting flow in the downstream channels (capturing of contaminated stormwater), will be limited (JG Afrika , Hydrological assessment, 2022).

It is noted that the volume of water captured in the open pit (which would convert to runoff to the Polfonteinspruit River under natural conditions) equates to 8 868 m^3/annum. It is also noted that the volume of water that is being applied for to discharge to the Polfonteinspruit River far exceeds this volume. Therefore, if the licence is granted, the quarry will contribute more water to the downstream environment than that which would have occurred under natural conditions (JG Afrika , Hydrological assessment, 2022).

Water requirements at the quarry include domestic water (for showers and cleaning purposes for example), potable water for human consumption, operational water (for washdowns for example) and water required for dust suppression. This water is obtained from the following sources:

- ✓ Borehole 1, located at the Tswana Quarry. Water is pumped from the borehole to a Jojo Tank, which is then used to supply water for domestic and operational purposes.
- ✓ External source. Potable water is sourced externally and used on site, strictly for human consumption.
- ✓ Tswana Quarry Sump 1. Water from the sump is used for dust suppression at the crushers as well as for cleaning machinery at the wash bay located adjacent to the quarry sump (JG Afrika , Hydrological assessment, 2022).

There will be no water that will be abstracted from Polfonteinspruit and therefore there will be no impact associated with reducing catchment water resources as a result of abstractions from this drainage line (JG Afrika , Hydrological assessment, 2022).

3.4.3.2 Reduction in Catchment Water Quality

Currently stormwater runoff from the crushers, stockpile and office areas associated with the Tswana Limestone Quarry is directed back into the open pit, mostly to the Quarry Sumps. As mentioned previously, part of the Water Use Licence Application is to pump water from the Quarry Sump 1 into the Polfonteinspruit. It is therefore important to ensure that the quality of water in the Quarry Sump 1 is sufficiently good to allow this water to be pumped to the Polfonteinspruit River and downstream environment (JG Afrika , Hydrological assessment, 2022).

These abstractions include four licenced abstractions for water supply services, and three for industrial water supply (one non-urban, one urban and one for mining purposes). Any reduction in water quality for these licenced

water users is associated with a high significance level. Potential types and sources of surface water contamination are as follows:

- ✓ Sediment – which may potentially enter the quarry sump and downstream environment from the crushing plant and associated infrastructure, overburden stockpiles and disturbed bare surfaces (sediment).
- ✓ Hydrocarbons – which may occur from spillages around fuel and hydrocarbon stores, workshop areas and scrap yards.
- ✓ Sewage – which includes spillages of untreated sewage to the downstream environment (JG Afrika , Hydrological assessment, 2022).

3.4.3.3 Changes in Flood Hydrology

All stormwater runoff from the quarry site, including the crusher area and offices, flows towards the Quarry Sumps. The quarry sumps have no discharge point. Therefore, the likelihood of an increase in peak discharge rates from the quarry and its associated infrastructure is very **low** (JG Afrika , Hydrological assessment, 2022).

It is noted that the Tswana Lime open pit is located relatively close (approximately 100 m) to the Polfonteinspruit River along its northern boundary. However, a recent floodline study has confirmed that the Tswana Lime Pit and any associated infrastructure is located outside of the 1:100-year floodline. Therefore, there is no obvious impact of the mine on the banks or floodplain of the Polfonteinspruit River (JG Afrika , Hydrological assessment, 2022).

3.4.3.4 Conclusion

Changes in catchment water resources. Based on the assessment undertaken, it was found that the potential impact of the quarry on catchment water resources (volume of water available to downstream users) is **moderate**. This is largely due to the rainfall and runoff that is captured in the open pit, therefore reducing contributions to the Polfonteinspruit River (compared to what would occur naturally). It is, however, noted that as part of the Water Use Licence Application, a licence to pump water stored in the quarry sump has been applied for. If this is granted, the impact of a reduction to downstream water resources as a result of the open pit will largely be mitigated against (JG Afrika , Hydrological assessment, 2022).

Changes in catchment water quality. The potential sources of contamination to the downstream environment were identified as sediment (from the crushing plant and stockpiles), hydrocarbon spills (through fuel stores and machinery on site) and raw sewage. In order to reduce the risk of surface water contamination, numerous recommendations were made, largely with respect to management of contaminants at their source (JG Afrika , Hydrological assessment, 2022).

Changes in catchment flood hydrology. It was noted that the likelihood of changes in flood hydrology in the local and regional catchment context as a result of the quarry and its associated infrastructure, is **low**. The location of the open pit was, however, noted to be in a close proximity to the Polfonteinspruit River. However, a recent floodline study has confirmed that the Tswana Lime Pit and any associated infrastructure are located outside of the 1:100 year floodline. Therefore, there is no obvious impact of the mine on the banks or floodplain of the Polfonteinspruit River (JG Afrika , Hydrological assessment, 2022).

It is concluded that if the Lafarge Tswana Limestone Quarry is compliant with the various regulations guiding the management and protection of water resources (as outlined in this report), the impact of the quarry on the local and regional hydrology will be **low** (JG Afrika , Hydrological assessment, 2022).

3.4.4 1:50 and 1:100 Year Floodline Study

JG Afrika (Pty) Ltd were appointed by Lafarge Industries South Africa (Pty) Ltd to undertake a 1:50 and 1:100-year floodline study for a portion of the Polfonteinspruit River, located adjacent to the Tswana Limestone Quarry. The full report is attached as **Appendix 15** and summarised below.

As part of this study, the 1:50 and 1:100-year return period peak discharge values of the Polfonteinspruit were calculated using the Rational Method. The extent of the corresponding floodlines were determined through

hydraulic modelling using the HEC-RAS model. The floodlines were modelled using 2 m contour information, which were surveyed for the purposes of this study (JG Afrika, Floodline Study, 2022).

It is also important to note that there were no culverts identified on the Polfonteinspruit to include in the hydraulic modelling. The catchment soil permeability was predominantly permeable. The surface slopes for the catchment were estimated from a Digital Elevation Model (DEM), created from 5 m contour data of the project area. The surface slopes were classed according to the threshold slopes of less than 0 – 3%, 3 – 10%, 10 – 30% and >30% (JG Afrika, Floodline Study, 2022).

Based on the 2 m contour information provided, the estimated 1:50 and 1:100-year peak discharge values and catchment conditions, the resultant delineated 1:50 and 1:100-year return period floodlines for the study site, are presented in **Figure 6** below. It was noted that both the delineated 1:50 and 1:100-year floodlines are outside of the Tswana Limestone Quarry and its associated infrastructure (JG Afrika, Floodline Study, 2022).

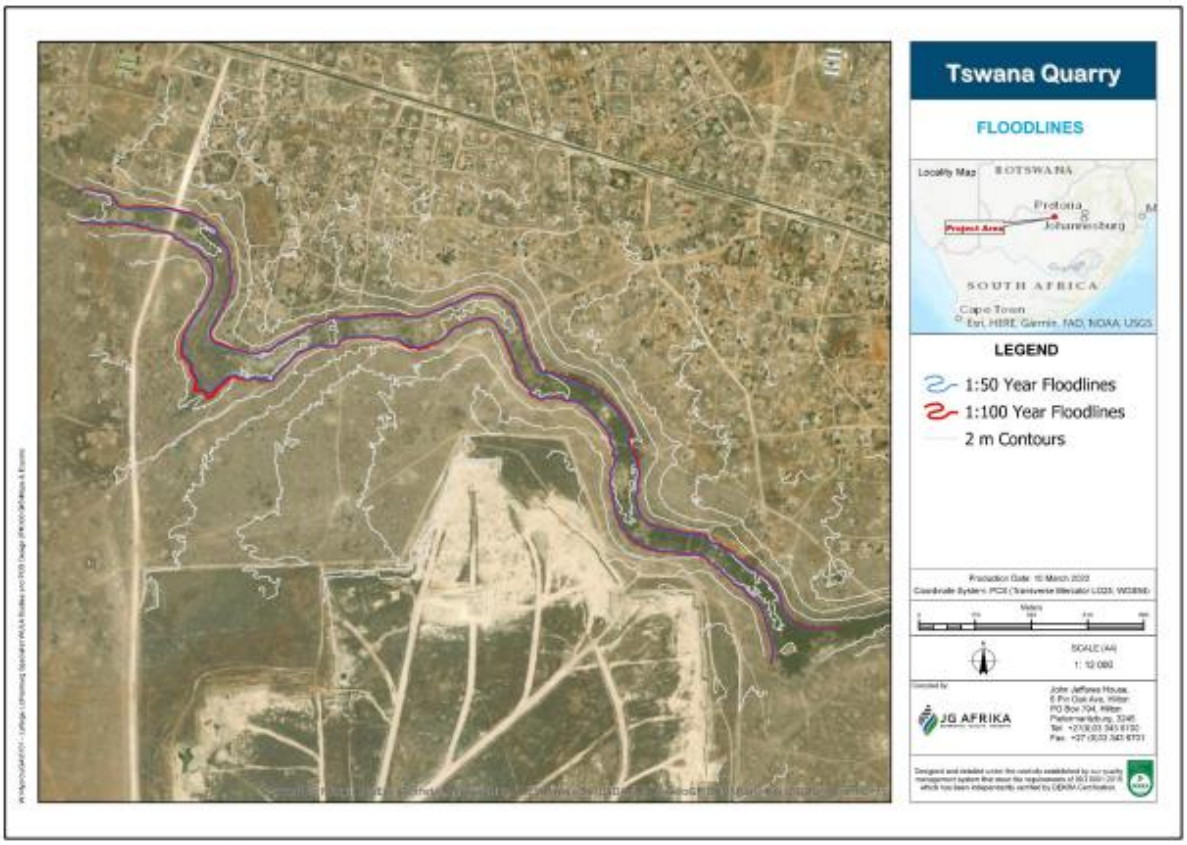


Figure 6: 1:50 and 1:100 Year Floodlines for the Polfonteinspruit River

3.4.5 Surface Water Quality

Aquatico was commissioned by Lafarge Industries to sample, analyse and evaluate the physical, chemical and bacteriological quality of surface (monthly).

The results of the August 2022 sampling period can be found below:

Surface water

- The water quality sampled at Tswana Lime Pit was compared against the General Authorisation limit and the SAWQG for Livestock Watering.
- The water at Tswana Lime Pit can be described as neutral, non-saline (Tswana Lime Pit) to saline and hard (Tswana Lime Pit) to very hard. All of the analysed variables complied with the General Authorisation limit at Tswana Lime Pit during August 2022. The compliant ("unaffected") water quality might be a result of the influx of fresh rainwater that causes a dilution effect (Monthly Water Quality Assessment Aquatico, 2022)

From water quality investigations on free water at the Tswana Limestone Quarry that were undertaken as part of the approved Environmental Management Programme (EMPr) and EMPr amendment, the following can be deduced:

- ✓ Remarks relating to results of Lafarge Village water sample on Test Report 2016-10338 submitted to Scientific Services on 8 January 2016
- ✓ Algae and bacteria were not subsequently analyzed which are associated with tastes and odors in drinking water. The organic content (TOC) is insignificant and much lower that the limit of 10 mg/L as prescribed by SANS 241: 2015. There is no noticeable activity of bacteria associated with such problems.
- ✓ No toxic or harmful concentrations of any elements were found
- ✓ The water quality is suitable for a number of uses (drinking, aquatic life, animal use, agricultural use and recreation).
- ✓ Additional water samples were taken from a number of locations The samples were classified in terms of the DWAF Water Quality Guidelines. These results showed that generally, the surface water and groundwater quality of the samples taken from the localities listed above are of ideal and good water quality.

3.5 Geohydrological Report

A Geohydrological Report was prepared by JG Afrika (Pty) Ltd, in support of the water use authorisation for Lafarge Tswana Limestone Quarry and is attached as **Appendix 17**. The aim of the assessment was to determine the sustainable yield of the current supply borehole designated LQBH4, conduct a hydrocensus to establish potential receptors, and to develop a numerical groundwater flow and mass transport model, to determine risk and impact.

A summary of the findings of the assessment are found below:

The project area is underlain by a karst aquifer type and the aquifer class unit in terms of the South African Aquifer Classification System is characterized as *Major* (JG Afrika, Geohydrological Assessment, 2022).

Borehole Yield Assessment
The yield testing of the borehole was carried out by JG Afrika (Pty) Ltd over the period 02 to 03 August 2022, in accordance with the guidelines of the South Africa National Standard SANS10299-4:2003 Part 4: Test Pumping of Water Boreholes. The maximum daily volume that can be abstracted from the borehole using the conservative critical drawdown is 91.6 kl/d. Given the pump cycle observed on site, the borehole likely operates at less than 7.5 hours per 24 hour cycle. This is inferred to be a reasonable representation of the main strike depth and the borehole is considered to be operating within the design of its sustainable yield (JG Afrika, Geohydrological Assessment, 2022).

