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INTEGRATED WATER AND WASTE MANAGEMENT PLAN FOR:

FARM LICHTENBURG TOWN AND TOWNLANDS 27, PORTION 1, 30, 32, 61, AND 71. ERF 1024 PORTION 0, ERF 960 PORTION 0, NORTHWEST PROVINCE

Water Use License Application Reference Number: WU20466

Lafarge Mining South Africa (Pty) Ltd

Prepared by:	**On behalf of:**	**Prepared for:**
Afzelia Environmental Consultants (Pty) Ltd. 236 Ninth Avenue, Windermere, Durban, 4001 Tel: 031 303 2835 E-mail: info@afzelia.co.za	Greenmined Environmental Tel: 076 792 6327 Email: Murchellin.S@greenmined.co.za	Lafarge Mining South Africa (Pty) Ltd Contact person: Uneysa Taljard Postal Address: P.O. Box 188 Lichtenburg 2740 uneysa.taljard@lafarge.com

EAP Company Details	**Report Writer**	**Signature**	**Date**
Afzelia Environmental Consultants Environmental Assessment Practitioner Number is 2020/1067	Mrs Joleen Wilson		28th October 2022
Greenmined Environmental Environmental Assessment Practitioner Number is 2021/4203	Mrs Murchellin Saal		31st October 2022
Lafarge Mining South Africa	Mrs. Uneysa Taljard		31st October 2022

ACRONYMS

BA	Basic Assessment
DOT	Department of Transport
DWS	Department of Water and Sanitation
DFFE	Department of Forestry, Fisheries and Environment
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control officer
EDTEA	Department of Economic Development, Tourism and Environmental Affairs
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
I&AP	Interested and Affected Parties
IDP	Integrated Development Plan
IWRM	Integrated Water Resource Management
IWWMP	Integrated Water and Waste Management Plan
KZN	KwaZulu-Natal
KZN DAEA	Department of Agriculture and Environmental Affairs
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
SUDS	Sustainable Urban Drainage Systems
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. PROJECT DESCRIPTION

Lafarge South Africa (Pty) Ltd Lichtenburg site is in the process of applying for a water use license application from the Department of Water and Sanitation. Greenmined have been appointed to apply for this application on their behalf. Further, Afzelia Environmental Consultants (Pty) Ltd have been appointed to compile the Integrated Water and Waste Management Plan and the Section 27 Motivation documents for the application.

The existing plant includes two (2) kilns and associated material storage, raw mills, coal mills, cement mills, cement silos and raw material preparation. Currently, the clinker produced at Lichtenburg is milled and packaged on site and distributed as cement.

Lafarge South Africa (Pty) Ltd Lichtenburg site houses a cement production facility. The existing operation which includes the cement production and packaging was authorised in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) by the Department of Minerals and Energy in 2001 ((File Reference No. RDNW(KL) 6/2/2/101).

2. WATER USE APPLIED FOR

Forty-Nine (49) water uses are being applied for, for the Lichtenburg Cement Plant. These are listed in detail in Section 2 of this report in Table 5.

3. SUMMARY OF IMPACTS OF ACTIVITIES ON WATER RESOURCES

Through various specialist assessments carried out as part of the water use application process, the list of impacts include:

- Changes in catchment water resources due to an increase in impervious areas
- Changes in catchment water resources due to impeding or altering the flow of water in a drainage line
- Changes in catchment water resources due to abstractions
- Changes in catchment water resources due to limiting flow (capturing of contaminated stormwater)
- Reduction in catchment water quality due to erosions from the project site and sedimentation of downstream water resources
- Reduction in catchment water quality due to discharging waste or contaminated water
- Changes in flood hydrology due to an increase in impervious areas
- Changes in flood hydrology due to altering the bed, banks, course or characteristics of a watercourse
- Changes in flood hydrology due to disturbance of the soil and topography of the wetland area as a result pf past mining activities in the area upstream of the cement factory
- Changes in flood hydrology due to disturbance of the wetland in the lower area as a result of past draining and agricultural activities
- Changes in flood hydrology due to grazing by livestock in the upper section is reducing the plant biomass there and may be reducing plant diversity
- Infilling with factory waste and road and rail crossings in the factory areas
- Stormwater and other surface flows entering the wetland
- Future upgrades to cement plant

4. 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.

The authorisation holder or Applicant is obligated 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*".

5. CONCLUSION AND RECOMMENDATIONS

Based on the information analysed in this report and supporting specialist studies, it is clear that the Lafarge Lichtenburg Cement Plant has over time caused negative impacts on the surrounding environment. The most important two aspects being that the adjacent and surround wetland areas have been infilled with inert waste material from the cement plant instead of this waste being correctly removed from site and disposed of in a responsible manner. The second aspect being that the stormwater management of the plant has been poorly designed according to work areas and topography, therefore contaminated water has not been prevented from entering into the environment, therefore impacting on the water supply and surrounding environment.

Due to the large scale footprint of the Cement Plant, and the historical time frame for which this cement plant has already been in existence, it is not feasible to close down the operations, however, with mitigation measures implemented, the plant could be brought into a compliance with environmental legislation. The main over-arching mitigation measures for the Cement Plant are to: 1. Rehabilitate the wetland areas, which will see the improvement of drainage systems and 2. Implementation of the Stormwater Management Plan, Infrastructure and Pollution Control Dams to ensure that stormwater runoff and contaminated water flow into correct areas for proper treatment before being released or re-used.

Mitigations measures recommended in this IWWMP and all specialist studies including rehabilitation must be incorporated into an Environmental Management Programme (EMPr) for immediate implementation, thus seeing the plant working towards achieving environmental compliance. The successful implementation of these management objectives would be best achieved through enforcement and monitoring for compliance by an independent Environmental Control Officer (ECO).

It is therefore the opinion of the Environmental Assessment Practitioner (EAP) that the water uses as applied in this report and supporting applications be approved and a water use license with strict conditions as per specialist recommendations be granted to Lafarge Lichtenburg.

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1. INTRODUCTION

Lafarge South Africa (Pty) Ltd Lichtenburg site is in the process of applying for a water use license application from the Department of Water and Sanitation. Greenmined have been appointed to apply for this application on their behalf. Further, Afzelia Environmental Consultants (Pty) Ltd have been appointed to compile the Integrated Water and Waste Management Plan and the Section 27 Motivation documents for the application.

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1.1 CONTACT DETAILS OF THE APPLICANT

The Applicant is Lafarge Industries South Africa (Pty) Ltd (2005/033309/07). The contact details for the applicant are shown in Table 1 below.

Table 1: Applicant Details

Item	Details
Company	Lafarge Industries South Africa (Pty) Ltd
Contact Name	Mrs Uneysa Taljard
Telephone Number	018 633 3011 | 065 913 1666
Postal Address	1 Manana Road, Industrial Site, Lichtenburg, 2740
Email Address	Uneysa.taljard@lafargeholcim.com

1.2 PURPOSE OF THE IWWMP

It is a Departmental requirement that a water user needs to compile a IWWMP for any one of the following purposes:

- As the supporting technical document for any Water Use License Application (the main purpose of this document);
- When converting Existing Lawful Use (ELU) to licensed water use; and
- On order to comply with the conditions of an existing water use license.

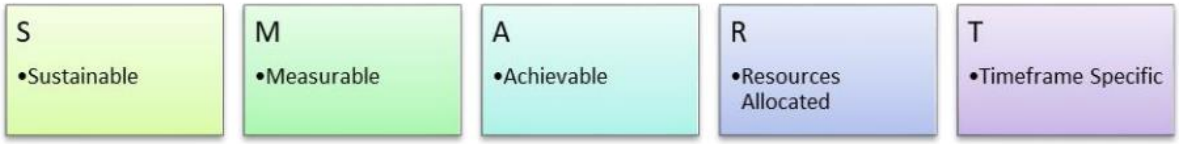
The requirements for the compilation of an IWWMP was originally aimed at collating and rationalising the information submitted for Water Use License Applications to the Department of Water and Sanitation (DWS), however, they have since progressed beyond this purpose to:

- Providing the regulatory authorities with focused and structured information not only to meet their general information needs, but also to articulate the required management measures and actions to achieve the water and waste related performance on an on-going basis; and
- Provide direction and guidance to the water user on water and waste management of an activity.

The development of the IWWMP for this project is done to meet the water use authorisation requirements in terms of the National Water Act, 1998 (Act No. 36 of 1998). This IWWMP defines the responsibility and accountability for the execution of the water and waste management. It also identifies and plans for future water and waste management requirements.

The IWWMP further outlines the management of water and waste on site and serves to document the methods to be implemented and the management of water and waste related emergencies that may arise.

The implementation of the IWWMP is an interactive process and its performance must be monitored on an annual basis. The assessment of the IWWMP document itself, as well as the submission of information relating to monitoring and auditing conducted in terms of it could lead to its shortcomings, which must be addressed in the annual update of the action plan of the IWWMP. This will ensure that the concept of continual improvement is applied throughout the life cycle of the activity. It is the responsibility of the water user to demonstrate to the Department that the selected management measures in the IWWMP action plan adhere to the "SMART" concept, i.e.:



PROJECT SPECIFIC NEED FOR 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 operation of the existing Lafarge Lichtenburg Cement Plant, 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 LOCALITY AND PROPERTY DETAILS

The Lichtenburg operation is situated in Ward 6 of Ditsobotla Local Municipality, within the North-West Province. The area forms part of the Lower Vaal Water Management Area and the Upper Molopo Sub-Water Management Area. The area falls within the C31A quaternary drainage system also known as the Harts and Molopo River catchments. The entrance to the facility is approximately 600 metres from a tributary of the Harts River. Refer to the Locality Map in Figure 1 below, showing the facility in relation to major roads and landmarks in the area.

The surrounding community consists of various private landowners, land owned by the local municipality and some by Transnet, farm labourers and formal and informal settlements in and around Lichtenburg.

Table 2: Locality Details

Criteria	Lichtenburg Plant
Province	North West Province
District Municipality	Ngaka Modiri Molema District Municipality
Magisterial District	Ditsobotla Local Municipality
Tribal Jurisdiction	This is a municipality area.
Farm/Property names	Farm Lichtenburg Town and Townlands 27, Portion 1, 30, 32, 61 and 71. Erf 1024 Portion 0, Erf 960 Portion 0
21 Digit Surveyor General Code	T0IP00000000002700001
	T0IP00000000002700030
	T0IP00000000002700032
	T0IP00000000002700061
	T0IP00000000002700071
	T0IP00260000102400001
	T0IP00260000096000000
Property ownership	Lafarge South Africa (Pty) Ltd
Mineral rights ownership	Lafarge South Africa (Pty) Ltd
Extent of operations on site	Facility is currently 98.667 hectares in extent. Future expansions at the plant will be within the existing plant area.
Surrounding land uses	The land immediately adjacent to the Lichtenburg Plant is owned by the Ditsobotla Local Municipality and private owners. Surrounding land uses are agricultural (north and east), residential (south) and industrial (west).

Table 3: Property Information

Properties		
1	Property Type	ERF
	Description	Land parcel 1024 of the Minor Region Lichtenburg
2	Property Type	Farm
	Description	Portion 1 of Land Parcel 27 of the Major Region IP
3	Property Type	Farm
	Description	Portion 71 of Land Parcel 27 of the Major Region IP
4	Property Type	Farm
	Description	Portion 32 of Land Parcel 27 of the Major Region IP
5	Property Type	Farm
	Description	Portion 30 of Land Parcel 27 of the Major Region IP
6	Property Type	Farm
	Description	Portion 61 of Land Parcel 27 of the Major Region IP

Table 4: GPS Coordinates of the site

Latitude /Longitude	Degrees	Minutes	Seconds
South	26	8	3.04
East	26	10	53.08

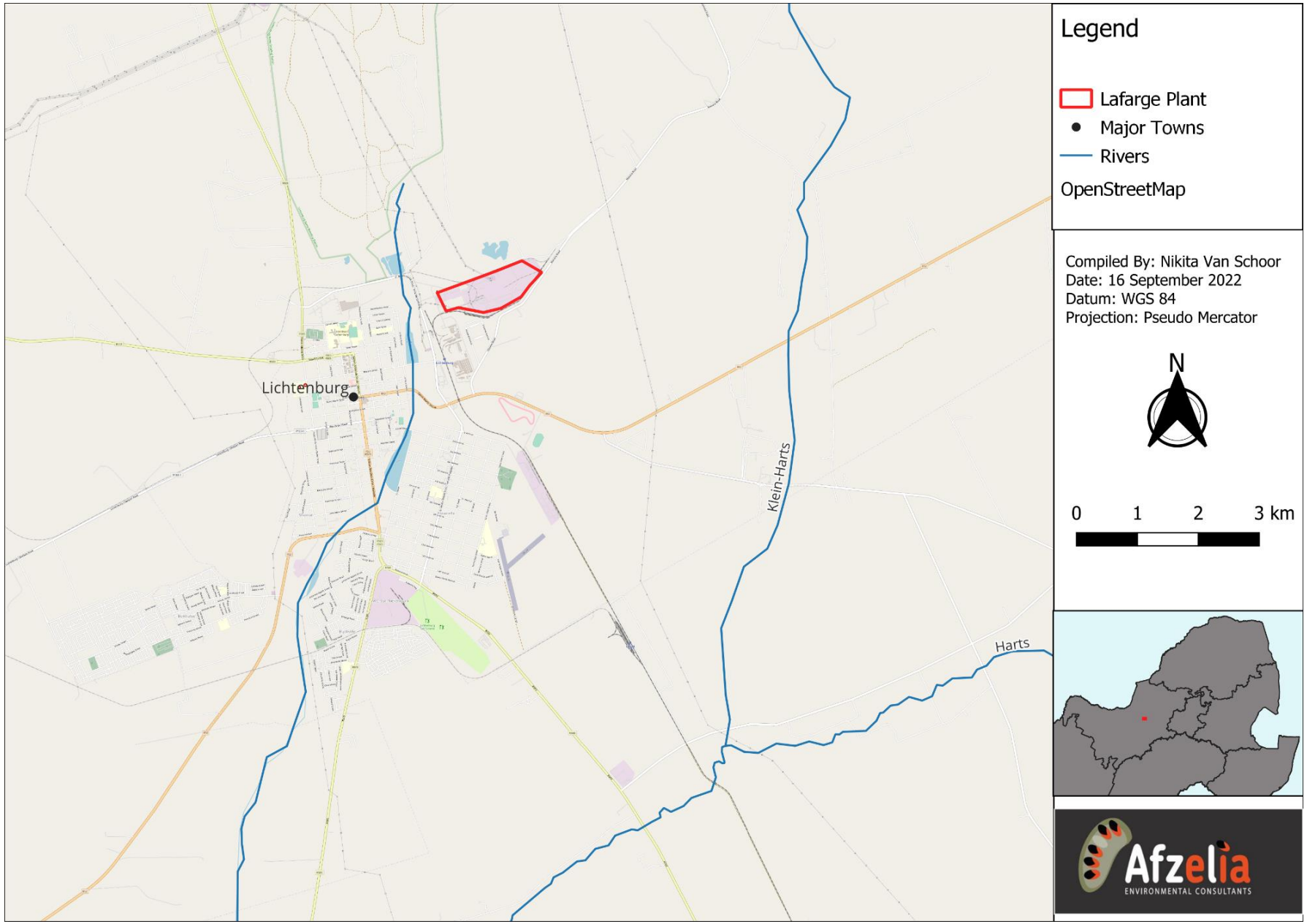


Figure 1: Locality of Lafarge Lichtenburg Facility

2. CONCEPTUALISATION OF ACTIVITY

2.1 ACTIVITY BACKGROUND

Lafarge operates a cement manufacturing facility in Lichtenburg, Northwest Province. The operation consists of a cement manufacturing plan and a quarry. The plant includes 3 kilns (named kiln 2, 3 and 4) and the associated raw material storage area, raw mills, coal mills, cement mills, cement silos and raw material preparation area. There is also the use of secondary (waste) materials as alternative fuels and raw materials occurring on site.

A process of grinding and burning takes place at the cement plant. Fine grinding produces a fine powder (known as raw meal) which is preheated and then sent to a Kiln. The material is heated to approximately 1 500°C before being rapidly cooled. The water used for cooling is piped and does not come into contact with any of the raw materials or products. It is therefore chemically not altered. This produces clinker, the basic material required for the production of all cements. The final manufacturing process involves cement grinding and shipping. A small amount of gypsum (3-5%) is added to the clinker to regulate how the cement will set. The mixture is then very finely ground to obtain “pure cement”. During this phase, different mineral materials, called “cement additives”, may be added alongside the gypsum. Used in varying proportions, these additives, which are of natural or industrial origin, give the cement specific properties such as reduced permeability, greater resistance to sulphates and aggressive environments, improved workability, or higher-quality finishes. Finally, the cement is stored in silos before being shipped in bulk or in bags to the sites where it will be used. Refer to the Master Layout Plan in Figure 2 and attached as **Appendix 10.**

Lafarge has increased cement production at the plant by 50% and this required the introduction of a third production line (new burning line and mill) at the plant and increased production activity at Tswana Quarry.

Secondary materials / alternative fuels and resources are used at the Lichtenburg facility to substitute for the need for coal, providing an environmentally beneficial alternative to landfilling.

Water Uses being applied for are described in Table 5.

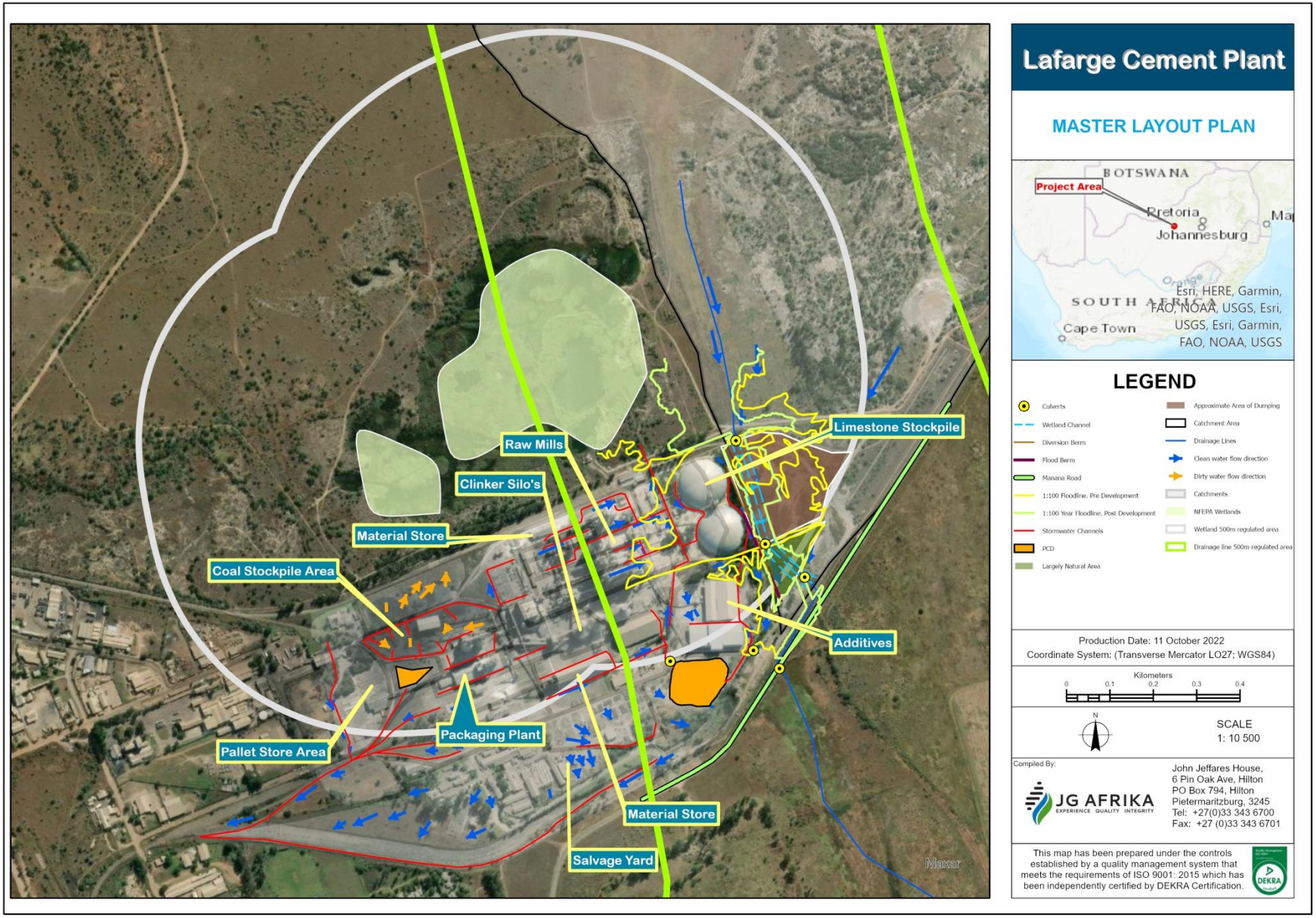


Figure 2: Master Layout Plan for the Lichtenburg Cement Plant

Table 5: Water Uses Applied for

No.	Water use	Water source	Quaternary Catchment	Location	Quantity	Sector
21 A – TAKING WATER						
1.	Section 21 (a) Taking water from water resource	Lichtenburg Plant Borehole 1	C31A	26°07'06.00"S 26°10'04.01"E	75 727 m³ per annum Meter reading in place	Drinking water for village and plant
2.	Section 21 (a) Taking water from water resource	Lichtenburg Plant Borehole 2	C31A	26°07'03.7"S 26°10'02.0"E	27 941 m³ per annum Meter reading in place	Domestic and garden use and processing.
3.	Section 21 (a) Taking water from water resource	Lichtenburg Plant Borehole 3	C31A	26° 7'8.10"S 26°11'4.14"E	452 077 m³ per annum Meter reading in place	Top up Water from BH3 contained separately and not discharged into the Pit (Process use)+ Watering livestock
4.	Section 21 (a) Taking water from water resource	Townlands Pit	C31A	26° 7'42.42"S 26°11'2.58"E	Kiln 3 = 407 340 m³/y - Kiln 26° 04 59 .70"S 25 ° 48'12.14"E Kiln 4 located at = 10 220 m³/y 26° 04'59.70"S 25°48'12.14"E Evaporation = 474 852 m³/y Processing: 454536 m³/y = 505 486mper year	The water is then used for cooling purposes. Above pipe leading to Quarry pump. Kiln 1 and 2 no longer in use.
21 G - STOCKPILES						
1.	Section 21 (g) Waste discharge related water use	Undercover Coal Stockpiles:	C31A	26°7'59.57"S 26°10'48.80"E	19440m³	Stockpile areas
2.	Section 21 (g) Waste discharge related water use	Emergency Coal Stockpiles:	C31A	26° 8'0.52"S 26°11'6.55"E	96811.20m³	Stockpile areas
3.	Section 21 (g) Waste discharge related water use	Coal Stockpiles Area	C31A	26° 8'0.12"S 26°10'47.22"E	27000m³	Stockpile areas
4.	Section 21 (g) Waste discharge related water use	Limestone Stockpiles:dome 1	C31A	26° 7'49.97"S 26°11'13.21"E	112840m³	Stockpile areas

