Table 7.3.3-1: Summary of Flood Calculations

Catchment Description	Area (km^2)	Notes	1:50 year	1: 100 year
			Peak Flow (Q_{p50}) in m^3/s	Peak Flow (Q_{p100}) in m^3/s
Effective Catchment 1	1753	The define water course within this area is Swartlintjies River originates in both F40B and F40C quaternary catchment.	398.15	504.21
Effective Catchment 2	1747	Spoeg River originates within F40E quaternary catchment flowing to the F40F catchment which the study area falls within especially the Lang Klip 489 farm and Mitchel's Bay 495 farm which Spoeg transverses.	459.91	582.43
F40A catchment	1016	No define water course within this quaternary catchment.	289.36	366.44
F40D Catchment	740	Swartlintjies River flows for 29.1 km within this catchment to discharge to the sea.	266.61	337.63
F40F Catchment	683	Spoeg river flows for 22.5 km in the south westerly direction before it discharges to the sea.	287.66	364.29

7.4 Floodline Delineation

The run-off that is generated within a catchment through precipitation depends on the following Characteristics:

- Characteristics of the storm event;
- The response characteristics of the catchment; and
- The influence of temporal storage on the run-off.

The temporal distribution of the run-off is reflected in a hydrograph. The flood peak (QP) is reached as soon as the entire catchment contributes to the flood, which is also referred to as the time of concentration (TC). Flood lines are usually determined for areas where proposed infrastructure could be influenced by in-stream flood volumes and their respective levels. Swartlintjies and Spoeg Rivers were modelled and based on flow technical data, flood lines were delineated.

7.4.1 Source of Survey Data

The following data, data sources, software, and methods were used to generate contours and Digital Elevation Maps:

- 1:50 000 topographical data (National Surveyor General) including the following;
  - Contours and
  - rivers;
- Google Earth survey data sourced from Zonums Information System.;
- Client data in the form of *.ECW ;
  - Total Project boundary;
  - Site specific boundaries; and

7.4.2 Roughness parameters

In order to accurately model the flow in the river the roughness parameters along each cross section had to be defined. The river was divided into three sections i.e. the left bank, main channel and right bank. The positioning of the main channel was based on the anticipated flow in the river (low flows). The Manning n roughness values used for each of the three sections was 0.025 for gravelly river bed.

The following guidelines were used for the selection of the suitable Manning Coefficient:

Table 7.4.2-1: Manning Roughness Coefficient (Source: www.engineering tools.com)

Surface Material	Manning's Roughness Coefficient - *n* -
Earth, smooth	0.018
Earth channel - clean	0.022
Earth channel - gravelly	0.025
Earth channel - weedy	0.03
Earth channel - stony, cobbles	0.035
Floodplains - pasture, farmland	0.035
Floodplains - light brush	0.05
Floodplains - heavy brush	0.075
Floodplains - trees	0.15
Galvanized iron	0.016
Glass	0.01
Gravel,	0.023
Lead	0.011
Masonry	0.025
Metal - corrugated	0.022
Natural streams - clean and straight	0.03
Natural streams - major rivers	0.035

7.4.3 Flow data

Flood calculations were conducted and the peak flows are summarised in Table below:

Table 7.4.3-0-1: Summary of Flood Calculations (1:50 and 1:100 years)

Catchment Description	1:50 year	1: 100 year
	Peak Flow (Q_{p50}) in m3/s	Peak Flow (Q_{p100}) in m3/s
Effective Catchment 1 (F40B, F40C, and F40D)	398.15	504.21
Effective Catchment 2 (F40E and F40F)	459.91	582.43
F40A catchment	289.36	366.44
F40D Catchment	266.61	337.63
F40F Catchment	287.66	364.29

7.4.4 Hydraulic Model Used

The public domain and internationally accepted software package HEC-RAS (version 3.1.3) developed by the US Army Corps of Engineers was used to hydraulically model the river system. The system consists of three components i.e. flow data, geometric data and simulation options. These components are described in more detail below.

The software provides graphical output of the flow in the river as well as tabulated output of the calculated results. A list of errors and warnings are also provided as an output in order to carefully evaluate and interpret the obtained results.

7.4.5 Cross Section Data

Google Earth elevation data was sourced from Zonum Solutions (www.zonums.com). This data was revised in 2016 and is reliable for Hydraulics, Hydrology, Irrigation, Watershed management, Geographic Information Systems and Remote Sensing.Hec Ras Output

The 1:100 year flood-line restriction is the internationally accepted norm for the placement of anything that may be in danger of failing or have a potential safety hazard. This norm is also reflected in section 144 of the National Water Act in respect of the locality of townships.

The purpose of this paragraph is to summarise the output from a surface water assessment. The output variables can be defined as follows:

- E.G. Elev: Energy Grade line for calculated WS elevation
- Flow Area: Total Area of cross section active flow.
- Froude # Chnl: Froude Number for the main channel.
- Min Ch El: Minimum main channel elevation.
- Q total: Total flow in cross section
- Top W Chnl: Top Width of the main channel.
- Vel Chnl: Average Velocity of flow in main channel.

The following tables indicate the details relating to each river system:

Table 7.4.5-1: Swartlintjies River Output

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	20	1 in 50	266.61	26.24	27.25	27.25	27.64	0.005707	2.94	100.39	130	0.96
Upper	20	1 in 100	337.63	26.24	27.4	27.4	27.84	0.005483	3.16	119.18	135.93	0.96
Upper	19	1 in 50	266.61	24.44	26.37	26.37	26.87	0.00618	3.16	84.46	83.87	1
Upper	19	1 in 100	337.63	24.44	26.55	26.55	27.13	0.005682	3.38	100.41	90.91	0.99
Upper	18	1 in 50	266.61	23.69	24.64	24.64	25.03	0.006736	2.78	95.75	122.56	1.01
Upper	18	1 in 100	337.63	23.69	24.78	24.78	25.23	0.006241	2.99	113.17	127.03	0.99
Upper	17	1 in 50	266.61	23.96	25.05	25.05	25.4	0.00711	2.62	101.75	148.58	1.01
Upper	17	1 in 100	337.63	23.96	25.18	25.18	25.58	0.006662	2.79	121.18	158.88	1
Upper	16	1 in 50	266.61	13.9	15.01	15.11	15.46	0.01136	3	89.01	151.12	1.25
Upper	16	1 in 100	337.63	13.9	15.09	15.22	15.65	0.012335	3.29	102.54	160.82	1.32
Upper	15	1 in 50	266.61	13.52	14.16	14.16	14.36	0.008487	2.01	132.33	327.36	1.01
Upper	15	1 in 100	337.63	13.52	14.23	14.23	14.47	0.007942	2.16	156.43	344.58	1
Upper	14	1 in 50	266.61	2.84	3.51	3.59	3.87	0.014357	2.67	99.97	240.87	1.32
Upper	14	1 in 100	337.63	2.84	3.56	3.68	4.01	0.015548	2.96	114.1	249.7	1.4
Upper	13	1 in 50	266.61	4.17	4.93	4.93	5.2	0.006201	2.55	123.47	238.06	0.95

