HYDROLOGICAL IMPACT ASSESSMENT

FOR A PROPOSED MIXED-USE DEVELOPMENT IN CATO RIDGE, ETHEKWINI METROPOLITAN, KWAZULU-NATAL

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FINAL REPORT

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Specialist Details & Declaration

This report has been prepared in accordance with Section 13: General Requirements for Environmental Assessment Practitioners (EAPs) and Specialists as well as per Appendix 6 of GNR 982 – Environmental Impact Assessment Regulations and the National Environmental Management Act (NEMA, No. 107 of 1998 as amended 2017) and Government Notice 704 (GN 704). It has been prepared independently of influence or prejudice by any parties.

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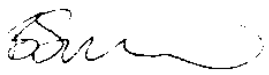
Author signature			Co-author signature		
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1. INTRODUCTION

1.1 Project Background and Description of the Activity

A mixed-use development has been proposed in the Cato Ridge area. The application for authorisation for the project will include the following land uses light industry (all non-noxious), housing & Logistics and the associated infrastructure and service connections for water, electricity, roads and sewerage (including an interim sewage package plant for the first phase). The project broadly includes:

- Open spaces and conservation areas.
- Mixed-use activities (potentially offices, retail, and commercial facilities).
- light industry, warehousing, distribution and logistics.
- Internal roads (7 m wide excluding road reserve, 3.5 m single lane in both directions), road upgrades and new intersections.
- Stormwater infrastructure, including pipelines and attenuation ponds.
- Sewer infrastructure, including pipelines, collection sumps, pump stations and a 2 megalitre (ML) modular wastewater treatment plant (WTP) with an effluent discharge point (to be phased in a modular fashion as the development progresses).
- Water infrastructure, including pipelines and an elevated storage tank.
- Electrical infrastructure, including substations and underground/overhead transmission lines. Two alternative options are being reviewed for Phase 2. The final electrical designs are subject to approval by Eskom.

The requirement for the hydrological assessment is in part due to the potential presence of watercourse features on site and the impervious nature of the proposed activity. A key component of the investigation will be potential flood areas, accommodation of peak storm events, best practice erosion control and the general impact of the development on downstream surface water resources for water users in the catchment. The proposed activities occur on the following properties:

Table 1 Properties located at the proposed Cato Ridge Development Company Ltd. site

Portion	Farm Name	Farm No.	Latitude	Longitude	SG Code	Deed	Area
208	Uitkomst & Doomrug	852	-29.72431	30.61159	N0FT00000000085200208	T9790/1957	12.15
229	Uitkomst & Doomrug	852	-29.72505	30.60964	N0FT00000000085200229	T7407/1960	12.36
95	Uitkomst & Doomrug	852	-29.72349	30.60778	N0FT00000000085200095	T7836/1948	80.92
101	Uitkomst & Doomrug	852	-29.71963	30.61498	N0FT00000000085200101	T8234/1949	36.43
102	Uitkomst & Doomrug	852	-29.72320	30.61522	N0FT00000000085200102	T1396/1950	24.49
202	Riet Vallei	851	-29.70264	30.63221	N0FT00000000085100202		0.73
39	Uitkomst & Doomrug	852	-29.71072	30.61750	N0FT00000000085200039	1420/1980	133.05
24	Riet Vallei	851	-29.70955	30.62448	N0FT00000000085100024		8.83
198	Riet Vallei	851	-29.71041	30.62518	N0FT00000000085100198	16448/1984	1.07
197	Riet Vallei	851	-29.71055	30.62532	N0FT00000000085100197	16814/1983	0.82
29	Riet Vallei	851	-29.71337	30.62869	N0FT00000000085100029	819/1987	77.80
305	Uitkomst & Doomrug	852	-29.71583	30.62155	N0FT00000000085200305	16814/1983	1.51
41	Uitkomst & Doomrug	852	-29.71588	30.62320	N0FT00000000085200041	818/1987	16.38
262	Uitkomst & Doomrug	852	-29.73909	30.62173	N0FT00000000085200262	18356/1968	0.47
0	Uitkomst & Doomrug	852	-29.73105	30.59967	N0FT00000000085200000	1048/1986	19.93
29	Uitkomst & Doomrug	852	-29.73173	30.61590	N0FT00000000085200029	4349/1922	162.70
27	Riet Vallei	851	-29.68788	30.62932	N0FT00000000085100027	1420/1980	105.52
26	Riet Vallei	851	-29.69837	30.62822	N0FT00000000085100026	1420/1980	98.23
40	Uitkomst & Doomrug	852	-29.69945	30.61874	N0FT00000000085200040		59.46
25	Riet Vallei	851	-29.70018	30.62351	N0FT00000000085100025	1420/1980	70.71
465	Uitkomst & Doomrug	852	-29.72973	30.61045	N0FT00000000085200465		22.30
471	Uitkomst & Doomrug	852	-29.72786	30.61243	N0FT00000000085200471		0.41

95	Uitkomst & Doornrug	852	-29.72078	30.60710	N0FT00000000085200095	T1420/1980	33.68
369	Riet Vallei	851	-29.70086	30.63165	N0FT00000000085100369	T33500/2012	10.82
29	Uitkomst & Doornrug	852	-29.73168	30.61650	N0FT00000000085200029	T4349/1922	130.15

Uninformed and poorly planned infrastructural developments in the vicinity of water resources, such as sensitive surface and groundwater, can rapidly degrade these resources. Thus, pre-development (or in some cases post development) assessments are required to gain an understanding of the natural environment and guide the developmental process in order that site-specific mitigation measures can be put in place.

Figure 1 Site setting for the Cato Ridge Development Company Ltd. site

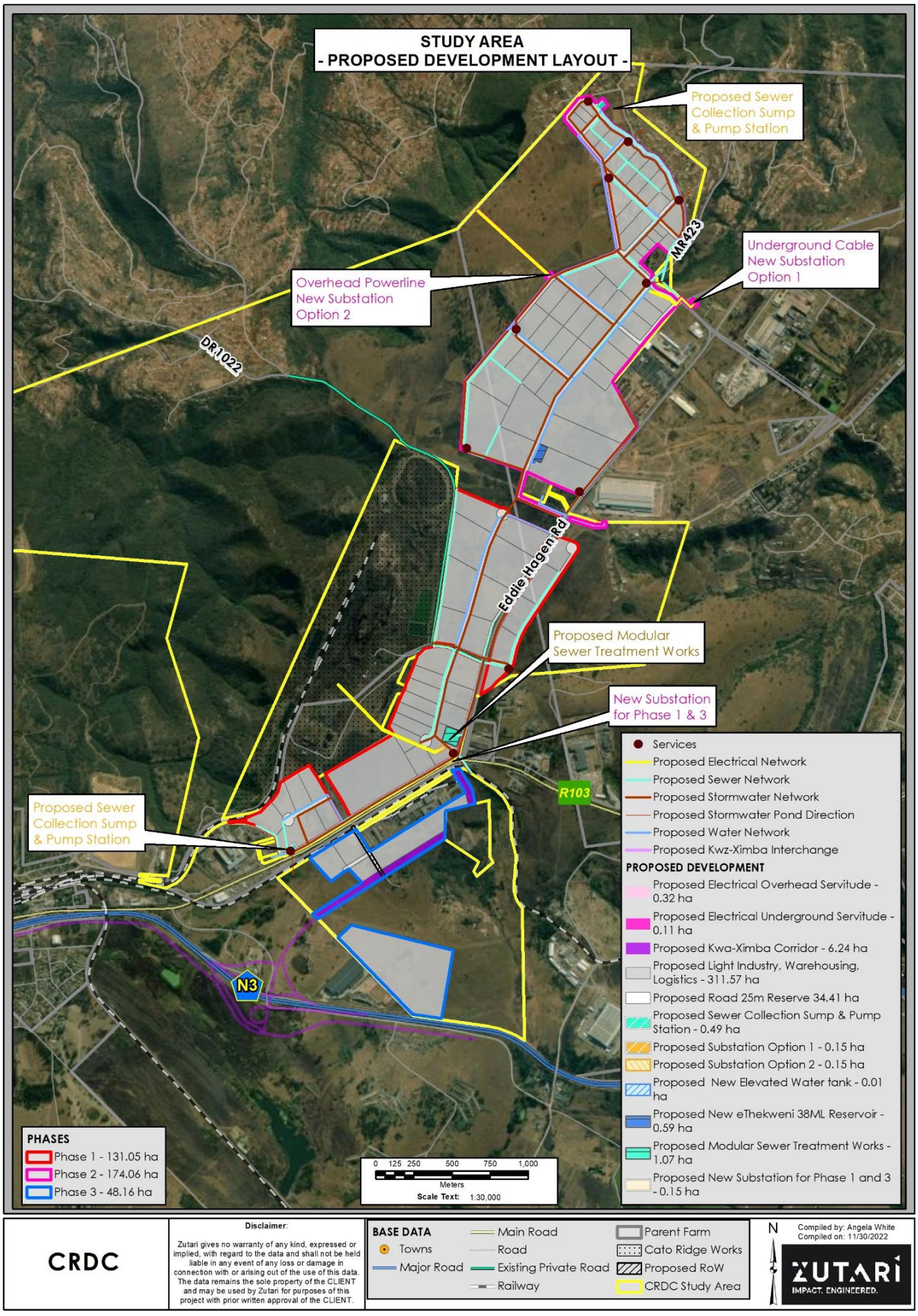


Figure 2 Development layout for the Cato Ridge Development Company Ltd. site

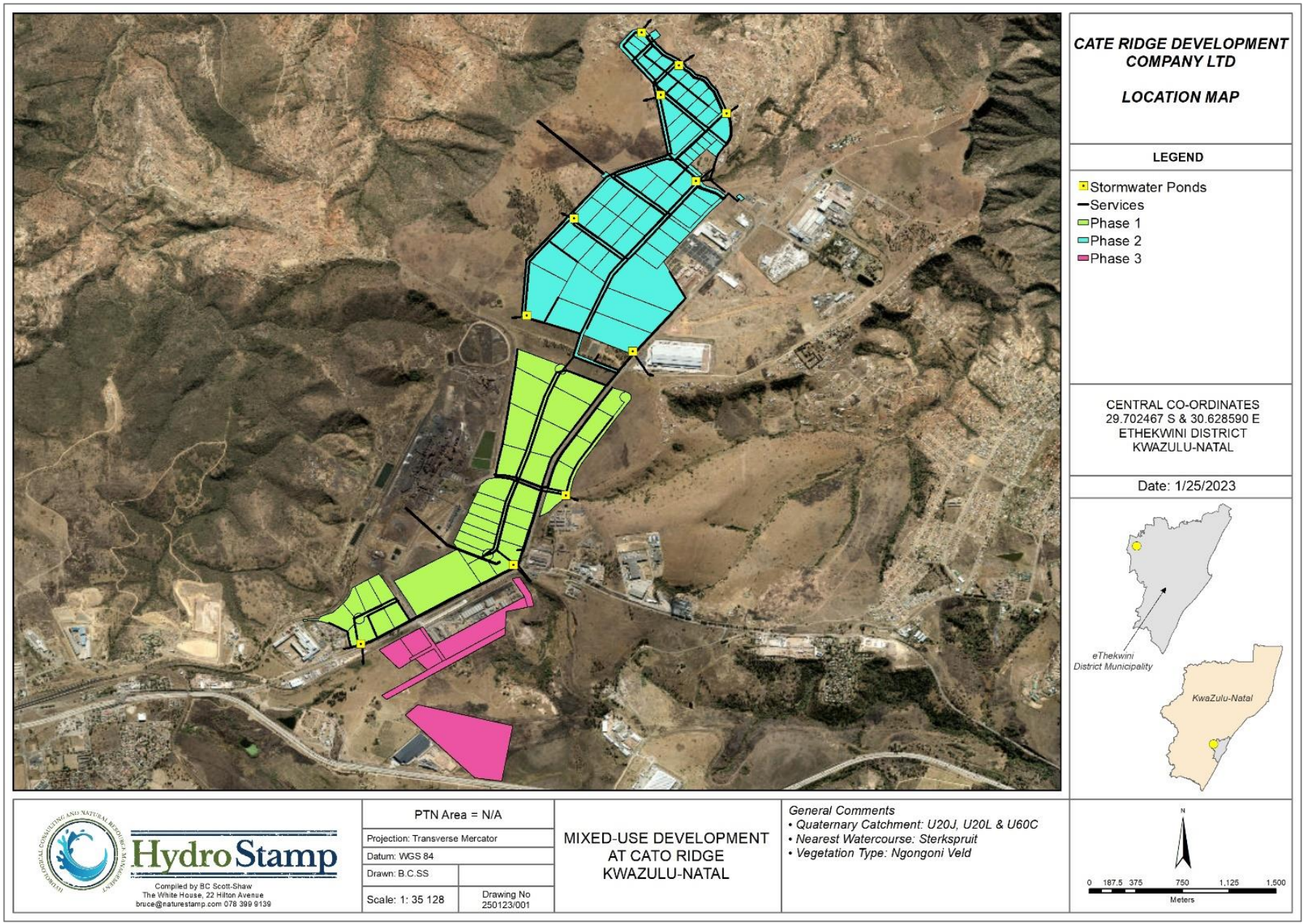


Figure 3 Locality map of the proposed Cato Ridge Development Company Ltd. site

1.2 Terms of reference

Phase 1

i. **Desktop Assessment**
- Analysis of rainfall data.
- Analysis and description of streamflow data.
- Determination of catchment characteristics.
- A legal review of the key legislative requirements and policy objectives.
- A description of the hydrological cycle of the catchment, including both upstream and downstream users.