No.	Water use	Water source	Quaternary Catchment	Location	Quantity	Sector
5.	Section 21 (g) Waste discharge related water use	Limestone Stockpiles:dome 2	C31A	26° 7'53.09"S 26°11'13.76"E	112840m³	Stockpile areas
6.	Section 21 (g) Waste discharge related water use	Additive Stockpiles:	C31A	26° 8'1.14"S 26°11'12.90"E	24542.48m³	Stockpile areas
7.	Section 21 (g) Waste discharge related water use	Gypsum Stockpiles	C31A	26° 8'5.10"S 26°10'55.32"E	23600m³	Stockpile areas
21G – DAMS (Section 21 g Waste discharge related water use)						
1	Section 21 (g) Waste discharge related water use	PCD 1- SWMP Coal stockpile area	C31A	26°8'4.78'' S 26°10'46.88'' E	3268 m³	Coal stockpile
2	Section 21 (g) Waste discharge related water use	PCD2 – SWMP Additives area	C31A	26°8'3.5'' S 26°11'14.01'' E	13071 m³	Additives
3	Section 21 (g) Waste discharge related water use	Townlands Pit	C31A	26° 7.707'S 26° 11.043'E	454 536 m³/y	Water pumped from the Townlands pit will be used for cooling purposes (Processing)
21 G - SEPTIC TANKS						
1.	Section 21 (g) Waste discharge related water use	Septic Tank Railway	C31A	26° 8'16.19"S 26°10'25.64"E	Maximum quantity: 30m³	Septic Tank
2.	Section 21 (g) Waste discharge related water use	Septic Tank – Palletiser ablution	C31A	26° 8'8.18"S 26°10'41.82"E	Maximum quantity: 30m³	Septic Tank
3.	Section 21 (g) Waste discharge related water use	Septic Tank – Cement bulk loading ablution	C31A	26° 8'0.44"S 26°10'54.68"E	Maximum quantity: 10m³	Septic Tank
4.	Section 21 (g) Waste discharge related water use	Septic Tank – Electrical workshop ablution	C31A	26° 8'2.14"S 26°10'57.45"E	Maximum quantity: 10m³	Septic Tank
5.	Section 21 (g) Waste discharge related water use	Septic Tank – Limestone tip ablution	C31A	26°7'51.55"S 26°11'10.14"E	Maximum quantity: 10m³	Septic Tank
6.	Section 21 (g) Waste discharge related water use	Septic Tank – Main road reception	C31A	26° 8'32.10"S 26°10'43.75"E	Maximum quantity: 10m³	Septic Tank
7.	Section 21 (g) Waste discharge related water use	Septic Tank – Swart dam	C31A	26° 8'7.57"S 26°11'10.05"E	Maximum quantity: 10m³	Septic Tank
8.	Section 21 (g) Waste discharge related water use	Septic Tank – contractor building by alpha gate contractor office	C31A	26° 8'8.01"S 26°10'50.44"E	Maximum quantity: 10m³	Septic Tank
9.	Section 21 (g) Waste discharge related water use	Septic Tank – Railway gate (clover side)	C31A	26° 8'1.32"S 26°10'39.40"E	Maximum quantity: 20m³	Septic Tank
10.	Section 21 (g)	Septic Tank – B Works	C31A	26° 7'57.76"S	Maximum quantity:	Septic Tank

No.	Water use	Water source	Quaternary Catchment	Location	Quantity	Sector
	Waste discharge related water use			26°11'5.91"E	10m³	
21E – IRRIGATION (wastewater in gardens)						
1.	Section 21 (e) - Irrigation with water containing waste, artificial recharge of aquifer, modification of atmospheric precipitation and in-stream power generation activities.	Garden patch 1	C31A	26° 8'0.02"S 26°10'40.58"E	16.5m³ p year	Garden irrigation/Non edible
2.	Section 21 (e)- Irrigation with water containing waste, artificial recharge of aquifer, modification of atmospheric precipitation and in-stream power generation activities	Garden patch 2	C31A	26° 8'3.04"S 26°10'41.01"	16.5m³ p year	Garden irrigation/Non edible
3.	Section 21 (e)- Irrigation with water containing waste, artificial recharge of aquifer, modification of atmospheric precipitation and in-stream power generation activities	Garden patch 3	C31A	26° 8'2.06"S 26°10'43.20"E	16.5m³ p year	Garden irrigation/Non edible
4.	Section 21 (e)- Irrigation with water containing waste, artificial recharge of aquifer, modification of atmospheric precipitation and in-stream power generation activities	Garden patch 4	C31A	26° 8'3.39"S 26°10'47.49"E	16.5m³ p year	Garden irrigation/Non edible
5.	Section 21 (e)- Irrigation with water containing waste, artificial recharge of aquifer, modification of atmospheric precipitation and in-stream power generation activities	Garden patch 5	C31A	26° 8'7.40"S 26°10'48.31"E	16.5m³ p year	Garden irrigation/Non edible
6.	Section 21 (e)- Irrigation with water containing waste, artificial recharge of aquifer, modification of atmospheric precipitation and in-stream power generation activities	Garden patch 6	C31A	26° 8'10.81"S 26°10'52.48"E	16.5m³ p year	Garden irrigation/Non edible
7.	Irrigation with water containing waste, artificial recharge of aquifer, modification of atmospheric precipitation and in-stream power	Garden patch 7	C31A	26° 8'12.29"S 26°10'52.89"E	16.5m³ p year	Garden irrigation/Non edible

No.	Water use	Water source	Quaternary Catchment	Location	Quantity	Sector
	generation activities.					
8.	Section 21 (e)- Irrigation with water containing waste, artificial recharge of aquifer, modification of atmospheric precipitation and in-stream power generation activities	Garden patch 8	C31A	26° 8'10.76"S 26°10'54.18"E	16.5m³ p year	Garden irrigation/Non edible
9.	Section 21 (e)- Irrigation with water containing waste, artificial recharge of aquifer, modification of atmospheric precipitation and in-stream power generation activities	Garden patch 9	C31A	26° 8'11.42"S 26°11'2.62"E	16.5m³ p year	Garden irrigation/Non edible
10.	Section 21 (e) Irrigation with water containing waste, artificial recharge of aquifer, modification of atmospheric precipitation and in-stream power generation activities.	Garden patch 10	C31A	26°8'4.71"S 26°10'57.32"E	16.5m³ p year	Garden irrigation/Non edible Effluent from waste water treatment works will be used for irrigation in gardens
11.	Section 21 (e) Irrigation with water containing waste, artificial recharge or aquifer, modification of atmospheric precipitation and in-stream power generation activities	Village garden and domestic use	C31A	26°8'25.89"S 26°10'45.13"E	38 106m³ p year per year	Water will be used in the village area for domestic and garden use
12.	Section 21 (e) Irrigation with water containing waste, artificial recharge of aquifer, modification of atmospheric precipitation and in-stream power generation activities	Wetland Rehabilitation	C31A	26°7'51.35"S 26°11'18.39"E	35.04m³ p year per year	Irrigation to assist in the wetland rehabilitation process

	LAFARGE LICHTENBURG SECTION (C) AND (I) APPLICATION				
No.	Water use	Description	Quaternary Catchment	Location	
				Start	End
1.	Section 21 (c) Impeding or diverting the flow of water in a watercourse Section 21 (i) Altering the Bed, Banks, Course or Characteristics of a watercourse	Wetland Drainage and Infilling from start to end.	C31A	26° 6'55.30"S 26°11'4.68"E	26° 8'33.23"S; 26°11'25.19"E
2.	Section 21 (c) Impeding or diverting the flow of water in a watercourse Section 21 (i) Altering the Bed, Banks, Course or Characteristics of a watercourse	Culvert 1	C31A	26° 7'46.36"S 26°11'15.20"E	26° 7'47.64"S; 26°11'15.77"E
3.	Section 21 (c) Impeding or diverting the flow of water in a watercourse Section 21 (i) Altering the Bed, Banks, Course or Characteristics of a watercourse	Culvert 2	C31A	26° 8'7.80"S; 26°10'43.75"E	26°7'57.29"S 26°11'22.55"E
Culvert 3&4 is no longer applicable and will be removed from site.. (Note included in application forms)					
4.	Section 21 (c) Impeding or diverting the flow of water in a watercourse Section 21 (i) Altering the Bed, Banks, Course or Characteristics of a watercourse	Road crossing 1	C31A	26° 7'40.69"S; 26°11'27.69"E	26° 8'11.88"S; 26°11'9.58"E
5.	Section 21 (c) Impeding or diverting the flow of water in a watercourse Section 21 (i) Altering the Bed, Banks, Course or Characteristics of a watercourse	Road crossing 2	C31A	26° 7'44.73"S 26°11'18.56"E	26° 7'14.69"S 26°11'2.73"E
6	Section 21 (c) Impeding or diverting the flow of water in a watercourse Section 21 (i) Altering the Bed, Banks, Course or Characteristics of a watercourse	Road crossing 3	C31A	26° 7'45.59"S 26°11'15.12"E	26° 7'45.59"S 26°11'15.12"E
7.	Section 21 (c) Impeding or diverting the flow of water in a watercourse Section 21 (i)	Rail Crossing 1	C31A	26° 7'54.90"S; 26°11'16.52"E	26° 8'13.96"S 26°10'31.19"E

	LAFARGE LICHTENBURG SECTION (C) AND (I) APPLICATION				
	Altering the Bed, Banks, Course or Characteristics of a watercourse				
8.	Section 21 (c) Impeding or diverting the flow of water in a watercourse Section 21 (i) Altering the Bed, Banks, Course or Characteristics of a watercourse	Rail Crossing 2	C31A	26° 7'58.61"S; 26°10'35.14"E	26° 7'45.55"S 26°11'28.23"E
9.	Section 21 (c) Impeding or diverting the flow of water in a watercourse Section 21 (i) Altering the Bed, Banks, Course or Characteristics of a watercourse	Present railway line	C31A	26° 7'46.58"S 26°11'20.21"E	26° 7'47.35"S 26°11'13.56"E
10.	Section 21 (c) Impeding or diverting the flow of water in a watercourse Section 21 (i) Altering the Bed, Banks, Course or Characteristics of a watercourse	Present railway line 2	C31A	26° 7'46.58"S 26°11'20.21"E	26° 7'47.35"S 26°11'13.56"E
11.	Section 21 (c) Impeding or diverting the flow of water in a watercourse Section 21 (i) Altering the Bed, Banks, Course or Characteristics of a watercourse	Vehicle Track	C31A	26° 7'52.41"S 26°11'22.32"E	26° 7'54.56"S 26°11'16.11"E
12.	Section 21 (c) Impeding or diverting the flow of water in a watercourse Section 21 (i) Altering the Bed, Banks, Course or Characteristics of a watercourse	Septic Tank – Limestone tip ablution within 500m of wetland	C31A	26°7'51.55"S 26°11'10.14"E	26° 8'7.20"S 26°11'9.69"E
13.	Section 21 (c) Impeding or diverting the flow of water in a watercourse Section 21 (i) Altering the Bed, Banks, Course or Characteristics of a watercourse	Septic Tank B Works Ablution within 500m of wetlands	C31A	26° 7'57.76"S 26°11'5.91"E	26° 7'57.36"S 26°11'6.19"E
14.	Section 21 (c) Impeding or diverting the flow of water in a watercourse Section 21 (i) Altering the Bed, Banks, Course or Characteristics of a watercourse	Septic Tank Swart Dam ablution within 500m of wetlands	C31A	26° 8'7.57"S 26°11'10.05"E	26° 8'7.20"S 26°11'9.68"E

2.1 ALTERNATIVE WATER SOURCES

Alternative water sources for the Lichtenburg Cement Plant were identified by JG Afrika (refer to **Appendix 21**). A summary of this report can be found below.

Based on the water balance study, it was noted that the total water demand for the cement plant and associated housing complex equated to approximately 1 900 m^3/day. This is comprised of approximately 248 m^3/day for potable/domestic water usage and 1 644 m^3/day for process water requirements. The potential alternative sources of water for the cement plant were identified as the Townlands Pit, Tswana Lime Pit, Ditsobotla Local Municipality, and recycling of water within the cement plant.

Townslands Pit

The Townslands Pit is located to the north of the plant and is currently not mined. It serves as a sump into which stormwater and process water accumulates. Based on the water balance, it is noted that approximately 200 m^3/day can be abstracted from the Pit, assuming that return flows from the plant occur.

However, the Townsland Pit was not determined to be a sustainable alternative water source for the plant in the long term. This is due to the significant difference in the demand (approximately 1 900 m^3/day) compared to the potential sustainable supply (approximately 200 m^3/day). The cement plant would therefore still need to source approximately 1 700 m^3/day from an outside source to ensure that operations at the plant are not interrupted due to inadequate water supply.

Tswana Lime Pits

Although the Tswana Lime Pits are a potential source for water supply and have therefore been considered as a potential water supply option for the Cement Plant, the distance between the Tswana Lime Mine and the Cement Plant results in this option being discarded at the first point of analysis. If water were to be sourced from the Tswana Lime, the pipeline that would need to be constructed between Tswana Lime and the Cement Plant would need to be approximately 47 km in length. The costs associated with this make this option not viable.

Ditsobotla Local Municipality Water Supply

Based on an interview with Mr Thabiso Tshabalala, who is the manager of the PMU at the Ditsobotla Local Municipality, it was noted that current water supply to the municipality is strained. In order to ensure that the municipality is able to provide for the current water demands, requests to drill an additional 6 boreholes have been applied for with the WSA. If Lafarge were to source its entire water requirement from the municipality, this would increase the volume of water that the municipality would need to source by approximately 16%. Considering the current strained situation of water supply in the municipality, sourcing water from the municipality may result in an increase in its risk of not being able to supply water to the region. Further to this, it was noted that the costs associated with sourcing water from the municipality would be high (equating to approximately R765 700/month).

Recycling of water within the Cement Plant

Although recycling of water within the cement plant is not strictly an alternative water source, implementing an effective water conservation and water recycling system will significantly reduce the Cement Plant's dependency on alternative water supply options. There are a number of areas from which water could be recycled. This includes the water discharged into the wetland area, water from the water treatment works and water from the PCD's.

The potential total volume of water that can be recycled back into the Lafarge Cement Plan process water system equates to approximately 1 765 m^3/ day. If 80% of this water could effectively be recycled, the demand for outside water sources could potentially drop by as much as 74% (412 m^3/day divided by 1 900 m^3/day). This is a significant reduction on the Cement Plants dependence on outside sources of water. It is, however, noted that in order to implement the proposed recycling of water, particularly from the PCD's and process water currently discharged to the wetland area, effective water treatment processes would need to be implemented.

Based on the alternative water sources above, it was recommended that a water reuse and recycling initiative be implemented instead of sourcing high volumes of water from outside the factory. This would result in significant reductions in water demands from an outside source. If this is implemented, the remainder of the water that is required for the factory could be obtained from the municipality, as the volume and costs of sourcing water from the municipality would be significantly reduced.

3. PRESENT ENVIRONMENTAL SITUATION

3.1 CLIMATE

Lichtenburg has a mild climate with average maximum temperatures of 33°C during the summer and 22°C during winter. Average daily minimum temperatures are 18°C mid-summer and 5 °C mid-winter. Frost occurs during winter.

The average rainfall is measured to be approximately 596mm. Rainfall usually occurs as thunderstorms and the rainy season lasts from November to March with the peak of the rainy season being in January. The evaporation in Lichtenburg exceeds the mean annual precipitation.

3.2 MEAN ANNUAL RUNOFF (MAR)

According to the Lower Vaal WMA Overview of Water Resources Availability Report, DWAF (2003a), "Flow in the Vaal River, which is the main source of water in the water management area, virtually all originates from the Upper Vaal and Middle Vaal water management area. A summary of the mean annual runoff (MAR), together with the estimated requirements for the ecological component of the Reserve, is provided in Table 6, below:

Table 6: Natural Mean Annual Runoff and Ecological Reserve (million m3/a)

Source: Lower Vaal Water Management Area: Overview of Water Resources Availability, November 2003

Sub-Catchment	Natural MAR[1]	Ecological Reserve [2] [3]
Harts	138	15
Vaal downstream of Bloemhof	43	5
Molopo	197 (3)	29
Total	**181**	**49**

3.3 CATCHMENT CHARACTERISTICS AND WATERCOURSES

3.3.1 WATER MANAGEMENT AREA

The Lower Vaal Water Management Area (WMA) is part of a larger water supply system which includes adjacent Water Management Areas. The Lower Vaal is one of three WMAs in the Vaal River System, which is the drainage area of the Vaal River from its headwaters to the confluence of the Vaal and Orange Rivers.

The Vaal River forms the main tributary to the Orange River and originates on the plateau west of the Drakensberg escarpment and drains much of the central highveld of South Africa. The Vaal River is possibly the most developed and regulated river in Southern Africa, while some of the largest dams in Africa have been built in Lesotho and on the main stem of the Orange River. Although linked together by the natural watercourses, a particular characteristic of the Orange/Vaal WMAs is the extensive inter-catchment transfer of water within WMAs as well as inter-basin transfers between these and other adjoining WMAs.

The Lower Vaal WMA is dependent on water releases from the Middle Vaal WMA for meeting the bulk of water requirements by the urban, mining and industrial sectors within its area of jurisdiction, with local resources mainly used for irrigation and smaller towns. Water quality in the Lower Vaal is strongly influenced by usage and management practices in the Upper and Middle Vaal WMA.

Major rivers in the Lower Vaal water Management Area include the Molopo, Harts, Dry Harts, Kuruman and Vaal Rivers.

An important conservation area in the Lower Vaal WMA is Barberspan which is located in the upper reaches of the Harts River. This off-channel pan is known for its rich bird life. Other areas of importance include pans around Kimberly as well as the Vaalbos National Park.

Lichtenburg is the largest manufacturing town in the WMA, where manufacturing includes cement and cheese factories. Since manufacturing production is far less than mining production in the area it can be deduced that only a small percentage of beneficiation is done locally. This implies that a large percentage of raw mining products are exported to other areas for beneficiation.

Lower Vaal Water Management Area: Internal Strategic Perspective, 2004.

[1] Quantities given are incremental and refer to the sub-catchment under consideration only.
[2] Total volume give, based on preliminary estimates. Impact on yield being a portion of this.
[3] Estimated runoff from catchment, which is lost through evaporation and infiltration before reaching the Orange River. This runoff therefore does not add to the total for the water management area.

3.3.2 WATER RESOURCE AVAILABILITY

Surface Water

According to the Lower Vaal WMA Overview of Water Resources Availability Report, DWAF (2003a), "As a result of the low rainfall, flat topography and sandy soils over much of the water management area, little usable surface runoff is generated in the water management area" additionally, it mentions, "in the natural state the quality of surface water in the water management area is of acceptable standard, although typical of high turbidity."

The ISP: Lower Vaal Water Management Area, 2004 explains that the water quality in the Vaal River is seriously impacted on by urban and industrial use as well as mining activities in the Upper and Middle Vaal Water Management area and is of relative high salinity.

Furthermore, the return flows from the Vaalharts irrigation scheme are of a poor quality due to the poor quality of the water received from the Middle Vaal with better quality water from this WMA resulting in marginally improved salinity levels. Water in the Harts River downstream of the Vaal harts irrigation scheme is of exceptional high salinity as a result of saline leachate from the irrigation fields and needs to be carefully managed through blending with fresher water.

Additionally, the development of surface water naturally occurring in the water management area has reached its potential and all the water is being fully utilised. The ISP also states that there are no feasible options for meaningful development of surface water resources in the water management area.

Groundwater

The ISP for this water management area explains that groundwater utilisation is of major importance in the Lower Vaal water management area and is the only source of water over much of the water management area. Groundwater is essentially used for mining, agriculture and domestic use in this water management area. Groundwater use at the mining sites within the water management area is limited and should any seepage occur into opencast pits or underground workings, the water is usually pumped and utilised in processes to minimise use of other water sources. It is estimated that the mining activities will affect the boreholes and that an additional amount of 30-50 Ml per month will be needed in the next 5 years.

Additionally, almost every farm unit in the water management area is dependent on groundwater for domestic use and stock watering. There are however abstraction volumes available but in terms of quantities of water, stock farming has a relatively small influence on the regional groundwater resource. Large-scale irrigation is developed where aquifer types are suitable. Problems encountered at these irrigation areas are over utilisation of the resources with the associated lowering of water tables.

Several municipalities are dependent on groundwater as a source of bulk supply. The water is supplied from boreholes within the municipal grounds. Some of the towns' water supply is augmented by surface water supply e.g. Vryburg. The total population dependant on groundwater in urban areas is estimated to be 140 000 residents.

The natural occurring water quality in the WMA is generally good in the dolomitic/karstic and fractured/crystalline aquifers. In the western portion of the WMA in the Kalahari group primary (sand/gravel) aquifers and clay formations, the quality is often naturally poor with TDS values ranging from 1500mg/l and higher.

Activities related to urban area result in localised or even diffuse pollution of groundwater. Poor management of sewage treatment works can contribute to the groundwater pollution as can landfill site, on-site sanitation (especially in informal settlements) and spills resulting from accidents or leaking underground tanks.

The groundwater is impacted on by TDS in the Vaalharts area which is caused by leaching of approximately 100000t/annum and is found to be the main source of this TDS increase. Simultaneously, the main contributor to the salt load within the Vaalharts Irrigation Scheme was found to be the incoming canal water from the Vaal River at Warrenton, whereas fertilizer contributes 50000t/annum. The incoming Vaal River contributes 130000 t/annum of salts. These salts are moving towards the Harts River at a rate of approximately 5 million t/annum.

There are a total of 180 monitoring points throughout the Lower Vaal WMA. These serve both the national and regional levels of groundwater monitoring. The monitoring includes water levels and ambient water quality.

Challenges in this WMA

The main challenges facing DWAF in this WMA is with regard to the management and allocation of the groundwater resources at the high-abstraction irrigation areas. Sixty-six applications was the current count at the time that this ISP was publish which required approximately 10 million m3/annum additional abstraction from the resource. Due to the report being published in 2004, this number and abstraction amount can be assumed to be outdated and a much higher number is expected to be applicable at this time (2022).

Furthermore, groundwater-surface water interaction has not been studied sufficiently in the WMA. According to some studies there is seldom groundwater contributing to base flow in rivers. However surface water recharge has been observed in normally dry riverbeds. Current quality problems experienced in the Vaal and Orange Rivers, waterlogging experienved within irrigation along these riverbanks indicate interaction. Further studies are motivated by DWAF to investigate groundwater-surface water interaction in the Vaal and Orange Rivers.

Water Balance

The water balance in the Lower Vaal is one of surplus, as indicated in Section 2.5 Water Balance of the Internal Strategic perspective for Central Region: Lower Vaal Water Management Area (2004) and is expected to remain this way as no major growth is predicted for this WMA. For further information and understanding of the water balance of the Lower Vaal WMA refer to the full Lower Vaal Water Management Area: Internal Strategic Perspective, 2004 document, found at **Appendix 13**.

3.3.3 SITE SPECIFIC WATER RESOURCES

Lichtenburg plant is located in the upper reaches of the Harts River catchment (C31A). The Groot Harts River, a tributary of the Harts River is the main river flowing through the town of Lichtenburg. Flow at the plant is towards the Groot Harts River and one of its tributaries. The Groot Harts River flows in a southerly direction into the Harts

River which then flows south-westerly towards the Vaal Dam and then into the Orange River. Both the Groot Harts River and its tributary are perennial watercourses. Stormwater drains into a nearby quarry as a result of stormwater control measures.

Groundwater in the vicinity of the site occurs within the Transvaal dolomites. These dolomites are considered the most significant groundwater resources in the area. The water supply wells for both Lafarge and the Lichtenburg municipality are all located upstream of Lafarge's operations within these dolomites. Due to the long residence times and slow recharge rates, these aquifers are highly sensitive to pollution and over-abstraction. The local aquifer in the vicinity of the cement plant is considered to be a major sole-source aquifer.

The groundwater is used for domestic use and in the event that water shortages occur, it can be diverted to the plant. Data sourced from boreholes in the vicinity of the plant indicates that the depth of the water table varies between three and six metres below ground level (mbgl).

3.3.4 SITE SPECIFIC WATER QUALITY

Through statements provided in the EIA/EMP which sourced information through pre-project water quality analysis, in general the surface water qualities taken from the quarry north of the plant are of good quality.

Additionally, the groundwater qualities of samples taken from water supply boreholes are of ideal and good water quality. The groundwater is characterised by high calcium, magnesium and alkalinity due to the dolomitic origins of the aquifer. The groundwater also indicates active recharge of the dolomitic aquifer and no evidence of contamination is present. These boreholes are however located upstream of Lafarge's operations.

At the cement plant, there are stockpiles of coal and bauxite which may impact on groundwater resources. There are plans by Lafarge to surface these areas in the future which will reduce the risk of negative impact on the groundwater resources. All other plant areas are paved limiting the potential for pollution through seepage.

Environmental Impact Assessment and Management Programme Report for the Proposed Use of Secondary (Waste) Materials as Alternative Fuels and Raw Materials (AFRS) at Lafarge Cement Plant in Lichtenburg, August 2011).

