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Hydrology Assessment for the Proposed Mokolo River Bridge Crossing

Report

Version – Final 2

08 December 2021

EcoLeges

GCS Project Number: 21-1007

Client Reference: Mokolo River Crossing

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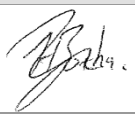
Author(Principal Hydrogeologist)	Hendrik Botha (Msc, PriSciNat)		08 December 2021

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EXECUTIVE SUMMARY

GCS Water and Environment (Pty) Ltd (GCS) was appointed by EcoLeges to undertake a hydrological assessment for the proposed Mokolo River bridge, on the Kaingo Game Reserve, situated on the eastern bank of the Mokolo River, near Mokolo Dam, Limpopo Province. The project falls within quaternary catchment A42F of the Limpopo Water Management Area (WMA) (DWS, 2016).

Kaingo Game Reserve has recently acquired a neighbouring property on the opposite bank of the Mokolo River, called Mokolo River Private Nature Reserve. Access to the neighbouring property is required by the Management Authority to fulfil its conservation mandate during the day-to-day operations or management of both Nature Reserves. There is currently one existing dirt and gravel crossing that is only accessible during the dry winter months of the year. For the remainder of the year, access to the neighbouring property would entail an extended round trip that requires any driver to exit Kaingo Game Reserve and then enter the Mokolo River Private Nature Reserve. The proposal, therefore, is to develop a second low water crossing/bridge further downstream that will ensure year-round connectivity between both properties. The proposed activities (crossings) will negate the unnecessary and wasteful expenditure of time and money to access the neighbouring property by exiting Kaingo Game Reserve. The position of the Low-level bridge crossing is on the farm Laurel 159 in the Waterberg.

The hydrology assessment found that the project area has a mean annual precipitation (MAP) in the order of 530 mm/yr, and mean annual evaporation (MAE) > 1700 mm/yr. The estimated runoff volume for quaternary catchment A42F is in the order of 28.23 Mm^3/yr.

The site falls within a sub-catchment associated with the Mokolo River, and spans over several quaternary catchments (namely A42A, A42B, A42C, A42D, A42E and partially A42F). The Mokolo River has its origin in the headwaters of A42A, and composes the combined inflow of the Sandspruit, Grootspruit, Sand, Klein-Sand, Dwars, Sondagsloop, Sterkstroom and Taaibokspruit Rivers. The water quality of the Mokolo River is considered good and constituents analysed (except for dissolved iron) fall well within the DWAF (1996) target values for domestic water use.

The proposed crossing is situated in the 1:50 and 1:100 year flood lines. PG Consulting Engineers (2021) has designed the bridge to allow unobstructed flow in the Mokolo River, as well as to withstand 1:20 year flooding events.

The source-pathway-receptor (SPR) model (DWAF, 2008) was used to evaluate potential pollution sources and primary receptors within the study area (which is the Mokolo River and the subsequent soils around the bridge). The risk assessment for construction phase is negligible (refer to Section 5). This is largely due to the project type, activity proposed and the limited receivers in the project area. Furthermore, the river crossing bridge is designed to allow for adequate flow throughout the year, and will not impede river flow.

Several recommendations and mitigation measures have been made, and are available in Section 7. Moreover, a surface water monitoring plan was developed and can be viewed in Section 6, to monitor the impact on the Moklo River and surrounding soils associated with the river crossing.

DECLARATION OF INDEPENDENCE

GCS (Pty) Ltd was appointed to conduct this specialist surface water study and to act as the independent hydrological specialist. GCS objectively performed the work, even if this results in views and findings that are not favourable. GCS has the expertise in conducting the specialist investigation and does not have a conflict of interest in the undertaking of this study. This report presents the findings of the investigations which include the activities set out in the scope of work.

CONTENTS PAGE

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF ACRONYMS

Acronym	Description
ADD	Average Daily Demand
BA	Basic Assessment
BOD	Biological oxygen demand
COD	Chemical oxygen demand
CM	Concentrated Molasses
CSWMP	Conceptual stormwater management plan
DEM	Digital Elevation Model
DWS	Department of Water and Sanitation
GCS	GCS Water and Environment (Pty) Ltd.
GN704	General Notice 704
ha	Hectare
HRU	Hydrological Response Unit
IWULA	Integrated Water Use Licence Application
m³	Cubic Metres
MAE	Mean annual evaporation
MAR	Mean Annual Runoff
MIPI	Midgley and Pitman
NEMA	National Environmental Management Agency
n-Value	Manning's Roughness Coefficients
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PCD	Pollution Control Dam
PFD	Process flow diagram
SDF	Standard design flood
SW	Surface Water
TDS	Total dissolved solids
TIN	Triangulated Irregular Network
WMA	Water Management Area
WR2012	Water Resources of South Africa 2012

1 INTRODUCTION

GCS Water and Environment (Pty) Ltd (GCS) was appointed by EcoLeges to undertake a hydrological assessment for the proposed Mokolo River bridge, on the Kaingo Game Reserve, situated on the eastern bank of the Mokolo River, near Mokolo Dam, Limpopo Province (refer to Figure 1-1). The project falls within quaternary catchment A42F of the Limpopo Water Management Area (WMA) (DWS, 2016).

1.1 Project background

Kaingo Game Reserve has recently acquired a neighbouring property on the opposite bank of the Mokolo River, called Mokolo River Private Nature Reserve. Access to the neighbouring property is required by the Management Authority to fulfil its conservation mandate during the day-to-day operations or management of both Nature Reserves. There is currently one existing dirt and gravel crossing that is only accessible during the dry winter months of the year. For the remainder of the year, access to the neighbouring property would entail an extended round trip that requires any driver to exit Kaingo Game Reserve and then enter the Mokolo River Private Nature Reserve. The proposal, therefore, is to develop a second low water crossing/bridge further downstream that will ensure year-round connectivity between both properties. The proposed activities (crossings) will negate the unnecessary and wasteful expenditure of time and money to access the neighbouring property by exiting Kaingo Game Reserve. The position of the Low-level bridge crossing is on the farm Laurel 159 in the Waterberg (refer to Figure 1-1).

The hydrological assessment is required to supplement the BA for the proposed development of the river crossing, as well as to determine the hydrological risk associated with the proposed activities. The hydrology report will supplement the BA and WUL.

1.2 The objective of this report

The objectives of this study, were as follows:

- Undertake a site walkover assessment to identify natural and manmade drainage lines and establish baseline surface water quality.
- Evaluate the site hydrological setting (i.e. climate, rainfall, drainage, etc.) and flood line data.
- Undertake a hydrological risk assessment and compile mitigation measures; and
- Compile a surface water monitoring plan to monitor the impact on the receiving environment.

1.3 Scope of Work

The scope of work completed, were as follows:

1. **Site walk over assessment:**
    a. A walk over assessment for the prosed development site was undertaken, to verify vegetation, topography, and general site conditions.
    b. Surface water samples were collected to establish pre-development/baseline water quality objectives.
2. **Baseline Hydrology Review:**
    a. Hydro-meteorological data collection and analysis.
    b. Catchment delineation and drainage characteristics.
    c. Determination of catchment hydraulic and geometric parameters.
    d. Review of flood lines delineated by (PG Consulting Engineers, 2021).
3. **Risk assessment:**
    a. A hydrological risk assessment was undertaken, to contextualize the potential surface water risk of the project.
4. **Surface Water Monitoring Plan:**
    a. A surface water monitoring plan was developed.
5. **Reporting**
    a. This compliance statement report and recommended further works were drafted.

1.4 Study relevance to the season in which it was undertaken

This study was undertaken as a once-off study and relies on historical hydrological and climate data for the site, as well as recognised hydrological and water resource databases for South Africa. Data generated during the time of this study is not seasonally bound as average yearly data was applied where required and as scientifically acceptable.