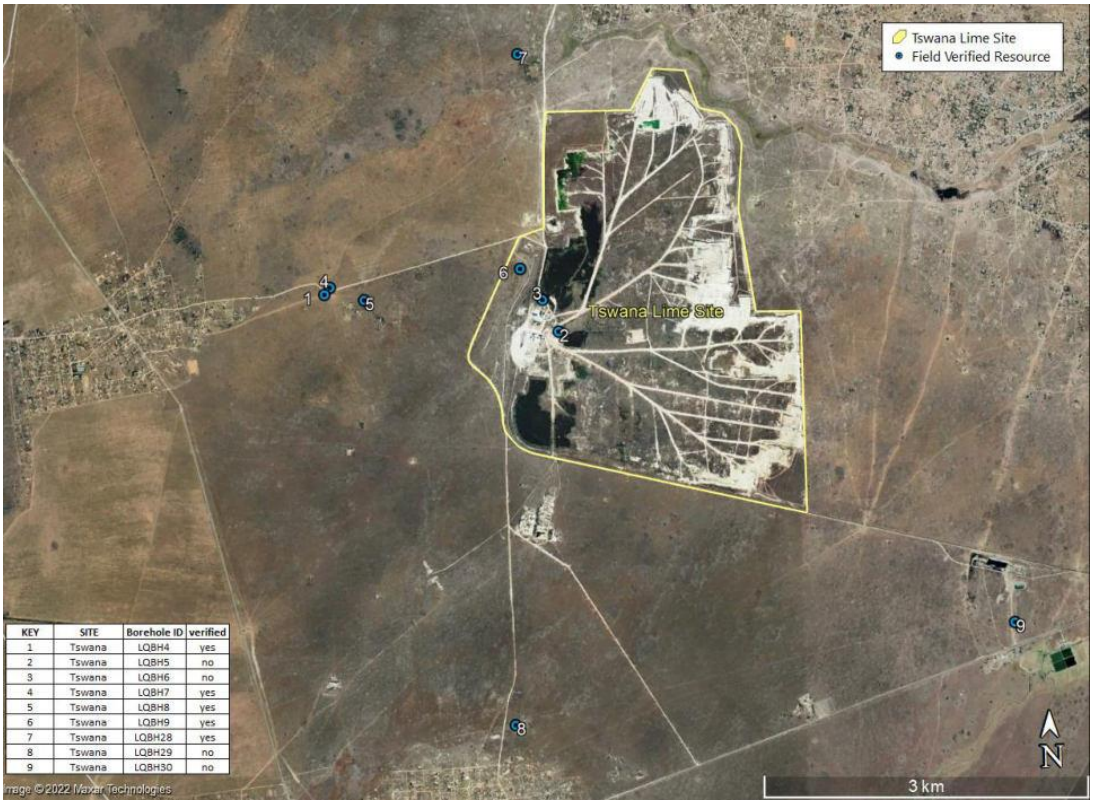
Groundwater Quality
A groundwater sample was collected from the borehole for chemical analysis by JG Afrika (Pty) Ltd during the site assessment and tested for selected determinants of the Domestic Consumption SANS241 raw water suite. The results of analysis indicated that all the determinants analysed were within the screening limits. The groundwater is therefore potable and suitable for domestic use without treatment (JG Afrika, Geohydrological Assessment, 2022).

Borehole Management Plan
Based on the analysis of the yield test data and water quality, a summary of the borehole management plan is listed below:

- Water quality for the LQBH4 borehole fell within the SANS241 limits;
- There were no compounds or risks of concern;
- Biannual monitoring was recommended;
- The water use application abstraction rate should be 1.86 l/s on a 24 hour duty to accommodate the maximum sustainable yield of the borehole. This equates to approximately 58657 m^3/a.

Hydrocensus
A hydrocensus was required to determine existing groundwater use in the project area and to establish possible impacts on existing resources from the Tswana Lime Quarry site activities. The hydrocensus further served to collect current water levels from known resources for the development of the groundwater model.

The National Groundwater Archive (NGA) of the Department of Water and Sanitation was interrogated to establish the existence of any groundwater resources and groundwater use in proximity to the site. The NGA reported 74 (No.) resources within 5 km of the site. A field verification hydrocensus was also carried out. A total of nine (9 No.) resources were identified during the previous and current survey. One (1 No.) water supply borehole, four (4 No.) monitoring boreholes and three (3 No.) unused boreholes were identified (**Figure 7**). (JG Afrika, Geohydrological Assessment, 2022)



KEY	SITE	Borehole ID	verified
1	Tswana	LQBH4	yes
2	Tswana	LQBH5	no
3	Tswana	LQBH6	no
4	Tswana	LQBH7	yes
5	Tswana	LQBH8	yes
6	Tswana	LQBH9	yes
7	Tswana	LQBH28	yes
8	Tswana	LQBH29	no
9	Tswana	LQBH30	no

Figure 7: Field Verified Resources (After Tucana Solutions 2017)

Numerical Groundwater Model
To determine the impact on the receiving environment, the groundwater flux into the mine pits was modelled through the numerical groundwater flow model, and the potential sources of pollution were modelled through the use of mass transport. Four time steps at 25, 50, 75 and 100 years for mass transport were considered. The model outputs were to simulate groundwater influx associated with the quarry pits, and determine mass transport travel distances for the individual model layers over the model time steps in 25 year increments.

The sustainable yield of the supply borehole was determined as 58656 m³/a through yield testing of the borehole. The model pit inflow results indicated that the net inflow from groundwater is in continual balance with the evaporation component resulting in a near zero net flow. The variability of the contribution from rainfall is offset by continuous evaporation, resulting in a general water balance in the pits, and as a result, the pit levels fluctuate periodically.

The mass transport results showed a strong dependence on the characteristics of a structural lineament through the project area. It was evident that the plume movement is affected by the pumping taking place at LQBH4 as the plume moves in that direction. More field data is required to confirm the effect of this feature, as the hydraulic conductivity of the structure was determined through the calibration process. Model calibration is also non-unique due to the many degrees of freedom that exist in the unknown parameters and/or uncertainty in measured results. To improve the model confidence, more data would be required to refine the current model. In particular, monitoring points around the pits would enhance the model output for determining groundwater flux into the pits. Additional monitoring boreholes were proposed around the pits and along the structural feature (JG Afrika, Geohydrological Assessment, 2022).

Quantitative Environmental Risk Assessment and Mitigation

The quantitative environmental risk assessment (ERA) identifies operational phase activities that may impact on the groundwater receiving environments. Most activities identified scored **LOW** or **MODERATE** for the pre mitigation ratings. Stockpiles scored **HIGH**. Most scores can be reduced with the introduction of mitigation measures. The potential impacts include:

- Aquifer dewatering
- Deterioration of groundwater quality
- Recharge of the groundwater system
- Impacts on downstream users
- Future pit decant
- Salt loading through evaporation process
- Prolonged leaks from stockpiles and impacts on groundwater
- Mobilisation of existing elevated compounds
- Increased turbidity loading from construction areas
- Major loss of contaminant dam overflows

Additionally, the aquifer vulnerability was considered as medium to high, and the Parsons Groundwater Quality Management System gives the site a High Level of Protection index for the second variable vulnerability (JG Afrika, Geohydrological Assessment, 2022).

Groundwater Monitoring Programme

It is recommended that groundwater sampling be carried out in accordance with the Water Research Commission's Comprehensive Guide for Groundwater Sampling JG Afrika's standard operating procedures for environmental monitoring and field work.

The current groundwater analysis suite being applied at the Tswana Limestone Quarry Site is summarized in **Table 10,** with the inclusion of additional recommended analysis.

Table 10: Analysis Suites

Frequency	Analytical List	Objective
Bi-annually	pH, EC, Ca, Mg, Na, K, Total Alkalinity, F, Cl, NH4(N), NO3(N), PO4, SO4, Al, Fe, Mn	Water quality and impacts
	SANS214:2015 – Raw Water	Domestic consumption

Annually	Ba, As, Co, Cr, Ni, Pb, Se, Sr, V, Zn, Mn, Cu, Ga, Ge, Rb, Y, Zr, Sn, W, Bi, Th, U, Hg	Water quality and impacts

The existing and proposed groundwater monitoring locations are presented in **Figure 8**. It is noted that LQBH5 and LQBH6 need to be reinstated, and additional monitoring boreholes may include NBH1 to NBH3 to augment the data set (JG Afrika, Geohydrological Assessment, 2022).

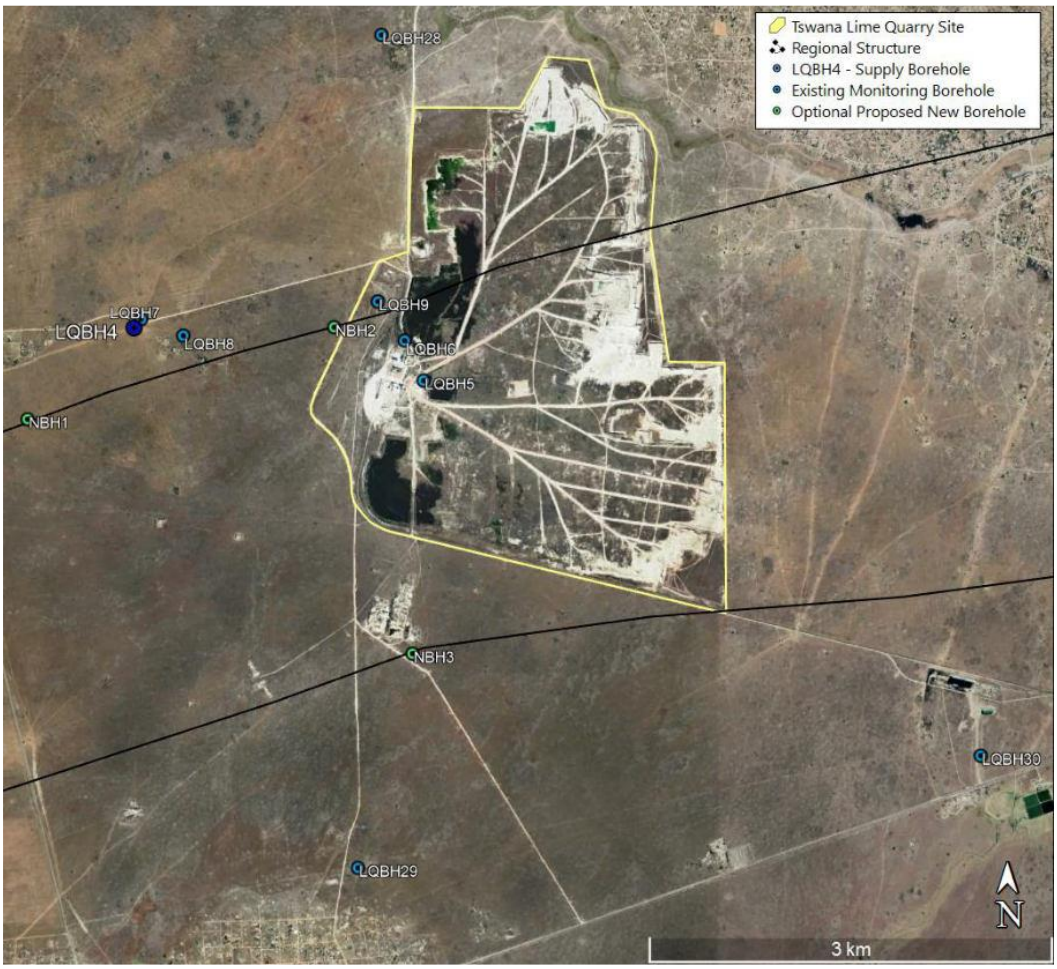


Figure 8: Tswana Lime Quarry Groundwater Monitoring Network

3.6 Cultural and Heritage aspect

Due to the disturbed nature of the operation no sites of archaeological or cultural importance are present on the site. The local community also did not identify any site of historical importance, and to date no complaints with regard to the impact of the mine on surrounding land uses has been received. Water uses associated with this land use are discussed below.

- ✓ Domestic: Water from the watercourses is apparently not used for domestic purposes. Residential areas around the mine obtain ground water for domestic purposes.
- ✓ Agriculture – irrigation: Irrigation of crops does occur in this area.
- ✓ Agriculture - livestock watering: Livestock are present in the area and other small wild animals in the nature reserve area presumably source their water from the rivers.

3.7 Description of the Surrounding Land Uses

All land immediately adjacent to the Tswana Limestone Quarry is owned by the Bodibe Tribe. Surrounding land uses are agricultural, formal and informal residential and grasslands and thickets.

4. ANALYSES AND CHARACTERISATION OF ACTIVITY

4.1 Infrastructure on the Site

The Tswana Limestone Quarry infrastructure currently includes the following:

- ✓ The quarry,
- ✓ Crushing plant,
- ✓ Screening,
- ✓ Sump,
- ✓ Railway line and siding,
- ✓ Loading area of the locomotive,
- ✓ Workshops, and
- ✓ Offices complex.

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4.2 Water Demand and Supply Analysis (including a water balance)

The Water Balance Report (attached as **Appendix 19**) that was compiled by JG Afrika (Pty) Ltd in April 2022 is limited to the reticulation associated with the Tswana Limestone Quarry. This includes water abstracted from the supply borehole, water used for dust suppression, domestic water requirements and the environmental water balance (rainfall, runoff, evaporation, and seepage) associated with the open pit and two main dams located within the open pit (JG Afrika, Water Balance, 2022).

The Following water reticulations have been included in the water balance schematic:

Borehole. The main source of water to the quarry is pumped from a borehole, located to the east of the quarry. Water is pumped from the borehole to the Jojo Tanks located near the workshop and administrative buildings. A significant amount of water is lost to the environment. This is as a result of leaks along the pipeline between the borehole and the Jojo Tank. Based on discussions with Lafarge, it is noted that community members have been known to puncture the pipeline, which causes a leak and allows them to access water for their livestock (JG Afrika, Water Balance, 2022).