4. REGULATORY WATER AND WASTE MANAGEMENT FRAMEWORK

4.1 SUMMARY OF ALL WATER USES

The following water uses have been identified and confirmed with the Department of Water and Sanitation during the pre-application site visit held on the 10th February 2022 by Greenmined. The water uses to be applied for have been provided in Table 5.

4.2 EXISTING LAWFUL WATER USES

No existing lawful water uses apply to the plant, however a previous water use authorisation ((Registration number: 26019718) exists. Registered activities are listed below:

- Section 21 (a) - Taking water from a water resource (From Townlands and Lovedale Borehole).
- Section 21 (b) - Storing water (For wastewater disposal and industrial residue in the Townlands Pit).
- Section 21 (f) - Discharging waste or water containing waste in a water resource through a pipe, canal, sewer, sea outfall or other conduit (Discharging domestic and biodegradable industrial wastewater into the Townlands Pit).

4.3 RELEVANT EXEMPTIONS

No exemptions are relevant to Lafarge Lichtenburg at present.

4.4 GENERAL AUTHORISED WATER USES

No water uses are classified or will be classified as General Authorisation water uses under this application.

4.5 NEW WATER USES TO BE LICENSED

All water uses to be licensed have been provided in Table 5 found on page 7 above.

4.6 WASTE MANAGEMENT ACTIVITY (NEMWA)

It has not been confirmed whether there is a valid waste management license applicable for this Lichtenburg Cement Plant.

4.7 OTHER AUTHORISATIONS

An Environmental Impact Assessment was done for the Lafarge Industries South Africa (Pty) Ltd, Lichtenburg premises regarding the use of Secondary (waste) materials as alternative fuels and raw materials. The authorisation has been granted and the reference numbers for this project are:

DMR Reference: RDNW (KL) 6/2/2/101

DEDECT Reference: NWP/WM/NM3/2011/06

Lafarge Mining South Africa Pty (Ltd) is in possession of a mining right (reference number: NW30/5/1/2/2/454MR), for the Lichtenburg Cement Plant and its Quarry Mines, which was issued by the Department of Mineral Resources on the 8th March 2013**.**

5. SPECIALIST STUDIES

5.1 ASSESSMENT OF TWO WETLANDS IN THE VICINITY OF THE LAFARGE CEMENT FACTORY IN LICHTENBURG

A wetland assessment was carried out by JG Afrika in March 2022 focusing on two wetlands in the vicinity of the Lafarge Cement Factory in Lichtenburg (**Appendix 7**).

Wetland Map 5

The wetland surrounding the cement factory is a Wetland Map 5 wetland, which originates approximately 1.0 km to the North of the factory property and then flows southwards through the factory area before turning westwards

to join another, and larger, wetland / watercourse system flowing southwards past the town of Lichtenburg, Refer to Figure 3. These two wetlands form a tributary of the Harts River.

A core area within the wetland area was identified during the assessment process and was created as a result of the infill material being placed in this are by the cement factory. This area has expanded to include all of the wetland area on the factory grounds.

The wetland specialist confirmed in the report that it was not possible to delineate the wetland edges using soil indicators. No trace of the wetland could be found within the infilled area since it had been entirely covered over by infill material. It was also observed that a man-made channel passed through the area on the side adjacent to the factory, however this too has been infilled with waste materials. It was therefore concluded that the wetland could not be meaningfully delineated within the factory property.

Upstream Wetland

A wetland identified north of the cement factory is clearly visible on the basis of the vegetation. However examination of the soil characteristics has very few traces of the mottling typically associated with hydromorphic soils. This is thought to be a consequence of the mining that took place in the early years of the 21st Century. Almost all of the wetland area, from the source to the factory boundary was affected and so few areas of natural soil remain. Additionally, the lack of mottling in the soils may be a natural characteristic of the region.

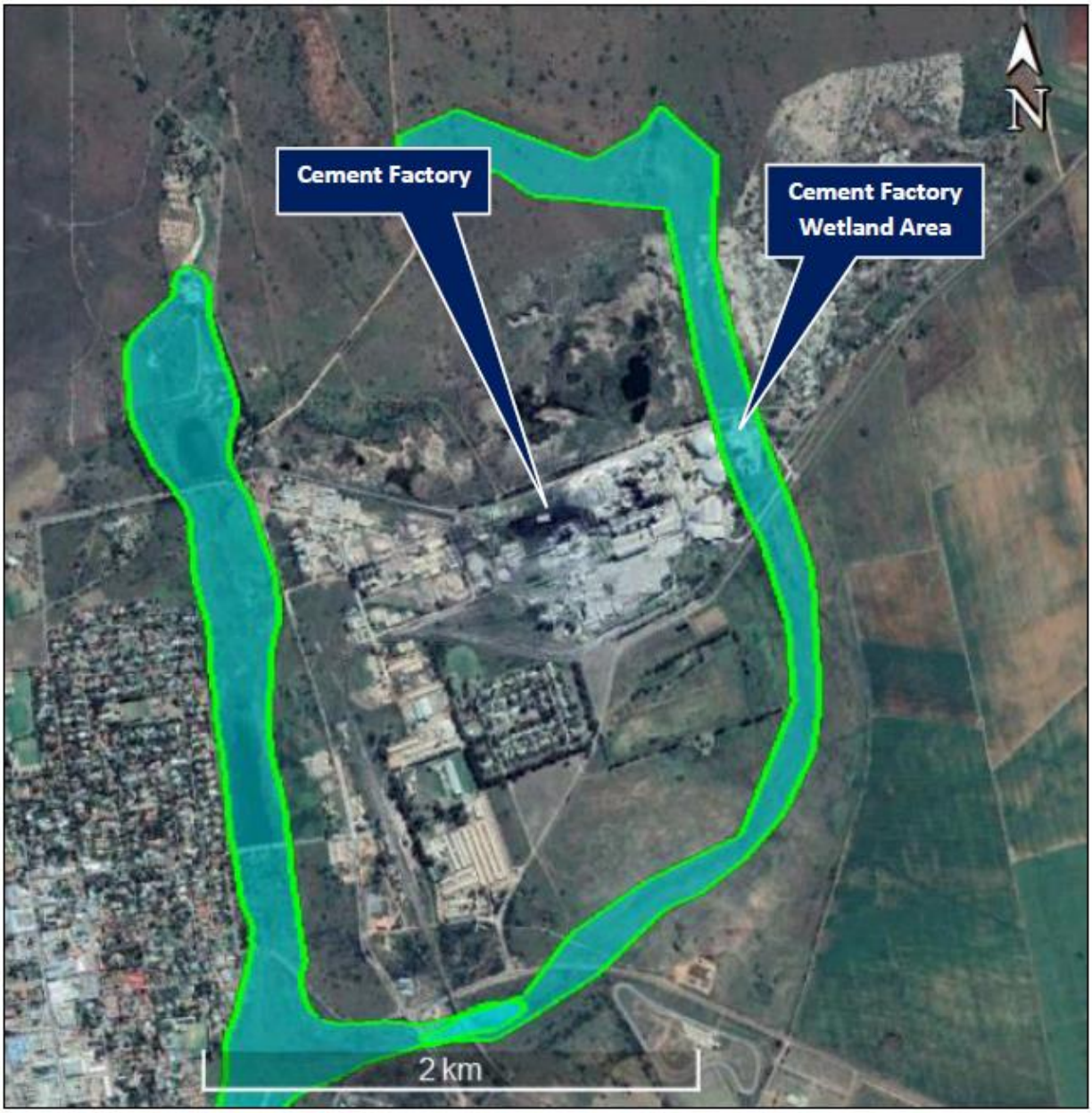


Figure 3: Wetland Map 5, Wetlands around the Town of Lichtenburg

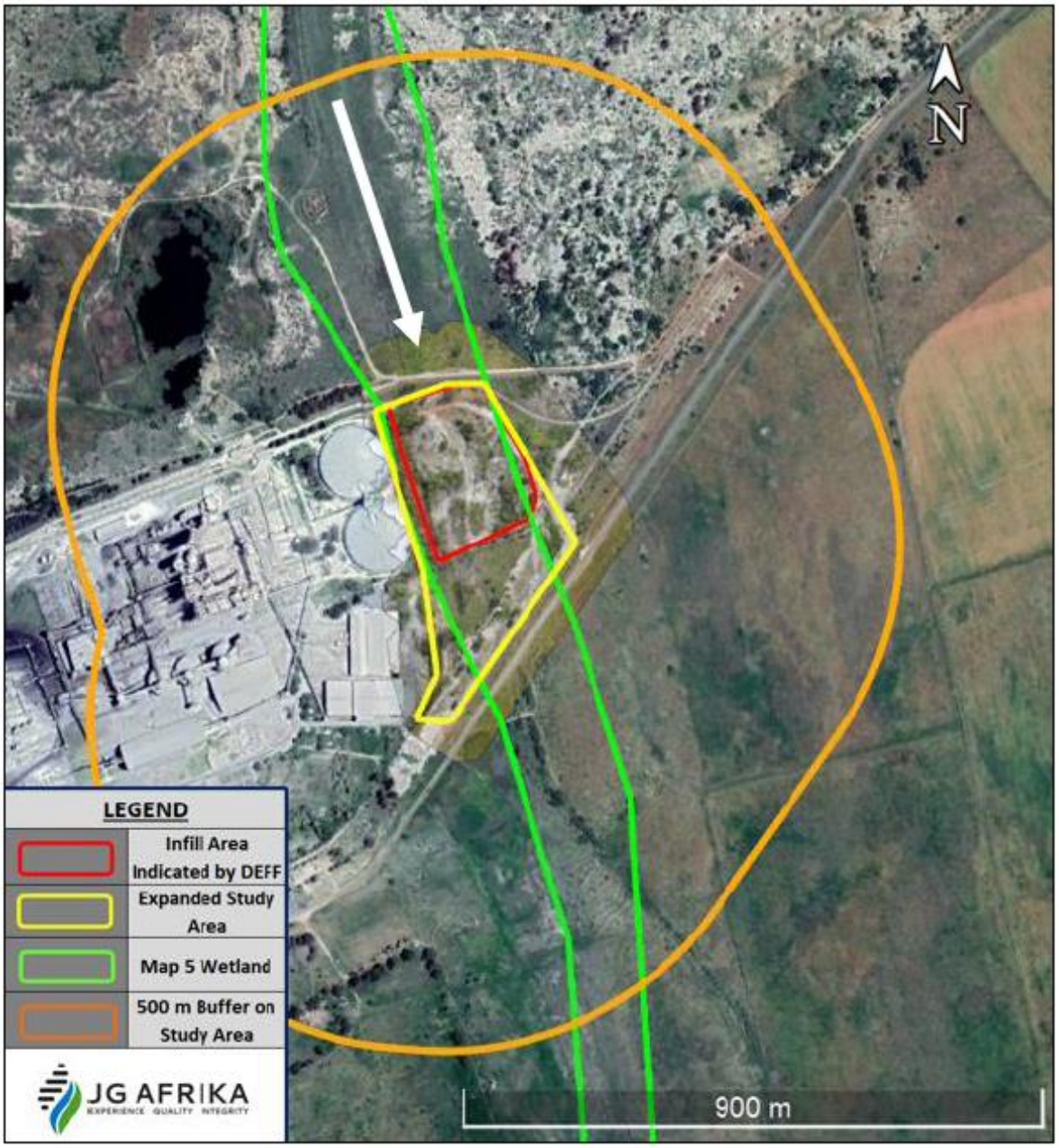


Figure 4: Study area as identified in the wetland assessment. The direction of water flow is indicated with the white arrow.

Downstream Wetland

This wetland system stretches from Manana Road to the confluence of the Groot Harts River. The distance from the road to the confluence is approximately 3.25km. Again, the wetland historically has been severely impacted on by agricultural activities, which include cultivation for crops and grazing by livestock. Flows have been canalized in this section presumably to allow the outer edges of the wetland to become arable. In the lower reaches are a number of bridges and causeways, some which may by pinch-points for water flows.

As seen with the upstream wetland, past activities have destroyed soil structures and normal delineation using the soil indicators is not possible.

Wetland Unit Identification

The wetland was determined to be an Unchanneled Valley Bottom (UVB) system. It was noted that despite much rain during the days preceding the site visit, only very few and limited puddles of surface water were seen. It was noted by the specialist, that the rapid downward percolation of water into the ground is in line with what is expected from the dolomitic geology of the area. Historic attempts made before the establishment of the Cement Factory, to canalise the wetland downstream of the Manana road have generally failed since the ditch is becoming less distinct and the wetted area is spreading.

Wetland Functionality

The wetland area within the cement factory area was not included in the wetland functionality since the wetland there is lost due to local impacts and so delivers either no ecosystem services or very few ecosystem services.

The results indicate that the wetland has a moderately high ecosystem service delivery capability in relation to stream flow regulation, sediment trapping, nitrate assimilation, toxicant assimilation, biodiversity maintenance an grazing for livestock. Low delivery services are water for human use, harvestable resources, tourism and recreation and cultural and spiritual. On balance, the supply meets or exceeds demand in 13 of the listed services with only a further three services having demand exceed supply, which are erosion control, water for human use and cultural and spiritual.

Wetland Health

The study area section within the factory area was excluded as the surface wetland there is totally destroyed by infill but the assessment of Wetland Map 5 having an outcome of PES Category E is accepted as the sub-surface water continues to move through the area.

Table 7: Present Ecological State Scores for the HGM 1 and HGM 2 areas:

HGM Unit	Ha	Extent (%)	Hydrology		Geomorphology		Vegetation	
			Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
1	22	73	3,5	0	2.0	0	3,0	1
2	8	27	1,0	1	0,8	1	4,5	1
Area weighted impact scores			**2,8**	**0,3**	**1,7**	**0,3**	**3,4**	**1,0**
PES Category			**C**	↑	**B**	↑	**C**	↑
Overall PES Category			**PES Score: 2,7 (Category C)**					

Wetland Ecological Importance and Sensitivity (EIS)

The data from HGM Unit 1 & 2 were combined. No red data species were observed but a search of the Animal Demography Unit Virtual Museum suggested that the Giant Bullfrog (*Pyxicephalus adspersus*) could be present and so was included. The finding is that the site is of Intermediate Ecological Importance and Sensitivity. The

presence of the reedbeds and other such aquatic vegetation in the lower area did raise the score slightly as opposed to the numerous impacts this area has been subject to in the past. It is expected that once the factory section of the wetland has been rehabilitated, the score will further improve.

Impact Assessment

Impacts as identified include:

- Disturbance of the soil and topography of the wetland area as a result of past mining activities in the area upstream of the cement factory;
- Disturbance of wetland in the lower area as a result of past draining and agricultural activities;
- Grazing livestock in the upper section, reducing the plant biomass and potentially reducing plant diversity; and
- Disruption of any surface flows through the wetland as a result of infilling and road and rail crossings in the factory area.

All impacts are negative and have already taken place. It was identified by the specialist that most of the impacts have self-mitigated to the extent that they may now be considered of "low" consequence. Only the impact relating to the infill and road/rail crossings of the wetland at the factory remains in place. Through the assessment done and the management plan which has been compiled for this area, through the implementation, the water will have free flow through the area and supplementary inputs from neighbouring flooded mine pit will improve the overall condition of the system.

Mitigation measures to address the remaining impacts include:

- It is recommended that the area which has been affected by past mining, in the absence of erosion and alien weed invasion, the site must be left to continue to self-repair as it is at present;
- The disturbance of the wetland area in the lower area is no longer used for agriculture and the recovery of the wetland vegetation is well advanced. The following recommendations are that the area be kept free of alien weeds; and any remaining drainage ditched must be plugged. It was stated that these actions are not the responsibility of Lafarge.
- The impact associated with the grazing by livestock in the upper section, if managed by the removal of the cattle would be controversial. Since there is minimal impact on the hydrology of the site it would be acceptable to leave the status quo.

NFEPA Wetlands

A second, but artificial wetland, which is listed in the NFEPA wetland database, lies in a disused mine pit adjacent to the factory (Figure 5). The NFEPA wetlands lie on the northern side of the cement factory and, at the closest point, are approximately 70 m from the factory fence. These old mine pits have become filled in with water over time. While some of the inflow is natural, a portion of the surface water flows to the wetland is also from the factory. Water is abstracted from the wetland for use as a coolant water and is returned to the wetland. Despite this the water levels fluctuate substantially, however, sufficient water levels have remained long enough in the wetland

area to allow for extensive reedbeds to have developed. In dry seasons the system shrinks into two separate pools but, because they join during the rainy season, allowing fish and other fauna to move between them, they are considered here to be a single entity.

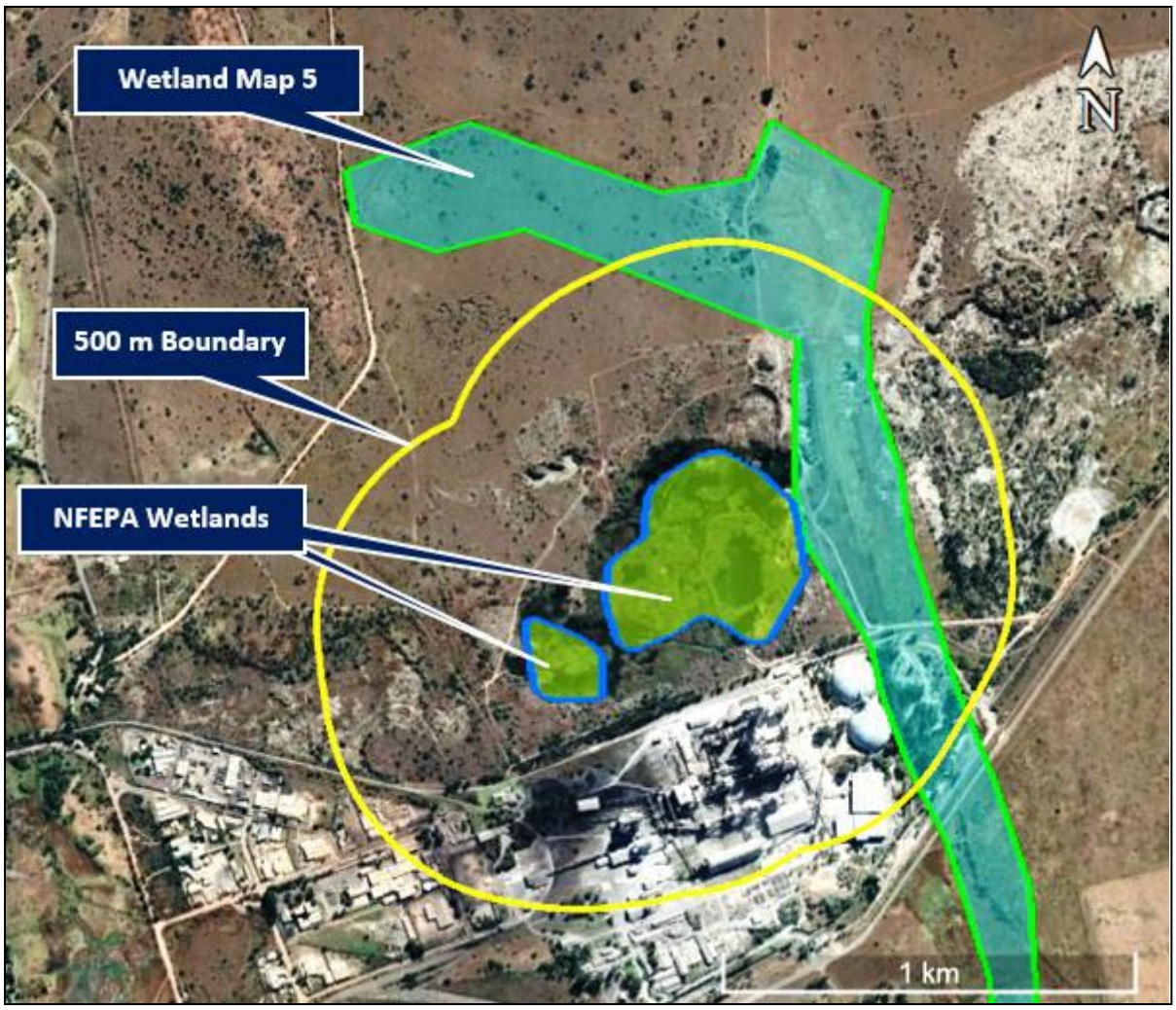


Figure 5: NFEPA wetlands adjacent to the cement factory

Wetland Functionality

While the WET-EcoServices tool would normally be used to determine the functionality of the site, the artificial nature of the wetland precluded some of the inputs in the model. Therefore, although Version 1 was attempted, they are not believed to be entirely credible. The high Biodiversity Maintenance score is justified by site observations and the system clearly has potential for Education and Research.

Wetland Health

While the WET-Health tool would normally be used to determine the PES of the wetland, its required inputs cannot be met by the conditions at the NFEPA Wetland site since there are no relevant surface catchment features, either upstream or downstream. For this reason, an assessment of the PES is based on the apparent state of the wetlands when compared with other infilled mine pits in the region. In addition, it is noted that the NFEPA site varies considerably between wet and dry years and so its ecological state will also vary accordingly. Therefore, the site is rated to have a variable PES ranking that fluctuates between Category D and Category B. At times its

functionality would suggest a PES Category A system but application of this score to an artificial wetland may be questionable.

Wetland Ecological Importance and Sensitivity

Because the wetland models are not able to properly assess the NFEPA site, the EIS is stated on the basis of professional opinion. It is believed that the site has high ecological importance as it is able to support a rich aquatic biodiversity in a region which is very dry at times. It is thus able to function as a refuge at times when other systems are completely dry on the surface and so to act as a source of recolonization for times of wetter conditions. The terrestrial vegetation around the site is also of high value as it is protected from grazing by livestock animals and so, although mined in the past, now has good indigenous plant diversity.

Impact Assessment

The NFEPA wetland is an artificial system but is ecologically dynamic. Thus, although it has no natural catchment it could still be experiencing some forms of impact and two are considered here.

- Increase of contaminant inputs from the cement factory. While some water is taken from the wetland for use in the factory, there are also return flows of water which could be contaminated.
- Greater uptake of water from the wetland basin. At present the uptake of water from the wetland does not appear to be having any great effect on the wetland, and especially so as some is returned. However, it is possible that water demand may increase in the future and so water levels in the wetland might be drawn down.

Mitigation measures

- A stormwater management plan for upgrading the surface stormwater in the factory is under preparation. This plan includes both improved movement of the water around the factory area and a number of new pollution control dams.
- Future developments must be designed to be as water efficient as possible. Consideration must be given to re-use of water for different purposes before it is released from the system.
- The pollution control dams must be as large as is feasible and design features such as labyrinth channels to improve circulation and surface contact should be considered.
- Water pumping to the factory wetland must be stopped once the level in the NFEPA wetland drops below a specified level irrespective of the season or weather conditions. It is provisionally suggested that this level will be such that some connection between the two deepest parts of the old mine is retained.

5.2 WETLAND REHABILITATION PLAN

A Wetland Rehabilitation Plan has been compiled by JG Afrika. This plan has been commented on and approved by DFFE. The document is titled Environmental Management Plan: Rehabilitation of the Wetland in the Vicinity of the Lafarge Cement Factory in Lichtenburg, August 2022. Refer to **Appendix 14** for this report.

The rehabilitation requirements for the wetland area located adjacent to the Lafarge Cement Factory in Lichtenburg included:

- Clearance of alien vegetation from an area around the wetland as designated in a pre-compliance Notice issued by the DFFE;
- Removal of all cement factory wastes which have been dumped into the designated wetland area as apparent in historic aerial imagery.
- Re-establishment of soil profiles including a 30 m wide wetland channel which must be within the original wetland area;
- Re-establishment of indigenous vegetation in the affected areas defined by the Pre-compliance Notice issued to Lafarge on 27/11/2020 as well as a further area downstream toward the Manana Road; and
- Installation of a supplementary water supply to the wetland from a nearby disused mine pit.

The main objective of the wetland rehabilitation plan is for the restoration of water flow from the wetland area to the north of the factory area to the Klein Harts River and wetland system to the south of the factory area. Further to this, it is also intended that the wetland and terrestrial vegetation in the rehabilitated section of the factory wetland / watercourse system and surrounds will be restored.