Upper	13	1 in 100	337.63	4.17	5.03	5.03	5.33	0.00595	2.73	148.55	257.57	0.96
Upper	12	1 in 50	266.61	4.79	5.56	5.56	5.81	0.005931	2.45	129.03	260.59	0.93
Upper	12	1 in 100	337.63	4.79	5.65	5.65	5.93	0.005779	2.63	153.7	275.68	0.94

Table 7.4.5-2: Spoeg River Output

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Lower	10	1 in 50	287.66	75.28	75.72	75.72	75.87	0.008279	2.07	172.83	578.73	1.01
Lower	10	1 in 100	364.29	75.28	75.77	75.77	75.94	0.007972	2.2	206.14	612.23	1.01
Lower	9	1 in 50	287.66	50.89	51.42	51.74	52.55	0.038691	5.1	63.9	160.42	2.25
Lower	9	1 in 100	364.29	50.89	51.48	51.86	52.84	0.040702	5.63	74.05	169.56	2.35
Lower	8	1 in 50	287.66	51.55	51.95	51.95	52.1	0.008655	2.03	174.38	606.69	1.02
Lower	8	1 in 100	364.29	51.55	52.01	52.01	52.17	0.008342	2.16	207.85	641.64	1.02
Lower	7	1 in 50	287.66	41.99	42.63	42.65	42.91	0.007142	2.5	131.04	279.1	1
Lower	7	1 in 100	364.29	41.99	42.71	42.75	43.03	0.0073	2.73	153.75	297.49	1.03
Lower	6	1 in 50	287.66	44.75	45.29	45.29	45.49	0.008103	2	147.71	386.57	0.99
Lower	6	1 in 100	364.29	44.75	45.36	45.36	45.59	0.007625	2.15	174.9	397.6	0.99

Lower	**5**	1 in 50	287.66	38.26	38.88	38.88	39.06	0.007862	2.56	155.62	423.52	1.04
Lower	**5**	1 in 100	364.29	38.26	38.95	38.95	39.16	0.00768	2.71	183.48	438.78	1.05
Lower	**4**	1 in 50	287.66	7.97	8.26	8.62	10.11	0.130487	6.22	49.18	204.76	3.74
Lower	**4**	1 in 100	364.29	7.97	8.3	8.71	10.53	0.134589	6.86	56.92	212.99	3.87

8. **A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;**

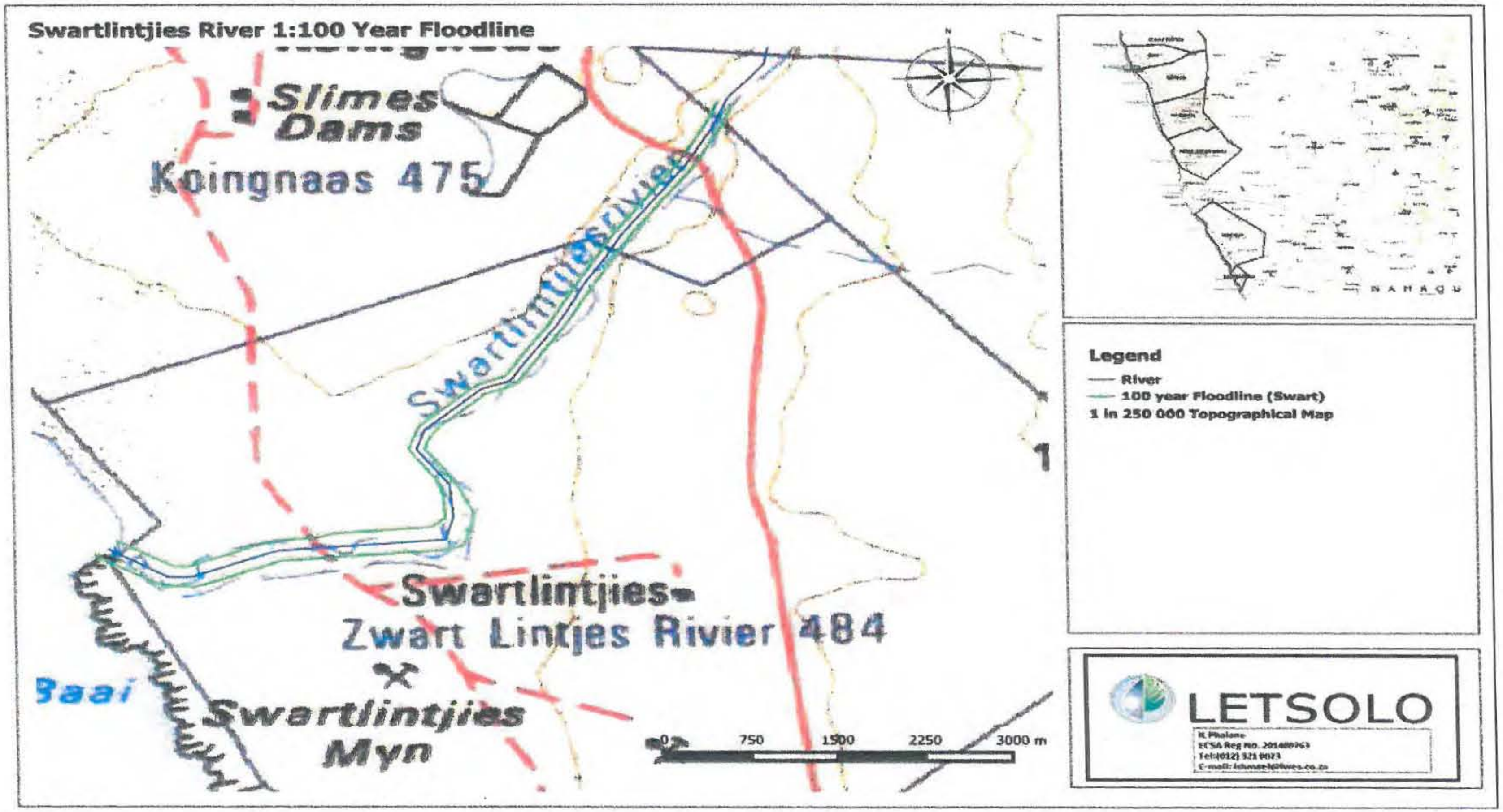


Figure 8-1: Floodline Map (including the 100m Buffer)

