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FRESHWATER ECOLOGICAL ASSESSMENT AS PART OF THE ENVIRONMENTAL ASSESSMENT AND AUTHORISATION PROCESS FOR THE PROPOSED DIAMOND PROSPECTING AND BULK SAMPLING PROJECTS IN THE RICHTERSVELD, NORTHERN CAPE PROVINCE.

SCOPING REPORT

Prepared for

NDI Geological Consulting Services (Pty) Ltd

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EXECUTIVE SUMMARY

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater ecological assessment as part of the Environmental Impact Assessment (EIA) and authorisation process for the proposed diamond prospecting and bulk sampling activities within and along the Orange River within the Richtersveld, Northern Cape Province.

The proposed prospecting and bulk sampling activities include seven (7) prospecting pockets within two greater Prospecting Right Application Area (PRAA). The south western area is referred to as PRAA 1 where prospecting pockets 1, 2 3A and 3B are located and PRAA 2, further north and east where the prospecting and bulk sampling Pockets 4, 5 and 6 are located. The PRAA 1 and PRAA 2 and the associated prospecting pockets are hereafter collectively referred to as the "focus area".

The prospecting pockets 1 to 5 and a portion of prospecting pocket 6 are located within the section of the Orange River that is considered important in terms of a fish corridor for threatened fish species. The PRAA 1 is classified as being in a natural to good ecological condition (Class A/B), while the PRAA 2 portion of the Orange River is moderately modified (Class C), according to the NFEPA Database (2011). However according to the PES 1999 classification as well as the NBA (2018), the Orange River is considered moderately modified. This is mainly attributed to historic and ongoing anthropogenic activities taking place within close proximity to the Orange River, such as historic and active sand and diamond mining, establishment of settlements and construction of a formal road on the Namibian side of the system. Significant impact from water abstraction from the system is also deemed likely. According to the PES /EIS Dataset (DWS, 2014) the Orange River is host to numerous fish and macro-invertebrate species all of which may potentially be affected should any disturbance occur within the Orange River.

The prospecting pockets 4 to 6 fall within the protected area, Richtersveld Cultural and Botanical Landscape and the Richtersveld National Park, which is a mountainous desert which has the highest diversity of succulent plants in the world. The coastal mists provide moisture to the moisture deficient landscape. Alluvial diamonds and truly indigenous cultures are also key characteristics of the area that need to be considered.

This area has formal long-term protection for important biodiversity and landscape features (NC CBA, 2016 and Mining and Biodiversity Guidelines, 2013). The Richtersveld National Park has a significantly high ecotourism aspect including but not limited to indigenous culture, rich biodiversity, river rafting, Fish River Canyon hike, sport fishing along the Orange River, birdwatching, and desert living. As such the proposed prospecting and bulk sampling activities will have the potential to have a significant impact on the ecotourism of the area.

The prospecting pockets 1 to 3 fall within Category 1 CBAs, wherein mining is not a compatible land-use (Northern Cape CBA, 2016). According to the Mining and Biodiversity Guidelines a portion of the prospecting pocket 1 and the entire extent of prospecting pockets 2, 3A and 3B fall within areas considered of highest biodiversity importance. The remaining portion of the prospecting pocket 1 is located within an area of high biodiversity importance.

The proposed prospecting and bulk sampling activities are located approximately 30km north of the estuary known as the Orange River Mouth RAMSAR Site. It is a transboundary area of extensive saltmarshes, freshwater lagoons, marshes, sand banks, and reedbeds shared by South Africa and Namibia. The upper Orange River serves as a domestic water source and is experiencing increasing demand. Extensive abstraction from the Orange River for domestic, commercial and industrial purposes could severely restrict the amount of water reaching the site. Following the collapse of the saltmarsh component of the estuary, the site was placed on the Montreux Record in 1995. The rapid degradation was the result of adjacent diamond mining activities (Alexander Bay) and flow regulation of the Orange River as a result of dam construction and water consumption. The Orange River Mouth is regarded as the second most important estuary in South Africa in terms of conservation importance after the Knysna Estuary. In Namibia it represents one of three globally important coastal wetlands. The Orange River mouth supports several fish and bird species that are listed in the Namibian, South African or international red data books. Development of further dams and diversion of flow in the headwaters of

the Orange River are likely to further reduce water availability in the Orange River Mouth. The proposed prospecting and bulk sampling activities have the potential to affect the Orange River Mouth and thus the RAMSAR wetland system. Such impact, if at all significant would be regarded as unacceptable.

Namaquacypris hospes, a fish species, is known only from the section of the Orange River below Augrabies Falls, it prefers rocky and cobble habitat. The mobilisation of sediment from the proposed prospecting and bulk sampling activities has the potential to result in habitat smothering and has the potential to have a significant impact on this species as well as the *Labeos* sp (mudfishes). and *Labeobarbus* sp. (yellowfishes) from within the river that also have the same habitat preference.

Based on the outcome of the desktop assessment, a detailed on-site investigation must be undertaken to validate the aquatic sensitivity of the area in the EIA phase. This scope of work as defined in this scoping report is to define the freshwater ecological characteristics of the Orange River, including the ecology, drivers, receptors, goods and services to ensure that all planning of the proposed development is cogently considered and all project plans and designs can adequately consider the characteristics of the system.

Provided that prospecting and bulk sampling activities do not to take place within the active channel of the Orange River and are undertaken in the low flow season with all rehabilitation completed before the rising of the river the risk can be significantly reduced. These mitigatory measures combined with other design management mechanisms and with well managed construction and implementation practices, could potentially lead to significantly reduced impacts. Even if all mitigatory measures are implemented the risk the project poses still remains high.

From the outset it is essential to consider that this system is extremely ecologically important and sensitive and that the proposed prospecting and bulk sampling activities poses a very significant risk to the system. It is thus deemed essential that all aspects of the proposed prospecting and bulk sampling activities are considered in extensive detail and all aspects are exceptionally well planned and executed. It must also be noted from the outset that significant constraints are likely to be placed on the activity to conserve the environment, as a minimum, if the development is authorised to proceed at all.

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ACRONYMS

BGIS	Biodiversity Geographic Information Systems
CBA	Critical Biodiversity Area
CSIR	Council of Scientific and Industrial Research
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation (formerly known as DWA, DWAF, see above)
EAP	Environmental Assessment Practitioner
EC	Ecological Class
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMP	Environmental Management Program
EPL	Ecosystem Protection Level
ESA	Ecological Support Area
ETS	Ecosystem Threat Status
FEPA	Freshwater Ecosystem Priority Areas
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
HGM	Hydrogeomorphic
m	Meter
m.a.m.s.l	Metres Above Mean Sea Level
MAP	Mean Annual Precipitation
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act
NEMBA	National Environmental Management: Biodiversity Act
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act
PES	Present Ecological State
PRAA	Prospecting Right Application Area
RAMSAR	Convention on Wetlands of International Importance
REC	Recommended Ecological Category
RMO	Recommended Management Objective
RQIS	Research Quality Information Services
SACNASP	South African Council for Natural Scientific Professions
SAIIAE	South African Inventory of Inland Aquatic Ecosystems
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
SQR	Sub-quaternary Reach
SAS	Scientific Aquatic Services
subWMA	Sub-Water Management Area
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WRC	Water Research Commission
ZOR	Zones of Regulation

1 INTRODUCTION

1.1 *Background*

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater ecological assessment as part of the Environmental Impact Assessment (EIA) and authorisation process for the proposed diamond prospecting and bulk sampling activities within and along portions of the Orange River within the Richtersveld, Northern Cape Province.

The proposed prospecting and bulk sampling activities include seven (7) prospecting pockets within two greater Prospecting Right Application Areas (PRAA). The south western area is referred to as PRAA 1 where prospecting pockets 1, 2 3A and 3B are located and PRAA 2, further north and east where the prospecting and bulk sampling Pockets 4, 5 and 6 are located. The PRAA 1 and PRAA 2 and the associated prospecting pockets are hereafter collectively referred to as the "focus area".

The individual prospecting pockets, cover approximately 640 ha. These areas are located within the Richtersveld Metropolitan Municipality which is an administrative area of the Namakwa District Municipality. The focus area is situated approximately 10 km northeast of the town of Sendelingsdrif, adjacent to the Orange River and bordering Namibia. The location and extent of the focus area, comprising the PRAA 1 and PRAA 2 and their associated prospecting pockets are indicated in Figures 1 and 2.

In order to identify all potential watercourses that may be impacted by the proposed prospecting and bulk sampling activities, a 500 m "zone of investigation" around the focus area, in accordance with Government Notice (GN) 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) (NWA), was used as a guide in which to assess possible sensitivities of the receiving watercourse environment. This area – i.e. the 500 m zone of investigation around the focus area - will henceforth be referred to as the "investigation area".

Samara Mining (Pty) Ltd intends to prospect for alluvial diamonds within the floodline of the Orange River. Prospecting for such resources will thus require the excavation of several trenches to obtain the bulk samples required. An expected ten trenches, each 100 m x 25 m x 4 m, are anticipated to be excavated per prospecting pocket. The volume of overburden/waste to be removed will be 2500 m^3 on each excavation and the Volume of resource bearing gravel to be abstracted will be 7500 m^3 for each excavation.

The processing of excavated samples will entail the use of 8 x 18 feet rotary pans with a minimum and maximum tonnage of 45 and 56 respectively, subject to the Gravel Specific Gravity. From the rotary pans, concentrate will be pumped to a vacuum and filter system for

further processing which will remove the dirt, filter the water to a drinkable standard and either release it back into the Orange River or supply surrounding communities with water by pumping it into the municipal reservoirs. As such, further development of associated infrastructure to support the prospecting includes:

- Ablution facilities;
- Access roads;
- Diesel storage facilities;
- Fences;
- Office sites;
- Plant sites; and
- Vehicle parking areas.

The active channel Orange River is 30-40 m wide, however the riverbed is approximately 300-400 m wide. It is proposed that eighty per cent (80%) of the riverbed will be worked dry; Samara will make small temporary diversions in the river to prospect (working in a phased manner with concurrent rehabilitation). No blasting will be required as part of prospecting activities, and there will be no processing in the riverbed only on the Orange River active channel embankment or within 50 m thereof. Only machinery and associated pumps will be located within the riverbed.

This report, after consideration and description of the ecological integrity of the focus area, must guide the future studies to be undertaken by the specialist in the EIA phase. The scope of work for the EIA Phase is to define the freshwater ecological characteristics of the Orange River, including the ecology, drivers, receptors, goods and services to ensure that all planning of the proposed development is cogently considered and all project plans and designs can adequately consider the characteristics of the system.

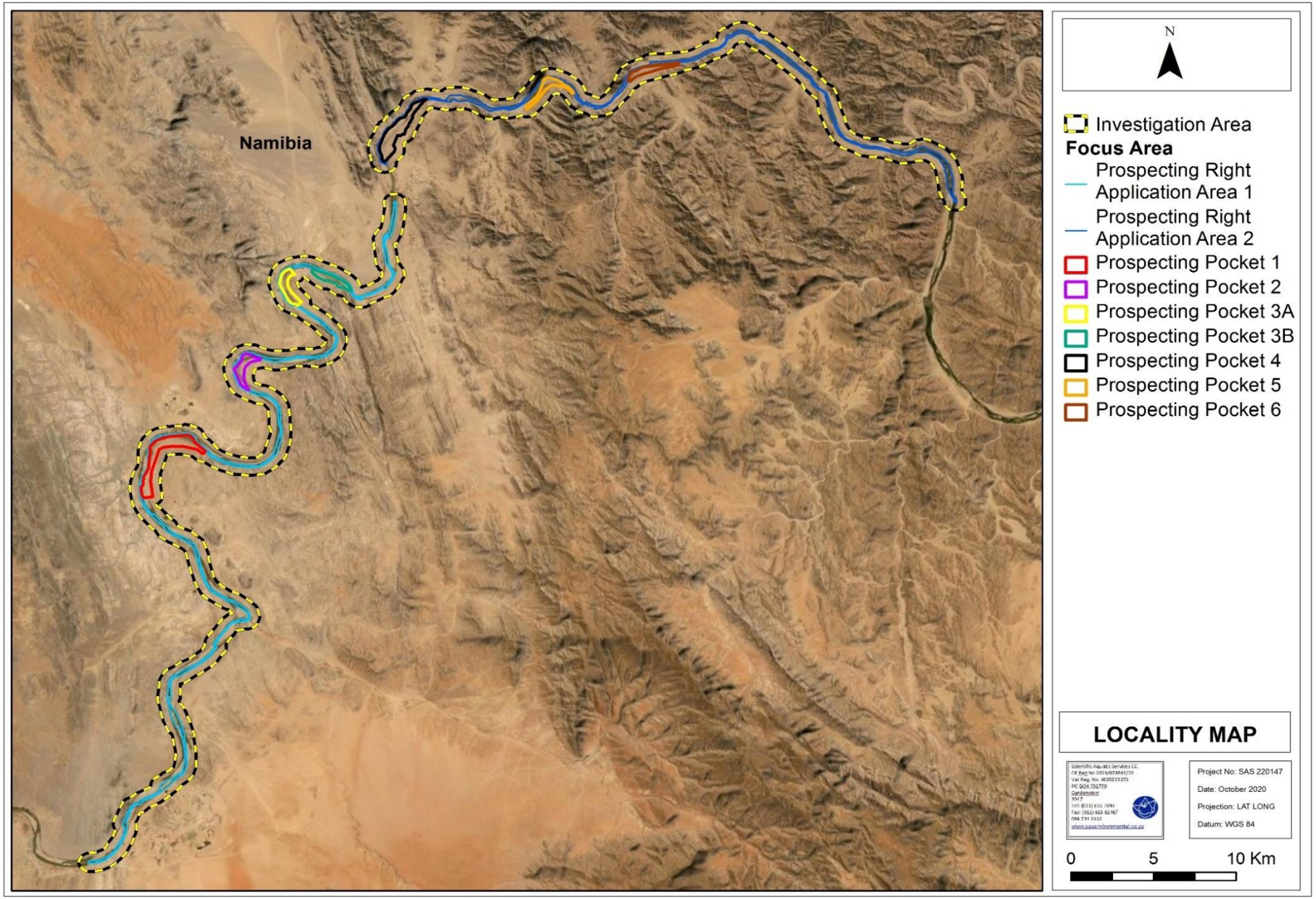

Figure 1: Digital satellite image depicting the location of the focus and investigation areas in relation to surrounding areas.

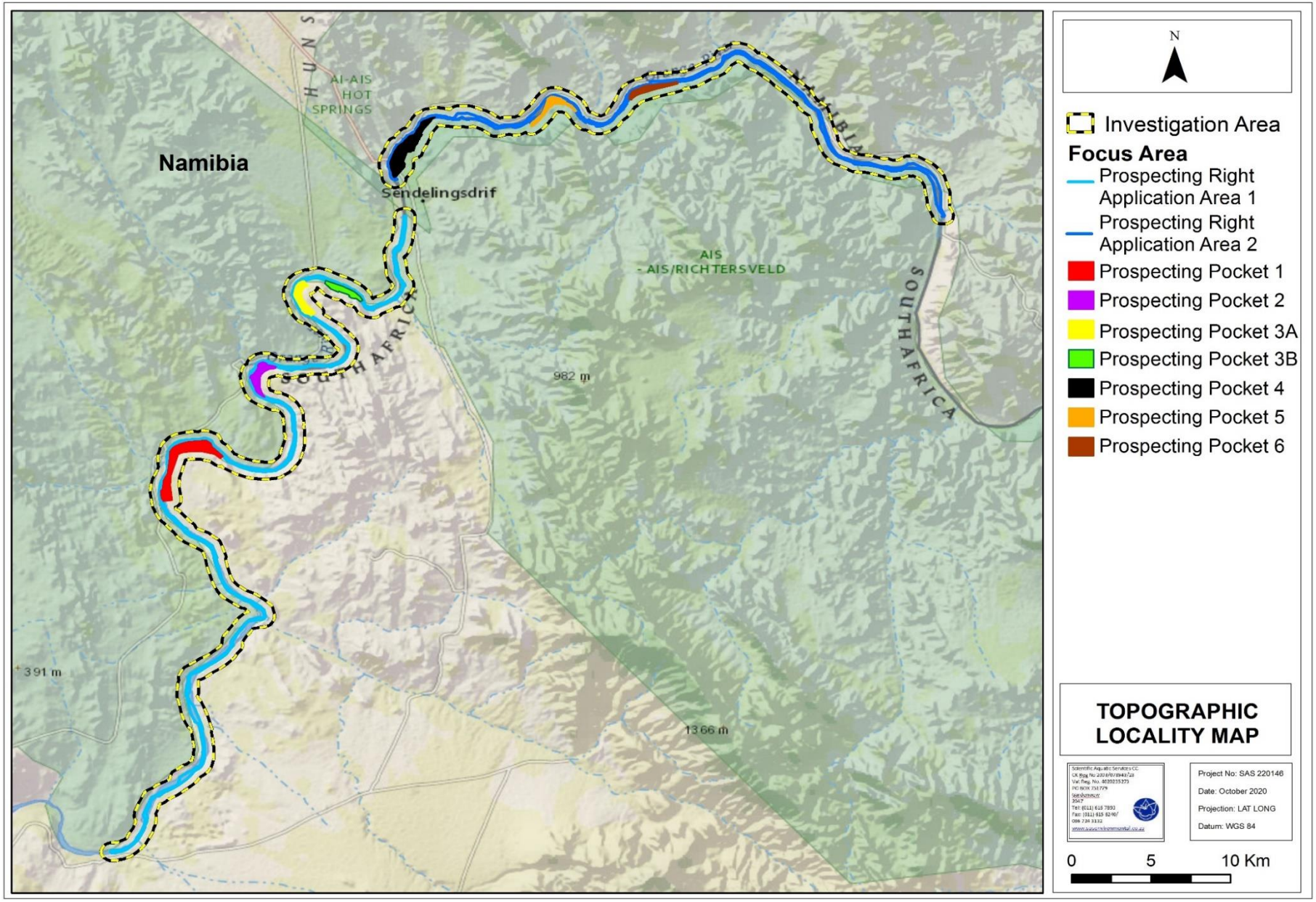

Figure 2: Location of the focus and investigation areas depicted on a 1:50 000 topographical map in relation to surrounding area.