Phased approach to rehabilitation activities:
Phase 1 – Removal of Alien Vegetation
Phase 2 – Construction of Hydraulic Crossings (culverts)
Phase 3 – Removal of the Infill Material and Landscaping of the Wetland Area
Phase 4 – Construction of Water Reintroduction Facility
Phase 5 – Construction of the Diversion Berm
Phase 6 – Revegetation of the Wetland and Rehabilitation Area

Engineering considerations have been included in the rehabilitation plan. These include:

- Road Crossing No.1: On existing gravel road
- Rail Line 1: Removal, construction of a culvert structure and re-installation approximately 280m of existing rail line
- Rail Line 2: Upliftment and removal
- Culvert No.2: Gravel road
- Removal of infill material

Reference must be made to the full document for detailed information regarding the wetland rehabilitation. This rehabilitation plan and EMPr has been approved by DFFE.

5.3 WATER BALANCE STUDY

A Water Balance Study was undertaken by JG Afrika in August 2022. The full report is attached at **Appendix 13**, which must be referred to when looking at this report. Additionally, the water balance for the Lafarge Litchenburg Cement Plan was based on assumptions, information supplied by management of the cement plant and notes taken during the site visit in January 2022. The accuracy of the water balance is therefore related to the accuracy of the assumption / estimations made.

The water balance results are summarised below:

- The annual average daily potable water requirement for the plant area equates to approximately 248m3 / day or 89 571m3 / annum.
- The most significant use of potable water is the lafarge staff village, with estimations of 130.5m3 / day (47 633m3 / annum) on averaged used for domestic consumption and approximately 104.4m3 / day (38 106m3 / annum) for irrigation and washing purposes (this water is considered to be water that is lost to the environment). The majority of the water used for domestic purposes is sourced from Softening Plant A, with an exception of water sent to the Packaging Plant Ablutions.
- The average volume of wastewater generated from the plant and village equates to 144.15m3 / day (52 615m3 / annum). Lafarge are in the process of upgrading their waste water treatment works, the wastewater in the future will be treated through the Lafarge Waste Water Treatment Works. However, currently the water is collected by service providers and transferred to the municipal sewage treatment works.
- Water Treated at the Softening Plant B is used predominately for water supply to Kiln 3 and the Cement / Raw Mills for cooling water. The estimated water used from the Softening Plant B equates to 1 643.98m3 / day (approx. 600 053m3 / annum). This water is used predominately at the Cement / Raw Mills (1 467.6m3 / day or 89% of the water treated at Softening Plant B).
- Water used at Kiln 3, which is sourced from the Softening Plant A (equating to 176.11m3 / day) is returned to the Quarry (Townlands Dam). A portion of this water (from the Townlands Dam) is then recycled for product cooling at the Cement Mill (0,48m3/day) and is also used at Kiln 4 for cooling purposes.
- A significant volume of water (1 467.6m/day or 535 680m3/annum) is discharged from the Cement / Raw Mills to the wetland area. There are plans to construct a reservoir to capture this water so that it can be recycled back into the cooling process at the Cement / Raw Mills, without being discharged into the environment. Based on the location of the discharge point , water discharged from the Cement / Raw Mills may eventually link into the Townlands Dam, however based on discussions, this linkage is uncertain. Therefore, it assumed that the water discharged to the wetland area is evaporated or seeps into the groundwater reserves.
- The majority of water used at Kiln 4 for cooling processes is returned to the Townlands Dam. Some water is lost to evaporation along the length of the channel linking Kiln 4 to the Townlands Dam.

- Analysis of the proposed Additives and Coal Stockyard PCD's indicated that in order for the dams not to result in a spillage to the environment, water from these dams need to be recycled and reused in the cement plant. Based on a proposed storage of approximately 20 000m3 at the Additives PCD and 4 000m3 at the Coal Stockyard PCD, the total volume of water that should be returned to the process water system equates to 153.2m3 / day (or 4 660m3/month). In the wet season, due to the increased rainfall and runoff into the dams, the volume of water that needs to be recycled back to the plant equates to approximately 295m3/day (or 55 914m3/annum). To reintegrate this water into the process water stream, there may be a requirement to treat the water, however this will only be confirmed once the chemical make-up of the wastewater is known and the water quality requirements for the process water used at the cement plant are know.

Recommendations as an outcome of the water balance study

- The water quality monitoring plan must include monitoring of water being discharged to the Townlands Dam from Kiln 4 and water being discharged from the Cement / Raw Mills to the back of the plant (wetland area).
- The investigation of the feasibility of constructing a reservoir to capture and recycle water used for cooling processes at the Cement / Raw Mill must continue and receive attention. This alternative would reduce the volume of water that needs to be brought into site from the wellfield and reduce the risk of any contamination to the environment (although the status of the current water being discharged is not known).
- Lafarge has suggested that they will capture water discharge from Kiln 3 in a reservoir, which currently recycles through the Townlands Dam and back to Kiln 3 for cooling purposes. A benefit of this is that the risk of contamination of the Townlands Dam would be reduced, as the water from the cooling process would no longer go into the Townlands Dam.
- In order for proposed PCD's not to spill, there must be an allowance to recycle water back into the process water stream for the plant. Recycling of this water must be incorporated into the water management system and water management philosophy in the future.
- Flow meters must be installed on water supply lines throughout the plant. The measurement of water sent to the Cement / Raw Mills and Kiln 3 and 4 and to measure water recycled back from cooling process to the Townlands Dam and wetland area is important. Measurement of water sent to each of the Softening Plants would provide great value in confirming estimated water consumption values.

5.4 BASELINE HYDROLOGY AND IMPACT ASSESSMENT

A baseline hydrology and impact assessment were carried out by JG Afrika. The report is titled, Baseline Hydrology and Impact Assessment, August 2022. Refer to **Appendix 3** for the full report.

The objectives of this baseline hydrological study were to:

- Describe the climatic, hydrological, landuse and topographical conditions of the study area by defining the general catchment conditions of the study site.

- Identify and delineate stream and river channels and their associated catchment areas in the vicinity of the plant.
- Determine the Mean Annual Runoff (MAR) for the project area and any contributing catchments in the vicinity of the plant.
- Undertake an impact assessment of the plant, focusing on the potential risks associated with the site related specifically to local and regional hydrology. Using the impact assessment, mitigation measures have been provided to reduce the risks associated with the identified potential impacts.

Quaternary Catchment Details

Quaternary Catchment	Catchment Area (km2)	Evaporation Zone	Rain Zone	Water Management Area	MAR (MCM)	MAR Depth (mm)
C31A	1403	8A	C3A	10	8.11	5.78

The potential hydrological impacts identified were:

- Changes to the catchment water resources
  - An increase in impervious areas
  - Impeding or altering the flow of water in a drainage line
  - Abstractions
  - Limiting flow (capturing of contaminated stormwater)
- Changes in catchment water quality;
  - Erosion from the project site and sedimentation of downstream water resources
  - Discharging waste or contaminated water (I.e. contamination from the coal stock yard and, additives areas, pit dewatering and sewage spills)
- Changes in catchment flood hydrology
  - An increase in impervious areas
  - Altering the bed, banks, course or characteristics of a watercourse

These impacts are discussed in greater detail in the full specialist report.

5.5 FLOOD LINE STUDY

A Floodline Study was carried out by JG Afrika. The report is titled, 1:50 and 1:100 Year Floodline Study, March 2022. Refer to **Appendix 24** for the full report.

Through the peak discharge calculation and the design rainfall values, the resultant peak discharge value of the unnamed drainage line is shown in the table below.

Summary of Inputs for Peak Discharge Calculation

Catchment	Catchment Area (km2)	Longest Watercourse (km)	Average Watercourse Slope (m/m)	Time of Concentration (hours)
Unnamed Drainage Line	5.48	2.53	0.005	2.98

Peak Discharge Results

Catchment	1:50 Year Peak Discharge (m3/s)	1:100 Year Peak Discharge (m3/s)
Unnamed Drainage Line	10.42	14.01

As part of the floodline analysis, three flood scenarios were simulated. These included:

- Hydraulic analysis of the catchment area under current catchment conditions, including the impact of the blocked culverts and drainage line on the delineated floodlines.
- Hydraulic analysis of the project area if the existing hydraulic structures (maintaining their current sizes) were to be unblocked, and an area of at least 6 m wide were cleared (i.e. dumped materials removed) along the original flow path of the identified drainage line.
- Hydraulic analysis of the 1:50 and 1:100 flood events, based on the recommendations provided to Lafarge for the rehabilitation of the drainage line and wetland area long the drainage line, including increasing of the hydraulic capacity of the road and rail crossings with reference: report title "*Environmental Management Plan: Rehabilitation of the Wetland in the Vicinity of the Lafarge Cement Factory in Lichtenburg*".

Floodlines Results

As shown in Figure 4, the simulated floodlines based on current catchment conditions (including the existing blockages to flow along the drainage line). The delineated floodlines shows:

- Floods will inundate extensive areas to the north and east of the project area;
- Simulations indicated that flows from the drainage line will backup against (and overtop) the railway line, until such time that flood waters both backup and flow into the non-operational quarry (Townlands Dam) and flood infrastructure in the north-eastern portion of the factory;
- Resulting in the current lime silos becoming flooded, as well as other infrastructure along the eastern border of the plant.
- Towards the lower end of the project site, simulations indicated limited flooding, particularly for the 1:50 year flood event. This is due to the majority of flood water being dammed up along the northern boundary of the project site during this flood event.
- During the 1:100-year flood event, more flood waters will overtop the railway line and roads, resulting in more extensive flooding along the southern areas of the project site.

To ascertain the degree of which the flooded area will reduce if the exiting culverts are unblocked and some of the materials dumped along the drainage line are removed (as per the rehabilitation plan), a simulation scenario was

undertaken. It is hypothesized that this flooding is a result of the limited capacity of the culverts through which flood water are required to pass (based on the existing culvert sizes). Simulations indicated that backing up of floodwaters occurred upstream of the culverts, resulting in extensive areas along the eastern boundary of the part being flooded, as presented in Figure 6.

A third scenario which considered the culverts being unblocked, some of the damped material being removed and included the assumption that the drainage line and wetland rehabilitation plan (as designed in the Rehabilitation Plan) had been implemented on site. The importance of this floodline study, is the increase in the hydraulic capacity of road and rail crossings, the inclusion of a diversion berm and the removal of infill material along the drainage line. This scenario is reflected in Figure 7 below.

The third and final simulation / scenario is the preferred situation. This scenario included increasing the capacity of the culverts, the construction of a flood protection berm and the removal of materials dumped along the drainage line (as per the proposed wetland rehabilitation plan). The results of this scenario showed significantly reduced flooding extents and resulted in no infrastructure associated with the Cement Plant falling within the delineated flood lines (Figure 8 and 9).

It is therefore recommended that the rehabilitation of the area impacted by the dumping of waste material be undertaken. The rehabilitation must include increasing the capacity of culverts at road and rail crossings, the construction of a berm running between the drainage line and the Cement Plant and the removal of materials dumped within the drainage line and floodplain.

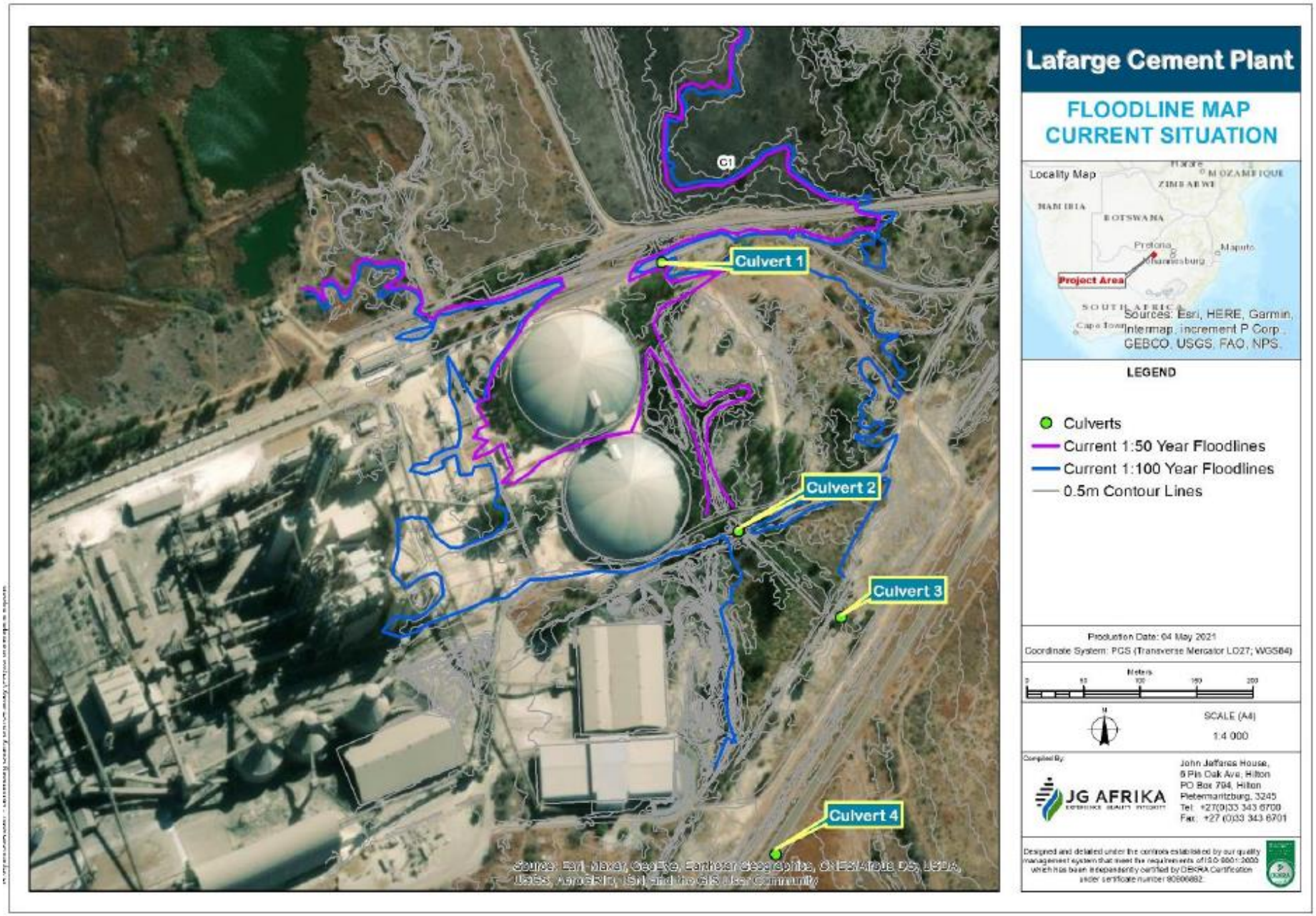


Figure 6: Hydraulic analysis results based on current catchment conditions and including blocked culverts and infilling of the drainage line

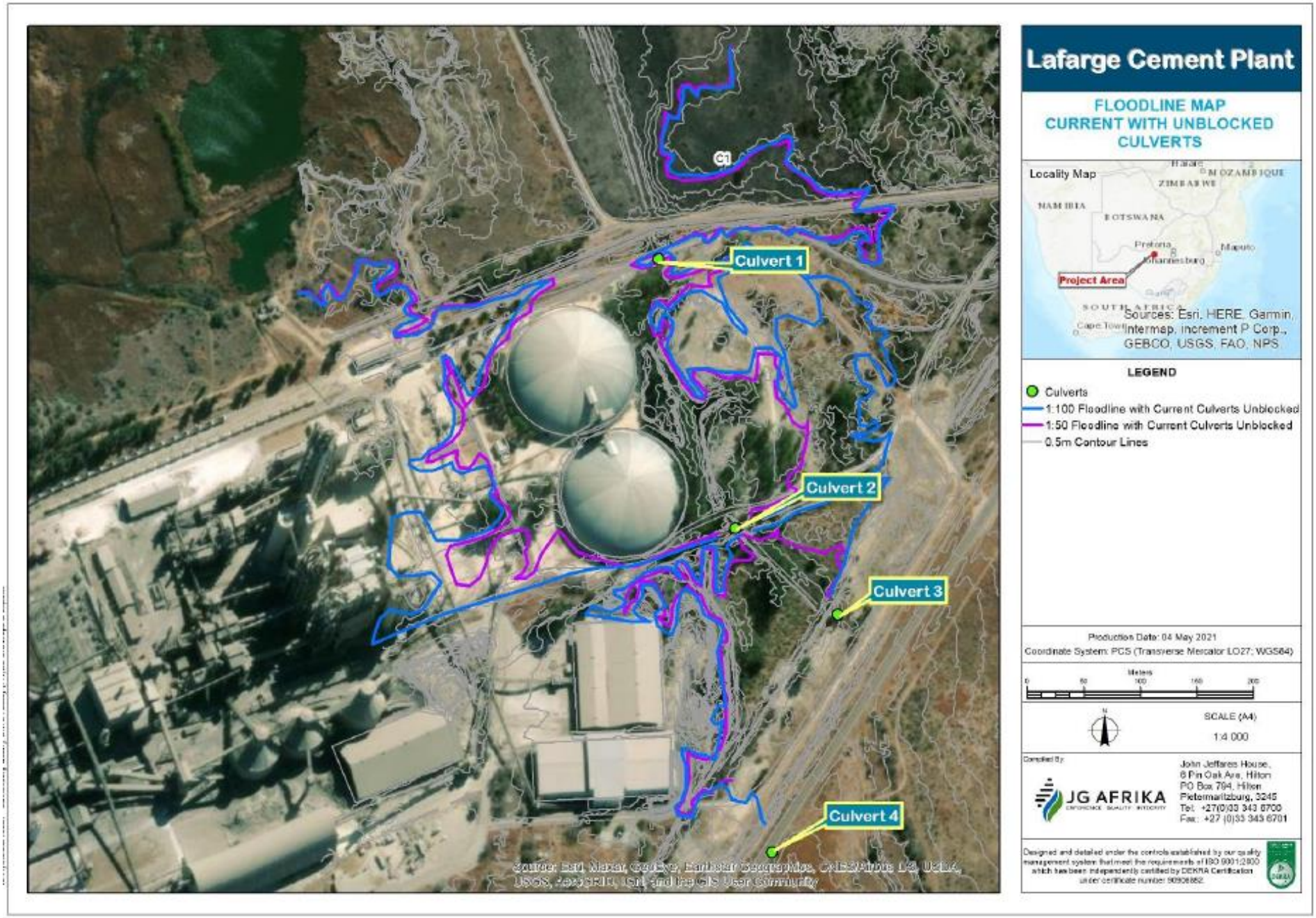


Figure 7: Hydraulic analysis results based on unblocked culverts and removal of portions of the dumped materials along the drainage line.

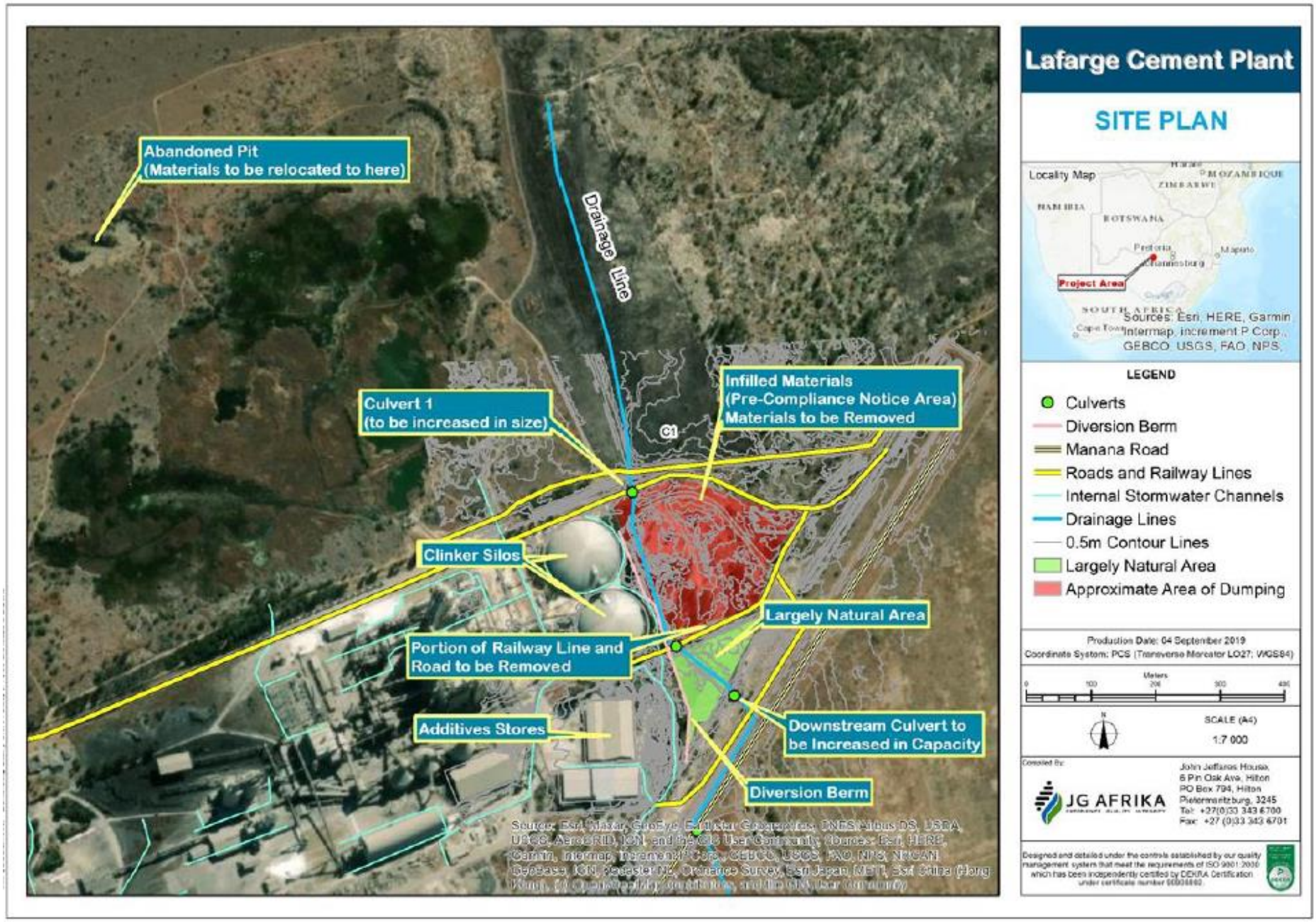


Figure 8: Proposed rehabilitation of the drainage line and locations of increased capacity of road and rail crossings

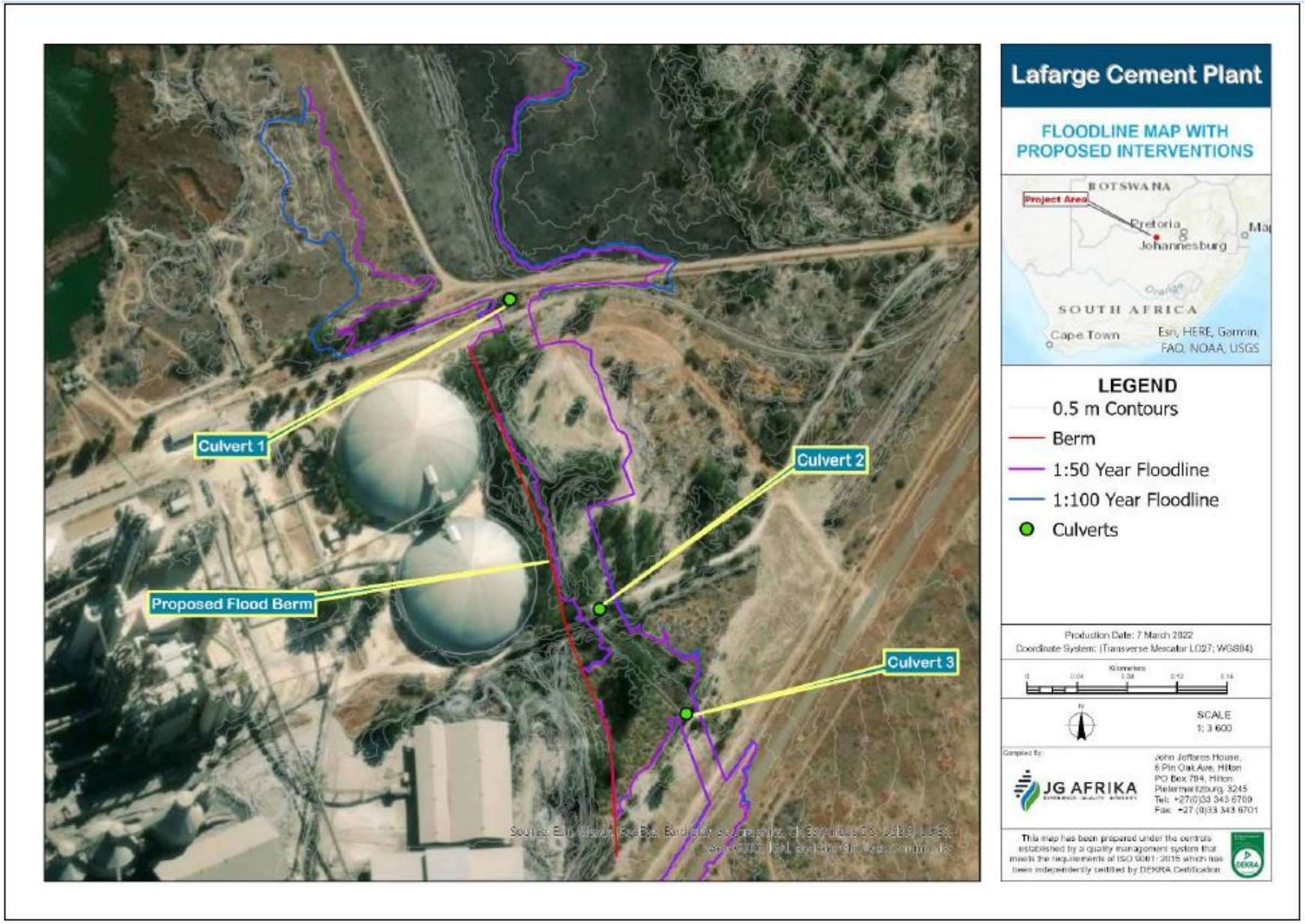


Figure 9: Updated hydraulic analysis results based on increased culvert capacities and a flood diversion berm being constructed

5.6 STORMWATER MANAGEMENT, INFRASTRUCTURE AND POLLUTION CONTROL DAMS

A Stormwater Management Plan has been compiled by JG Afrika for the Lichtenburg Cement Plant. Refer to **Appendix 11** for the full report.