Jojo Tank. Water is circulated from the Jojo Tank to the administration buildings, change-house and kitchen and to housing units (currently not used) located on site. In addition to the domestic water uses, water from the Jojo Tanks is also used for dust suppression at the crushing plant (JG Afrika, Water Balance, 2022).

Workshop. Water used at the workshop area is limited to water used for washdowns and for domestic purposes, and is sourced from the Jojo Tanks, as mentioned above (JG Afrika, Water Balance, 2022).

Crushing Plant. Associated with the crushing process is a high risk of producing dust. Therefore, a total of eight sprayers are located at the crushing plant to reduce the amount of dust produced. The volume of water used at each of these sprayers has been estimated (as presented later in Table 3-1) for the purposes of this water balance (JG Afrika, Water Balance, 2022).

Open Pit. The open pit covers an extensive area to the east, northeast and southeast of the administration and workshop areas. It is not a deep excavation and is estimated to be less than 10 m deep at its deepest point (JG Afrika, Water Balance, 2022).

Quarry Sumps. Located within the open pit are several sumps, located along the western edge of the pit. These sumps capture stormwater runoff from within the pit and stormwater from the workshop and administration building areas and the crusher area. Water from Quarry Sumps is used at the HDV wash bay and is also used for dust suppression on the roadways within the pit. Due to the interconnection between the sumps, and the fact that they are all located within the open pit, for the purposes of this water balance they have been considered as a single entity (JG Afrika, Water Balance, 2022).

Wash Bay. The wash bay is located within the open pit, on the southern banks of the Quarry Sump 1. During washing, water is pumped directly from the sump to a high-pressure spray gun. Water from the wash bay then runs off directly back into the sump area. During the site assessment no signs of hydrocarbon contamination were noted in the vicinity of the sump and surrounding vegetation (JG Afrika, Water Balance, 2022).

The water balance for the Tswana Lime Quarry was based on a number of assumptions (based on experience with similar projects), information supplied by management of the quarry and notes taken during a site visit in January 2022. The accuracy of the resulting water balance is therefore related to the accuracy of the assumptions/estimations made in the compilation of the water balance. The water balance compiled as part of this project provides average daily water movement in cubic meters for annual average, dry period average (based on the months of July) and wet period (based on the months of February (JG Afrika, Water Balance, 2022)).

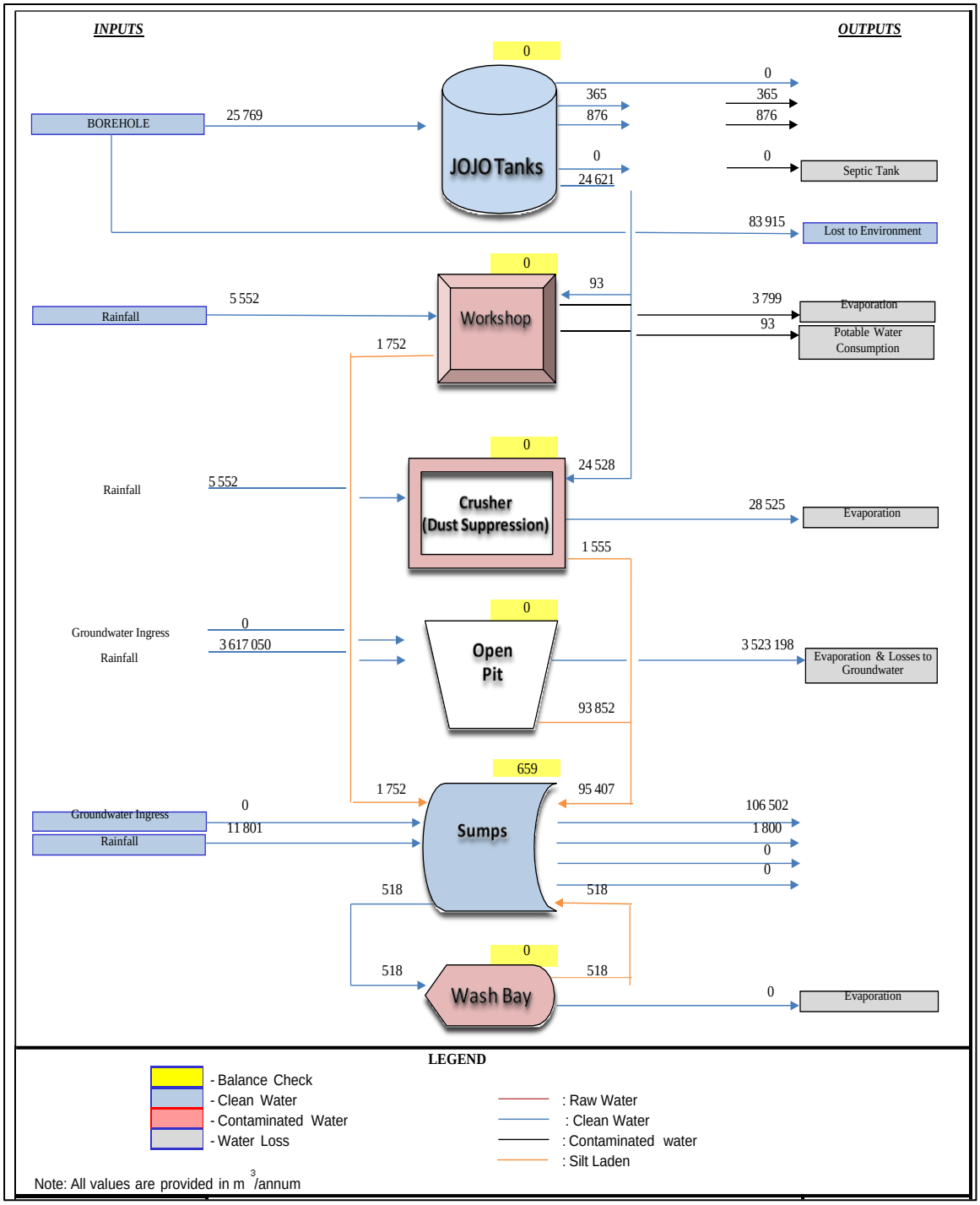

Figure 9: Tswana Lime Quarry Average Annual Water Balance

The water balance results are summarised as follows:

- ✓ Drinking water has been excluded from the water balance study as this is brought onto site from an external source and is used strictly for drinking purposes.
- ✓ Domestic water (used for the ablutions, cleaning purposes etc.) has been allowed for in the water balance. The total domestic water use is estimated at 3.65 m³ /day (or 1332 m³ /year). This water sourced from an onsite borehole, from which water is pumped to two Jojo Tanks and then distributed to the various areas of use.

- ✓ In addition to the domestic water use from the Jojo Tanks, water used for dust suppression is by far the biggest water user at the quarry. The water used for dust suppression purposes at the crushing plant equates to 67.2 m³ /day (or approximately 25 000 m³ /year).
- ✓ Flow meter records of water pumped from the borehole indicated significantly more water being pumped than what is estimated to be used at the quarry. Upon investigation of this, it was noted that community members often puncture the water supply pipeline so that they are able to provide drinking water to their livestock. This loss of water is estimated to be approximately 230 m³ /day (84 000 m³ /year), and has been captured in the water balance accordingly.
- ✓ Two main sumps were identified within the open pit. These were called Quarry Sump 1 and Quarry Sump 2. Quarry Sump 1, located to the northeast of the workshop area, is used for washing of vehicles (on the bank of sump) and for dust suppression along the haul roads (estimated to be 4.6 m³ /day or 1682 m³/month). For the purposes of the water balance study, due to the fact that all of the sumps are located within the open pit and are connected, the quarry sumps were treated as a single entity (JG Afrika, Water Balance, 2022).

Based on the water balance study, the following recommendations are provided:

- ✓ Flow meters should be installed on the pipeline used to supply water for dust suppression at the crushing plant. This will allow for more confidence to be gained in the water balance and the results associated with the water balance.
- ✓ Confirmation on the volume of water lost between the borehole and the Jojo Tanks should be investigated further. Based on the water balance results, the volume of water lost to the environment along this pipeline is significant. Interventions to try to reduce the volume of water lost would then also need to be investigated, so that these losses can be mitigated against (JG Afrika, Water Balance, 2022).

4.3 Domestic Waste Handling

Due to the nature of limestone quarrying, there will be no residue deposits. The quarry produces domestic and hazardous waste. Mine waste consists of mainly floor sweepings, collected dust. All stripped topsoil/overburden at the quarry will be utilised as topsoil in the rehabilitation process.

Appropriate waste bins are on site for waste disposal. The office domestic waste, solid waste and hazardous waste is collected by a registered waste management contractor/company, eg, EnviroServ. The solid waste is disposed of by a contractor at the Ditsobotla Local Municipality solid waste landfill site. No other solid waste is produced in the mining operations.

No polluted water will be released from the quarry or any other areas. The limestone deposit and overburden contain no chemically aggressive substances.

Waybills for all such disposals are to be kept by the Contractor on site for record purpose and review. Recycling must be undertaken where possible to reduce the amount of waste sent to the landfill site. Solid Waste Management has been addressed in the EMPr attached in **Appendix 13**.

4.4 Sewage Treatment Facility

Waste water servicing the kitchen and ablutions is directed to the french drain.

4.5 Stormwater Management Plan

4.5.1 Stormwater Infrastructure and Preliminary Design Report

JG Afrika Pty Ltd were appointed by Lafarge Industries South Africa (PTY) Ltd to provide a preliminary design of the Stormwater Management Plan (SWMP) infrastructure to manage the dirty water from the Lafarge Tswana Limestone Quarry (LTQ) for the purposes of a Water Use Licence Application (WULA). The full report is attached in **Appendix 20** and summarised below.

The LTQ stormwater infrastructure includes four interconnected channels (A to D) and one isolated channel (E) which discharges into an existing dam as shown in Table 1 of the SWMP. The channels are designed to accommodate 1 in 50-year flood peaks ranging from 0.14 m^3/s to 0.5 m^3/s. The interconnected channels are concrete lined trapezoidal channels with 1V:1.5H side slopes, 600 mm wide bases and longitudinal slopes at a minimum of 0.25% due to the flat terrain of the Lichtenburg area. The side slopes for earth and reno mattress lined channels are 1V:3H (JG Afrika, Preliminary SWMP, 2022).

For the purposes of road crossings five culverts were designed of which four are box-shaped culverts and one is pipe shaped. The culverts were designed to accommodate 1 in 50-year flood peaks ranging from 0.14 m^3/s to 0.5 m^3/s similar to the flood peaks accommodated by the channels (JG Afrika, Preliminary SWMP, 2022).

In order to maintain consistency across the site, and for ease of construction, the cross-sectional shape of the stormwater channels has been kept consistent (for each type of channel lining), with the exception of the concrete lined channels where two cross-sectional profiles have been recommended (JG Afrika, Preliminary SWMP, 2022).

For grass lined channels, the channels have also been designed in a trapezoidal shape, with side slopes of 1V:3H being used. This is typically the maximum side slope used for grass lined channels, as recommended by the Drainage Manual (SANRAL, 2013). With side steeper than 1V:3H there is increased possibility for erosion and slope instability (JG Afrika, Preliminary SWMP, 2022).

Some sections of the grass lined channels on the Tswana Limestone Quarry are lined with reno-mattresses. This is to provide erosion protection and typically the profile of the reno-mattress lined sections follows that of the grass lined sections of channels (JG Afrika, Preliminary SWMP, 2022).

As per the Drainage Manual (SANRAL, 2013), the minimum allowable slope for a concrete lined channel is 0.25%. This is recognised as being an extremely gradual slope for a channel and has only been used where completely necessary. As the Lichtenburg area is particularly flat, this slope has been used for a number of the channels. Typically, a slope of 0.5% and steeper has been targeted for the concrete lined channels (JG Afrika, Preliminary SWMP, 2022).

As a guideline, stormwater channels can increase in slope along the length of the channel, but it is preferred for the channels slopes not to decrease as this can lead to non-uniform flow and potentially a build-up of sediment. This principle has been followed in almost all cases, except where it becomes impractical or cannot be achieved due to limitations in the sites' topography (JG Afrika, Preliminary SWMP, 2022).

Due to the large plant and trucks travelling in and around the site, all road crossings have been designed as culverts. Open channels are typically preferred as they are easier to monitor and maintain, however, as a result of the depth of the channels crossing the roads and the required vertical alignments to ensure no issues are encountered by the vehicles, the channels would become excessively wide and lose their cost efficiency (JG Afrika, Preliminary SWMP, 2022).

Therefore, culverts have been used instead. These are typically box culverts which require less cover above the culvert, and therefore (at least in this case), prevent unnecessary changes in the slope of the channels. As per the Department of Transport typical sections and guidelines, a minimum cover of 300 mm has been maintained as an

absolute minimum above all box culverts on the site. Generally, this minimum is well surpassed (JG Afrika, Preliminary SWMP, 2022).

It is anticipated that openings for culverts under existing dirt roads would be done by conventional trenching ('open excavation') and existing concrete road surfaces would be saw cut prior to excavation for culvert pipes/ box culvert units. Allowances have been made within the preliminary design costing for construction of all required culverts. Detailed specifications, construction level detailing and further refined costing for culverts will be done during detailed design (JG Afrika, Preliminary SWMP, 2022).

The SWMP proposed the inclusion of five stormwater channels for the Lafarge Tswana Limestone Quarry (LTQ) site, channels A through to E. Four of the five channels are interconnected (channels A to D), whereas channel E is independent and discharges into an existing dam (JG Afrika, Preliminary SWMP, 2022). The proposed layout of the channels can be seen in **Figure 10** below, as taken from the SWMP.