1.2 *Assumptions and Limitations*

The following assumptions and limitations are applicable to this scoping study:

- The desktop ecological assessment and discussion thereof relates to the focus area, however the surrounding and adjacent properties were included in the background maps due to the scale of the map presentation;
- This scoping study was undertaken as a desktop assessment only and as such, the information gathered must be considered with caution, as inaccuracies and data capturing errors are often present within these databases. Moreover, without ground truthing, the true Present Ecological State of a locality may be misinterpreted from digital imagery or these images may be outdated. However, this desktop assessment is considered to provide adequate information to guide the further studies in the EIA phase;
- The determination of the watercourse boundaries and the assessment thereof, is confined to the watercourses situated directly within the focus area and within the 500 m investigation area. The watercourses were delineated in fulfilment of Government Notice 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998), using desktop methods, including use of 5 m contour lines and augmented with historical and current digital satellite imagery and aerial photographs. The general surroundings were however, considered in the desktop assessment of the focus area; and
- These preliminary watercourse delineations as presented in this report is regarded as a best estimate of the watercourse boundaries based on desktop methods. It is worth noting that this is largely dependent on the accuracy of the digital satellite imagery used for the delineation of watercourse features.

1.3 *Legislative Requirements and Provincial Guidelines*

The following legislative requirements and relevant provincial guidelines were taken into consideration during the desktop assessment. A description of some of these legislative requirements is presented in Appendix D:

- Constitution of the Republic of South Africa, 1996[1];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA);

[1] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 19996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.

- Government Notice 509 (GN 509) as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998);
- Government Notice 704 (GN 704) as published in the Government Gazette 20119 of 1999 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) regarding the use of water for mining and related activities aimed at the protection of water resources;
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
- Government Notice 598 Alien and Invasive Species Regulations (2014), including the Government Notice 864 Alien Invasive Species List as published in the Government Gazette 40166 of 2016, as it relates to the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004);
- The Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA);
- National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEMPAA); and
- The Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) (NCNCA).

2 METHOD OF ASSESSMENT

2.1 *Literature and Database Review*

A desktop study was compiled with all relevant information as presented by the relevant databases and SANBI's Biodiversity Geographic Information Systems (BGIS) website (http://bgis.sanbi.org). Biodiversity specific information resources taken into consideration during the desktop assessment of the Focus Area included:

- National Freshwater Ecosystem Priority Areas (NFEPA, 2011)
  - NFEPA Water Management Area (WMA);
  - NFEPA wetlands/National wetlands map;
  - Wetland and estuary FEPA;
  - FEPA (sub) WMA area;
  - Sub water catchment area FEPAs;
  - Water management area FEPAs;
  - Fish sanctuaries; and
  - Wetland ecosystem types.
- National Biodiversity Assessment, (2018);

- Mining and Biodiversity Guidelines, (2012);
- The Department of Water and Sanitation (DWS) Resource Quality Information Services (RQIS) PES/EIS database (2014); and
- Northern Cape Critical Biodiversity Areas Map (2016).

The results of the desktop assessment upon consultation of the relevant databases is provided in Section 3:

2.2 *Watercourse Classification and Mapping*

For the purposes of this investigation, the definitions of a watercourse and riparian habitat were taken as per that in the National Water Act, 1998 (Act No. 36 of 1998). The definitions are as follows:

A **watercourse** means:
(a) a river or spring;
(b) a natural channel in which water flows regularly or intermittently;
(c) a wetland, lake or dam into which, or from which, water flows; and
(d) any collection of water which the Minister may, by notice in the *Gazette,* declare a watercourse, and a reference to a watercourse includes where relevant, its bed and banks.

Riparian Habitat includes-

"The physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent areas".

The watercourse features were delineated using desktop methods with the use of aerial photographs, digital satellite imagery and topographical maps, contour lines and available provincial and national databases to aid in the delineation of the watercourses. As a result, the delineations as presented in this report are regarded as a best estimate of the boundaries based on digital signatures.

The following were taken into consideration when utilising the above desktop methods:

- Linear features: since water flows/moves through the landscape, watercourses often have a distinct linear element to their signature which makes them discernible on aerial photography or satellite imagery;
- Vegetation associated with watercourses: a distinct increase in density as well as shrub size near flow paths;

- Hue: with water flow paths often show as white/grey or black and outcrops or bare soils displaying varying chroma created by varying vegetation cover, geology and soil conditions. Changes in the hue of vegetation with watercourse vegetation often indicated on black and white images as areas of darker hue (dark grey and black). In colour imagery, these areas mostly show up as darker green and olive colours or brighter green colours in relation to adjacent areas where there is less soil moisture or surface water present; and
- Texture: with areas displaying various textures, created by varying vegetation cover and soil conditions.

In accordance with GN 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998), a regulated area of a watercourse in terms of Section 21 (c) and 21 (i) of the National Water Act, 1998 (Act No. 36 of 1998) is defined as:

- The outer edge of the 1 in 100-year flood line and or delineated riparian habitat whichever is the greatest distance;
- In the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or
- A 500 m radius from the delineated boundary (extent) of any wetland or pan.

3 RESULTS OF THE DESKTOP ANALYSIS OF CONSERVATION DATABASES

3.1 *Analyses of Relevant Databases*

The following section contains data accessed as part of the desktop assessment and are presented as a “dashboard style” report below (Table 1). The dashboard report aims to present concise summaries of the data on as few pages as possible in order to allow for integration of results by the reader to take place.

It is important to note that although all data sources used provide useful and often verifiable, high quality data, the various databases used do not always provide an entirely accurate indication of the focus area’s actual site characteristics at the scale required to inform the environmental authorisation and/or water use licencing processes. Given these limitations, this information is considered useful as background information to the study. It must however be noted that site verification of key areas may potentially contradict the information contained in the relevant databases, in which case the field verified information must carry more weight

in the decision-making process. It is noted that a field verification assessment is required for a more in-depth description of the focus area, should this be required.

Table 1: Desktop data relating to the character of watercourses associated with the focus area and investigation area.

Aquatic ecoregion and sub-regions in which the focus area is located			Detail of the focus area in terms of the National Freshwater Ecosystem Priority Area (NFEPA, 2011) database.	
Ecoregion (Figure 3)	The majority of the focus area (all prospecting pockets) falls within the Orange River Gorge and the southern portion falls within the Western Coastal Belt Aquatic Ecoregion.			
Catchment	Orange (Lower)		FEPACODE (Figure 4)	The majority of the focus area (including prospecting pockets 1 to 5 and a portion of prospecting pocket 6) is situated within a SubWMA currently not considered important in terms of fish or watercourse ecological importance, while the north eastern portion of the PRAA 2 (including a portion of prospecting pocket 6) is located within a SubWMA that is considered an important fish corridor. These are rivers identified for threatened fish species which form part of the fish sanctuary network.
Quaternary Catchment	The majority of PRAA 2 (prospecting pockets 5 and 6 and a portion of prospecting pockets 4) is within D82J, PRAA 1 (prospecting pockets 1,2,3A and 3B and the remaining portion of prospecting pockets 4) falls within D82K and D82L			
WMA	Lower Orange			
subWMA	Orange		NFEPA Wetlands (Figure 5)	According to the NFEPA database (2011) there is a natural floodplain wetland associated with the Orange River (associated with all the prospecting pockets). The floodplain wetland is moderately modified (Class C), according to the NFEPA Database (2011).
Dominant characteristics of the Western Coastal Belt and Orange River Gorge Aquatic Ecoregions Level 2 (Kleynhans *et al.,* 2007).				
Ecoregion Levell II	Orange River Gorge (28.01)	Western Coastal Belt (25.03)	Wetland Vegetation Type (Figure 6)	Prospecting pocket 6 falls within the Gariep Desert (Endangered), and prospecting pockets 1 to 5 are located within the Southern Namib Desert (Least Threatened) Wetland Vegetation Type. The remaining southern portion of the PRAA 1 falls within the Richtersveld (Least Threatened) Wetland Vegetation Type. The threat statuses were obtained from SANBI, 2012 and Mbona *et al.* (2015).
Dominant primary terrain morphology	Closed hills, mountains; moderate and high relief	Plain, moderate relief, slightly undulating terrain		
Dominant primary vegetation types	Upland Succulent Karoo	Upland Succulent Karoo, Strandveld Succulent Karoo	NFEPA Rivers (Figure 7)	According to the NFEPA Database, there are numerous tributaries (named and unnamed) associated with the Orange River. The northern portion of the Orange River as well as its tributaries are considered to be in a natrual or good ecological condition (Class A/B), while the southern portion of the Orange River is considered to be in a moderately modified ecological condition(Class C), according to the NFEPA Database (2011). Based on the PES 1999 classification the Orange River and all its tributaries are considered to be in a moderately modified ecological condition (Class C). The Orange River is not classified as a FEPA river. The Orange River is the largest river in South Africa.
Altitude (m a.m.s.l)	100 – 1100	0 – 300		
MAP (mm)	0 – 100	0 – 100		
The coefficient of Variation (% of the MAP)	40 - >40	30 – 40		
Rainfall concentration index	30 - >65	55 – 65		
Rainfall seasonality	Very late summer	Winter		
Mean annual temp. (°C)	18 – 22	16 – 20		
Summer temperature (Feb)	16 - >32	14 – 30		
Winter temperature (July)	4 – 24	>10 – 22		
Median annual simulated runoff (mm)	<5	<5		
National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) [2] (Figure 8).				
According to the NBA (2018): SAIIAE the portion of the Orange River where prospecting pockets 4, 5 and 6 are proposed is classified as a channelled valley bottom wetland. The channelled valley bottom wetland is currently affected by artificial features, roads, mining activities and a degraded river system. As such, the channelled valley bottom wetland is considered to be in a heavily to critically modified ecological condition according to the NBA 2018 Dataset, and is currently not protected (Ecosystem Protection Level (EPL)), and therefore considered critically endangered (Ecosystem Threat Status (ETS)). The portion of the Orange River where Prospecting pockets 1, 2, 3A and 3B are proposed is classified as a river according to the NBA 2018 Dataset, and several dam features are located along the PRAA 1. According to the NBA 2018 Dataset the Orange River is considered to be in a moderately modified ecological condition (Class C), moderately protected (EPL) and therefore least threatened (ETS).				

[2] The NBA (2018) Dataset includes the National Wetland Map 5 Information.

Detail of the farm portions and focus area in terms of the Northern Cape Critical Biodiversity Areas (2016) (Figure 9).	
Protected Area	Prospecting pockets 4,5 and 6 fall within a Protected Area, namely the Richtersveld Cultural and Botanical Landscape and the Richtersveld National Park. Protected Areas are declared or recognised in terms of the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEMPAA). Since protected areas have been secured through legal means and are mainly managed for biodiversity conservation, these areas contribute to meeting biodiversity targets for those biodiversity features that fall within their boundaries. Protected areas have formal long-term protection for important biodiversity and landscape features. Together with CBAs, protected areas ensures that a viable representative sample of all ecosystems types and species can persist. The management objectives of protected areas are that the area must stay in largely natural ecological condition, however management objectives within a protected area must be determined by the Protected Area Management Plan.
Critical Biodiversity Area (CBA) Category 1	Prospecting pockets 1, 2 3A and 3B fall within a Category 1 CBA. CBA1 areas consist of intact, undisturbed ecosystems. A CBA is an area that must remain in good ecological condition in order to meet biodiversity targets for ecosystem types, species of special concern of ecological processes. CBAs can meet biodiversity targets for terrestrial and / or aquatic features. CBA Category 1 are areas that are irreplaceable or near-irreplaceable for meeting biodiversity targets. There are no or very few other options for meeting biodiversity targets for this area. Mining is not a compatible land use within a CBA1. The area identified as a CBA1is mainly attributed to the following: having intact riparian vegetation, the area has natural wetlands and a river (Orange River), the area maintains important landscape structural elements, it is within a National Protected Areas Expansion Strategy (NPAES) protected and/or focus area, and within a World Heritage Site and a protected area buffer.
Detail of the focus area in terms of the Mining and Biodiversity Guidelines (2013) (Figure 10).	
Legally Protected	Prospecting pockets 4, 5 and 6 are located within a legally protected area according to the Mining and Biodiversity Guidelines. This is attributed to the location of the prospecting pockets both within the Orange River and within protected areas (namely the Richtersveld Cultural and Botanical Landscape and the Richtersveld National Park). **Risk for mining:** Mining prohibited. **Implications for mining:** Mining projects cannot commence as mining is legally prohibited. Although mining is prohibited in Protected Areas, it may be allowed in Protected Environments if both the Minister of Mineral Resources and Minister of Environmental Affairs approve the relevant application.
Highest Biodiversity Importance	A portion of prospecting pocket 1 and the entire prospecting pockets 2, 3A and 3B are located within areas considered of Highest Biodiversity Importance. This is likely a buffer generated for the Orange River as protective measures, in accordance with the Mining and Biodiversity Guidelines. **Risk for mining:** Highest risk for mining. **Implications for mining:** Environmental screening, EIAs and their associated specialist studies should focus on confirming the presence and significance of these biodiversity features, and provide a site-specific basis on which to apply the mitigation hierarchy to inform regulatory decision making for mining, water use licences, and environmental authorisations. If they are confirmed, the likelihood of a fatal flaw for new mining projects is very high due to the significance of the biodiversity features in these areas and the associated ecosystem services.
High Biodiversity Importance	The remaining portion of the prospecting pocket 1 is located within area considered to be of High Biodiversity Importance. **Risk for mining:** High risk to mining **Implications for mining:** An environmental impact assessment should include an assessment of optimum, sustainable land use for a particular area and will determine the significance of the impact on biodiversity. Mining options may be limited in these areas, and red flags for mining projects are possible. Authorisations may set limits and specify biodiversity offsets that would be written into licence agreements and/or authorisations.
National Web Based Environmental Screening Tool (2020)	
The Screening Tool is intended to allow for pre-screening of sensitivities in the landscape to be assessed within the EA process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas.	
Aquatic	No information was provided in the screening assessment.

CBA = Critical Biodiversity Area; DWS = Department of Water and Sanitation; EI = Ecological Importance; EPL = Ecosystem Protection Level; ES = Ecological Sensitivity; ESA = Ecological Support Area; ETS = Ecosystem Threat Status; m.a.m.s.l = Metres Above Mean Sea Level; MAP = Mean Annual Precipitation; NBA = National Biodiversity Assessment; NFEPA = National Freshwater Ecosystem Priority Areas; NPAES = National Protected Areas Expansion Strategy; PES = Present Ecological State; SAIIAE = South African Inventory of Inland Aquatic Ecosystems; WMA = Water Management Area

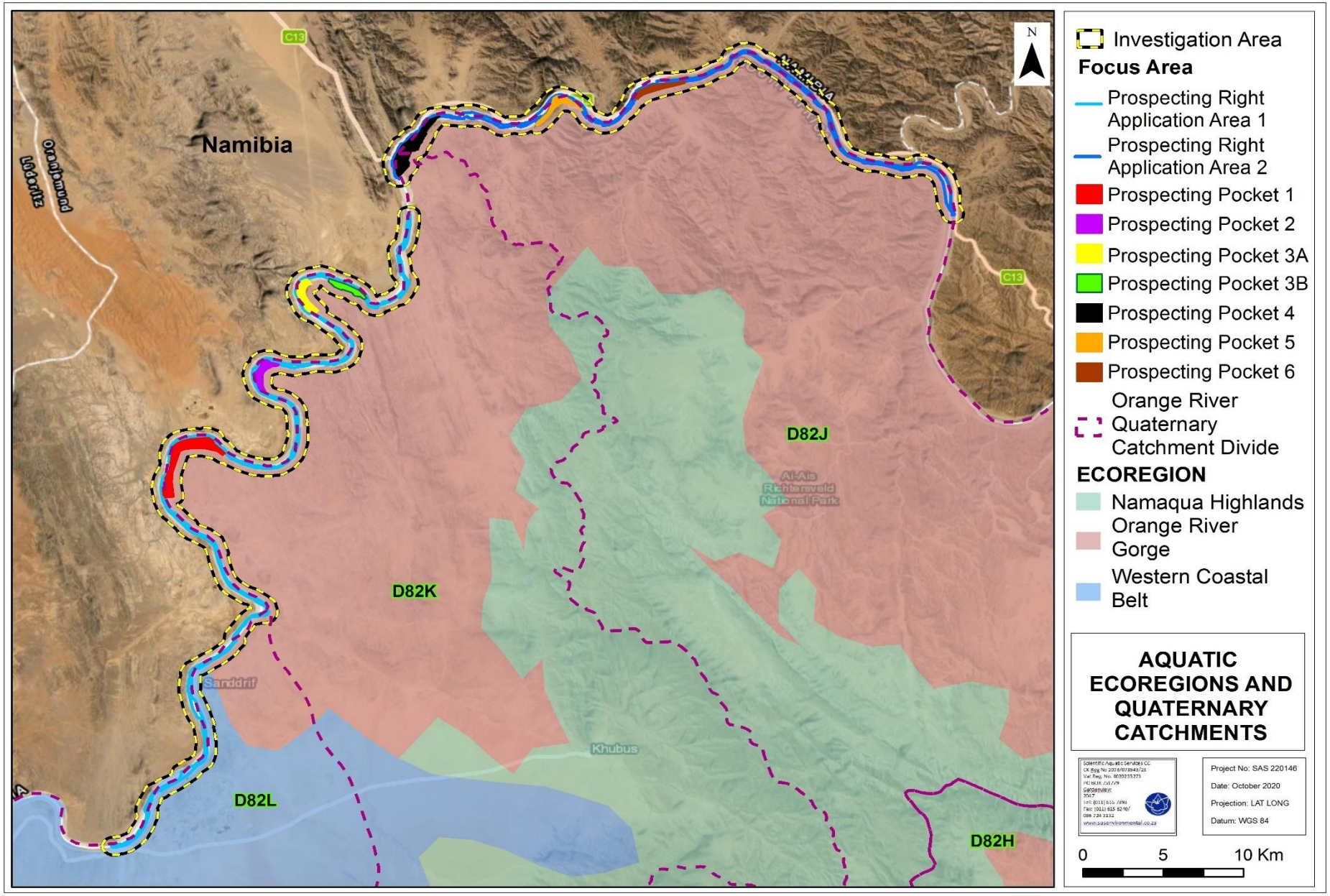

Figure 3: The Quaternary catchments and aquatic ecoregions that pertain to the focus area.