ii. **Hydrological Impact Assessment**
- A site visit will be performed to assess the dominant hydrological processes and patterns at the site and to comply with NEMA Appendix 6 (refer to the attached methodology and guideline for added detail).
- Incorporate the findings of the existing stormwater management plan and flood line delineations into the hydrological analysis.
- Set out the gaps and assumptions (i.e. % of the area to be hard surfaced) underpinning the assessment and motivating for a high-level assessment.
- Assess the pre-mitigation impacts of changes to the hydrological system (up- and down-stream), based on effluent discharge and increased stormwater runoff. The impact should be divided by project phases (Phase 1, 2 and 3) and also by life cycle (Construction, Operation, decommissioning & a no-go scenario).
- Recommend appropriate mitigation measures for inclusion into an EMPr
- Undertake a post-mitigation impact assessment of all identified impacts.
- Identify and assess cumulative hydrological impacts as well
- Development of a management plan, including mitigation measures, ongoing management and monitoring requirements (including frequencies and locations).

Phase 2

i. **Desktop Assessment & Revision**
- Collation of all background data obtained in Phase 1;
- Mapping of floodlines and stormwater interventions from existing studies to inform exclusion zones;

ii. **Impact Assessment and Mitigation Measures**
- A detailed evaluation of the predicted impacts of the project on the receiving environment, or of the receiving environment on the project as per the methodology that uses the criteria of extent, duration and intensity to quantify the significance of the potential impact. The evaluation of impacts will include:
    a. An assessment of impacts during the construction, operation phases and decommissioning phases;
    b. An assessment of the probability of each impact occurring, the reversibility of each impact and the level of confidence in each potential impact;
    c. An assessment of the significance of each impact before and after mitigation;
- The identification of any residual risks that will remain after the implementation of any mitigation of an impact; and
- The cumulative impact in terms of the current and proposed activities in the area.
- Recommendations to avoid negative impacts or where this will not be possible, then practical mitigation, management and/or monitoring options to reduce negative impacts and enhance positive impacts.
- Recommendations on the preferred placement of infrastructure will be provided if any watercourses intersect sensitive infrastructure (as determined by flood-lines).

iii. **Water balance assessment:**
- analysing climate data from the SAWS and other databases using nearby rainfall stations (input or known data);
- determining any water demands and water outputs; and
- determining whether water in the system is clean or contaminated.
- Development of a static water balance. The information gathered in the desktop assessment and during the site visit will be used to create a process water flow diagram. A series of models will be

considered for use in this balance study. The Department of Water Affairs and Forestry, 2006 Best Practice Guideline G2: Water and Salt Balances was followed in this study.

- Produce a water balance study report with recommendations. An average annual water balance will be provided including an average dry and average wet month water balance. A set of recommendations will be provided to assist in the WULA and help the land owners to manage their water appropriately.

iv. **Surface Water Monitoring Plan**

- Responsible person/body
- Frequency of monitoring actions;
- Standards to be met; and
- Reporting requirements.

1.3 Legislation Relevant to the Study

The following is relevant to this study:

- Section 24 of The Constitution of the Republic of South Africa (1996);
- Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998;
- National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) inclusive of all amendments, as well as the NEM: Biodiversity Act;
- National Water Act, 1998 (Act No. 36 of 1998);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA);
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002);
- Nature and Environmental Conservation Ordinance (No. 19 of 1974);
- National Forest Act (No. 84 of 1998); and
- National Heritage Resources Act (No. 25 of 1999).

2. STUDY SITE

The CRDC site is located primarily within Quaternary Catchment U20J, within the catchment area of the Mswathi River, and falls under the uMvoti to uMzimkhulu Water Management Area (WMA). The site is located at the upper reach of the catchment and has no defined watercourses. This site drains towards the Umsunduzi system which is heavily modified. The site is dominated by thornveld with some area of invaded bush.

The site is located between the N3 and open bush areas. The surrounding vegetation is categorized as part of the Hinterland Thornveld type. Several invasive alien plant species were identified on site, such as bugweed (*Solanum mauritianum*), peanut butter cassia (*Senna didymobotrya*), Black Wattle (*Acacia mearnsii*), and *lantana camara*. A quarry is located directly south of the proposed site.

Rainfall in the region occurs in the summer months (mostly December to February), with a mean annual precipitation of 726 mm (observed from rainfall station 0239518 W & 0239673 A). The reference potential evaporation (ET_o) is approximately 1667 mm (A-pan equivalent, after Schulze, 2011) and the mean annual evaporation is between 1300 – 1400 mm, which exceeds the annual rainfall. This suggests a high evaporative demand and a water limited system. Summers are warm to hot and winters are cool. The mean annual temperature is approximately 21.5 °C in summer and 13.8 °C in the winter months (Table 2). The underlying geology of the site is Natal Group Sandstone and the soils overlain are sandy-clay-loam ranging from Mispah, Glenrosa to Shortlands form in this particular area.

Table 2 Mean monthly rainfall and temperature observed at Camperdown (derived from historical data)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean Rainfall (mm)	86	79	74	36	18	8	9	15	36	65	78	82	**726**
Mean Temperature (°C)	22.0	22.9	21.4	19.8	17.8	15.2	15.4	16.3	18.1	18.3	19.9	21.1	**19.0**

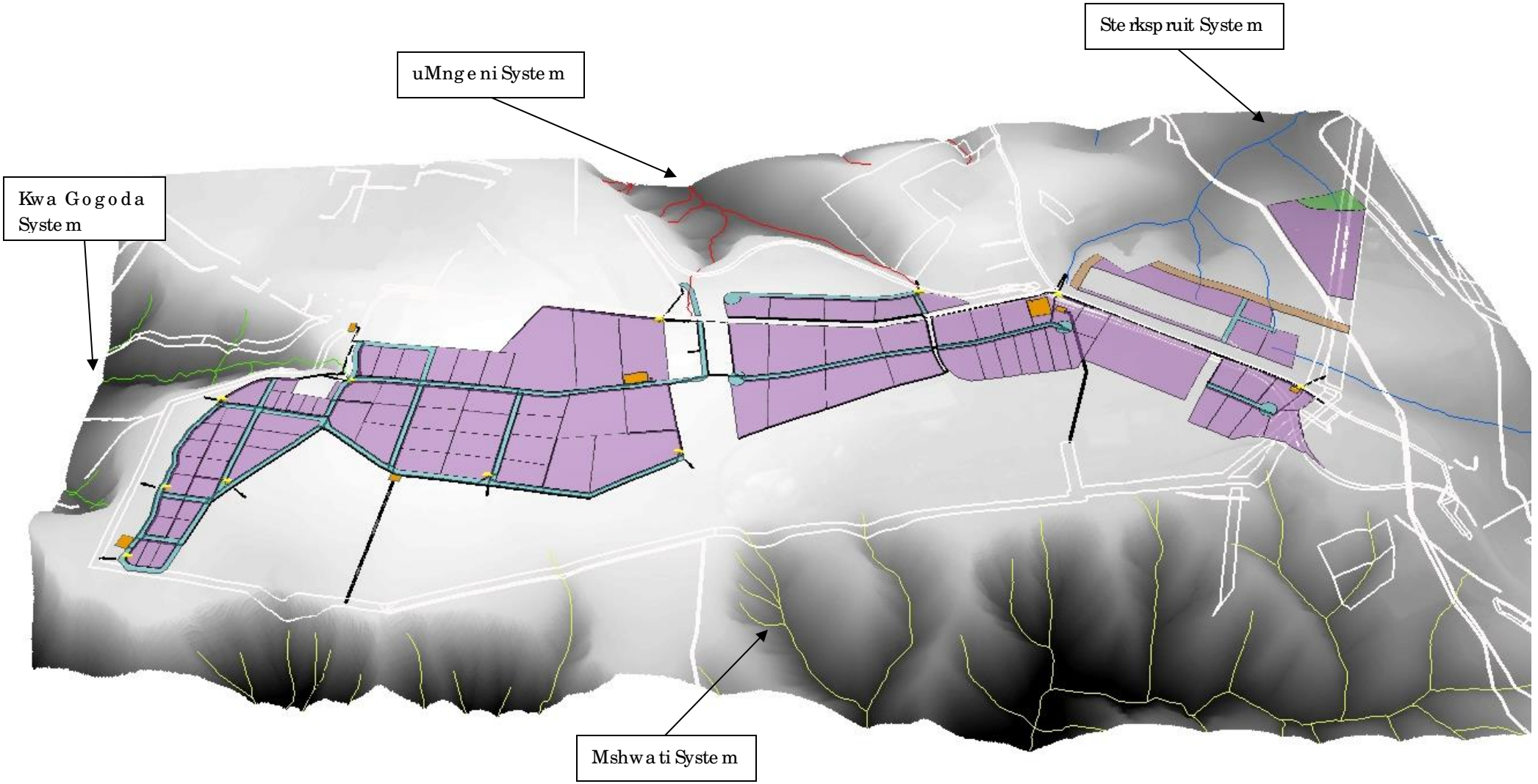


Figure 4 Exaggerated (2.5x) terrain model of the Cato Ridge development

3. METHODOLOGY

The following methodology was followed in order to meet the objectives as detailed in the terms of reference. The assessment of these systems considered the following databases where relevant:

Table 3 Data type and source for the CRDC assessment

Data Type	Year	Source/Reference
Aerial Imagery	2016	Surveyor General
1:50 000 Topographical	2011	Surveyor General
1 m Contour	2022	Zutari
River Shapefile	2011	eThekwini
Geology Shapefile	2011	Durban Geological Sheets/National Groundwater Archive
Land Cover	2014	EKZNW
Water Registration	2013	WARMS - DWS

*Data will be provided on request

3.1 Site Visit

A site visit was conducted by NatureStamp on the 24th February 2023. A partial pre-development state was assessed. The current condition was assessed as follows -

- The vegetation characteristics of the watercourse were assessed for the determination of the Manning's n-values;
- The presence and dimensions of any crossings, such as culverts and bridges, that would act as a barrier to a flood event and that may be damaged during the occurrence of such an event were noted;
- The overall state of drainage channels, streams and rivers was assessed;
- The slope of the study site as well as evidence of flood damage and erosion around the site were noted;
- The state of existing gauging stations (nearby) was assessed to determine if the structure is accurately recording streamflow (e.g. evidence of undercutting or damaged features); and
- The elevation at the water level and crossing level in order to verify contour data.

The watercourse systems were not flowing at the time of the site visit.

Figure 5 General site conditions observed during the site visit

3.2 Critical Catchment Delineation and River Reach Analysis

The critical contributing catchment area was determined for use in both the watershed delineation tool and HEC-HMS and SWAT models. The sub-catchments were delineated using the 2 m contour set provided by the topographical survey as an input. This was used to create a Digital Elevation Model (DEM) that was then used as an input to the watershed tool (Figure 6).