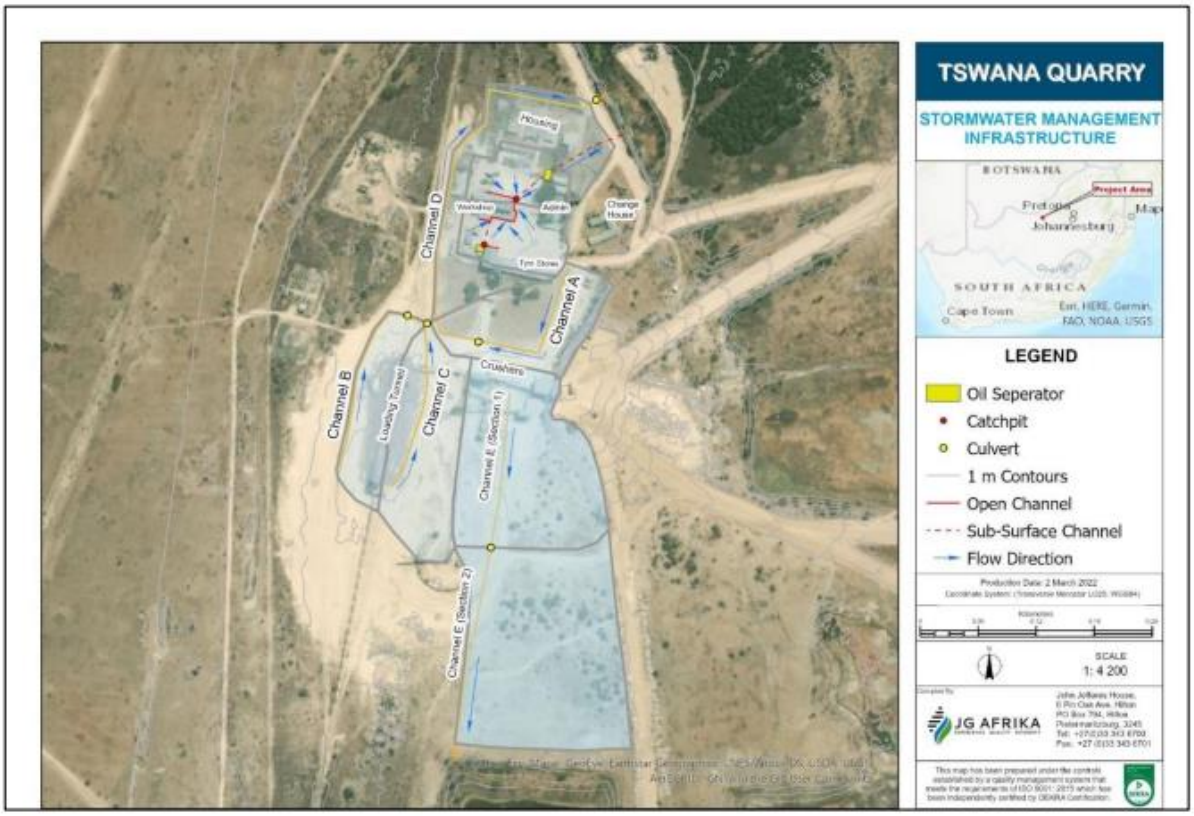

Figure 10: Proposed Stormwater Management Infrastructure

The contributing catchment areas (also indicated in **Figure 9** above), design rainfall depths and required capacity, based on the 1:50 year return period flood peak, for the channels as taken from the SWMP. The selection of concrete channel lining was in order to assist with maintenance and the transport of sediment which is often contained within the stormwater runoff (JG Afrika, Preliminary SWMP, 2022).

Additionally, due to the flat topography of the quarry site it was necessary to reduce the slopes of the channels to an absolute minimum of 0.25% in some areas, which was necessary in order to prevent excessive channel depths and large top widths. In total the site requires approximately 1.14 km of concrete lined channel, 189 m of grass lined channel, with a short section (32 m in total) of reno-mattress lining on the channel at the start and end of the grass lined sections to provide protection against erosion, particularly at the end of the channel where the slope increases as the channel discharges into the dam. Five culverts are required to convey the water beneath roads and railways (JG Afrika, Preliminary SWMP, 2022).

4.5.2 Stormwater Management Plan Revision 01

JG Afrika (Pty) Ltd were appointed by Lafarge Industries South Africa (Pty) Ltd to undertake a stormwater management plan (SWMP) and General Notice 704 (GN704) audit for the Lafarge Tswana Limestone Quarry. The Stormwater Management Plan is largely based on the findings of the General Notice 704 and Stormwater Management study undertaken in 2019. Refer to **Figure 11** below for the Tswana Limestone Quarry Site Plan. The full report is attached in **Appendix 20** and summarised below.

Section 26 (1) of the NWA (Act No. 36 of 1998) provides for the development of regulations that:

- ✓ Require that the use of incoming and discharging water from a water resource 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.

GN704 (Government Gazette 20118, 4 June 1999) was drawn up to address these issues in relation to mining activities. A summary of the principal conditions from GN704, upon which the proposed SWMP is based, includes:

- ✓ **Condition 4, which describes the location of infrastructure and mining activities**. Any residue deposit, dam, reservoir, together with any associated structure must not be located within the 1:100-year floodline or within 100m of any watercourse or borehole,
- ✓ **Condition 6, which 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, which 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.

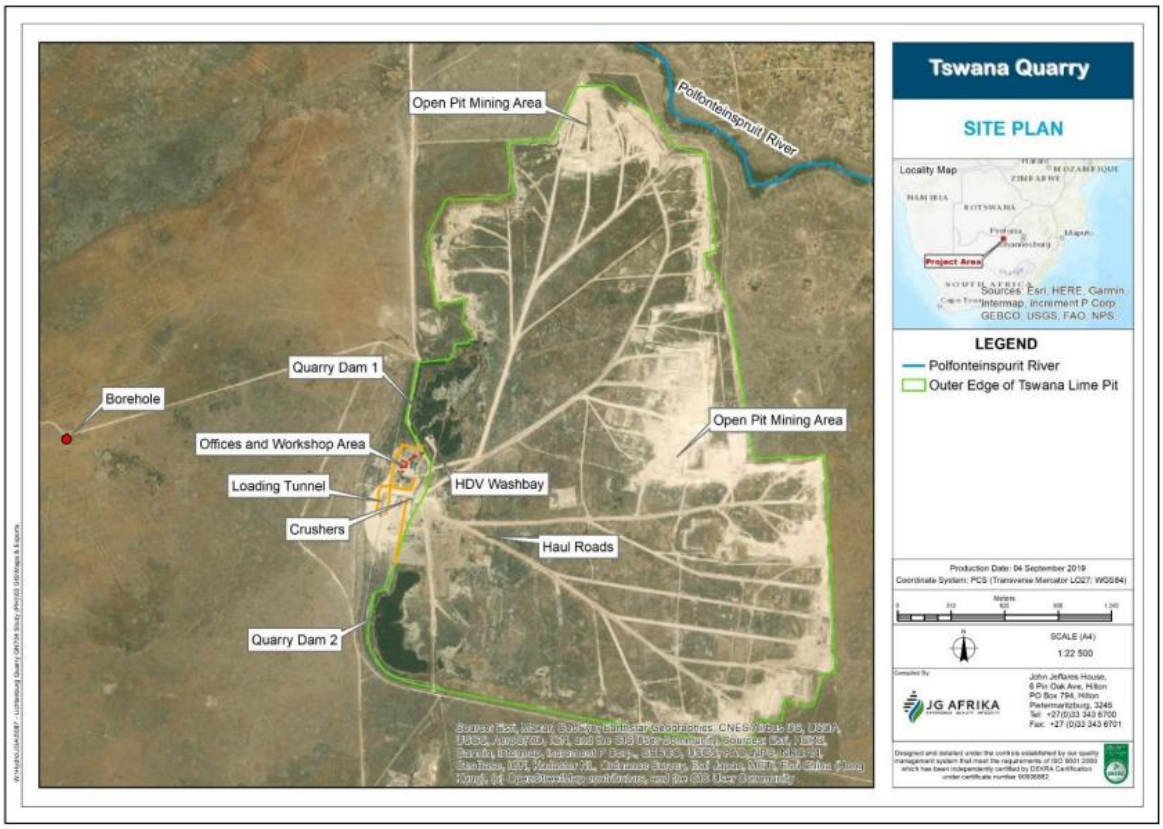

Figure 11: Tswana Quarry Site Plan

In order for the SWMP to be compliant with statutory requirements, the sizing of the stormwater management infrastructure was assessed based on the 1:50 year return period storm event. For this purpose, the Rational Method was used to calculate peak discharge values, used in the sizing of the stormwater infrastructure (i.e. diversion berms and channels) (JG Afrika, SWMP, 2022).

The Tswana Limestone Quarry site is characterized by a very flat topography, particularly in the area of the crushers, offices and workshop. This has resulted in flooding/pooling of stormwater runoff in a number of areas. Due to the low flow velocities associated with flat channels, sediment deposition in stormwater channels is an issue identified at the site (JG Afrika, SWMP, 2022).

It was noted during the site assessment that sources of hydrocarbon contamination are generally contained in the immediate vicinity of the potential source of contamination (i.e., the diesel tank is bunded, there are oil separators to separate out hydrocarbons from water emanating from the service bay, the workshop area is roofed and any sources of hydrocarbons in this area are bunded) (JG Afrika, SWMP, 2022).

Two oil separators were identified during the site assessment. These included the oil separator located adjacent to the Service Bay, and the one located to the northeast of the Workshop Area. Stormwater emanating from the Workshop Area (and therefore through the oil separator) reports to the Quarry Sump 1 located to the northeast of the workshop area (JG Afrika, SWMP, 2022).

It was noted that the vehicle Wash Bay is located within the Quarry pit, therefore water used for washing purposes is recycled through the sump. The Tswana Quarry pit and associated four sumps are endorheic (there are no surface water discharge points). During the site assessment, no signs of hydrocarbon contamination were noted in the vicinity of the wash bay or along the banks of the quarry sumps (JG Afrika, SWMP, 2022).

The main concern from a GN704 requirement perspective relates to the capacity of the stormwater management infrastructure, particularly considering the issues surrounding sedimentation of the stormwater channels. In order to reduce the likelihood of flooding/pooling of water in areas associated with the quarry (i.e., the crusher area) it is recommended that regular maintenance (which includes excavation of sediment) of the stormwater infrastructure is implemented. It was also noted that there were a number of areas where sediment build-up had occurred due to spillages from conveyor belts or similar. It is recommended that these areas are cleared prior to the sediment being eroded and deposited in the stormwater channels (JG Afrika, SWMP, 2022).

Due to the extremely flat nature of the project site, no clean stormwater diversion requirements were identified during the site assessment. The current stormwater channels were mainly identified in the vicinity of the workshop area (JG Afrika, SWMP, 2022).

Clean stormwater is diverted away from the quarry and runoff from within the quarry is contained. The Quarry Dams 1 and 2 have enough capacity to contain the 1:50yr 24 hr storm. This was verified by preparing a water balance report for the dams (JG Afrika, SWMP, 2022).

Clean and dirty water separation and compliance with Regulation 704 of the National Water Act will be upheld. Specific stormwater management measures at the existing plant are discussed below. The following recommendations can be made:

- In order to reduce the likelihood of flooding/pooling of water in areas associated with the quarry (i.e., the crusher area) several stormwater channels are recommended to be constructed.
- It is recommended that a main stormwater drainage channel framework be installed as per the layout in **Figure 7** and be integrated into the existing channel system to collect and divert dirty water runoff and prevent any such water from escaping beyond the facility outer boundaries. These channels were sized based on the 1:50 year design flood event, in accordance with GN704 requirements.
- The topographic fall of the drainage channels towards the ‘quarry dam pump house’ must not exceed 1:100m if possible, in order to prevent significant flow velocity build-up.

- It is recommended that regular maintenance (which includes excavation of sediment) of the stormwater infrastructure is implemented. The requirement for regular maintenance is largely as a result of the flat topography of the project site.
- The detailed design layout and measurement parameters of the main stormwater drainage channel framework must be determined by a suitably qualified engineer.
- The main stormwater drainage channel framework is to be adequately lined internally to prevent channel erosion and seepage.
- Silt catchment infrastructure must be installed in order to collect undesired surface materials which are being accumulated in the runoff water and prevent them from leaving the facility footprint.
- The main stormwater drainage channel framework and silt catchment infrastructure is to be adequately maintained and regularly cleaned out as and when necessary.
- Adequate bunding of stockpiles, chemical and hydrocarbons storage areas must be implemented to prevent wash off and accidental exposure or spillages.
- An adequate dust monitoring and management plan must be implemented to manage and reduce undesired dust emissions from the stockpiles and facility which could potentially contaminate and decrease surface water runoff quality (JG Afrika, Preliminary SWMP, 2022).

5. POLICY, REGULATORY FRAMEWORK AND WATER USE APPLIED FOR

5.1 Policy and Regulatory Framework

The NWA is a legal framework for the effective and sustainable management of water resources in South Africa. A Water Use Licence/Authorisation is a legislative process governed by the DWS for the licence/authorisation of all water uses defined in section 21 of the National Water Act, 1998 (Act No 36 of 1998) (NWA).

Therefore, a Water Use Authorisation Application (WUA) must be submitted to the Department of Water and Sanitation (DWS) in terms of Section 21 (a), (b), (c), (i), (f), (g) and (j) in accordance with the National Water Act 1998 (Act No. 36 of 1998) (NWA).