Additionally, A Stormwater Infrastructure and Pollution Control Dams Preliminary Design Report has been compiled by JG Afrika for the Lichtenburg Cement Plant. Refer to **Appendix 15** for the full report.

An effective storm water management system is essential to ensure operations at the Cement Plant are uninterrupted and to protect the downstream water resources. The main objective of the Stormwater Management Plan (SWMP) is to ensure that the risk of polluting water resources downstream of the Lafarge Cement Plant site are minimised. This includes the management of dirty water generated at the Cement Plant, stockpile areas, overburden stockpile areas and fuel and hydrocarbon stores.

The basic principles of a SWMP are outlined below and were followed in this study.

1. Clean water must be kept clean and be routed to a natural watercourse by a system separate from the dirty water system, while preventing or minimising, the risk of spillage of clean water into dirty water systems.
2. Dirty water must be collected and contained in a system separate from the clean water system and the risk of spillage, or seepage, into clean water systems must be minimised.
3. The SWMP must be sustainable over the life cycle of the dirty areas, over different hydrological cucles and it must incorporate principles of risk management.
4. The statuary requirements of various regulatory agencies and the interests of stakeholders must be considered and incorporated.

Stormwater Management Plan

Due to the extent of the Lafarge Cement Plant, the Plant has been subdivided into five areas, largely pertaining to different catchment areas and discharge points.

1. **Area A –** The Dispatch, Temporary Storage, Packing Plant, Cement Silos, Fly-Ash Silos, Gypsum Offload, Workshop, Wash Bay, Offices, Railway Sidings on the western portion of the property. The Stormwater runoff from Area A flows in a westerly direction, reporting to Channel A9, located adjacent to the railway line and eventually discharges into a tributary of the Harts River. This area is located on a ridge, and there is no requirement for clean stormwater runoff diversions. Channel A10 will carry water to a sump which is then pumped into Channel A2.

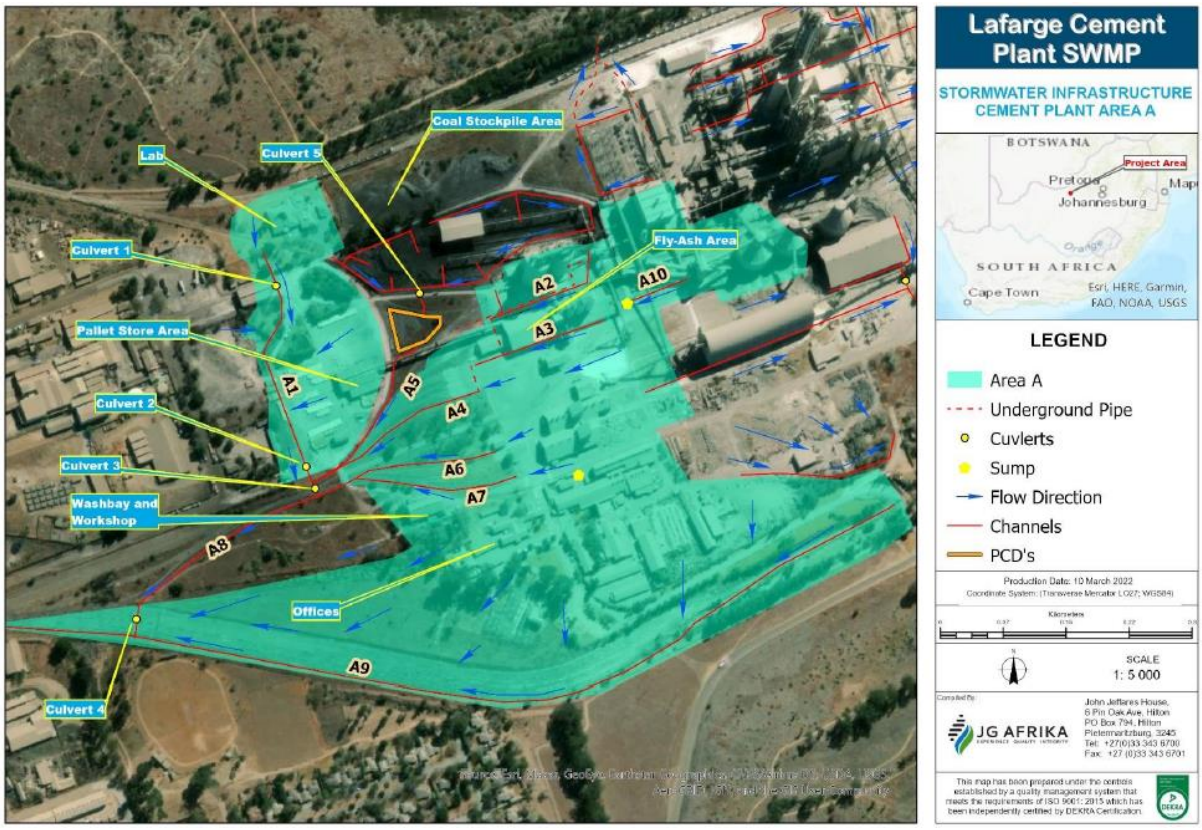


Figure 10: Lafarge Lichtenburg Cement Plan Stormwater Channels – Area A

2. **Area B –** The Coal Stockpile, Cement Silos, Fly-Ash Silos and Gypsum Offload Area located in the central area of the property. Currently, stormwater runoff from this area either discharges to the environment to the north of the cement plant or in a southerly direction into the stormwater channels around the Cement and Fly-Ash Silos and into Channels A4 and A5.

   The area of the Coal Stockyard is considered a source of potential contamination to the downstream environment. Currently, no dirty stormwater management infrastructure was noted in the area of the Coal Stockyard. Due to limited stormwater management infrastructure in the vicinity of the Coal Stockpile, the following is proposed:

   The area in which coal is stored on site must be minimised as far as possible. Through reducing the area in which the coal is stored, the volume of water that needs to be managed on site will be reduced. It was noted from discussions with Lafarge that the area to the north of the access road will no longer be used to store coal. This area is to be rehabilitated and therefore is not considered further in the recommendations for stormwater management around Area B.

   It is recommended that the Coal Stockyard area is lined. It should be noted that by reducing the area associated with the Coal Stockyard, the costs associated with lining the Coal Stockyard and the capacity requirements of the downstream PCD are reduced.

A stormwater channel is recommended to be constructed around the perimeter of the Coal Stockyard, with fish-bone drains extending from the perimeter channel into the coal stockyard. The purpose of this channel is to contain stormwater runoff from Coal Stockyard as well as to ensure that pooling of stormwater within the stockyard area is prevented.

Stormwater channels along the perimeter of the coal stockyard are proposed to direct stormwater runoff to the Coal Stockyard PCD

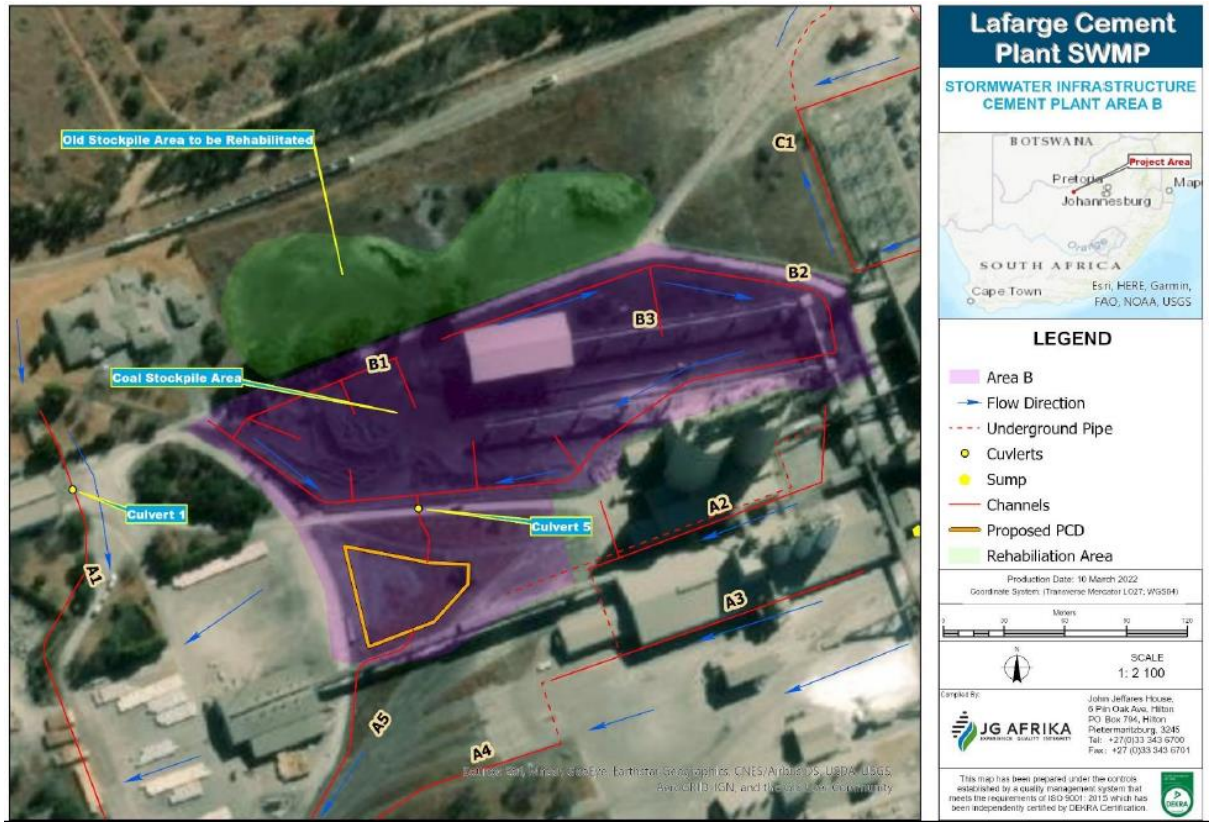


Figure 11: Lafarge Lichtenburg Cement Plant – Coal Stockyard Area Stormwater Management - Area B

3. **Area C –** The Electrical Substation, Fire-Tank, Fuel Storage area located along the northern portion of the property. Stormwater from these areas discharges in a northerly direction, through an underground stormwater channel, toward the Quarry (Townlands) Pit Sump.

   The potential hydrocarbon contamination sources in the substation area are bunded and the area north of the Sub-Station area is unlikely to contaminate surface water resources. The catchment pertaining to Area C is considered a clean stormwater runoff area.

   * It was noted that there are significant quantities of fine sediment in the area around the fuel tank. The source of these fine sediments was not known. In order to maintain its status as a clean stormwater catchment area (therefore avoiding the requirement of storing and/or treating stormwater runoff prior to discharge), all fine sediment located in this area needs to be removed to an area designated for storage of waste materials. This needs to be undertaken regularly so that there is never a build-up of waste (fine sediment), which could negatively impact upon the downstream environment.

It was found that a number of the stormwater channels in Area C were poorly maintained and had vegetation growing within the channels. This will result in a decrease the capacity of the stormwater channels. It is therefore recommended that all stormwater channels in this area are cleared of sediment and vegetation at least bi-annually.

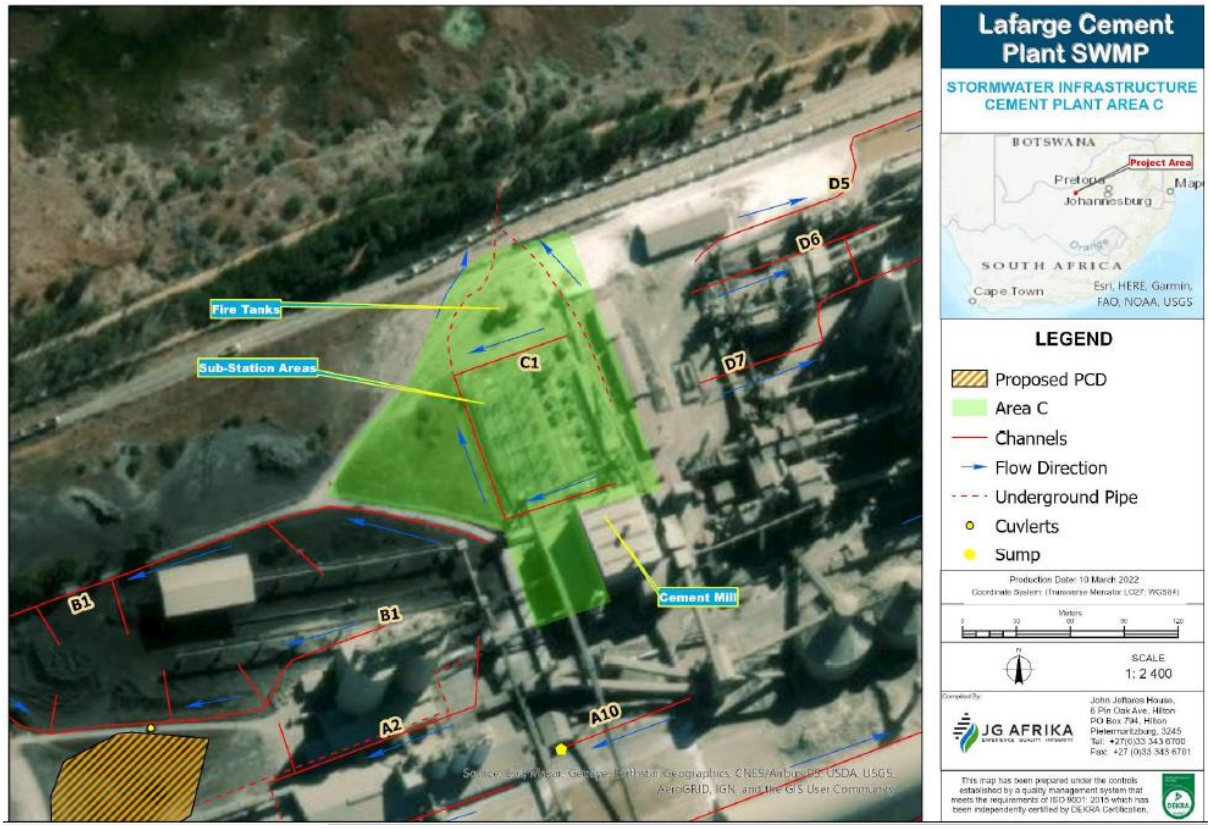


Figure 12: Lafarge Lichtenburg Cement Plant Stormwater Channels – Area C

4. **Area D –** The Raw Mills, Kiln, Limestone Domes, Clinker Silos, China Town (Materials store) and Additives Storage areas in the central and south eastern area of the project site. Stormwater runoff from these areas report to Channel D1C, which then discharges in a northerly direction into the Quarry Sump.

   The area contributing flows to Channel D1 is relatively large and consists predominantly of hardened surfaces within the main process area of the cement plant. The main concern for stormwater management in this area is that of excessive volumes of fine sediment. This has resulted in the majority of stormwater channels in Area D being partially or fully blocked. The chemical characteristics of the fine material is not known, however, it is noted that stormwater runoff from this area will be contained within the Quarry Sump. It is recommended that water quality sampling is undertaken, particularly from Channel D1 (last channel before the Quarry Sump), to determine the risk of chemical contamination of the water resources in the Quarry Sump. During the site assessment, no sources of hydrocarbon contamination were noted within the Area D catchment.

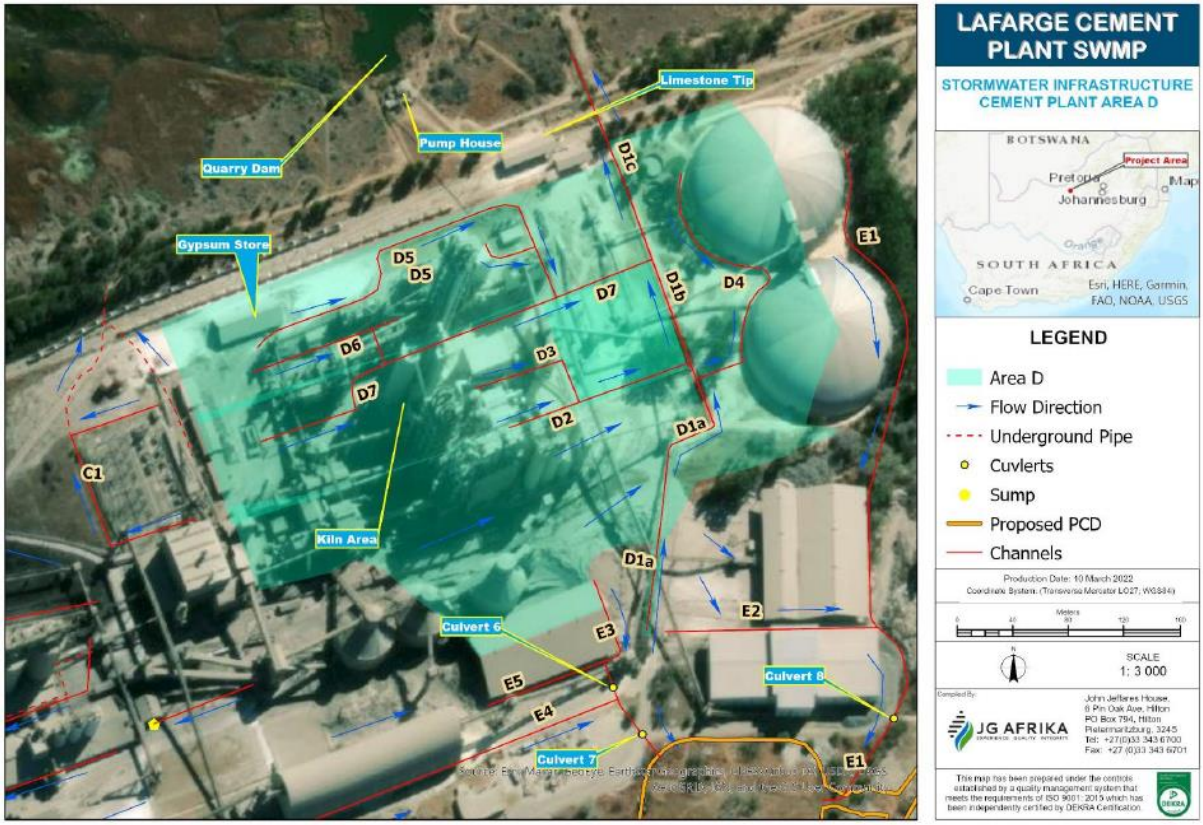


Figure 13: Lafarge Lichtenburg Cement Plant – Area D

5. **Area E –** materials, sediment and general dump area along the north eastern portion of the project site, where the unnamed stream traverses the project site. Stormwater discharges from this portion of the site are in a southerly direction.

Within the salvage yard area, it was noted that a significant number of oil drums (some empty and some containing used oil) are located outside of a bunded area. In order to ensure that hydrocarbon contamination of the downstream water resources is avoided, all oil drums on site (and any other sources of hydrocarbon contamination) must be stored within a bunded and lined area. Oil stores, including used oil drums, must have storage capacity within the bunded area, exceeding the volume of hydrocarbons being stored in the area. They also need to be sign posted, have access control and be roofed. Due to the high number of oil drums noted, it is recommended that the oil drums are appropriately disposed of and/or recycled.

Although the Additive Storage is located under a roofed structure, it is possible that additives may spill outside of the designated storage areas. Evidence of this was noted during the site assessment, where fine sediment (thought to originate from the additives stockpiles) was found in the main stormwater channel. It was also noted, based on information provided by the Client, that the additives may result in contamination to the downstream environment. Based on this, the area around the Additives Storage is considered as a dirty stormwater runoff catchment. Therefore, stormwater runoff from this area must report to a pollution control dam. It is noted that Vanchem Magnetite, Bauxite, Zimalco Aluminium Dross, Silica sand and Pozz Sand (Fly Ash) are stored in the additives area.