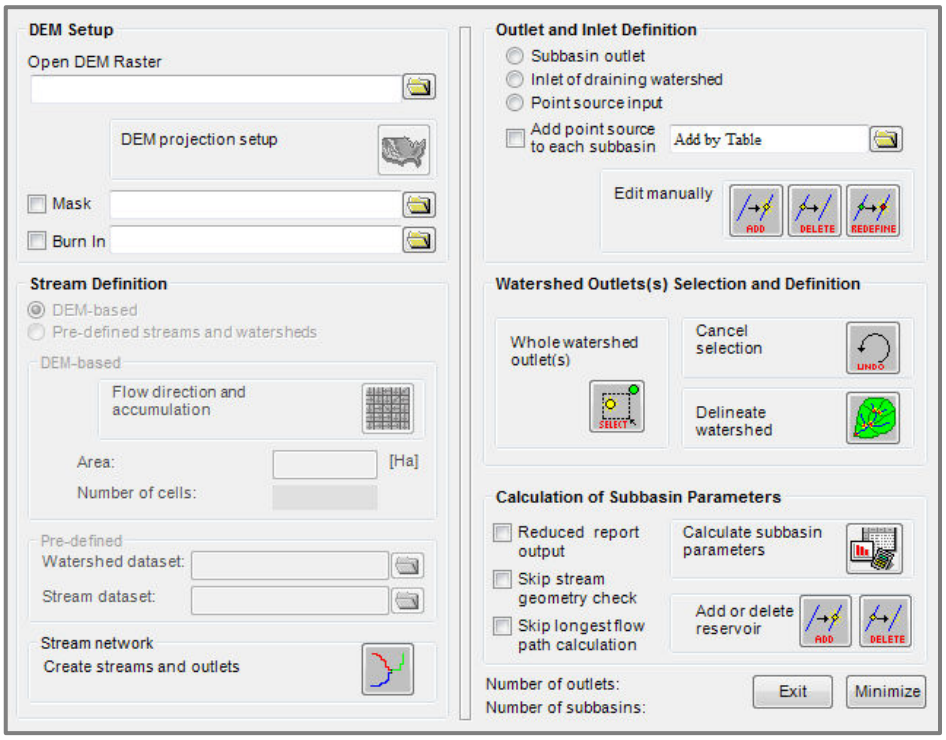


Figure 6 Soil Water Assessment Tool (*SWAT*) watershed delineation tool for sub-catchment delineation and stream network creation

3.3 Impact Assessment Methodology

The following impact assessment methodology ensures that specialists address all relevant factors that contribute to significance (avoiding arbitrary assessment). The specialist report should outline the impact assessment methodology that provides the reader with a clear summary of how the specialist derived the significance.

For each predicted impact, criteria are applied to establish the significance of the impact based on likelihood and consequence, both without mitigation being applied (pre-mitigation) and with the implementation of the recommended mitigation measure(s) (post-mitigation).

"Significant impact" means an impact that may have a notable effect on one or more aspects of the environment or may result in non-compliance with accepted environmental quality standards, thresholds or targets and is determined through rating the positive and negative effects of an impact on the environment based on criteria such as duration, magnitude, intensity and probability of occurrence" (2014 EIA regulations, as amended).

The criteria that contribute to the consequence of the impact are:

- Intensity (the degree to which pre-development conditions are changed), which also includes the type of impact (being either a positive or negative impact); the duration (length of time that the impact will continue); and the extent (spatial scale) of the impact.
- The sensitivity of the receiving environment and/or sensitive receptors are incorporated into the consideration of consequence by appropriately adjusting the thresholds or scales of the intensity, duration and extent criteria based on expert knowledge.

For each impact, the specialist applies professional judgement to ascribe a numerical rating for each criterion according to the examples provided in Table 1, Table 2 and Table 3 below. The consequence is then established using the formula:

$$\text{Consequence} = \text{type} \times (\text{intensity} + \text{duration} + \text{extent})$$

Depending on the numerical result, the impact's consequence would be extremely, highly, moderately or slightly detrimental; or neutral; or slightly, moderately, highly or extremely beneficial. These categories are provided in Table 5.

To determine the significance of an impact, the probability (or likelihood) of that impact occurring is also considered. In assigning probability, the specialist considers the likelihood of occurrence and takes cognisance of uncertainty and detectability of the impact. The most suitable numerical rating for probability is selected from Table 4 below and applied with the consequence according to the following equation:

$$\text{Significance} = \text{consequence} \times \text{probability}$$

When assigning a probability to an impact, it is vitally important to distinguish this from the concepts of frequency and confidence, with which it is sometimes confused:

- Probability refers to the likelihood that an impact will occur.
- Frequency refers to the regularity with which an impact occurs. To illustrate the difference between frequency and probability, it must be considered that something that happens infrequently may still be a certainty (i.e. have a high probability). For instance, Halley's Comet only comes close to the sun every 75 to 76 years (i.e. it has a very low frequency), but it is still a certainty.
- Confidence refers to the degree of certainty of a prediction. Confidence may be related to impact assessment criteria (extent, intensity, duration or probability) and is not necessarily only related to probability. Confidence may be influenced by any factors that introduce uncertainty into a prediction. The specialists appointed to contribute to this impact assessment have empirical knowledge of their respective fields and can thus comment on their confidence in their findings based on the availability of data and the certainty of their findings. All specialists should inlcude a short assessment and description of their confidence rating in their impact assessment report.

Depending on the numerical result of this calculation, the impact would fall into a significance category of negligible, minor, moderate or major, and the type would be either positive or negative. Examples of these categories are provided in Table 6.

Once the significance of an impact occurring without mitigation has been established, the specialist must apply their professional judgement to assign ratings for the same impact after the proposed mitigation has been implemented.

Lastly, two further points are important when applying these criteria to impacts:

- Specialists need to assess the impact, not the source or origin of the impact (i.e. the activity that causes the impact). For instance, although the activity that causes a specific impact may take place over a long period of time, this does not necessarily imply that the impact itself will persist for the same length of time. The assessment must focus on the impact (the change in the environment) rather than on the activity that causes an impact.
- Consider the direct impact of the proposed project design. If the design of a project avoids an area where a highly sensitive or irreplaceable resource occurs, it would be a mistake to assume that this resource would experience an impact simply because the resource occurs within the boundaries of the study area. For example, if a wetland or archaeological site occurs on portion

A, but the project is located on portion B, the wetland or archaeological site may not be directly affected.

The tables on the following pages show the scales used to classify the above variables and define each of the rating categories.

Status of Impact is classified as:

- Positive: + (A benefit to the receiving environment).
- Negative: - (A cost to the receiving environment).
- Neutral: N (No cost or benefit to the receiving environment).

3.3.1 Mitigation measures

The significance of an impact indicates the level of mitigation measures required to minimise negative impacts and reduce environmental damage during the various project phases. Suitable and appropriate mitigation measures should be identified for each potential impact based on specialist recommendations and expertise.

Table 4 Definition of Intensity ratings for cumulative impact assessment

Rating	Criteria	
	Negative impacts (Type of impact = -1) impacts	**Positive impacts (Type of impact = +1) impacts**
7	Complete destruction (irreversible and irreplaceable loss) of natural or social systems, resources (e.g. species) and human health. No chance of these processes or resources ever being restored to their pre-impact condition.	Noticeable, sustainable benefits that improve the quality and extent of natural or social systems or resources, including formal protection.
6	The very high degree of damage to natural or social systems or resources. These processes or resources may restore to their pre-project condition over very long periods (more than a typical human lifetime).	Great improvement to the ecosystem or social processes and services or resources.
5	Serious damage to components of natural or social systems or resources and the contravention of legislated standards.	Ongoing and widespread benefits to natural or social systems or resources.
4	High degree damage to natural or social system components, species or resources.	Average to intense positive benefits for natural or social systems or resources.
3	Moderate damage to natural or social system components, species or resources.	Average, ongoing positive benefits for natural or social systems or resources.
2	Minor damage to natural or social system components, species or resources. Likely to recover over time. Ecosystems and valuable social processes are not affected.	Low positive impacts on natural or social systems or resources.
1	Negligible damage to individual components of natural or social systems or resources, such that it is hardly noticeable.	Limited low-level benefits to natural or social systems or resources.

Table 5 Definition of Duration ratings for cumulative impact assessment

Rating	Criteria
7	**Permanent:** The impact will remain indefinitely.
6	**Beyond project life**: The impact will remain for some time after the life of the Project.
5	**Project life:** The impact will cease after the operational life span of the Project
4	**Long-term**: The impact will continue for 6-15 years.
3	**Medium-term:** The impact will continue for 2-5 years.

2	**Short-term:** The impact will continue for between 1 month and 2 years.
1	**Immediate**: The impact will continue for less than 1 month.

Table 6 Definition of Extent ratings for cumulative impact assessment

Rating	Criteria
7	**International:** The effect will occur across international borders.
6	**National:** The impact will affect the entire country.
5	**Province/ Region:** The impact will affect the entire province or region
4	**Municipal Area:** The impact will affect the whole municipal area.
3	**Local:** The impact will extend across the study area and the LAP area.
2	**Limited:** The impact will be limited to the study area.
1	**Very limited:** The impact will be limited to the footprint of the development and will not extend to the boundaries of the study area.

Table 7 Definition of Probability ratings for cumulative impact assessment

Rating	Criteria
7	**Certain/ Definite:** There are sound scientific reasons to expect that the impact will definitely occur.
6	**Almost certain/Highly probable:** It is most likely that the impact will occur.
5	**Likely:** This impact has occurred numerous times here or elsewhere in a similar environment and with a similar type of development and could very conceivably occur.
4	**Probable:** This impact has occurred here or elsewhere in a similar environment and with a similar type of development and could conceivably occur.
3	**Unlikely:** This impact has not happened yet but could happen.
2	**Rare/ improbable:** The impact is conceivable, but only in extreme circumstances. The possibility of the impact manifesting is very low due to the design, experience or implementation of adequate mitigation measures.
1	**Highly unlikely/None:** The impact is expected never to happen or has a very low chance of occurring.

Table 8 Definition of Consequence ratings for cumulative impact assessment

Range		Significance rating
-21	-18	Extremely detrimental
-17	-14	Highly detrimental
-13	-10	Moderately detrimental
-9	-6	Slightly detrimental
-5	5	Negligible
6	9	Slightly beneficial
10	13	Moderately beneficial
14	17	Highly beneficial
18	21	Extremely beneficial

Table 9 Definition of Significance ratings for cumulative impact assessment

Range		Significance rating
-147	-109	Major - negative
-108	-73	Moderate - negative
-72	-36	Minor - negative
-35	-1	Negligible - negative
0	0	Neutral
1	35	Negligible - positive
36	72	Minor - positive

73	108	Moderate - positive
109	147	Major - positive

Table 10 Definition of Confidence ratings for cumulative impact assessment

Rating	Criteria
Low	Judgement is based on intuition, and some major assumptions are used to assess the impact that may prove untrue.
Medium	Determination is based on common sense and general knowledge. The assumptions made, whilst having a degree of uncertainty, are fairly robust.
High	Substantive supportive data or evidence exists to verify the assessment.

3.3.2 Assessment of cumulative impacts

A "cumulative impact" is defined in the EIA regulations, 2014 as the 'past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities'.

Examples of cumulative impacts include those resulting where several hydroelectric projects are constructed or planned on the same river or within the same watershed, multiple oil and gas projects or mines are developed in proximity, or several wind farms are constructed or planned within the same flyway or region. In other cases, cumulative impacts occur from the combined effects over a given resource of a mix of different types of projects, for example, the development of a mining site, access roads, transmission lines, and other adjacent land uses.

4. LIMMITATIONS & ASSUMPTIONS

In order to apply generalized and often rigid design methods or techniques to natural, dynamic environments, a number of assumptions are made. Furthermore, a number of limitations exist when assessing such complex hydrological systems. The following constraints may have affected this assessment:

- 1-meter contour interval data and Digital Elevation Models (DEMs) were used in the assessment. However, outside of the immediate study area, the 5 meter contours were used.
- Given the setting of the site (some existing industries) not all locations were accessible.
- There was little flow out of the system. The catchments are very small and the watercourse associated with the site has been historically transformed. In addition, boreholes nearby are used for small scale livestock drinking and are negligible.
- It is assumed that all the spoil and construction areas/plants has the potential to contaminate surface water, hence all storm water infrastructure is based on the worst case dirty water catchment sizes.

5. RESULTS AND DISCUSSION

A detailed desktop assessment was undertaken for the site. This was the point of departure for the calculation of design flood volumes. These adopted values were then used in the HEC-RAS and HEC-geoRAS models to route this flood event through the channel.

5.1 Desktop Hydrological Assessment

The Camperdown station (0240073 W) was used in the hydrological assessment as it is located in close proximity to the site (~3.7 km) and has a record that is longer than 30 years. Additional gauges were used to patch the missing data of the rainfall record. The 24-hour rainfall depths for different return period storm events as given by Smithers and Schulze (2003) at the Camperdown site is provided in Table 11.

Additional assessments of rainfall stations and weirs were undertaken for the contributing catchment area. Rainfall stations were considered based on their proximity to the site, altitude and length/reliability of the data record. In similar vein, flow gauging stations were considered only if good quality data with a reasonable record length was available.