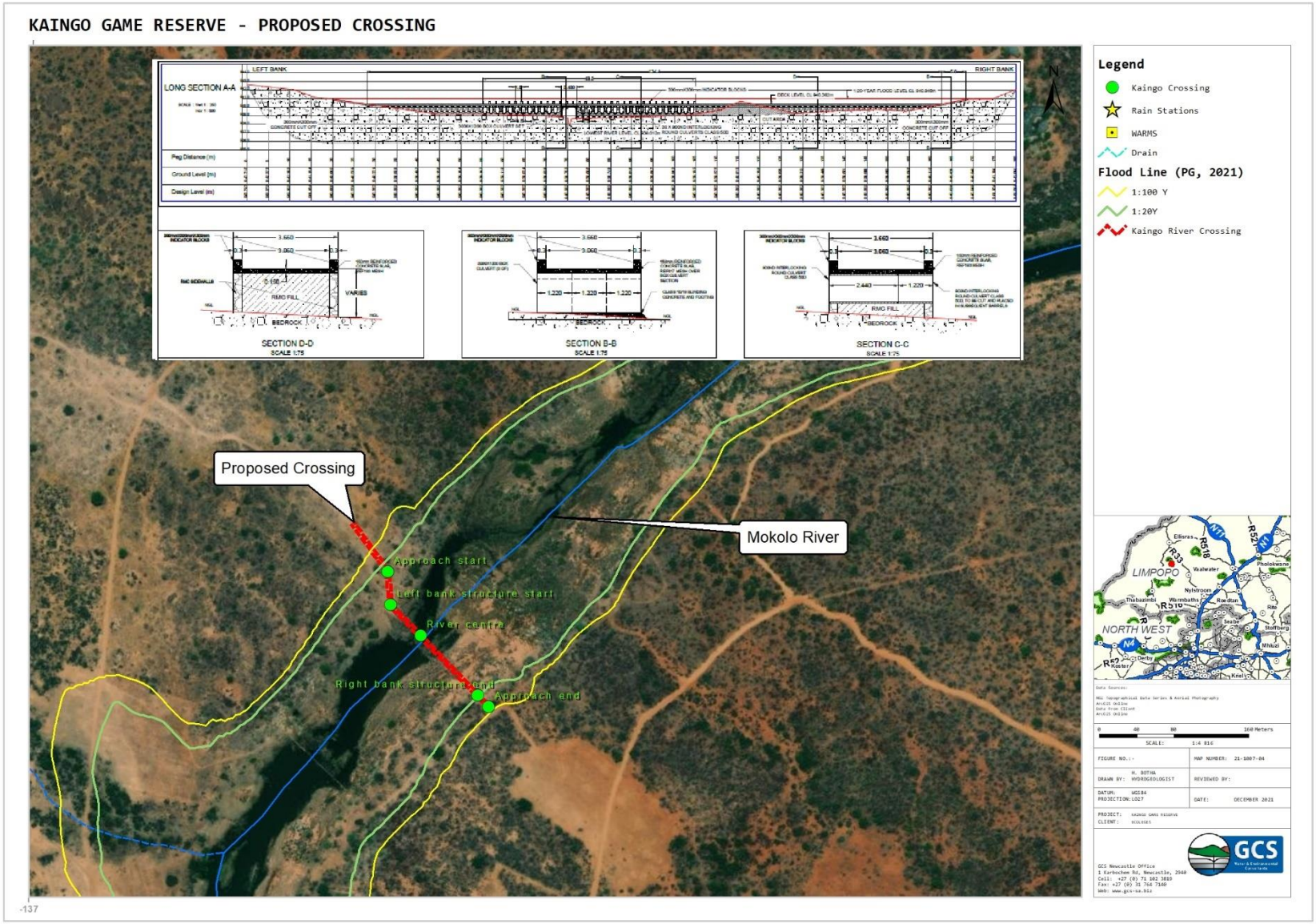


Figure 1-1: Proposed crossing

2 METHODOLOGY

The methodological approach for the study is described in the sub-sections below.

2.1 Legal considerations

The National Water Act, (Act 36 of 1998) (NWA) governs the use of water and protection of water resources in South Africa. There are two sets of regulations on water use thus far:

- Government Notice No. 704, 4 June 1999, National Water Act, 1998 (No. 36 of 1998): Regulations on the use of water for mining and related activities aimed at the protection of water resources (GN704).
- Government Notice No. 1352, 12 November 1999, National Water Act, 1998 (No. 36 of 1998): Regulations requiring that water use be registered.

In terms of Section 144 of the National Water Act of 1998 (Act 36 of 1998), a flood line, representing the highest elevation that would probably be reached during a storm with a return interval of 100 years, must be indicated on all plans for the establishment of townships. The term, "establishment of townships" includes the subdivision of stands or farm portions in existing townships/development, if the 100-year flood lines are not already indicated on these plans, or when the land-use category of a particular portion of land is changed.

The National Environmental Management Act (Act 107 of 1998) (NEMA) stipulates that all relevant factors be considered for proposed developments to ensure that water pollution and environmental degradation is avoided. Section 2 of the Act establishes a set of principles that apply to the activities of all organs of the state that may significantly affect the environment. These include the following:

- Development must be sustainable
- Pollution must be avoided or minimized and remedied
- Waste must be avoided or minimized, reused or recycled
- Negative impacts must be minimized.

The requirements laid down by the National Building Regulations and Building Standards Act (Act 103 of 1977) in terms of development within the 1:50-year flood line area are based only on safety considerations without proper consideration and understanding of the underlying natural streamflow processes. The Town Planning and Townships Ordinance (Ordinance 15 of 1986) also makes provision in Regulation 44(3) for the extension of flood line areas up to 32 m from the centre of a stream in instances where the 1:50-year flood line is less than 62 m wide in total (CSIR, 2005).

The above-mentioned regulations and guidelines were used to guide the hydrological assessment.

2.2 Hydrological assessment

Hydrometeorological data for the study area were obtained from various sources including the South African Water Resources Study WR2012 database (Bailey & Pitman, 2015), South African Atlas of Agrohydrology, and Climatology (Schulze, 1997), and the Daily Rainfall Data Extraction Utility (Lynch, 2004). Moreover, sources such as the Köppen Climate Classification (Kottek, et al., 2006), World Climate Data CMIP6 V2.1 (Eyring, 2016), and Meteoblue (Meteoblue, 2021) were used to refine hydrological data. These sources provided means of determining the Mean Annual Precipitation (MAP), Mean Annual Runoff (MAR), and Mean Annual Evaporation (MAE) of the study site.

2.2.1 Catchment description and delineation

A 30 m Digital Terrain Model (DTM) data from the Advanced Land Observing Satellite (ALOS) (JAXA, 2021) was used to delineate the area draining to the streams relevant to this study, sub-catchment flow path as well as to derive river geometry characteristics. These characteristics (area, slopes, and hydraulic parameters) are used to parameterize a sub-catchment. 2019 South African (SA) National Land Cover data (DEA, 2019) was used to characterize the sub-catchment vegetation and derive manning roughness (n-values) coefficients.

2.3 *Hydrological risk assessment*

As per GNR 982 of the EIA Regulations (2014), the significance of potential hydrological impacts was assessed to inform the hydrological risk assessment. The risk assessment methodology is available in **Appendix B**.

2.4 Surface water monitoring plan

The monitoring network is based on the principles of a monitoring network design as described by the DWAF Best Practice Guidelines: G3 Monitoring (DWAF, 2007). The methodological approach which the monitoring plan follows is represented in Figure 2-1, below.

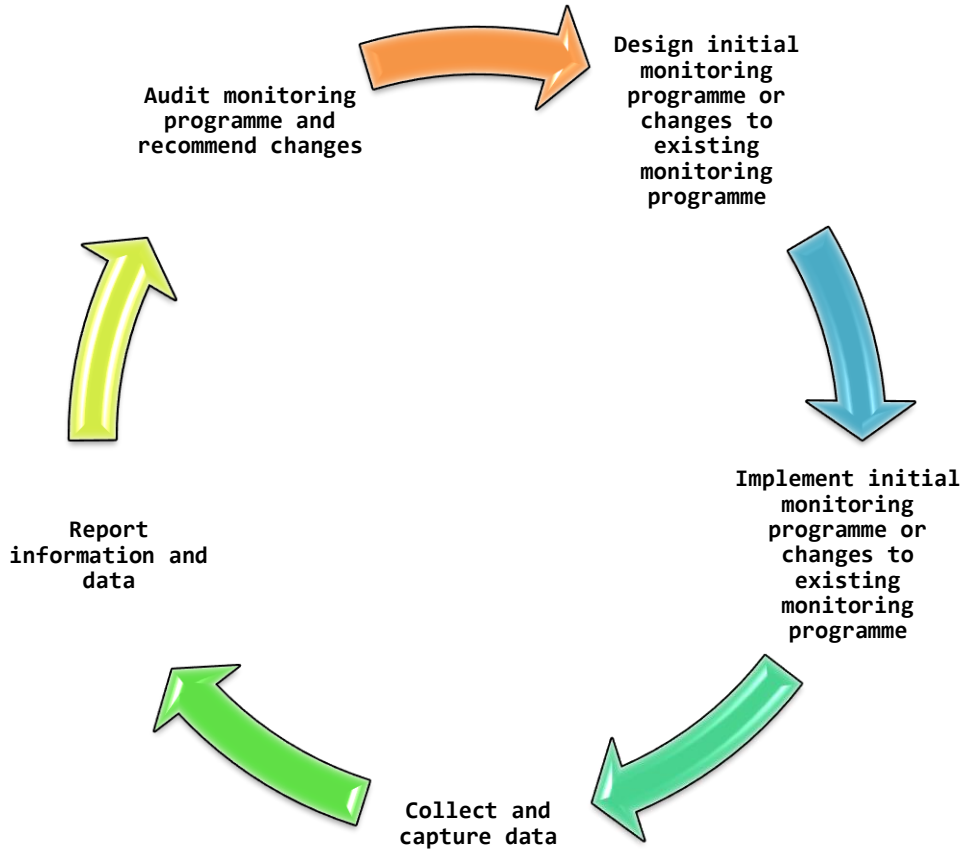


Figure 2-1: Monitoring Process

A surface water monitoring program that presents water quality constituencies to be analysed, the frequency of sampling, and the locality of sampling points were drafted. This plan focuses on monitoring during the construction phase. Baseline water quality samples were obtained during the site walkover assessment.

3 SITE OVERVIEW AND HYDROLOGY

As mentioned previously, the project falls within the lower reaches of quaternary catchment A42F of the Limpopo Water Management Area (WMA) (DWS, 2016). Elevations on the site typically range from 959 to 1040 metres above mean sea level (mamsl).

3.1 Sub-catchments / hydrological response units (HRUs)

The site falls within a sub-catchment associated with the Mokolo River, and spans over several quaternary catchments (namely A42A, A42B, A42C, A42D, A42E and partially A42F). The Mokolo River has its origin in the headwaters of A42A, and composes the combined inflow of the Sandspruit, Grootspruit, Sand, Klein-Sand, Dwars, Sondagsloop, Sterkstroom and Taaibokspruit Rivers.

Surface water drainage from the position of the proposed crossing, is towards the northeast, via the Mokolo River (this is the proposed river which the bridge will cross), and the bank drainage is primarily towards the Mokolo River.