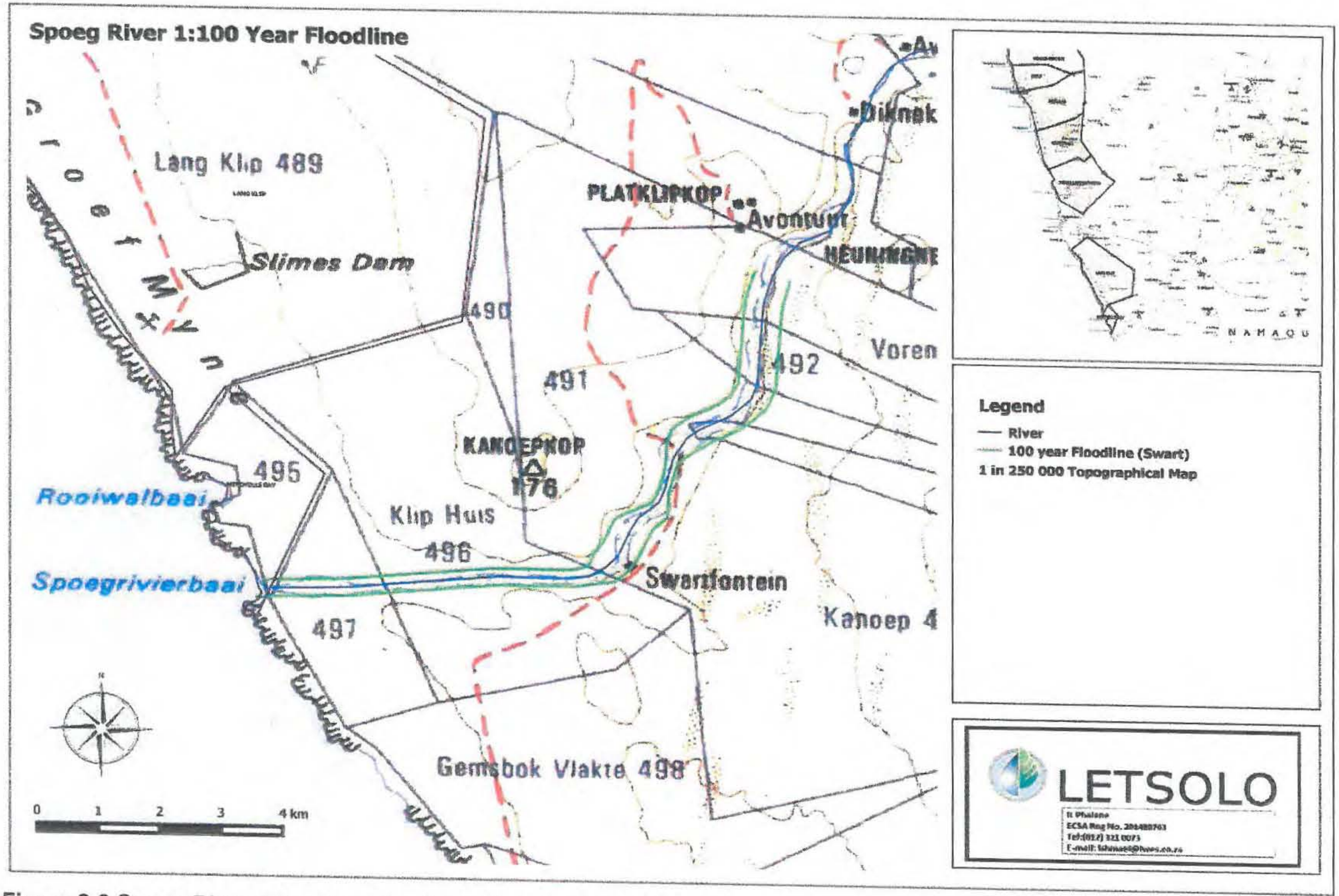


Figure 8-2:Spoeg River Floodline Map (including the 100m Buffer

9. A description of any assumptions made and any uncertainties or gaps in knowledge;

The hydrological Impact Assessment was based on the anticipated mining methods provided by the mine. The following assumptions relating to the operations of the mine are as follows:

9.1 Land Based (Opencast)

Opencast mining methods will be applied at some sections. Strip mining defines the mineable area as a series of parallel strips and the mining sequence is as follows:

- Overburden stripping
- Mechanical extraction of ore
- Bedrock cleaning

Overburden stripping involves the salvaging or stripping of the top soil or other growth medium, which is then either stockpiled or placed directly in another part of the mine undergoing reclamation. Mining of overburden will start at the end of the first strip and progress along the strip exposing the ore for eventual mining. Waste overburden from subsequent strips will be placed in adjacent mined-out strips where feasible.

Overburden from the first mine cut in the strip sequence will in all likelihood be backfilled to some of the multitude of existing mining voids and no new overburden dump disturbance will be created. Stripping will be carried out in advance of ore excavation with the objective of creating a six-month reserve of pre-stripped area. This will allow blending of ore to match plant and production requirements.

9.2 Surf Zone

This will be undertaken by diver-operated suction hoses. These hoses feed diamondiferous gravels to shore-based pumping units comprising a tractor, modified to drive a centripetal pump and a rotary classifier.

Surf zone mining is small scale operations that has been ongoing for many years and are approved under the current authorizations The oversize tailing heaps which accumulate around the classifier are dispersed during the high tide, or mechanically redistributed over the beach at the end of mining operations. Care is taken to deposit oversized tailing below the High Water Mark (HWM) to allow natural redistribution by wave action. A shore-based operation typically consists of two to four divers, their assistants, and the necessary equipment.

9.3 Beach and Offshore Channel Mining

Beach mining operations of mineralized gravel deposits has been on-going for many years. These gravel deposits are found in various places along the coast. WCR is currently continuing with these approved activities.

Beach mining operations of mineralized gravel deposits found in various places between the low and high water marks along the coast has been on-going for many years. WCR are currently continuing with these approved activities above the low water mark on a limited scale.

Please refer to Picture below for details.

Picture 9.3-1: Koignaas Off shore mining activity

9.4 Processing Infrastructure:

Koignaas Mine will start with construction of a new 200 tons per hour (tph) screening and scrubbing plant at Michell's Bay. The plant will feed to the existing 50 tph Michell's Bay plant.

10. LEGAL REQUIREMENTS

10.1 Introduction

This section contains the national and international requirements related only to Hydrological specialist field. For this Hydrological Assessment, the principal act of relevance is The National Water Act, 1998 (Act 36 of 1998) which provides for the protection, usage, development, conservation, management and control of the country's water resources in an integrated manner. The Act provides the legal basis, upon which to develop tools and means to give effect to the protection of water resources.