Table 11 Comparison of values from some of the rainfall stations that were assessed during the data analysis

Station No.	Estimated MAP (mm)	Years	Reliable	Altitude (m)	Station Name
0239855 A	715	107	28.4	757	Cosmore
0240361 U	739	5	99.9	826	Umlaas Road (WW)
0240014 W	691	107	38.6	772	Umlaas Road
0240422 A	643	3	97.4	717	Tshani
0240073 W	690	107	73.2	589	Camperdown

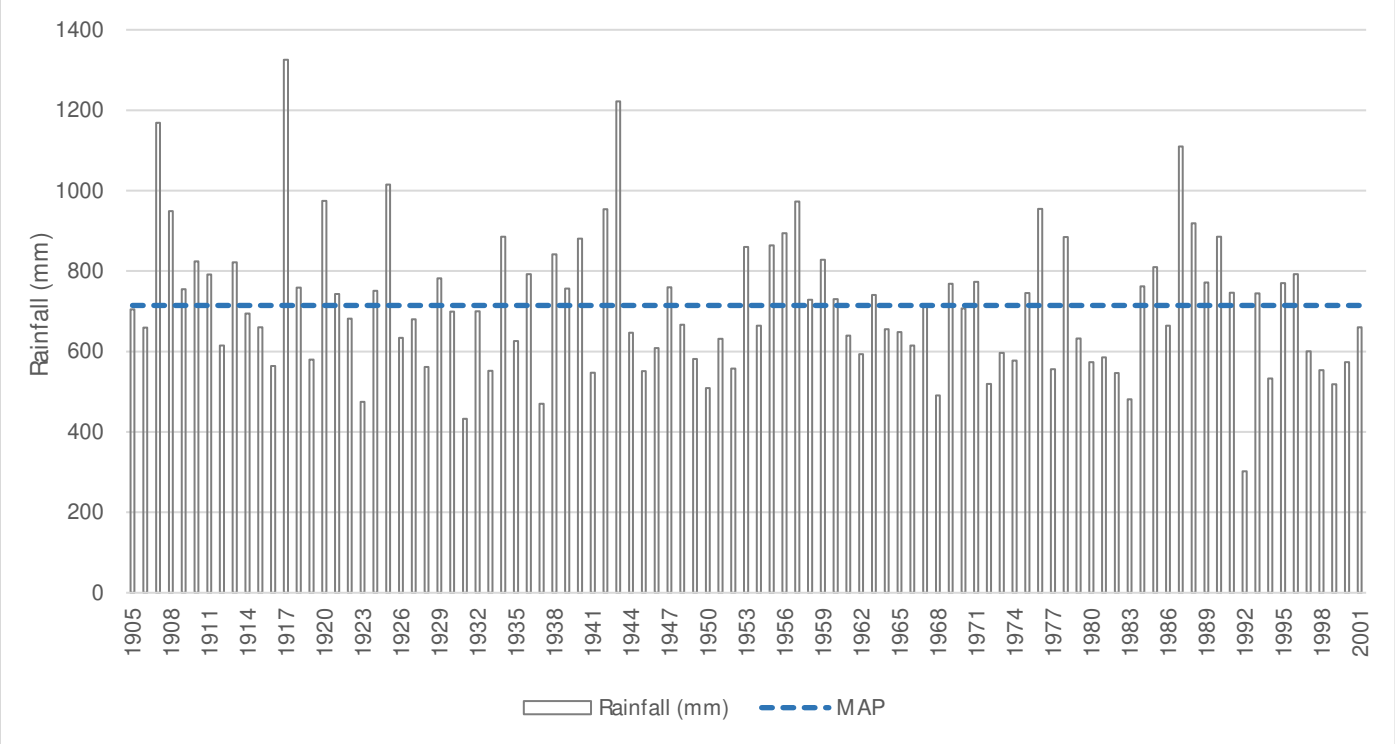


Figure 7 Long term synthesized annual rainfall values with the mean annual precipitation indicated in blue

5.2 Allowable Abstractions and Water Registration

Quaternary Catchment (QC) site: U20J (Mgeni). According to GN 538 (2016), the General Authorization (GA) limits for this QC are as follows–

- Abstraction of surface water: 2 000 m^3 / year @ 1 l/s throughout the year

- Storage of water: 2 000 m^3
- Groundwater abstraction: 275 m^3/ha/year (allowed under GA).

These limits show that this catchment area is somewhat water limited and restricted water use applies. 40 000 m^3 of groundwater could be abstracted from this site under a GA. This would be capped at 40 000 m^3 per year.

5.3 Catchment

The Camperdown area surveyed has soils derived from Natal Group Sandstone. These deposits give rise to abrasive, fine-grained, often shallow, sandy soils which are grey or bleached in colour.

Contour lines (1 meter) and the Alos Palsar 12.5 meter DEM were used to derive the surface terrain (Figure 4). The soils and geology were obtained from GIS layers obtained from eThekwini and national databases and site samples. The site is situated close to the catchment divide at the top of small un-named tributaries. The majority of runoff from the site would flow towards the north-eastern extent of the property. The site has a gentle slope with undulating terrain.

This site is dominated by Ngongoni veld (SVs 4, Mucina and Rutherford, 2006). This occurs within the sub-escarpment savanna biome. The desktop analysis revealed that the area is largely transformed, with the possibility for some flagged fauna and flora (e.g. red data species and endangered wildlife) being found from the C-plan, SEA and MINSET databases. However, this does not necessarily mean that rare or endangered species will occur in the area of interest. The following information was collected for the vegetation unit SVs 4 (Mucina & Rutherford, 2006; Scott-Shaw & Escott, 2011):

- Undulating plains and hilly landscape mainly associated with drier coast hinterland valleys in the rain-shadow of the rain-bearing frontal weather systems from the east coast.
- Sour sparse wiry grassland dominated by unpalatable Ngongoni grass (*Aristida junciformis*) with this mono-dominance associated with low species diversity.
- In good condition dominated by *Themeda triandra* and *Tristachya leucothrix*.
- Wooded areas are found in valleys at lower altitudes, where this vegetation unit grades into KwaZulu-Natal Hinterland Thornveld and Bisho Thornveld.
- Termitaria support bush clumps with *Acacia* species, *Cussonia spicata*, *Ehretia rigida*, *Grewia occidentalis* and *Coddia rudis*.

Large patches of alien invaders were noted as well as subsistence farming, surrounded by industry and infrastructure.

Table 12 Existing land cover area for the contributing catchment area

Land Cover	Pre-development Area (ha)	Pre-development Percentage	Post-development Area (ha)	Post-development Percentage
Proposed Industrial Area (CRDC)	0.00	0.00	353.27	11.45
Grassland & Woodland	1828.50	59.27	1561.83	50.62
Existing Agriculture	59.21	1.92	59.21	1.92
Existing Industry	269.74	8.74	268.41	8.70
Existing Mixed Use	8.13	0.26	8.13	0.26
Existing Residential	29.77	0.97	29.77	0.97
Existing Rural	357.68	11.59	357.68	11.59
Existing Social and Civic	6.96	0.23	6.96	0.23
Open Space / Conservation	147.46	4.78	147.36	4.78
Proposed Agriculture	0.02	0.00	0.02	0.00
Proposed Industry	326.12	10.57	254.98	8.26
Proposed Landfill	35.26	1.14	21.23	0.69
Proposed Mixed Use	1.18	0.04	1.18	0.04
Proposed Railway	0.00	0.00	0.00	0.00
Proposed Residential	14.53	0.47	14.53	0.47
Proposed Road	0.00	0.00	0.00	0.00
Proposed Social and Civic	0.53	0.02	0.53	0.02
Total	**3085.09**	**100**	**3085.09**	**100**

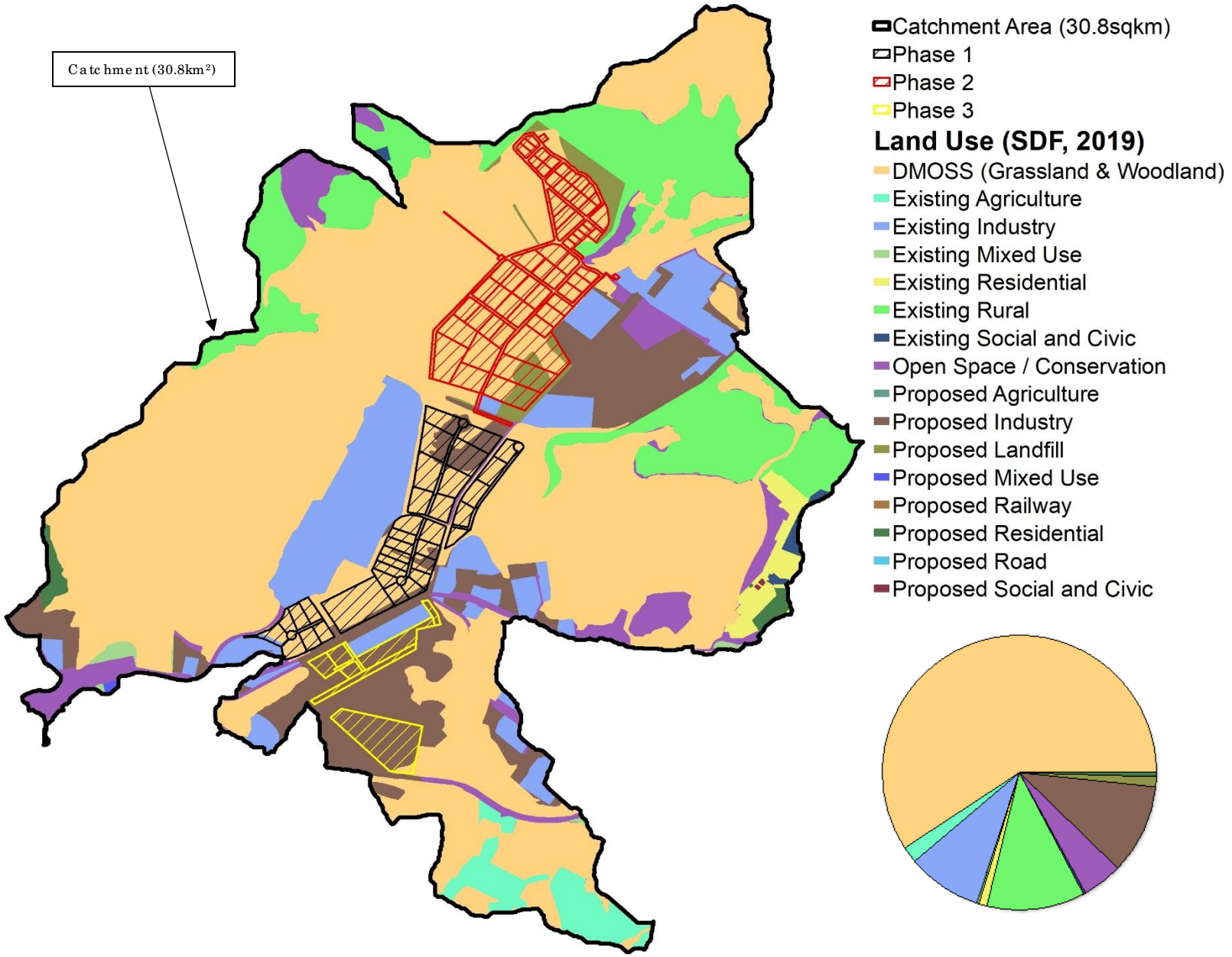


Figure 8 Existing and proposed land use for the catchment area of CRDC

5.4 Input from the Storm Water Management Plan (Kantey & Templer, 2020)

The Storm Water Management Plan compiled by K&T(2020) with the objective to propose methods (structural controls) for managing runoff flows to prevent detrimental impacts on receiving waters, considering both quality and quantity of stormwater runoff. A series of stormwater channels, headwall, gabion and reno mattress structures have been designed and strategically located to direct flow into attenuation ponds (Figure 9).