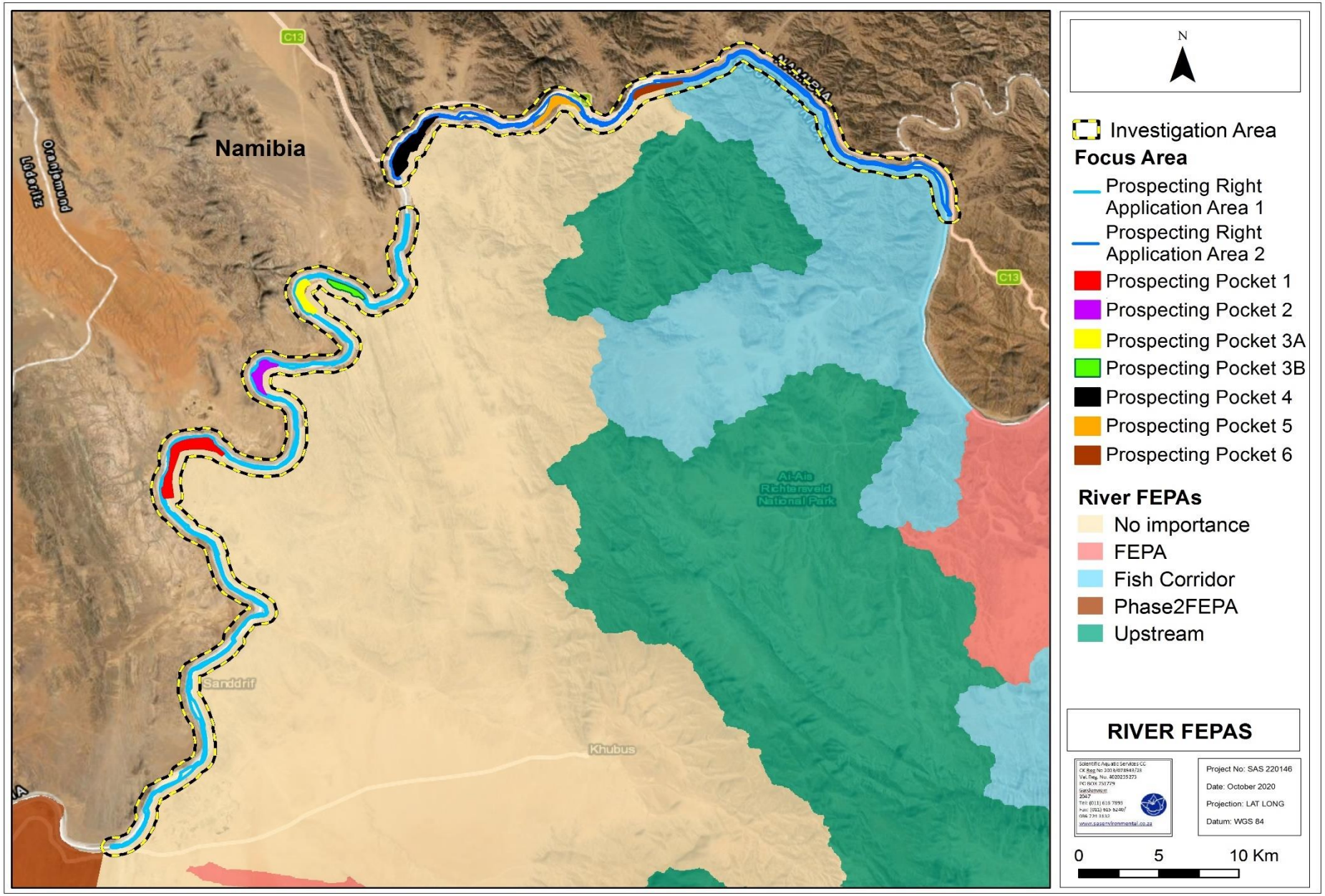

Figure 4: The River FEPAS associated with the focus area.

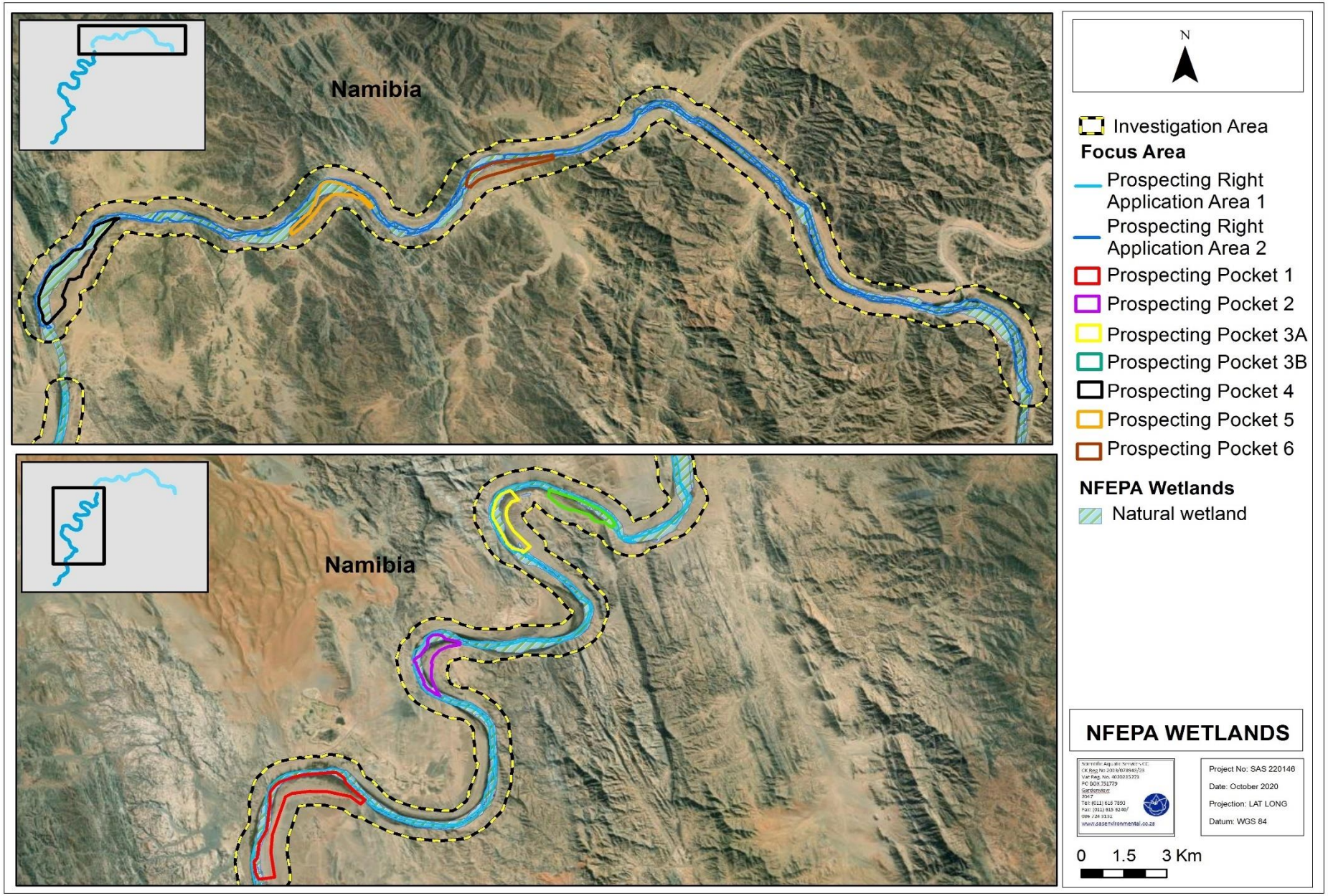

Figure 5: The natural floodlplain wetland associated with the Orange River associated with the focus area according to NFEPA (2011).

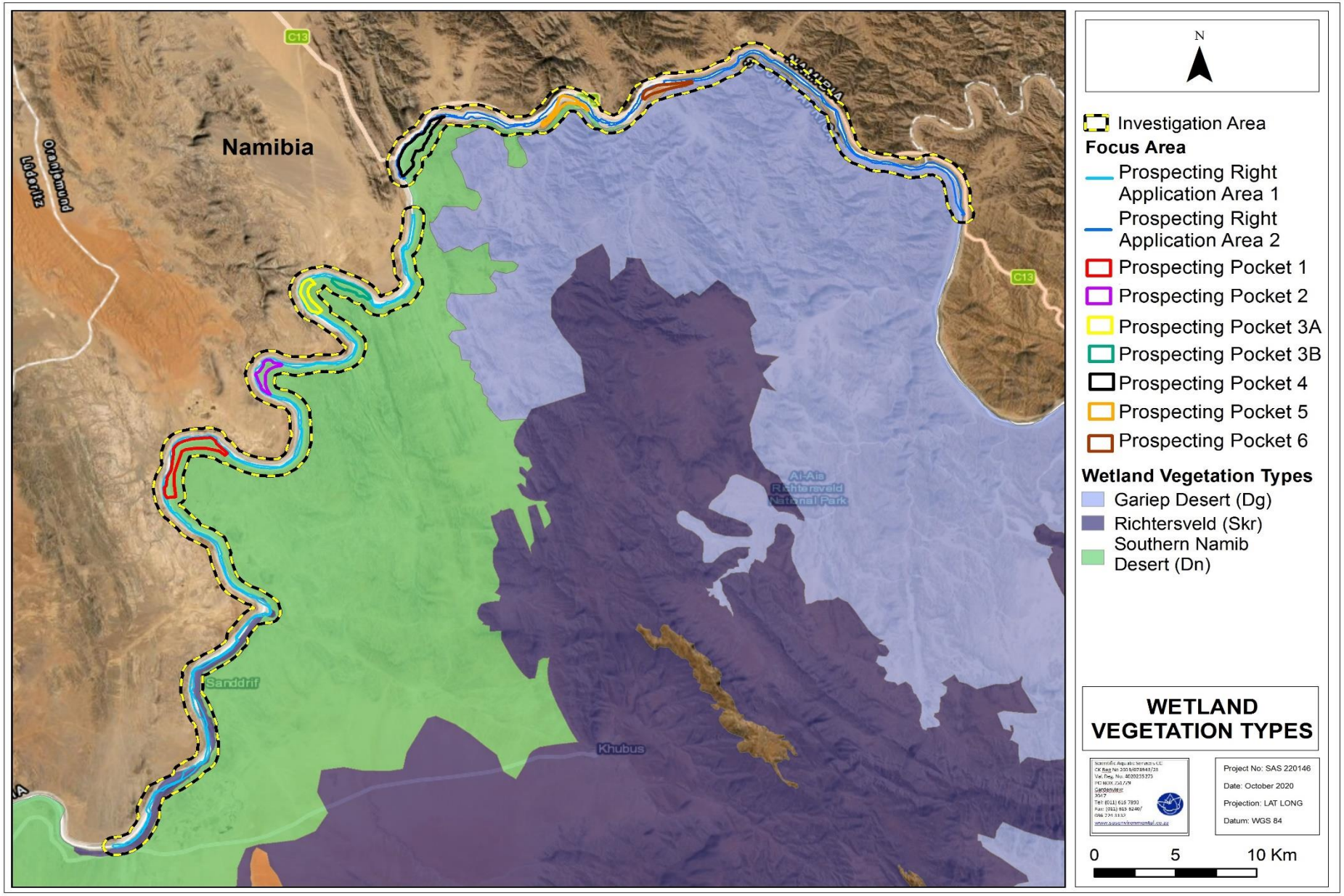

Figure 6: The Wetland Vegetation Types associated with the focus area according to Mbona *et al*. (2015).

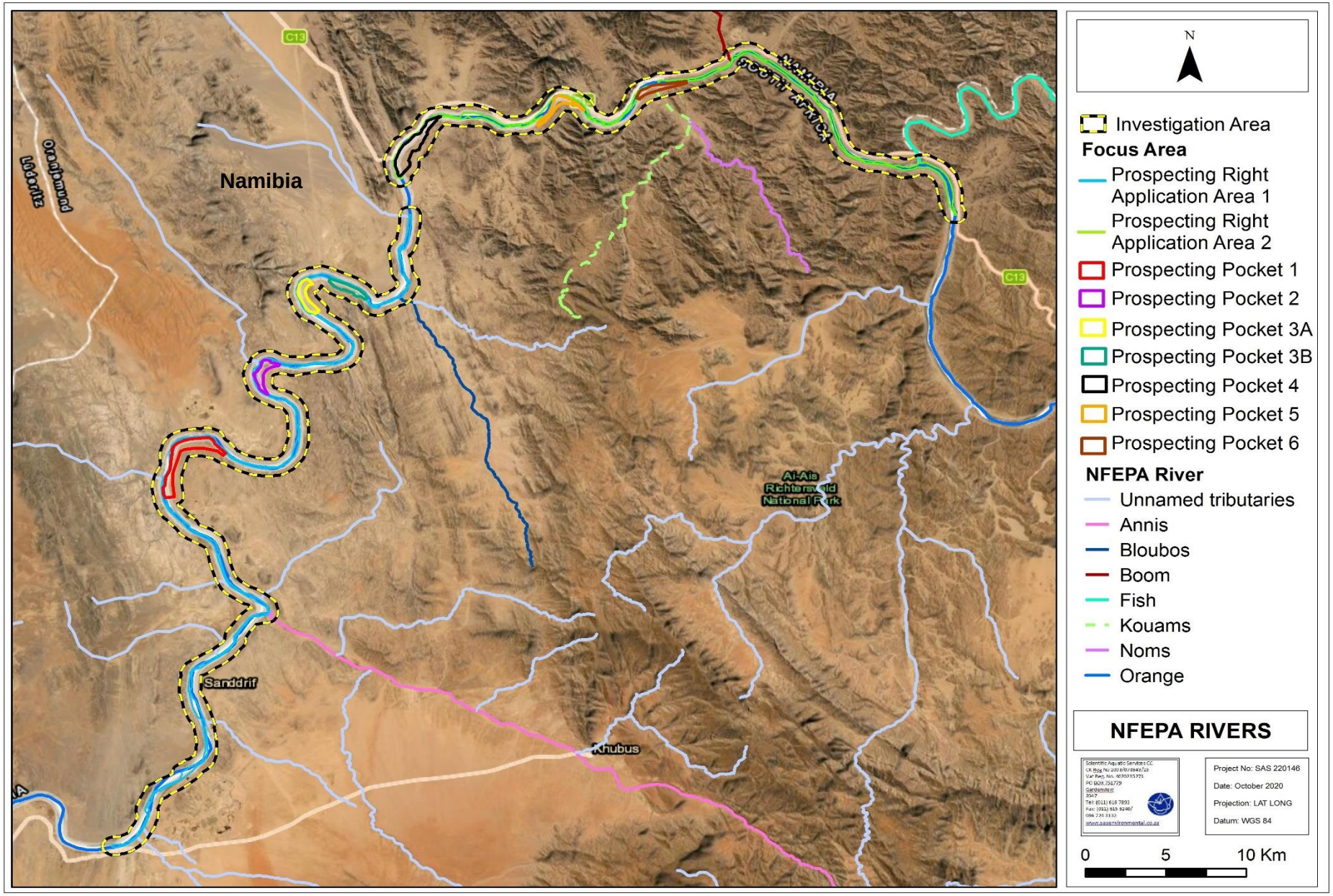

Figure 7: The Orange River and its associated tributaries in relation to the focus area, according to the NFEPA Database (2011).

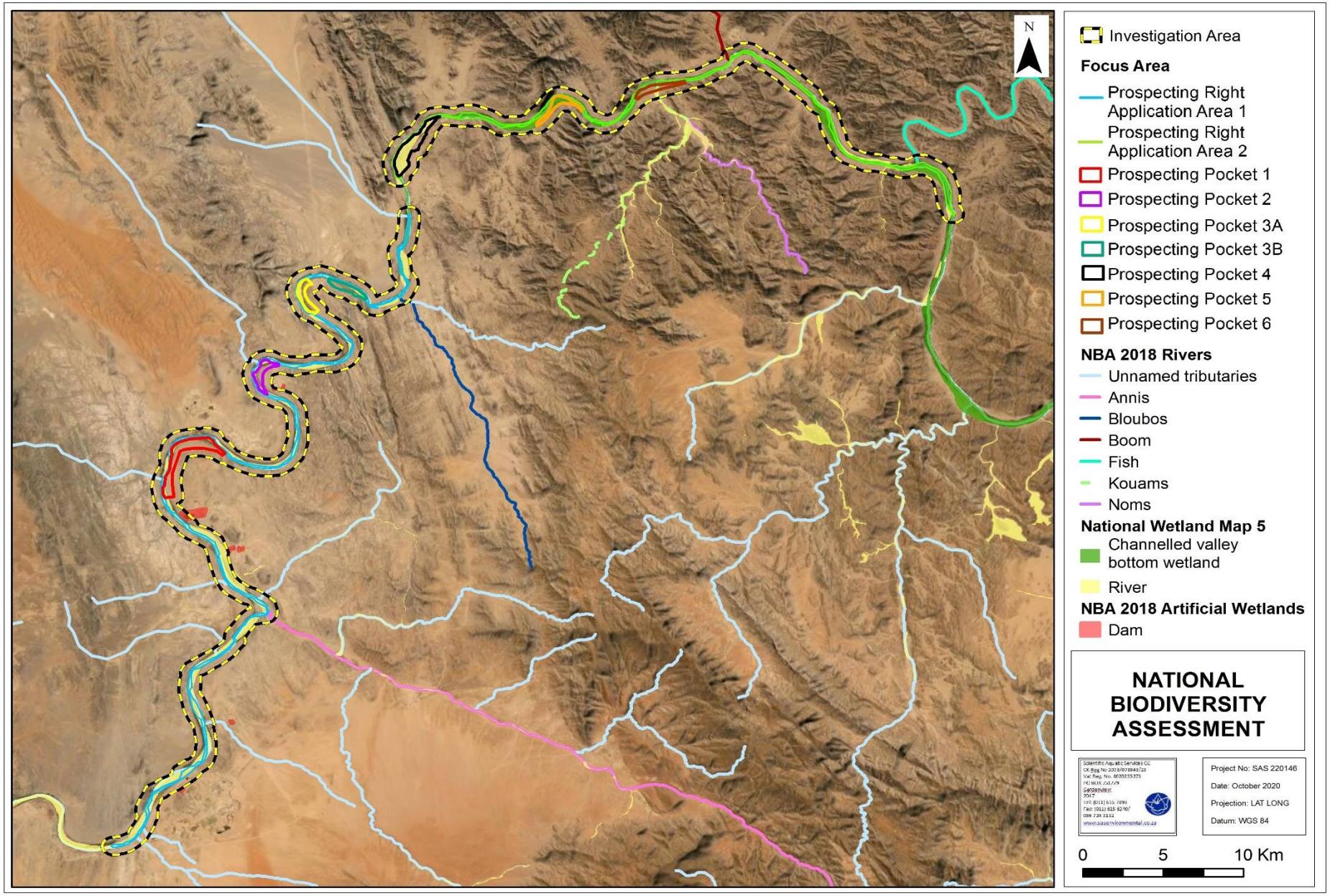

Figure 8: Watercourses including the Orange River and its tributaries associated with the focus area, according to the NBA (2018).