5.2 Water Uses Applied for

5.2.1 Water Uses Applied for the Tswana Limestone Quarry

Table 11: Water uses applied for the existing developed infrastructure

Water use(s)	Watercourse	Purpose (Activity)	Volume (m^3/a) / Dimensions / Crossing distance	Co-ordinates	Property Description	Property Owner
Section 21(a)	Groundwater from Borehole 1	Water abstracted from the borehole to supply water to two Jojo tanks (Domestic and process water use) However, drinking water is bought and not used from the borehole.	25 769 m^3 /annum	26° 4'34.26"S 25°46'49.14"E	Land Parcel 46 of the Major Region IO	Department of Rural Development & Land Reform
Section 21 (b)	Quarry Sump 1 / Mine Pit Wetland (W1)	Captures stormwater runoff from the workshop, administrative buildings, and wash bay into the sump. Water used for dust suppression will be collected by a truck.	480 000m^3	26° 04' 28.64"S 25°48' 08.43"E	Land Parcel 46 of the Major Region IO	Department of Rural Development & Land Reform
Section 21 (g)	Tswana Quarry Sump 1	Limestone Stockpiles Storm water runoff from workshop, administrative buildings, and water from wash bay used as dust suppression at crushing plant and a long-haul road	24 528 m^3/annum (Dust suppression at crushers) 1 681 m^3/annum (Tankers dust suppression on roads)	26° 07' 99.20" S 25°80' 02.90" E	Land Parcel 46 of the Major Region IO	Department of Rural Development & Land Reform

Water use(s)	Watercourse	Purpose (Activity)	Volume (m^3/a) / Dimensions / Crossing distance	Co-ordinates	Property Description	Property Owner
Section 21 (g)	Tswana Quarry Sump 1	Tswana Quarry - Loading Tunnel, Limestone stockpile	8000/tons	26° 04' 80.70"S 25°47' 91.70"E	Land Parcel 46 of the Major Region IO	Department of Rural Development & Land Reform
Section 21(c)	Tswana Quarry (Polfonteinspruit.)	Discharging wastewater into the Polfonteinspruit.	700 000 m^3/ annum	26° 03' 11.94"S 25° 48' 13.09"E	Land Parcel 46 of the Major Region IO	Department of Rural Development & Land Reform
Section 21 (i)	Tswana Quarry (Polfonteinspruit)	Discharging wastewater into the Polfonteinspruit.	700 000 m^3/ annum	26° 03' 11.94"S 25° 48' 13.09"E	Land Parcel 46 of the Major Region IO	Department of Rural Development & Land Reform
Section 21 (f)	Tswana Quarry (Polfonteinspruit).	Discharging wastewater into the Polfonteinspruit.	700 000 m^3/ annum	26° 03' 11.94"S 25°48' 13.09"E	Land Parcel 46 of the Major Region IO	Department of Rural Development & Land Reform
Section 21 (j)	Tswana Quarry	Sump 1 Dust suppression along haul roads/crushing plant	1 681.66 m^3/year	26° 04' 20.53"S 25°48' 17.14"E	Land Parcel 46 of the Major Region IO	Department of Rural Development & Land Reform

5.3 Other Authorisations

- Lafarge Mining South Africa Pty (Ltd) is in possession of a mining right (reference number: NW30/5/1/2/2/454MR), for the Tswana Limestone Quarry, which was issued by the Department of Mineral Resources on the 8th March 2013 **(**refer to **Appendix 25).**
- Lafarge Mining is also in possession of a water use certificate (Registration number: 26019718) which it obtained in 2006 from the Department of Water Affair and Forestry. Registered activities are listed below:
    - Section 21 (a) - Taking water from a water resource (For Tswana industrial water and drinking water).
    - Section 21 (b) - Storing water (For agricultural irrigation, and industry).

6. IMPACTS OF ACTIVITIES ON WATER RESOURCES AND MITIGATION MEASURES

Table 12: Impacts of mining activities on water resources and mitigation measures

Water Use	Activity	Operation	
		Impacts	**Mitigation Measures**
Section 21 (a)	**During operation phase** • Abstraction of groundwater and surface water for uses in the mine such as dust suppression and vehicle washing at the Wash Bay.	**Changes in Catchment Water Resources** *Nature of potential impact* ○ Abstraction of groundwater and surface water. ○ Reduction of groundwater quantity, lowering of groundwater level. ○ Interference with minimum flow requirements. ○ Limiting Flow to the downstream environment. ○ Disturbance of natural flow regime. ○ Lowered water surface. ○ Loss of wetland space.	• Mitigation may be achieved by means of drawing water from different mine pits in a rotational fashion. • Some measure of mitigation may be achieved through leaving worked out pits in a condition that will hold water at least some of the time so that wetlands may have some change of becoming established.
Section 21 (c), (i), (g), (f) and (j)	**During operation phase** • Tswana Quarry mining operation. • Clearance of vegetation. • Stripping and stockpile of topsoil. • Earth moving activities. • Blasting. • Excavation. • Crushing, screening, and production lines. • Stockpiling and transporting of materials via rails. • Operation of stormwater infrastructure..	**Erosion and sedimentation** *Nature of potential impact* ○ Loss of topsoil. ○ Loss of soil structure ○ Increased sediment inputs. ○ Increase in on-site and off-site erosion. ○ Increased wind and water erosion. ○ Siltation. ○ Increased silt load. ○ Compaction of soils. ○ Decrease in the productivity of land. ○ Increased stormwater runoff volume and velocity.	• Areas earmarked for mining operation must be securely delineated to ensure a controlled footprint area. Activity outside of the delineated work footprint is STRICTLY prohibited. • Rehabilitation must take place continuously to ensure that bare surfaces are rehabilitated as soon as practically possible. • Run off control measures must be provided at rehabilitated areas and roads where necessary. • Roads must be maintained regularly. • Storm water management techniques must be designed and placed correctly to ensure that storm water runoff is controlled and channelled effectively to prevent soil erosion and sedimentation. • All stormwater runoff from areas likely to be a source of sediment contamination must be directed to a sediment trap, where sediment will be deposited rather than entering into the receiving environment. • Erosion protection measures must be installed at all pipe culverts or storm water drainage pipe outlets located along the routes. This is a requirement in addition to velocity control measures e.g., Berms, sandbags, reno mattress and hessian sheets, erosion control blankets, silt fences, geotextiles such as soil cells and retention or replacement of vegetation. • Cut and fill slopes stabilisation will be required to avoid erosion. This may be achieved through effective use of erosion control measures (gabions). • Water must not be allowed to flow down cut or fill slopes without adequate soil erosion protection in place. • Attenuation of stormwater from the road is important to control the velocity of runoff towards the natural environment. i.e., stormwater must not be deposited directly into any wetlands. • Water spreaders must be used to reduce the velocity of flow. • Energy dissipaters must be constructed at any surface water outflow points. • Install sediment barriers to prevent sediment flow into the natural watercourse. • The parking lot design must incorporate various soft engineering features to improve drainage. This must include areas draining into swales with planted gardens (trees to provide shade), perforated parking bays or areas, etc. • Areas sensitive to erosion must be identified and monitored to ensure that erosion risks are minimised. • Any erosion features must be stabilised following dilapidation of stormwater infrastructure with soft engineering (preferred over hard engineering options) such

Water Use	Activity	Operation	
		Impacts	**Mitigation Measures**
			as re-sloping and stabilising. Where risks are high, unstable/eroding banks must be reinforced/stabilised using appropriate engineering works such as gabions/rock pack/geotextile bags.
Section 21 (c), (i), (g), (f) and (j)	**During operation phase** •Tswana Quarry mining operation. •Clearance of vegetation. •Stripping of topsoil. •Earth moving activities. •Blasting. •Excavation. •Crushing, screening, and production lines. •Stockpiling and transporting of materials via rails. Operation of stormwater infrastructure.	**Increased impervious area (Hardened surfaces)** *Nature of potential impact* ○ Change in volume and velocity of stormwater runoff. ○ Drainage patterns change due to increased hardened surfaces. ○ Changes in flood hydrology. ○ Disturbance of surface drainage patterns. ○ Possible input of pathogens ○ Alterations to flow volumes and patterns. ○ Change in the hydrological and geomorphological dynamics of the natural environment. ○ Impeding the flow of water.	• Attenuation of stormwater from the road is important to control the velocity of runoff towards the natural environment. • Address increased runoff volumes at source. • A disturbed area as a result of maintenance works must be rehabilitated as soon as maintenance in an area is complete or near complete. • The revegetation of the exposed soil must be undertaken once construction activities have ceased. • The grass must be allowed to lengthen and thicken naturally to facilitate reduction in runoff velocity and volume, increase sediment deposition within the buffer zone and increase infiltration of stormwater. • Stockpiled topsoil must be used for rehabilitation and placed in original profiles following completion of activities. Finished soil levels must be graded to match the natural topography of the site. All stripped topsoil MUST be appropriately used on the site. • The design and use of SUDS which includes, but is not limited to, swales, filter strips and infiltration trenches that capture runoff, filter out the pollutants and allow for the diffuse release of water into the receiving environment is paramount to limiting the long-term effects of an increase in hardened surfaces adjacent to the watercourse areas. • It is important to maintain any SUDS feature that are installed on the site. Un-maintained SUDS features may eventually fail operationally as a result of sediment build up and the effect this has on vegetation growth. • The use of SUDS features can also be used to remediate the natural environment that will be impacted through allowing for erosion control, attenuation of water which will promote vegetation growth in these areas.
Section 21 (b), (c), (i), (g), (f) and (j)	**During operation phase** •Tswana Quarry mining operation. •Clearance of vegetation. •Stripping of topsoil. •Earth moving activities. •Blasting. •Excavation. •Crushing, screening, and production lines. •Stockpiling and transporting of materials via rails. • Operation of stormwater infrastructure.	**Potential pollution on surface water and groundwater** *Nature of potential impact* ○ Discharging waste or contaminated water (Hydrocarbon spills, pit dewatering and sewage spills). ○ Water pollution. ○ Reduction of surface water quality. ○ Reduction in Catchment Water Quality. ○ Potential impact on wetlands and groundwater as a result of on-site accidental fuel spills and leaks or as a result of leachate from waste disposal areas and infiltration through soil of dirty water. ○ Mismanagement of waste and pollutants like hydrocarbons, solid waste and hazardous substances resulting in these substances entering and polluting sensitive natural environments either directly through surface runoff, or subsurface water movement. ○ Potential pollution of wetlands and soil. ○ Contamination of soil and surface water resource. ○ Potential impact on wetlands and groundwater. ○ Increase in first flush effect of the pollutants into adjacent natural environment. ○ Contamination of water resources through toxic organic and/or heavy metals from fuel storage, chemicals stored on site.	• Clean and dirty water separation and compliance with Regulation 704 of the National Water Act must be adhered to. • Provision of bunded facilities: all oil and fuel storage facilities are bunded as specified by government notice No. 704. • MSDS' for hydrocarbon materials must be easily accessible on site and the relevant personnel are to be familiar with their content • The water quality must be monitored twice a year (April and October). • A chemical analysis must be done on every sample and a report submitted monthly to the Department of Water and Sanitation. • Hazardous chemical substances must be stored within a bunded and roofed area to prevent spills from occurring directly on the ground / soil and the ingress of stormwater ○ "Watertight" bund to have a volume equal to 1.5 times the stored volume. ○ Spills in the bund to be recorded including photographs. • Handling of hazardous chemical substances (i.e., re-fuelling, pouring of oil etc.) must be done on a lipped spill tray and must not take place within 100m of wetlands areas or watercourses. • Spillages of fuels, oils and other potentially harmful chemicals must be cleaned up immediately and contaminants properly drained and disposed of using permitted solid/hazardous waste facilities (not to be disposed of within the natural

Water Use	Activity	Operation	
		Impacts	Mitigation Measures
			environment). Any contaminated soil must be removed, and the affected area rehabilitated immediately – consult with relevant I specialists if spills occur. • Machinery must be regularly (at least daily) checked for oil leaks. During periods where the machinery is not in use, drip trays should be placed under the machinery to contain any spillages. • The sizing and positioning of "dirty" stormwater channels and recommendations on bunding around areas containing potential for surface water contamination must be designed such that: o Dirty stormwater channels and bunding walls will contain runoff generated during the 1:50 year storm event, as per the requirements stipulated in General Notice 704 (GN704) of the National Water Act (Act 36 of 1998). o "Clean" stormwater runoff diversion infrastructure will be sized to divert runoff generated during the 1:50 year storm event as per the GN704 requirements. • Areas that may result in the contamination to groundwater must be sufficiently lined to meet with regulatory requirements. • Strict management and disposal of waste must occur during the lifespan of the mining operation. • All domestic waste must be regularly removed from the quarry site on a regular basis and dumped in appropriate waste handling facilities. • Strict housekeeping practices are to be implemented. • Regular collection of domestic waste and disposal at a suitable permitted waste disposal site. • The mining operation site must be kept clean on a daily basis and all litter must be collected and disposed of in waste bins on site. • All waste generated during construction is to be disposed of as per the EMPr attached in **Appendix 13**. • Berms upslope and downslope of areas likely to be a source of sediment contamination must be implemented. Upslope berms will ensure limited surface flows through areas associated with sediment loss. Downslope berms will ensure that sediments eroded from areas associated with sediment loss will be trapped, therefore reducing the impact to the downstream receiving environment. It is recommended that the berms are constructed out of a non-erodible material. • A collection and disposal strategy must be implemented to ensure that waste is removed at least twice per month and taken to a suitably permitted landfill site. • Domestic / organic waste to be removed on a weekly basis. • Hazardous waste must be stored separately and disposed of at a suitably permitted hazardous landfill site. • Long-term sewage containment management and/or treatment facilities implemented at the quarry must be sufficiently sized, such that spillages of untreated sewage to the environment are unlikely. • All machinery and equipment must be inspected regularly for faults and possible leaks and must have drip trays to contain oil leakage, these must be serviced off-site. • All equipment found to be leaking oil, hydraulic fluid, or fuel to be removed from site immediately. • Waste bins must be secured and have lids to prevent litter from being blown and spread over the area. • Separation and recycling of different waste materials must be undertaken where possible.