The main focuses of the NWA are summarized as follows:

To evaluate the natural Hydrological conditions for the specific site area and its larger surrounding areas (up and downstream catchments);

To evaluate Hydrological conditions for the specific project development and its associated processes and infrastructure;

To evaluate these Hydrological conditions under the following storm events;

- 1:50 year 24 hour storm; and
- 1:100 year 24 hour storm event.

To ensure that the Hydrological conditions as well as the specific project development and its associated processes and infrastructure are in harmony and that they can both exist and co-exist and operate optimally under all of these environmental conditions;

To ensure that the natural environment is preserved and protected as far as possible; and

To ensure that clean and dirty water is separated (collected, contained, and controlled) effectively.

10.2 South African Legal Framework

The Department of Water and Sanitation published the Best Practice Guidelines for Impact Prediction (BPG G4). Various tools and techniques have been developed to enable the assessment of future water quality impacts from mining operations to be made. It is important to understand that these tools were generally developed to answer very specific questions that are relevant to the regulatory environment.

The legal platform, on which the Hydrological Impact Assessment is based, is summarized briefly by the following main legislation and Guidelines (prescribed by the DWS, previously known as the Department of Water Affairs and Forestry (DWAF)):

General Notice 704 (GN704) of 1999, regulations on use of water for mining and related activities aimed at the protection of water resources. Specifically related to this proposed project the following restrictions are applicable in terms of GN704

Activity 4: "No person in control of mine or activity may:

- Locate or place any residue deposit, dam reservoir, together with any associated structure or any other facility within the 1:100 year floodline or within a horizontal distance of 100 meters from watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on waterlogged ground, or on ground likely to become water-logged, undermined, unstable or cracked;
- Except in relation to a matter contemplated in regulation 10, carry on any underground or opencast mining, prospecting or any other operation or activity under or within 1:50 year floodline or within a horizontal distance of 100 meters from any watercourse or estuary, whichever is the greatest;
- Place or dispose of any residue or substance which causes or is likely to cause pollution of a water resource, in the workings of any underground or opencast mine excavation, prospecting diggings, pit or any other excavation; or
- Use any area or locate any sanitary convenience, fuel depots for any substance which causes or is likely to cause pollution of a water resource within the 1:50 year floodline of any watercourse or estuary."

A description of the findings and potential implications of such finding on the impact of the proposed activity, including identified alternatives on the environment;

10.3 Methodology used in determining the significance of impacts

Assessment of predicted significance of impacts for a proposed development is by its nature, inherently uncertain – environmental assessment is thus an imprecise science. To deal with such uncertainty in a comparable manner, standardized and internationally recognized methodology has been developed, and is applied in this study to assess the significance of the potential environmental impacts of the proposed exploration activities. The significance of the impacts was determined through the following:

For each impact, the SEVERITY (size or degree scale), DURATION (time scale) and EXTENT (spatial scale) are described (Table 1-1). These criteria are used to determine the CONSEQUENCE of the impact (Table 1-2), which is a function of severity, spatial extent and duration.

Table 10.3-1: Ranking criteria for environmental impacts

SEVERITY/INTENSITY	H	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Irreplaceable loss of resources.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Noticeable loss of resources.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Limited loss of resources.
DURATION	L	Quickly reversible. Less than the project life. Short term (0-5 years)
	M	Reversible over time. Life of the project. Medium term (6-11 years)
	H	Permanent. Beyond closure. Long term (>11 years)
SPATIAL SCALE	L	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national

Table 10.3-2: Determining the consequence

SEVERITY	DURATION		SPATIAL SCALE		
			Site Specific (L)	Local (M)	Regional/ National (H)
Low	Long term	H	Medium	Medium	Medium
	Medium term	M	Low	Low	Medium
	Short term	L	Low	Low	Medium
Medium	Long term	H	Medium	High	High
	Medium term	M	Medium	Medium	High
	Short term	L	Low	Medium	Medium
High	Long term	H	High	High	High
	Medium term	M	Medium	Medium	High
	Short term	L	Medium	Medium	High

The SIGNIFICANCE of an impact is then determined by multiplying the consequence of the impact by the probability of the impact occurring, as shown in Table 10.3-3, with interpretation of the impact significance outlined in
Table 10.3-4.

Table 10.3-3: Determining the Significance Rating

PROBABILITY (of exposure to impacts)		CONSEQUENCE		
		L	M	H
Definite/ Continuous	H	Medium	Medium	High
Possible/ frequent	M	Medium	Medium	High
Unlikely/ seldom	L	Low	Low	Medium

Table 10.3-4: The interpretation of the impact significance

SIGNIFICANCE	CRITERIA
High	It would influence the decision regardless of any possible mitigation.
Medium	It should have an influence on the decision unless it is mitigated.
Low	It will not have an influence on the decision.

Table 10.3-5: The interpretation of the status of the impact

IMPACT STATUS	CRITERIA
Positive	The impact benefits the environment
Negative	The impact results in a cost to the environment
Neutral	The impact has no effect on the environment

Once the significance of an impact has been determined, the CONFIDENCE in the assessment of the significance rating is ascertained using the rating systems outlined in Table 10.3-6

Table 10.3-6: Definition of confidence ratings

CONFIDENCE RATINGS*	CRITERIA
High	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact. Greater than 70% sure of impact prediction
Medium	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact. Between 35% and 70% sure of impact prediction.
Low	Limited useful information on and understanding of the environmental factors potentially influencing this impact. Less than 35% sure of impact prediction.

* The level of confidence in the prediction is based on specialist knowledge of that particular field and the reliability of data used to make the prediction.

The degree to which the impact can be reversed is estimated using the rating system shown in Table 10.3-7.

Table 10.3-7: Definition of Reversibility Ratings

REVERSIBILITY RATINGS	CRITERIA
Irreversible	**Where the impact is permanent.**
Partially Reversible	**Where the impact can be partially reversed.**
Fully Reversible	**Where the impact can be completely reversed.**

The degree to which there will be a loss of resources, as shown in Table 10.3-8 refers to the degree to which a resource is permanently affected by the activity, i.e. the degree to which a resource is irreplaceable.

Table 10.3-8: Definition of loss of resources

LOSS OF RESOURCES	CRITERIA
Low	**Where the activity results in a loss of a particular resource but where the natural, cultural and social functions and processes are not affected.**
Medium	**Where the loss of a resource occurs, but natural, cultural and social functions and processes continue, albeit in a modified way.**
High	**Where the activity results in an irreplaceable loss of a resource.**

Lastly, the degree to which the impact can be mitigated or enhanced is shown in Table 10.3-9.