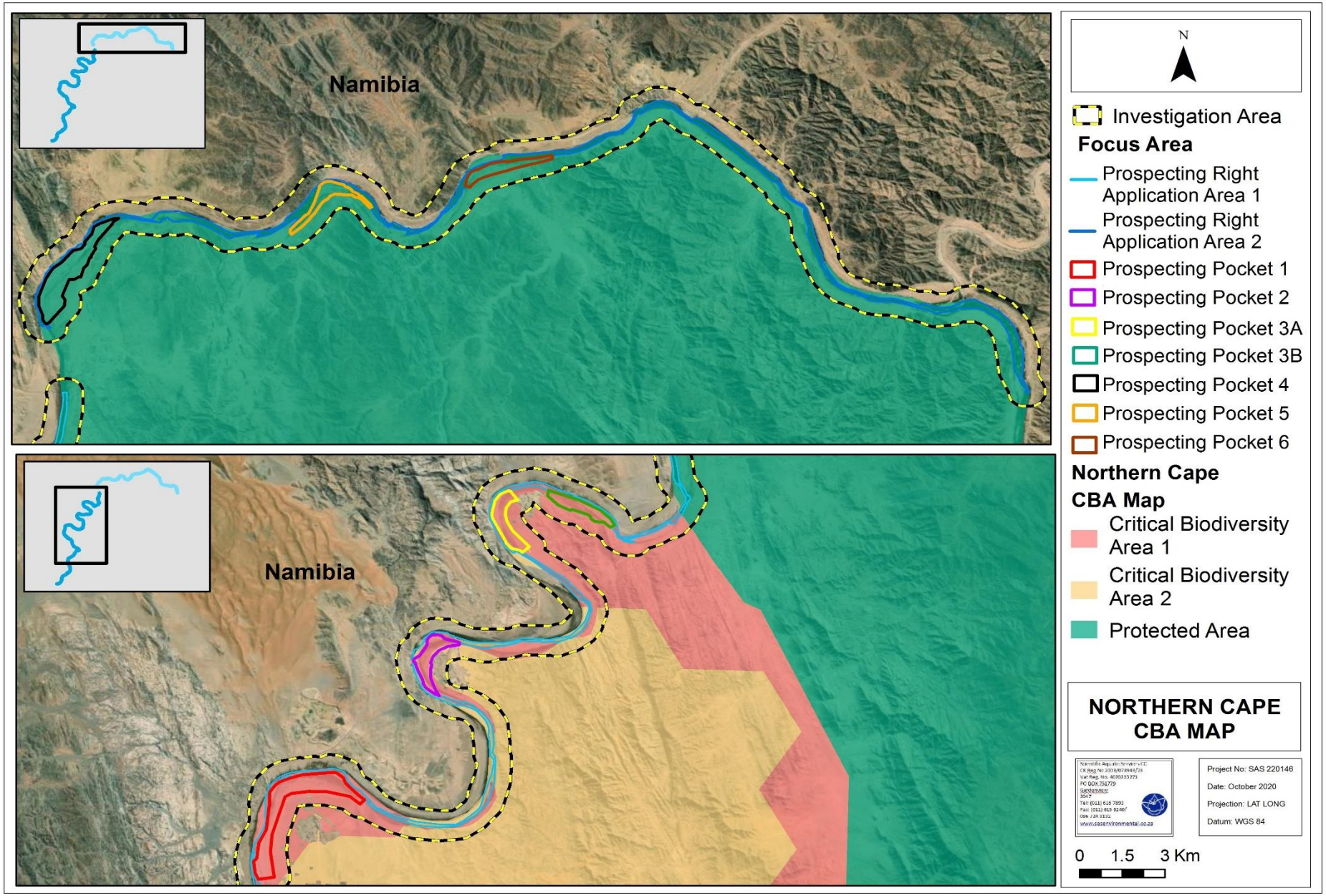

Figure 9: Northern Cape Critical Biodiversity Areas associated with the focus area (NC CBA, 2016).

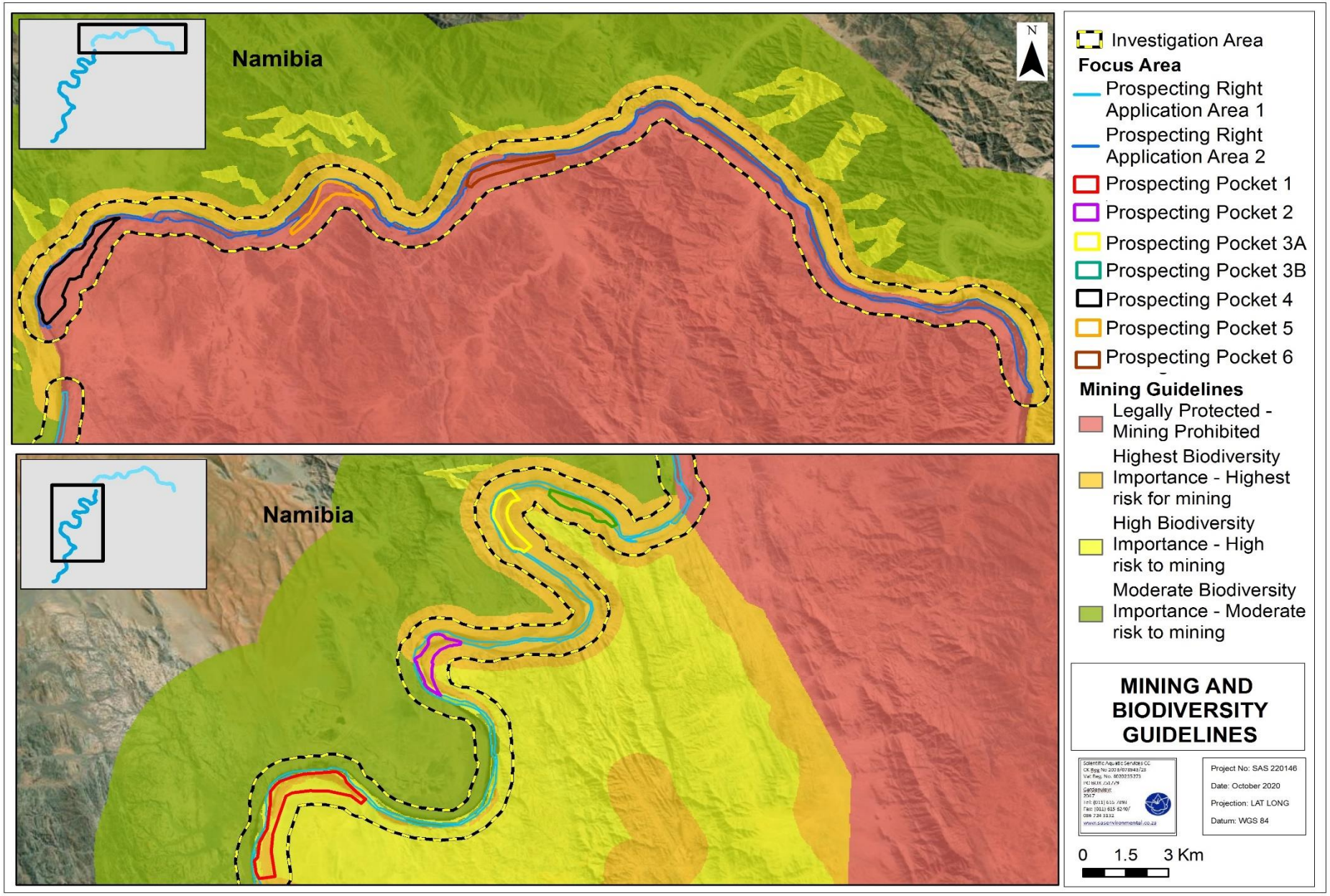

Figure 10: Biodiversity importance of the focus area according to the Mining and Biodiversity Guidelines (2013).

3.2 *Department of Water and Sanitation (DWS) Resource Quality Information Services (RQIS) PES/EIS database*

The PES/EIS database, as developed by the DWS RQIS department, was utilised to obtain additional background information on the focus area. The information from this database is based on information at a sub-quaternary catchment reach (SQR) level. Descriptions of the aquatic ecology is based on information collated by the DWS RQIS department from available sources of reliable information, such as SA RHP sites, Ecological Water Requirements (EWR) sites and Hydro Water Management system (WMS) sites.

In this regard, information for the SQRs of the Orange River associated with the focus area are as follows:

- D82L – 03298
- D82L – 03238
- D82L – 03166
- D82K – 03175
- D82K – 03084
- D82K – 02994
- D82K – 0000
- D82J – 02886
- D82J – 02869

Key information on fish species, macro-invertebrates and background conditions, associated with the above listed SQRs as contained in this database and pertaining to the Present Ecological State (PES), ecological importance and ecological sensitivity for the Orange River, are tabulated in Tables 2 to 4 below.

Table 2: Fish species previously collected from or expected in the various SQR monitoring points associated with the various assessment areas

	D82L – 03298	D82L – 03238	D82L – 03314	D82L – 03166	D82K – 03175	D82K – 03084	D82K – 02994	D82K - 00000	D82J – 02886	D82J – 02869
Austroglanis sclateri									X	X
Namaquacypris hospes	X	X	X	X	X	X	X	X	X	X
Enteromius pallidus	X					X				
Enteromius paludinosus	X	X	X	X	X	X	X	X	X	X
Enteromius trimaculatus	X	X	X	X	X	X	X	X	X	X
Clarias gariepinus	X	X	X	X	X	X	X	X	X	X
Gilchristella aesturia	X	X	X							
Labeobarbus aeneus	X	X	X	X	X	X	X	X	X	X
Labeobarbus kimberleyensis	X	X	X	X	X	X	X	X		X
Labeo capensis	X	X	X	X	X	X	X	X	X	X
Chelon richardsonii	X	X	X	X	X	X	X	X	X	
Mesobola brevianalis	X	X	X	X	X	X	X	X	X	X
Mugil cephalus	X									
Oreochromis mossambicus	X	X	X	X	X	X	X	X	X	X
Pseudocrenilabrus philander	X	X	X	X	X	X	X	X	X	X
Tilapia sparrmanii	X	X	X	X	X	X	X	X	X	X

Table 3: Macro-invertebrates previously collected from or expected at the various SQR monitoring points associated with the various assessment areas.

	D82L – 03298	D82L – 03238	D82L – 03314	D82L – 03166	D82K – 03175	D82K – 03084	D82K – 02994	D82K - 00000	D82J – 02886	D82J – 02869
Aeshnidae	X	X	X	X	X	X	X	X	X	X
Ancylidae	X	X	X	X	X	X	X	X	X	X
Atyidae	X	X	X	X	X	X	X	X	X	X
Baetidae > 2 sp	X	X	X	X	X	X	X	X	X	X
Belostomatidae	X	X	X	X	X	X	X	X	X	X
Bulininae	X	X	X	X	X	X	X	X	X	X
Caenidae	X	X	X	X	X	X	X	X	X	X
Ceratopogonidae	X	X	X	X	X	X	X	X	X	X

	D82L – 03298	D82L – 03238	D82L – 03314	D82L – 03166	D82K – 03175	D82K – 03084	D82K – 02994	D82K - 00000	D82J – 02886	D82J – 02869
Chironomidae	X	X	X	X	X	X	X	X	X	X
Chlorocyphidae	X	X	X	X	X	X	X	X	X	X
Coenagrionidae	X	X	X	X	X	X	X	X	X	X
Corbiculidae	X	X	X	X	X	X	X	X	X	X
Corixidae	X	X	X	X	X	X	X	X	X	X
Crambidae (Pyralidae)									X	X
Culicidae	X	X	X	X	X	X	X	X	X	X
Dytiscidae	X	X	X	X	X	X	X	X	X	X
Ecnomidae							X	X	X	X
Elmidae/Dryopidae							X	X	X	X
Gerridae	X	X	X	X	X	X	X	X	X	X
Gomphidae	X	X	X	X	X	X	X	X	X	X
Gyrinidae	X	X	X	X	X	X	X	X	X	X
Heptageniidae							X	X	X	X
Hirudinea	X	X	X	X	X	X	X	X	X	X
Hydracarina	X	X	X	X	X	X	X	X	X	X
Hydraenidae							X	X		
Hydrometridae	X	X	X	X	X	X	X	X	X	X
Hydrophilidae	X	X	X	X	X	X	X	X	X	X
Hydropsychidae > 2 sp							X	X	X	X
Hydroptilidae							X	X	X	X
Leptoceridae							X	X	X	X
Leptophlebiidae							X	X	X	X
Libellulidae							X	X	X	X
Lymnaeidae	X	X	X	X	X	X	X	X	X	X
Muscidae	X	X	X	X	X	X	X	X	X	X
Naucoridae	X	X	X	X	X	X	X	X	X	X
Nepidae	X	X	X	X	X	X	X	X	X	X
Notonectidae	X	X	X	X	X	X	X	X	X	X
Oligochaeta	X	X	X	X	X	X	X	X	X	X
Perlidae							X	X	X	X
Physidae	X	X	X	X	X	X	X	X	X	X
Planorbinae							X	X	X	X
Pleidae	X	X	X	X	X	X	X	X	X	X
Porifera							X	X	X	X
Potamonautidae	X	X	X	X	X	X	X	X	X	X
Simuliidae	X	X	X	X	X	X	X	X	X	X
Sphaeriidae	X	X	X	X	X	X	X	X	X	X

	D82L – 03298	D82L – 03238	D82L – 03314	D82L – 03166	D82K – 03175	D82K – 03084	D82K – 02994	D82K - 00000	D82J – 02886	D82J – 02869
Synlestidae/Chlorolestidae									X	X
Tabanidae	X	X	X	X	X	X	X	X	X	X
Tipulidae	X	X	X	X	X	X	X	X	X	X
Tricorythidae							X	X	X	X
Turbellaria							X	X	X	X
Unionidae	X	X	X	X	X	X	X	X	X	X
Veliidae/Mesoveliidae	X	X	X	X	X	X	X	X	X	X

Table 4: Summary of the ecological status of the sub-quaternary catchment reaches (SQRs) associated with the focus area based on the DWS RQS PES/EIS database (2014)

	D82L – 03298	D82L – 03238	D82L – 03314	D82L – 03166	D82K – 03175	D82K – 03084	D82K – 02994	D82K - 00000	D82J – 02886	D82J – 02869
Synopsis										
PES Category Median	Moderately modified (Class C)	Moderately modified (Class C)	Moderately modified (Class C)	Moderately modified (Class C)	Largely Natural (Class B)	Moderately modified (Class C)	Largely Natural (Class B)	Largely Natural (Class B)	Moderately modified (Class C)	Moderately modified (Class C)
Mean EI class	High	High	High	High	High	High	High	High	High	High
Mean ES class	High	High	High	High	High	High	High	High	High	High
Length	29.00	9.00	0.60	13.72	1.53	38.00	18.00	6.60	24.00	18.00
Stream order	1	7	7	7	7	7	7	7	7	7
Default EC[4]	B (High)	B (High)	B (High)	B (High)	B (High)	B (High)	B (High)	B (High)	B (High)	B (High)
PES Details										
Instream habitat continuity MOD	Moderate	Small	Small	Small	Small	Small	Small	Small	Small	Small
RIP/wetland zone continuity MOD	Moderate	Small	Small	Moderate	Small	Small	Small	Small	Small	Small
Potential instream habitat MOD activities	Small	Small	Small	Small	Small	Small	Small	Small	Small	Small
Riparian/wetland zone MOD	Moderate	Moderate	Moderate	Moderate	Small	Moderate	Small	Small	Moderate	Moderate
Potential flow MOD activities	Serious	Serious	Serious	Serious	Serious	Serious	Serious	Serious	Serious	Serious
Potential physico-chemical MOD activities	Large	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
EI Details										
Fish spp/SQ	15.00	13.00	13.00	12.00	12.00	13.00	12.00	12.00	13.00	12.00
Fish average confidence	5.00	1.00	1.00	1.00	3.33	4.08	2.67	1.00	4.69	5.00
Fish representivity per secondary class	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High
Fish rarity per secondary class	Very High	Very High	Very High	Very High	High	Very High	High	High	High	Low
Invertebrate taxa/SQ	37.00	37.00	37.00	37.00	37.00	37.00	51.00	51.00	52.00	52.00

	D82L – 03298	D82L – 03238	D82L – 03314	D82L – 03166	D82K – 03175	D82K – 03084	D82K – 02994	D82K - 00000	D82J – 02886	D82J – 02869
Invertebrate average confidence	2.89	2.89	2.89	2.89	2.89	2.89	2.92	4.02	4.19	4.19
Invertebrate representivity per secondary class	High	High	High	High	High	High	Very High	Very High	Very High	Very High
Invertebrate rarity per secondary class	High	High	High	High	High	High	High	High	Very High	Very High
EI importance: riparian-wetland-instream vertebrates (excluding fish) rating	Very High	High	High	High	Low	High	High	High	High	High
Habitat diversity class	Moderate	NA	NA	NA	Very Low	NA	NA	NA	NA	NA
Habitat size (length) class	Low	Very Low	Very Low	Very Low	Very Low	Moderate	Very High	Very Low	Low	Low
Instream migration link class	High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High
Riparian-wetland zone migration link	High	Very High	Very High	High	Very High	Very High	Very High	Very High	Very High	Very High
Riparian-wetland zone habitat integrity class	High	High	High	High	Very High	High	Very High	Very High	High	High
Instream habitat integrity class	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High
Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500m	Very High	Very High	Very High	Moderate	Very High	Very High	Very High	High	Moderate	Very High
Riparian-wetland natural vegetation rating based on expert rating	High	Moderate	High	Moderate	Moderate	Moderate	Moderate	Moderate	High	High
ES Details										
Fish physical-chemical sensitivity description	High	High	High	High	High	High	High	High	High	High
Fish no-flow sensitivity	High	Very High	High	High	High	High	High	High	High	High
Invertebrates physical-chemical sensitivity description	Very High	High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High
Invertebrates velocity sensitivity	High	High	High	High	High	High	Very High	Very High	Very High	Very High
Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes description	High	High	High	High	High	High	High	High	High	High
Stream size sensitivity to modified flow/water level changes description	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Riparian-wetland vegetation intolerance to water level changes description	High	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate

[1] PES = Present Ecological State; confirmed in database that assessments were performed by expert assessors;
[2] EI = Ecological Importance;
[3] ES = Ecological Sensitivity
[4] EC = Ecological Category; default based on median PES and highest of EI or ES means.