Water Use	Activity	Operation	
		Impacts	**Mitigation Measures**
			• Regular quality monitoring of waste before discharge. • Compliance to appropriate construction standards of the waste storing and drainage systems. • Implementation of best practice procedures for storage and handling hazardous substances. • Immediately report significant spillages and initiate an environmental site assessment for risk assessment and remediation. • Fuels and hydrocarbon stores must be lined and bunded such that spills from the store areas will not enter the receiving environment. • Spill kits must be available on site to ensure that any fuel or oil spills are cleaned-up and discarded correctly. • Storm water outlet structures and attenuation ponds must be maintained and inspected on a monthly basis to ensure that littler is removed and correctly disposed of (at a permitted landfill site). • All disturbed soils must be rehabilitated with local plant species to ensure that alien vegetation does not invade the area. • All soils compacted as a result of construction activities must be ripped and profiled. • Water on the road must be diverted away to minimise the amount of water running directly from the road into wetlands. Such drainage must lead the water to vegetated filter strips, which remove particles and contaminants from the water. • Regular maintenance and checking of the infrastructure such as surface water drainage, road surface and kerbing must however take place over the lifespan of the project. • Regular checking the integrity of underground infrastructures (sewage and stormwater drains and manholes) for cracks identification and possible blockages. • The likelihood of dust being produced must be reduced. Dust suppression methods include: o Limiting the speed of all mining equipment/vehicles to 40 km/h on the internal haul roads. o Site management are to ensure denuded areas (dust source) are kept to a minimum. o Strips of used conveyor belts can be attached to the drop end of the crusher plant where crushed material falls onto the stockpiles. This will lessen the distribution of fine particles from the minerals. o Compacted dust collected by the crusher plant should be cleaned weekly to eliminate it as a dust source. • Water downstream of quarry must be monitored to ensure no degradation of water quality occurs.
Section 21 ((b), (c), (i), (g), (f) and (j)	**During operation phase** • Tswana Quarry mining operation. • Clearance of vegetation. • Stripping of topsoil. • Earth moving activities. • Blasting. • Excavation. • Crushing, screening, and production lines. • Stockpiling and transporting of materials via rails.	**Proliferation of alien invasive vegetation** *Nature of potential impact* o Encroachment of invasive species into disturbed areas o Disturbance of indigenous vegetation. o Alteration of habitat structure. o Lower biodiversity (both number and quality of species). o Change nutrient cycling and productivity. o Increased water usage. o Modify food webs. o Destruction of indigenous species.	• An alien invasive management programme must be incorporated into EMPr and must be implemented throughout the operational and rehabilitation phases of the development to prevent its introduction and spread, as per the legislative requirements specified under the Conservation of Agricultural Resources Act, 1983 amended in 2001 and the National Environmental Management: Biodiversity Act 2004 (Act No, 10 of 2004). • Ongoing invasive alien plant control must be undertaken and implemented for the clearing/eradication of alien species during the operational phase of the quarry and particularly in the disturbed areas as these areas could quickly be colonised by invasive alien species.

Water Use	Activity	Operation	
		Impacts	Mitigation Measures
	• Operation of stormwater infrastructure.		• Re-instate indigenous vegetation (grasses and indigenous trees) in disturbed areas as soon as practically possible so as to attain environmental integrity of the area. • All disturbed soils must be stabilised with a suitable indigenous grass seed mix and ongoing weed control is undertaken. • The quarry must be rehabilitated as specified in the Rehabilitation Plan. • Minimise disturbance during setting out and site establishment. • All areas of disturbance resulting from the implementation of the mining operation must be cleared of alien invasive vegetation in accordance with Section 28 of the NEMA (Duty of Care). • A landscape rehabilitation plan must be prepared for approval by the ECO. • All areas disturbed must be rehabilitated to an acceptable state and must be monitored afterwards to prevent these areas from being colonised by alien invasive species.

7. ENVIRONMENTAL MANAGEMENT PROGRAMME

The objectives of the environmental management plan (EMP) are to:

- Ensure compliance with environmental legislation;
- Manage identified impacts;
- Provide a reference by which future performance can be audited.

In accordance with the Mineral and Petroleum Resources Development Act No 28 of 2002 (MPRDA), an amendment to the EMPR 2001 was required for the proposed modifications at the Tswana Limestone Quarry. The amended EMPR was undertaken by SRK Consulting in 2006 (refer to **Appendix 13**). Key features of this plan are summarized below:

- A water monitoring protocol (surface and ground) will be developed for the Tswana Limestone Quarry.
- Discussions will be held with the Ditsobotla Local Municipality regarding the additional abstraction of groundwater and the monitoring measures that Lafarge is implementing. The Ditsobotla Local Municipality needs to agree to the additional abstraction of groundwater.
- Continuous monitoring of stack emissions (Dust, NO2) needs to be undertaken at the plant and alarms triggered when emission limits set by the Chief Air Pollution Control Officer (CAPCO) are exceeded. Remedial action then needs to be taken to reduce, if not eliminate, potential environmental impacts depending on the situation and levels of emissions during the operational phase. This will include an emergency warning and response system for on-site personnel.
- A dust fallout monitoring network will be established within a 1-3 km radius of the quarry during the operational phase so as to determine 'hot spot' areas. This should include establishing baseline levels and identifying other sources of dust in the area.
- Blasting will not be undertaken when wind speeds exceed 5.4 m/s (this trigger for wind speed will need to be confirmed by site specific measurements) during the operational phase.
- Further detailed research will be undertaken into three historical settlements which have been identified in the vicinity of the Tswana Quarry and their heritage values. Discussions will also be held with the Bodibe people regarding the excavation/preservation of these.
- A communication plan will be developed for the Bodibe Community so as to ensure that relations between Lafarge and the Bodibe people improves and are built on a relationship of trust and mutual respect. This plan will need to be implemented for the life of the operation, with early planning and implementation being a pre-requisite for the successful continuation of operations at the Quarry. Key aspects that need to be addressed in these communications are:
    - heritage resources and their protection relocation
    - noise and air quality impacts
    - impacts of blasting
    - access to the quarry and grazing land
    - issues from previous operations: compensation and relocation
    - royalties and social investment
    - the development of effective communication structures

No fatal flaws were identified at the Tswana Limestone Quarry, however, there are impacts associated with the proposed operations which were identified that could constitute fatal flaws if not appropriately mitigated. These are the impact on heritage resources and the relationship that Lafarge has with the community of Bodibe. These impacts can be appropriately managed as suggested in the EMPR (refer to **Appendix 13**).

8. REHABILITATION PLAN

A site rehabilitation plan has been compiled and must be implemented to address the negative impacts that might occur and to return the receiving environment to an acceptable level of integrity. The site rehabilitation plan has been incorporated into the EMPr attached in **Appendix 13**. The proposed management / rehabilitation measures are as follows:

- ✓ Contamination of wetlands through spillage of hydrocarbons such as fuel and oils. This impact is one which should not happen and so is in the avoid/prevent level of the hierarchy,
- ✓ Future loss of wetlands as a result of mining activities. This impact is unavoidable and is in the repair/restore level of the hierarchy,
- ✓ Abstraction of water for uses in the mine such as dust suppression. This impact is in the minimise level of the hierarchy,
- ✓ Grazing by livestock at site W3 is reducing the plant biomass there and is probably also reducing plant diversity. This impact, although taking place in the study area, is not the responsibility of Lafarge. It would belong to the minimise level of the hierarchy, and
- ✓ Various alien invaders have infested the site area including *Lantana camara*, *Rubus cunefolius* and *Solanum mauritianum.* The removal of alien invasive vegetation must be undertaken prior to the re-vegetation of disturbed areas and landscaping. The control needed to eradicate the specific species is provided in detail in the EMPr attached in **Appendix 13**.

Since the Polfonteinspruit, which is a natural feature of the landscape, is outside the mining area, it is not expected that the operators will result in mine-related impacts. The mine appears to be having little effect on the Polfonteinspruit despite being within 100 m of the delineated boundary in places. It is therefore recommended that the edge of the workings be stabilized and grassed in those areas. It is also recommended that, should the mining right area ever be expanded in the future, that it not be closer than 100 m from the delineated edge of the Polfonteinspruit at any point. In this way a buffer strip may be created on the southern side of the spruit.

Expansion of the built-up area of Bodibe in a direction toward the Polfonteinspruit may happen in the future but for the moment the area is held open for livestock grazing and so some buffering is happening. It is not known if a dry climatic spell might lead to the area once again being cultivated for food crops but nothing can be done about it for the present.

Financial Provision

The Department of Mineral Resources requires the holders of mining rights or mining permits to annually assess his or her environmental liability and increase his or her financial provision to the satisfaction of the Minister. This requirement ensures that the holder of the mining permit or mining right has sufficient funds to cover any environmental liabilities at any time, or during the mine closure. Costs are calculated for any concurrent rehabilitation; mitigation measures; and monitoring which may be required during pre-closure, closure and post closure of the mine.

The financial provisions for 2021 (refer to **Appendix 24**) for the Tswana Limestone Quarry were determined from the EMPr (refer to **Appendix 13**) and an approved financial guarantee provided by a financial institution (refer to **Appendix 24**).

9. MONITORING AND CONTROL

An independent Environmental Control Officer (ECO) must be appointed by the authorisation holder or Applicant to ensure that the conditions as stipulated in the Water Use Authorisation (WUA) and the approved EMPr are adhered to (Refer to **Appendix 13**).

The authorisation holder or Applicant is obliged to adhere to the requirements of Section 28 of the NEMA (Duty of Care and Remediation of Environmental Damage) which states that: "(1) *Every person who causes has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is*

authorised by law or cannot be reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment".

9.1 Surface Water Monitoring

The monitoring programme must be designed to enable the detection of potential negative impacts brought about by the Tswana quarry.

It is recommended that water sampling is undertaken in the vicinity of the site located to the east (downstream) of the quarry area for monitoring purposes. In addition to this, routine water quality monitoring must be completed within this sampling area at the specified GPS coordinates twice a year (April and October) during the operational phase.

A chemical analysis must be done on every sample and a report submitted monthly to the Department of Water and Sanitation.

9.2 Groundwater Monitoring

The groundwater monitoring plan is required to monitor the quarry's impacts on groundwater quality. It is recommended that additional borehole monitoring be carried out either on a quarterly or bi-annual basis. The water must be tested for pH, EC, TDS, macro nutrients and microbial organisms and hydrocarbon which may arise from the fuels and oil stored on site. The groundwater monitoring plan which has been included in **Appendix 17** must be carried out as follows:

I. Groundwater samples must be collected by-annually.
II. Groundwater samples must be tested for macro and micronutrients including microbial contamination.
III. If required, a hydrocarbon analysis must be done. This may only be considered if a hydrocarbon contamination event on site has occurred.
IV. Depending on the level and/or type of contamination identified, remedial procedures by the hydrogeological consultant must be followed.
V. The water sampling must be carried out following strict protocol so that cross contamination or contamination of water does not occur during the sampling phase. Sterilised sample bottles must be used, and these can be obtained from the analytical laboratory.
VI. Depending on the professional carrying out the work, sampling methods may vary, but it is imperative that sterile equipment be used. It is suggested that basic parameters such as pH and EC be recorded in the field.
VII. The water sample(s) must be kept cool. In this regard, it is suggested that a cooler box with ice brick be used for this purpose. A sampling data sheet must be completed for each sample taken and kept as document control for the work carried out.
VIII. Water samples must be submitted to a SANAS accredited laboratory for testing. A groundwater monitoring report must be compiled in line with the DWS guidelines (JG Afrika , Hydrological assessment, 2022).
IX. A geophysical survey should be completed to determine the best positions for drilling of monitoring boreholes.
X. At least two monitoring boreholes must be drilled in the vicinity of the project site. Depending on the subsurface structures the area just northeast and southeast of the project site should be explored for the drilling of the monitoring boreholes.
XI. The monitoring boreholes should be yield tested in order to obtain the necessary aquifer parameters like transmissivity and hydraulic conductivity for input in the calibration of the numerical groundwater flow and transport model.
XII. A numerical groundwater flow and transport model must be compiled and calibrated in order to determine the potential risk for contamination of the aquifer.
XIII. The monitoring boreholes should never be utilised for abstraction purposes.