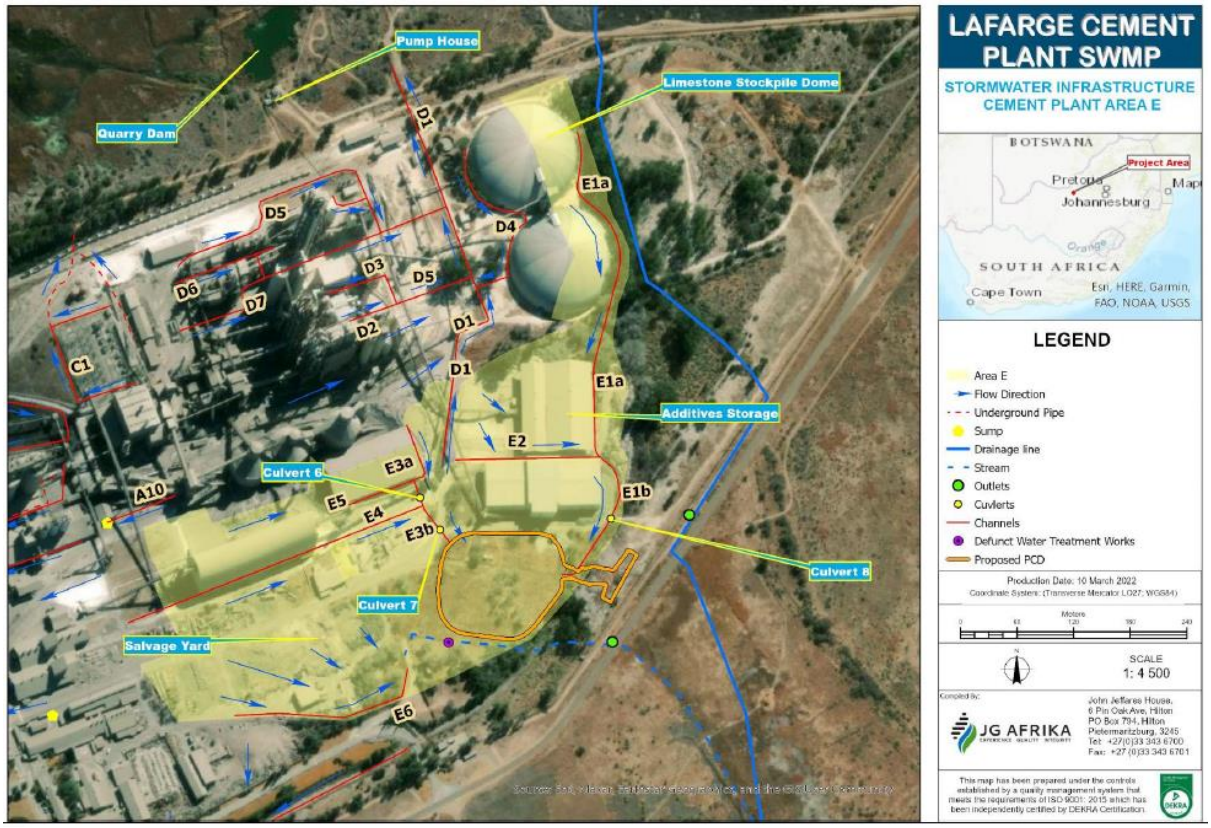


Figure 14: Lafarge Lichtenburg Cement Plant – Area E

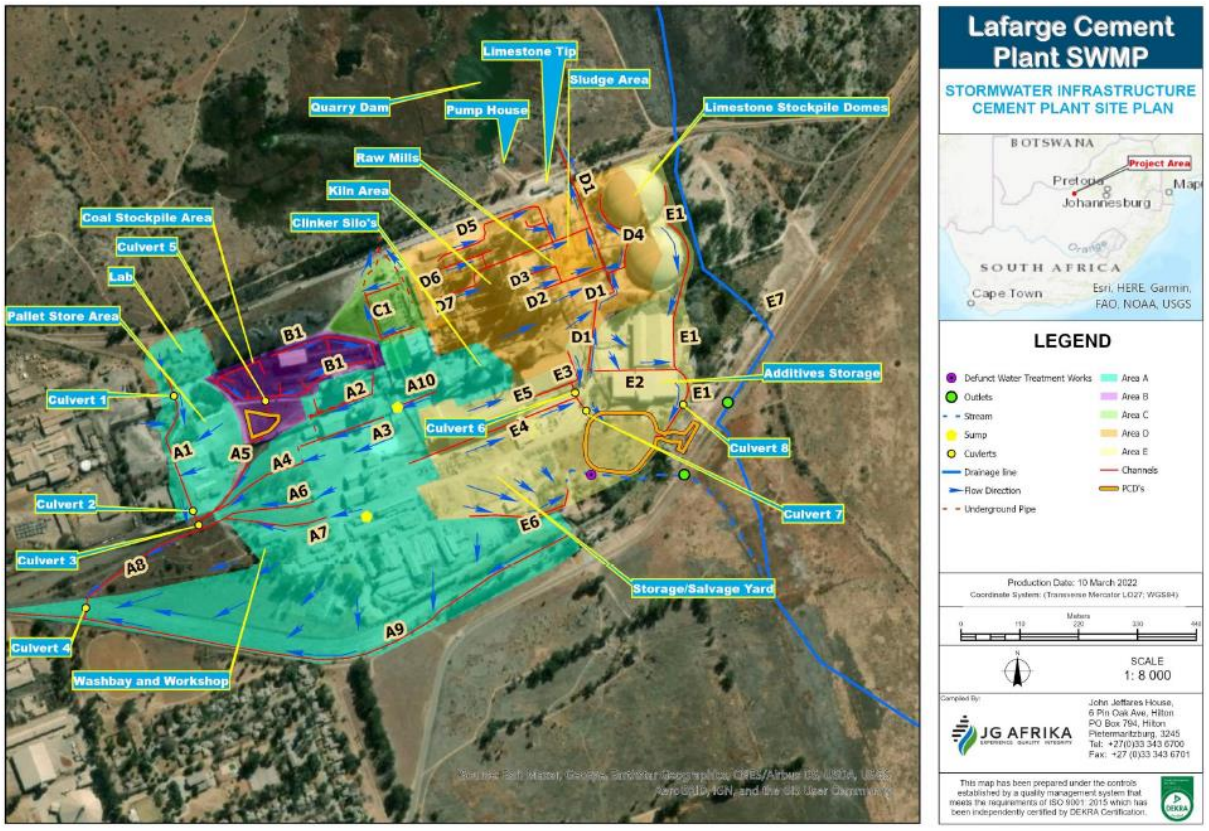


Figure 15: Lafarge Lichtenburg Cement Plant Focal Areas and Conceptual SWMP Assessment Areas

Proposed Infrastructure Layouts

The SWMP for the Cement Plant includes the five stormwater management areas A through E (as discussed above) with interconnecting channels. The proposed layout of the channels can be seen in Figure 16 below as taken from the SWMP. Some of these channels are existing and will remain in place as is.

Preliminary level designs of the proposed stormwater channels and engineering drawings of the proposed stormwater infrastructure are detailed in the Lichtenburg Lafarge Cement Plant and Tswana Quarry Stormwater Infrastructure and Pollution Control Dams Preliminary Design Report. Refer to **Appendix 15** for this full report and details.

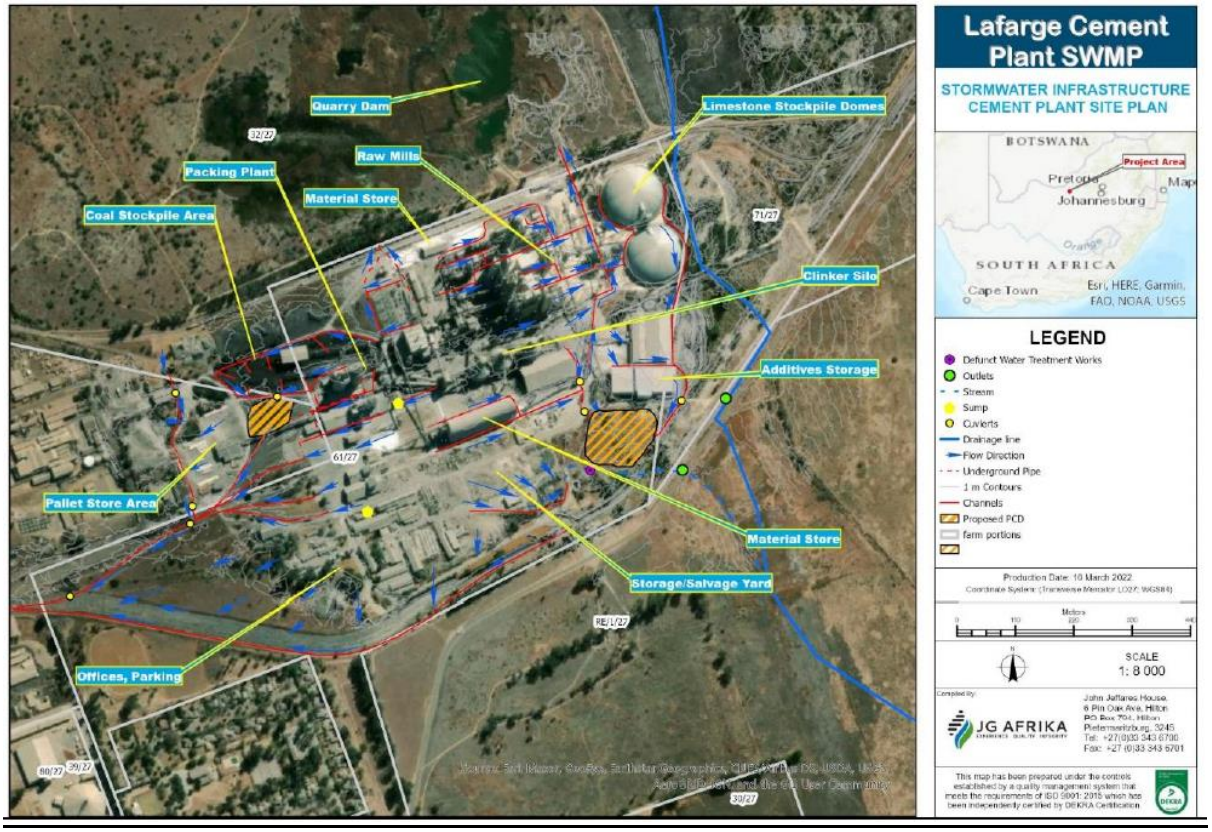


Figure 16: Lafarge Lichtenburg Cement Plant Proposed Stormwater Management Infrastructure

Figure 17 presents the channels as well as the delineated catchment areas for each stormwater management area. Not all areas require new infrastructure to be designed, therefore, for the purposes of this preliminary design report only areas A, B and E are the areas requiring new infrastructure. Refer to the full Stormwater Infrastructure and Pollution Control Dams Preliminary Design Report for detailed information on the proposed stormwater channel design, proposed culvert sizing and flood calculations and detailed information regarding the stormwater management of each connecting to channels and PCD's.

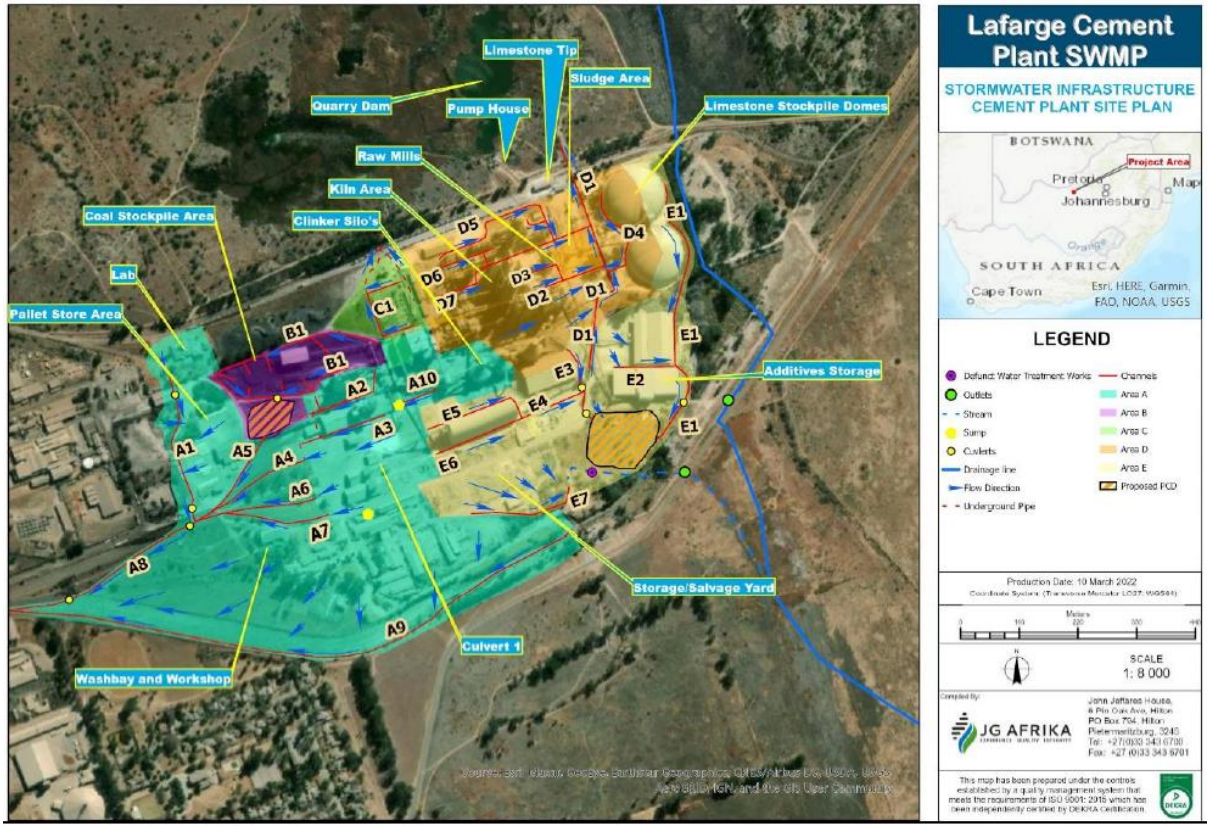


Figure 17: Lafarge Lichtenburg Cement Plant Proposed Stormwater Management Infrastructure

Pollution Control Dam (PCD's)

At the Lafarge Cement Plant (LCP), two areas have been identified to require new PCD's to be constructed as per the Stormwater Management Plan. The primary purpose of the PCD's is to store the contaminated stormwater runoff passing through the additives area and the coal stockyard area. A pumpstation footprint has been included at each PCD, for the ultimate inclusion of a return water pump which recycles the water from the PCD back to the factory for reuse.

The PCD forms part of a complex stormwater management system and will accept all contaminated run-off during storm events. The PCD's are suitably sized to accommodate the entire volume of the 1 in 50-year storm event in that the facility and greater stormwater system will not spill contaminated water to the downstream environment more than once in a 50 year return period.

The level at which the PCD's are operated, will naturally determine the storage capacity available for storm events and as such it is recommended that the PCD's be operated at as low a level as is feasibly possible to allow for the capturing of as much runoff from storm events as possible to prevent the overflow of stormwater into the downstream environment. The operation of the PCD's is to be guided by the principles of the Lichtenburg Lafarge Cement Plant Water Balance Study.

One of the PCD's is required to contain dirty water from the additive area of the factory, whilst the other is required to capture runoff from the coal stockyard. The locations identified for the PCD's have been indicated in Figure 16.

The required sizes for these PCD's are:

- Additive PCD: 20 000m3
- Coal Stockyard PCD: 4 000m3

Refer to the full report for design requirements of the PCD's.

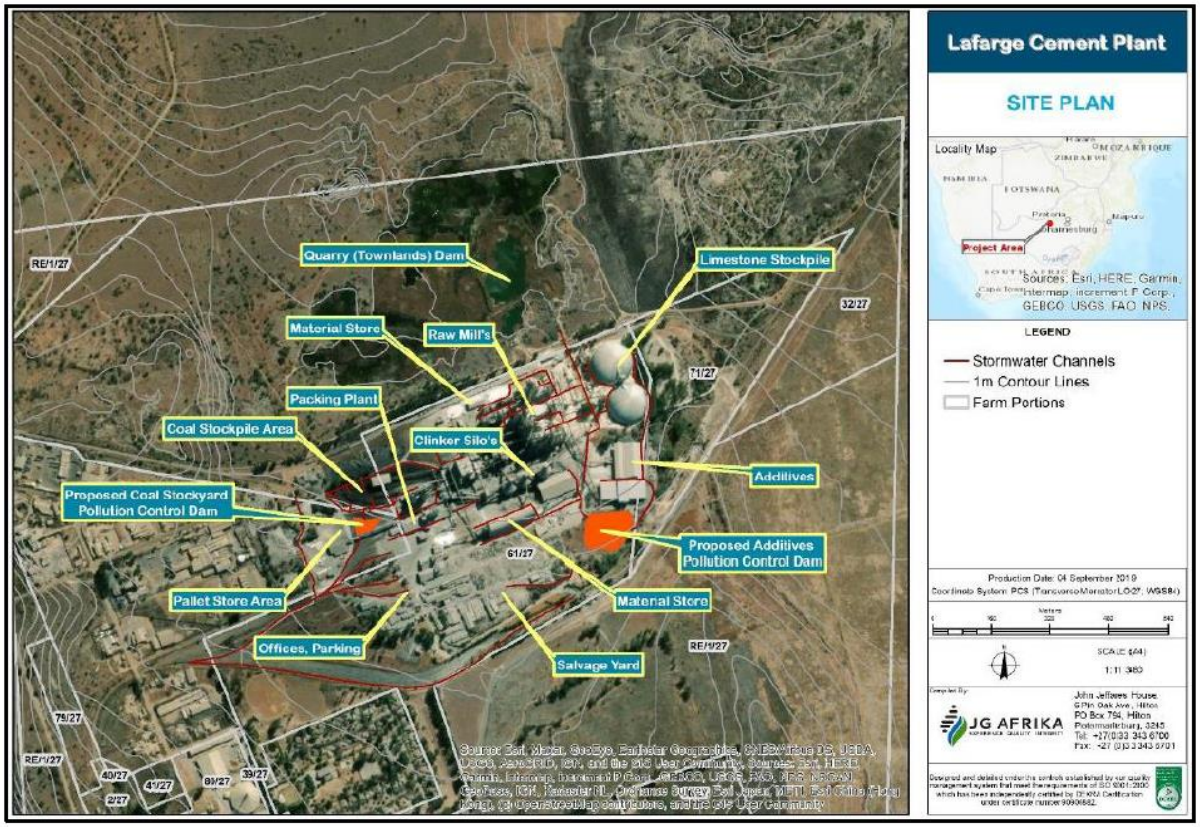


Figure 18: Locality Map of Lafarge Cement Factory PCD's

5.7 WATER QUALITY ASSESSMENT

Aquatico was commissioned by Lafarge Industries to sample, analyses and evaluate the physical, chemical and bacteriological quality of drinking (monthly) and surface (monthly). The results of the August sampling period can be found below (Refer to **Appendix 8**):

Potable Water

- Of the sampled potable water localities, Ants Hill, Tank and Village Recreation Club complied with the SANS 241-1:2015 limits in terms of all the analysed variables in August 2022.
- No bacteriological content in terms of E. coli and total coliforms were detected at any of the sampled localities.
- Elevated Total hardness, exceeding the Quality of Domestic Water Supplies Good (Class 1) water quality was recorded at all of the potable water localities (Table 6).

Ant Hill

Based on the assessment of variables analysed in comparison to 'SANS 241-1:2015 Drinking Water Standard (SABS, 2015)' and 'Quality of Domestic water supplies' (WRC, 1998), Ants Hill can be classified as Marginal (Class 2) water quality and is Conditionally Fit for use as potable water and domestic use due to Total Hardness.

Tank

Based on the assessment of variables analysed in comparison to 'SANS 241-1:2015 Drinking Water Standard (SABS, 2015)' and 'Quality of Domestic water supplies' (WRC, 1998), Tank can be classified as Marginal (Class 2) water quality and is Conditionally Fit for use as potable water and domestic use due to Total Hardness.

Village Recreational Club

Based on the assessment of variables analysed in comparison to 'SANS 241-1:2015 Drinking Water Standard (SABS, 2015)' and 'Quality of Domestic water supplies' (WRC, 1998), Ants Hill can be classified as Marginal (Class 2) water quality and is Conditionally Fit for use as potable water and domestic use due to Total Hardness.

Process water quality

Nearby quarry water (locality Process water) is pumped throughout the process system and utilised for the cooling processes at Lafarge industries. The Zinc Dam is utilised as a water storage facility. Alkaline pH values (pH > 8.5) were recorded at locality Zinc Dam, while a neutral pH (pH 6.0 - 8.5) prevailed at Process Water during August 2022. Exceedances of the SAWQG for Industrial Use at locality Process Water were recorded in terms of pH and electrical conductivity (EC), while Zinc Dam exceeded for the aforementioned variables as well as chloride (Cl), sulphate (SO4) and manganese (Mn) concentrations.

EC and Mn of the analysed variables at locality Zinc Dam also exceeded the General Authorisation Limits during August 2022 (Table 8). It should be noted that significantly high EC, Cl and SO4 concentrations prevail at locality Zinc Dam and should not be released into the receiving environment. The possible reason for the high concentrations of the variables mentioned above is the concentration effect taking place in the dam due to evaporation.

Townlands Pit Water Quality

The water at the Townlands PPit can be described as saline and hard to very hard. All of the analysed variables complied with the General Authorisation limit at Townlands Pit during August 2022. The compliant (“unaffected”) water quality might be as a result of the influx of fresh rain water that causes a dilution effect. No exceedances in terms of any analysed variables compared to the SAWQG for Livestock Watering limits.

5.8 GEOHYDROLOGICAL ASSESSMENT

A Geohydrological Report was prepared by JG Afrika (Pty) Ltd, in support of the water use authorisation for Lafarge Cement Plant. The aim of the assessment was to determine the sustainable yield of the current supply borehole designated LBH1, LBH2 and LBH3, conduct a hydrocensus to establish potential receptors, and to develop a numerical groundwater flow and mass transport model, to determine risk and impact. Refer to **Appendix 2** for the full report. 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 characterised as *Minor* beneath the plant site, and *Major* 1km to the north of the site (JG Afrika, Geohydrological Assessment, 2022).

Borehole Yield Assessment

The yield testing of the boreholes was carried out by JG Afrika (Pty) Ltd over the period 19 to 28 August 2022, in accordance with the guidelines of the South Africa National Standard SANS10299-4:2003 Part 4: Test Pumping of Water Boreholes. The observed operations were that LBH2 was the main supply borehole for the plant, while LBH1 served as a backup supply, and LBH3 was used for community stock watering. The sustainable yield for each borehole is depicted below:

Borehole LBH1 - The maximum daily volume that can be abstracted from the borehole at 2.5 l/s for 24 hours of pumping is 216 m3/d. The recommended daily volume in a 12 hour duty at 3.54 l/s is 153 m3/d.
Borehole LBH2 - The maximum daily volume that can be abstracted from the borehole at 21.1 l/s for 24 hours of pumping is 1823 m3/d. The recommended daily volume in a 12 hour duty at 29.8 l/s is 1289 m3/d.
Borehole LBH3 - The maximum daily volume that can be abstracted from the borehole at 17.1 l/s for 24 hours of pumping is 1478 m3/d. The recommended daily volume in a 12 hour duty at 24.19 l/s is 1045 m3/d.

This equates to approximately: LBH1: 78 840, LBH2: 665 395, and LBH3: 539 105 m3/a. The cumulative annual volume is 1 283 340 m3/a.

Groundwater Quality

Groundwater samples were 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 indicate that total coliforms exceeded the operational screening limits in LBH3, and heterotrophic plate counts exceeded the operational screening limits in LBH1 and LBH3. These results may be indicative of sample holding times and/or the increased activity in the boreholes associated with the yield testing. Shock treatment with a once off chlorine dose is recommended and future monitoring according to the groundwater monitoring plan will determine if these counts are persistent (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:

Table 8: Borehole Management Plan

Borehole ID	LBH1	LBH2	LBH3
Water Quality	SANS241 operational limits have been exceeded	All within SANS241 limits	SANS241 operational limits have been exceeded
Compounds of Concern	Heterotrophic plate count	none	Total coliforms Heterotrophic plate count
Risk	Operational	none	operational
Treatment / Action	Once of shock treatment, biannual Monitoring	Biannual monitoring	Once off shock treatment, biannual monitoring
Sustainable Yield (l/s)	2.5	21.1	17.1
Recommended Duty	12	12	12
Abstraction Rate for Duty Period (8 hrs)	3.54	29.85	24.19
Volume on Specified Duty (m3/d)	152.76	1289.33	1044.90
Critical Drawdown (mbgl)	22	24	24
Anticipated Maximum Head (m)	46	47	43
Recommended Pump Installation Depth (mbgl)	22	24	24

Hydrocensus

A hydrocensus was required to determine existing groundwater use in the project area and to establish possible impacts on existing resources from the Lichtenburg Cement Plant 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 108 (No.) resources within 5 km of the site. A field verification hydrocensus was also carried out. A total of 54 (No.) resources were identified during the previous and current survey. Thirty-nine (39 No.) water supply boreholes, and fourteen (14 No.) unused boreholes were identified.