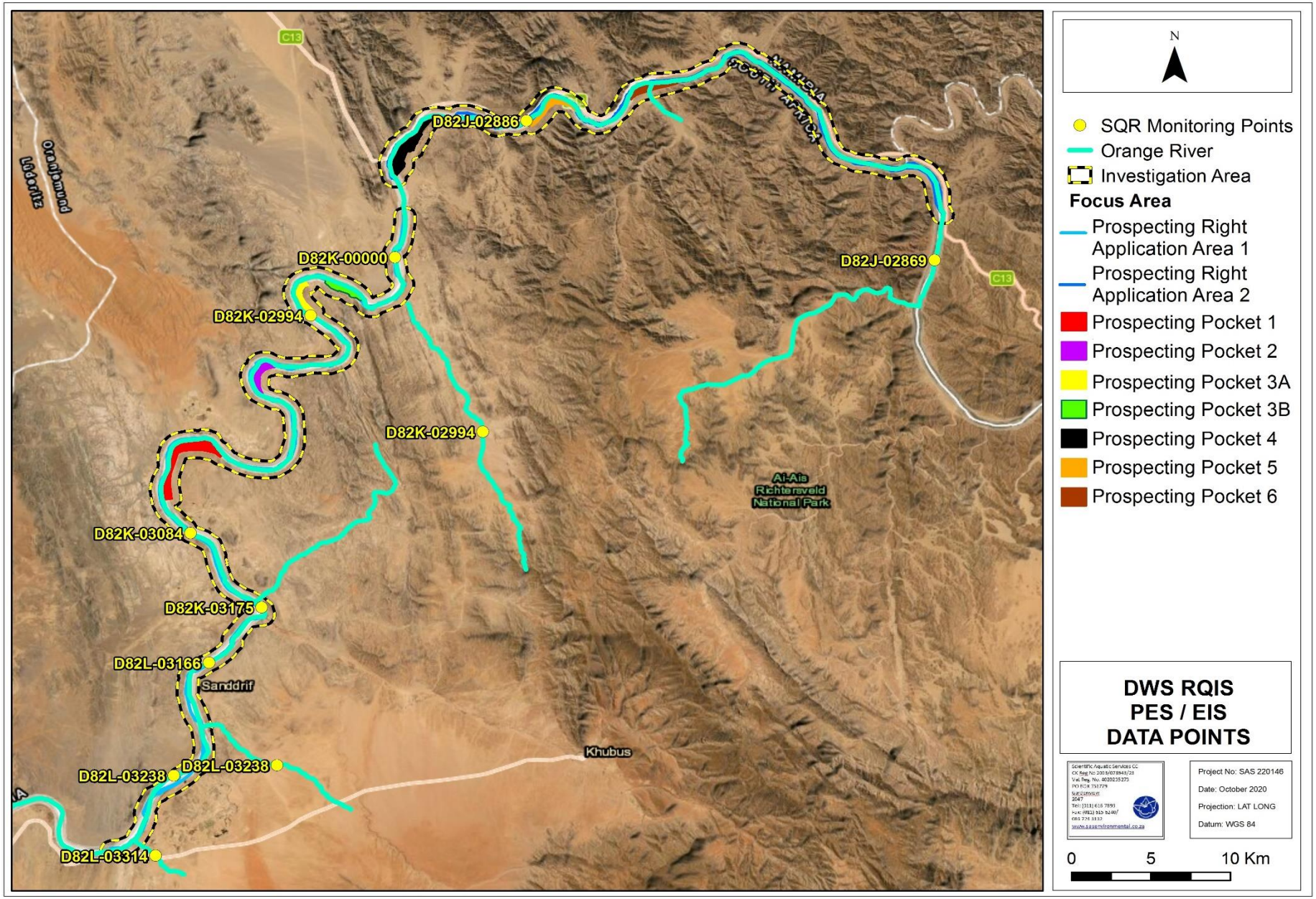

Figure 11: Relevant Sub-Quaternary Catchment Reaches (SQRs) of the Orange River associated with the focus area.

3.3 *Watercourse Delineation and Sensitivity Mapping*

The Orange River with its associated riparian habitat and alluvial deposits as well as the tributaries of the Orange River were delineated using desktop methods with the use of aerial photographs, digital satellite imagery and topographical maps. The delineations as presented in this report are regarded as a best estimate of the watercourse boundaries based on digital signatures.

The Orange River is identified as an alluvial river channel, which are self-formed features, meaning that they are shaped by the magnitude and frequency of the floods that they experience, and the ability of these floods to erode, deposit, and transport sediment. Alluvial channels are, therefore, formed in material that is able to move during moderate floods. This indicates that the bed and banks of an alluvial river channel are characteristically made up of unconsolidated mobile sediments such as silt, sand or gravel or cobbles and small boulders. Alluvial river channels tend to erode their banks and deposit the eroded material on bars and on their floodplains (Ollis *et al.*, 2013).

Based on digital satellite imagery it is evident that various anthropogenic activities have occurred along the Orange River, such as; historic sand and diamond mining on both sides of the river, establishment of small settlements such as the Drifsand settlement, and a formalised road within 32m of the Orange River on the Namibian side. The settlements were likely established because of the mining activities along the river. The settlements may have become reliant on ecoservices provided by the Orange River. Based on the above activities it is evident that the Orange River has undergone varying degrees of disturbance, as such the boundary of the riparian habitat may differ slightly from the delineated boundary that will be undertaken during the field assessment during the EIA Phase. According to the NBA 2018 Dataset numerous dams along the Orange River were identified. Upon further investigation of digital satellite imagery, these dams are quarries from historic mining activities. The delineations of the Orange River and its associated riparian habitat and floodplain will be refined during the field assessment in the EIA Phase of the project.

In terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) any activities falling within 32 m of the delineated boundary will trigger a listed activity. Any activities proposed within the watercourse and the associated 100 m GN 509 Zone of regulation (ZOR), including rehabilitation, must be authorised by the DWS in terms of Section 21 (c) & (i) of the National Water Act, 1998 (Act No. 36 of 1998). In addition, according to GN 704 of the National Water Act, 1998 (Act No. 36 of 1998), the activity footprint must fall outside of the 1:100 year flood line of the watercourse or 100 m from the edge of the watercourse, whichever distance is the greatest. Should this not be feasible, the proponent could undergo

a Water Use License Application Process to attempt to obtain approval from the DWS in terms of Section 21 c and i of the National water Act. In addition, exemption from the requyirements in terms of Regulation GN704 promulgated in 1999 will be required.

The 100 m and 32 m ZOR around the watercourses are indicated in Figure 11. It is considered essential that the 1 in 100 year floodline be determined for this reach of the Orange River to verify the regulated zone of the watercourse.

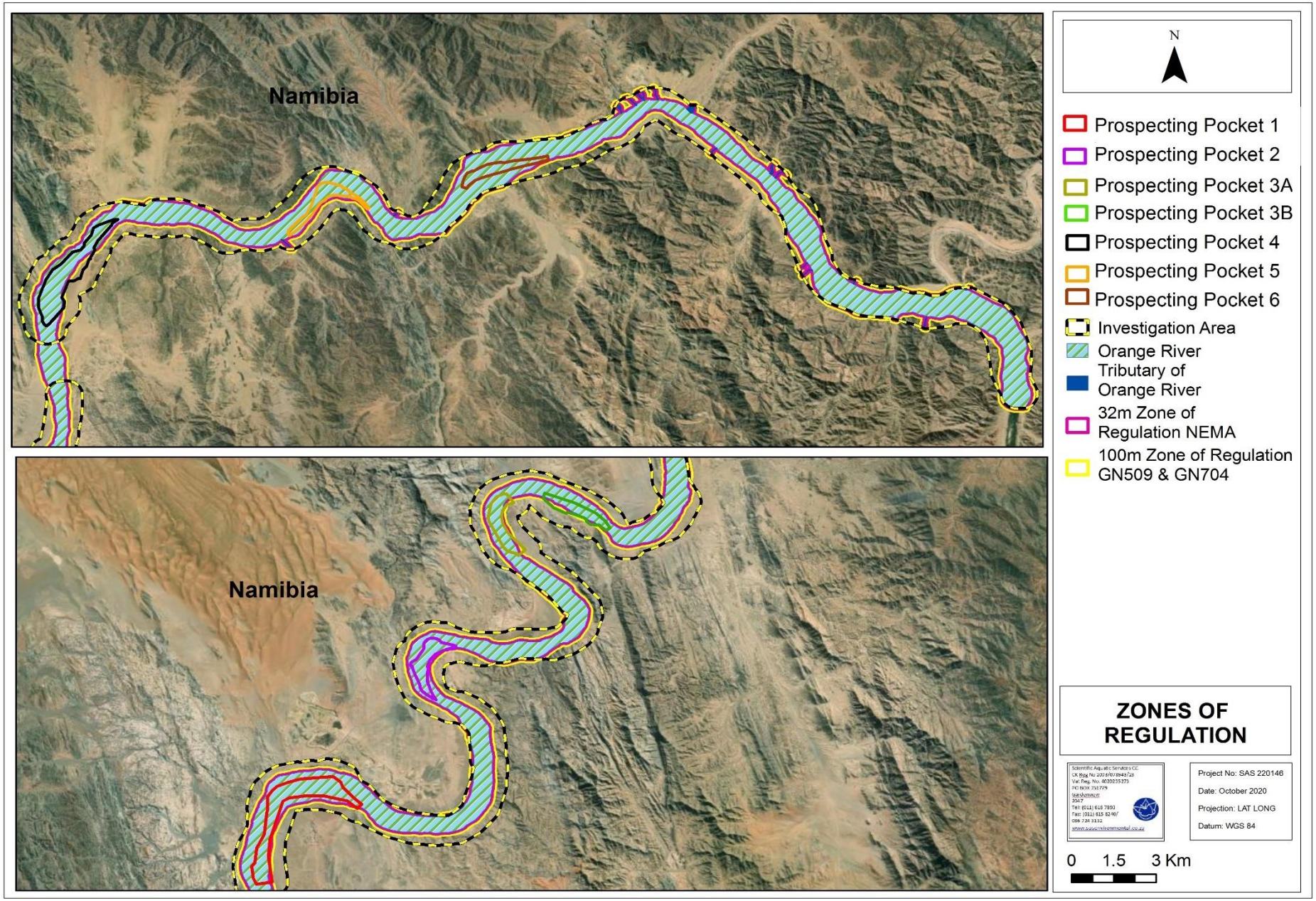

Figure 12: Conceptual watercourse delineation and associated Zones of Regulation (ZOR) associated with the prospecting pockets.

4 POTENTIAL IMPACTS ASSOCIATED WITH THE PROPOSED PROSPECTING AND BULK SAMPLING ACTIVITIES

This section of the scoping report aims to provide a brief summary of the most likely impacts that the proposed prospecting and bulk sampling activities may have on the Orange River.

Since the proposed prospecting and bulk sampling activities are taking place directly adjacent to and within the delineated boundary of the Orange River, the potential impacts on the Orange River are significant.

The following points provide a list of potential impacts that the proposed prospecting and bulk sampling activities will have on the Orange River:

- The prospecting pockets 4,5 and 6 are situated within the Richtersveld National Park, which is a mountainous desert which has the highest diversity of succulent plants in the world (4 849 species, of which 1 940 are endemic), as well as coastal mists that recharge the dry landscape. The area also plays host to truly indigenous cultures. The Richtersveld National Park has a significantly high ecotourism aspect including but not limited to indigenous culture, rich biodiversity, river rafting, the Fish River Canyon hike, sport fishing along the Orange River, birdwatching and desert living. As such the proposed prospecting and bulk sampling activities have the potential to have a significant impact on the ecotourism of the area. Furthermore, the Richtersveld National Park was declared a UNESCO World Heritage Site in 2007;
- The proposed prospecting and bulk sampling activities are located approximately 30 km north of the estuary known as the Orange River Mouth RAMSAR Site. It is a transboundary area of extensive saltmarshes, freshwater lagoons and marshes, sand banks, and reedbeds shared by South Africa and Namibia. The Orange River mouth is important for resident birds and staging locally migrant waterbirds. The upper Orange River serves as a domestic water source and is experiencing increasing demand. This could severely restrict the amount of water reaching the site. Following the collapse of the saltmarsh component of the estuary, the site was placed on the Montreux Record in 1995. This record is a register of wetland sites on the List of Ramsar wetlands of international importance where changes in ecological character have occurred, are occurring, or are likely to occur as a result of technological developments, pollution or other human interference. The rapid degradation was the result of adjacent diamond mining activities (Alexander Bay) and flow regulation of the

Orange River as a result of dam construction for supply of water for domestic, industrial and agricultural purposes. The Orange River Mouth is regarded as the second most important estuary in South Africa in terms of conservation importance after the Knysna Estuary. In Namibia it represents one of three globally important coastal wetlands (the others being Walvis Bay lagoon and the Kunene River mouth). It supports several fish and bird species that are listed in the Namibian, South African or international red data books. Development of further dams and diversion of flow in the headwaters of the Orange River are likely to further reduce water availability in the Orange River Mouth in future. Construction of the proposed Neckartal dam in the lower Fish River in Namibia will further compound this situation since the Fish River is currently the main source of floods at the Orange River Mouth.

- The proposed prospecting and bulk sampling activities have the potential to affect the Orange River. Key risks include:
    - The creation and utilisation of temporary tracks to the prospecting pockets especially when the activities move from one prospecting pockets to the next, leading to soil compaction, damage and/or removal of vegetation and altered runoff patterns. Vegetation clearing for the site establishment of the bulk sampling and prospecting activities resulting in the exposure of soils, leading to increased runoff and erosion, and thus increased sedimentation and changes to the geomorphological processes and sediment balance;
    - Impacts on water clarity and suspended solids;
    - Blanketing of benthos;
    - Impacts on riparian vegetation and associated habitat for fauna;
    - Salinization of the system and other impacts on water quality including:
        - Soil and surface water contamination from oils and hydrocarbons;
        - This will affect the ecoservice provision of the Orange River to the settlements downstream of the proposed activities and potentially impact the downstream estuary;
    - Changes to the quantity, pattern, flow and timing of water in the landscape;
    - Impacts on instream habitat and migratory connectivity both in the riparian zone and in the instream environment;
    - Impacts on aquatic biota and community structure including:
        - Temporary instream diversions will alter aquatic habitats for aquatic macro-invertebrates and fish, and will have an impact on flow dependant species;

- Increased sedimentation within the Orange River will affect the habitat integrity and aquatic biota. This is particularly significant in the case of the Orange River since the biota of this system is particularly reliant on clear fast flowing water flowing over a rocky and or gravel substrate, clear of fine sediment for foraging, breeding and cover. Furthermore, the fish community of the systems are reliant on the availability of deeper refugia which can become silted up if the catchment is excessively disturbed and not appropriately managed.
- *Namaquacypris hospes* is known only from the section of the Orange River below the Augrabies Falls, it prefers rocky and cobble habitat and the mobilisation of sediment from the proposed prospecting and bulk sampling activities will result in habitat smothering and have a significant impact on this species as well as the *Labeo* sp. (Mudfish) and *Labeobarbus* spp. (Yellowfishes) from within the river that also have this habitat preference;

- Gauging weirs within the area are vital due to the Orange River being a shared resource between Namibia and South Africa. South Africa has an international obligation to allow a certain amount of water to pass for Namibian users. It is therefore essential that measurement of the water is vital to know that South Africa is fulfilling those obligations. Sedimentation will impact the functioning of the weirs and affect their accuracy. Furthermore, sedimentation will also affect the estuary function at Alexander Bay, resulting in it possibly closing if there is too much sediment deposition within the estuary;
- Alien species proliferation due to edge effects caused by vegetation clearing for roads and prospecting activities;
- Soil and surface water contamination from oils and hydrocarbons;
- Contamination of soil and surface water and the removal of vegetation will lead to the inability to support biodiversity;
- Site decommissioning and rehabilitation of the trenched areas within the Orange River, potentially leading to increased sedimentation by backfill material, soil and surface water contamination from hydrocarbons;

Provided that prospecting and bulk sampling activities do not to take place within the active channel of the Orange River and are undertaken in the low flow season with all rehabilitation completed before the rising of the river the risk can be significantly reduced. These mitigatory measures combined with other design management mechanisms and with well managed construction and implementation practices could potentially lead to significantly reduced

impacts. Even if all mitigatory measures are implemented the risk the project poses still remains high.

5 EIA PHASE – PLAN OF STUDY

Specific outcomes in terms of the EIA Phase report are presented in the points below:

Aquatic assessment

- A field assessment of the focus area. Two field assessments of three and 14 days each (including travel time) will be undertaken;
- Aquatic field data collection will include:
  - Accurate watercourse delineations augmented with field verified mapping using hand held GPS devices;
  - A visual assessment and photographic record of conditions at the time of sampling, including an assessment of existing and historical impacts;
  - On-site testing of biota specific water quality parameters including pH, electrical conductivity (EC), dissolved oxygen concentration (DO), clarity and temperature;
  - Habitat suitability for aquatic macro-invertebrates will be determined using the Invertebrate Habitat Assessment System (IHAS) method according to the protocol of McMillan (1998);
  - The general habitat integrity will be discussed based on the application of the Index of Habitat Integrity (IHI) (Kleynhans *et al.* 2008) as well as the Riparian Vegetation Response Assessment Index (VEGRAI) (Kleynhans *et al*., 2007);
  - The integrity of the aquatic macro-invertebrate community will be assessed using the South African Scoring System version 5 (SASS5) as defined by Dickens & Graham (2002) as well as the application of the Macro-Invertebrate Response Assessment Index (MIRAI) Ecostatus tool as described by Thirion (2007);
  - The fish community integrity will be assessed based on the Fish Response Assessment Index (FRAI) Ecostatus tool to characterise and define the PES and potential risks to the fish community;
- Ground-truthing of delineation of the outermost edge of the watercourses associated with the focus area and investigation area in accordance with “DWAF120052: A practical field procedure for identification of wetlands and riparian areas”. Aspects such as soil morphological characteristics, vegetation types and wetness were used to delineate the watercourses;
- The watercourse classification assessment will be undertaken according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa.