10. RISK ASSESSMENT

It is shown that the risks arising from possible spillage or leakage of hydrocarbons, and from loss of wetlands from future mining activities are both rated as "**Moderate**" before any mitigatory measures are taken. While the risks associated with hydrocarbons can be managed and be significantly reduced or even avoided, any losses due to future mining cannot be remediated to any great extent. Such losses must be accepted but the following must be considered:

- ✓ Loss of wetland as a result of mining. The area is being operated under an authorisation and so the excavations are a part of the operator's core business and must be accepted as being inevitable,
- ✓ Toxicity of the mined material. The extracted limestone is non-hazardous and so will not lead to contamination or pollution of the area and the Polfonteinspruit which flows from it,
- ✓ Recovery of wetland sites. The mine pits will in the future fill with water to some extent as has already happened with the existing worked-out pits. These areas will develop wetland habitat as has happened before,
- ✓ Status of the wetlands. The wetlands in the mining area are, with one possible exception, artificial. In the distant future it is possible that they will all cease to exist but no time scale for such change can be provided.

It is to be noted that, although there has been mining activity at the site for some 40 years, the mine only approached to within 100 m of the delineated Polfonteinspruit channel in 2016. However, there appear to be no visible impacts on the Polfonteinspruit as a result of the incursion. The risk associated with the mine activities to the Polfonteinspruit is considered to be **Low**. Therefore, it is considered that, if the proposed mitigatory measures are applied, there are no new risks to the Polfonteinspruit system.

11. WATERCOURSE IMPACT REPORT

An environmental audit regarding water management was required as part of the water use licence application for the Tswana Limestone Quarry.

The assessment focused on compliance with legal requirements and the site's own systems and procedures, as well as on impacts with regards to watercourse characteristics namely surface flow, interflow, groundwater flow, water quality, geomorphology, habitat and biota. Site visits and document reviewing was conducted and information from recently conducted specialist studies were used to reach conclusions.

The following table describes the matters which require attention, at the Tswana Limestone Quarry, in respect of water and waste management.

Theme	Matter/Issue
Water Conservation and Water Demand Management	A water efficiency evaluation should be done, as a minimum, by skilled persons. Lafarge Quarries are located in an area where most of the users are dependent on groundwater as their sole source of supply, therefore water management is critical to minimise over abstraction from boreholes.
Water Use authorisations	Specialist studies to inform the water use licence application were reconducted, and the application will be submitted before the end of October 2022. An IWUL has not been issued yet. Water use strategies should be aligned after the approval of the IWUL and IWWMP with the EMPr and its amendments.
Management of possible risks to groundwater resources	According to the Geohydrological Study 2017, the aquifers in the Lichtenburg area are highly sensitive to pollution risks and over abstraction. The current groundwater monitoring network was assessed during the geohydrological assessment conducted in 2022 which included yield testing of boreholes and updating of the numeric and transport flow model.
Management of possible risks to surface water resources	The Polfonteinspruit runs next to the Tswana Quarry with a Wetland system in the Quarry. The Tswana Quarry wash bay samples reported high levels of TSS, soaps, oils, and greases, which confirms the non-effectiveness of the oil separator. Refurbishment is required

Compliance Audit to and Exemption required in terms of GN 704 of 4 June 1999	Lafarge appointed Greenmined/JG Afrika to undertake a compliance audit against the conditions of GN 704 of 4 June 1999 and the development of a Storm Water Management Plan for the Cement Plant and the Tswana Quarry.
Disposal of residue in underground or opencast areas	Classification was conducted by Enviroserv to verify whether residue disposed of into the Quarries and used as backfill may cause pollution.
Diversion of clean storm water from dirty areas and capacity of diversion structures	Berms were constructed around the Quarries at the active mining area,Tswana, to prevent clean storm water from entering the Quarry. Adequate pollution control and maintenance measures will be provided and implemented at critical pollution control equipment. The affected storm water system will be able to contain the 1:50 year flood event volume.
Capacity of the affected water system	A capacity assessment has been done at the Tswana Quarry, to identify the capacity required for affected water storage to contain affected water during normal operations up to 1:50 year flood event.
Inspection and maintenance on clean and affected water channels	Inspections and maintenance currently done on the clean and affected water systems will need to be expanded once the recommended infrastructure is built, in order to ensure proper operation of these systems.
Biodiversity Management	The Tswana Limestone Quarry lies within sensitive areas. A biodiversity assessment was updated in 2022. The updated biodiversity assessment is critical in the rehabilitation on closure planning, and future management of all identified sensitive areas and protected plants, species and ecosystems.
Weeds and invader plant management	Implementation of a detailed eradication and control plan for the identification of weeds and invader plants is needed.

According to the Watercourse Impact Audit Report (October 2022), Lafarge will need to commence implementation of the recommendations of the specialist studies and closing of the findings identified during the audit, so long as legal authorisation for implementation of the recommendations of the specialist studies and closing of the findings identified during the audit do not require authorisation. Please refer to **Appendix 22** for the full Water Impact Audit Report.

12. PUBLIC CONSULTATION

A pre-application meeting for the Water Use Authorisation/Licence Application process was held with the DWS Regional Office on the 23rd of January 2022. The pre-application meeting requirement record, and attendance register are attached in **Appendix 23**.

English and Tswana site notices were erected at strategic points in the vicinity of the proposed site (Itsoseng community health centre, Tswana Limestone Quarry, Itsoseng Police Station, and Taxi Rank) on the 29th of April 2022 to inform the surrounding local residents and other Interested and Affected Parties (I&APs) of the Tswana Limestone Quarry Activities (refer to **Appendix 23**). Registration and notification letters were also sent to inform stakeholders and I&AP's about the Tswana Quarry WULA on the 29th April 2022.

An advert was placed in a local newspaper namely, The Noordwester Newspaper, for English advertisement on 29th April 2022 (refer to **Appendix 23**).

A public meeting invite was circulated in June 2022. The meeting was held on the 28th June 2022 at the Mothlako Primary School. No comments were received (refer to **Appendix 23**).

The initial Public Participation Process of 60days was from the 29th April to the 24th June 2022, however, as per the DWS requirement letter dated 17th March 2022, specialist studies were still to be completed for the WULA Process for the Tswana Limestone Quarry. The specialist studies have now been completed and an email was circulated to all I&APs on the 18th October 2022 which can now be obtained from Greenmined Environmental (Pty) Ltd upon request or downloaded from the company website at https://www.greenmined.com/water-use-applications/ (refer to **Appendix 23**).

13. CONCLUSION AND RECOMMENDATIONS

Based on the information analysed in this report and supporting specialist studies, it is considered that there could be some concerns with the proposed mining operation from a hydrogeological perspective. Risks are generally assessed as moderate to low and with appropriate mitigation, potential impacts on surface and ground water resources are likely to be negligible. Thus, the Tswana Limestone Quarry operation may continue, provided that the recommendations provided in this report, wetland report, geohydrological report, geotechnical report and SWMP are adhered to. It is recommended that ongoing groundwater and surface water monitoring be carried out to identify any impact that may arise during the operational phase.

The operation of the mine has resulted in the creation of a number of artificial wetlands in an area that was previously almost entirely dry which have been classified as being Depression Wetlands. However, as further areas within the mining right area are opened up for mineral extraction many of these wetlands may be lost or will be changed from their present state into mine pit wetlands.

The Polfonteinspruit, which flows by the northern end of the mining right area, is severely degraded as a result of the channel having been used for agricultural or pastoral purposes in the past, and present ongoing excavation activities within it. The areas affected in this way are large and further impacts come from overgrazing of the area by livestock.

The mine would have little effect on the Polfonteinspruit despite being within 100 m of the delineated boundary in places provided that the edge of the mining operation footprint be stabilized and grassed, and that it is not closer than 100 m from the delineated edge of the Polfonteinspruit at any point.

Mitigations measures recommended in this IWWMP report and all specialist studies including rehabilitation plans to manage potentially significant impacts to surface and groundwater resources during the operation phase have been incorporated into an Environmental Management Programme (EMPr) for the proposed development. The successful implementation of these management objectives would be best achieved through enforcement and monitoring for compliance by an independent qualified/trained Environmental Control Officer (ECO).

14. MOTIVATION IN TERMS OF SECTION 27(1) OF THE NATIONAL WATER ACT, 1998

S27 (a) Existing Lawful Water Uses

An existing lawful water use licence refers to the use of water which has taken place anytime during a period of two years before the establishment of the National Water Act. Lafarge Industries Ltd has been operating for over 60 years. No existing lawful water uses apply to the Tswana Limestone Quarry, however a previous water use authorisation (Registration number: 26019718) exists. Registered activities are listed below:

- Section 21 (a) - Taking water from a water resource (For Tswana industrial water and drinking water).
- Section 21 (b) - Storing water (For agricultural irrigation, and industry).

In addition to the above-mentioned water uses, the following activities have been operational and are being applied for through a new Water Use License Application:

- Section 21 (a) of Act - Taking water from a water resource (one borehole to the west of the quarry used for domestic and processing).
- Section 21 (b) of Act – Storing water (Water stored in sump for dust suppression).
- Section 21 (c) of Act – Impeding of diverting the flow of water in a watercourse (Discharging water into the Polfonteinspruit).
- Section 21 (j) of Act - Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people (Dewatering operation located at Quarry Pit 1).
- Section 21 (f) of Act - Discharging waste or water containing waste in a water resource through a pipe, canal, sewer, sea outfall or other conduit (the discharging of stormwater to the Polfonteinspruit River).

- Section 21 (g) of Act - Disposing of waste in a manner which may detrimentally impact on a water resource (Stormwater runoff from the crushing plant area, stormwater runoff from workshops and administration buildings to Quarry Pit 1, limestone stockpiles).
- Section 21 (i) of Act – Altering the bed, banks, course or characteristics of a watercourse (Vehicle tracks, rail and road crossings through wetlands, discharging water into Polfonteinspruit).

Additionally, there are seven licensed water users downstream of the Tswana Limestone Quarry. Details of the water users according to the 2022 DWS Water Authorisation and Registration Management System (WARMS) can be found in the table below (Extracted from JG Afrika Hydrology Impact Assessment, 2022 and is attached as **Appendix 18**). Currently no water is extracted by the quarry from the Polfonteinspruit River, which feeds into the Molopo River downstream. Therefore, downstream existing water users will not be negatively affected by the authorisation of the water uses mentioned above for the Tswana Quarry.

Registration/ Water Use No.	Sector	Volume m3/year	Source	Quaternary	Location
26020341/3	Water Supply Service	62	Molatedi Dam	D41A	-25.8561 S ; 25.50842 E
26020341/4	Water Supply Service	0.8	Pella Dam	D41A	-25.8561 S ; 25.5084 E
26020341/5	Water Supply Service	2	Madikwe Dam	D41A	-25.8807 S ; 25.5113 E
26033621/3	Water Supply Service	3650000	Scheme	D41A	-25.8572 S ; 25.5089 E
26038234/2	Industry (Non-Urban)	3326	Molopo River	D41A	-25.8864 S ; 25.5817 E
26048937/2	Mining	300	Molopo River	D41A	-25.9365 S ; 25.5969 E
26057310/5	Industry (Urban)	5300000	Scheme	D41A	-25.8572 S ; 25.5089 E

S27 (b) The need to redress the results of past racial and gender discrimination

Lafarge Mining recognises the need to redress the imbalances of the past and regards Black Economic Empowerment (BEE) to be one of the supporting pillars of the Transformation Process in South Africa. Lafarge draws on Corporate Centre for its human resource management and development strategies and planning which supports employment equity. Employment opportunities are directed towards local people, upholding the affirmative action, equal employment policies of the company. The following plans are implemented at Lafarge to assist in the implementation of Mining Charter objectives to redress imbalances of the past:

Training:

All employees, especially designated group members, are encouraged to participate in voluntary programmes that increase their skills or knowledge. Selection of candidates for Company training programmes is made solely on the basis of performance, development and potential without regard to race, creed, colour, sex, national origin, age or disability or any of the other categories of discrimination described in the Employment Equity Act.

Development:

Departmental managers ensure that procedures are established to ensure the upward mobility and growth of all suitably qualified employees, with due emphasis being placed on the promotion of designated employees.

Promotions and transfers are carried out without regard to race, sex, colour, creed, age, national origin or disability or any other discriminatory category. Exceptions may occur that fall within the implementation of the Company's employment equity initiatives, after due consideration of the inherent requirements for the position.

Compensation, benefits, use of facilities:

Each operating unit ensures that there is no unfair discrimination in matters of compensation and benefits for its employees. All Company facilities are continued to be maintained on a non-racially segregated and equal basis and with due regard to access and mobility for disabled employees.

Social and recreational activities:

All Company sponsored social and recreational activities are on a non-segregated basis. Management and supervisory personnel encourage all employees to participate in Company sponsored social and recreational activities to the fullest extent possible.

S27 (c) Efficient and Beneficial Use of Water in the Public Interest

One of the principles of the National Environmental Management Act (Act No. 107 of 1998 as amended) (NEMA) in section 2 (4) (o), states: "The environment is held in public trust for the people, the beneficial use of **environmental resources** must serve the public interest and the environment must be protected as the people's common heritage."

As a public trustee of the water resources, the Department of Water and Sanitation (DWS) must ensure that **water** is protected, used, developed, conserved, managed, and controlled in a sustainable and equitable manner for the benefit of all users.

Within the surrounding towns of the Tswana Limestone Quarry, groundwater is used extensively for municipal, domestic, industrial and agricultural practices. Water demands from groundwater sources are therefore highly stressed. Therefore, water is pumped only from one borehole located to the west of the Tswana Limestone Quarry to two Jojo tanks, which are then distributed throughout site for various uses. The greatest volumes of water, besides for domestic use, are used for dust suppression, equating to 24 528m^3/year. According to the Water Balance Specialist Report, water quantities pumped from the borehole were significantly higher than estimates. This was likely linked to community members puncturing the pipes leading to the Jojo tanks to provide drinking water for their livestock.