KEY	SITE	Borehole ID	verified
1	Cement Plant	LBH1	yes
2	Cement Plant	LBH2	yes
3	Cement Plant	LBH3	yes
4	Cement Plant	LBH10	yes
5	Cement Plant	LBH11	yes
6	Cement Plant	LBH12	yes
7	Cement Plant	LBH13	yes
8	Cement Plant	LBH14	yes
9	Cement Plant	LBH15	yes
10	Cement Plant	LBH16	yes
11	Cement Plant	LBH17	yes
12	Cement Plant	LBH18	no
13	Cement Plant	LBH19	yes
14	Cement Plant	LBH20	yes
15	Cement Plant	LBH21	yes
16	Cement Plant	LBH22	yes
17	Cement Plant	LBH23	yes
18	Cement Plant	LBH24	yes
19	Cement Plant	LBH25	yes
20	Cement Plant	LBH26	yes
21	Cement Plant	LBH27	yes
22	Cement Plant	LBH31	no
23	Cement Plant	LBH32	no
24	Cement Plant	LBH33	no
25	Cement Plant	LBH34	no
26	Cement Plant	LBH35	yes
27	Cement Plant	LBH36	no
28	Cement Plant	LBH37	no
29	Cement Plant	LBH38	yes
30	Cement Plant	LBH39	yes
31	Cement Plant	LBH40	yes
32	Cement Plant	LBH41	yes
33	Cement Plant	LBH42	yes
34	Cement Plant	LBH43	yes
35	Cement Plant	LBH44	yes
36	Cement Plant	LBH45	yes
37	Cement Plant	LBH46	no
38	Cement Plant	LBH47	no
39	Cement Plant	LBH48	no
40	Cement Plant	LBH49	new
41	Cement Plant	LBH50	new
42	Cement Plant	LBH51	new
43	Cement Plant	LBH52	new
44	Cement Plant	LBH53	new
45	Cement Plant	LBH54	new
46	Cement Plant	LBH55	new
47	Cement Plant	LBH56	new
48	Cement Plant	LBH57	new
49	Cement Plant	LBH58	new
50	Cement Plant	LBH59	new
51	Cement Plant	LBH60	new
52	Cement Plant	LBH61	new
53	Cement Plant	LNH62	new

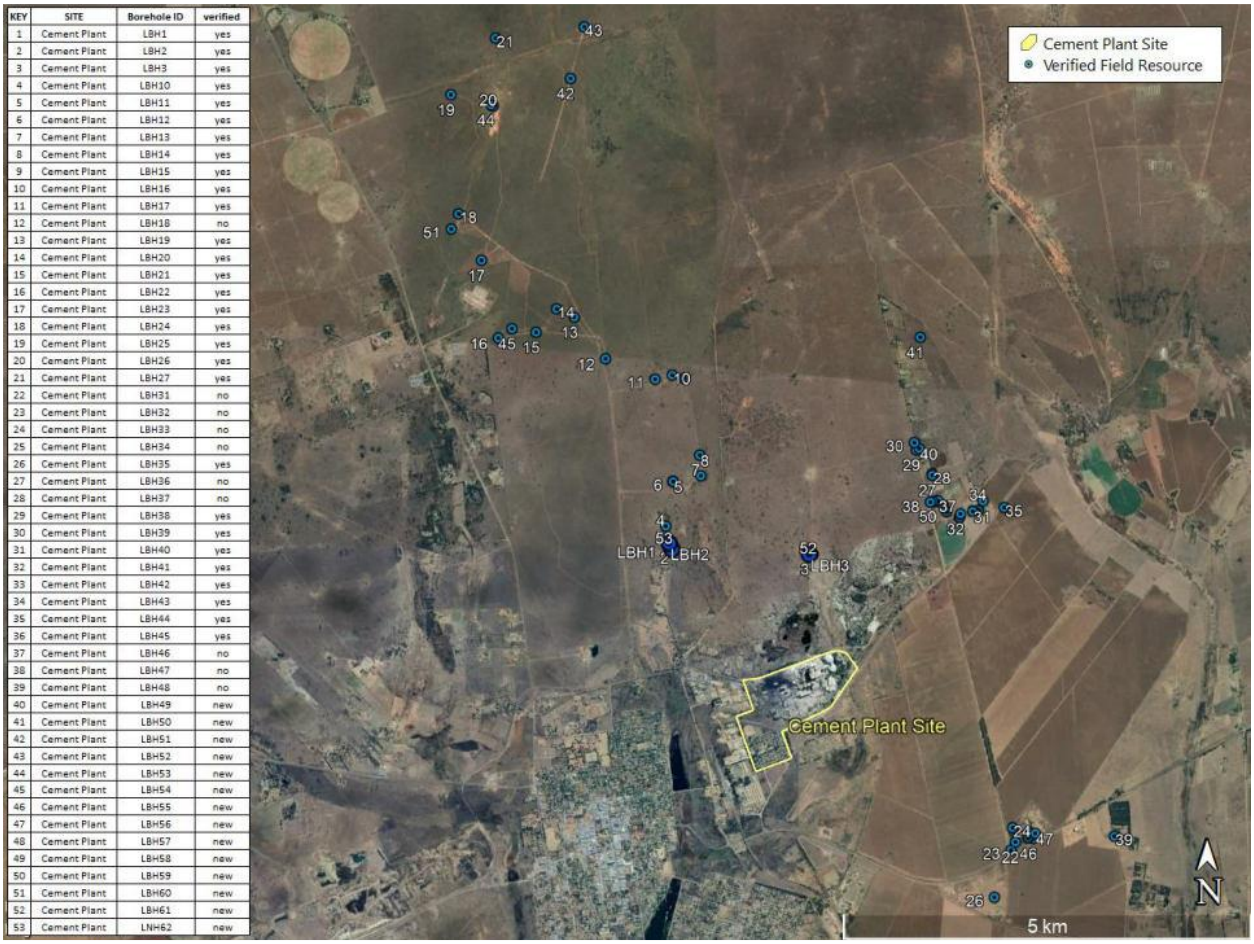


Figure 19: Field Verified Resources (After Tucana Solutions 2017)

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 boreholes were determined as 78 840, 665 395 and 539 105 m3/a for LBH1, LBH2 and LBH3 respectively through yield testing of the boreholes. The model results indicated that the net inflow is dependent on the water level in the pit such that the higher the pit level, the greater the net inflow, and groundwater is in continual balance with the evaporation component resulting in a near zero net flow for a particular pit level. The pit inflow reduces as the pit level drops. The variability of the contribution from rainfall and stormwater is offset by continuous evaporation, resulting in a general water balance in the pit, and as a result, the pit level does fluctuate periodically given these inputs.

The mass transport results showed a northerly plume migration as a result of the abstraction taking place north of the plant. It is evident that pumping borehole does have an influence on plume migration. It is also evident that the source concentrations increase over time as the evaporation process does not allow for mass transport out of the system. This leads to a concentration of salts over time. Model calibration is 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 pit would enhance the model output for determining groundwater flux in this area. Additional monitoring boreholes were proposed adjacent to and downslope of the stockpile and PCD, around the pit 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 and PCDs 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
- Use of dam water for dust suppression and impacts on groundwater quality in surrounding areas
- Impacts on downstream users
- Future pit decant
- Salt loading through evaporation process
- Prolonged leaks from stockpiles/PCDs and impacts on groundwater
- Mobilisation of existing elevated compounds
- Major loss of contaminant dam overflows
- Sludge removal and impacts on groundwater quality

Additionally, the aquifer vulnerability was considered as medium to high, and the Parsons Groundwater Quality Management System gives the site a Medium Level of Protection index for the second variable vulnerability.

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 revised sampling plan to being applied at the Lichtenburg Cement Plant is summarized in Table 9 below.

Table 9: Revised Sampling Plan

Frequency	Sample Locations	Analytical List	Comments
Bi-annually	P1 or P3	pH, EC, Ca, Mg, Na, K, Total Alkalinity, F, Cl, NH4(N), NO3(N), PO4, SO4, Al, Fe, Mn SANS241 Raw Water	Reinstate borehole
	P2		*Reinstate borehole*
	LBH1		Ongoing, include monthly water levels and meter readings
	LBH2		
	LBH3		
	NBH1		Proposed
	NBH2		*Proposed*
Annually	P1 or P3	Ba, As, Co, Cr, Ni, Pb, Se, Sr, V, Zn, Mn, Cu, Ga, Ge, Rb, Y, Zr, Sn, W, Bi, Th, U, Hg	Reinstate borehole
	P2		*Reinstate borehole*
	LBH1		Ongoing, include monthly water levels and meter readings
	LBH2		
	LBH3		
	NBH1		Proposed
	NBH2		*Proposed*

It is noted that existing monitoring boreholes P1 or P3 and P2 need to be reinstated as they are flagged as demolished or dry. Additional monitoring boreholes may include NBH1 and NBH2 to augment the data set (Figure 20). These boreholes target the stockpile and PCD area and the regional structure north of the site.

Figure 20: Cement Plant Groundwater Monitoring Network

6. SOCIO ECONOMIC ENVIRONMENT

This section provides an overview of the Socio-Economic profile on a provincial and local level. Statistics at the Provincial level were taken from the North West Economic Status, November 2020.

Provincial Level – North West Province

The North-West Province (NW) has a population of close to 4.1 million people. Bojanala Platinum District comprises approximately 47% of the total population of the NW with Ngaka Modiri Molema DM comprising 22% of the total population of the NW. Females make up approximately 49.1% (2.0 million) and Men make up approximately 50.88% (2.1 million) of the population in the NW.

The NW contributes 6% to the National Economy in 2018, with a growth of 0.6% in 2018. Mining is the dominant industry in the North West.

During the third quarter of 2020, the number of unemployed increased to 0.37 million, with 1.35 million people between the ages of 15 and 64 years which were not economically active in the third quarter of 2020. NW gained 60 thousand employed persons in the second quarter of 2020. The official unemployment rate for the North West was lower than the national average, however the official and expanded (to include those discouraged and other reasons for not searching i.e. Lockdown) unemployment rate showed a 1.2% increase to 46.5%. the unemployment rate for the NW increased to 28.3% in the third quarter.

North West Economic Status, Statistics South Africa, Phil Selemela, 30 November 2020; Accessed from http://www.nwpg.gov.za/dedect/newsletter/PRESENTATIONS/North%20West%20Economic%20Status%20-%20Stats%20SA.pdf

Local Level (Lichtenburg)

As at 2001, the total number of people in Lichtenburg was estimated to be approximately 130 381. It is estimated that unemployment is between 20% and 30%. Majority of the residents are labourers in the various industries. Cement factories in the area are a major source of employment.

Schooling in the area is poor with about 37% of the population over 20 having completed primary schooling. Twenty one percent of the general population of Lichtenburg is estimated to be illiterate.

Housing in Lichtenburg varies from formal to informal residential areas in the surrounding townships. The provision of basic services varies between the urban and rural areas. About 67% of households are supplied with electricity. Water in the dwelling is provided to 28.5% of households. Flush sanitation is available to 45% of households. Municipal waste removal services are provided to 45% of households. Only 13% of households are currently living in informal dwellings or settlements. Social infrastructure in Lichtenburg and the surrounding areas is well developed.

The socio-economic impact of the water uses (if authorised or of the failure to authorise)

The authorisation of water uses for the Lafarge cement plant will provide the flowing 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 proposed expansion 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 disadvantage communities' business forums.

If the water uses are not approved the 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.

7. CHARACTERISATION OF THE WATER AND WASTE MANAGEMENT

7.1 WATER MANAGEMENT

7.1.1 PROCESS WATER

During the Water Balance assessment, water reticulation associated with the Cement Plant was evaluated. The study showed that abstraction occurs from three (3) supply boreholes. The reticulation of water is then broken down into various circulation areas as explained below.

Main Tank – Majority of the water that is pumped from the three boreholes is pumped into the Main Tank. Water is then circulated from the Main Tank to water used at the Cement Plant Toilets, the Quality Laboratory, Irrigation at the Old packaging Plant Gardens, water used for fire protection and then water that is distributed to Softening Plants A and B.

Softening Plant A – Water treated at the Softening Plant A is distributed to the Safety Offices, Stores, Offices and Boiler Shop, Plumber Stores, Clinic, Main Offices and to the Village. The Village being the greatest user of water from the Softening Plant A. A portion of the water used at the Village is lost to the environment. This water is assumed to be used for irrigation of gardens and for washing cars for example. Potable water is assumed to be returned to the circuit as wastewater, which is either removed by honey suckers (as it currently is) or reports to the WWTW (once the WWTW has been refurbished/commissioned).

Softening Plant B - Water from Softening Plant B is predominantly used for process water at the Kiln 3 and Cement/Raw Mills. In addition to this, water is also used from Softening Plant B to supply the Packaging Plant Ablutions.

Quarry (Townlands) Pit and Sump - Water from the Townlands Sump is used both for cooling product at the Cement Mills (which is then lost to evaporation) and for water to Kiln 4, for cooling purposes. The cooling water does not come into direct contact with Trunnion Bearings but is rather piped through the Kilns to cool the mechanical processes. This water is, therefore, understood to be of the same chemical makeup as water that is pumped from the dam (only the temperature of the water is changed). This water is then discharged, via stormwater channels, back into the Townlands Quarry Sump.

7.1.2 SEPTIC TANKS / SEWAGE PURIFICATION WORKS

Wastewater Treatment Works - There is a waste water treatment works situated within the Cement Plant facility, however it is defunct at present and needs to be upgraded and repaired in order to be of use.

7.1.3 POTABLE WATER

As explained above, water is supplied by Three (3) Boreholes, water is then transferred to the Softening Plant A which is treated and distributed to various operational areas, clinic, main offices and the village.

7.1.4 MONITORING AND CONTROL

Borehole monitoring must be done frequently to ensure quality of water being abstracted as well as supply reliability. Monitoring of water quality coming from the Softening Plant supplied to areas to be used as potable water must be tested regularly to ensure that water quality limits are within the drinking water quality standards. Waste water to be used for garden irrigation (non-edible) must also be tested on a regular basis to ensure that water quality limits are within acceptable standards.

7.2 WASTE MANAGEMENT

7.2.1 DOMESTIC WASTE

A waste management plan has not been provided for the Cement Plant; however it is assumed that the following waste streams are generated.

- General domestic waste – generated by office-based tasks
- Solid waste – generated by mining and processing activities including cement by-pass dust
- Hazardous waste – generated by workshop activities and through processing raw materials into the product.

It is assumed that general domestic and hazardous waste is disposed of at an appropriately licensed landfill sites, through the use of registered waste services providers.

7.2.2 PROCESS WASTE

Waste Produced Through Cement Manufacturing Process

Ash – Under normal operating conditions, a cement kiln produces no ash. The waste materials combust with any solid residue forming part of the clinker. Organic components are destroyed and inorganic components are bound up in the structure of the clinker.

Emissions – Air cleaning equipment at the plant will continue to be used for the project. The kilns are equipped with baghouse, electrostatic precipitators, and gravel bed filters. Cleaned gas is emitted to atmosphere via stacks.

Waste Materials Dumped in the adjacent Wetland

Historically, waste from the Cement Plant has been dumped within the adjacent wetland. This waste has been classified as non-hazardous waste by EnviroServ and there are no applicable landfill restrictions for the correct disposal of this waste. The EnviroServ classification certificate concludes that a Safety Data Sheet is not required for this waste, the waste assesses as a Type 3 and Type 3 waste may be disposed at a licensed H:H or H:h landfill or a licensed GLB+ landfill .

A wetland rehabilitation plan has been compiled by JG Afrika to ensure that the dumped waste within the wetland is removed, disposed of correctly and the sensitive area be rehabilitated.

Waste classification of waste to be collected by the Pollution Control Dams

A waste classification was, at the time of writing, in the process of being undertaken by Lafarge and the final findings of this had not yet been determined. In order to proceed with the preliminary design phase

of the PCD's and based on the type of waste present and experience at previous projects with similar waste types, the assumption was made that the type of waste would be a Type 3 waste.

Pollution Control Dam Liner Requirements

Based on the assumed findings of the waste classification being undertaken on samples obtained from the Lafarge factory, the resulting waste terminating in both of the PCD's is anticipated to be classified as a Type 3 waste. Type 3 waste according to the National Environmental Management: Waste Act, Regulation 636 (NEM:WA, Reg 636) of 23 August 2013, National Norms and Standards for Disposal of Waste to Landfill, requires a Class C liner or a historical GLB+ liner system, as detailed in the Minimum Requirements 2nd Edition, to be installed.

Type 3 Waste	Type 3 waste may only be disposed of at a **Class C** landfill designed in accordance with section 3(1) and (2) of these Norms and Standards, or, subject to section 3(4) of these Norms and Standards, may be disposed of at a landfill site designed in accordance with the requirements for a **GLB+ landfill** as specified in the Minimum Requirements for Waste Disposal by Landfill (2nd Ed., DWAF, 1998).

Figure 21: Type 3 Waste Liner Requirement According to NEM:WA, Reg 636

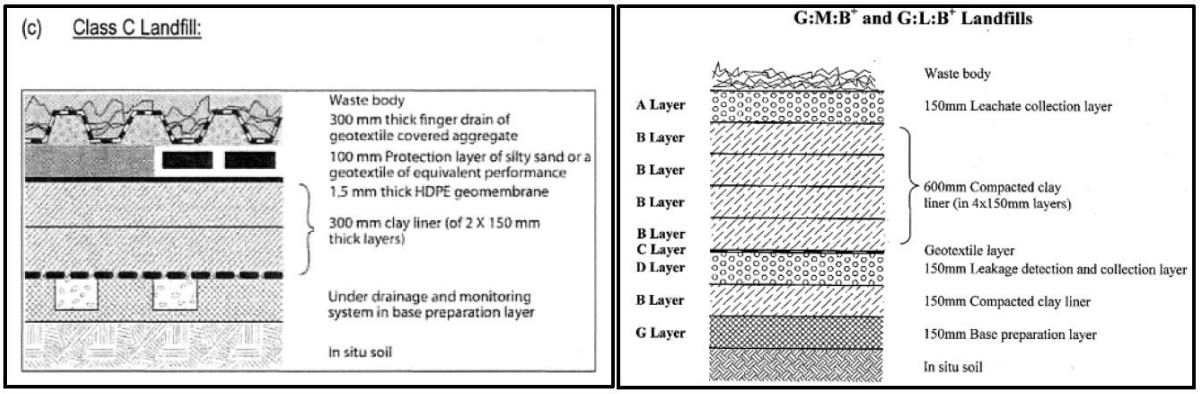


Figure 22: Class C and GLB Liner detail as per NEM:WA Reg 636 & MR2

Contaminated Stormwater

Contaminated stormwater runoff is currently not separated between 'clean' and 'dirty' water which leads to contaminated runoff entering into the environment at various locations. A stormwater management plan has been compiled in order to address this and ensure that the runoff is separated between 'clean' and 'dirty' and discharged into respective areas according to their characteristics. Refer to the Stormwater Management Plan and Infrastructure designs for details regarding the proposed management of the stormwater water.

7.2.3 WASTE RECYCLING

Waste used in the Clinker Manufacturing Process

Lafarge firmly supports the principle of waste management hierarchy and the need to conserve non-renewable resources and to recover, re-use and recycle materials to their fullest potential. Through

recycling waste, the plant is able to play a valuable role in maximising the use of latent energy within waste material and provide an environmentally beneficial alternative to landfilling.

By co-processing waste in cement kilns and substituting for coal, a non-renewable resource, savings are made through resource conservation and associated Carbon Dioxide emissions. For example, tyres are regarded as a nuisance waste and create significant environmental issues when they are burnt in an uncontrolled way (in the veldt). Lafarge has a special industrial ecology department, which is dedicated to support cement plants in the management of co-processing nuisance waste.

Secondary Materials or Alternative Fuels and Resources

The cement making process is energy and material intensive. Traditionally, fossil fuels and natural raw materials have been used to make Clinker (main ingredient in cement). To operate their business in a more environmentally, economically, and social beneficial way, the Association of Cementitious Material Producers (ACMP) are using 'Secondary Materials' or 'Alternative Fuels and Resources' (AFR), that are non-traditional for Clinker and Cement Production. These secondary materials or AFR allow for the recovery of both energy and material from selected by-products thus conserving non-renewable natural resources. To use these resources in a responsible way, the members of the ACMP apply the Secondary Materials or AFR Policy. Refer to Appendix 25 for the Policy document for reference.

(Association of Cementitious Material Producers, Secondary Materials or AFR Policy, 2004)

The Association of Cementitious Material Producers, which Lafarge (Pty) Ltd belongs to, when using Alternative Fuels and Resources, refuse "banned wastes", which include:

- Anatomical hospital waste;
- Asbestos-containing wastes;
- Bio-hazardous wastes;
- Electronic Scrap;
- Entire batteries;
- Explosives;
- High-concentration cyanide wastes;
- Mineral Acids;
- Radioactive wastes;
- Unsorted municipal garbage; and
- Unknown and/or unidentified waste.

According to Lafarge Cement's, Resource Recovery Policy, April 2007, the following will apply regarding waste quality control:

- All candidate waste will be subject to a detailed source of identification procedure prior to acceptance.
- Each customer is identified and relevant documentation will be established describing the waste stream, the known risks, protocols for reception and responsibility of each party;

- Specific analytical equipment will be used, either internally or at an assessed external laboratory;
- Documented control plans are to be developed and implemented;
- In the event of non-compliance, appropriate protocols must be communicated and implemented;
- Traceability of waste is ensured, through identification protocol and supply chain procedures; through regular audits of the equipment and procedure of the customers in case of waste streams outing from pre-treatment facility; and through notifications to the authorities according to the local regulation.

Typical AFR's used by Lafarge International:

- Tyres
- Solid Shredded Waste
- Liquid AF Tanks

Re-use of waste materials used by Lafarge Lichtenburg is gypsum and fly ash.

The preparation of AFR materials take place mainly offsite at Lafarge's approved waste management facility, located in Kaalfontien, near Kempton Park, Gauteng. The materials leave Kaalfontein facility and travel to the Lichtenburg plant using the existing rail infrastructure and road transport. The waste which arrives at Lichtenburg includes:

- Tyres are either shredded or whole;
- Solid waste, including solid shredded wastes; and
- Hydrocarbon wastes.

7.2.4 MONITORING AND CONTROL

Waste removal must be document, with records kept on site at all times. Documentation must include the type of waste removed, the quantity of waste removed, the disposal site and date. Proof that the waste disposal site is a licensed site must be kept with the waste removal documents.

8. IMPACTS OF ACTIVITIES ON WATER RESOURCES AND MITIGATION MEASURES

Table 10: Impacts of Lichtenburg Cement Plant Activities on water uses and mitigation measures

Activity	Operation	
	Impacts	**Mitigation Measures**
Changes in Catchment Water resources due to	An increase in impervious areas	No mitigation measures are recommended, as this would require the impervious areas to be removed. It should, however, be noted that the impact of the impervious areas on the local and regional hydrology is insignificant
	Impeding or altering the flow of water in a drainage line	There are currently projects in place for the rehabilitation of the drainage line and the incorporation of culverts to ensure that there is no impediment to the natural flow of water. Once these projects are completed, there will be no impact on catchment water resources and therefore this significance rating has gone from high to low.
	Abstractions	There are no current or planned abstractions from surface water resources
	Limiting flow (capturing of contaminated stormwater)	The implementation of PCD's at the project site will reduce the volume of water to the downstream environment, however, in the context of the local and regional catchment this impact is low.