User Manual: Inland systems (Ollis *et al*., 2013);

- Consideration of the Geomorphological processes sand gathering of data including:
  - Sediment texture profiles;
  - Elevation profiles;
  - Flood data
- The EIS of the watercourses will be determined according to the method described by Rountree & Kotze (2013);
- The PES of the watercourses will be determined according to the resource-directed measures guideline of Macfarlane et al. (2008);
- Allocation of a suitable REC (Recommended Ecological Category) to the watercourses based on the results obtained from the PES and EIS assessments;
- The watercourses will be mapped according to the ecological sensitivity of the watercourses in relation to the focus area. In addition to the watercourse boundaries, the appropriate provincial recommended buffers and legislated regulated areas will be depicted where applicable;
- A detailed baseline wetland and aquatic ecological assessment report will present a synthesis of gathered data; and
- Evaluation of environmental issues and potential impacts (direct, indirect and cumulative impacts and residual risks) identified, including:
  - The nature of the impact;
  - The extent of the impact;
  - Anticipated duration of the impact;
  - Magnitude;
  - Probability of occurrence;
  - The significance of the impact;
  - The status of the impact (positive, negative or neutral);
  - The degree to which the impact can be reversed/cause irreplaceable loss of resources and/or can be mitigated; and
  - Assessment of cumulative Impacts.
- Recommendations on management and mitigation measures (including opportunities and constraints) with regards to the proposed development activities will be presented.

The details of the various methodologies employed, as they pertain to this study, are provided in Appendix C of this report.

6 CONCLUSION

The proposed prospecting and bulk sampling activities include 7 prospecting pockets within two greater Prospecting Right Application Areas (PRAA). The south western area is referred to as PRAA 1 where prospecting pockets 1, 2 3A and 3B are located and PRAA 2, further north and east where the prospecting pockets 4, 5 and 6 are located. The PRAA 1 and PRAA 2 and the associated prospecting pockets are hereafter collectively referred to as the “focus area”.

The prospecting pockets 1 to 5 and a portion of prospecting pocket 6 are located within the section of the Orange River that is considered important in terms of a fish corridor for threatened fish species. The PRAA 1 is classified as being in a natural to good ecological condition (Class A/B), while the PRAA 2 portion of the Orange River is moderately modified (Class C), according to the NFEPA Database (2011). However according to the PES 1999 classification as well as the NBA (2018), the Orange River is considered moderately modified. This is mainly attributed to historic and ongoing anthropogenic activities taking place within close proximity to the Orange River, such as historic and active sand and diamond mining, establishment of settlements and construction of a formal road on the Namibian side of the system. Significant impact from water abstraction form the system is also deemed likely. According to the PES /EIS Dataset (DWS, 2014) the Orange River is host to numerous fish and macro-invertebrate species all of which may potentially be affected should any disturbance occur within the Orange River.

The prospecting pockets 4 to 6 fall within the protected area, Richtersveld Cultural and Botanical Landscape and the Richtersveld National Park, which is a mountainous desert which has the highest diversity of succulent plants in the world. The coastal mists provide moisture to the moisture deficient landscape. Alluvial diamonds and truly indigenous cultures are also key characteristics of the area that need to be considered.

This area has formal long-term protection for important biodiversity and landscape features (NC CBA, 2016 and Mining and Biodiversity Guidelines, 2013). The Richtersveld National Park has a significantly high ecotourism aspect including but not limited to indigenous culture, rich biodiversity, river rafting, Fish River Canyon hike, sport fishing along the Orange River, birdwatching, and desert living. As such the proposed prospecting and bulk sampling activities will have the potential to have a significant impact on the ecotourism of the area.

The prospecting pockets 1 to 3 fall within Category 1 CBAs, wherein mining is not a compatible land-use (Northern Cape CBA, 2016). According to the Mining and Biodiversity Guidelines a portion of the prospecting pocket 1 and the entire extent of prospecting pockets 2, 3A and 3B fall within areas considered of highest biodiversity importance. The remaining portion of the prospecting pockets 1 is located within an area of high biodiversity importance.

The proposed prospecting and bulk sampling activities are located approximately 30 km north of the estuary known as the Orange River Mouth RAMSAR Site. It is a transboundary area of extensive saltmarshes, freshwater lagoons, marshes, sand banks, and reedbeds shared by South Africa and Namibia. The upper Orange River serves as a domestic water source and is experiencing increasing demand. Extensive abstraction from the Orange River for domestic, commercial and industrial purposes could severely restrict the amount of water reaching the site. Following the collapse of the saltmarsh component of the estuary, the site was placed on the Montreux Record in 1995. The rapid degradation was the result of adjacent diamond mining activities (Alexander Bay) and flow regulation of the Orange River as a result of dam construction and water consumption. The Orange River Mouth is regarded as the second most important estuary in South Africa in terms of conservation importance after the Knysna Estuary. In Namibia it represents one of three globally important coastal wetlands. The Orange River mouth supports several fish and bird species that are listed in the Namibian, South African or international red data books. Development of further dams and diversion of flow in the headwaters of the Orange River are likely to further reduce water availability in the Orange River Mouth. The proposed prospecting and bulk sampling activities have the potential to affect the Orange River Mouth and thus the RAMSAR wetland system. Such impact, if at all significant would be regarded as unacceptable.

Namaquacypris hospes, a fish species, is known only from the section of the Orange River below Augrabies Falls, it prefers rocky and cobble habitat. The mobilisation of sediment from the proposed prospecting and bulk sampling activities has the potential to result in habitat smothering and has the potential to have a significant impact on this species as well as the *Labeos* sp (mudfishes). and *Labeobarbus* sp. (yellowfishes) from within the river that also have the same habitat preference.

Based on the outcome of the desktop assessment, a detailed on-site investigation must be undertaken to validate the aquatic sensitivity of the area in the EIA phase. This scope of work is defined in this scoping report to define the freshwater ecological characteristics of the Orange River, including the ecology, drivers, receptors, goods and services to ensure that all

planning of the proposed development is cogently considered and all project plans and designs can adequately consider the characteristics of the system.

Provided that prospecting and bulk sampling activities do not to take place within the active channel of the Orange River and are undertaken in the low flow season with all rehabilitation completed before the rising of the river the risk can be significantly reduced. These mitigatory measures combined with other design management mechanisms and with well managed construction and implementation practices, could potentially lead to significantly reduced impacts. Even if all mitigatory measures are implemented the risk the project poses still remains high.

From the outset it is essential to consider that this system is extremely ecologically important and sensitive and that the proposed prospecting and bulk sampling activities poses a very significant risk to the system. It is thus deemed essential that all aspects of the proposed prospecting and bulk sampling activities are considered in extensive detail and all aspects are exceptionally well planned and executed. It must also be noted from the outset that significant constraints are likely to be placed on the activity to conserve the environment, as a minimum, if the development is authorised to proceed at all.

7 REFERENCES

Chutter, F. M. (1998). Research on the rapid biological assessment of water quality impacts in streams and rivers. Report to the water research commission by Environmentek, CSIR, WRC report No 422/1/98. Pretoria: Government printer.

Dallas, H.F. (2007). River Health Programme: South African Scoring System (SASS) data interpretation guidelines. The Freshwater Consulting Group / Freshwater Research Unit, University of Cape Town

Department of Water Affairs and Forestry (DWAF). South Africa Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999 [Appendix W3].

Department of Water Affairs and Forestry (DWAF). 2005. Final draft: A practical field procedure for identification and delineation of wetlands and Riparian areas.

Department of Water Affairs and Forestry (DWAF). 2008. Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas, prepared by M. Rountree, A. L. Batchelor, J. MacKenzie and D. Hoare. Report no. X. Stream Flow Reduction Activities, Department of Water Affairs and Forestry, Pretoria, South Africa.

Department of Water and Sanitation (DWS). 2014. *A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa.* Secondary: C2 Compiled by RQIS-RDM: Online available: https://www.dwa.gov.za/iwqs/rhp/eco/peseismodel.aspx as retrieved in November 2016

Department of Water Affairs and Forestry (DWAF). (1996). South African water quality guidelines vol. 7, Aquatic ecosystems.

Dickens, C. & Graham, M. (2002). The South African Scoring System (SASS) Version 5. Rapid Bioassessment Method for Rivers. African Journal of Aquatic Science 27: 1-10.

Gerber, A. and Gabriel, M.J.M. (2002). Aquatic Invertebrates of South African Rivers. First Edition. Department of Water Affairs: Pretoria, South Africa.

Kleynhans C.J., Louw M.D., Graham M., 2008. Module G: EcoClassification and EcoStatus determination in River EcoClassification: Index of Habitat Integrity (Section 1, Technical manual) Joint Water Research Commission and Department of Water Affairs and Forestry report. WRC Report No. TT 377-08.

Kleynhans C.J., 1999. *A procedure for the determination of the ecological reserve for the purposes of the national water balance model for South African River*. Institute of Water Quality Studies, Department of Water Affairs & Forestry, Pretoria.

Kleynhans C.J., Thirion C. and Moolman J. 2005. A Level 1 Ecoregion Classification System for South Africa, Lesotho and Swaziland. Report No. N/0000/00/REQ0104. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria

Kleynhans CJ, Louw MD, Graham M, 2008. Module G: EcoClassification and EcoStatus determination in River EcoClassification: Index of Habitat Integrity (Section 1, Technical manual) Joint Water Research Commission and Department of Water Affairs and Forestry report. WRC Report No. TT 377-08

Kotze D.C., Marneweck G.C., Batchelor, A.L., Lindley D.S. and Collins N.B. 2009*. WET-EcoServices: A technique for rapidly assessing ecosystem services supplied by wetlands.* WRC Report No TT 339/08, Water Research Commission, Pretoria.

Kleynhans CJ, MacKenzie J, Louw MD. (2007a). Module F: Riparian Vegetation Response Assessment Index in River EcoClassification: Manual for EcoStatus Determination (version 2). Joint Water Research Commission and Department of Water Affairs and Forestry report. WRC Report No. TT 333/08.

Kleynhans CJ, Louw MD, Moolman J. (2007b). Reference frequency of occurrence of fish species in South Africa. Report produced for the Department of Water Affairs and Forestry (Resource Quality Services) and the Water Research Commission.

Kleynhans CJ. (2007). Module D: Fish Response Assessment Index in River EcoClassification: Manual for EcoStatus Determination (version 2). Joint Water Research Commission and Department of Water Affairs and Forestry report. WRC Report No. TT330/08.

Kleynhans, C.J., Louw, M.D., Graham, M. (2008). Module G: EcoClassification and EcoStatus determination in River EcoClassification: Index of Habitat Integrity (Section 1, Technical

manual). Joint Water Research Commission and Department of Water Affairs and Forestry report. WRC Report No. TT 377-08.

Macfarlane D.M., Kotze D.C., Ellery W.N., Walters D., Koopman V., Goodman P. and Goge C. 2008. WET-Health: A technique for rapidly assessing wetland health. WRC Report No. TT 340/08. Water Research Commission, Pretoria.

McMillan, P.H. (1998). An integrated habitat assessment system (IHAS v2) for the rapid biological assessment of rivers and streams. A CSIR research project. Number ENV-P-I 98132 for the water resources management programme. CSIR. ii +44 pp/

National Environmental Management Act (NEMA) (Act No. 107 of 1998)

National Water Act 36 of 1998. Section 21(c) and (i).

Nel, J.L., Driver, A., Strydom W.F., Maherry, A., Petersen, C., Hill, L., Roux, D.J, Nienaber, S., Van Deventer, H., Swartz, E. & Smith-Adao, L.B. 2011. *Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources.* Water Research Commission Report No. TT 500/11, Water Research Commission, Pretoria.

NEMBA. National Environmental Management: Biodiversity Act (No. 10 of 2004).

NFEPA: Driver, A., Nel, J.L., Snaddon, K., Murruy, K., Roux, D.J., Hill, L., Swartz, E.R., Manuel, J. and Funke, N. 2011. Implementation Manual for Freshwater Ecosystem Priority Areas. Water Research Commission. Report No. 1801/1/11. Online available: http://bgis.sanbi.org/nfepa/project.asp

Ollis, D.J., Snaddon, C.D., Job, N.M. & Mbona, N. 2013. Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. South African Biodiversity Institute, Pretoria

Ollis, D.J., Boucher, C., Dallas, H.F. and Esler, K. (2006). Preliminary testing of the integrated habitat assessment system (IHAS) for aquatic macroinvertebrates. Southern Africa Journal of Aquatic Science 31 (1) 1-14.

Skelton, P. H. (2001). A complete guide to freshwater fishes of Southern Africa. Southern Book Publishers (Pty) Ltd., Halfway House. 388pp.

Thirion C. (2007). Module E: Macro-Invertebrate response assessment index (MIRAI). In: River ecoclassification manual for ecostatus determination (Version 2). Joint Water Research Commission and Department of Water Affairs and Forestry report.

Thirion, C. A; Mocke, A and Woest, R. (1995). Biological Monitoring of Streams and Rivers using SASS4: A User Manual. Final Report, No. N 000/00/REQ/1195. Institute of Water Quality Studies, Department of Water Affairs and Forestry.

SANBI 2012. Further Development of a Proposed National Wetland Classification System for South Africa. Primary Project Report. Prepared by the Freshwater Consulting Group (FCG) for the South African National Biodiversity Institute (SANBI).

SANBI 2013. The South African National Biodiversity Institute is thanked for the use of data from the Biodiversity Geographical Information System (BGIS).

SANBI 2014. The South African National Biodiversity Institute is thanked for the use of data from the National Herbarium, Pretoria (PRE) Computerised Information System (PRECIS).

Van Deventer, H.; Smith-Adao, L.; Mbona, N.; Petersen, C.; Skowno, A.; Collins, N.B.; Grenfell, M.; Job, N.; Lötter, M.; Ollis, D.; Scherman, P.; Sieben, E.; Snaddon, K. 2018. *South African Inventory of Inland Aquatic Ecosystems. South African National Biodiversity Institute, Pretoria. Report Number: CSIR report number CSIR/NRE/ECOS/IR/2018/0001/A; SANBI report number http://hdl.handle.net/20.500.12143/5847.*

Van Deventer, H., Smith-Adao, L., Collins, N.B., Grenfell, M., Grundling, A., Grundling, P-L., Impson, D., Job, N., Lötter, M., Ollis, D., Petersen, C., Scherman, P., Sieben, E., Snaddon, K., Tererai, F. & Van der Colff, D. 2019. *South African National Biodiversity Assessment 2018: Technical Report. Volume 2b: Inland Aquatic (Freshwater) Realm. CSIR report number CSIR/NRE/ECOS/IR/2019/0004/A. South African National Biodiversity Institute, Pretoria. http://hdl.handle.net/20.500.12143/6230.*

APPENDIX A – TERMS OF USE AND INDEMNITY

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and SAS CC and its staff reserve the right to, at their sole discretion, modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation, should the authors deem this necessary.

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This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

APPENDIX B – LEGISLATION

The Constitution of the Republic of South Africa, 1996	The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996) by way of section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive realisation of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.
The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)	The National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) and the associated EIA Regulations, 2014 (as amended), states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact. Provincial regulations must also be considered.
The National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA)	The objectives of this act are (within the framework of NEMA) to provide for: ➢ The management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity; ➢ The use of indigenous biological resources in a sustainable manner; ➢ The fair and equitable sharing among stakeholders of the benefits arising from bio prospecting involving indigenous biological resources; ➢ To give effect to ratify international agreements relating to biodiversity which are binding to the Republic; ➢ To provide for cooperative governance in biodiversity management and conservation; and ➢ To provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act. This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of the surrounding areas are not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of the benefits arising from indigenous biological resources. Furthermore, a person may not carry out a restricted activity involving either: a) A specimen of a listed threatened or protected species; b) Specimens of an alien species; or c) A specimen of a listed invasive species without a permit.
Government Notice 598 Alien and Invasive Species Regulations (2014), including the Government Notice 864 Alien Invasive Species List as published in the Government Gazette 40166 of 2016, as it relates to the National Environmental Management Biodiversity Act, 2004 (Act No 10 of 2004)	NEMBA is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. This act in terms of alien and invasive species aims to: • Prevent the unauthorised introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur; • Manage and control alien and invasive species, to prevent or minimize harm to the environment and biodiversity; and • Eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats. Alien species are defined, in terms of the NEMBA as: a. A species that is not an indigenous species; or b. An indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention. Categories according to NEMBA (Alien and Invasive Species Regulations, 2017): • **Category 1a:** Invasive species that require compulsory control; • **Category 1b:** Invasive species that require control by means of an invasive species management programme; • **Category 2:** Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread; and • **Category 3:** Ornamentally used plants that may no longer be planted.