3.2 Land cover and slope

The sub-catchment that describes flow towards the approximate position of the river crossing, predominantly consist of thick bush & plantation land cover types, light bush & farmlands, grasslands and bare/no vegetation (commercial) land types (DEA, 2019) – refer to Figure 3-6 and Table 3-1. The slope rise (%) for each HRU was determined using an ALOS 30mDTM and can be seen in Figure 3-7. The average % slope rise for the sub-catchment associated with the Mokolo River is 0.22%.

Table 3-1: Summary of land cover types

Sub-Catchment		HRU1
Area (km²)		3820.880
Longest Drainage Line (km)		18.48
Average Slope (%)		0.22%
Land Cover	Thick bush & plantation	60%
	Light bush & farm-lands	21%
	Grasslands	17%
	No Vegetation	2%

3.3 Climate

Climate, amongst other factors, influences soil-water processes and stormwater peak flows. The most influential climatic parameter is rainfall. Rainfall intensity, duration, evaporative demand, and runoff were considered in this study to indicate rainfall partitioning within the project area.

3.3.1 Temperature

The yearly temperature (refer to Figure 3-1) for the project area ranges from 23 to 37 C (high) and 4 to 20 °C (Low). The study area is situated in a Warm Temperate, Winter Dry, Hot Summer climate (Cwa), as per the Köppen Climate Classification (Kottek, et al., 2006). Hence, the area received summer rainfall.

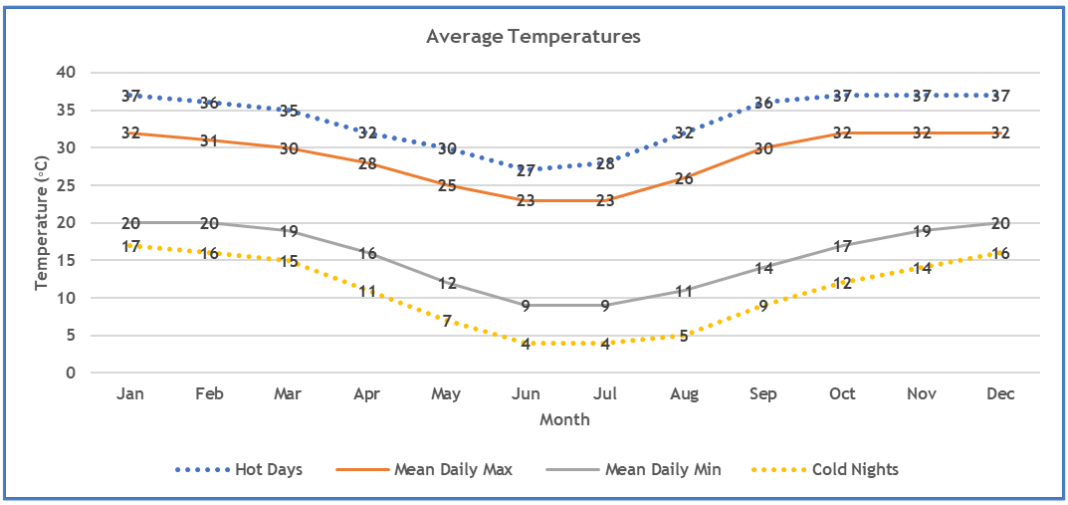


Figure 3-1: Average yearly temperatures (Meteoblue, 2021)

3.3.2 Wind speed and direction

Figure 3-2 shows the wind rose for the project area (the site used as a reference site) and presents the number of hours per year the wind blows from the indicated direction. Wind generally blows from N, NE, NNE, ENE at velocities from <5 to >28 km/h. Precipitation intensity during wind will likely cause intensity changes on slopes perpendicular to the wind direction, throughout the year.

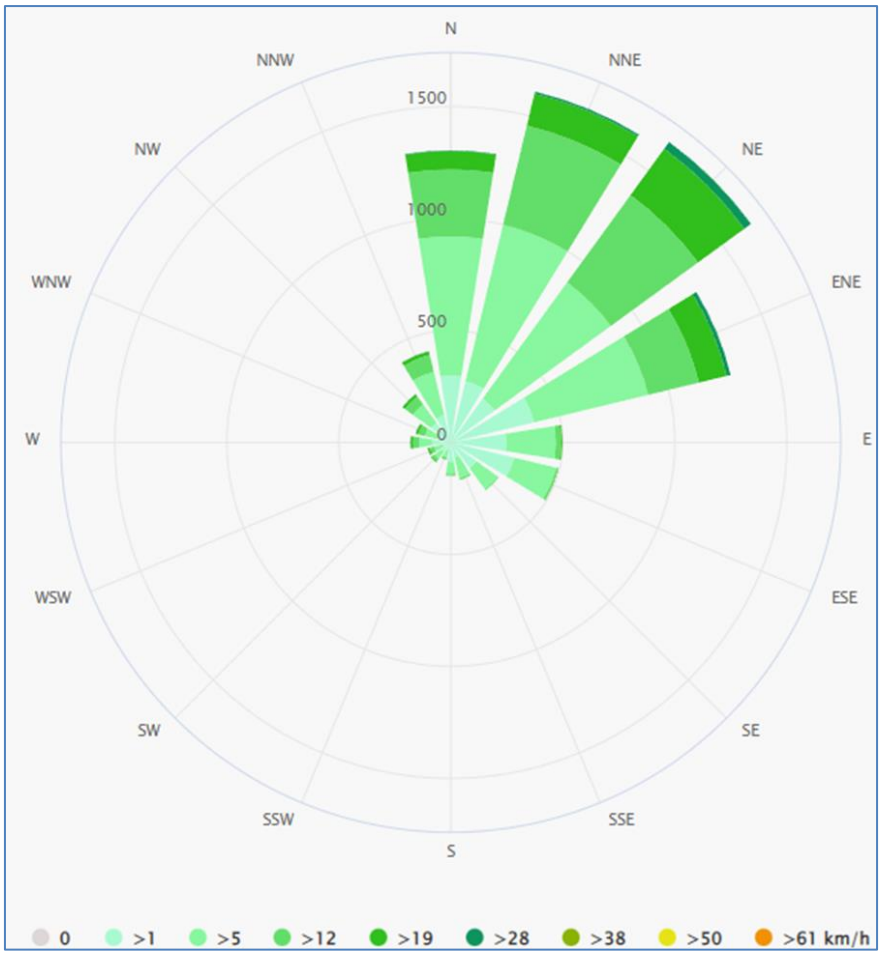
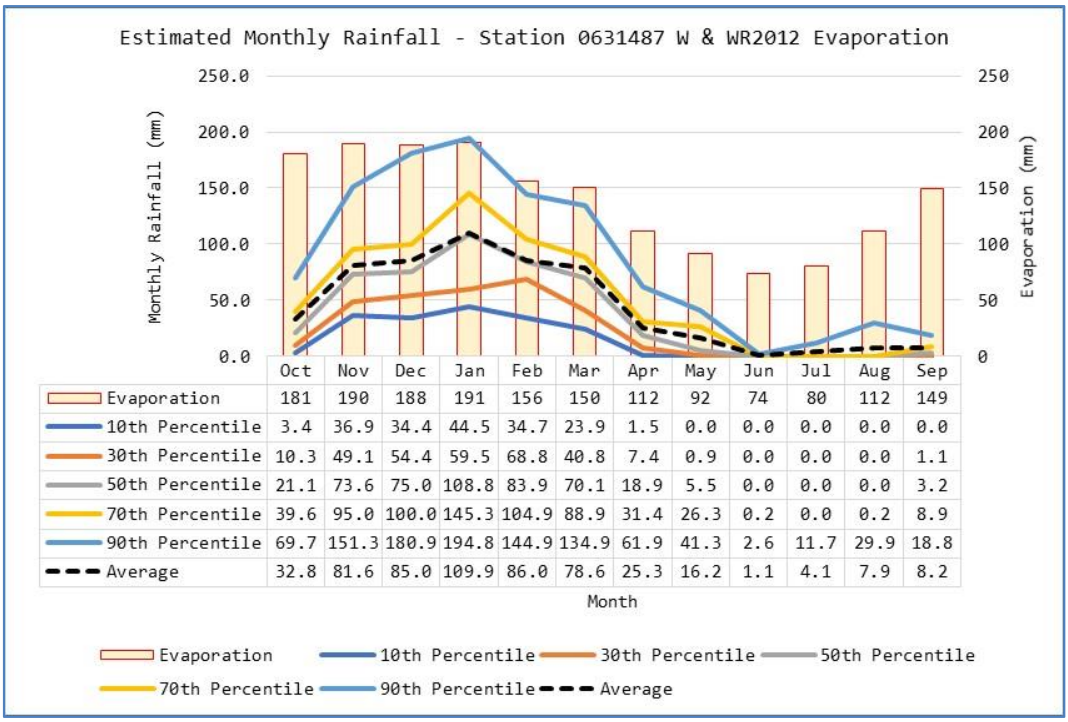


Figure 3-2: Wind rose (Meteoblue, 2021)

3.3.3 Rainfall and evaporation

The project area is situated in rainfall zone A4D. The rainfall data used to calculate Mean Annual Precipitation (MAP) was obtained from rainfall station 0631487 (situated 2.3km south of the site). Available rainfall data suggest a MAP ranging from 292 (30th percentile) to 1042 (90th percentile) mm/yr, based on a historical record of 22 years (i.e., 1915 to 1936). The average rainfall is in the order of 536 mm/yr. Monthly rainfall for the site is likely to be distributed as shown in Figure 3-3, below.

The site falls within evaporation zone 1D, of which Mean Annual Evaporation (MAE) ranges from 1 700 to 1 800 mm/yr. The MAE far exceeds the MAP for the site, which implies greater evaporative losses when compared to incident rainfall. Monthly evapotranspiration for the site is likely to be distributed as shown in Figure 3-3, below.