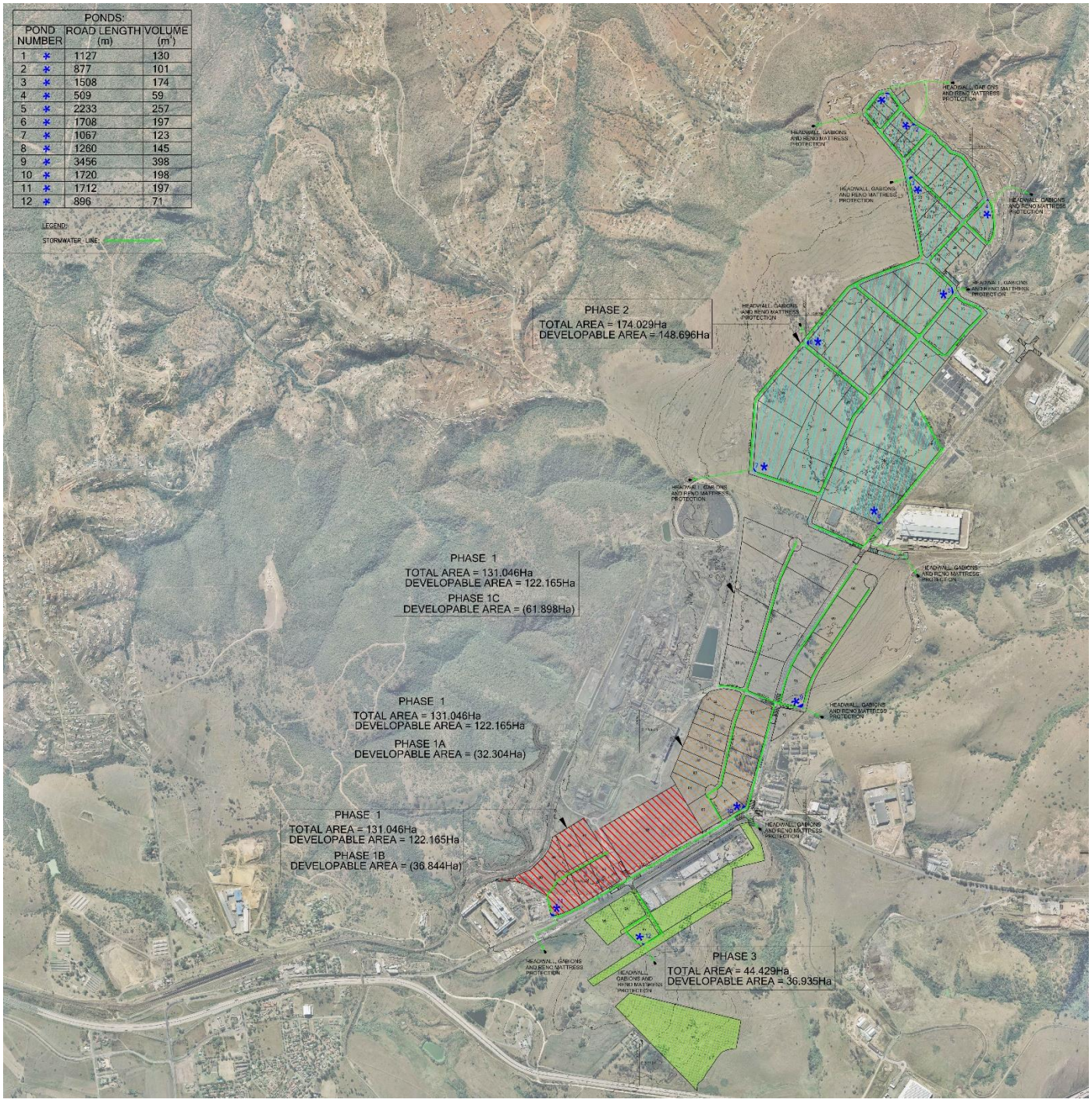


Figure 9 Proposed stormwater intervention measures for the CRDC

5.5 Input from the Flood Assessment (Aurecon, 2019)

The 1:50 and 1:100 year flood extent was derived using the Rational Method and compared with the Alternative Rational Method. Future conditions, assuming the new development comprises 50% of the area. An additional 15% for increase was included to account for climate change circumstances. These findings

were then used to determine other relevant input parameters required to complete the flood line model in HEC-RAS.

The results showed the development is outside of flood areas and thus the risk of flooding on the development is minimal.

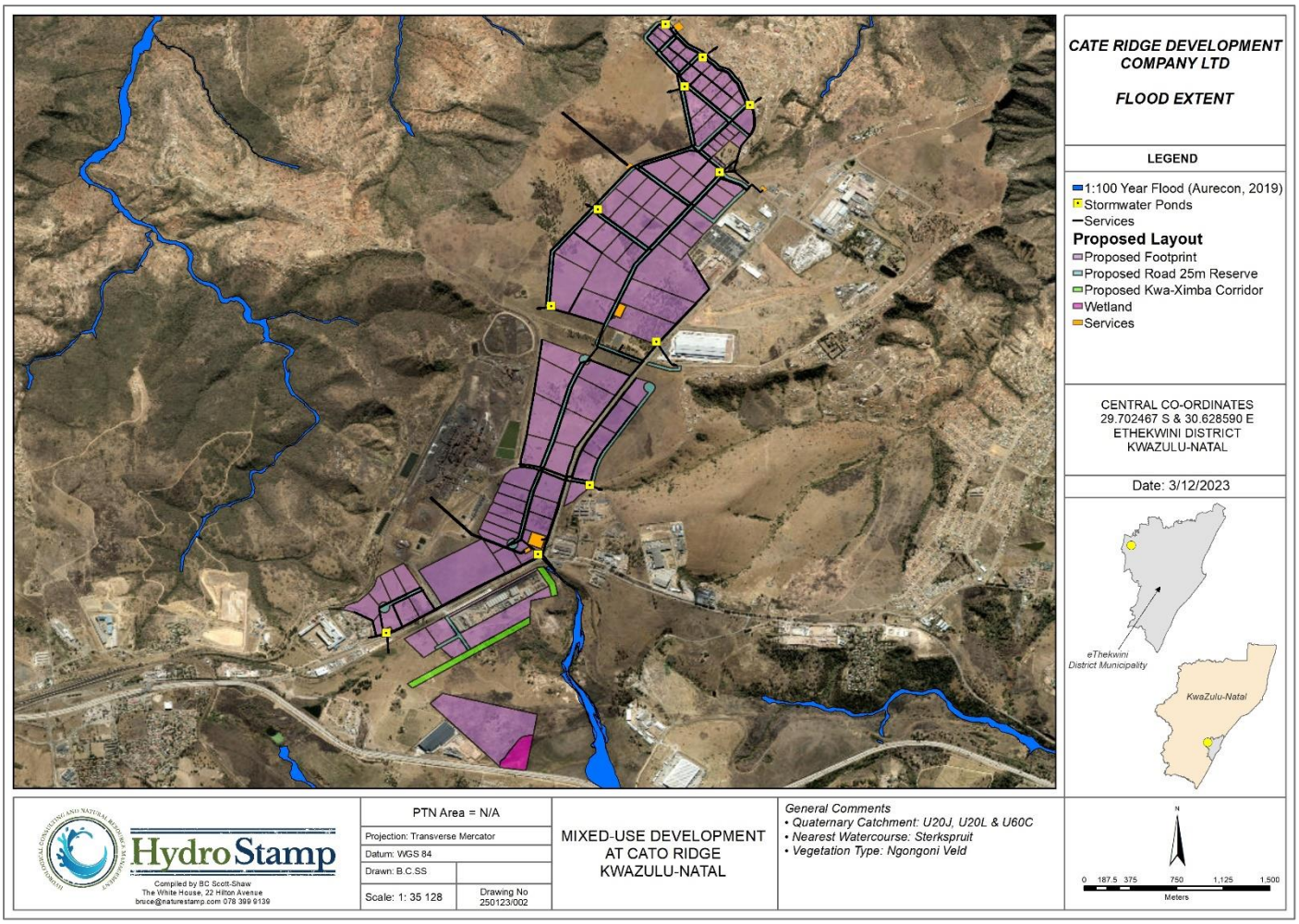


Figure 10 1:100 year flood extent derived for the CRDC

5.6 Input from the Watercourse/Aquatic Assessment

The watercourse assessment was undertaken. The following summarised key impacts were identified.

Phase 1: Construction Phase

- Direct physical loss or modification of wetland and/ or aquatic habitat associated with the onsite watercourses
- Alteration of hydrological and geomorphological processes (erosion and sediment)
- Impacts to water quality
- Impacts to ecological connectivity and/or ecological disturbance impacts

Phase 1: Operational Phase

- Alteration of hydrological and geomorphological processes (erosion and sediment)
- Impacts to water quality
- Impacts to ecological connectivity and/or ecological disturbance impacts

Phase 2 Construction Phase

- Direct physical loss or modification of wetland and/ or aquatic habitat associated with the onsite watercourses
- Alteration of hydrological and geomorphological processes (erosion and sediment)
- Alteration of hydrological and geomorphological processes (erosion and sediment)
- Impacts to water quality
- Direct physical loss or modification of wetland and/ or aquatic habitat associated with the onsite watercourses

Various mitigation measures were proposed. Those relevant to the hydrological impact were included in the impact assessment.

5.7 Impact on Upstream and Downstream Users

An investigation of the upstream and downstream users was undertaken for the overall system. Cognisance of proposed developments was also considered, even those that would not be directly impacted upon but could if transfers were implemented. The site is located on the catchment divide of three quaternary catchments (U20J, U20L and U60C). As such, there are **no upstream users**. The proposed stormwater discharge points are directed towards the Sterkspruit to the south (tributary of the Umlazi river) and of the Mshwathi system to the north east (tributary of the Umngeni). This system has a significant amount of users. No abstractions were identified close to the site. The following abstractions and dams are registered downstream of these two systems:

Dams:

- Reg No. 21192120 – Inanda Dam – 241 700 000m³ – QC U20L- Mgeni – Dept of Water Affairs
- Reg No. 21071475 – Shongweni Dam – 3 700 000m³ – QC U60C - Mlazi – Umgeni Water
- Reg No. 21171768 – Kavchell Dam – 25 000m³ – QC U60C - Sterkspruit – Berriman DE
- Reg No. 21155786 – Uitkomst & Doornrug Dam – 190 000m³ – QC U60C – Sterkspruit trib – Albert Goswell
- Reg No. 21170000 – Uitkomst & Doornrug Dam 1 – 2 500m³ – QC U60C – Sterkspruit trib – Trigoni
- Reg No. 21170000 – Uitkomst & Doornrug Dam 2 – 2 000m³ – QC U60C – Sterkspruit trib – Trigoni
- Reg No. 21171802 –Doornrug Dam 1 – 600m³ – QC U60C – Sterkspruit trib – Guthrie S
- Reg No. 21179421 – NPC Dam 1 – 5 000m³ – QC U60A – Sterkspruit – Sterkspruit Aggregates
- Reg No. 21179421 – NPC Dam 2 – 8 000m³ – QC U60C – Sterkspruit – Sterkspruit Aggregates

Abstractions:

- Reg No. 21184870/1 – Borehole – 2 000m³ – Sterkspruit Catchment
- Reg No. 21179421/1 – Borehole – 2 000m³ – Sterkspruit Catchment
- Reg No. 21179421/2 – Borehole – 2 000m³ – Sterkspruit Catchment
- Reg No. 21179421/3 – Borehole – 2 000m³ – Sterkspruit Catchment

Given the catchment analysis, it is clear that this system is somewhat stressed and the highest priority water users are the potable users, the community and the environment. The water use would not change as it would be connected to municipal infrastructure. The quantity of the **net discharge of water on the system is the same as the pre-development state**. However, there is an increased risk of increased storm water discharge affecting the downstream environments (sediment discharge and contaminants). This must be managed through stormwater management.

6. HYDROLOGICAL/ SURFACE WATER IMPACT ASSESSMENT

Within and around the CRDC footprint, the existing impacts on surface water and respective catchment areas include -

- The clearance of natural habitat for settlements and associated roads;
- Hardened surfaces resulting in a reduction in infiltration;

- Point source pollution from settlements & industry;
- Concentrated flow paths from drain outlets/dongas along the roads;
- Historical modification of watercourse systems for agriculture and infrastructure construction; and
- Various servitudes.

In the broader catchment, similar impacts are present as noted for the site proposed CRDC project. Additional existing impacts on the groundwater resources and respective catchment areas include -

- Infrastructure development within wetland systems (wetland encroachment) or river banks – leading to a direct loss of wetland systems and decrease in groundwater recharge;
- Expansion of town areas resulting in an increased water demand and an increase in water pollution;
- Unregulated boreholes that may put strain on the limited groundwater resources;
- Litter and solid waste disposal – direct water pollution; and
- Poor or absent sanitation – direct water pollution.

6.1 Potential Impacts During Construction/Implementation

Impacts likely to occur during construction are described in Section 6.1.1 to 6.1.3. These impacts are further assessed in Table 13.

6.1.1 Increase in Sedimentation and Erosion

The construction activities associated with the roads, buildings, industries, servitudes and batching areas result in disturbances in the soils (earth moving equipment, spoil areas, excavation etc.) which lead to concentrated flow paths (erosion) and transport of sediments during rainfall events.