Prior to the development of the Quarry Pits, no wetlands, beside the Polfonteinspruit, were found in the area. The operation of the mine has therefore resulted in the creation of numerous artificial wetlands. Although these wetlands may change form over time with increased mining, the area will still experience a net gain of wetlands at the end of the mine life span. These wetlands (specifically Quarry Pit 1) may offer a place of refugia for wildlife, particularly during dryer seasons when other wetlands have dried up. Other benefits arising from wetland areas include sediment trapping, nitrate assimilation, food for livestock, flood attenuation, erosion control and carbon storage.

Currently rainfall and runoff is captured within the open pit of the quarry, reducing the contributions to the Polfonteinspruit River, compared to natural flows. However, Lafarge Mining is in the process of applying for a water use license to pump the water within the pit into the Polfonteinspruit. As long as water quality is of good standard, the released water will increase flows to the Polfonteinspruit. This will be highly beneficial to the seven licensed water users downstream of the quarry which abstract water from the river for water services, mining and industrial activities.

S27 (d) The Socio-economic Impact of (i) the Water Uses(s) if authorised; or, (ii) of the Failure to authorise the Water Uses

The authorisation of water uses for the Tswana Limestone Quarry will provide the following socio-economic benefits:

- The North West Province is a growing market surpassing national trends in the cement industry and, as such, demand for Lafarge's products in the North West Province has already exceeded existing production capacity. The continued operation of the mine is therefore required to meet the growing product demand and ensure that provincial and national economic development is not hampered;
- Job retention - approximately 345 people are employed on a permanent basis in addition to temporary and contract employment;
- Local economic benefits are derived as a result of wage income and increased demand for goods;

- Training is provided to employees resulting in an improvement of the local skills base;
- Support is given to the local and national economy by the purchase of goods and services;
- Lafarge will achieve profits from the increase in the production of cement resulting in increased tax revenues for the government;
- Lafarge will continue to support projects that will benefit the local community leading to improved living conditions and improvement of skills;
- Support to local municipality in terms of road repairs, road construction, upgrading of youth centres, town clean-up, water supply etc;
- Support to schools in terms of adopt a school, fundraising campaigns, sport activities, giving books to learners, waste recycling projects;
- Support to small enterprises namely historically disadvantage communities, courier services, tent hiring, shirt printing, gardening services, maintenance contractors etc; and
- Initiation of historically disadvantaged community business forums.

If the water uses are not approved the continuation of the Tswana Limestone Quarry and future expansion of the Lafarge cement production line will not occur. As such the socio-economic benefits outlined above will not be achieved. Consequently, the South African economy will be negatively affected and the livelihood of communities will not improve as expected.

S27 (e) Catchment management strategy applicable to the relevant water resource

The Tswana Limestone Quarry is situated in the Molopo River Catchment within the Quaternary Catchment D41A of the Crocodile West and Marico Catchment Management Area. The Polfonteinspruit flows alongside the northern boundary of the Tswana Quarry and flows into the Lotlhakane tributary which drains into the Molopo River. The Molopo River is located approximately 42 km downstream of the project site.

The Crocodile West and Marico Catchment Management Strategy highlights that the above mentioned catchment is situated on a high yielding aquifer system, which is associated with boreholes which can yield between 5l/s to 20l/s. This water resource is most valued in this region. As such, the Catchment Management Strategy highlights the importance of groundwater, through strategy 1.3, and suggests that the quality and quantity of this water resource be monitored (DWAF, 2004). Lafarge Mining has upheld this policy by only making use of one borehole to extract groundwater.

Based on the updated water balance study (JG Afrika, August 2022), the following recommendations are provided to reduce water stress from the groundwater resource:

- Flow meters should be installed on the pipeline used to supply water for dust suppression at the crushing plant. This will allow for more confidence to be gained in the water balance and the results associated with the water balance.
- Confirmation on the volume of water lost between the borehole and the Jojo Tanks should be investigated further. Based on the water balance results, the volume of water lost to the environment along this pipeline is significant. Interventions to try to reduce the volume of water lost would then also need to be investigated, so that these losses can be mitigated against.

S27 (f) The likely effect of the water use to be authorised on the water resource and on other water users

The possible impacts of the Tswana Limestone Quarry relates to the pit wetlands on site (referred to as W1, W2 in the Wetland Specialist Report and Quarry Pit 1 in the Water Balance Report), and the Polfonteinspruit wetland which is found 100m outside the mine boundary.

The relevant potential impacts for the pit wetlands (Quarry Pit 1) include:

- The contamination of the wetlands through the spillage of hydrocarbons such as fuel and oils. Hydrocarbons are toxic and could lead to loss of aquatic biodiversity. This level of impact is one which should not happen if preventative measures such as drip trays are employed. During the site assessment,

performed by JG Afrika, no signs of hydrocarbon contamination were noted in the Quarry Pit 1 and surrounding vegetation. Rather hydrocarbon contamination was found within the immediate vicinity of the contamination source (i.e. the diesel tank is bunded, there are oil separators to separate out hydrocarbons from water emanating from the service bay, the workshop area is roofed and any sources of hydrocarbons in this area are bunded). This highlights that the risk of contamination of the wetland is low.

- Future loss or change of wetlands as a result of mining activities. The loss of wetlands will result in a loss of aquatic biodiversity. It should be noted that over time, the depression wetlands might be replaced by pit wetlands which will be expected to have a longer persistence. This impact is unavoidable and is in the "Repair/Restore" level of the hierarchy.
- Abstraction of water for uses in the mine such as dust suppression. Water abstraction will result in a lowered water surface and loss of wetland space and habitat. This is a minor impact which is only likely to become an issue during periods of exceptionally low rainfall.
- Seepage from the wetlands (which may contain stormwater runoff contaminants) may contaminate the groundwater resources. The recommendations and conclusion of the geohydrological specialist report should be kept in mind in terms of monitoring.

The relevant potential impacts on the Polfonteinspruit include:

- Close proximity of the mine edge to the wetland edge. The mining right area lies well within the 500 m radius around the Polfonteinspruit channel, and at a few points, is within 100 m of the delineated edge of the system. Observations both on the ground as well as in figure 16 (according to the wetland report), indicate that the floor of the pit is at an elevation of approximately 1.5 m lower than the water surface in the Polfonteinspruit. It is therefore theoretically possible that the mine is creating a cone of depression in the water table which would be affecting the channel. The Polfonteinspruit could therefore be deprived of some water. There is, however, presently no discernible impact in the intervening area or on the two sides of the channel.
- Increased mining could result in an increase in exposed soil surfaces which may lead to greater erosion rates. These eroded soils may wash off into the wetlands increasing turbidity.
- The ongoing excavation of pits in the wetland to either provide open water or to extract material for block making. The degradation would have reduced wetland condition and functionality.
- Spillage of domestic sewage into downstream environments.
- Disturbance of the wetland in the lower area as a result of past draining and agricultural activities. These former two points have not been caused by Lafarge but rather are a result of past activities.

It is to be noted that, although there has been mining activity at the site for some 40 years, the mine only approached to within 100 m of the delineated channel in 2016. However, as noted above, there appears to be no visible impacts on the wetland as a result of the incursion. Therefore, it is considered that, if the proposed mitigatory measures are applied (Refer to the JG Afrika Wetland Report and Hydrological Report), there are no new risks to the Polfonteinspruit system.

S27 (g) The Class and the Resource Quality Objectives of the Water Resource

The Tswana Limestone Quarry is situated in the Molopo River Catchment within the Quaternary Catchment D41A. This catchment has been designated a water resource class II. Class II refers to "the configuration of Ecological Categories of the water resources within a catchment that results in an overall condition of that water resource which is moderately altered from its predevelopment condition" (Department of Water and Sanitation, Notice 562 of 2019). It is recommended that this quaternary catchment remain in an ecological category D.

The resource quality objectives for the above catchment according to the National Water Act (Act 36 of 1998), Government Gazette Notice 1388 of 8th December 2017, are represented in the table below:

Sub-component	Resource Quality Objective	Indicator/Measure	Numerical Limit
Quantity	Groundwater flow patterns based on piezometric elevations in aquifer units should not be reversed from its natural flow directions toward the local drainages. Discharge areas (i.e. Malapo Eye) should be protected against total depletion of water table (i.e. as the case is for Grootfontein Eye and Bodibe Eye	Water Levels - Depth to groundwater level from ground elevation. Time series water level monitoring (Monthly) vs. abstractions and rainfall input. Abstraction of groundwater within prescribed zones from the river course/wetland/eye-spring).	Dolomite aquifer systems: Saturation levels should not be lowered >6 metres below an average water level depth of ~19 m in the dolomite water area. Water level recession rate must be less than 0.75 m/a. Abstraction zoning: should be regulated (1000 m for karst aquifer systems).
	Groundwater balance (aquifer recharge and irrigation abstraction) needs to be assessed for wet and dry cycles (to secure groundwater yields during dry periods). Proper irrigation schedules need to be developed and applied at all times (100% compliance).	Abstraction - Volume (Q).Time series of abstraction-rainfall-water level of aquifer system. Annual groundwater balance (aquifer recharge and irrigation abstraction) needs to be for wet and dry cycles.	Annual abstraction should not be larger than 65% of average annual recharge (i.e. SI of 65%).
	Water balance Status	Calculation of Stress Indexes (Aquifer Unit Use/ Aquifer Unit Recharge) as percentages.	
Quality	Nitrate values in the recharge area must be maintained to support domestic water users. (Agricultural sources for nitrate).	Nutrients - Nitrate (NO_3–N, mg/l). Bi-annual Monitoring Monthly monitoring at DWS gauging stations.	Nitrate: Less than 1.0 mg/l; Annual long-term trend should not approach the 95th percentile (3.0 mg/l).
	Salinity levels should not increase. Concentrations must be maintained at levels to secure a healthy water quality status.	Salts - Electrical Conductivity. Monthly monitoring at DWS gauging stations.	Electrical Conductivity: 50 mS/m; Annual long-term trend should not approach the 95th percentile (80 mS/m)48.
	Industrial/agricultural pollutants for Molopo, Grootfontein, Itsoseng (Bodibe) Eyes	Sulphates SO_4 concentrations) Monthly water quality monitoring at source areas (eye's and well fields)	SO_4: Less than 5.0 mg/l; Annual long-term trend should not approach the 95th percentile (30 mg/l).
Protection Zone	Protection of Intergranular and Fractured Aquifers: Protect lower sections of Madibe, Polfonteinspruit and Molopo River against industrial/ agricultural/microbial pollution.	Distance from drainage valley: based on 50 Day travel time (microbial) and 365 day dilution period (inorganic constituents).	<1000m protection zoning (DLMT aquifers) <500m protection zoning (hard rock aquifers).
		Distance from discharge area of dolomite eyes: based on 50 Day travel time (microbial) and 365 day dilution period (inorganic constituents)	<1000m protection zoning (hard rock aquifers)

When looking at the site-specific PES, wetland 1 (Pit 1 within the quarry boundary) and wetland 2 were identified as having a PES Category B. These wetlands were taken as being "natural", although it is known that they are an unnatural consequence of the mining operations. It was determined that the condition of each wetland would remain the same for the next five years. The Channelled Valley Bottom Wetland (situated north of the quarry

around the Polfonteinspruit River) was given a PES Category E. This was largely due to degradation of the system from past agricultural activity and livestock grazing.

S27 (h) Investments already made and to be made by the Water User in Respect of the Water Use in Question

Lafarge currently operates 166 cement plants in 50 countries around the world with a production capacity in excess of 200 million tons. With the South African domestic market for cement growing, Lafarge is likely to continue to invest in its South African plants and mines to expand production and ultimately profits. Increased expansion and profits may lead to further local employment opportunities and support to local municipalities, schools, and community upliftment projects.

S27 (i) The Strategic Importance of the Water Use to be Authorised

The continued operation of the Tswana Limestone Quarry will be of strategic importance to Lafarge Mining South Africa (Pty) Ltd, the local community and the South African economy in general. The mine provides the raw materials which are essential for the cement production process at the Lafarge Cement Facility. The operation also employs 345 people, falling in line with the IDP vision for the Ditsobotla Local Municipality which states *"A developmental Municipality dedicated to the social and economic upliftment of its communities".* The continued operation will therefore improve socio-economic development as stated in the above sections.

S27 (j) The Quality of Water in the Water Resource which may be required for the Reserve and for Meeting International Obligations

The groundwater quality, in terms of bacterial coliforms, has been up to standard. Future monitoring, however, should include testing of chemical constituents (EMPr, 2015). The mined material, limestone, has also been approved as non-hazardous and so will not lead to contamination or pollution of the area and the Polfonteinspruit which flows from it. Additionally, the watercourse is not utilised by residence for drinking purposes, resulting in no potential health risks to the local community.

The Stormwater Management Plan (JG Afrika, August 2022) provides the following recommendations to prevent contamination of the watercourses through runoff:

- Several stormwater channels should be constructed;
- Regular maintenance of stormwater infrastructure to prevent pooling/flooding; and
- Regular clearing of sediment built up from conveyor belt spillages.

S27 (k) The Probable Duration of any undertaking for which a Water Use is to be Authorised

It is recommended that the duration of the Water Use Licence for the Tswana Limestone Quarry is to be issued as per the Approved Mining Right (DMR Ref NW30/5/1/2/2/454MR) that is valid for a period of thirty (30) years ending on the 07th March 2043.

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