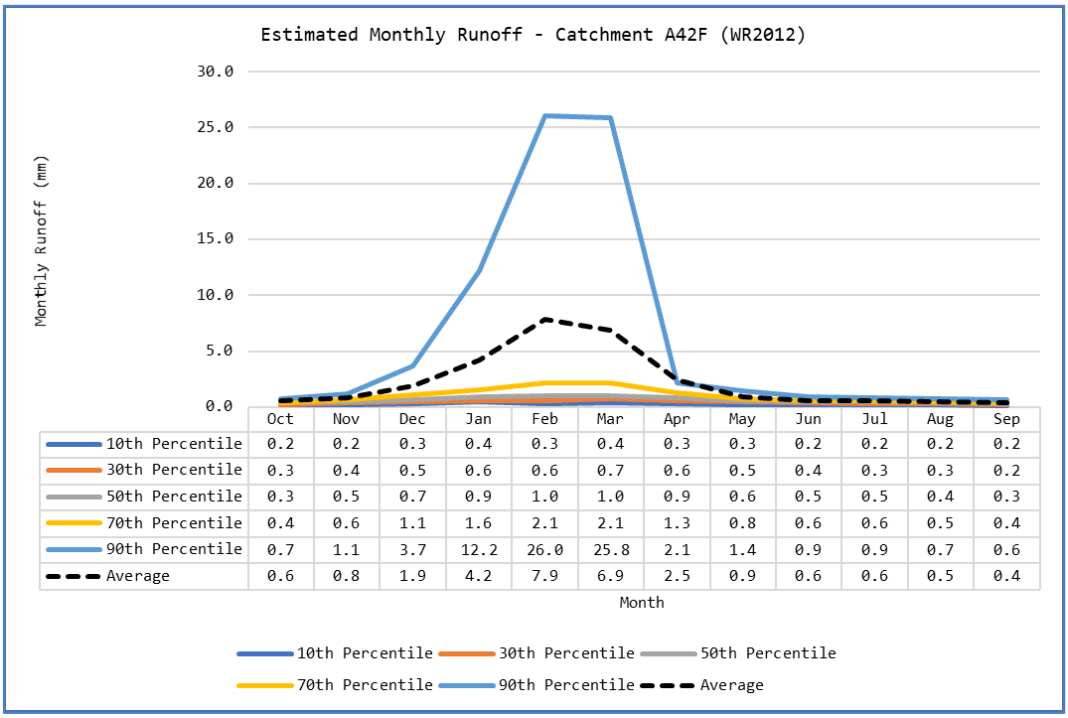


	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Evaporation	181	190	188	191	156	150	112	92	74	80	112	149
10th Percentile	3.4	36.9	34.4	44.5	34.7	23.9	1.5	0.0	0.0	0.0	0.0	0.0
30th Percentile	10.3	49.1	54.4	59.5	68.8	40.8	7.4	0.9	0.0	0.0	0.0	1.1
50th Percentile	21.1	73.6	75.0	108.8	83.9	70.1	18.9	5.5	0.0	0.0	0.0	3.2
70th Percentile	39.6	95.0	100.0	145.3	104.9	88.9	31.4	26.3	0.2	0.0	0.2	8.9
90th Percentile	69.7	151.3	180.9	194.8	144.9	134.9	61.9	41.3	2.6	11.7	29.9	18.8
Average	32.8	81.6	85.0	109.9	86.0	78.6	25.3	16.2	1.1	4.1	7.9	8.2

Figure 3-3: Rainfall distribution (station 0631487) (WRC, 2015)

3.3.4 Runoff

Runoff from natural (unmodified) catchments in Catchment A42F is simulated in WR2012 as being equivalent to 27 mm/yr over the surface area (WRC, 2015). This is equal to approximately 5% of the MAP and amounts to approximately 28.2 Mm^3/yr over the surface of the quaternary catchment. Monthly runoff is distributed as shown in Figure 3-4, below.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
10th Percentile	0.2	0.2	0.3	0.4	0.3	0.4	0.3	0.3	0.2	0.2	0.2	0.2
30th Percentile	0.3	0.4	0.5	0.6	0.6	0.7	0.6	0.5	0.4	0.3	0.3	0.2
50th Percentile	0.3	0.5	0.7	0.9	1.0	1.0	0.9	0.6	0.5	0.5	0.4	0.3
70th Percentile	0.4	0.6	1.1	1.6	2.1	2.1	1.3	0.8	0.6	0.6	0.5	0.4
90th Percentile	0.7	1.1	3.7	12.2	26.0	25.8	2.1	1.4	0.9	0.9	0.7	0.6
Average	0.6	0.8	1.9	4.2	7.9	6.9	2.5	0.9	0.6	0.6	0.5	0.4

Figure 3-4: Simulated runoff for quaternary catchment A42F (WRC, 2015)

3.4 Mokolo River peak flows and flooding

There is a DWS river weir directly upstream of the proposed crossing (ID: A4H005) that has a historical flow record of 59 years (from 1963 to 2021) – refer to Figure 3-5. PG Consulting Engineers (2021) estimated the Mokolo River 1:20, 1:50 and 1:100 year flood peaks, and the flood peak flows are listed in Table 3-2. The 1:50 and 1:100 year flood lines as modelled by PG Consulting Engineers (2021) are shown in the map insert in Figure 3-6.

The proposed activity falls within a flood line, and reference is made to the conceptual design report for particulars about the bridge designs (PG Consulting Engineers, 2021). Impacts in terms of runoff and impeding flow as a result of the development of the river crossing is anticipated to only take place during the construction phase of the bridge and is predicted to be marginal. The bridge is designed based on a 1:20 year flood level.

Table 3-2: Estimated flood peaks for the Mokolo River (PG Consulting Engineers, 2021)

Flood levels derived (masl)			
	Flood recurrence intervals		
	Q_{20}	Q_{50}	Q_{100}
Flood peak applied (m³/s)	680	*1 000*	1 300
At recommended crossing (with low-level crossing constructed)	940.946	*941.433*	941.643
At alternative crossing investigated (upstream)	947.853	*948.478*	948.747

Figure 3-5: Mokolo River DWS Weir (A4H005) (DWS, 2021)