The **significance** of this impact is **minor negative** without mitigation and **minor negative** with mitigation.

The following **mitigation measures** are recommended:

- Manage storm water on site (the post development discharge should equal the pre-development discharge). This can be done through attenuation structures below significant impervious areas/disturbed areas, silt traps and water storage structures;
- Stop activities during and immediately after rainfall events until accumulated water has dissipated and soils have become stable;
- Identify and rectify erosion areas immediately should they occur;
- Preserve topsoil for use in rehabilitation during and after construction completion; and
- Revegetate disturbed areas during and after construction completion to the pre-development state.

Monitoring is important to ensure that the implemented mitigation measures are successful. The following monitoring is required:

- All impervious and disturbed surfaces to be monitored to ensure drainage is functional and sediments are not being transported off the site.
- Ensure all clean water is dissipated towards the natural flow area and all dirty water is directed towards a control structure.
- Ensure no sediments are allowed to enter the natural system.

6.1.2 Increase in Surface Runoff

The construction activities associated with the roads, buildings, industries, servitudes and batching areas result in compacted soil areas and loss of vegetation. As the construction phase progresses, the impervious surface area increases. This results in a reduction of infiltration and an increase in potential flood peaks and storm water discharge (alteration of flow pattern).

The **significance** of this impact is **moderate negative** without mitigation and **minor negative** with mitigation.

The following **mitigation measures** are recommended:

- Implement an adequate storm water management plan specific to the construction phase.

- Temporary silt traps should be installed around stockpiles or spoil areas. Constructed permanent areas should include attenuation structures that allow clean water to infiltrate.
- Stop activities during and immediately after rainfall events until accumulated water has dissipated and soils have become stable.

Monitoring is important to ensure that the implemented mitigation measures are successful. The following monitoring is required:

- Ensure compacted areas are rehabilitated and revegetated.
- Ensure all clean water is allowed to infiltrate where possible.
- Ensure permanent impervious areas have attenuation or flow dissipating structure.

The increased sedimentation/erosion and the increase in surface runoff are overlapping impacts. As such, their significance has been collectively assessed in terms of local hydrology (Table 14).

6.1.3 Potential Spills Contaminating Surface Water

Construction activities associated machinery/vehicles (spills), handling of fuels, cement mixing areas etc. lead to a decrease in water quality due to contamination of surface water. This could be at the time of the spill due to proximity to water resources or at a later period after a rainfall event. Additionally, spills may alter the movement of water through the soils (water repellent substances).

The **significance** of this impact is **moderate negative** without mitigation and **minor negative** with mitigation. This is largely due to the difficulty of managing spills should they not be prevented.

The following **mitigation measures** are recommended:

- Provide suitable ablution facilities for construction workers with waste removed from the site and disposed of at a suitable location;
- Prevent and manage spills;
- Manage and remove construction waste from the site before it accumulates to a hazardous level (potential point source pollution areas);
- Ensure a spill management plan is in place and appropriate spill management materials are available on site;
- Ensure drip trays are used under machinery/equipment and any storage of hazardous chemicals is on a bunded area; and
- Environmentally friendly alternatives to chemicals commonly used should be considered.

Monitoring is important to ensure that the implemented mitigation measures are successful. The following monitoring is required:

- The site should be continually checked to ensure vehicles and equipment are not leaking (prevention).
- Construction areas should be continually checked to identify spill areas. Should a spill be identified, the spill management procedure should be implemented.

6.2 Potential Impacts During Operation

The operational impacts are similar to the construction phase impacts. The key impacts include the increase in runoff (due to increased impervious areas) and a decrease in water quality (potential spills/contaminants from maintenance vehicles, infrastructure and equipment). The significance of the identified operation impacts has been classified in the form of impact table (Table 14) which addresses both water quality and quantity. Although a relatively low rainfall area, rainfall events exceeding 170 mm in a day have occurred here. As such, these events need to be accommodated to match the pre-development state and ensure the continued hydrological patterns.

6.2.1 Increase in Surface Runoff

The operation activities associated with the access roads, industries/businesses and treatment facilities result in impervious areas that were previously sparsely vegetated natural land. This results in a reduction of infiltration and an increase in potential flood peaks and storm water discharge (alteration of flow pattern).

The **significance** of this impact is **minor negative** without mitigation and **minor negative** with mitigation.

The following **mitigation measures** are recommended:

- Manage storm water on site (the post development discharge should equal the pre-development discharge). This can be done through permanent attenuation structures below significant impervious areas;
- Buildings must have gutters and downpipes that direct rain water into storage structures that release water or recycle water on the site;
- Storm water should allow for clean water to be released and allowed to infiltrate;
- Gutters and drains should be monitored to ensure blockages are not present and sediments/contaminants are not present;
- Revegetation must occur below the quarry and batching areas; and
- Strategic cut off drains must be placed along roads.

Monitoring is important to ensure that the implemented mitigation measures are successful. The following monitoring is required:

- Ensure storm water structures are clean and operational.
- Inspect and ensure that no erosion occurs near attenuation structures or cut off drains.
- Inspect success of revegetated areas.

6.2.2 Potential Spills Contaminating Surface Water

Operation activities include vehicles (spills), storage of chemicals and detergents which may lead to a decrease in water quality due to contamination of surface water. This could be at the time of the spill due to proximity to water resources or at a later period after a rainfall event. Additionally, spills may alter the movement of water through the soils (water repellent substances).

The **significance** of this impact is **moderate negative** without mitigation and **moderate negative** with mitigation. This is largely due the footprint of the site.

The following **mitigation measures** are recommended:

- Prevent and manage spills;
- Remove any waste from the site at a suitable disposal facility;
- Ensure a spill management plan is in place and appropriate spill management materials are available on site;
- Ensure cleaning materials do not get discharged into the soil;
- Ensure hazardous chemicals is on a bunded area (110 % of the storage volume); and
- Environmentally friendly alternatives to chemicals commonly used should be considered.

Monitoring is important to ensure that the implemented mitigation measures are successful. The following monitoring is required:

- The site should be intermittently checked to ensure service vehicles and storage areas are not leaking (prevention).
- Should a spill be identified, the spill management procedure should be implemented.
- An ECO should identify, record and report chemicals, spills and disposal of any chemicals on site.

Table 13 Pre- and post-mitigation impact significance for the proposed CRDC development

Activity	Potential Environmental Significance	Applicable Area of Influence	Significance Pre-Mitigation							Summary of Mitigation Measures	Significance Post-Mitigation						
			Intensity	Duration	Extent	Probability	Total	Status (Pos/Neg)	Significance		Intensity	Duration	Extent	Probability	Total	Status (Pos/Neg)	Significance
Phase 1, 2 & 3 Construction																	
Construction of roads, buildings and services	Alteration of hydrological and geomorphological processes (erosion and sediment)	Phase 1, 2 & 3-Construction site	4	5	3	5	12	Neg	-60	• Limit the duration of construction to reduce the risk of prolonged sedimentation and erosion impacts occurring. • Implement and adhere to buffer zones for wetlands and riparian areas, with planned development infrastructure to remain outside of the buffer zones. • Demarcate buffers on the ground to avoid incursions into these areas. • Address potential erosion and sedimentation risks on site through the implementation of Best Management Practices (BMPs) in erosion and sediment control. • Rehabilitate any erosion or vegetation clearing impacts as soon as practically possible and in accordance with a Rehabilitation & Management Plan. • Implement bi-monthly aquatic biomonitoring and water quality monitoring during construction and use findings to inform site management.	4	5	3	4	12	Neg	-48
Hardened/Impervious construction surfaces	Increase in Surface Runoff	Phase 1, 2 & 3-Construction site	5	6	4	5	15	Neg	-75	o Manage storm water on site (the post development discharge should equal the pre-development discharge). This can be done through attenuation structures below significant impervious areas/disturbed areas, silt traps and water storage structures; o Stop activities during and immediately after rainfall events until accumulated water has dissipated and soils have become stable; o Identify and rectify erosion areas immediately should they occur; o Preserve topsoil for use in rehabilitation during and after construction completion; and o Revegetate disturbed areas during and after construction completion to the pre-development state.	5	5	4	4	14	Neg	-56
Potential for Contamination from Machinery and Stored Petro-chemicals	Impacts to water quality	Phase 1, 2 & 3-Construction site	5	6	4	5	15	Neg	-75	• Address potential erosion and sedimentation risks on site through the implementation of Best Management Practices (BMPs) in erosion and sediment control. • Address potential spill and pollution risks on site through the implementation of Best Management Practices (BMPs) in spill and pollution control and hazardous substances management. • Rehabilitate any spill related impacts as soon as practically possible in accordance with an 'Aquatic Contingency Plan'. • Implement bi-monthly aquatic biomonitoring and water quality monitoring during construction and use findings to inform site management.	4	6	3	5	13	Neg	-65
Phase 1, 2 & 3 Operation																	
Operation of industries, roads and businesses	Alteration of hydrological and geomorphological processes (erosion and sediment)	Phase 1, 2 & 3-Operation	4	5	4	5	13	Neg	-65	• Implement best practice stormwater management design, including erosion protection at outfalls and allow for unimpeded base flows along watercourses. • Stormwater and energy dampening systems to be designed and implemented to decreases the risk of stream bank erosion. • Maintain storm water infrastructure as necessary. • Implement and adhere to 33m and 31m buffer zones for wetlands and riparian areas, respectively. • Wetland rehabilitation focused on re-establishing low energy diffuse flow along the system, rather than concentrated flow along the central drain, as it currently the situation. • Implement aquatic biomonitoring and water quality monitoring during operation and use findings to inform site management.	4	5	3	5	12	Neg	-60
Hardened/Impervious Surfaces (roofs, roads etc.)	Increase in Surface Runoff	Phase 1, 2 & 3-Operation	5	5	4	6	14	Neg	-84	• An adequate storm water management plan to be designed by an appropriate engineer. Here, the engineer should account for both natural run-off (that which can be released into the natural landscape with no detrimental effect) and excess artificial run-off generated by the proposed development structures. • Other structures that may be considered are semi-permeable surfaces that can absorb artificial run-off but releases a certain amount into the landscape. Energy dissipating structures can also be used.	5	5	4	5	14	Neg	-70

Operational Contamination from Industries, businesses, vehicles etc.	Water Quality: Increase in contaminated runoff from hardened surfaces	Phase 1, 2 & 3- Operation	6	5	4	5	15	Neg	-75	• Sewage Treatment Plant: implement best practice design and operation according to an approved management plan that accounts for expected biological and hydraulic loads, makes provision for system failures. • Develop a maintenance programme that includes regular inspections for wear and tear of mechanical and electrical plant components. • Develop a discharge water quality monitoring programme. • Wetland rehabilitation focused on re-establishing low energy diffuse flow along the system, rather than concentrated flow along the central drain, as it currently the situation. • Implement best practice stormwater management design, including erosion protection at outfalls and allow for unimpeded base flows along watercourses. • Maintain storm water infrastructure as necessary, • Implement and adhere to buffer zones for wetlands and riparian areas. • Implement bi-monthly aquatic biomonitoring and water quality monitoring in accordance with the 'Aquatic Monitoring Plan' during construction and use findings to inform site management. • Address potential erosion and sedimentation risks on site through the implementation of Best Management Practices (BMPs) in erosion and sediment control. • Address potential spill and pollution risks on site through the implementation of Best Management Practices (BMPs) in spill and pollution control and hazardous substances management. • Rehabilitate wetlands, riparian areas, and buffer zones and in accordance with a 'Wetland Rehabilitation & Management Plan'	5	5	4	5	14	Neg	-70
No Go Alternative																		
No development of the land		N/A	1	3	3	3	7	Neg	-21	• Impact accrued due to the development not proceeding. • The natural environment would subsequently not change under its current management. • Pre-existing impacts would continue with a slight projected increase in impacts due to surrounding settlements. • Due to financial constraints, landowners may not be able to secure the land leading to illegal excavation, grazing and littering.	1	4	3	4	8	Pos	32
Cumulative Impact																		
Combined Impact	Hydrological impact combined with nearby developments	Phase 1, 2 & 3- Operation	5	6	3	6	14	Neg	-84	• Accumulated stormwater increase due to the combined impervious nature requiring detailed SWMPs • Share construction access roads • Utilize the same spoil areas • Utilize water efficiently • Create 'green' areas	2	6	3	6	11	Neg	-66

6.3 Potential Cumulative Impacts

In relation to an activity, cumulative impact "means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may be significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities" (NEMA EIA Reg GN R982 of 2014). It is important to consider the bigger picture where numerous small impacts can lead to greater cumulative impacts.