Table 10.3-9: Degree to which impact can be mitigated

DEGREE TO WHICH IMPACT CAN BE MITIGATED	CRITERIA
None	No change in impact after mitigation.
Very Low	Where the significance rating stays the same, but where mitigation will reduce the intensity of the impact.
Low	Where the significance rating drops by one level, after mitigation.
Medium	Where the significance rating drops by two to three levels, after mitigation.
High	Where the significance rating drops by more than three levels, after mitigation.

- Environmental Assessment Policy requires that, "as far as is practicable", cumulative environmental impacts should be taken into account in all environmental assessment processes. EIAs have traditionally, however, failed to come to terms with such impacts, largely as a result of the following considerations:
- Cumulative effects may be local, regional or global in scale and dealing with such impacts requires coordinated institutional arrangements; and
- Environmental assessments are typically carried out on specific developments, whereas cumulative impacts result from broader biophysical, social and economic considerations, which typically cannot be addressed at the project level.

However, when assessing the significance of the project level impacts, cumulative effects have been considered as far as it is possible (as High, Medium or Low) in striving for best practice. The sustainability of the project is closely linked to assessment of cumulative impacts. An example of what the impact table would look like is shown in Table 1-10 below.

10.4 Risk Rating

The potential risk associated with the proposed activity was conducted as indicated in the paragraphs below:

10.4.1 Impact Identification

The purpose of this section is to identify potential impacts which may be associated with the Project and which have to be further investigated as part of the specialist investigations and environmental impact assessment phase. It is important that interactions that could lead to potential impacts which may result from the Project aspects, or interactions that could lead to potential impacts which may be intensified as a result of the Project aspects, be identified (including potential areas of impact) to assist in focusing the specialist investigations.

10.4.2 Potential Impacts

This section contains a summary and a motivation of the potential interactions and impacts which may be associated with the project activities, specifically related to the Hydrological specialist field.

The identified potential impacts are summarised as follows:

- Deterioration of water quality
  - Physical processes are applied for Diamond mining. No chemical processes are anticipated. Water Quality Related Impacts were rated low.
- Change in flow regime / Hydrological Characteristics
  - Due to the nature of topsoil on site, infiltration rates are high and even though vegetation clearance activities are anticipated, the potential impact of a change in flow regime is rated low.
- Erosion/sediment transport

Table 10.4.2-1: Impact assessment for the proposed mining activities (below)

<table>
<tr><th>Activities</th><th>Impacts</th><th>Aspects affected</th><th>Pl Phase</th><th>Significance rating</th><th>Typical mitigation measures</th></tr>
<tr>
<td>Deterioration in water quality due to:
1. Spillages during maintenance of vehicles.
2. Generation of Waste (coarse and fine residue)
3. Sewage Disposal
4. Construction material
5. Seepage of Slimes storage facility
6. Leakage of Pipelines of the channel resource blocks for the plant area at Mitchell's Bay</td>
<td>Deterioration in water quality
Potential health impact on surface water users and on the natural environment associated with the sea.
Rate of seepage is expected to below and the dilution effect of the sea is expected to lower the risk on surface water users.</td>
<td>Aspect Affected: Storm Water
1. Oil spillages during maintenance may be in contact with storm water.
2. Poorly managed waste may result in storm water getting into contact with material with a potential to pollute water.
3. Poor sanitation measures may result in contamination of storm water
4. Construction material may pose a risk to potential Storm water contamination.
5. Slimes if not properly managed, will result in the deterioration in water quality</td>
<td>Co
Construction, Operational and Rehabilitation</td>
<td>
<table>
<tr><th></th><th>Without mitigation</th><th>With mitigation</th></tr>
<tr><td>Severity</td><td>Low</td><td>Low</td></tr>
<tr><td>Duration</td><td>Medium</td><td>Low(slimes into existing voids)</td></tr>
<tr><td>Extent</td><td>Local</td><td>Local</td></tr>
<tr><td>Consequence</td><td>Low</td><td>Low</td></tr>
<tr><td>Probability</td><td>Medium</td><td>Low</td></tr>
<tr><td>Significance</td><td>Medium</td><td>Low</td></tr>
<tr><td>Status</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Confidence</td><td>Medium</td><td>Medium</td></tr>
<tr><td>Reversibility</td><td>Partial</td><td>Partial</td></tr>
<tr><td>Loss of resource</td><td>Low</td><td>Low</td></tr>
<tr><td>Degree to which the impact can be mitigated</td><td>Medium</td><td>Medium</td></tr>
</table>
</td>
<td>Aspect Affected: Storm Water
1. Maintenance of vehicles will be conducted on a clearly demarcated area at the workshop. Maintenance will be conducted on a concrete slab. Any spillages of oil and grease will be recovered through the oil collector.
2. Waste will be separated on site and disposed of at a registered landfill site.
3. Chemical Toilets will be utilised at remote locations.
4. Only Environmentally Friendly material must be used for construction purposes.
5. Slimes will be disposed of in existing voids from historic mining activities.</td>
</tr>
<tr>
<td>Change in Hydrological Yield resulting from:
1. Removal of vegetation;
2. Ponding water;</td>
<td>Factors which influence the change in Hydrological Yield Includes the following:
• Infiltration loss due to removal of vegetation</td>
<td>Aspect Affected: Storm Water
1. Vegetation clearance for establishment of required infrastructure.
2. Collection and storage of storm water in a dam</td>
<td>Construction, Operational and Rehabilitation</td>
<td>
<table>
<tr><th></th><th>Without mitigation</th><th>With mitigation</th></tr>
<tr><td>Severity</td><td>Low</td><td>Low</td></tr>
<tr><td>Duration</td><td>Medium</td><td>Low</td></tr>
<tr><td>Extent</td><td>Local</td><td>Local</td></tr>
</table>
</td>
<td>Aspect Affected: Storm Water
1. Vegetation clearance for establishment of required infrastructure must be managed as minimum as possible.</td>
</tr>
</table>