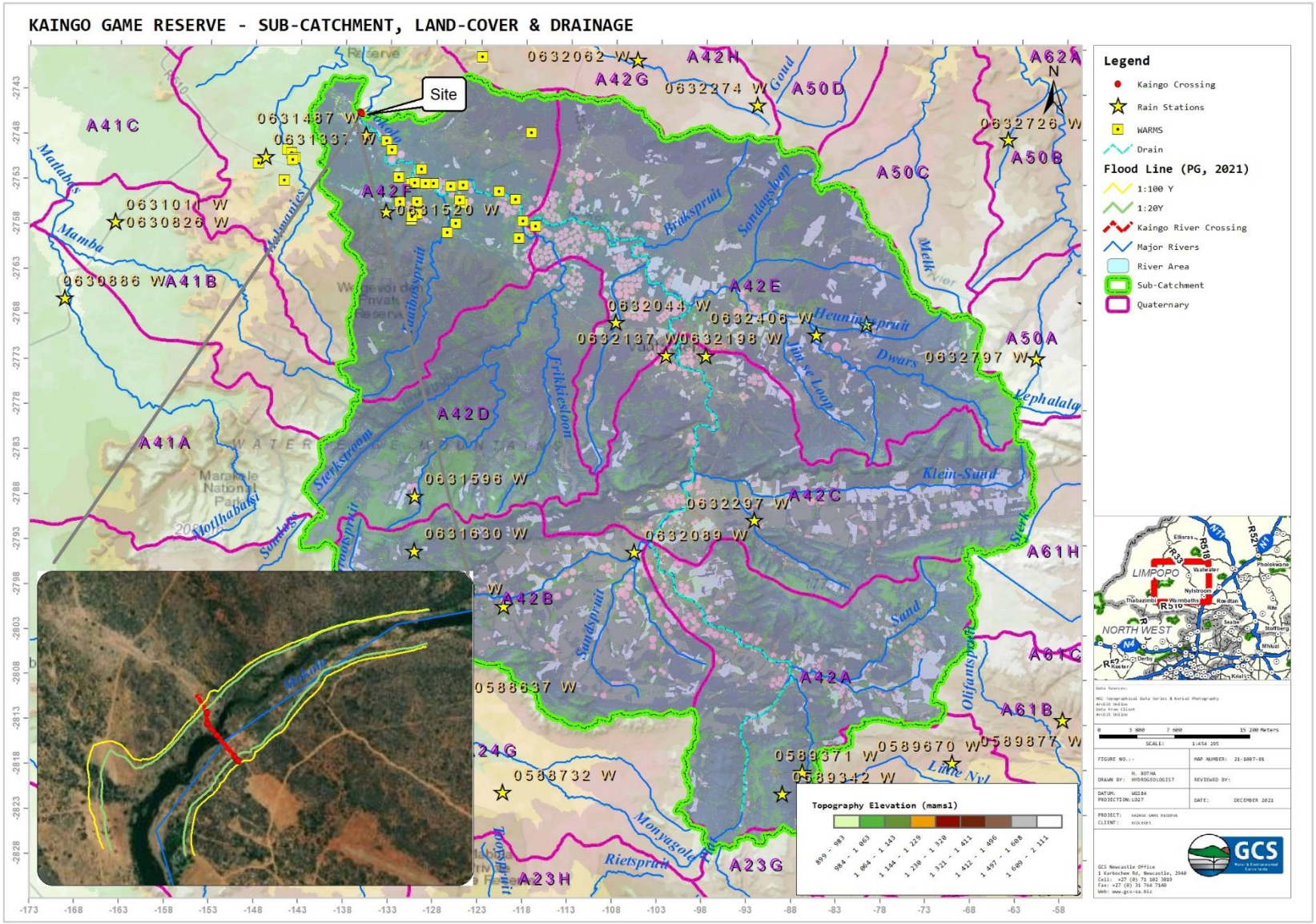


Figure 3-6: Landcover types

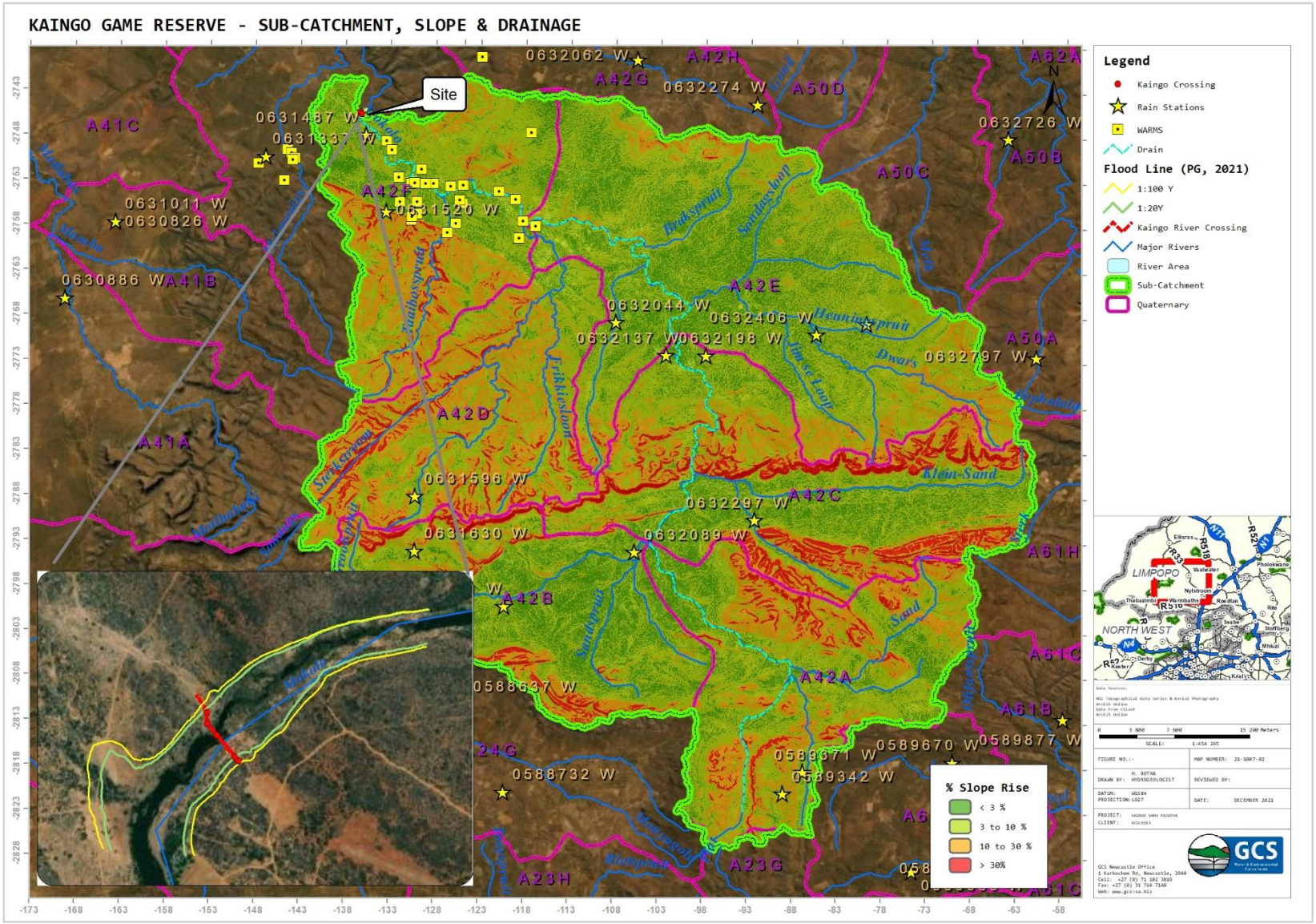


Figure 3-7: Sub-catchment % slope rise

3.5 Local geology and soils

A survey of the geological maps issued by the Council for Geoscience indicates the site is the Vaalwater Formation of the Kransberg Sub-group of the Waterberg Group. Exposed sandstone bedrock was visible at the proposed location of the crossing. Refer to the copy of the geological map below showing the location of the proposed low-level crossing underlain by feldspathic sandstone with lesser arkose, siltstone, and shale from the (PG Consulting Engineers, 2021).

During the site visit, rock outcrops along the Mokolo River were noted as well as well rounded arkose sandstone bedrock was observed – refer to Figure 3-8.

According to the Land types of South Africa databases (Land Type Survey Staff, 1972 – 2006c), the soils in the area predominantly consist of red and yellow, dystrophic/mesotrophic, apedal soils with plinthic subsoils (plinthic soils comprise >10% of land type, red soils comprise <33% of land type).

Upstream of river crossing

Downstream of river crossing

Figure 3-8: Photographs of geological occurrences in the river flow path

3.6 Depth to groundwater

According to WR2012 (Bailey & Pitman, 2015) and DWAF GRAII (DWAF, 2006) data, the groundwater level in the study area on average is in the order of 18.5 mbgl (metre below ground level).

3.7 Surface water users within the sub-catchment associated with the site

According to Water Allocation Registration Management System (WARMS) for Section 21(a) and Section 21 (b) water uses, there are several registered water users upstream of the proposed river crossing position (along the Mokolo River). The Mokolo Dam forms the only registered water storage dam within the Mokolo River and is situated approximately 10km downstream of the proposed river crossing position.

The impact on registered water users along the river is therefore considered “zero” as water users fall upstream of the proposed crossing, and the crossing is designed not to impede or take water from the Mokolo River.

3.8 Wetland areas

Based on available National Wetland Freshwater Ecosystem Priority Areas (NFEPA) (Van Deventer, 2018) no recognised NFEPA wetlands fall within the study area. A wetland report was not made available for this assessment to confirm wetland areas associated with the site.

3.9 Present ecological state (PES) and ecological importance and sensitivity (EIS)

Quaternary A42F PES is classified as a category C (moderately modified) and EIS is classified as moderately sensitive (WRC, 2015).

4 WATER QUALITY

The following section supplies an overview of the surface water (SW) chemistry for the site. Data were derived from field data.

4.1 Field sample procedure

Surface water samples were collected and handled as follows:

- Samples were taken in 1 L polyethene containers.
- Samples were taken in areas where clear river/streamflow was observed, hence no stagnant water was sampled.
- Samples were not filtered or preserved with acid.
- Samples were kept at a cool temperature and out of direct sunlight during storage and transport to X-Lab Earth (SANS No. T0775), to slow down potential chemical reactions.

4.2 Surface water quality

Two (2) water samples were collected, one upstream and one downstream of the proposed river crossing position. The sampling points can be seen in Figure 6-1 and the analytical results are listed in Table 4-1. The results are compared against DWAF (1996a) Ideal Water Quality Values for Domestic Water Use to illustrate the suitability of the water for operational uses. These guidelines are used as a means of comparison to give context to the data.

The results are summarised as follows:

- The samples exhibit neutral pH conditions;
- The constituents analysed are well within the DWAF (1996) ideal target ranges for domestic water use, except for dissolved iron which is slightly high.

The sample data presented in the tables below is considered the baseline water quality of the project area, and in the absence of water quality objectives for the Mokolo River, forms the resource water quality objectives (RWQO) pre-and post-development.

Table 4-1: Summary of Mokolo River water quality

Analyte Name	Unit	Upstream MRC01	Downstream MRC01	DWAF 1996 Domestic Use – TWQR
pH in water at 25ºC	-	7.4	7.4	4 - 9
Conductivity in mS/m @ 25ºC	mS/m	13	13	0 - 70
TDS (0.7µm) @ 105ºC	mg/l	80	85	0-350
Bicarbonate Alkalinity as CaCO3	mg/l	30	30	ns
Carbonate Alkalinity as CaCO3	mg/l	<12	<12	ns
Total Alkalinity as CaCO3	mg/l	30	30	ns
Aluminium	mg/l	0.02	0.02	<0.15
Arsenic	mg/l	<0.01	<0.01	<0.01
Boron	mg/l	0.008	0.008	ns
Barium	mg/l	0.012	0.007	ns
Calcium	mg/l	3.8	4	0 - 32
Ca hardness as CaCO3	mg/l	9.5	9.9	ns
Cadmium	mg/l	<0.001	<0.001	<0.005
Chromium	mg/l	<0.002	<0.002	<0.05
Copper	mg/l	<0.02	<0.02	<1
Iron	mg/l	0.19	0.33	<0.1
Potassium	mg/l	1.1	1.1	0 - 50
Magnesium	mg/l	5	4.9	0 - 30
Mg hardness as CaCO3	mg/l	21	20	ns
Manganese	mg/l	<0.01	<0.01	<0.05
Sodium	mg/l	11	11	0 - 100
Nickel	mg/l	<0.005	<0.005	ns
Phosphorus	mg/l	<0.03	<0.03	ns
Lead	mg/l	<0.01	<0.01	<0.01
Antimony	mg/l	<0.01	<0.01	ns
Selenium	mg/l	<0.01	<0.01	<0.02
Strontium	mg/l	0.033	0.033	ns
Total hardness as CaCO3	mg/l	30	30	<50 Soft
Uranium	mg/l	<0.01	<0.01	ns
Vanadium	mg/l	<0.001	<0.001	ns
Zinc	mg/l	<0.01	<0.01	0-3
Chloride	mg/l	15	15	0 - 100
Fluoride	mg/l	0.13	0.25	0 - 1
Nitrate	mg/l	<0.1	<0.1	0 - 6
Sulphate	mg/l	6	5.8	0 - 200
Mercury	µg/l	<0.001	0.001	<0.01
Ammonia	mg/l	<0.012	<0.012	<1

5 HYDROLOGICAL RISK ASSESSMENT

The anticipated hydrological risk with regards to the construction phase risk was assessed. The source-pathway-receptor (SPR) model (DWAF, 2008) was used to evaluate potential pollution sources and primary receptors within the study area (which is the Mokolo River and the subsequent soils around the bridge).