The National Water Act 1998 (Act No. 36 of 1998) (NWA)	The NWA recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS). Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) & (i).
Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the NWA	In accordance with Regulation GN509 of 2016, a regulated area of a watercourse for section 21c and 21i of the NWA is defined as: 1. The outer edge of the 1 in 100 year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; 2. In the absence of a determined 1 in 100 year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or 3. A 500 m radius from the delineated boundary (extent) of any wetland or pan. This notice **replaces GN1199** and may be exercised as follows: ➢ Exercise the water use activities in terms of Section 21(c) and (i) of the Act as set out in the table below, subject to the conditions of this authorisation; ➢ Use water in terms of section 21(c) or (i) of the Act if it has a low risk class as determines through the Risk Matrix; ➢ Do maintenance with their existing lawful water use in terms of section 21(c) or (i) of the Act that has a LOW risk class as determined through the Risk Matrix; ➢ Conduct river and stormwater management activities as contained in a river management plan; ➢ Conduct rehabilitation of wetlands or rivers where such rehabilitation activities has a LOW risk class as determined through the Risk Matrix; and ➢ Conduct emergency work arising from an emergency situation or incident associated with the persons' existing lawful water use, provided that all work is executed and reported in the manner prescribed in the Emergency protocol. A General Authorisation (GA) issued as per this notice will require the proponent to adhere with specific conditions, rehabilitation criteria and monitoring and reporting programme. Furthermore, the water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this GA. Upon completion of the registration, the responsible authority will provide a certificate of registration to the water user within 30 working days of the submission. On written receipt of a registration certificate from the Department, the person will be regarded as a registered water user and can commence within the water use as contemplated in the GA.
Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA)	The obtaining of a New Order Mining Right (NOMR) is governed by the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA). The MPRDA requires the applicant to apply to the Department of Mineral Resources (DMR) for a NOMR which triggers a process of compliance with the various applicable sections of the MPRDA. The NOMR process requires environmental authorisation in terms of the MPRDA Regulations and specifically requires the preparation of a Scoping Report, an Environmental Impact Assessment (EIA) and Environmental Management Programme (EMP), and a Public Participation Process (PPP).
The Northern Cape Nature Conservation Act, 2009 (Act No 9 of 2009)	The purpose of this Act is to provide for the sustainable utilisation of wild animals, aquatic biota and plants; to provide for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; to provide for offences and penalties for contravention of the Act; to provide for the appointment of nature conservators to implement the provisions of the Act; to provide for the issuing of permits and other authorisations; and to provide for matters connected therewith.
National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEMPAA)	This act was developed in 2003 for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes ➢ Restricted activities involving national and protected parks: ➢ 48(1) Despite other legislation, no person may conduct commercial prospecting, mining, exploration, production, or related activities– (a) in a special nature reserve, national park, or nature reserve (b) in a protected environment without the written permission of the Minister and the Cabinet member responsible for minerals and energy affairs; or (c) in a protected area referred to in section 9(b), (c) or (d).

APPENDIX C -METHOD OF ASSESSMENT

Freshwater Methodology

1. Classification System for Wetlands and other Aquatic Ecosystems in South Africa

The freshwater features encountered within the Pienaarspoort unauthorised activities were assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems (Ollis *et al*., 2013), hereafter referred to as the "Classification System". A summary of Levels 1 to 4 of the classification system are presented in Table C1 and C2, below.

Table C1: Proposed classification structure for Inland Systems, up to Level 3.

WETLAND / AQUATIC ECOSYSTEM CONTEXT		
LEVEL 1: SYSTEM	LEVEL 2: REGIONAL SETTING	LEVEL 3: LANDSCAPE UNIT
Inland Systems	DWA Level 1 Ecoregions OR NFEPA WetVeg Groups OR Other special framework	Valley Floor
		Slope
		Plain
		Bench (Hilltop / Saddle / Shelf)

Table C2: Hydrogeomorphic (HGM) Unit for the Inland System, showing the primary HGM Types at Level 4A and the subcategories at Level 4B to 4C.

FUNCTIONAL UNIT		
LEVEL 4: HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	**B**	**C**
River	Mountain headwater stream	Active channel
		Riparian zone
	Mountain stream	Active channel
		Riparian zone
	Transitional	Active channel
		Riparian zone
	Upper foothills	Active channel
		Riparian zone
	Lower foothills	Active channel
		Riparian zone
	Lowland river	Active channel
		Riparian zone
	Rejuvenated bedrock fall	Active channel
		Riparian zone
	Rejuvenated foothills	Active channel
		Riparian zone
	Upland floodplain	Active channel
		Riparian zone
Channelled valley-bottom wetland	(not applicable)	(not applicable)
Unchannelled valley-bottom wetland	(not applicable)	(not applicable)
Floodplain wetland	Floodplain depression	(not applicable)
	Floodplain flat	(not applicable)
Depression	Exorheic	With channelled inflow
		Without channelled inflow
	Endorheic	With channelled inflow

FUNCTIONAL UNIT		
LEVEL 4: HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	**B**	**C**
		Without channelled inflow
	Dammed	With channelled inflow
		Without channelled inflow
Seep	With channelled outflow	(not applicable)
	Without channelled outflow	(not applicable)
Wetland flat	(not applicable)	(not applicable)

Level 1: Inland systems

From the Classification System, Inland Systems are defined as aquatic ecosystems that have no existing connection to the ocean[3] (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but which are inundated or saturated with water, either permanently or periodically. It is important to bear in mind, however, that certain Inland Systems may have had a historical connection to the ocean, which in some cases may have been relatively recent.

Level 2: Ecoregions & NFEPA Wetland Vegetation Groups

For Inland Systems, the regional spatial framework that has been included at Level 2 of the classification system is that of DWA's Level 1 Ecoregions for aquatic ecosystems (Kleynhans *et al.,* 2005). There is a total of 31 Ecoregions across South Africa, including Lesotho and Swaziland. DWA Ecoregions have most commonly been used to categorise the regional setting for national and regional water resource management applications, especially in relation to rivers.

The Vegetation Map of South Africa, Swaziland and Lesotho (Mucina & Rutherford, 2006) group's vegetation types across the country according to Biomes, which are then divided into Bioregions. To categorise the regional setting for the wetland component of the National Freshwater Ecosystem Priority Areas (NFEPA) project, wetland vegetation groups (referred to as WetVeg Groups) were derived by further splitting bioregions into smaller groups through expert input (Nel *et al*., 2011). There are currently 133 NFEPA WetVeg Groups. It is envisaged that these groups could be used as a special framework for the classification of wetlands in national- and regional-scale conservation planning and wetland management initiatives.

Level 3: Landscape Setting

At Level 3 of the Classification System, for Inland Systems, a distinction is made between four Landscape Units (Table C1) on the basis of the landscape setting (i.e. topographical position) within which an HGM Unit is situated, as follows (Ollis *et al.,* 2013):

- **Slope:** an included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley;
- **Valley floor:** The base of a valley, situated between two distinct valley side-slopes;
- **Plain:** an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land; and
- **Bench (hilltop/saddle/shelf):** an area of mostly level or nearly level high ground (relative to the broad surroundings), including hilltops/crests (areas at the top of a mountain or hill flanked by down-slopes in all directions), saddles (relatively high-lying areas flanked by down-slopes on two sides in one direction and up-slopes on two sides in an approximately perpendicular direction), and shelves/terraces/ledges (relatively high-lying, localised flat areas along a slope,

[3] Most rivers are indirectly connected to the ocean via an estuary at the downstream end, but where marine exchange (i.e. the presence of seawater) or tidal fluctuations are detectable in a river channel that is permanently or periodically connected to the ocean, it is defined as part of the estuary.

representing a break in slope with an up-slope one side and a down-slope on the other side in the same direction).

Level 4: Hydrogeomorphic Units

Seven primary HGM Types are recognised for Inland Systems at Level 4A of the Classification System (Table C2), on the basis of hydrology and geomorphology (Ollis *et al*., 2013), namely:

- **River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water;
- **Channelled valley-bottom wetland:** a valley-bottom wetland with a river channel running through it;
- **Unchannelled valley-bottom wetland:** a valley-bottom wetland without a river channel running through it;
- **Floodplain wetland:** the mostly flat or gently sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank;
- **Depression:** a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates.
- **Wetland Flat:** a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat; and
- **Seep:** a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley but they do not, typically, extend into a valley floor.

The above terms have been used for the primary HGM Units in the classification system to try and ensure consistency with the wetland classification terms currently in common usage in South Africa. Similar terminology (but excluding categories for “channel”, “flat” and “valleyhead seep”) is used, for example, in the recently developed tools produced as part of the Wetland Management Series including WET-Health (Macfarlane *et al*., 2008), WET-IHI (DWAF, 2007) and WET-EcoServices (Kotze *et al*., 2009).

2. WET-Health

Healthy wetlands are known to provide important habitats for wildlife and to deliver a range of important goods and services to society. Management of these systems is therefore essential if these attributes are to be retained within an ever-changing landscape. The primary purpose of this assessment is to evaluate the eco-physical health of wetlands, and in so doing to promote their conservation and wise management.

Level of Evaluation

Two levels of assessment are provided by WET-Health:

- Level 1: Desktop evaluation, with limited field verification. This is generally applicable to situations where a large number of wetlands need to be assessed at a very low resolution; or
- Level 2: On-site evaluation. This involves structured sampling and data collection in a single wetland and its surrounding catchment.

Framework for the Assessment

A set of three modules has been synthesised from the set of processes, interactions and interventions that take place in wetland systems and their catchments: hydrology (water inputs, distribution and retention, and outputs), geomorphology (sediment inputs, retention and outputs) and vegetation (transformation and presence of introduced alien species).

Units of Assessment

Central to WET-Health is the characterisation of HGM Units, which have been defined based on geomorphic setting (e.g. hillslope or valley-bottom; whether drainage is open or closed), water source (surface water dominated or sub-surface water dominated) and pattern of water flow through the

wetland unit (diffusely or channelled) as described under the Classification System for Wetlands and other Aquatic Ecosystems above.

Quantification of Present State of a wetland

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present State score. This takes the form of assessing the spatial extent of the impact of individual activities and then separately assessing the intensity of the impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The impact scores, and Present State categories are provided in the table below.

Table C3: Impact scores and categories of Present State used by WET-Health for describing the integrity of wetlands.

Impact category	Description	Impact score range	Present State category
None	Unmodified, natural	0-0.9	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1-1.9	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	2-3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	D
Serious	The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognisable.	6-7.9	E
Critical	Modifications have reached a critical level and the ecosystem processes have been completely modified with an almost complete loss of natural habitat and biota.	8-10	F

Assessing the Anticipated Trajectory of Change

As is the case with the Present State, future threats to the state of the wetland may arise from activities in the catchment upstream of the unit or within the wetland itself or from processes downstream of the wetland. In each of the individual sections for hydrology, geomorphology and vegetation, five potential situations exist depending upon the direction and likely extent of change (table below).

Table C4: Trajectory of Change classes and scores used to evaluate likely future changes to the present state of the wetland.

Change Class	Description	HGM change score	Symbol
Substantial improvement	State is likely to improve substantially over the next 5 years	2	↑↑
Slight improvement	State is likely to improve slightly over the next 5 years	1	↑
Remain stable	State is likely to remain stable over the next 5 years	0	→
Slight deterioration	State is likely to deteriorate slightly over the next 5 years	-1	↓
Substantial deterioration	State is expected to deteriorate substantially over the next 5 years	-2	↓↓

Overall health of the wetland

Once all HGM Units have been assessed, a summary of health for the wetland as a whole needs to be calculated. This is achieved by calculating a combined score for each component by area-weighting the scores calculated for each HGM Unit. Recording the health assessments for the hydrology, geomorphology and vegetation components provide a summary of impacts, Present State, Trajectory of Change and Health for individual HGM Units and for the entire wetland.

3. Wetland Function Assessment

"The importance of a water resource, in ecological social or economic terms, acts as a modifying or motivating determinant in the selection of the management class".[4] The assessment of the ecosystem services supplied by the identified freshwater features was conducted according to the guidelines as described by Kotze *et al.* (2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

- Flood attenuation;
- Stream flow regulation;
- Sediment trapping;
- Phosphate trapping;
- Nitrate removal;
- Toxicant removal;
- Erosion control;
- Carbon storage;
- Maintenance of biodiversity;
- Water supply for human use;
- Natural resources;
- Cultivated foods;
- Cultural significance;
- Tourism and recreation; and
- Education and research.

The characteristics were used to quantitatively determine the value, and by extension sensitivity, of the freshwater features. Each characteristic was scored to give the likelihood that the service is being provided. The scores for each service were then averaged to give an overall score to the freshwater features.

Table C5: Classes for determining the likely extent to which a benefit is being supplied.

Score	Rating of the likely extent to which the benefit is being supplied
<0.5	Low
0.6-1.2	Moderately low
1.3-2	Intermediate
2.1-3	Moderately high
>3	High

4. Ecological Importance and Sensitivity (EIS) (Rountree & Kotze, 2013)

The purposed of assessing importance and sensitivity of water resources is to be able to identify those systems that provide higher than average ecosystem services, biodiversity support functions or are especially sensitive to impacts. Water resources with higher ecological importance may require managing such water resources in a better condition than the present to ensure the continued provision of ecosystem benefits in the long term (Rountree & Kotze, 2013).
In order to align the outputs of the Ecoservices assessment (i.e. ecological and socio-cultural service provision) with methods used by the DWA (now the DWS) used to assess the EIS of other watercourse types, a tool was developed using criteria from both WET-Ecoservices (Kotze, *et, al,* 2009) and earlier

[4] Department of Water Affairs and Forestry, South Africa Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999

DWA EIA assessment tools. Thus, three proposed suites of important criteria for assessing the Importance and Sensitivity for wetlands were proposed, namely:

- Ecological Importance and Sensitivity, incorporating the traditionally examined criteria used in EIS assessments of other water resources by DWA and thus enabling consistent assessment approaches across water resource types;
- Hydro-functional importance, taking into consideration water quality, flood attenuation and sediment trapping ecosystem services that the wetland may provide; and
- Importance in terms of socio-cultural benefits, including the subsistence and cultural benefits provided by the wetland system.

The highest of these three suites of scores is then used to determine the overall Importance and Sensitivity category (Table C6) of the wetland system being assessed.

Table C6: Ecological Importance and Sensitivity Categories and the interpretation of median scores for biota and habitat determinants (adapted from Kleynhans, 1999).

EIS Category	Range of Mean	Recommended Ecological Management Class
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and <=2	C
Low/marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	D

5. Recommended Management Objective (RMO) and Recommended Ecological Category (REC) Determination

"A high management class relates to the flow that will ensure a high degree of sustainability and a low risk of ecosystem failure. A low management class will ensure marginal maintenance of sustainability but carries a higher risk of ecosystem failure" (DWA, 1999).

The RMO (table below) was determined based on the results obtained from the PES, reference conditions and EIS of the freshwater resource (sections above), with the objective of either maintaining, or improving the ecological integrity of the freshwater resource in order to ensure continued ecological functionality.

Table C7: Recommended management objectives (RMO) for water resources based on PES & EIS scores.

			Ecological and Importance Sensitivity (EIS)			
			Very High	High	Moderate	Low
PES	A	Pristine	A Maintain	A Maintain	A Maintain	A Maintain
	B	Natural	A Improve	A/B Improve	B Maintain	B Maintain
	C	Good	A Improve	B/C Improve	C Maintain	C Maintain
	D	Fair	C Improve	C/D Improve	D Maintain	D Maintain
	E/F	Poor	D* Improve	E/F* Improve	E/F* Maintain	E/F* Maintain

***PES Categories E and F are considered ecologically unnacceptable (Malan and Day, 2012) and therefore, should a freshwater resource fall into one of these PES categories, an REC class D is allocated by default, as the minimum acceptable PES category.**

A freshwater resource may receive the same class for the REC as the PES if the freshwater resource is deemed in good condition, and therefore must stay in good condition. Otherwise, an appropriate REC should be assigned in order to prevent any further degradation as well as enhance the PES of the freshwater resource.

Table C8: Description of Recommended Ecological Category (REC) classes.

Class	Description
A	Unmodified, natural
B	Largely natural with few modifications
C	Moderately modified
D	Largely modified

6. Watercourse Delineation

The freshwater resource delineation took place according to the method presented in the "Updated manual for the identification and delineation of wetland and riparian resources" published by DWAF in 2008. The foundation of the method is based on the fact that wetlands and riparian zones have several distinguishing factors including the following:

- The presence of water at or near the ground surface;
- Distinctive hydromorphic soils;
- Vegetation adapted to saturated soils; and
- The presence of alluvial soils in stream systems.

According to the DWA (2005) like wetlands, riparian areas have their own unique set of indicators. It is possible to delineate riparian areas by checking for the presence of these indicators. Some areas may display both wetland and riparian indicators and can accordingly be classified as both. If you are adjacent to a watercourse, it is important to check for the presence of the riparian indicators described below, in addition to checking for wetland indicators, to detect riparian areas that do not qualify as wetlands. The delineation process requires that the following be taken into account:

- topography associated with the watercourse;
- vegetation; and
- alluvial soils and deposited material.

By observing the evidence of these features in the form of indicators, wetlands and riparian zones can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWA, 2005).

Aquatic Methodology

The sections below describe the methodology used to assess the aquatic ecological integrity of sites selected based on water quality, instream and riparian habitat condition and biological impacts and integrity.

Visual Assessment

Each site was investigated in order to identify visible impacts on the site, with specific reference to impacts from surrounding activities. Both natural constraints placed on ecosystem structure and function, as well as anthropogenic alterations to the system, were identified by observing conditions and relating them to professional experience. Photographs of each site were taken to provide visual indications of the conditions at the time of assessment. Factors which were noted in the site specific visual assessments included the following:

- Stream morphology;
- Instream and riparian habitat diversity;

- Stream continuity;
- Erosion potential;
- Depth flow and substrate characteristics;
- Signs of physical disturbance of the area; and
- Other life forms reliant on or associated with aquatic ecosystems.

Physico Chemical Water Quality Data
On-site testing of biota specific water quality parameters including pH, Electrical Conductivity (EC), dissolved oxygen concentration (DO), clarity and temperature. The results aid in the interpretation of the data obtained by the biomonitoring. Results are discussed against the guideline water quality values for aquatic ecosystems (DWAF 1996 vol. 7). Although the guideline water quality values pertain to temporal comparisons, it will also be applied to spatial comparisons for the purpose of this report, as no suitable alternative is currently available.

General Habitat Integrity
The general habitat integrity of each site was discussed based on the application of the Index of Habitat Integrity (Kleynhans *et al.* 2008). It is important to assess the habitat at each site in order to aid in the interpretation of the results of the community integrity assessments, by taking habitat conditions and impacts into consideration. This method describes the Present Ecological State (PES) of both the in-stream and riparian habitat at each site. The method classifies habitat integrity into one of six classes, ranging from unmodified/natural (Class A) to critically modified (Class F), as indicated in Table C1 below.