<table>
<tr>
<td>3. Facility (i.e slime dam) located within the 1:100 year flood line</td>
<td>• Evaporation loss due to ponding
• Change in flow direction due to facilities within the floodline</td>
<td></td>
<td></td>
<td>
<table>
<tr><td>Consequence</td><td>Low</td><td>Low</td></tr>
<tr><td>Probability</td><td>Medium</td><td>Low</td></tr>
<tr><td>Significance</td><td>Medium</td><td>Low</td></tr>
<tr><td>Status</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Confidence</td><td>Medium</td><td>Medium</td></tr>
<tr><td>Reversibility</td><td>Partial</td><td>Partial</td></tr>
<tr><td>Loss of resource</td><td>Low</td><td>Low</td></tr>
<tr><td>Degree to which the impact can be mitigated</td><td>Medium</td><td>Medium</td></tr>
</table>
</td>
<td></td>
<td>2. Clean water from the clean water catchment area will be allowed to freely flow back to the receiving environment. Ocean water will be abstracted for re-use at the plant.
3. Continuous monitoring of the tailings dam structure throughout the mining operations.</td>
</tr>
<tr>
<td>Erosion / Sediment Transport</td>
<td>Erosion from :
1. Slimes Dams ;
2. Haul roads;</td>
<td>Aspect Affected: Sediment Transport
1. Tailings Dams are associated with steep slopes and high porosity due to loosened material.
2. Erosion from the roads may result in scouring at the culvert crossings.</td>
<td>Construction, Operational and Rehabilitation</td>
<td>
<table>
<tr><td></td><td>Without mitigation</td><td>With mitigation</td></tr>
<tr><td>Severity</td><td>Low</td><td>Low</td></tr>
<tr><td>Duration</td><td>Medium</td><td>Low(slimes into existing voids)</td></tr>
<tr><td>Extent</td><td>Local</td><td>Local</td></tr>
<tr><td>Consequence</td><td>Low</td><td>Low</td></tr>
<tr><td>Probability</td><td>Medium</td><td>Low</td></tr>
<tr><td>Significance</td><td>Medium</td><td>Low</td></tr>
<tr><td>Status</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Confidence</td><td>Medium</td><td>Medium</td></tr>
<tr><td>Reversibility</td><td>Fully</td><td>Fully</td></tr>
<tr><td>Loss of resource</td><td>Low</td><td>Low</td></tr>
<tr><td>Degree to which the impact can be mitigated</td><td>Medium</td><td>Medium</td></tr>
</table>
</td>
<td></td>
<td>Aspect Affected: Sediment Transport
1. The side slopes of the Tailings Dams must not exceed 1:3 (vertical: horizontal) in order to reduce flow velocity on the side slopes.
2. A maintenance schedule must be produced for maintenance of roads in order to prevent and manage sediment transport.</td>
</tr>
</table>

11. Any mitigation measures for inclusion in the EMPr;

11.1 Water quality

Sanitation – Chemical toilets must be made available at remote places. The effect of sewage on sea water is similar to the effect on freshwater. Sewage depletes the available oxygen at the point of discharge. Because the sea is large and has a much greater diluting effect than rivers, the potential impact t is localised. Designs of discharge outfalls for water removed from the mining area for the safe continuity of mining: The issue of raised turbidity raise a concern of the potential impact of discharge activities to the sea. The following factors affect the design and performance of sea outfalls:

- Waves and swell
  - Strong surf is favourable and increases the mixing energy near the shoreline.
- Tides
  - Tides can set up currents which either assist discharge, or hold the discharge back.
- Currents
  - Long shore currents are favourable in that they carry the discharge away from the outfall.
- Topography
  - The favourable location would be at a place where there is a steep sloping ocean floor.

11.2 Sediment Transport

Beached form a natural coastal protection. Sedimentation on coastal areas depends on the type of wave (Storm or swell) and the beach material (Sand or shingle). If the beach is of a mobile material, then there will be sedimentation. Mining along the beach may result in exposure of movable material. Whether beaches are stable or not, depends on the the rates of sediment transport from the feeding stream. The Mean Annual Runoff of the affected catchment areas is very low, and may not have a significant influence on the beach at the point of discharge of the river.

Table 11.2-1: Impacts to be mitigated in their respective phase

ACTIVITIES	PHASE	SIZE AND SCALE of disturbance	MITIGATION MEASURES	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
Deterioration in water quality	• Construction, • Operational, • Rehabilitation, • Closure, • Post closure.		Aspect Affected: Storm Water 1. Maintenance of vehicles will be conducted on a clearly demarcated area at the workshop. Maintenance will be conducted on a concrete slab. Any spillages of oil and grease will be recovered through the oil collector. 2. Waste will be separated on site and disposed of at a registered landfill site. 3. Chemical Toilets will be utilised at remote locations. 4. Only Environmentally Friendly material must be used for construction purposes. 5. Slimes will be disposed of in existing voids from historic mining activities.	Section 19 of the National Water Act, 1998 (Act 36 of 1998). Management of emergency incidents.	Authorisation is required before the commencement of the activity.
Change in Hydrological Yield	• Construction, • Operational, • Rehabilitation, • Closure, • Post closure.		**Aspect Affected: Storm Water** 1. Vegetation clearance for establishment of required infrastructure must be managed as minimum as possible. 2. Clean water from the clean water catchment area will be allowed to freely flow back to the receiving environment. Ocean water will be abstracted for re-use at the plant.	Section 21 (a), (b) and (g) of the national Water Act, 1998 (Act 36 of 1998) - Consumptive water uses which may result in a reduction of water volumes from a water resource. This includes	Authorisation is required before the commencement of the activity.

				abstraction and storage of water.	
Erosion / Sediment Transport	• Construction, • Operational, • Rehabilitation, • Closure, • Post closure.		Aspect Affected: Sediment Transport 1. The side slopes of the Tailings Dams must not exceed 1:3 (vertical: horizontal) in order to reduce flow velocity on the side slopes. 2. A maintenance schedule must be produced for maintenance of roads in order to prevent and manage sediment transport.	Section 21 (c) and (i) of the national Water Act, 1998 (Act 36 of 1998) Non-Consumptive water uses which may result in a reduction of water volumes from a water resource. This includes abstraction	Authorisation is required before the commencement of the activity.

12. Any conditions for inclusion in the environmental authorisation;

The following inclusions are recommended:

12.1 Sizing and location of infrastructure

General Notice 704 (GN704) of 1999, regulations on use of water for mining and related activities aimed at the protection of water resources. Specifically related to this proposed project the following restrictions are applicable in terms of GN704

12.2 Location of infrastructure

General Notice 704 (GN704) of 1999, regulations on use of water for mining and related activities aimed at the protection of water resources. Specifically related to this proposed project the following restrictions are applicable in terms of GN704

Activity 4: "No person in control of mine or activity may:

- Locate or place any residue deposit, dam reservoir, together with any associated structure or any other facility within the 1:100 year floodline or within a horizontal distance of 100 meters from watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on waterlogged ground, or on ground likely to become water-logged, undermined, unstable or cracked;
- Except in relation to a matter contemplated in regulation 10, carry on any underground or opencast mining, prospecting or any other operation or activity under or within 1:50 year floodline or within a horizontal distance of 100 meters from any watercourse or estuary, whichever is the greatest;

- Place or dispose of any residue or substance which causes or is likely to cause pollution of a water resource, in the workings of any underground or opencast mine excavation, prospecting diggings, pit or any other excavation; or
- Use any area or locate any sanitary convenience, fuel depots for any substance which causes or is likely to cause pollution of a water resource within the 1:50 year floodline of any watercourse or estuary."