In terms of the proposed development, several hydrological risks during the construction phase of the development were identified. The potential impacts identified and environmental significance for the construction phase is listed in Table 5-1. No operational or closure phase risks are anticipated, due to the project type (hydrological assessment for a BA).

Typical hydrological risks identified include:

- Impact on the soils (both quality and soil structure) as a result of excavations on the river banks, for the bridge access ways. There is a risk of some soil contamination and sedimentation as a result of the usage of excavation machinery and concrete laydown activities.
- There may be an impact on the Mokolo River water quality as a result of the potential for hydrocarbon spillages as a result of the use of excavation machinery.

The risk assessment for both construction phases of the project is negligible. This is largely due to the project type, activity proposed and the limited receivers in the project area. Furthermore, the river crossing bridge is designed to allow for adequate flow throughout the year, and will not impede river flow.

Table 5-1: Construction (preparation and development) phase hydrological risk

Component Being Impacted On	Activity Which May Cause the Impact	Activity	Pre- Mitigation							Recommended Mitigation Measures	Post Mitigation							Confidence
			Duration	Extent	Irreplaceable resources	Severity	Consequence	Probability	Significance		Duration	Extent	Irreplaceable resources	Severity	Consequence	Probability	Significance	
Vadose zone soils	Disturbing vadose zone during soil along the banks associated with the river crossing.	Earthworks	Short-term (2)	Footprint (1)	Yes (1)	Low (-1)	Negligible (0 to -6)	Definite (2)	Negligible (0 to -12)	Only excavate areas applicable to the project area. Cover excavated soils with a temporary liner to prevent contamination. Keep the site clean of all general wastes. All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential. Retain as much indigenous vegetation as possible. For steep banks, it is advised that temporary sandbags be used to prevent sedimentation until permanent erosion controls are put in place. Exposed soils to be protected using a suitable covering. Existing roads should be used as far as practical to gain access to the site, and crossing the streams in areas where no existing crossing is apparent should be unnecessary, but if it is essential crossings should be made at right angles.	Short-term (2)	Footprint (1)	Yes (1)	Negligible (0)	Negligible (0 to -6)	Definite (2)	Negligible (0 to -12)	Medium
Primary surface water Receivers - > Mokolo River	Surface water contamination and sedimentation from the following activities: Equipment and vehicles are washed in the water bodies (when there is water); Erosion and sedimentation of watercourses due to unforeseen circumstances (i.e. bad weather); and Alteration of natural drainage of the Mokolo River and alteration of the river banks if engineering designs are not followed.	Earthworks	Short-term (2)	Footprint (1)	Yes (1)	Low (-1)	Negligible (0 to -6)	Definite (2)	Negligible (0 to -12)	Water quality monitoring and visual assessments are to be undertaken monthly during the construction phase. Ensure that strict no littering policies are put in place before entering the site. Ensure that vehicles using the bridge are not leaking oils or fuels. Vehicles are to be inspected before entering the site.	Short-term (2)	Footprint (1)	Yes (1)	Negligible (0)	Negligible (0 to -6)	Definite (2)	Negligible (0 to -12)	Medium

6 SURFACE WATER MONITORING

Currently, no surface water monitoring is taking place. It is proposed that a proper monitoring programme be implemented to monitor both the water quality and quantity at the site. It is proposed that monitoring take place during the construction phase only.

6.1 Proposed monitoring protocols during construction

During any construction activities, water and soil monitoring should focus on active excavation sites and equipment / heavy machinery parking or housing areas. Regular visual inspections of these areas need to be undertaken. Moreover, placement and monitoring of drip trays underneath parked construction vehicles will help to determine which vehicles need to be repaired/taken off-site to prevent contamination while in service.

It is further proposed that two (2) sampling points be established, one upstream ad one downstream in the Mokolo River, from the position where the bridge will be constructed. Preliminary monitoring positions are indicated in Figure 6-1 and correspond with GCS sample sites.

6.2 Monitoring duration

In terms of monitoring duration, it is proposed that visual monitoring take place monthly during the construction phase of the bridge.

6.3 Monitoring responsibility

It is proposed that the applicant be responsible for the monitoring. The proposed monitoring type, frequencies and constituents to monitor are listed in Table 6-1 below.

Table 6-1: Proposed monitoring points, frequencies and sample analyses

Site Type	Frequency	Type	Field Measurements	Laboratory Analyses

Surface Water (Mokolo River)	Monthly visual inspections
	Monthly water quality sampling.
		• Field assessment and laboratory (if required).	• pH.
			• Electrical Conductivity (EC) / Total Dissolved Solids (TDS).
			• Temperature.
				• Turbidity (TUR), suspended solids (SS), EC and pH.
				• If the constituents mentioned above are higher than normal (i.e., are observed to be significantly higher than baseline water quality presented) the following should be included in laboratory analyses:
				  • Ca, Mg, Na, Fe and Mn.
				• If obvious signs of oil/fuel spillages are observed and concurrently occur hydrocarbons should be tested for:
				  • BTEX, PAH, DRO and GRO.

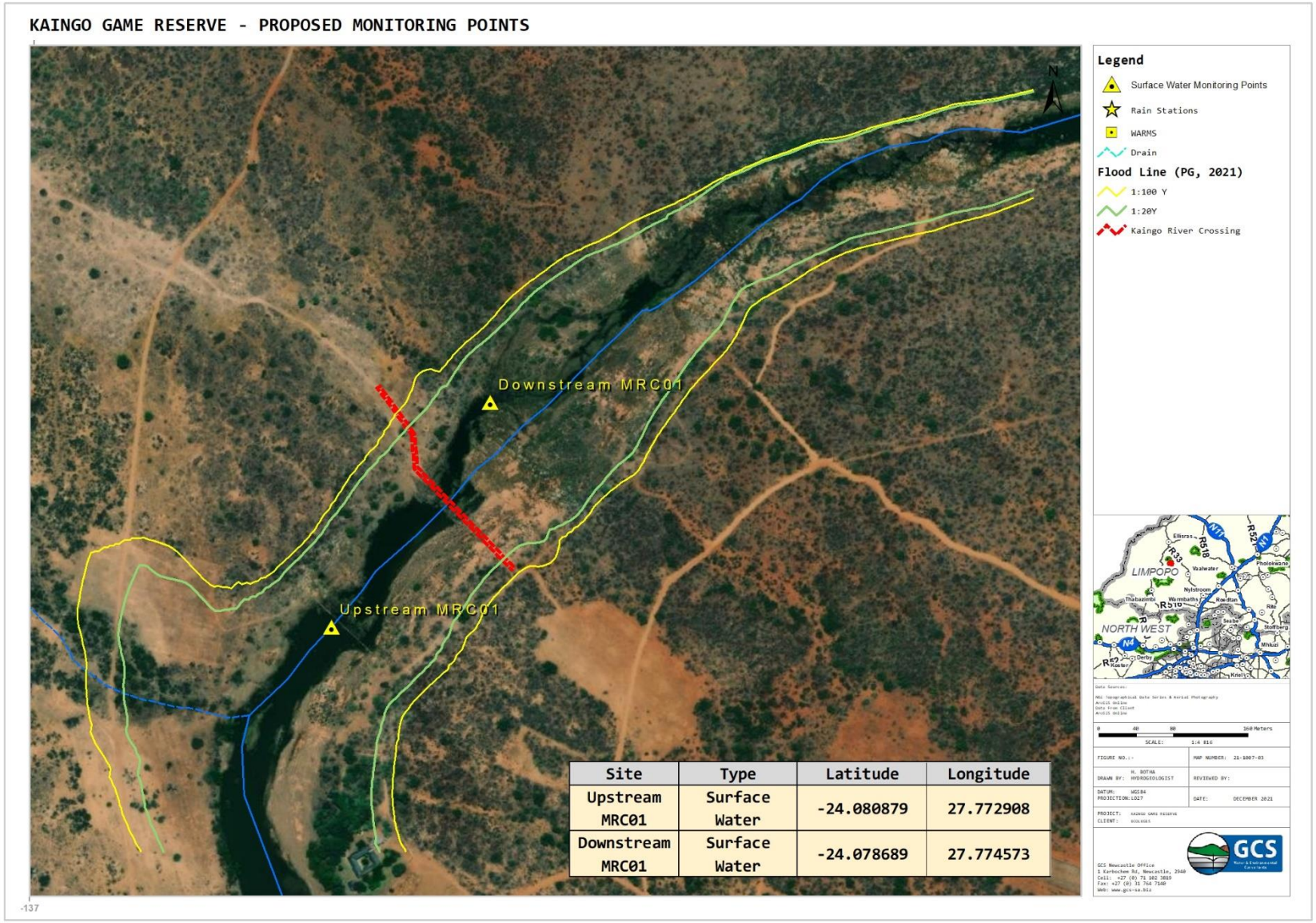


Figure 6-1: Proposed monitoring points

7 CONCLUSIONS

Based on the investigation undertaken, the following conclusions are made:

- The Mokolo River is associated with a large sub-catchment system which entails quaternary catchment A42A, A42B, A42C, A42D, A42E and partially A42F. The proposed river crossing is situated in A42F.
- The MAP for the project area is in the order of 530 mm/yr, and MAE is > 1700 mm/yr. The estimated runoff volume for quaternary catchment A42F is in the order of 28.23 Mm^3/yr.
- The proposed crossing is situated in the 1:50 and 1:100 year flood lines. PG Consulting Engineers (2021) has designed the bridge to allow unobstructed flow in the Mokolo River, as well as to withstand 1:20 year flooding events.
- The risk assessment for both construction and post-construction phases of the project is negligible. This is largely due to the project type, activity proposed and the limited receivers in the project area. Furthermore, the river crossing bridge is designed to allow for adequate flow throughout the year, and will not impede river flow.