There are quarries nearby that are to be used for the N3 upgrade. However, these quarries have been strategically located close to the N3 and will be closed once the N3 upgrade is completed. The nearby developments are listed in Table 14. Due to these nearby developments and the proposed large footprint of the CRDC, the combined cumulative impact on watercourses have a **moderate negative**.

The recommended mitigation measures are aligned with the identified construction and operation impacts. Key mitigation measures would be to minimize Stormwater runoff, share construction access roads, utilize the same spoil areas and utilize water efficiently.

Table 14 List of projects near the proposed CRDC development site

NEAS number	Provincial Ref. Number	Project title	Project Description	Status
KZN/EIA/0001602/2021	DM/0021/2021	Decommissioning of the facilities At Goswell Developments (Pty) Ltd located in Cato Ridge, eThekwini Metropolitan Municipality, KZN	Goswell Developments (Pty) Ltd are proposing to decommission its facility for the recycling of aluminium which was established at the Goswell Developments waste processing site in Cato Ridge within the eThekwini Metropolitan Municipality.	Authorised
KZN/EIA/0001545/2021	DM/0009/2021	Proposed levelling of 18.7ha of virgin land for Industrial purposes, located on portion 34 of Uitkomst and Doomrug no. 852, Cato Ridge, KwaZulu-Natal (Phase two)	Proposed levelling of 18.7ha of virgin land for Industrial purposes, located on portion 34 of Uitkomst and Doomrug no. 852, Cato Ridge, KwaZulu-Natal (Phase two)	Authorised
KZN/EIA/0001650/2021	DM/0030/2021	Basic Assessment Process for the proposed levelling of 16.7 of virgin land for industrial purposes, located on portion 34, portion 45, portion 46, portion 293 and portion 298 of Uitkomst and Doomrug No. 852, Cato Ridge, eThekwini Municipality, KZN	levelling of 16.7 of virgin land for industrial purposes, located on portion 34, portion 45, portion 46, portion 293 and portion 298 of Uitkomst and Doomrug No. 852, Cato Ridge. The realignment and relaxation of a portion of rem of portion 34 of Uitkomst and Doomrug No. 859	Current
N/A	DM/S24G/0001/2018	Cato Ridge crematorium	Portion 8 of 50, Cato Ridge, within the eThekwini Municipality	Finalized
N/A	DM/0067/2013	Construction of warehousing for Lougat Properties	The remainder of Portion 30 of Farm Uitkomst and Droonrug, No 862, located within the eThekwini Municipality	Finalized
N/A	N/A	N3 Upgrade & Quarries	Blasting of quarries in the area and expansion of the N3 to a 5 lane road	Current

6.4 No-Go Alternative

The No-Go Option, should the Cato Ridge Land Development and Release Project not proceed, would be that CRDC would not pursue any development of the land. The site will remain in the ownership of CRDC/ Assmang and the status quo will be retained for the site.

For purposes of comparative assessment in terms of the EIA, a likely worst-case scenario approach for the no-go option is considered and compared with the impact assessment for the worst-case scenario preferred development alternative for consistency. Extrapolating the existing land use practices under a no-go development option, it is reasonable to assume that incursions onto the property for illegal sand mining, waste dumping, grazing (including burning) and informal settlements would continue. This is already visible within some parts of the study area. The landowner would continue to manage the areas together with law enforcement to the extent reasonable. However, historical impacts and in the absence of additional income to facilitate an intensified management approach to the land, it would be reasonable to assume that these

impacts would continue and possibly escalate as the surrounding rural communities continue to expand and densify, creating increasing demand for land and resources.

6.5 Impacts associated with Climate Change Projections

The following potential impacts may arise as a result of climatic changes in the future, which would possibly affect the CRDC drainage areas and surrounding environment:

- Increase in extreme weather events such as powerful rain/thunderstorms, strong winds, intense heat waves, severe coldness and increased lightning strikes.
- This would likely cause flooding within the watercourses, which could damage the surrounding environment.
- The risk of contamination of watercourses would increase due to significantly greater volumes of runoff, which may lead to disease outbreaks and human health problems.
- Alien vegetation uses more water than indigenous vegetation, therefore reducing natural water supplies / choking natural watercourses. Alien plants have the ability to overpower indigenous vegetation and becoming overgrown within rivers and streams.

7. CONCLUSION

This report details the hydrological impact of the proposed Cato Ridge Development Company Ltd. A detailed desktop hydrological investigation was undertaken. Input from the wetland assessment, storm water management plan and flood assessment was used to guide the impact significance assessment.

The findings and recommendations are:

1. The nearby watercourses are in a modified condition due to significant historic alencroachment and woody invasion.
2. The proposed site is located outside of the 1:100 year flood event.
3. The significance of the impact of the proposed development on water quality is moderate during both the construction and operation phases.
4. The significance of the impact of the proposed development on surface runoff is moderate during both the construction and operation phases but can be considered to be minor if intervention/mitigation measures are adopted.
5. The significance of the impact of the proposed development on local hydrology is minor during both the construction and operation phases.
6. Strict adherence to best practice guidelines, spill management and erosion control must be throughout operation of the development.
7. Regular maintenance of culverts must be undertaken to ensure that the flood risk is not increased due to blockages by debris.
8. Stormwater interventions have been recommended based on calculated peak discharge.

Through this hydrological impact assessment, Nature Stamp (PTY) Ltd. Has determined that no fatal flaws exist from a hydrological perspective. This is largely due to the existing state of the site and its surrounding area, its position in the catchment, its projected state if not developed and the assumed proposed intervention measures. Should the recommended mitigation measures be effectively implemented and stormwater infrastructure maintained and managed, the specialist finds no grounds to withhold the environmental authorisation.

8. REFERENCES

1. Drainage Manual, The South African Roads Agency Limited (SANRAL), 6th edition, 2013
2. Drainage Manual, The South African Roads Agency Limited (SANRAL), 5th edition, 2006
3. Lynch, SD. 2003: Development of a Raster Database of Annual, Monthly and Daily Rainfall for Southern Africa, WRC Report No. 1156/1/03, Water Research Commision, Pretoria, RSA.
4. SCHULZE, RE. (2011) Atlas of Climate Change and the South African Agricultural Sector: A 2010 Perspective. Department of Agriculture, Forestry and Fisheries, Pretoria, RSA. pp 387.
5. SCHULZE, RE. (2012) Climate Change and the South African Water Sector: Where from? Where now? Where to in future? University of KwaZulu-Natal, Pietermaritzburg Campus, South Africa.

ANNEXURE A Design Rainfall

Design Rainfall in South Africa: Ver 3 (July 2012)

User selection has the following criteria:
Coordinates: Latitude: 29 degrees 42 minutes; Longitude: 30 degreess 30 minutes
Durations requested: 30 m, 24 h, 1 d
Return Periods requested: 2 yr, 5 yr, 10 yr, 20 yr, 50 yr, 100 yr, 200 yr
Block Size requested: 0 minutes

Data extracted from Daily Rainfall Estimate Database File
The six closest stations are listed

Station Name	SAWS Number	Distance (km)	Record (Years)	Latitude (°)	Latitude (')	Longitude (°)	Longitude (')	MAP (mm)	Altitude (m)	Duration (m/h/d)	Return Period (years) 2	2L	2U	5	5L	5U	10	10L	10U	20	20L	20U	50	50L	50U	100	100L	100U	200	200L	200U
UMLAAS ROAD	0240014_W	4.0	46	29	44	30	31	753	790	1 d	49.4	48.7	49.9	72.0	71.1	72.4	90.9	89.1	92.5	112.6	108.6	116.6	147.3	139.5	157.4	179.0	168.0	196.7	216.5	200.5	244.7
COSMOORE, CATO RIDGE	0239855_A	5.7	33	29	45	30	29	769	777	1 d	60.2	59.3	60.7	87.6	86.6	88.2	110.6	108.5	112.7	137.1	132.2	142.0	179.3	169.9	191.7	217.9	204.6	239.5	263.6	244.2	298.0
CAMPERDOWN	0240073_W	5.7	85	29	43	30	33	714	600	1 d	54.3	53.5	54.8	79.1	78.1	79.6	99.8	97.9	101.6	123.7	119.3	128.1	161.7	153.3	172.9	196.5	184.5	216.0	237.8	220.2	268.8
MEYER IFJ CAMPERDOWN	0240077_P	10.5	36	29	47	30	33	738	598	1 d	49.2	48.4	49.6	71.6	70.8	72.1	90.4	88.7	92.0	112.0	108.0	116.0	146.5	138.8	156.6	178.0	167.2	195.7	215.4	199.5	243.5
UKULINGA AGR RES STA	0239700_A	11.4	33	29	40	30	24	714	866	1 d	54.1	53.3	54.6	78.8	77.8	79.3	99.4	97.5	101.2	123.2	118.8	127.6	161.1	152.7	172.3	195.8	183.8	215.2	236.9	219.4	267.8
KILLARNEY ISLES	0240078_W	12.1	49	29	48	30	33	648	614	1 d	47.8	47.1	48.2	69.6	68.7	70.0	87.8	86.2	89.4	108.9	105.0	112.7	142.3	134.9	152.2	173.0	162.4	190.1	209.3	193.8	236.6

Gridded values of all points within the specified block

Latitude (°)	Latitude (')	Longitude (°)	Longitude (')	MAP (mm)	Altitude (m)	Duration (m/h/d)	Return Period (years) 2	2L	2U	5	5L	5U	10	10L	10U	20	20L	20U	50	50L	50U	100	100L	100U	200	200L	200U
29	42	30	30	764	762	30 m	22.7	16.9	28.6	33.1	24.7	41.5	41.8	31.0	53.0	51.8	37.7	66.8	67.8	48.5	90.1	82.4	58.4	112.6	99.7	69.7	140.1
						24 h	62.7	52.5	72.8	91.3	76.7	105.7	115.3	96.1	135.0	142.8	117.1	170.1	186.8	150.5	229.7	227.0	181.2	286.9	274.7	216.2	357.0
						1 d	53.2	44.5	61.7	77.5	65.0	89.6	97.8	81.5	114.5	121.2	99.3	144.3	158.4	127.6	194.8	192.6	153.7	243.4	233.0	183.4	302.8

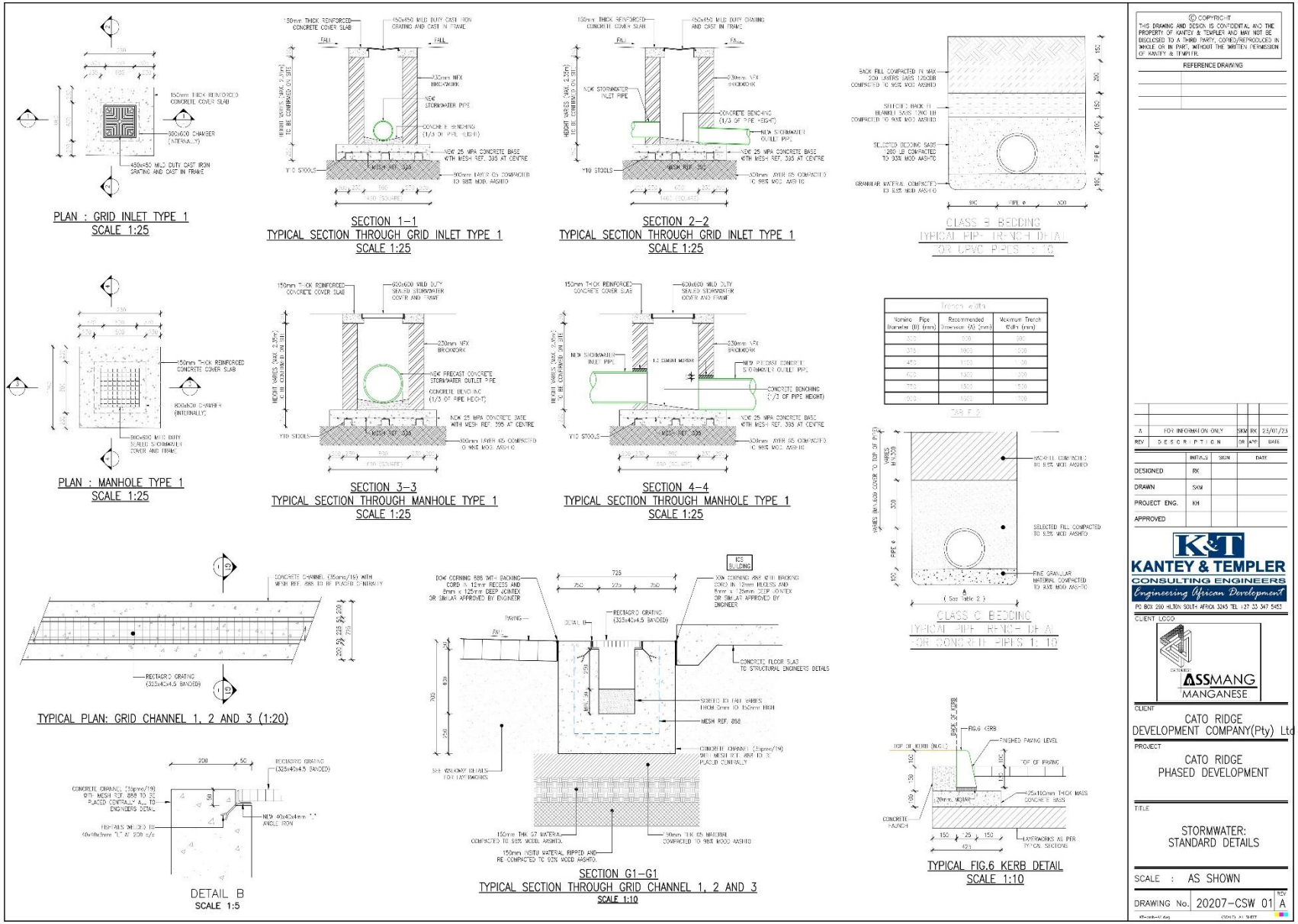
ANNEXURE B **Storm Water Mitigation Measures (Kantey & Templer)**