12.3 Capacity of the Pollution Control Dam

The pollution control dam must be designed, constructed, maintained and operated in such a way that it is not likely to spill into any clean water system more than once in 50 years. The pollution control dam must have a minimum freeboard of 0.8m above full supply level.

12.4 Restrictions on use of material

As indicated in GN 704, regulation 5, No person in control of a mine or activity may use any residue or substance which causes or is likely to cause pollution of a water resource for the construction of any dam or other impoundment or any embankment, road or railway, or for any other purpose which is likely to cause pollution of a water resource.

12.5 Surface Water Quality Monitoring

The surface water quality monitoring plan must include the proposed water monitoring points. This plan can be used as a management tool to ensure that potential impacts on surface water resources are managed according to the hierarchy of water and impact management. This tool will ensure that negative impacts are identified at the early stages and that the appropriate action is implemented for the protection of water resources.

Water Management System must be implemented for proper record keeping. This system must be populated with Water Quality Objectives (like RWQO published by the DWS) as well as monthly water quality results.

As indicated on the Water Quality Monitoring Map (, Four (4) water quality monitoring points are recommended on the two surface water resources for the study area.

However, it must be noted that due to the dry nature of the study area, it may not be possible to collect water samples unless after significant storm events.

Two additional monitoring points are recommended as follows:

- Sea Water Abstraction points;
- Discharge to the sea.

These additional monitoring points will be used as a management tool to identify and manage potential impact on Sea Water Quality from the mining activities. Should there be any significant impact from the mining processes, reasonable measures will be in place.

13. Any monitoring requirements for inclusion in the EMPr or environmental authorisation;

The purpose of the water quality monitoring is to provide timely and accurate water quality data as per the Department of Water and Sanitation's requirements, as well as to inform the management of West Coast Resources (Pty) Ltd about extent of possible mining impact on the surface water. This data is used for a variety of purposes, which may be summarized in broad terms as the determination of status and trends in resource water quality. Specific objectives of the water quality monitoring program are as follows:

- Determine whether water quality at sampling sites exceeds water quality standards as prescribed by the Department;
- Assess the status of water quality in the surrounding areas;

- Provide analytical water quality information which describes present conditions and changes.
- Data for the first month of sampling is insufficient for the purpose of generating water quality trends. These trends will be produced as soon as more data is recorded.
- Provide timely data for other users.

13.1 Data management and reporting

During field, laboratory, and data evaluation operations, effective data management is the key to providing consistent, accurate, and defensible data and data products. The management and reporting of field and laboratory data will generally follow the procedures outlined in the Best Practice Guidelines.

13.2 Monthly

Surface water samples must be collected on a monthly basis. A report summarising the findings must be produced monthly. This report is an internal report which is used to keep records of changing water qualities as well as to notify mine management team of the changes in water quality and areas of concerns..

13.3 Quarterly

The quarterly report must be produced to summarise the 3 months observations and analysis. This report will be submitted to the authorities in order to indicate compliance or challenges in relation to water quality changes. The quarterly report must include the following components:

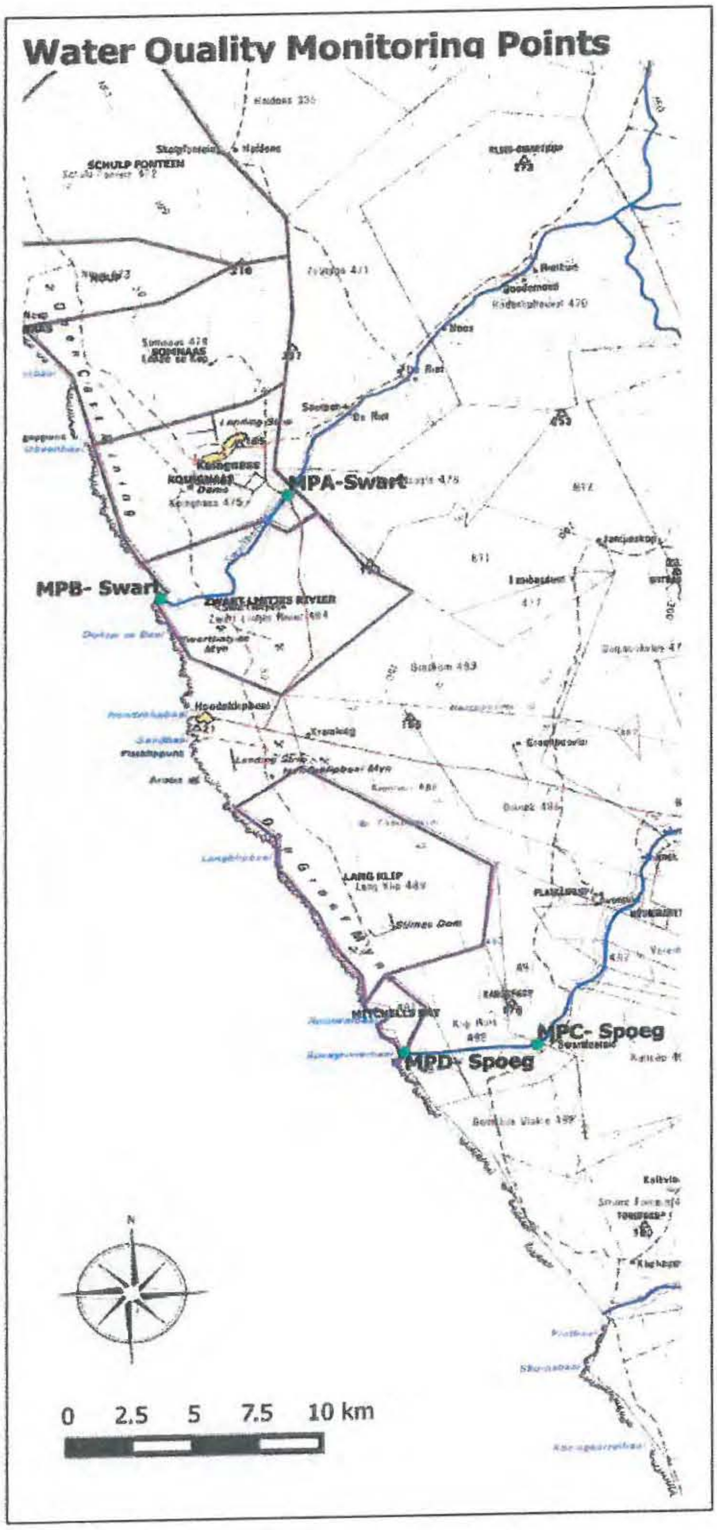
- Brief compliance assessment description;
- Brief description of monitoring actions performed;
- Flow characteristics (low/high flows);