7.1 Recommendations

From the output of the flood lines as presented by PG Consulting Engineers (2021), the following mitigation measures can be implemented as part of the EMPr to further reduce flooding potential:

- Ensure a stormwater management plan is implemented if construction activities take place in a wet month, and that all stormwater systems are kept clean of any debris to reduce flooding risk. No stormwater management plan will be required if construction takes place in dry months.
- Ensure that eroded areas are re-vegetated (along with the entryways to the bridge) or covered with rock rip-rap to ensure reduced sedimentation risk and reduced runoff volumes to the streams.
- The sample data presented in the water quality section of this report (Section 4) is considered the baseline water quality of the project area, and in the absence of water quality objectives for the Mokolo River, forms the resource water quality objectives (RWQO) pre-and post-development.
- No further monitoring or mitigation will be required as part of the EMPr.

The following additional recommendations are made:

- All waste generated during construction on site (this is temporary waste i.e. building rubble, used oil and paint containers etc.) must be stored in designated areas that are isolated from surface drains. Waste storage facilities should be covered to prevent dust and litter from leaving the containment area and rainwater accumulation.
- Minimise the amount of exposed ground and stockpiles of building material (i.e. sand, cement, wood, metal, paint, solvents etc.) to prevent suspended solid transport loads and leaching of rocks/materials. Stockpiles can be covered, and sediment fences constructed from a suitable geotextile.
- There is some potential for erosion. Measures should be taken to ensure that this is minimized where possible.
- It is proposed that water quality monitoring be implemented as discussed in Section 6

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APPENDIX A: LABORATORY CERTIFICATES

TEST REPORT

CLIENT DETAILS

Contact	Keolebogile
Client	GCS - GROUNDWATER CONSULTING SERVICES (PTY) LTD
Address	4a Old Main Road☐ Judges Walk☐ Kloof☐
Telephone	
Facsimile	
Email	Keolebogileb@gcs-sa.biz
Order Number	21-1007
Samples	2
Sample matrix	WATER

LABORATORY DETAILS

Laboratory	X-Lab Earth Science
Address	259 Kent Avenue Ferndale, 2194
Telephone	+27 (0)11 590 3000
Laboratory Manager	Mrs Tasneem Tagari
Lab Reference	JBX21-10171
Report Number	0000034196
Date Received	27/10/2021 10:22
Date Started	29/10/2021 11:04
Date Reported	06/11/2021 11:43

The document is issued in accordance with SANAS's accreditation requirements.☐
Accredited for compliance with ISO/IEC 17025. SANAS accredited laboratory T0775.
☐
☐
Samples recieved at ambient temp good condition.

ilac-MRA

sanas
Testing Laboratory
T0775

SIGNATORIES

Tasneem Tagari

General Manager/Technical Signatory

X-Lab Earth Science (Pty) Ltd www.xlab.earth LAB-QLT-REP-001

X-LAB EARTH

JBX21-10171

Report number 0000034196
Client reference:
21-1007

TEST REPORT

Parameter	Units	LOR	Sample Number / Sample Name: JBX21-10171.001 Upstream MRC01	JBX21-10171.002 Downstream MRC01
Calculation of Anion-Cation Balance				
Anion-Cation Balance	%	-100	-0.50	-0.62
Sum of Anion Milliequivalents	meq/l	-	1.14	1.14
Sum of Cation Milliequivalents	meq/l	-	1.13	1.13
Alkalinity on waters by titration Method: ME-AN-001				
Total Alkalinity as CaCO3	mg/l	12	30	30
Bicarbonate Alkalinity as CaCO3	mg/l	12	30	30
Carbonate Alkalinity as CaCO3	mg/l	12	<12	<12
Conductivity on waters Method: ME-AN-007				
Conductivity in mS/m @25°C	mS/m	2	13	13
Total Dissolved Solids (TDS) in water at 105 deg Method: ME-AN-011				
TDS (0.7µm) @105°C	mg/l	21	80	85
ICP-OES Metals on waters (Dissolved) Method: ME-AN-027				

11/6/21 Page 2 of 6

X-LAB EARTH

JBX21-10171

Report number 0000034196
Client reference:
21-1007

TEST REPORT

Parameter	Units	LOR	Sample Number: JBX21-10171.001 Sample Name: Upstream MRC01	JBX21-10171.002 Downstream MRC01
ICP-OES Metals on waters (Dissolved) Method: ME-AN-027 (continued)				
Aluminium	mg/l	0.02	0.02	0.02
Antimony	mg/l	0.008	<0.01	<0.01
Arsenic	mg/l	0.01	<0.01	<0.01
Barium	mg/l	0.002	0.012	0.007
Boron	mg/l	0.005	0.008	0.008
Ca hardness as CaCO3	mg/l	1.4	9.5	9.9
Cadmium	mg/l	0.001	<0.001	<0.001
Calcium	mg/l	0.5	3.8	4.0
Chromium	mg/l	0.002	<0.002	<0.002
Copper	mg/l	0.02	<0.02	<0.02
Iron	mg/l	0.05	0.19	0.33
Lead	mg/l	0.01	<0.01	<0.01
Magnesium	mg/l	0.01	5.0	4.9
Manganese	mg/l	0.01	<0.01	<0.01
Mg hardness as CaCO3	mg/l	0.05	21	20
Nickel	mg/l	0.005	<0.005	<0.005
Phosphorus	mg/l	0.03	<0.03	<0.03
Potassium	mg/l	0.2	1.1	1.1
Selenium	mg/l	0.01	<0.01	<0.01
Sodium	mg/l	0.5	11	11
Strontium	mg/l	0.001	0.033	0.033
Total hardness as CaCO3	mg/l	1.5	30	30
Uranium *	mg/l	0.01	<0.01	<0.01
Vanadium	mg/l	0.001	<0.001	<0.001
Zinc	mg/l	0.01	<0.01	<0.01

11/6/21 Page 3 of 6

X-LAB EARTH

JBX21-10171

Report number 0000034196
Client reference:
21-1007

TEST REPORT

Parameter	Units	LOR	Sample Number / Sample Name: JBX21-10171.001 Upstream MRC01	JBX21-10171.002 Downstream MRC01
Anions on Waters by Ion Chromatography Method: ME-AN-014				
Chloride	mg/l	0.05	15	15
Fluoride	mg/l	0.05	0.13	0.25
Nitrate	mg/l	0.1	<0.1	<0.1
Nitrate as N	mg/l	0.03	<0.03	<0.03
Nitrite	mg/l	0.5	<0.5	<0.5
Nitrite as N	mg/l	0.2	<0.2	<0.2
Sulphate	mg/l	0.05	6.0	5.8
pH in water Method: ME-AN-016				
pH in water at 25°C	-	1	7.4	7.4
Dissolved Hg on waters by ICP-MS Method: ME-AN-026				
Mercury	ug/l	0.001	<0.001	0.001
Ammonia on waters by Discrete Analyser Method: ME-AN-041				
Ammonia	mg/l	0.012	<0.012	<0.012
Ammonia as N	mg/l	0.01	<0.01	<0.01

11/6/21 Page 4 of 6

X-LAB EARTH

JBX21-10171

Report number 0000034196
Client reference:
21-1007

TEST REPORT

Sample Number			JBX21-10171.001	JBX21-10171.002
Sample Name			Upstream MRC01	Downstream MRC01
Parameter	**Units**	**LOR**		
SUB_Subcontracted Aquatico				
Ammonium as N ^1	mg/l	0.05	0.064	0.061

METHOD SUMMARY

METHOD	METHOD SUMMARY
ME-AN-014	Inorganic anions (Br, Cl, F, NO3, NO2, SO4) are determined on aqueous samples by ion chromatography. The method is based on EPA 300.1 and APHA 4110 B.
Calculation of Anion-Cation	Calculation of the cation/anion balance
ME-AN-001	An aliquot of aqueous sample is titrated first to pH 8.3 and then to 4.3 using standardised acid. The volumes of acid titrated are used to calculate total alkalinity and/or alkaline species. The method is based on EPA 310.2 and APHA 2320 B.
ME-AN-026	Dissolved Hg on waters by ICP-MS
ME-AN-027	Dissolved metals are determined on a filtered and acidified (to 1% HNO3) portion of aqueous sample by inductively coupled plasma optical emission spectrometry (ICP-OES). The method is based on EPA 200.7 and APHA 3120.
ME-AN-041	
ME-AN-016	The pH of an aliquot of aqueous sample is measured electrometrically using an electrode connected to a calibrated meter with automated temperature correction. This method is based on APHA 4500-H B.
ME-AN-011	Total dissolved solids (TDS) is determined gravimetrically on a filtered aliquot of aqueous sample by evaporating the sample to dryness in a pre-weighed container at 105 deg C. The method is based on APHA 2540 C.
ME-AN-007	The conductivity of an aliquot of aqueous sample is measured electrometrically using a standard cell connected to a calibrated meter with automated temperature correction. This method is based on APHA 2510.