Activity	Operation	
	Impacts	**Mitigation Measures**
Reduction in Catchment Water Quality due to	Erosion from the project site and sedimentation of downstream water resources	There are currently projects in place that include the design and construction of PCD's downstream of the Coal Stockpile and Additives areas. Once implemented the likelihood of sediment discharging from the Cement Factory will be significantly reduced, hence the reduction in the significance rating of this identified potential impact.
Reduction in Catchment Water Quality due to	Discharging waste or contaminated water (i.e., contamination from the coal stockyard and additive areas, pit dewatering and sewage spills)	PCD's for the management of contaminated stormwater runoff from the project site will significantly reduce the risks associated with the contamination of downstream water resources
Changes in Flood Hydrology due to	An increase in impervious areas	Due to the incorporation of PCD's to the stormwater management infrastructure at the factory site, the impact of impervious areas increasing the discharge rate from the project site will be reduced. It is also noted that the stormwater management plan developed for the project site, will also assist in limiting the impact of the factory site on the downstream flood hydrology.
	Altering the bed, banks, course or characteristics of a watercourse	Rehabilitation of the drainage line. Once implemented, the drainage line will be restored to its natural condition, which result in the stream to flow freely across the project site.
	Disturbance of the soil and topography of the wetland area as a result of past mining activities in the area upstream of the cement factory.	The mined areas have been left largely undisturbed for over 10 years and have largely recovered in terms of establishing a vegetation cover which has wetland characteristics. Underlying the vegetation are soils that would appear to be typical of wetlands in the region. In the absence of any erosion and alien weed invasion, it is recommended that the site be left to continue self-repair as at present.
	Disturbance of the wetland in the lower area as a result of past draining and agricultural activities.	The area downstream of the mine is no longer used for agriculture and the recovery of the wetland vegetation is well advanced. The following recommendations are put forward: • It is recommended that it should be kept free of alien weeds; and • Any remaining drainage ditch should be plugged. NOTE: These actions are not the responsibility of Lafarge.
	Grazing by livestock in the upper section is reducing the plant biomass there and may be reducing plant diversity.	This impact is taking place but the removal of the cattle will be controversial. Since there is minimal impact on the hydrology of the site it would be acceptable to leave the *status quo*.
Infilling with factory wastes and road and rail crossings in the factory areas	Disruption of any surface flows through the wetland as a result of channel infilling. Possible loss of water from the greater wetland system	Remove all the infill material from the area identified. The material is to be properly disposed of and the area must be rehabilitated.
	The natural soil has been buried under the waste causing loss of indigenous plant biodiversity. The area is invaded by weed species,	Remove all the infill material from the area identified. The material is to be properly disposed of and the area must be rehabilitated. To establish a 30m wide channel for the wetland and to landscape the adjacent cleared areas. An earth berm to separate the wetland channel from the raw stormwater control system must be raised.
Stormwater and other surface flows entering the wetland	Contamination of system with fine sediment which could impact on aquatic biodiversity	A stormwater management plan for upgrading the surface stormwater in the factory has been compiled. This includes both improved movement of the water around the factory area and a number of new pollution control dams. Water from the dams will be reused once it is suitabily cleaned. If there is a surplus, and if the water is sufficiently clean to meet the DWS waste water standards, some may be returned to the open environment. To install a water supply system which will feed from the NFEPA wetland and boost flows in the factory wetland. The discharge point is to release the water approximately 25cm below ground level.
Future upgrades to the Cement Plant	Greater uptake of water from the wetland basin.	Future upgrades to the factory may require that a greater quantity of water is taken from the NFEPA wetland. The following mitigatory measures are

Activity	Operation	
	Impacts	Mitigation Measures
		recommended: • Future developments must be designed to be as water efficient as possible. Consideration must be given to re-use of water for different purposes before it is released from the system. • The pollution control dams must be as large as is feasible and design features such as labyrinth channels to improve circulation and surface contact should be considered. • Water pumping to the factory wetland must be stopped once the level in the NFEPA wetland drops below a specified level irrespective of the season or weather conditions. It is provisionally suggested that this level will be such that some connection between the two deepest parts of the old mine is retained.

9. ENVIRONMENTAL MANAGEMENT PLAN

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 Lichtenburg Cement Plant, namely the use of alternative fuels and raw material/resources (AFRs). The amended EMPR was undertaken by Metago Environmental Engineers in 2011 (refer to **Appendix 1**). Key features of this plan are summarized below:

Monitoring of AFRs as they arrive at the Lichtenburg plant will be undertaken by plant personnel. This will comprise a visual inspection of the transport facilities and materials where possible to ensure no tampering has taken place en-route and ad hoc sampling and analysis of AFR materials. The visual inspection will be undertaken for every wagon and tanker entering the site and a record of the inspection kept for auditing purposes.

Ad hoc sampling of AFR materials and more specifically the blended liquid wastes and SSWs will be done. As a general approach, Lafarge will ensure that the monitoring programme comprises:

- a formal procedure;
- the use of a an accredited, independent, commercial laboratory for undertaking sample analyses;
- parameters to be monitored will be identified in consultation with a specialist in the field and/or the relevant authority;
- the results will be stored in a structured database;
- reports on the data and its compliance with set criteria will be compiled by an appropriately qualified person on a quarterly basis; and
- both the data and the reports will be kept on record for the life of project.

Groundwater

- Lafarge will ensure that polluting materials are handled in a manner which does not pollute groundwater

- Storage facilties will be on impermeable floors, have appropriate runoff containment measures, bunded areas capable of holdings 125% spill volume.
- All project activities will take place within bounds of a surface dirty water management system that complies with R704.
- Continue to implement waste management practices.

Air Quality

- The conditions of the sites' Atmospheric Emission License (AEL) and requirements of the National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004) (NEM:AQA) will be included in Lafarge's air monitoring programme.
- A sampling programme for ambient particulate matter will be implemented to the west of the plant close to the Lafarge residential area. This should include measurement of meteorological parameters, dust deposition rate and regular measurements of daily average PM10 concentration. Should these screening measurements indicate frequent exceedences of the proposed SA standards, more sophisticated measurements methods such as continuous monitoring will be instituted.

General

The environmental manager will conduct internal management audits against the commitments in the EIA/EMP amendment report. During the construction phase, these audits will be conducted every two weeks. In the operational phase, these audits will be conducted on a quarterly basis. The audit findings will be documented for both record keeping purposes and for informing continual improvement. In addition, and in accordance with mining regulation R527, an independent professional will conduct an EMP performance assessment every 2 years. The site's compliance with the provisions of the EMP and the adequacy of the EIA/EMP amendment report relative to the on-site activities will be assessed in the performance assessment.

Metago Environmental concluded that provided all the objectives, actions and procedures included in the EMP are implemented, there is no environmental reason why the project and the associated activities should not be approved. Key to this is compliance with the National Policy for the Thermal Treatment of General and Hazardous Waste (Government Notice 777, DEA 2009), careful planning on the sourcing and blending of AFRs that meet the required specifications, responsible implementation of the project by Lafarge and monitoring to confirm predicted impacts and where necessary, provide input on additional management measures if required.

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 for the Lichtenburg Cement Plant were determined from the EMPr (refer to **Appendix 1**) and an approved financial guarantee was provided by a financial institution.

10. 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.

The authorisation holder or Applicant is obligated 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*".

10.1 WATERCOURSE IMPACT AUDIT

An environmental audit regarding water management was required as part of the water use licence application for the Lichtenburg Cement Plant.

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.

Lafarge had unlawfully carried out the following activities in terms of regulations under NEMA without prior authorisation:

• Infilling of a watercourse, and or a wetland, with more than 10 cubic metres of material; and

• The clearing of indigenous vegetation.

The non-compliance was based on a time series of Google Earth images. At the time of a site visit by a wetland specialist on 30 March 2021 it was observed that the area in question had indeed been used as a spoil site, and the progression of the infilling could be confirmed through the assessment of historical aerial imagery.

The following table describes the matters which require attention in respect of water and waste management

Theme	Matter
Access control at high risk areas and/or pollution control equipment	No warning signs were in place at the partially flooded pits outside the electric perimeter fence, which contained screenings from the Sewage Plant, as well as burning garden and other waste. Ponding has also occurred outside the electric perimeter fence, which may present health hazards and even a risk of drowning to smaller children.
Water Conservation and Water Demand Management	A water efficiency evaluation should as a minimum be done by appropriately skilled persons. Lafarge Cement Plant and Quarries are however 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.

Theme	Matter
Water Use Authorisations	Although various water use activities are undertaken at Lafarge, no IWUL is yet in place to authorise the activities. An application was submitted to DWS in 2011, which had to be re-submitted in 2018. After various discussions, specialist studies to inform the water use licence application had to be reconducted and the application will be submitted before end October 2022.
Alignment of water management strategies	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.
Surface water resources	The wetland to the east of the Cement Plant has been impacted upon with "infilling" / backfilling in the Quarry Area, as well as within the Cement Plant area. No evidence of protection of the regulated area of 500 m at the Wetland could be verified; apart from infilling, no bufferzone was identified around the wetland (500 m), therefore roads and other activities were and are taking place within the wetland system. Mining activities also occurred in 2003 on both sides of the wetland together with subsequent backfilling; the "Townlands Pit" forms part of a Wetland System with affected storm water from the Cement Plant running off into the system. The Wetland to the east of the Cement Plant is located within a tributary to the Groot Harts River, which tributary was diverted with the expansion of the Cement Plant without any EIA and WUL in terms of Section 21(c) and (i). The diversion was also not maintained to ensure effective flow and as discussed above, backfilled with inert plant material. This issue forms part of an enforcement process with both DFFE and DWS and is still in process.
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.
Diversion of clean storm water from dirty areas and capacity of diversion structures	Townlands Quarries will be rehabilitated for closure. Pollution control dams are recommended in the stormwater management plan to divert clean storm water from the Coal Stockpile area and from the additives storage area to minimise pollution of stormwater. If not practical, affected storm water must be contained in a proper affected storm water system. The affected storm water system will be able to contain the 1:50 year flood event volume.
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 Lichtenburg Cement Plant lies within sensitive areas. The 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.

As part of the impact assessment, a general hydrological characterisation of the area in which the Lichtenburg Lafarge Cement Plant is located was undertaken. This included defining the MAP, MAR and MAE for the project site. In order to determine the impact of the Cement Plant on the local and regional hydrology, the catchment areas corresponding to these regions were defined.

In addition to the hydrological characterisation of the Cement Plant, an impact assessment of the plant on the local and regional hydrology was undertaken. Mitigation measures to reduce the significance of the identified potential impacts were provided. The potential impacts and mitigation measures identified included:

- Changes in catchment water resources. The most significant impact associated with changes in water resources is associated with materials that have been deposited along the drainage line located to the east of the Cement Factory, which has resulted in impeding the natural flow of water across the site. It is, however, noted that a process of rehabilitation of the affected drainage line has been initiated. The proposed rehabilitation plan is currently with the DFFE and is awaiting approval from the relevant authorities. Once the proposed rehabilitation has been implemented, the impact of the blocked drainage line on the catchment water resources will be significantly reduced, resulting in the post-mitigation impact rating going from "high" to "low".
- Changes in catchment water quality. The potential sources of contamination were identified as the fine sediment located throughout the project site and especially in the area of the Additives Stores, contaminated runoff from the Coal Stockpiles, hydrocarbon spills (through fuel stores and machinery on site) and domestic and sewage waste. In order to reduce the risk of surface water contamination, numerous recommendations were made, largely with respect to management of contaminants at their source. It is noted that
- Lafarge have appointed JG Afrika to undertake the design of two PCD's, located downstream of the Coal Stockpile and Additives areas. Once constructed, the risk of contamination of surface water resources will be significantly reduced.
- Changes in catchment flood hydrology. The impact of the blocked drainage line on the eastern boundary of the project site is a significant change in the flooding dynamics of the project site. It was noted that during a flood event, the flooding in the area in which the stream has been blocked will be exacerbated. However, the rehabilitation of the drainage line and the implementation of proposed culverts along road and rail crossings will ensure that the impact of the impeded flows is mitigated against. The proposed culvert crossings have been based on transferring flows associated with the 1:50 year flood event. Therefore, once implemented, the significance of the changes in flood hydrology, as a result of the blocked drainage line, will reduce from "high" to "low".
- Changes in peak discharge rates from the Cement Plant. It was noted that as a result of stormwater runoff from the cement plant being directed to the Townlands Pit (with no point of discharge) and considering the proposed construction of PCD's downstream of the Coal Stockpile and Additives stores, the risk of increase discharge rates from the cement plant is largely reduced. The significance of changes in the flood hydrology of stormwater discharging from the project site is associated with a low significance.

Based on the baseline hydrology and impact assessment study, it is noted that there are a number of significant impacts associated with the Cement Plant, particularly on the local hydrology. These impacts are associated with the current blockage of the unnamed drainage line to the east of the project site. Further to this, there is currently a risk of contaminated stormwater discharge to the downstream environment, particularly from the Coal Stockyard and Additives areas. It is, however, noted that Lafarge are taking significant steps to alleviate the identified impacts. In line with this, they are in the process of obtaining approval for the rehabilitation of the drainage line that has

been blocked and have also appointed engineers to design PCD's that will be located downstream of the Coal Stockyard and Additives areas. This will limit any contamination to the downstream environment. Once the proposed mitigation measures have been implemented, the impact of the Cement Plant on the local and regional hydrology will be limited.

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 19** for the full Water Impact Audit Report.

11. PUBLIC CONSULTATION

A pre-application meeting for the Water Use Authorisation/Licence Application process was held with the DWS Regional Office on the 10th of February 2022. Refer to the full Public Participation Process report for detailed information.

English and Tswana site notices were erected at strategic points in the vicinity of the site (Lichtenburg Cement Plant main gate, Superspa mini market, Superspar Palm Sands, Game Store, Natah Health Shop) on the 29th of April 2022 to inform the surrounding local residents and other Interested and Affected Parties (I&APs) of the Cement Plant Activities (refer to **Appendix 4**). Registration and commenting notification letters were also sent to inform stakeholders and I&AP's about the Lichtenburg Cement Plant 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 4**).

A public meeting invite was circulated in June 2022. The meeting was held on the 28th June 2022 at the Lafarge Recreational Club, Lafarge Village, Lichtenburg. Refer to table 11 for the objection received on the 27th June 2022 and discussed during the meeting on the 28th June 2022.

Comments and Responses

Table 11: Comments and Responses.

I&AP	Comments	Responses
Johann Pistor	An objection to the operations at Lichtenburg Cement Plant was submitted. The reasoning's were related to: • Illegal operations; • Unsafe health practices; • Conditions which pose a danger to human life; and • Corruption	Greenmined acknowledged the receipt of the objections and stated that comments would be incorporated into the Public Participation Report.

12. CONCLUSION

Based on the information analysed in this report and supporting specialist studies, it is clear that the Lafarge Lichtenburg Cement Plant has over time caused negative impacts on the surrounding environment. The most important two aspects being that the adjacent and surround wetland areas have been used as 'dumping grounds' for solid waste dumping from the cement plant instead of this waste being correctly removed from site and disposed of in a responsible manner. The second aspect being that the stormwater management of the plant has been poorly designed according to work areas and topography, therefore contaminated water has not been prevented from entering into the environment, therefore impacting on the water supply and surrounding environment.

Due to the large scale footprint of the Cement Plant, and the historical time frame for which this cement plant has already been in existence, it is not feasible to close down the operations, however, with mitigation measures implemented, the plant could be brought into a compliance with environmental legislation. The main over-arching mitigation measures for the Cement Plant are to: 1. Rehabilitate the wetland areas, which will see the improvement of drainage systems and 2. Implementation of the Stormwater Management Plan, Infrastructure and Pollution Control Dams to ensure that stormwater runoff and contaminated water flow into correct areas for proper treatment before being released or re-used.

Mitigations measures recommended in this IWWMP and all specialist studies including rehabilitation must be incorporated into an Environmental Management Programme (EMPr) for immediate implementation, thus seeing the plant working towards achieving environmental compliance. The successful implementation of these management objectives would be best achieved through enforcement and monitoring for compliance by an independent Environmental Control Officer (ECO).

It is therefore the opinion of the Environmental Assessment Practitioner (EAP) that the water uses as applied in this report and supporting applications be approved and a water use license with strict conditions as per specialist recommendations be granted to Lafarge Lichtenburg.

13. 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 operational for over 60 years. No existing lawful water uses apply to the plant, however a previous water use authorisation ((Registration number: 26019718) exists. Registered activities are listed below:

- Section 21 (a) - Taking water from a water resource.
- Section 21 (b) - Storing water (For wastewater disposal and industrial residue in the Townlands Pit).
- Section 21 (f) - Discharging waste or water containing waste in a water resource through a pipe, canal, sewer, sea outfall or other conduit (Discharging domestic and biodegradable industrial wastewater into the Townlands Pit).

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 (three boreholes from the plant, drinking water for the village, garden use and water taken from the NFEPA wetland for the kilns cooling process).
- Section 21 (c) of Act – Impeding or diverting the flow of a watercourse (Drainage and infilling of Wetland Map 5 which runs through the factory, rail and road crossings though Wetland Map 5).
- Section 21 (e) of Act – Engaging in a controlled activity: Irrigation of any land which waste or water containing waste generated through any industrial activity or by a waterworks (For garden patches).
- Section 21 (g) of Act - Disposing of waste in a manner which may detrimentally impact on a water resource (coal stockpile, returned water from cement processing to NFEPA wetland (Townlands Pit), treated effluent from sewage works, and stormwater runoff into NFEPA wetland).
- Section 21 (h) of Act - Disposing of water in any manner of which contains waste from, or which has been heated in any industrial or power generation process (Returning heated water to the NFEPA wetland).
- Section 21 (i) of Act – Altering the bed, banks, course or characteristics of a watercourse (Vehicle tracks, rail and road crossings through wetlands).

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

Lafarge 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 encourages 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 town of Lichtenburg, groundwater is used extensively for municipal, domestic, industrial and agricultural practices. Water demands from groundwater sources are therefore highly stressed. Lafarge has ensured minimum additional stress on this resource by operating a dry process for the manufacturing of cement. During this process, water is abstracted for the main tank and circulated throughout the additional softening plants and kilns. Additional water for cooling purposes is extracted from the NFEPA wetland (Townlands Pit) but is returned after use.

Lafarge acknowledges the impacts imposed on the wetland system situated at the factory site (Wetland Map 5) and rehabilitation and management plans to restore this wetland area are underway. The result of this process will be that water will flow freely again through this system improving its overall condition. The improvement in this wetland condition will provide vital ecosystem services to the surrounding area such as; stream flow regulation, sediment trapping, nitrate assimilation, toxicant assimilation, biodiversity maintenance, and grazing for livestock.

Additionally, Lafarge plans to implement a number of pollution control dams in which water will be purified and reused within the cement factory. Surplus water produced from this process after sufficient purification, has the potential to be released into the receiving environment which will be highly beneficial to the largely arid area.

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 Lafarge cement plant will provide the flowing 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 proposed expansion 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 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 Lafarge cement production facility is situated within the upper reaches of the Harts River Catchment (C31A) and falls under the Lower Vaal Water Management Area. A drainage line can be found along the eastern boundary of the cement factory which drains into an unnamed tributary, and eventually discharges into the Harts River. The Harts River flows along the south west of the factory discharging into the Hart River which then flows southwards to the Vaal Dam (downstream of the Vaal River) and then to the Orange River. The Lower Vaal catchment management strategy highlights the importance of groundwater in this area and suggests that the quality and quantity of this water resource be monitored (DWAF, 2004). Lafarge has upheld this policy by operating a dry process for the cement manufacturing plant.

In addition, the following recommendations have been suggested to reduce water stress to groundwater resources (JG Afrika Water Balance Study, August 2022):

- The water monitoring plan should be extended to include water discharged into the Townlands Pit/wetlands from Kiln 4 and the cement mills;
- The construction of a reservoir to capture and recycle water used for cooling processes at the Mills is highly recommended;
- It has been suggested that water discharged from Kiln 3 be captured and reused, instead of being discharged into the Townlands Pit;
- The water that will need to be recycled from the PCD's needs to be incorporated into the water management system and water management philosophy in the future; and
- Flow meters should be installed on water supply lines throughout the plant.

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

Lafarge has been operational for over 60 years. As such, few new risks are posed to the surrounding wetlands and watercourses. The wetland situated within the cement factory property (Wetland Map 5) has experienced a disruption of surface water flows as a result of infilling from the factory waste. However, Lafarge is currently in the process of rectifying this non-compliance which will improve the overall condition of the wetland (JG Afrika Wetland Assessment Report, 2022).

The most prominent new impacts may be directed towards changes in water quality and quantity; particularly of the NFEPA wetland (Townlands Pit) situated 70m outside the factory boundary. Possible impacts to this system include:

- Some stormwater from the factory currently flows into the NFEPA wetland (Townlands Pit). If stormwater runoff and the separation of clean and dirty water at the plant are not appropriately managed, water quality in the wetland may be compromised. Multiple stormwater channels at the plant were found to be blocked with sediment which can negatively affect inflowing water quality. Fine sediments which may be present in stormwater may also impact aquatic biodiversity. Seepage from the wetland, which then contains stormwater contaminants, may contaminate the groundwater resources. Contaminated groundwater would impose health risks to the surrounding communities which rely on this water source for domestic uses.
- Stormwater management around the coal stockpile was found to be insufficient during a site visit by JG Afrika. Runoff from this stockpile has the potential to negatively affect downstream environments.
- Spillage of additives in the storage area may negatively affect downstream environments. Magnetite,Vanchem Bauxite, Zimalco Aluminium Dross, Silica sand and Pozz Sand (Fly Ash) are stored in the additives area.
- Seepage of contaminated water into the Harts River may impact negatively on livestock and small wildlife which drink from the river. According to the Stormwater Management Report (JG Afrika, 2022), a number of channels within Area A of the plant were found to be blocked or undersized which could likely affect the water quality entering the Harts River. Recommendations were given to rectify this issue.
- Hydrocarbon spills were evident during the site inspection by JG Afrika. These pollutants can enter downstream environments affecting water quality.

- Agriculture is an important land use in the surrounding area. Contaminated groundwater and/or river water used for irrigation may affect crop growth or render the crop unsafe for consumption.
- At present, the uptake of water from the wetland for use in the factory does not have an effect on the wetland water levels. However future water demands of the factory may increase pressure on the wetland resulting in reduced water levels, affecting the ecological functioning of the system.

Groundwater is currently of good quality and it is anticipated that operations, run-off from the plant and seepage from the unlined coal and gypsum stockpiles will not negatively impact this resource. Impacts from these sources have not yet been felt by the well field after more than 50 years of operation, but require close monitoring. The following measures are in place or planned to prevent water resource impacts (JG Afrika Stormwater Management Plan, 2022):

- Refining the Stormwater Management System and the installation of several new pollution control dams;
- The water discharged into the wetlands should be monitored through water quality sampling;
- Water pumping to the factory from the wetland must be stopped once the water level within the wetland drops below a specified level;
- Flow meters should be installed on water supply lines throughout the plant;
- The area used for coal stockpiling has been reduced and the remaining stockpile area is in the process of being covered;
- The coal stockpile yard should be lined;
- Stormwater channels should be frequently cleared of sediment and vegetation;
- All oil drums should be stored in bunded areas and lined;
- Channels around the Additives area should be constructed and directed towards a pollution control dam; and
- The recommendations and conclusion of the geohydrological specialist report must be kept in mind in terms of monitoring.

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

The Lafarge cement factory falls within the quaternary catchment C31A of the Harts River. This river, along with the Molopo, Kuruman and lower reaches of the Vaal River form part of the Lower Vaal Water Management Areas.

Resource quality objectives have not been set for the water resource catchment C31A, although the adjacent quaternary catchments (C31B and C31C) have been given a Present Ecological State (PES) of Moderately Modified (Class C). (DWS Government Gazette No. 470 of 22nd April 2016).

When looking at the site-specific PES, the Wetland Map 5 (which runs through the cement factory) has been identified as having a PES Category E. This is in light of the infilling of the wetland area. The wetland health tool could not be used to ascertain the PES of the NFEPA wetland as the requirements for this wetland could not be met. Instead the PES of this wetland was based on a comparison with other mined pits in the area. The NFEPA wetland was therefore rated as having a variable PES, ranging between a Category D and B.

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 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 Lafarge cement factory will be of strategic importance to Lafarge South Africa (Pty) Ltd, the local community and the South African economy in general. Increased production associated with the expansion of the production lines will improve socio-economic development as stated in the above. Rehabilitation plans for Wetland Map 5 will also improve the overall ecological state of the wetland, which will be beneficial to the community and the environment.

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

Water quality investigations on free water at the Lichtenburg plant were undertaken as part of the approved EMPr (1995) and EMPr amendment (2006). Water samples were submitted to scientific services on the 8th January 2016 (Test Report 2016-10338). Results were as follows:

- The organic content (TOC) was insignificant and much lower that the limit of 10 mg/L as prescribed by SANS 241: 2015. There was no noticeable activity of bacteria associated with such problems.
- No toxic or harmful concentrations of any elements were found.
- The water quality was deemed 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.

An updated water quality report was produced for August 2022 (Aquatico Scientific Water Quality Report, 2022). The results were as follows:

- Exceedances observed in terms of pH and EC at locality Process water, while pH, EC, Cl, SO4 and Mn exceeded at Zinc Dam when measured against the SAWQG for Industrial Use.
- EC and Mn exceeded the General Authorisation Limit at Zinc Dam.
- All of the analysed variables complied with the General Authorisation Limit for surface water quality at the Townlands Pit. The good water quality might be attributed to the influx of fresh rain water.
- Elevated NO^3 concentrations persist at Lovedale Quarry DW.

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 Lichtenburg Cement Plant 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.

14. REFERENCES

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