Table C9: Classification of Present State Classes in terms of Habitat Integrity [Kleynhans *et al.* 2008]

Class	Description	Score (% of total)
A	Unmodified, natural.	90 - 100
B	Largely natural with few modifications. The flow regime has been only slightly modified and pollution is limited to sediment. A small change in natural habitats may have taken place. However, the ecosystem functions are essentially unchanged.	80 - 89
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	60 - 79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40 – 59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20 – 39
F	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0 - 19

The Riparian Vegetation Response Assessment Index (VEGRAI)
VEGRAI is designed for qualitative assessment of the response of riparian vegetation to impacts in such a way that qualitative ratings translate into quantitative and defensible results (Kleynhans *et al.*, 2007a). Results are defensible because their generation can be traced through an outlined process (a suite of rules that convert assessor estimates into ratings and convert multiple ratings into an Ecological Category).

Riparian vegetation is described in the National Water Act (NWA; Act 36 of 1998) as follows: 'riparian habitat' includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

Table C10: Descriptions of the A-F ecological categories.

Ecological category	Description	Score (% of total)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitat and biota may have taken place but the ecosystem functions are essentially unchanged.	80-89
C	Moderately modified. Loss and change of natural habitat have occurred, but the basic ecosystem functions are still predominately unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Critically modified. Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances, the basic ecosystem functions have been destroyed and the changes are irreversible	0-19

Habitat for aquatic macro-invertebrates

The Integrated Habitat Assessment System (IHAS) was applied according to the protocol of McMillan (1998). This index was used to determine specific habitat suitability for aquatic macro-invertebrates as well as to aid in the interpretation of the results of the South African Scoring System version 5 (SASS5) scores. However, according to a study conducted within the Mpumalanga and Western Cape regions, the IHAS method does not produce reliable scores with regard to the suitability of habitat at sampling sites for aquatic macroinvertebrates (Ollis *et al*., 2006). Furthermore, the performance of the IHAS seems to vary between geomorphologic zones and between biotope groups (Ollis *et al*., 2006). It has, however; become clear that IHAS requires further validation and testing, although the basic data remains of value (Thirion, 2007).

Table C11: IHAS Scores and their corresponding description of overall condition (quality and quantity) of available aquatic macroinvertebrate habitat (McMillan, 1998)

IHAS Score (%)	Description
>75	Excellent
65 – 74	Good
55 – 64	Adequate / Fair
<55	Poor

Aquatic Macro-Invertebrates: South African Scoring System version 5 (SASS5)

Aquatic Macro-invertebrates were sampled using the qualitative kick sampling method called SASS5 (South African Scoring System version 5) (Dickens and Graham, 2002). The SASS5 method has been specifically designed to comply with international accreditation protocols. This method is based on the British Biological Monitoring Working Party (BMWP) method and has been adapted for South African conditions by Dr. F. M. Chutter (1998). The assessment was undertaken according to the protocol, as defined by Dickens & Graham (2002). All work was undertaken by an accredited SASS5 practitioner.

The SASS5 method was designed to incorporate all available biotypes at a given site and to provide an indication of the integrity of the of the aquatic macro-invertebrate community through recording the presence of various macro-invertebrate families at each site, as well as consideration of abundance of various populations, community diversity and community sensitivity. Each taxon is allocated a score according to its level of tolerance to river health degradation (Dallas 2007).

This method relies on churning up the substrate with your feet and sweeping a finely meshed SASS net, with a pore size of 1000 micron mounted on a 300 mm square frame, over the churned up area several times. In stony bottomed flowing water biotopes (rapids, riffles, runs, etc.) the net downstream of the assessor and the area immediately upstream of the net is disturbed by kicking the stones over and against each other to dislodge benthic invertebrates. The net was also swept under the edge of marginal and aquatic vegetation to cover from 1-2 meters. Identification of the organisms was made to family level (Thirion *et al*., 1995; Dickens & Graham, 2002; Gerber & Gabriel, 2002).

Interpretation of the results of biological monitoring depends, to a certain extent, on interpretation of site-specific conditions (Thirion *et.al*, 1995). In the context of this investigation it would be best not to use SASS5 scores in isolation, but rather in comparison with relevant habitat scores. The reason for this is that some sites have a less desirable habitat or fewer biotopes than others do. In other words, a low SASS5 score is not necessarily regarded as poor in conjunction with a low habitat score. Also, a high SASS5 score, in conjunction with a low habitat score, can be regarded as better than a high SASS5 score in conjunction with a high habitat score. A low SASS5 score, together with a high habitat score, would be indicative of poor conditions. The IHAS Index is valuable in helping to interpret SASS5 scores and the effects of habitat variation on aquatic macro-invertebrate community integrity.

Classification of the system took place by comparing the present community status to reference conditions, which reflect the best conditions that can be expected in rivers and streams within a specific area, and also reflect natural variation over time.

Aquatic Macro-Invertebrates: Macro-invertebrate Response Assessment Index (MIRAI)
The four major components of a stream system that determine productivity, with particular reference to aquatic organisms, are flow regime, physical habitat structure, water quality and energy inputs. An interplay between these factors (particularly habitat and availability of food sources) result in the discontinuous, patchy distribution pattern of aquatic macro-invertebrate populations. As such aquatic invertebrates shall respond to habitat changes (i.e. changes in driver conditions).

To relate drivers to such changes in habitat and aquatic invertebrate condition, two key elements are required. Firstly, habitat preferences and requirements for each taxa present should be obtained. As such reference conditions can be established against which any response to drivers can be measured. Secondly, habitat features should be evaluated in terms of suitability and the requirements mentioned in the first point. As a result, expected and actual patterns can be evaluated to achieve an Ecostatus Category rating.

Based on the three key requirements, the MIRAI provides an approach to deriving and interpreting aquatic invertebrate response to driver changes. The index has been applied to the sites following methodology described by Thirion (2007). Aquatic macro-invertebrates expected at each point were derived both from the Department of Water and Sanitation (DWS) Resource Quality Information Services (RQIS) PES/EIS database, as well as habitat, flow and water parameters (Thirion, 2007).

Fish biota: Fish Response Assessment Index (FRAI)
The FRAI (Kleynhans, 2007) is based on the premise that “drivers” (environmental conditions) may cause fish stress which shall then manifest as changes in fish species assemblage. The index employs preferences and intolerances of the reference fish assemblage, as well as the response of the actual (present) fish assemblage to particular drivers to indicate a change from reference conditions. Intolerances and preferences are divided into metric groups relating to preferences and requirements of individual species. This allows cause-effect relationships to be understood, i.e. between drivers and responses of the fish assemblage to changes in drivers. These metric groups are subsequently ranked, rated and finally integrated as a fish Ecological Category.

The fish community of each site was sampled for a period of twenty minutes by means of a battery operated electro-fishing device. Fish species identified were compared to those expected to be present at the sites, which were compiled from a literature survey employing the DWS RQIS database, Skelton (2001) and the Reference Frequency of Occurrence of Fish Species in South Africa (Kleynhans, *et al*., 2007b).

Ecological Importance and Sensitivity (EIS) Method of assessment
The EIS method considers a number of biotic and habitat determinants surmised to indicate either importance or sensitivity. The determinants are rated according to a four-point scale (Table C12). The median of the resultant score is calculated to derive the EIS category (Table C13).

Table C12: Definition of the four-point scale used to assess biotic and habitat determinants presumed to indicate either importance or sensitivity

Four point scale	Definition
1	One species/taxon judged as rare or endangered at a local scale.
2	More than one species/taxon judged to be rare or endangered on a local scale.
3	One or more species/taxon judged to be rare or endangered on a Provincial/regional scale.
4	One or more species/taxon judged as rare or endangered on a National scale (i.e. SA Red Data Books)

Table C13: Ecological importance and sensitivity categories (DWAF, 1999)

EISC	General Description	Range of median
Very high	Quaternaries/delineations that are considered to be unique on a national and international level based on unique biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are usually very sensitive to flow modifications and have no or only a small capacity for use.	>3-4
High	Quaternaries/delineations that are considered to be unique on a national scale based on their biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) may be sensitive to flow modifications but in some cases may have substantial capacity for use.	>2-≤3
Moderate	Quaternaries/delineations that are considered to be unique on a provincial or local scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are not usually very sensitive to flow modifications and often have substantial capacity for use.	>1-≤2
Low/ marginal	Quaternaries/delineations that are not unique on any scale. These rivers (in terms of biota and habitat) are generally not very sensitive to flow modifications and usually have substantial capacity for use.	≤1

Impact Assessment Methodology

In order for the EAP to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

The first stage of risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that are possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[5]. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or well-being, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.

[5] The definition has been aligned with that used in the ISO 14001 Standard.

- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria. Refer to the table below. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary[6].

The assessment of significance is undertaken twice. Initial, significance is based on only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment takes into account the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act (No. 108 of 1997) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

Table C14: Criteria for assessing significance of impacts.

LIKELIHOOD DESCRIPTORS

Probability of impact	**RATING**
Highly unlikely	1
Possible	2
Likely	3
Highly likely	4
Definite	5
Sensitivity of receiving environment	**RATING**
Ecology not sensitive/important	1
Ecology with limited sensitivity/importance	2
Ecology moderately sensitive/ /important	3
Ecology highly sensitive /important	4
Ecology critically sensitive /important	5

[6] Some risks/impacts that have low significance will however still require mitigation

CONSEQUENCE DESCRIPTORS

Severity of impact	RATING
Insignificant / ecosystem structure and function unchanged	1
Small / ecosystem structure and function largely unchanged	2
Significant / ecosystem structure and function moderately altered	3
Great / harmful / ecosystem structure and function largely altered	4
Disastrous / ecosystem structure and function seriously to critically altered	5
Spatial scope of impact	**RATING**
Activity specific / < 5 ha impacted / Linear features affected < 100m	1
Development specific / within the site boundary / < 100ha impacted / Linear features affected < 1000m	2
Local area / within 1 km of the site boundary / < 2000ha impacted / Linear features affected < 3000m	3
Regional within 5 km of the site boundary / < 5000ha impacted / Linear features affected < 10 000m	4
Entire habitat unit / Entire system / > 5000ha impacted / Linear features affected > 10 000m	5
Duration of impact	**RATING**
One day to one month	1
One month to one year	2
One year to five years	3
Life of operation or less than 20 years	4
Permanent	5

Table C15: Significance rating matrix.

	CONSEQUENCE (Severity + Spatial Scope + Duration)														
LIKELIHOOD (Frequency of activity + Frequency of impact)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table C16: Positive/Negative Mitigation Ratings.

Significance Rating	Value	Negative Impact management recommendation	Positive Impact management recommendation
Very High	126 - 150	Consider the viability of the project. Very strict measures to be implemented to mitigate impacts according to the impact mitigation hierarchy	Actively promote the project
High	101 - 125	Consider alternatives in terms of project execution and location. Ensure designs take environmental sensitivities into account and Ensure management and housekeeping is maintained and attention to impact minimisation is paid according to the impact mitigation hierarchy	Promote the project and monitor ecological performance
Medium High	76 – 100	Consider alternatives in terms of project execution and Ensure management and housekeeping is maintained and attention to impact minimisation is paid according to the impact mitigation hierarchy	Implement measures to enhance the ecologically positive aspects of the project while managing any negative impacts
Medium Low	51 - 75	Ensure management and housekeeping is maintained and attention to impact minimisation is paid	Implement measures to enhance the ecologically positive aspects of the project while actively managing any negative impacts
Low	26 - 50	Promote the project and ensure management and housekeeping is maintained	Monitor ecological performance and pay extensive attention to minimising potential negative environmental impacts
Low Very	1 - 25	Promote the project	Actively seek measures to implement impact minimisation according to the impact mitigation hierarchy and identify positive ecological aspects to be promoted

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the client and its contractors develop or controls;
  - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for all stages of the project cycle including:
  - Infill activities
  - Rehabilitation
- If applicable, transboundary or global effects were assessed;
- Individuals or groups who may be differentially or disproportionately affected by the project because of their *disadvantaged* or *vulnerable* status were assessed.
- Particular attention was paid to describing any residual impacts that will occur after rehabilitation.

APPENDIX D -SPECIALIST INFORMATION

DETAILS, EXPERTISE AND CURRICULUM VITAE OF SPECIALISTS

1. (a) (i) Details of the specialist who prepared the report

Stephen van Staden	MSc (Environmental Management) (University of Johannesburg)
Leandra Jonker	MSc (Aquatic Health) (University of Johannesburg)
Kim Marais	BSc (Hons) Zoology (Herpetology) (University of Witwatersrand)
Sanja Erwee	BSc (Zoology) (University of Pretoria)

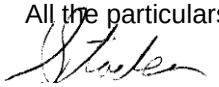
1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Aquatic Services		
Name / Contact person:	Stephen van Staden		
Postal address:	29 Arterial Road West, Oriel, Bedfordview		
Postal code:	1401	Cell:	083 415 2356
Telephone:	011 616 7893	Fax:	011 615 6240/ 086 724 3132
E-mail:	stephen@sasenvgroup.co.za		
Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Natural Scientist at South African Council for Natural Scientific Professions (SACNASP) Accredited River Health Practitioner by the South African River Health Program (RHP) Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum		

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Stephen van Staden, declare that -

- I act as the **independent specialist** in this application;
- 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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, 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



Signature of the Specialist

SAS ENVIRONMENTAL GROUP OF COMPANIES –

SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Group CEO, Water Resource Discipline Lead, Managing Member, Ecologist, Aquatic Ecologist
Joined SAS Environmental Group of Companies	2003 (year of establishment)

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)
Accredited River Health Practitioner by the South African River Health Program (RHP)
Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum
Member of the Gauteng Wetland Forum
Member of International Association of Impact Assessors (IAIA) South Africa;
Member of the Land Rehabilitation Society of South Africa (LaRSSA)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000

Short Courses

Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017
Tools for Wetland Assessment (Rhodes University)	2017
Legal liability training course (Legricon Pty Ltd)	2018
Hazard identification and risk assessment training course (Legricon Pty Ltd)	2018
Wetland Management: Introduction and Delineation (WLID1502S) (University of the Free State)	2018
Hydropedology and Wetland Functioning (TerraSoil Science and Water Business Academy)	2018

AREAS OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe Zambia
Eastern Africa – Tanzania Mauritius
West Africa – Ghana, Liberia, Angola, Guinea Bissau, Nigeria, Sierra Leona
Central Africa – Democratic Republic of the Congo

DEVELOPMENT SECTORS OF EXPERIENCE

1. Mining: Coal, chrome, Platinum Group Metals (PGMs), mineral sands, gold, phosphate, river
2. Linear developments (energy transmission, telecommunication, pipelines, roads)
3. Minerals beneficiation
4. Renewable energy (Hydro, wind and solar)
5. Commercial development
6. Residential development
7. Agriculture
8. Industrial/chemical

KEY SPECIALIST DISCIPLINES

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions

Freshwater Assessments

- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant Species and Landscape Plans
- Freshwater Offset Plans
- Hydropedological Assessment
- Pit Closure Analysis

Aquatic Ecological Assessment and Water Quality Studies

- Habitat Assessment Indices (IHAS, HRC, IHIA & RHAM)
- Aquatic Macro-Invertebrates (SASS5 & MIRAI)
- Fish Assemblage Integrity Index (FRAI)
- Fish Health Assessments
- Riparian Vegetation Integrity (VEGRAI)
- Toxicological Analysis
- Water quality Monitoring
- Screening Test
- Riverine Rehabilitation Plans

Biodiversity Assessments

- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Biodiversity Offset Plan

Soil and Land Capability Assessment

- Soil and Land Capability Assessment
- Hydropedological Assessment

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF KIM MARAIS

PERSONAL DETAILS

Position in Company	Senior Scientist Water Resource Manager
Joined SAS Environmental Group of Companies	2015

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP – Reg No. 117137/17)
Member of the Western Cape Wetland Forum (WCWF)

EDUCATION

Qualifications

BSc (Hons) Zoology (University of the Witwatersrand)	2012
BSc (Zoology and Conservation) (University of the Witwatersrand)	2011

Short Courses

Aquatic and Wetland Plant Identification (Cripsis Environment)	2019
Tools for Wetland Assessment (Rhodes University)	2018
Certificate in Environmental Law for Environmental Managers (CEM)	2014
Certificate for Introduction to Environmental Management (CEM)	2013

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Biodiversity Action Plans (BAP)
- Alien and Invasive Control Plans (AICP)
- Faunal Eco Scans
- Faunal Impact Assessments

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Watercourse Maintenance and Management Plans
- Freshwater Offset Plan

Aquatic Ecological Assessment and Water Quality Studies

- Riparian Vegetation Integrity (VEGRAI)
- Water quality Monitoring
- Riverine Rehabilitation Plans

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions
- Public Participation processes

SAS ENVIRONMENTAL GROUP OF COMPANIES –

SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF LEANDRA JONKER

PERSONAL DETAILS

Position in Company	Aquatic Ecologist
Joined SAS Environmental Group of Companies	2012

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Accredited River Health practitioner by the South African River Health Program (RHP)
Southern African Society of Aquatic Scientists

EDUCATION

Qualifications

MSc Aquatic Health (University of Johannesburg)	2015
BSc Environmental Management (Hons) (University of South Africa)	2011
BSc Botany and Zoology (North-West University)	2009

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Free State

KEY SPECIALIST DISCIPLINES

Aquatic Ecological Assessment and Water Quality Studies

- Habitat Assessment Indices (IHAS, HRC, IHIA, IHI & RHAM)
- Aquatic Macro-Invertebrate Assessments (SASS5 & MIRAI)
- Fish Community Assessments (FRAI)
- Fish Health Assessments
- Diatom Community Assessments
- Riparian Vegetation Integrity (VEGRAI)
- Toxicological Analysis
- Water Quality Monitoring
- Sediment Chemical Analysis
- Riverine Rehabilitation Plans

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF SANJA ERWEE

PERSONAL DETAILS

Position in Company	GIS Technician and Visual Specialist
Joined SAS Environmental Group of Companies	2014

EDUCATION

Qualifications

BSC Zoology (University of Pretoria)	2013

Short Courses

Global Mapper	2015
SANBI BGIS Course	2017
Global Mapper Lidar Course	2017
ESRI MOOC ARCGIS Cartography	2018

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Northern Cape, Western Cape Free State

KEY SPECIALIST DISCIPLINES

Freshwater Assessments

- Desktop Freshwater Delineation
- Plant species and Landscape Plan

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments
- View Shed Analyses
- Visual Modelling

GIS

- Mapping and GIS for various sectors and various disciplines (biodiversity, freshwater, aquatic, soil and land capability).