11/6/21 Page 5 of 6

X-LAB EARTH

JBX21-10171

Report number 0000034196
Client reference:
21-1007

FOOTNOTES

IS	Insufficient sample for analysis.	QFH	QC result is above the upper tolerance
LNR	Sample listed, but not received.	QFL	QC result is below the lower tolerance
^	Performed by outside laboratory.	-	The sample was not analysed for this analyte
LOR	Limit of Reporting	*	*Results marked "Not SANAS Accredited" in this report are not included in the SANAS Schedule of Accreditation for this laboratory /certification body /inspection body".*

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Unless otherwise indicated, samples were received in containers fit for purpose.

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11/6/21 Page 6 of 6

APPENDIX B: RISK ASSESSMENT METHODOLOGY

Due to the hydrological assessment forming part of a larger risk assessment for the study area, the potential impacts and the determination of impact significance were assessed. The process of assessing the potential impacts of the project encompasses the following four activities:

1. Identification and assessment of potential impacts;
2. Prediction of the nature, magnitude, extent, and duration of potentially significant impacts;
3. Identification of mitigation measures that could be implemented to reduce the severity or significance of the impacts of the activity; and
4. Evaluation of the significance of the impact after the mitigation measures have been implemented i.e. the significance of the residual impact.

Per GNR 982 of the EIA Regulations (2014), the significance of potential impacts was assessed in terms of the following criteria:

I. Cumulative impacts;
II. Nature of the impact;
III. The extent of the impact;
IV. Probability of the impact occurring;
V. The degree to which the impact can be reversed;
VI. The degree to which the impact may cause irreplaceable loss of resources; and
VII. The degree to which the impact can be mitigated.

Table 8-1 provides a summary of the criteria used to assess the significance of the potential impacts identified. An explanation of these impact criteria is provided in Table 8-2.

The net consequence is established by the following equation:

Consequence = (Duration + Extent + Irreplaceability of resource) x Severity

And the environmental significance of an impact was determined by multiplying consequence with probability.

Table 8-1: Proposed Criteria and Rating Scales to be used in the Assessment of the Potential Impacts

Criteria	Rating Scales	Notes
Nature	Positive (+)	An evaluation of the effect of the impact related to the proposed development.
	Negative (-)	
Extent	Footprint (1)	The impact only affects the area in which the proposed activity will occur.
	Site (2)	The impact will affect only the development area.
	Local (3)	The impact affects the development area and adjacent properties.
	Regional (4)	The effect of the impact extends beyond municipal boundaries.
	National (5)	The effect of the impact extends beyond more than 2 regional/ provincial boundaries.
	International (6)	The effect of the impact extends beyond country borders.
Duration	Temporary (1)	The duration of the activity associated with the impact will last 0-6 months.
	Short term (2)	The duration of the activity associated with the impact will last 6-18 months.
	Medium-term (3)	The duration of the activity associated with the impact will last 18 months-5 years.
	Long term (4)	The duration of the activity associated with the impact will last more than 5 years.
Severity	Low (1)	Where the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally affected.
	Moderate (2)	Where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; and valued, important, sensitive, or vulnerable systems or communities are negatively affected.

Criteria	Rating Scales	Notes
	High (3)	Where natural, cultural, or social functions and processes are altered to the extent that the natural process will temporarily or permanently cease; and valued, important, sensitive, or vulnerable systems or communities are substantially affected.
Potential for impact on irreplaceable resources	No (0)	No irreplaceable resources will be impacted.
	Yes (1)	Irreplaceable resources will be impacted.
Consequence	Extremely detrimental (-25 to -33)	A combination of extent, duration, intensity, and the potential for impact on irreplaceable resources.
	Highly detrimental (-19 to -24)	
	Moderately detrimental (-13 to -18)	
	Slightly detrimental (-7 to -12)	
	Negligible (-6 to 0)	
	Slightly beneficial (0 to 6)	
	Moderately beneficial (13 to 18)	
	Highly beneficial (19 to 24)	
	Extremely beneficial (25 to 33)	
Probability (the likelihood of the impact occurring)	Improbable (0)	It is highly unlikely or less than 50 % likely that an impact will occur.
	Probable (1)	It is between 50 and 70 % certain that the impact will occur.
	Definite (2)	It is more than 75 % certain that the impact will occur or it is definite that the impact will occur.
Significance	Very high – negative (-49 to -66)	A function of Consequence and Probability.
	High – negative (-37 to -48)	
	Moderate – negative (-25 to -36)	
	Low – negative (-13 to -24)	
	Very low (0 to -12)	
	Low – positive (0 to 12)	

Criteria	Rating Scales	Notes
	Moderate – positive (13 to 24)	
	High–positive (37 to 48)	
	Very high – positive (49 to 66)	

Table 8-2: Explanation of Assessment Criteria

Criteria	Explanation
Nature	This is an evaluation of the type of effect the construction, operation, and management of the proposed development would have on the affected environment. Will the impact change in the environment be positive, negative, or neutral?
Extent or Scale	This refers to the spatial scale at which the impact will occur. The extent of the impact is described as footprint (affecting only the footprint of the development), site (limited to the site), and regional (limited to the immediate surroundings and closest towns to the site). The extent of scale refers to the actual physical footprint of the impact, not to the spatial significance. It is acknowledged that some impacts, even though they may be of a small extent, are of very high importance, e.g. impacts on species of very restricted range. To avoid "double counting, specialists have been requested to indicate spatial significance under "intensity" or "impact on irreplaceable resources" but not under "extent" as well.
Duration	The lifespan of the impact is indicated as temporary, short, medium, and long term.
Severity	This is a relative evaluation within the context of all the activities and the other impacts within the framework of the project. Does the activity destroy the impacted environment, alter its functioning, or render it slightly altered?
Impact on irreplaceable resources	This refers to the potential for an environmental resource to be replaced, should it be impacted. A resource could be replaced by natural processes (e.g. by natural colonization from surrounding areas), through artificial means (e.g. by reseeding disturbed areas or replanting rescued species) or by providing a substitute resource, in certain cases. In natural systems, providing substitute resources is usually not possible, but in social systems, substitutes are often possible (e.g. by constructing new social facilities for those that are lost). Should it not be possible to replace a resource, the resource is essentially irreplaceable e.g. red data species that are restricted to a particular site or habitat of a very limited extent.
Consequence	The consequence of the potential impacts is a summation of the above criteria, namely the extent, duration, intensity, and impact on irreplaceable resources.
Probability of occurrence	The probability of the impact occurring is based on the professional experience of the specialist with environments of a similar nature to the site and/or with similar projects. It is important to distinguish between the probability of the impact occurring and the probability that the activity causing a potential impact will occur. Probability is defined as the probability of the impact occurring, not as the probability of the activities that may result in the impact.

Criteria	Explanation
Significance	Impact significance is defined to be a combination of the consequence (as described below) and the probability of the impact occurring. The relationship between consequence and probability highlights that the risk (or impact significance) must be evaluated in terms of the seriousness (consequence) of the impact, weighted by the probability of the impact occurring. In simple terms, if the consequence and probability of an impact are high, then the impact will have a high significance. The significance defines the level to which the impact will influence the proposed development and/or environment. It determines whether mitigation measures need to be identified and implemented and whether the impact is important for decision-making.
Degree of confidence in predictions	Specialists and the EIR team were required to indicate the degree of confidence (low, medium, or high) that there is in the predictions made for each impact, based on the available information and their level of knowledge and expertise. The degree of confidence is not taken into account in the determination of consequence or probability.
Mitigation measures	Mitigation measures are designed to reduce the consequence or probability of an impact or to reduce both consequence and probability. The significance of impacts has been assessed both with mitigation and without mitigation.

APPENDIX C: DISCLAIMER AND DECELERATION OF INDEPENDENCE

The opinions expressed in this Report have been based on site /project information supplied to GCS (Pty) Ltd (GCS) by EcoLeges based on public domain data, field data and data supplied to GCS by the client. GCS has acted and undertaken this assessment objectively and independently.

GCS has exercised all due care in reviewing the supplied information. Whilst GCS has compared key supplied data with expected values, the accuracy of the results and conclusions are entirely reliant on the accuracy and completeness of the supplied data. GCS does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them.

Opinions presented in this report, apply to the site conditions, and features as they existed at the time of GCS's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this report, about which GCS had no prior knowledge nor had the opportunity to evaluate.

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

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

PROJECT TITLE

Hydrology Assessment for the Proposed Mokolo River Bridge Crossing

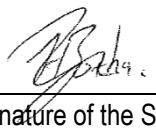
SPECIALIST INFORMATION

Specialist Company Name:	GCS Water and Environment Pty Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	
Specialist name:	Hendrik Botha			
Specialist Qualifications:	MSc Environmental Sciences (Geohydrology & Geochemistry) BSc. Hons. Hydrology			
Professional affiliation/registration:	PR SCI NAT 400139/17			
Physical address:	1 Karbochem Road, Newcastle, KZN			
Postal address:				
Postal code:	2940	Cell:		
Telephone:	071 102 3819	Fax:		
E-mail:	hendrikb@gcs-sa.biz			

DECLARATION BY THE SPECIALIST

I, Hendrik Botha, declare that –

- I act as the independent specialist in this application.
- I will perform the work relating to the application objectively, 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 concerning the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.



Signature of the Specialist

GCS

Name of Company:

08 December 2021

Date