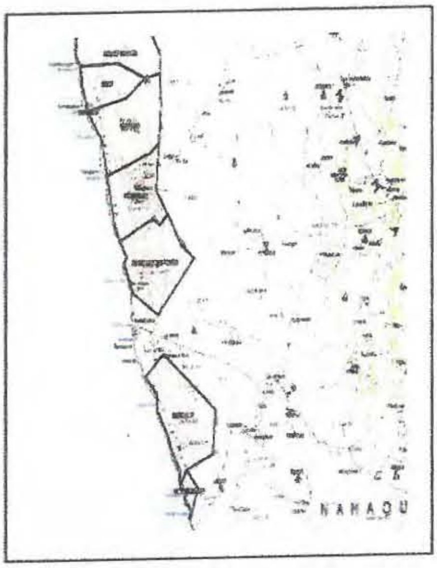
- Field parameters including odour and color observations;
- Highlight significant issues that require immediate corrective/ preventative action;
- Geographical presentations in a form of GIS maps indicating monitoring points and surface infrastructure; and
- Time dependent graphs for the selected water quality variables.

13.4 Annually

The annual report must consist of all the active environmental components. The following components should be included:

- Statutory/Regulatory Requirements;
- Monitoring Points and nearby surface Infrastructure;
- 12 months data captured;
- The compliance interpretation based on Resource Quality Objectives and SANS 241:2015 (Or any later version of SANS 241); and
- Recommendation of corrective measures.





Legend

- Farms-Study Area
- River
- 1 in 250 000 Topographical Map
- Monitoring Points-WCR

LONGITUDE	LATITUDE	LABEL
17.31307610	-30.21793310	MPA-Swart
17.26068478	-30.26376003	MPB- Swart
17.41542291	-30.46940320	MPC- Spoeg
17.36088473	-30.47159133	MPD- Spoeg

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Figure 13.4-1: Water Quality Monitoring Map

14. A reasoned opinion

(a) as to whether the proposed activity or portions thereof should be authorised; and

The proposed activity is recommended. In relation to the potential Hydrological Impacts, the proposed activity may be authorised. The Potential Hydrological Impacts are rated low.

The following surface activities require proper mitigation measures during the operational phase.

14.1 Oil Separator at the workshop area

The workshop will be a permanent building constructed with bricks, roofs. As part of stormwater management, the following measures are being considered:

- Impermeable concrete slab to prevent infiltration of contaminated water,
- Cut-off trench to restrict clean runoff from coming into contact with contaminated water stored in the grease and oil sump;
- Regular inspection at the oil separator and silt trap.

Provision has also been made for a wash bay. The design of the wash bay is in accordance with best practice and will be bunded, with a cut-off trench on the open side and will link to the oil separator and silt trap.

14.2 Sanitation

Chemical toilets will be provided at remote areas.

Conservancy tanks are used at the main office area for sanitation purposes. These tanks are emptied regularly by an external entity.

(b) if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;

No infrastructure may be located within the 1:100 years floodline area unless the authorisation is granted in accordance to section 21 (c) and (I) of the National Water Act.

15. A description of any consultation process that was undertaken during the course of preparing the specialist report;

A separate Public Consultation Process was followed.

16. A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and

A concern was raised regarding the impact s of storing sea water in the pollution control dam. In order to minimise water losses due to infiltration as well as the potential impact on groundwater resources, the water storage facilities must be lined.

17. Any other information requested by the competent authority

The content of the report covers the following key requirements:

- Catchment Characteristics
- Catchment Hydrology
- Water Balance Calculations
- Water Quality Management
- Risk Rating and Assessment
- Floodline Deliniation

18. Conclusion

Koingnaas is an existing mining area with most infrastructure requirements already in place. Infrastructure at each mine site and processing operation comprising electric power supply, roads, potable, fresh and seawater supplies, fuel supply and storage and workshops, have been established and maintained.

There are no fresh water sources, other than rain water in the region of the selected slimes sites.

Due to the mining methods applied on site, No chemicals are used in the beneficiation process as physical processes are implemented.

Existing mining voids in mined out areas were identified in central areas where processing plants would be placed over the life of the operation. The bedrock profiles in each of these areas were checked to ensure that the bedrock slope dipped towards the coast and that the site was within 1 km from the coastline. These attributes ensure that any seepage of seawater associated with the slimes would end up back in the ocean.

The identified potential impacts were rated low.

18.1 Legislative requirements

The study was conducted in line with the requirements of the National Water Act, 1998 (Act 36 of 1998) as well as the Best Practice Guidelines for the Protection of Water Resources and "Regulations 704" as published in Government Gazette, Volume 408, No 20119 of June 1999 (Also known as General Notice 704, 04 June 1999).

18.2 Domestic Water

Domestic water is sources from the underground water resource. This water must be monitored and compared against the Water Quality Guidelines for drinking water. Monitoring of this water will serve as a management tool in order to determine at the early stages if the water is suitable for domestic use.

19. Recommendations

Reasonable measures as recommended in this report must be implemented in order to reduce the impact on surface water resources. In view of the above conclusions, the following recommendations are made:

- Only environmentally friendly materials must be used during the construction phase to minimize pollution;
- Vegetation stripping must be limited to the minimum width required;
- The topography of all disturbed areas must be rehabilitated, in such a manner that it blends with the surrounding natural area. This will reduce soil erosion and improve natural re-vegetation;
- Storage of Contaminated Water is deemed a water use and the Department of Water and Sanitation must be consulted for an authorisation prior to the construction phase. Concurrent rehabilitation must be implemented in order to reduce desertification. The general philosophy that WCR has adopted is that any material excavated, moved or processed as part of any new mining or plant activity should be placed in such a way that it is part of the final rehabilitation solution. This will ensure that all operations are aligned with good environmental practice and will reduce the final closure liabilities. Backfilling existing mining voids with slimes generated from the processing plants is seen as the most effective and environmentally friendly way of disposing of slimes material.
- The final landform of the rehabilitated pits must be sustainable, free draining, minimize erosion and avoid ponding. Where final voids are maintained, these must be properly sloped to ensure a safe landscape.
- The disturbed area and footprint of the mine's operations must be kept as small as possible by mining strips.
- During the operational phase, uncontaminated surface water from the site must be allowed to freely flow to the environment.