Item	Recommendations
Grading of the site	To avoid the formation of preferential stormwater flow paths and associated point source erosion/ scouring the entire site must be graded/ sloped to encourage shallow diffuse sheet flow towards stormwater collection and conveyance systems.
	All stormwater management infrastructure/ systems including collection, detention, attenuation, conveyance and outlet structures must be located outside of delineated watercourses and their respective buffer zones with some allowance for outlet protection/ armouring within buffers where this is not practically feasible.
Source controls & Rainwater harvesting	Stormwater should be harvested onsite from roofed surfaces thus reducing the quantity (volume) of water received by downstream water resources as surface flow. This water is to be used onsite for non-potable applications or made available to landowners / communities for irrigation or other non-potable uses.
	The use of hardened surfaces on the property will be kept to a minimum as far as possible to encourage infiltration and reduce runoff capacity. Car parks for example could be gravel or another semi-permeable material (permeable paving, porous bricks/blocks) rather than impermeable asphalt or concrete.
Local controls and stormwater conveyance	Use a combination of open, grass-lined channels/swales and stone-filled infiltration ditches rather than simply relying on underground piped systems or concrete V-drains. This will encourage infiltration across the site, provide for the filtration and removal of pollutants and provide for some degree of flow attenuation by reducing the energy and velocity of storm water flows through increased roughness when compared with pipes and concrete V-drains
	For parking lots and driveways - garden beds (landscaped areas) and stormwater conveyance channels, the use of concave open-lined swales or bio-retention areas should be used to receive and convey stormwater. For these areas no curbs or spaced curbs are recommended so water can move freely from hardened surfaces into the swales or bio-retention areas.
	Equally, if flower/plant beds are to be established adjacent to paved surfaces, then these should be designed to receive stormwater from hardened surfaces and should be planted with robust indigenous species that contribute to stormwater management objectives.
	Road runoff will need to be managed through use of grassed swales or grassed drainage trenches running parallel along the road on the downslope side of the access road. Grassed swales/drainage ditches/trenches will intercept runoff and promote stormwater infiltration thus reducing surface runoff volumes and velocities downslope. Alternatively, numerous mitre drains can be constructed to dissipate water in small quantities and low velocities.
	Bio-retention methods do not only address flow volume and velocity issues but are an effective means of removing suspended solids, heavy metals, hydrocarbons, organic compounds, and dissolved nutrients from stormwater. Images 1 and 2, below, provide a visual example of the type of bio-retention swales being recommended[7].
Stormwater outlets	Stormwater discharge outlets are to be used to ensure that the erosive energy of surface run-off is dissipated, and sediment suspended in the run-off is trapped before entering aquatic ecosystems. With regards to these outlets, the following environmentally responsible storm water discharge/outlet design considerations should be considered:
	A series of smaller stormwater outlets is recommended over a few large outlets. The stormwater outlets must be constructed at regular intervals to spread out surface flow and avoid flow concentration.
	All outlets must be designed to dissipate the energy of outgoing flows to reduce point source scouring and erosion risks. In this regard, adequately sized concrete stilling basins/sumps must be installed at all outlets and flow from these stilling basins must fall onto suitably designed gabion reno-mattresses with wing walls. The reno-mattresses must extend an appropriate distance downslope to ensure that erosion risks are minimised.

	Appropriate armouring (e.g. reno-mattresses or rock packs) downstream/downslope of discharge points is essential to avoid scouring and sedimentation. This applies to discharge points in terrestrial and aquatic ecosystems and is of importance due to the sandy erodible nature of the soils in the study area.
	The outlet reno-mattresses must be established to reflect the natural slope of the surface it is constructed on and are to be located at the natural ground-level.
	The outlets and associated outlet protection structures should be aligned parallel to contours wherever possible to reduce the gradient of outflows and remain outside of wetland, river and their buffers.
Stormwater attenuation structures	Stormwater attenuation structures should be designed to allow for the maintenance of base flow.
	The outlets of stormwater attenuation structures should be associated with appropriate erosion protection measures.
	A series of small outlets from attenuation structures is preferred to a single large outlet.
Inlet protection	Measures to capture solid waste and debris entrained in stormwater entering the stormwater management system (inlet protection devices) will be incorporated into the design of the system and could include the use of either curb inlet/inlet drain grates and/or debris baskets/bags.
Management of 'dirty water'	The recycling/reuse of dirty water is promoted; alternatively, this water will need to be directed into the sewer system.
Internal Road Design Recommendations	
A. Road Stormwater Management Recommendations	Key design considerations for the management of stormwater and erosion linked with road development have been included below:
	Measures must be implemented to distribute storm water as evenly as possible to avoid point sources of discharge directly into watercourses.
	The location and design of road drainage and discharge points shall be done in a manner that minimises peak discharge to downstream aquatic resources by considering the following:
	Decreasing volume of water reaching wetlands as surface flow by encouraging infiltration; and
	Decreasing velocity of flows entering aquatic resources (either through structural or vegetative means).
	To reduce the volume and velocity of stormwater runoff received by watercourses, road runoff should be removed from roads via road drainage infrastructure constructed at regular intervals at the approach to watercourse crossings to avoid point source scouring at the outlets.
	Wherever possible, all outlets must be located outside of the delineated watercourses (wetlands/river).
	When designing stormwater outlets, many small outlet discharges must be favoured over a few large outlets to reduce outlet flow volumes and velocities.
	All outlets must have adequately designed erosion protection and energy dissipation measures (e.g., Reno-mattresses, stone-pitching) suitable to reduce anticipated discharge velocities to levels that do not pose an erosion risk.
	Armouring (e.g., reno-mattresses with vetiver bands) must be installed below all storm water outlets prior to flows entering downstream watercourses.
	Wherever possible, vegetated swales/side drains should be specified rather than concrete lined drainage channels (e.g., concrete V-drains). Vegetated swales/side drains should be well-vegetated with appropriate species and stabilized by means of gabion or concrete cut-off walls to prevent erosion and vertical incision. Similarly, outlets should not be piped outlets but open vegetated channels or vegetated mitre drains.
	Water should be discharged at regular intervals along road segments on the approach to watercourses so that the volume and velocity of flows reaching final discharge point into a watercourse is reduced as far as possible.
	Appropriate outlet structures and energy dissipator blocks are to be specified at all discharge points to break the energy of the storm water.
	Where possible, construct attenuation features (e.g. stilling basins) at the discharge points of the side drains to control the flows entering the water courses.
	No pipelines or manholes should be established within 50m of a watercourse.

Wastewater Reticulation Pipeline Design Recommendations	To reduce the risk of surcharging sewer manholes onsite and downstream, a form of gully trap should be installed at or before the connection of the various components of the development with the main line. This gully trap will block foreign objects from entering the main internal line of the site and isolate blockage problems at the source.
1. Wastewater Package Plant Design Recommendations	The main risk associated with the proposed WWTP is the malfunction and / or failure of the treatment process. The success of the treatment process is largely influenced by its design which needs to make adequately accounts for expected biological and hydraulic loads. The following basic recommendation should be adhered to ensure adequate design and operation of the plant:
	The plant must be designed to the appropriate specifications to treat the type of wastewater being delivered (domestic, industrial, etc.).
	The plant should be designed to include emergency sewage storage and process pump infrastructure in case of system failure.
	The plant must be designed to consistently achieve General Limit Values (GLVs) as defined in Section 3.6 of Government Notice No. 339 (2004).
	The effluent discharge point should include suitable erosion protection measures. This could be gabions or a stilling basin, etc.
2. Sewer Pump Station Design Recommendations	All sewer infrastructure, including pump station and sewer pipelines, must be designed according to best-practice environmental principles and requirements.
	No sewer pump stations are to be located within the delineated watercourses (wetlands and rivers) and must be located outside of the recommended aquatic buffer zone.
	Pump stations must be fenced off to prevent unauthorized access by humans/wildlife which could cause damage to infrastructure and cause accidental malfunction and/or spillage of untreated wastewater.
	Reasonable measures must be taken to provide back-up for mechanical, electrical, operational or process failure and malfunction at pump stations. At a minimum there should be an alarm system to warn of an electrical failure and sufficient standby equipment to provide for reasonable assurance that the pump station can be functional within 24 hours.
	The pump station must be placed within a lined, impermeable concrete bunded area with the capacity to hold untreated wastewater in an emergency and provide for sufficient time for maintenance staff to address any faults/ problems. This is to limit the risk of untreated wastewater overflowing in the event of any leakage or accidental spillage at the pump station(s).
	Signage should be provided at a visible location at pump stations to inform local residents in the area of the purpose of the pump station. Emergency telephone contact details should also be provided on the signs so that pump station failure, leakage or electrical power outages affecting the system can be easily reported.

ANNEXURE C **Storm Water Infrastructure proposed for the CRDC site (Kantey & Templer)**



REFERENCE DRAWING

REV	DESCRIPTION	DR	APP	DATE
A	FOR INFORMATION ONLY	SKM	RK	22/07/23

	INITIALS	SIGN	DATE
DESIGNED	RK		
DRAWN	SKM		
PROJECT ENG.	KH		
APPROVED			

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CLIENT LOGO

ASSMANG MANGANESE

CLIENT
CATO RIDGE DEVELOPMENT COMPANY(Pty) Ltd

PROJECT
CATO RIDGE PHASED DEVELOPMENT

TITLE
STORMWATER: STANDARD DETAILS

SCALE : AS SHOWN

DRAWING No. 20207–CSW 01 REV A

KWAZULU-NATAL PROVINCE
ECONOMIC DEVELOPMENT, TOURISM AND ENVIRONMENTAL AFFAIRS
REPUBLIC OF SOUTH AFRICA

	(For official use only)
Provincial Reference Number:	
NEAS Reference Number:	KZN / EIA /
Waste Management Licence Number (if applicable):	
Date Received by Department:	

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

Submitted in terms of section 24(2) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) or for a waste management licence in terms of section 20(b) of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008).

KINDLY NOTE:

1. This form is current as of **May 2021**. It is the responsibility of the Applicant / Environmental Assessment Practitioner ("EAP") to ascertain whether subsequent versions of the form have been released by the Department.

PROJECT TITLE

Hydrological Impact Assessment for a proposed Mixed-Use Development in Gib Ridge, eThekwini Metropolitan, KZN.

DISTRICT MUNICIPALITY

eThekwini

1. SPECIALIST INFORMATION

Specialist name:	Naturestamp (PTY) Ltd		
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Professional affiliation(s) (if any)	International Water Association		

Project Consultant / EAP: Zutari

EAPASA Registered EAP number:			
Contact person:			
Postal address:			
Postal code:		Cell:	
Telephone:		Fax:	
E-mail:			

2. DECLARATION BY THE SPECIALIST

I, Bruce Scott-Shaw are that --

General declaration:

- I act as the independent specialist in this application;
- do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I am aware that a person is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading information. A person who is convicted of an offence in terms of sub-regulation 48(1) (a)-(e) is liable to the penalties as contemplated in section 49B(1) of the National Environmental Management Act, 1998 (Act 107 of 1998).

Signature of the specialist:

Nature Stamp (PTY) Ltd

Name of company:

29/04/2023

Date: