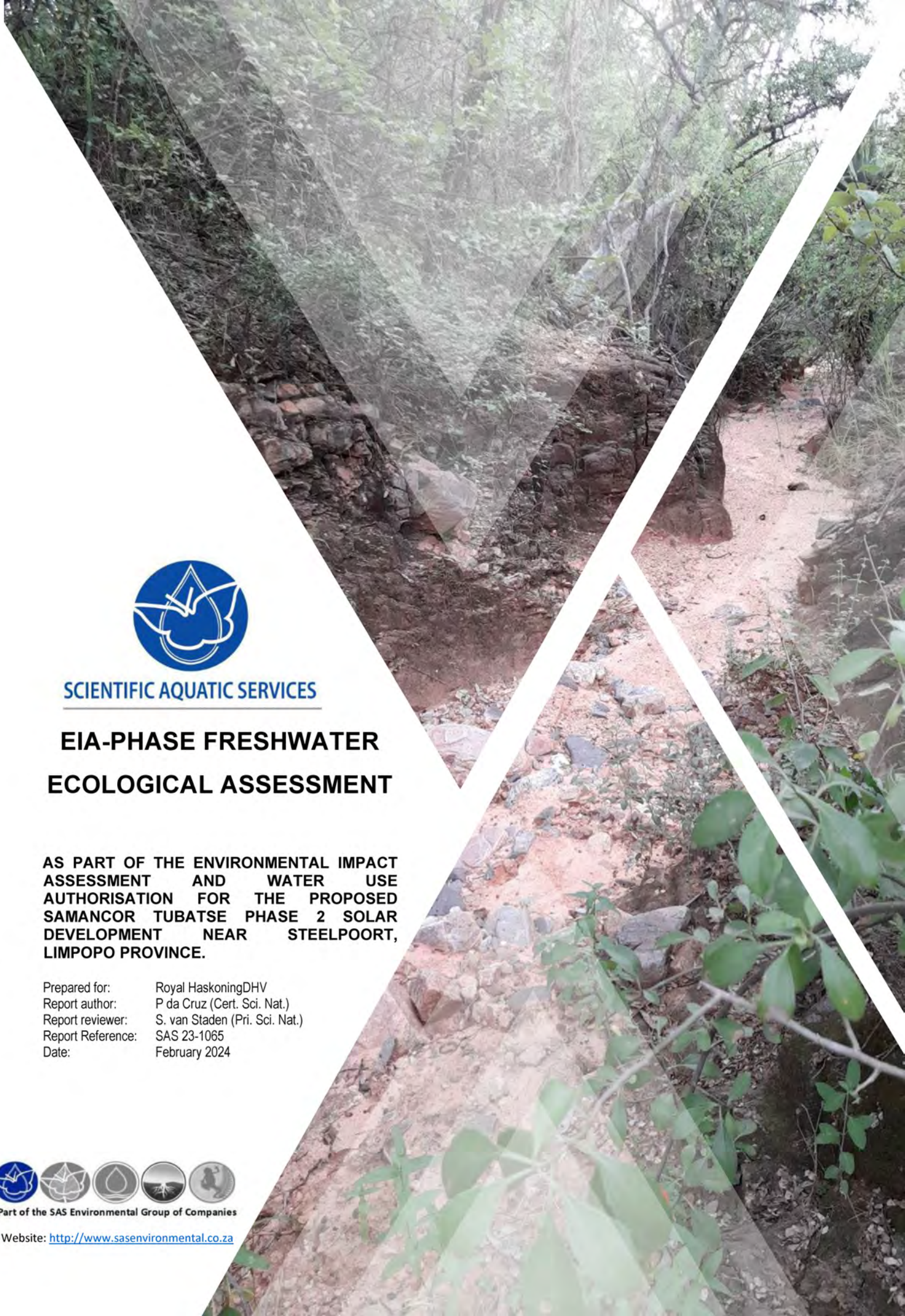

SCIENTIFIC AQUATIC SERVICES

EIA-PHASE FRESHWATER ECOLOGICAL ASSESSMENT

AS PART OF THE ENVIRONMENTAL IMPACT ASSESSMENT AND WATER USE AUTHORISATION FOR THE PROPOSED SAMANCOR TUBATSE PHASE 2 SOLAR DEVELOPMENT NEAR STEELPOORT, LIMPOPO PROVINCE.

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Date:	February 2024

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EXECUTIVE SUMMARY

Scientific Aquatic Services (SAS) (Pty) Ltd was appointed to conduct a freshwater ecological assessment as part of the Environmental Impact Assessment (EIA) process for the proposed 40MW PV Plant (Samancor Tubatse Phase 2 Solar Development) on the Farm Goudmyn 337 KT near Steelpoort in the Limpopo Province in the Steelpoort area of the Limpopo Province. The area of assessment consists of the five development sites for the phase 2 solar project (i.e. Site 2 extension, Sites 3B, 3C, 4B and 5B) (the 'study area'), along with a 500 m "zone of investigation" (the investigation area), in accordance with Government Notice (GN) 4167 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) as amended (NWA).

A scoping-phase freshwater assessment was conducted in October 2023 in which delineation of freshwater ecosystems was undertaken using desk-based methods to identify all freshwater ecosystems in the study and investigation areas. Nine (9) freshwater ecosystems were identified in the investigation area, all of which are episodic drainage lines with the exception of two areas falling within the riparian zone of the Steelpoort River. The drainage line running between the Site 3B/C and 4B development area and the drainage line and tributary around which the Site 2B development area has been planned were assessed in detail due to the potential for indirect impacts on these drainage lines associated with the solar panel arrays and as both are proposed to be crossed by overhead power lines.

In line with the designation of the DFFE's National Web-based Environmental Screening Tool (2020), all freshwater ecosystems are associated with a high aquatic biodiversity (freshwater-related) sensitivity and the presence of freshwater ecosystems in parts of the study and investigation areas has resulted in the disputing of the web-based screening tool designation of low aquatic biodiversity sensitivity for the study area. The remainder of the study and investigation areas have been confirmed to have a low freshwater sensitivity.

Areas of the proposed development site in which freshwater ecosystems have been delineated, and an associated 20m development exclusion buffer have been designated as non-developable areas. The drainage lines and associated buffer zones have been kept free of development in terms of the solar array footprint layout provided by the applicant, thus entailing that indirect impacts on the freshwater environment are most likely to materialise.

The DWS Risk Assessment Matrix has been applied to the proposed development to determine the nature and intensity of impacts that could potentially affect the receiving freshwater ecosystems. Due to the avoidance of the drainage lines by the physically transformative aspects of the proposed development, the development will be associated with "low" significance impacts, with the avoidance of direct impacts and the ability of the power lines to span the respective drainage lines being largely responsible for the low degree of risk to the freshwater environment associated with the proposed development. The low degree of risk is however dependent on the application of various mitigation and control measures as stipulated in this report.

Provided that these mitigation measures are implemented across all development phases, it is the professional opinion of the freshwater ecologist that the proposed Tubatse Phase 2 Solar development would be acceptable and can be granted environmental authorisation.

MANAGEMENT SUMMARY

Scientific Aquatic Services (SAS) (Pty) Ltd was appointed by Royal HaskoningDHV to conduct a freshwater ecological assessment as part of the environmental authorisation processes in terms of the EIA Regulations of 2014 as amended and in terms of the National Water Act (Act 36 of 1998) as amended (NWA) for the proposed Samancor Tubatse Phase 2 Solar Development located near Steelpoort in the Limpopo Province.

The purpose of this report is to define the ecology of the freshwater ecosystems associated with the study and associated investigation area (defined as a 500 m radius around the development sites), in line with GN 4167 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) as amended in terms of freshwater characteristics, including mapping of the freshwater ecosystems, defining areas of increased Ecological Importance and Sensitivity (EIS) and defining the Present Ecological State (PES) of the freshwater ecosystems associated with the study area. The report also aims to define the socio-cultural and ecological service provision of the freshwater ecosystems and additionally outlines the Recommended Ecological Category (REC), Recommended Management Objective (RMO) and Best Attainable State (BAS) for the freshwater ecosystems. The assessment took the following approach:

- A scoping phase desktop-based study was conducted, in which possible freshwater ecosystems were identified for on-site investigation, and relevant national and provincial databases were consulted;
- Previous field assessments undertaken for the already-authorised Tubatse Solar Phase 1 development (which has a very similar overall footprint to the Phase 2 development) were utilised, along with an additional site assessment undertaken in January 2024 to assess the reach of a drainage line and its tributary in the vicinity of the Site 2B development parcels were utilised to identify various natural fluvial drainage features (non-perennial Solar took place on the 18th and 19th December 2023 through which various non-perennial drainage lines and parts of the Steelpoort River's riparian zone were identified in the investigation area. Certain of the development sites – i.e. parts of the Site 2B development parcels and Sites 3B/C and 4B are located in close proximity to certain of these drainage lines and were accordingly assessed in greater detail.

The results of the field assessment are presented in Section 4 of this report, and are summarised in the table below:

Table A: Summary of the assessment results.

Freshwater Ecosystem	Present Ecological State (PES) / Ecostatus	Ecoservices	Ecological Importance and Sensitivity (EIS)	Recommended Ecological Category / Recommended Management Objective / Best Attainable State
Site 2B Drainage Line	Riparian PES Category C (Moderately Modified)	Moderately Low to Very Low	Low	REC Category: C BAS Category: C RMO: Maintain
Site 3/4 Drainage Line	Riparian PES Category B/C (Largely Natural /Moderately Modified)	Moderate to Very Low	Low	REC Category: B/C BAS Category: B/C RMO: Maintain

Following the freshwater ecosystem assessment, the DWS Risk Assessment Matrix (2023) was applied to determine the significance of impacts of the proposed PV facility on the receiving freshwater environment, with the summarised results detailed in Table B:

Table B: Summary of the results of the risk assessment.

Phase	Activity	Impact	Risk Rating
Pre-construction Phase	Potentially inadequate planning of stormwater management for the project.	•Alteration of hydrology and geomorphology of receiving freshwater ecosystems and resulting degradation of freshwater habitat through poor stormwater design.	L
Construction Phase	Clearing of Vegetation and Terrain Levelling (Bulk Earthworks) within the catchments of the drainage lines.	•Transformation of vegetation associated with freshwater ecosystems as well as associated habitat and ecosystem services as a result of indirect impacts; •Transportation of construction materials can result in disturbances to soils, and increased risk of sedimentation/erosion; and •Soil and stormwater contamination from oils and hydrocarbons originating from construction vehicles. •Earthworks and the associated disturbed soil could be potential sources of sediment, which may be transported in runoff into the downgradient freshwater ecosystem areas. This is particularly pertinent in this project areas as the soils are prone to erosion; •Exposure of soil, leading to increased runoff, and erosion, and thus increased sedimentation of the freshwater ecosystems; •Increased sedimentation of the freshwater ecosystems, leading to smothering of the vegetation and aquatic biota associated with the freshwater ecosystems; and •Proliferation of alien and/or invasive vegetation as a result of disturbances.	L
	Construction of surface infrastructure associated with the proposed development within the catchments of the drainage line reaches e.g. solar panel arrays and other associated infrastructure.	•Earthworks and excavations could be potential sources of sediment, which may be transported as runoff into the downgradient freshwater ecosystem areas; •Disturbances of soils leading to increased alien vegetation proliferation within the terrestrial buffer zone surrounding the freshwater ecosystems, with the potential to affect the freshwater habitat; •Altered runoff patterns within the local catchment of the freshwater ecosystems, potentially leading to increased erosion and sedimentation of the receiving freshwater environment; •Potential impacts on the water quality of surface water runoff (when present) which may potentially enter the downgradient freshwater ecosystems and contamination of soils due to concrete casting; and •Potential of backfill material entering the freshwater ecosystems, increasing the sediment loads therein.	L
	Installation of the power line towers (support structures) and stringing of the proposed power line across the respective drainage lines.	•Disturbances of soil leading to potential impacts to the freshwater ecosystem vegetation, increased alien vegetation proliferation in the footprint areas, and in turn to altered freshwater ecosystem habitat; •Mixing of concrete for tower supports which if transported by runoff or dumped into the drainage lines could be harmful to biota and freshwater habitat; and •Altered runoff patterns, leading to increased erosion and sedimentation of the freshwater ecosystems.	L
	Development and construction of new roads within the immediate catchments of freshwater ecosystems, involving: •Site preparation prior to construction activities including movement of construction equipment / vehicles within the	•Earthworks and exposure of soil could result in sedimentation of the freshwater ecosystems, which may be transported as runoff into the downgradient freshwater ecosystem areas and may smother vegetation associated with the freshwater ecosystem areas; and	L

Phase	Activity	Impact	Risk Rating
	freshwater ecosystems and removal of vegetation; •Ground-breaking, excavations and concrete works in the catchments of the drainage lines.	•Proliferation of alien and/or invasive vegetation as a result of disturbances.	
Operational phase	Operational presence of a solar PV development within the catchments of the respective drainage lines.	•Permanent alteration of patterns and timing of flows and recharge to the receiving drainage lines due to the levelling or parts of their catchments and the permanent removal of vegetation from the solar PV footprints that could alter the hydrological regimes of the drainage lines and cause degradation of riparian habitat; •Altered runoff patterns in the catchment of the drainage lines that could lead to creation of erosion within the buffer areas and within the drainage lines themselves.	L
	Operational maintenance of the development (including washing of panels and the maintenance of the power line, especially in the vicinity of the drainage lines).	•Disturbance to soil and ongoing erosion as a result of periodic maintenance activities; and •Altered water quality (if surface water is present) as a result of increased availability of pollutants.	L
	Operational stormwater control and design of stormwater attenuation facilities on the development site.	•Potential pollutants and toxicants entering the downgradient drainage lines if attenuation facilities are not properly maintained; •Potential changes to the water retention pattern, timing and flows within the downgradient drainage lines if attenuation facilities are not properly maintained and thereby become ineffective; •Potential exacerbation of existing erosion and development of new erosion, along with concomitant increased sedimentation within the downgradient drainage lines as a result of the increased stormwater discharge causing increased scour and velocity if the attenuation features are not properly maintained.	L
	Operation and maintenance of the proposed internal access roads located on the development sites in the catchments of the drainage lines (where applicable).	•Concentrated runoff from the road crossings leading to erosion and subsequent sedimentation of the freshwater ecosystems (increase in the sediment load) and turbulent flows when surface water is present. Litter and spills (e.g. oils, hydrocarbons) could be washed off the road surface by stormwater and could pollute downgradient areas, including the downgradient drainage lines.	L
Decommissioning Phase	Removal of all surface infrastructure from the project area.	•Disturbance of soil and vegetation that established within the decommissioning area.	L

All activities associated with the construction, operation and decommissioning of the proposed PV facility pose a "Low" risk significance to the freshwater ecosystems within the study and investigation areas. To a large degree the assessment of low risk is due to the exclusion of the drainage line reaches and a 20m development exclusion buffer around their delineated extents from the development footprint. Two power line crossings are proposed, but it is likely that with careful planning the freshwater drainage lines can be fully spanned. It is however highly important that all mitigation measures be fully implemented and that the integrity of the 20m development exclusion area be protected through all development phases. It is also critical that responsible stormwater controls be designed and implemented with the inclusion of SuDS principles being of vital importance.

Based on the strict proviso that all mitigation measures specified in this report be implemented, it is the professional opinion of the freshwater ecologist that the proposed development can be considered acceptable and be able to be granted environmental and water use authorisation.

DOCUMENT GUIDE

The table below provides the specialist report requirements for the assessment and reporting of impacts on aquatic biodiversity in terms of Government Notice 320 as promulgated in Government Gazette 43110 of 20 March 2020 in line with the Department of Environment, Forestry, and Fisheries screening tool requirements, as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) as well as for the Environmental Impact Assessment (EIA) Regulations 2014 (as amended) requirements for Specialist Reports (Appendix 6).

No.	Requirements	Section in report
2.1	Assessment must be undertaken by a suitably qualified SACNASP registered specialist	Front Page and Appendix J
2.2	Description of the preferred development site, including the following aspects-	
2.2.1	a. Aquatic ecosystem type b. Presence of aquatic species and composition of aquatic species communities, their habitat, distribution, and movement patterns	Section 4
2.2.2	Threat status, according to the national web-based environmental screening tool of the species and ecosystems, including listed ecosystems as well as locally important habitat types identified	Sections 3 and 4
2.2.3	National and Provincial priority status of the aquatic ecosystem (i.e. is this a wetland or river Freshwater ecosystem Priority Area (FEPA), a FEPA sub- catchment, a Strategic Water Source Area (SWSA), a priority estuary, whether or not they are free-flowing rivers, wetland clusters, etc., a CBA or an ESA; including for all a description of the criteria for their given status	Section 3
2.2.4	A description of the Ecological Importance and Sensitivity of the aquatic ecosystem including: a. The description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); b. The historic ecological condition (reference) as well as Present Ecological State (PES) of rivers (in-stream, riparian, and floodplain habitat), wetlands, and/or estuaries in terms of possible changes to the channel, flow regime (surface and groundwater)	Section 3
2.3	Identify any alternative development footprints within the preferred development site which would be of a "low" sensitivity as identified by the national web based environmental screening tool and verified through the Initial Site Sensitivity Verification	Section 7
2.4	Assessment of impacts - a detailed assessment of the potential impact(s) of the proposed development on the following very high sensitivity areas/ features:	Section 7
2.4.1	Is the development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?	Section 3
2.4.2	Is the development consistent with maintaining the Resource Quality Objectives for the aquatic ecosystems present?	Section 3
2.4.3	How will the development impact on fixed and dynamic ecological processes that operate within or across the site, including: a. Impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding, or destruction of floodplain processes); b. Change in the sediment regime (e.g. sand movement, meandering river mouth/estuary, changing flooding or sedimentation patterns) of the aquatic ecosystem and its sub-catchment; c. The extent of the modification in relation to the overall aquatic ecosystem (i.e. at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone, or within the channel of a watercourse, etc.). d. Assessment of the risks associated with water use/s and related activities.	Section 7
2.4.4	How will the development impact on the functionality of the aquatic feature including: a. Base flows (e.g. too little/too much water in terms of characteristics and requirements of system); b. Quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over-abstraction or instream or off-stream impoundment of a wetland or river); c. Change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchannelled valley-bottom wetland to a channelled valley-bottom wetland); d. Quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication); and	Section 7

	e. Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal).	
2.4.5	How will the development impact on key ecosystem regulating and supporting services, especially Flood attenuation; Streamflow regulation; Sediment trapping; Phosphate assimilation; Nitrate assimilation; Toxicant assimilation; Erosion control; and Carbon storage?	Section 7
2.4.6	How will the development impact community composition (numbers and density of species) and integrity (condition, viability, predator-prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	Section 7
2.4.7	In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: size of the estuary; availability of sediment; wave action in the mouth; protection of the mouth; beach slope; volume of mean annual runoff; and extent of saline intrusion (especially relevant to permanently open systems).	NA – PV Facility not in proximity to estuaries.
3.	**The report must contain as a minimum the following information:**	
3.1	Contact details and curriculum vitae of the specialist including SACNASP registration number and field of expertise and their curriculum vitae;	Appendix J
3.2	A signed statement of independence by the specialist;	Appendix J
3.3	The duration, date, and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 2
3.4	The methodology used to undertake the impact assessment and site inspection, including equipment and modelling used, where relevant;	Section 2, Appendix C
3.5	A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	Section 1.4
3.6	Areas not suitable for development, to be avoided during construction and operation (where relevant);	Section 6,7
3.7	Additional environmental impacts expected from the proposed development based on those already evident on the site and a discussion on the cumulative impacts;	Section 7
3.8	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted protocol;	Section 4.3
3.9	Impact management actions and impact management outcomes proposed by the specialist for inclusion in the EMPr;	Section 7
3.10	A motivation where the development footprint identified as per 2.3 were not considered stating reasons why these were not being considered; and	Section 7
3.11	A reasoned opinion, based on the finding of the specialist assessment, regarding the acceptability or not, of the development and if the development should receive approval, and any conditions to which the statement is subjected.	Section 8
3.12	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies.	Section 4.3
3.13	Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr).	Section 7
3.14	A motivation must be provided if there were development footprints identified as per paragraph 2.3 for reporting in terms of Section 24(5)(a) and (h) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) that were identified as having a "low" aquatic biodiversity and sensitivity and that were not considered appropriate.	Sections 6 and 7
3.15	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not.	Section 8
3.16	Any conditions to which this statement is subjected.	Sections 7 and 8

TABLE OF CONTENTS

EXECUTIVE SUMMARY ..... **ii**
DOCUMENT GUIDE ..... **vi**
TABLE OF CONTENTS ..... **viii**
LIST OF FIGURES ..... **ix**
LIST OF TABLES ..... **x**
GLOSSARY OF TERMS ..... **xi**
ACRONYMS ..... **xiii**
1 INTRODUCTION **1**
1.1 Background 1
1.2 Project description 2
1.3 Scope of Work 6
1.4 Assumptions and Limitations 7
1.5 Legislative Requirements and Provincial Guidelines 9
2 ASSESSMENT APPROACH **10**
2.1 Freshwater Ecosystem Definition 10
2.2 Freshwater Ecosystem Field Verification 10
2.3 Risk Assessment, Impact Assessment and Recommendations 11
3 RESULTS OF THE DESKTOP ANALYSIS **12**
3.1 Analyses of Relevant Databases 12
3.2 Department of Water and Sanitation (DWS) Resource Quality Information Services (RQIS) PES/EIS database 21
4 RESULTS: FRESHWATER ECOSYSTEM ASSESSMENT **25**
4.1 Freshwater Ecosystem Characterisation and Delineation 25
4.2 Detailed Freshwater Assessment 32
4.3 Freshwater Buffers 38
5 LEGISLATIVE REQUIREMENTS **43**
5.1 Legislative Zones of Regulation 43
6 FRESHWATER SENSITIVITY VERIFICATION **49**
7 ASSESSMENT OF IMPACTS **50**
7.1 DWS Risk assessment - analysis 51
7.1.1 Consideration of impacts and application of mitigation measures 51
7.1.2 Risk Assessment discussion of anticipated ecological impacts 51
7.2 Impact Rating Matrix 63
7.3 Cumulative Impacts 65
8 CONCLUSION **66**
9 REFERENCES **68**
APPENDIX A – Terms of Use and Indemnity **70**
APPENDIX B – Legislation **71**
APPENDIX C – Method of Assessment **74**
APPENDIX D – Risk Assessment Methodology **83**
APPENDIX E – Impact Assessment Methodology **86**
APPENDIX F – Results of Field Investigation **89**
APPENDIX G – Risk Assessment Outcome **92**
APPENDIX H – Site Sensitivity Verification Report **100**
APPENDIX I – General "Good Housekeeping" Mitigation Measures **103**
APPENDIX J – Specialist information **105**

LIST OF FIGURES

Figure 1: Digital satellite image depicting the location of the proposed Samancor Tubatse Phase 2 Solar Development study area and associated investigation area in relation to the surrounding area. 4
Figure 2: The proposed Samancor Tubatse Phase 2 Solar Development, and associated investigation area depicted on a 1:50 000 topographical map in relation to the surrounding area. 5
Figure 3: Freshwater ecosystems associated with the proposed Samancor Tubatse Phase 2 Solar Development study area and associated investigation area according to the NFEPA (2011) database. 15
Figure 4: Freshwater ecosystems associated with the proposed Samancor Tubatse Phase 2 Solar Development and associated investigation area according to the NBA (2018) database. 16
Figure 5: Land types located withing the proposed Samancor Tubatse Phase 2 Solar Development study area and associated investigation area. 17
Figure 6: Areas of ecological importance associated with the Samancor Tubatse Phase 2 Solar Development study area and associated investigation area as indicated by the Limpopo Conservation Plan (2018). 18
Figure 7: The relevant Sub-Quaternary Catchment Reach (SQR) associated with the proposed Samancor Tubatse Phase 2 Solar Development and associated investigation area according to the DWS (2014). 19
Figure 8: Map of relative aquatic biodiversity theme sensitivity for the proposed Samancor Tubatse Phase 2 Solar Development's study area and investigation area according to the National Web-Based Environmental Screening Tool (Accessed 2023). 20
Figure 9 – A reach of the draiange line that runs between Sites 3C and 4B that is characterised by bedrock outcropping in a part of the reach where the terrain drops steeply. 26
Figure 10 – A reach of the Steelpoort River close to the investigation area characterised by a run, with flanking woody riparian vegetation. 27
Figure 11: Delineated freshwater ecosystems associated with the proposed Samancor Tubatse Phase 2 Solar Development study area and associated investigation area. 29
Figure 12 - Delineated freshwater ecosystems associated with the proposed Samancor Tubatse Phase 2 Solar Development study area and associated investigation area in the vicinity of Sites, 3B/ and 4B. 30
Figure 13: Delineated freshwater ecosystems associated with the proposed Samancor Tubatse Phase 2 Solar Development study area and associated investigation area in the vicinity of Site 2B. 31
Figure 14 – 20m development exclusion buffer of freshwater ecosystems associated with the proposed Samancor Tubatse Phase 2 Solar Development study area and associated investigation area. 40
Figure 15 - 20m development exclusion buffer of freshwater ecosystems in the vicinity of Sites 3B/C and 4B associated with the proposed Samancor Tubatse Phase 2 Solar Development study area and associated investigation area. 41
Figure 16: 20m development exclusion buffer of freshwater ecosystems in the vicinity of Site 2B associated with the proposed Samancor Tubatse Phase 2 Solar Development study area and associated investigation area. 42
Figure 17: Conceptual presentation of the zones of regulation applicable to the Samancor Tubatse Phase 2 Solar Development in relation to the delineated freshwater ecosystems. 46
Figure 18: Conceptual presentation of the freshwater zones of regulation applicable to the Samancor Tubatse Phase 2 Sites 3B/C and 4B. 47

Figure 19: Conceptual presentation of the freshwater zones of regulation applicable to the Samancor Tubatse Phase 2 Site 2B. 48

LIST OF TABLES

Table 1: Desktop data relating to the characteristics of the freshwater ecosystems associated with Samancor Tubatse Phase 2 Solar Development and investigation area [Quarter Degree Square (QDS) 2430CA and 2430CC]. 13
Table 2 - Fish species previously collected from or expected in the various SQR monitoring points associated with the wider area. 21
Table 3 - Invertebrates previously collected from or expected at the various SQR monitoring points associated with the wider area. 22
Table 4: Summary of the ecological status of the sub-quaternary catchment reaches (SQRs) associated with the wider area based on the DWS RQS PES/EIS database (2014) 23
Table 5: Characterisation at Levels 3 and 4 of the Classification System (Ollis *et al.*, 2013) of the freshwater ecosystems associated with the Samancor Tubatse Phase 2 Solar Development study and investigation areas. 25
Table 6: Summary of the assessment of the drainage line and tributary in the vicinity of Site 2B. 33
Table 7: Summary of the assessment of the drainage line and tributary in the vicinity of Site 3B, 3C, 4B and 5B. 35
Table 8 – Development Exclusion Buffers as recommended by the buffer tool for the Steelpoort River and the Site 3,4 and 5 drainage line. 39
Table 9: Articles of Legislation and the relevant zones of regulation applicable to each article. 44
Table 10: Summary of the results of the DWS risk assessment matrix applied to the freshwater ecosystems associated with the proposed Tubatse Solar Phase 2 development. 53
Table 11: Impact Assessment - Vegetation Clearing and Construction of Infrastructure. 63
Table 12: Impact Assessment - Stormwater management and runoff-related impacts 64
Table 13: Summary of results of the field assessment as discussed in Section 5. 66

GLOSSARY OF TERMS

Alien vegetation:	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
Alluvial Material / Deposits	Sedimentary deposits resulting from the action of rivers, including those deposited within river channels, floodplains, etc
Apedal	A term indicating the degree of aggregation of soil particles within a soil horizon, where the material is well aggregated, but without well-formed peds (individual soil aggregates); in the context of the South African Soil Classification System, apedal soils also include structureless soils (e.g. sands) and somewhat more structured soils than the above description.
Baseflow	The component of river flow that is sustained from groundwater sources rather than from surface water runoff.
Biodiversity:	The number and variety of living organisms on earth, the millions of plants, animals, and micro-organisms, the genes they contain, the evolutionary history and potential they encompass, and the ecosystems, ecological processes, and landscape of which they are integral parts.
Buffer:	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.
Calcrete	A type of rock cemented together by calcareous material, formed in soils in semi-arid conditions
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flows into a river, wetland, lake, and ocean or contributes to the groundwater system.
Cumulative Impact	The impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area
Delineation (of a wetland):	To determine the boundary of a wetland based on soil, vegetation, and/or hydrological indicators.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Episodic:	Highly flashy systems that flow or flood only in response to extreme rainfall events, usually high in their catchments. May not flow in a five-year period or may flow only once in several years. Flow is absent for 76% of the year or greater.
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas.
First order stream	Refer to 'Stream Order' below
Fluvial:	The physical interaction of flowing water and the natural channels of rivers and streams.
Graminoid	Grasses, sedges and rushes.
Groundwater:	Subsurface water in the saturated zone below the water table.
Hydromorphic soil:	A soil that in its undrained condition is saturated or flooded long enough to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soils).
Hydrology:	The study of the occurrence, distribution, and movement of water over, on, and under the land surface.
Hydroperiod	The term hydroperiod describes the different variations in water input and output that form a freshwater ecosystem characterising its ecology – i.e. the water balance of the wetland
Land Type	Distinct areas defined as part of the Land Type Survey of South Africa based on a unique combination of soil pattern, macroclimate and terrain form
Macro channel (bank)	The (overall) compound channel of a watercourse that is situated between the two outermost and highest-lying banks
Perennial:	Flows all year round.
RDL (Red Data listed) species:	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status
Reach	A longitudinal stretch of a river
Redoximorphic	Features within soil that are a result of the reduction, translocation and oxidation (precipitation) of Fe (iron) and Mn (manganese) oxides that occur when soils are saturated for sufficiently long periods of time to become anaerobic.
Riparian Area / Corridor	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
Stream Order	A morphometric classification of a drainage system according to a hierarchy or orders of the channel segments. Within a drainage network the un-branched channel segments which terminate at the stream head are termed as "first order streams"

Watercourse:	In terms of the definition contained within the National Water Act, a watercourse means: • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam, or lake into which, or from which, water flows; and • Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse; • and a reference to a watercourse includes, where relevant, its bed and banks
Wetland Vegetation (WetVeg) type:	Broad groupings of wetland vegetation, reflecting differences in regional context, such as geology, climate, and soils, which may, in turn, have an influence on the ecological characteristics and functioning of wetlands.

ACRONYMS

°C	Degrees Celsius.
BAS	Best Attainable State
BGIS	Biodiversity Geographic Information Systems
BESS	Battery Energy Storage System
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
EAP	Environmental Assessment Practitioner
EA	Environmental Authorisation
EC	Ecological Class or Electrical Conductivity (use to be defined in relevant sections)
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class
EMPr	Environmental Management Program
ESA	Ecological Support Area
EWR	Ecological Water Requirements
FEPA	Freshwater Ecosystem Priority Areas
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
HGM	Hydrogeomorphic
m	Meter
MAP	Mean Annual Precipitation
MW	Megawatt
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystems Priority Areas
NBA	National Biodiversity Assessment
NWA	National Water Act
OHPL	Overhead Powerline
PV	Photo voltaic
PES	Present Ecological State
REC	Recommended Ecological Category
RMO	Resource Management Objective
RoW	(Construction) Right of Way
RQIS	Research Quality Information Services
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
SQR	Sub quaternary catchment reach
subWMA	Sub-Water Management Area
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WMS	Water Management System
WRC	Water Research Commission
WUA	Water Use Authorisation
ZoR	Zone of Regulation

1 INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) (Pty) Ltd was appointed to conduct a freshwater ecological assessment as part of the Environmental Impact Assessment (EIA) and Water Use Authorisation process for the proposed 40MW Solar PV Plant (Samancor Tubatse Phase 2 Solar Development) on the Farm Goudmyn 337 KT near Steelpoort in the Limpopo Province. The "Phase 1" Samancor Tubatse Solar development has been previously authorised, however the applicant intends to apply for environmental authorisation for additional generating capacity to allow the proposed intended generation capacity to be met, and hence a number of additional development parcels that are located immediately adjacent to certain of the various Phase 1 development sites have been proposed for the development of PV solar panel arrays and associated infrastructure including overhead power lines.

The area of assessment for the Phase 2 project consists of five (5) separate development sites:

- Site 2 extension (Site 2B) (47.49 ha);
- Site 3B (2.37 ha);
- Site 3C (1.71 ha);
- Site 4B (5.52 ha); and
- Site 5B (2.14) ha.

The sites, along with the proposed power line alignments are collectively known as the 'study area'. In order to identify all freshwater ecosystems that may potentially be impacted by the development of the proposed Samancor Tubatse Phase 2 Solar Development, a 500 m "zone of investigation" was implemented around the proposed development sites / study area, in accordance with Government Notice (GN) 4167 of 2023 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) as amended (NWA), in order to assess possible sensitivities of the receiving freshwater environment. This area – i.e., the 500 m zone of investigation around the proposed Samancor Tubatse Phase 2 Solar Development - will henceforth be referred to as the 'investigation area'.

A scoping phase freshwater report was compiled in October 2023 to assess the baseline characteristics of the receiving freshwater environment in the study and investigation areas and to identify potential impacts associated with the proposed development on the freshwater environment. The scoping report provided a description of the ecology of the freshwater

ecosystems associated with the proposed study and investigation area, including mapping of the natural freshwater ecosystems, a brief description of their characteristics, verification of freshwater sensitivity in the context of the aquatic biodiversity sensitivity that has been assigned through the DFFE Web-based Screening Tool, an assessment of areas of freshwater sensitivity and resultant development constraints and opportunities. This EIA-phase report has assessed the present ecological state (PES), ecological importance and sensitivity (EIS) and ecological goods and services provisioned by the freshwater ecosystems that have been identified to have the potential to be impacted by the proposed Phase 2 development and has assessed the potential impacts on the freshwater environment through the application of the DWS Risk Assessment (as contained within GN 4167 of 2023) and through the application of the RHDHV impact assessment matrix.

1.2 Project description[1]

The rising electricity tariffs in South Africa, combined with the increasingly severe load shedding patterns experienced across the country, has a negative impact on the production and revenue of Samancor Chrome business. Climate change is also a concern for Samancor Chrome referring to the emissions of greenhouse gases (GHG) in the use of fossil fuel electricity. This has motivated Samancor Chrome to consider renewable energy generation at their smelter plants. Implementing solar PV generation will result in improved availability of supply and reduced utility bills as well as going 'green' in terms of environmental considerations.

In 2021, a Special Purpose Vehicle (SPV), TFC Solar (Pty) Ltd, proposed the development of a Solar PV facility of up to 100-Megawatt (MW) generation capacity over five (5) sites: 1, 2, 3, 4 and 5. These five (5) sites were subject to an EIA and an Environmental Authorisation was granted on 25 April 2022 from the Department of Forestry, Fisheries and the Environment (DFFE) (DFFE Ref: 14/12/16/3/3/2/2079). A General Authorisation was received from the Department of Water and Sanitation on 28 March 2022. Site 1 is no longer considered for the Solar PV development.

[1] Note: the information in this section was provided by the proponent.

A total of 60MW output can be achieved from the previously authorised Sites 2 – 5. Additionally, TFC Solar (Pty) Ltd, propose the development of a 40MW Solar PV facility to be developed on Site 2B, 3B, 3C, 4B and 5B – refer to Figure 1. All previously authorised Sites 2, 3, 4 and 5 as well as new Sites 2B, 3B, 3C, 4B and 5B would achieve a total of 100MW.

The PV plant will consist of the following infrastructure presented below. Note that the below may be revised at a later stage when the concept design is available, and there will be sharing of infrastructure with the first phase i.e. previously authorised Sites 2, 3,4 and 5.

- Solar PV panels that will be able to deliver the required 40MW output to the Samancor grid;
- Inverters that convert direct current (DC) generated by the PV modules into alternating current (AC) to be exported to the Samancor electrical grid;
- Transformer/ s that raises the system AC low voltage to medium voltage. The transformer converts the voltage of the electricity generated by the PV panels to the correct voltage for delivery to the TFC Plant;
- Transformer substation; and
- Instrumentation and Control consisting of hardware and software for remote plant monitoring and operation of the facility.

Associated infrastructure includes:

- Mounting structures for the solar panels in a fixed tilt of rotating tracking configuration;
- Cabling between the structures, to be lain underground where practical;
- New 33kV overhead powerlines between the various sites and the Tubatse East and -West substation buildings;
- Local substation and transformer yard at each PV site;
- Containerized switchgear substation at Tubatse East and -West MV substations for connecting to the Tubatse substation busbars;
- Water provision infrastructure (i.e. pipeline/ s, storage tank/ s, etc.) for PV panel cleaning; and
- Internal access roads (typically 5m-wide) roads will be constructed, but existing roads will be used as far as possible), fencing (approximately 3m in height), gates and access control.

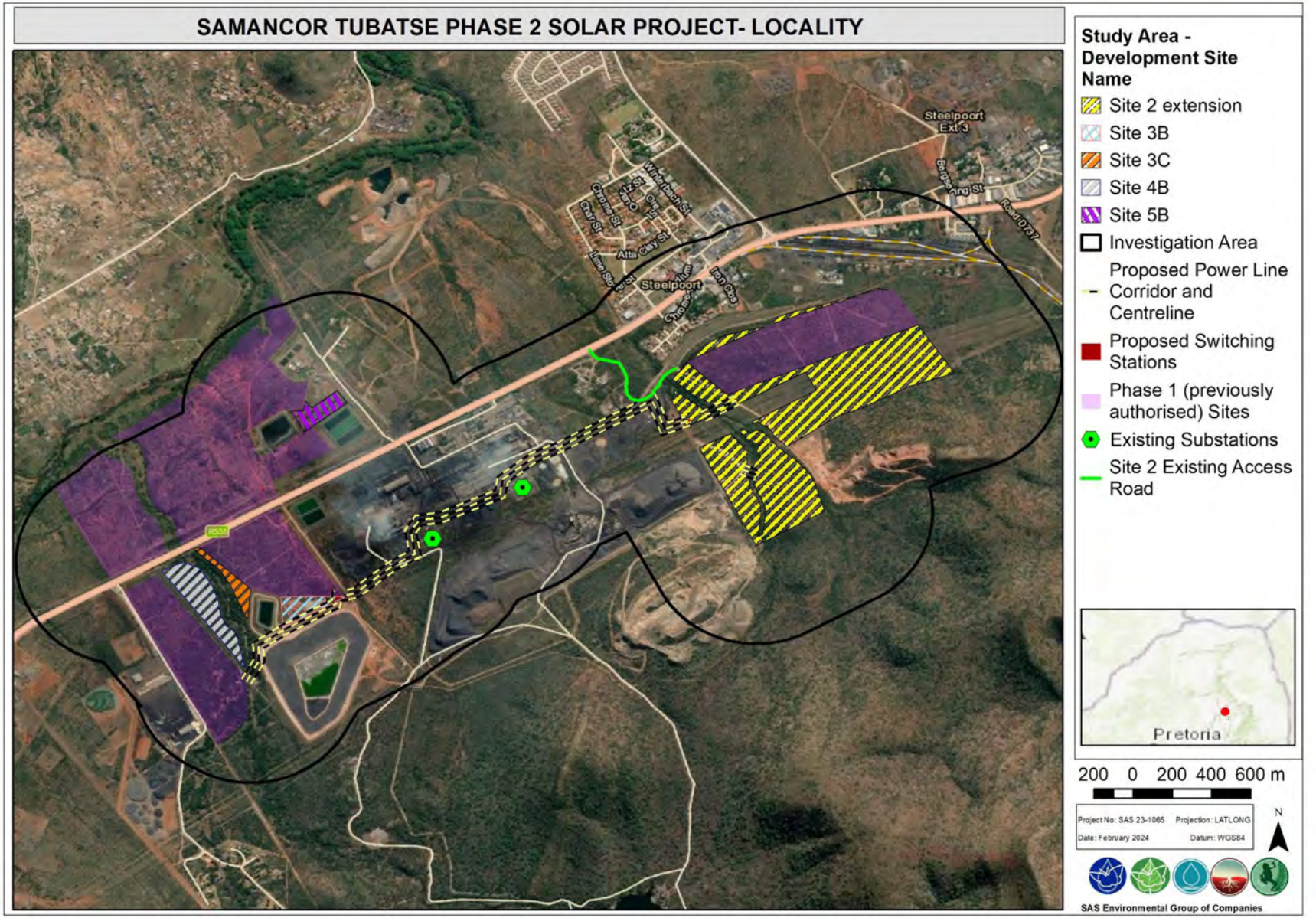


Figure 1: Digital satellite image depicting the location of the proposed Samancor Tubatse Phase 2 Solar Development study area and associated investigation area in relation to the surrounding area.

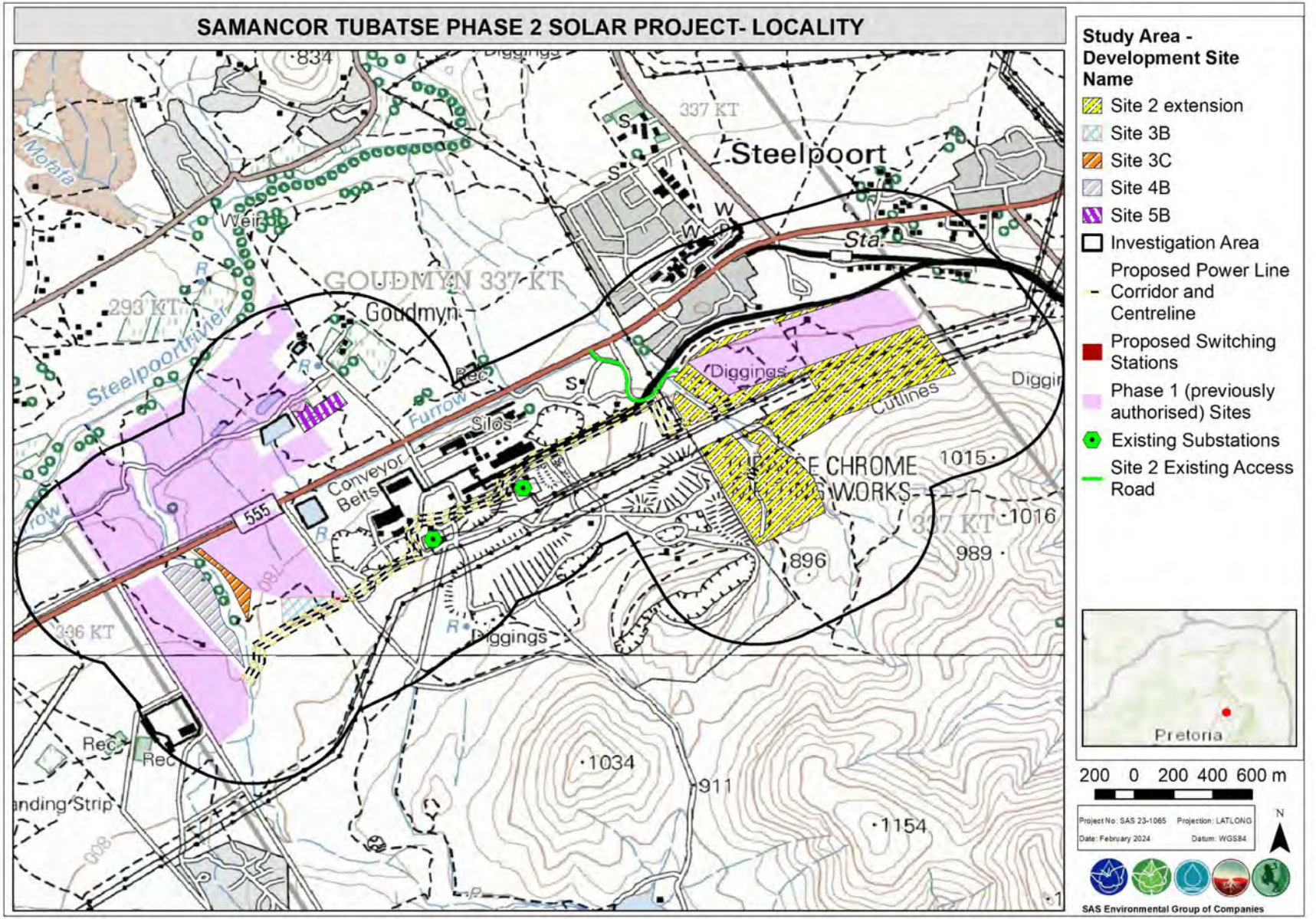


Figure 2: The proposed Samancor Tubatse Phase 2 Solar Development, and associated investigation area depicted on a 1:50 000 topographical map in relation to the surrounding area.

1.3 Scope of Work

Specific outcomes in terms of this freshwater assessment report are outlined below:

- A background study of relevant national, provincial, and municipal datasets (such as National Freshwater Ecosystem Priority Areas [NFEPA] (2011), and the National Biodiversity Assessment 2018: South African Inventory of Inland Aquatic Ecosystems (SAIIAE) databases were undertaken to aid in defining the Ecological Importance and Sensitivity (EIS) of the freshwater ecosystems;
- All freshwater ecosystems associated with the footprint of the proposed PV facility and associated investigation area were delineated using desktop methods in accordance with GN 4167 of 2023 as it relates to activities as stipulated in the NWA and verified according to the "Department of Water Affairs and Forestry (DWAF)[2] (2008)[3]: A practical field procedure for identification of wetlands and riparian areas". Aspects such as soil morphological characteristics and wetness along with vegetation types were used to verify the freshwater ecosystems;
- The freshwater ecosystem classification assessment was undertaken according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems (Ollis *et al.*, 2013);
- The PES of the freshwater ecosystems was assessed according to the resource directed measures guideline as advocated by Macfarlane *et al.* (2008);
- The EIS of the freshwater ecosystems was determined according to the method described by Rountree and Kotze, (2013);
- The Ecoservices of the freshwater ecosystems were assessed according to "A technique for rapidly assessing ecosystem services supplied by wetlands" (Kotze *et al.*, 2020);
- The freshwater ecosystem boundaries, recommended development exclusion buffer and legislated zones of regulation (ZoR) were depicted for the freshwater ecosystems, where applicable;
- Allocation of a suitable Recommended Management Objective (RMO), Recommended Ecological Category (REC) and Best Attainable State (BAS) of the freshwater ecosystems were assigned based on the results obtained from the PES and EIS assessments;

[2] The Department of Water Affairs and Forestry (DWAF) was formerly known as the Department of Water Affairs (DWA) and subsequently as the Department of Water and Sanitation (DWS). For the purposes of referencing in this report, the name under which the Department was known during the time of publication of reference material, will be used.
[3] Even though an updated manual is available since 2008 (Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas), this is still considered a draft document currently under review.

- The Department of Water and Sanitation (DWS) Risk Assessment Matrix (as contained within GN 4167 of 2023) and the RHDHV impact assessment was applied to identify potential impacts that may affect the freshwater ecosystems as a result of the proposed development, and to aim to quantify the significance thereof; and
- Management and mitigation measures which should be implemented during the various development phases to assist in minimising the impact of the proposed development on the receiving freshwater environment.

1.4 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- Freshwater delineations as undertaken for the for the Samancor Tubatse Solar Project ("Phase 1")(SAS, 2021) as completed for Samancor Chrome have been utilised for this report, as the study and investigation areas for that project encompass the current study and investigation areas, however the delineation of the drainage lines in the vicinity of the Phase 2 Site 2 development areas has been refined through in-field verification as part of this study. These delineations are regarded as the best estimate of the boundaries based on the site conditions present and are deemed accurate enough to guide the authorisation process;
- The layout provided by the applicant indicates that new power line alignments would be developed. Following guidance from the EAP, the proposed power line alignments have been assessed as part of the scope of the Phase 2 project, with the exception of a certain alignment located to the north of the R555 road in the vicinity of the Phase Site 5 development area, which is considered a Phase 1 power line. The layout and technical project description indicates that proposed electrical crossings of certain of the drainage lines could be via overhead lines or via underground cabling, however at the guidance of the EAP it has been assumed that all electrical crossings of the drainage lines will be via overhead lines and that no cabling will be installed through / across the drainage lines. Accordingly no impacts related to physical cabling through drainage lines have been assessed as part of this report;
- The layout provided by the EAP shows that certain infrastructure (e.g. solar panel arrays) associated with the development extends outside of the Phase 2 development areas as provided to project specialists in the scoping phase of the project. In line with the guidance provided by the EAP, the assessments have been limited to the original extents of the Phase 2 development sites as provided to specialists in the scoping phase of the project;

- Global Positioning System (GPS) technology is inherently inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur. If more accurate assessments are required, the freshwater ecosystems will need to be surveyed and pegged according to surveying principles and with survey equipment;
- Wetland, riparian, and terrestrial ecosystem zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative species. Within this transition zone, some variation of opinion on the freshwater ecosystem boundary may occur. However, if the DWAF (2008) method is followed, all assessors should get largely similar results;
- With regards to data sources used to provide background information on the sensitivity of the assessed areas, it is important to note that although all data sources provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the proposed Samancor Tubatse Phase 2 Solar Development's actual site characteristics at the scale required to inform the environmental authorisation and water use authorisation processes;
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. However, it is expected that the existing activities have been accurately assessed and considered, based on the field observations and the consideration of existing studies and monitoring data in terms of aquatic, riparian, and wetland ecology; and
- The only activities which were assessed were the Samancor Tubatse Phase 2 Solar Development and identified freshwater ecosystems within 500 m thereof that may be impacted by the development footprint. All other activities located outside these boundaries that may intercept/create other potential impacts were not considered.
- Both the DWS risk Assessment Matrix (2016) and the Royal Haskoning DHV (Pty) Ltd (RHDHV) Impact Assessment method were applied to ascertain the significance of impacts on the receiving freshwater environment. It is crucial to note that although these two methods may present different scores and impact significance ratings for the same activity, this is due to differences in their methodologies (refer to Appendix C) and not due to inconsistencies in their application. Each should be judged individually for their specified purpose; i.e. the use of the Royal HaskoningDHV (Pty) Ltd Impact Assessment method for the purposes of the Environmental Authorisation process, and the use of the DWS Risk Assessment Matrix to determine in consultation with the relevant competent authority whether there is a need to apply for a Water Use Licence (WUL).

1.5 Legislative Requirements and Provincial Guidelines

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

- Constitution of the Republic of South Africa, 1996[4];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended (NEMA);
- The National Water Act, 1998 (Act No. 36 of 1998) as amended (NWA);
- Government Notice 4167 as published in the Government Gazette 49833 of 08 December 2023 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) as amended;
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
- The National Environmental Management: Biodiversity Act: Alien and Invasive Species Regulations, 2014;
- Limpopo Environmental Management Act, 2003 (Act No. 7 of 2003) (LEMA).
- The Department of Environment, Forestry and Fisheries (DEFF), (2020) National Web-based Environmental Screening Tool (hereafter the "screening tool").

[4] 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.

2 ASSESSMENT APPROACH

2.1 Freshwater Ecosystem Definition

The NWA is aimed at the protection of the country's water resources, defined in the Act as "a watercourse, surface water, estuary or aquifer". According to the NWA, 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;

For the purposes of this investigation, the definition of a freshwater ecosystem is considered to be synonymous with the definition of a watercourse as per the NWA and carries the same meaning as "watercourse" as defined by the Act.

The NWA further provides definitions of wetland and riparian habitats as follows:

Wetland habitat is "land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."

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 composition and physical structure distinct from those of adjacent areas.

2.2 Freshwater Ecosystem Field Verification

Use was made of historical and current digital satellite imagery, topographic maps, and available provincial and national databases to aid in the delineation of the freshwater ecosystems at a desktop level prior to the undertaking of a site assessment. The following were taken into consideration when utilising the above desktop methods:

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

- Hue: with water flow paths often showing 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 freshwater ecosystem 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 which are distinct from the adjacent terrestrial areas, created by varying vegetation cover and soil conditions within the freshwater ecosystems.

The freshwater ecosystem site verification and assessment undertaken as part of the Tubatse Solar ("Phase 1") assessment was utilised for this study due to the large-scale overlap of the study areas for the two projects, but an additional assessment of the drainage lines in the vicinity of the Phase 2 Site 2 development areas was undertaken on the 11th January 2024 (summer season) during which the presence of any freshwater ecosystem characteristics as defined by the Department of Water Affairs and Forestry (2008) and the NWA were noted and delineated (please refer to Section 4 of this report). A detailed explanation of the methods of assessment undertaken is provided in Appendix C of this report.

The freshwater ecosystem delineation took place, as far as possible, according to the method presented in the "Updated manual for the identification and delineation of wetland and riparian resources" (DWAF, 2008). The foundation of the method is based on the fact that freshwater ecosystems have several distinguishing factors including the following:

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

2.3 Risk Assessment, Impact Assessment and Recommendations

Following the completion of the assessment, a risk assessment (please refer to Appendix D for the method of approach) and an impact assessment using the methodology provided the EAP (refer to Appendix E for the method and approach) were conducted. Recommendations were developed to address and mitigate impacts associated with the proposed Tubatse Phase 2 Solar development activities. These recommendations also include general 'best practice'

management measures, which apply to the proposed development activities as a whole, and which are presented in Appendix I. Mitigation measures have been developed to address issues in all phases throughout the life of the operation including planning, construction and operation. The detailed site-specific mitigation measures are outlined in Section 7 of this report.

3 RESULTS OF THE DESKTOP ANALYSIS

3.1 Analyses of Relevant Databases

The following section contains data accessed as part of the desktop assessment and is presented as a "dashboard" report below (Table 1). The dashboard report aims to present concise summaries of the data on as few pages as possible to allow for the integration of results by the reader to take place. Where required, further discussion and interpretation are provided, and information that was considered of importance was emboldened.

It is important to note that although all data sources are used to provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the proposed Samancor Tubatse Phase 2 Solar Development's actual site characteristics at the scale required to inform the EA processes. Nevertheless, this information is considered useful as background information to the study, is important in legislative contextualisation of risk and impact, and was used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance. It must, however, be noted that site assessment of key areas may potentially contradict the information contained in the relevant databases, in which case the site-verified information must carry more weight in the decision-making process. The information contained in the dashboard report below is intended to provide background to the landscape of the proposed Samancor Tubatse Phase 2 Solar Development and the associated investigation area. Actual site conditions at the time of the assessment may differ from the background information provided by various datasets. Please refer to Section 4 for details pertaining to the site investigation results.

Table 1: Desktop data relating to the characteristics of the freshwater ecosystems associated with Samancor Tubatse Phase 2 Solar Development and investigation area [Quarter Degree Square (QDS) 2430CA and 2430CC].

Aquatic ecoregion and sub-regions in which the study area is located	
Ecoregion	Eastern Bankenveld
Catchment	Olifants North
Quaternary Catchment	B41J
WMA	Olifants
subWMA	Steelpoort
Dominant characteristics of the Eastern Bankenveld Ecoregion Level 2 (9.03) (Kleynhans *et al.*, 2007)	
Dominant primary terrain morphology	Closed hills, mountains – moderate and high relief, low mountains
Dominant primary vegetation types	Mixed Bushveld
Altitude (m a.m.s.l)	500 to 2300
MAP (mm)	400 to 700
Coefficient of Variation (% of MAP)	20 to 34
Rainfall concentration index	55 to 64
Rainfall seasonality	Early summer
Mean annual temp. (°C)	14 to 22
Winter temperature (July)	2 – 20 °C
Summer temperature (Feb)	12 – 30 °C
Median annual simulated runoff (mm)	20 to 150

Detail of the study area in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database	
FEPACODE	The study area falls within a sub quaternary catchment considered an important fish support area. Fish Support Areas include sub-quaternary catchments that are important for the migration of the fish species, in this case *Opsaridium peringueyi* (LC).
NFEPA Wetlands (Figure 4)	According to the NFEPA database, there are no natural or artificial wetlands situated within the study area however there is one artificial unchanneled valley bottom wetland feature located within the investigation area. This wetland is indicated by NFEPA to be heavily to critically modified. During the Phase 1 field assessment this feature was observed to be an impoundment associated with the Tubatse Ferrochrome operations.
Wetland Vegetation Type	The study area falls within the Central Bushveld Group 7 WetVeg group, considered Least Threatened, according to Mbona *et al.* (2015).
NFEPA Rivers (Figure 4)	According to the NFEPA Database the Steelpoort River is located to the north of the investigation area with only a small part of the river's reach being located on the investigation area northern boundary. The Steelpoort River is considered moderately modified (Class C) and considered a fish support area.
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.	
The aquatic sensitivity for the area is considered low, according to the screening tool. The Steelpoort River is listed as a very high aquatic biodiversity feature but is not located within the investigation area according to the screening tool (although parts of the delineated riparian zone of the river fall within the investigation area – refer to Section 4)	

Land Types

The majority of the study and investigation area is located within the **Ae27 land type.** Ae land types are characterised by red and yellow, freely drained apedal soils of the Hutton, Griffin and Clovelly soils that occupy more than 40% of the landscape. Deeper (> 300 mm, but generally 500 to 1 000 mm) red soils of the Hutton form are dominant. Mispah and Glenrosa soils usually occupy significant proportions of the landscape. Soils with neocutanic, plinthic, duplex horizons and shallow black clay soils may occupy small proportions of the landscape. Katspruit, duplex soils and black clay soils usually occupy bottomland terrain positions with streambeds and erosion.

A very small part of the Investigation Area to the north of Sites 3C, 4B and 5B is located in the **Ea 88 land type**. Ea Land Types accommodate high base status, dark coloured and/or red structured soils, usually of clay texture, associated with basis igneous rocks. More than half of the land surface is covered by vertic, melanic or red structured diagnostic horizons. Duplex soils or exposed rock may cover significant portions of the land surface, but vertic, melanic or red structured horizons are dominant.

A small part of the Site 2B and the associated investigation area to the south falls in to the **Ib 193 land type**. Ib land type groupings are areas where 60-80% of the surface is occupied by exposed rock and stones/boulders and the slopes are usually steep. The rest of the area comprises mostly shallow soils, directly underlain by hard or weathered rock.

National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (Figure 5)
According to the NBA 2018: SAIIAE there are no natural wetland features associated with the study area or investigation area, however a number of artificial reservoirs classified as dams and open reservoirs are located in the study area. Two such artificial wetlands are located in immediate proximity to Site 5C. According to the NBA Dataset the Steelpoort River is largely modified (Class D), while being currently poorly protected (Ecosystem Protection Level (EPL) and therefore considered endangered (Ecosystem Threat Status (ETS).

Ecological Status of the most proximal sub-quaternary reach (DWS, 2014) (Figure 6)	
Sub-quaternary reach	B41J – 00563 (Steelpoort River)
Proximity to study area	150 m north of the study area
Assessed by expert?	Yes
PES Category Median	Largely Modified (Class D)
Mean Ecological Importance (EI) Class	High
Mean Ecological Sensitivity (ES) Class	High
Stream Order	3
Default Ecological Class (based on median PES and highest EI or ES mean)	High

Importance of the study area according to the Limpopo Conservation Plan (2018) (Waterberg District Municipality Bioregional Plan) (Figure 7).	
Ecological Support Area	The majority of the study and investigation areas are located in an **ESA (1)** Ecological Support Areas (ESAs) are areas that are important for maintaining the ecological processes on which Critical Biodiversity Area (CBAs) or protected areas depend. ESA1 areas are in at least fair ecological condition i.e. in at least a semi-natural state, with their basic ecological functioning intact.
No Natural Remaining	Small parts of the investigation area fall within an area classified as **No Natural Remaining areas**. These are areas with no significant direct biodiversity value. These are either not natural areas or degraded natural areas that are not required as ESA. These areas include intensive agriculture, urban, industry; and human infrastructure.

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; LT = Least Threatened; m.a.m.s.l = Meters Above Mean Sea Level; MAP = Mean Annual Precipitation; NBA= National Biodiversity Assessment; NFEPA = National Freshwater Ecosystem Priority Areas; NP = Not Protected; ONA = Other Natural Areas; PES = Present Ecological State; SAIIAE = South African Inventory of Inland Aquatic Ecosystems; WMA = Water Management Area; OHPL = Overhead Powerline.

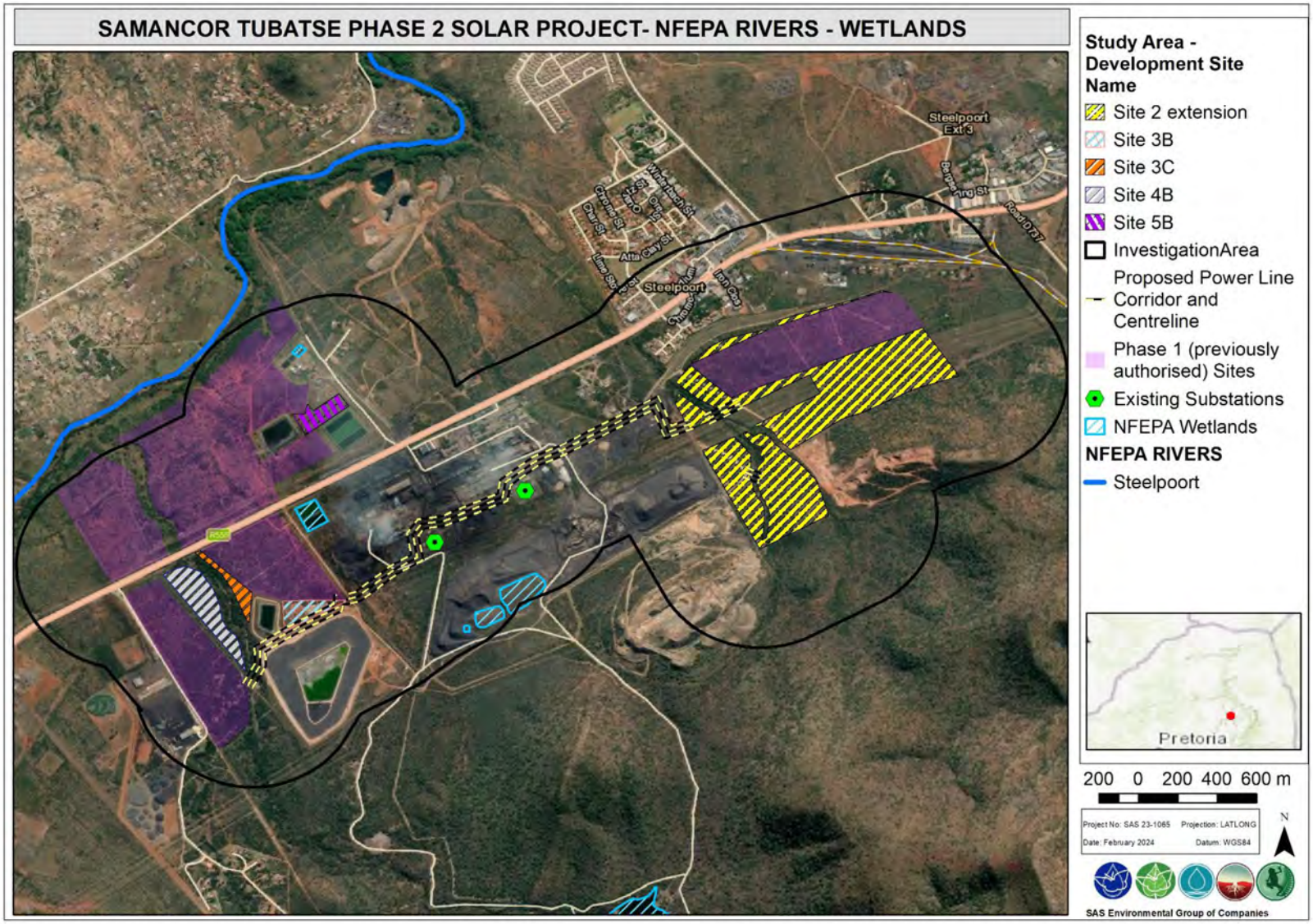


Figure 3: Freshwater ecosystems associated with the proposed Samancor Tubatse Phase 2 Solar Development study area and associated investigation area according to the NFEPA (2011) database.

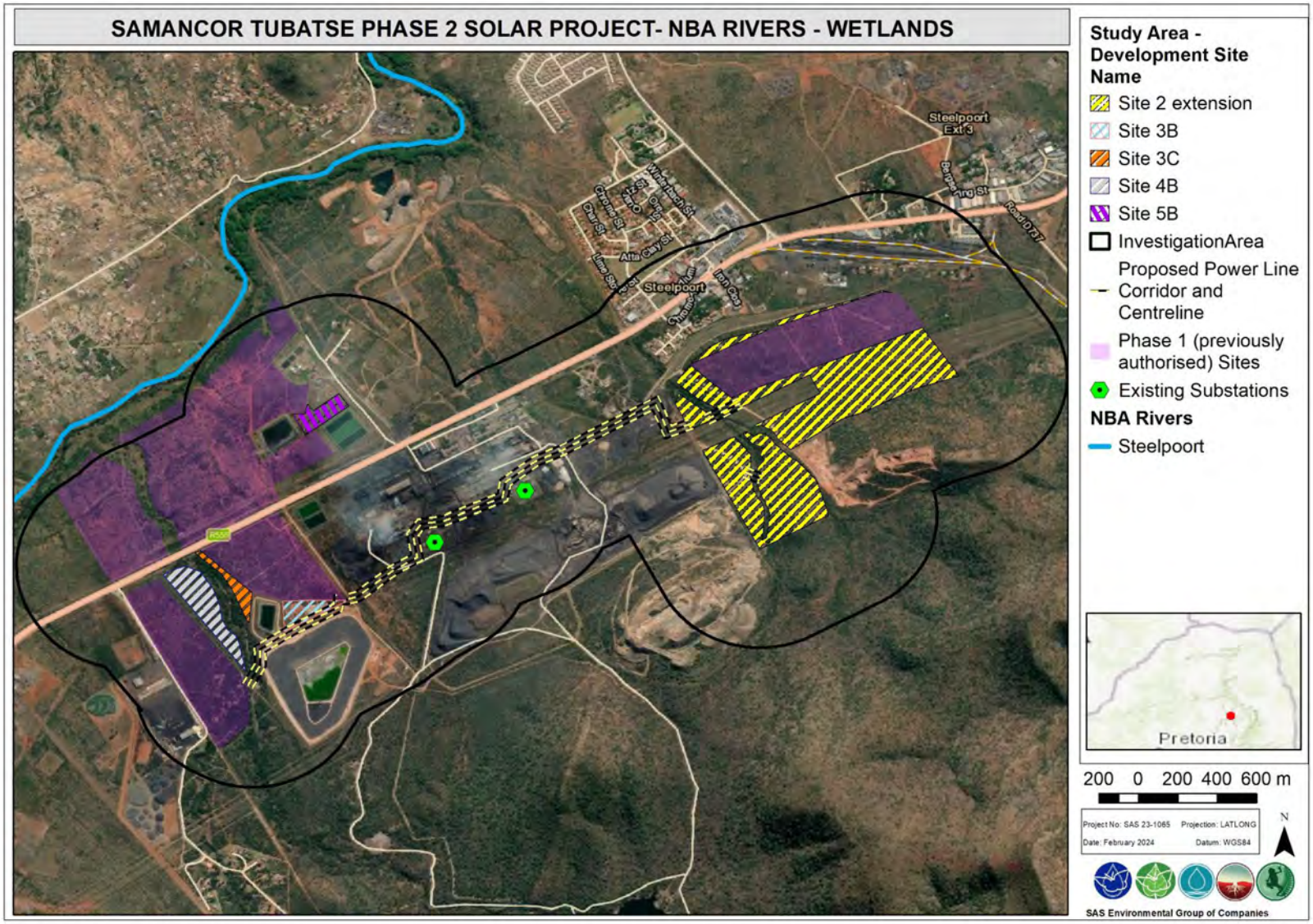


Figure 4: Freshwater ecosystems associated with the proposed Samancor Tubatse Phase 2 Solar Development and associated investigation area according to the NBA (2018) database.

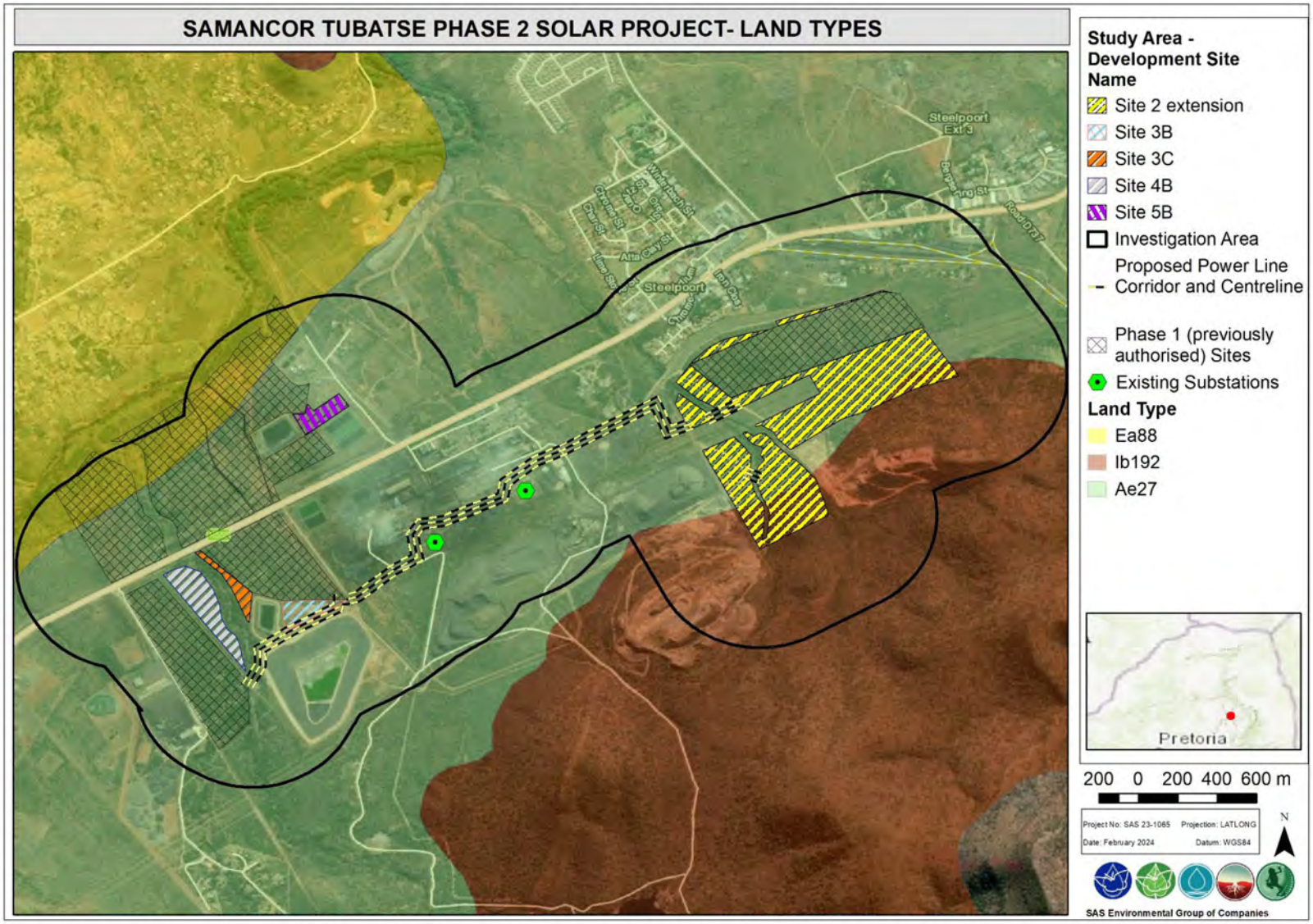


Figure 5: Land types located withing the proposed Samancor Tubatse Phase 2 Solar Development study area and associated investigation area.

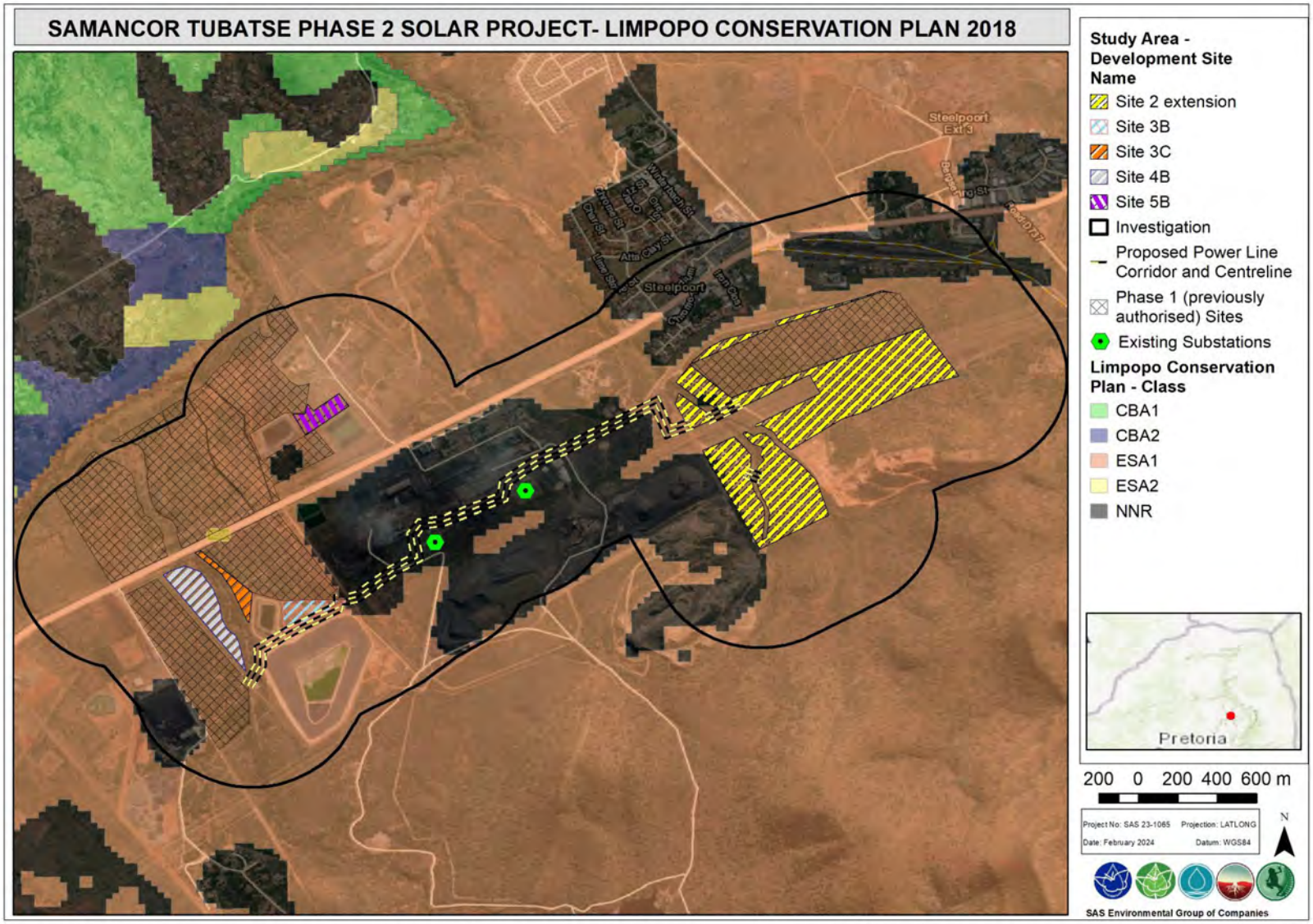


Figure 6: Areas of ecological importance associated with the Samancor Tubatse Phase 2 Solar Development study area and associated investigation area as indicated by the Limpopo Conservation Plan (2018).

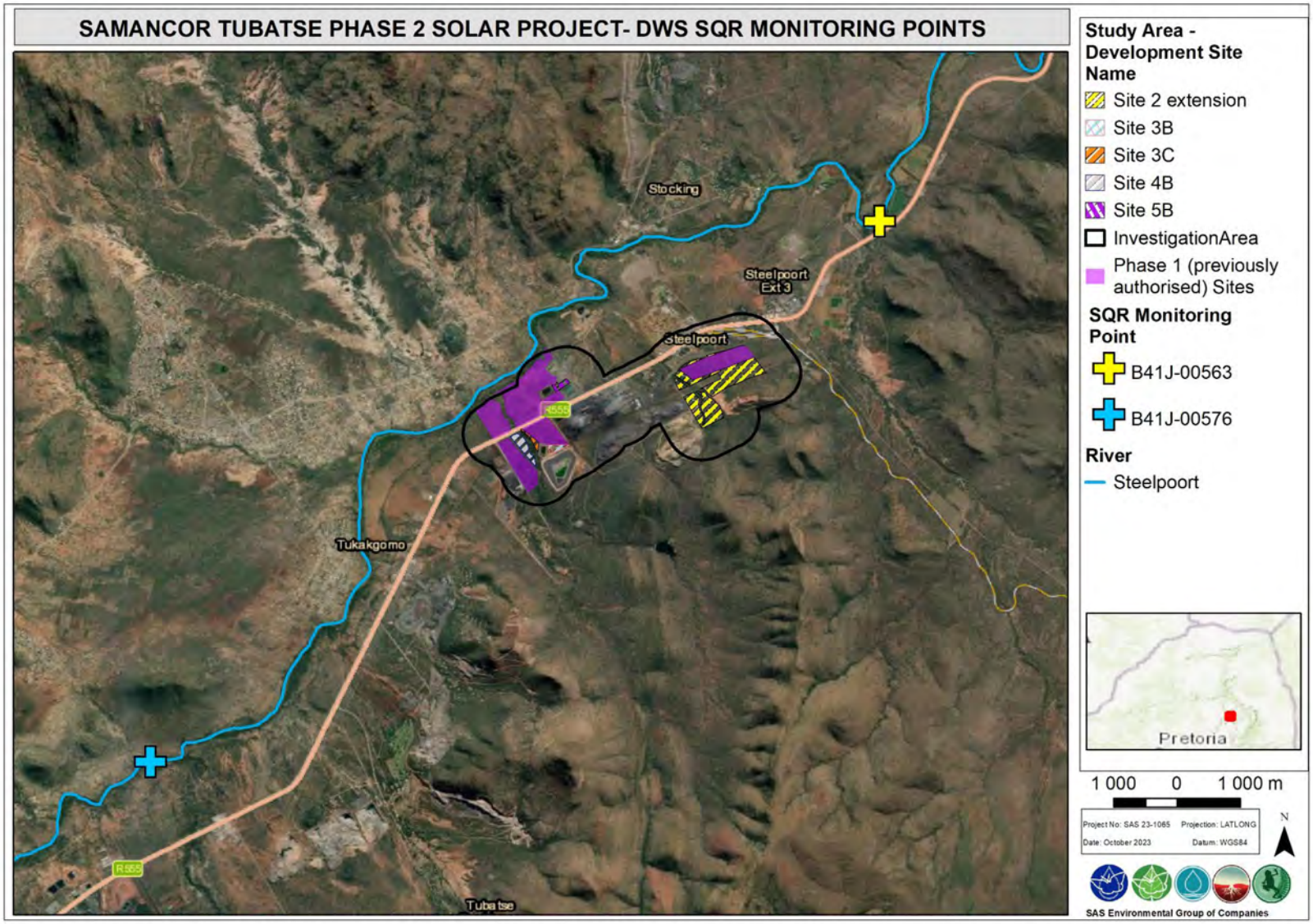


Figure 7: The relevant Sub-Quaternary Catchment Reach (SQR) associated with the proposed Samancor Tubatse Phase 2 Solar Development and associated investigation area according to the DWS (2014).

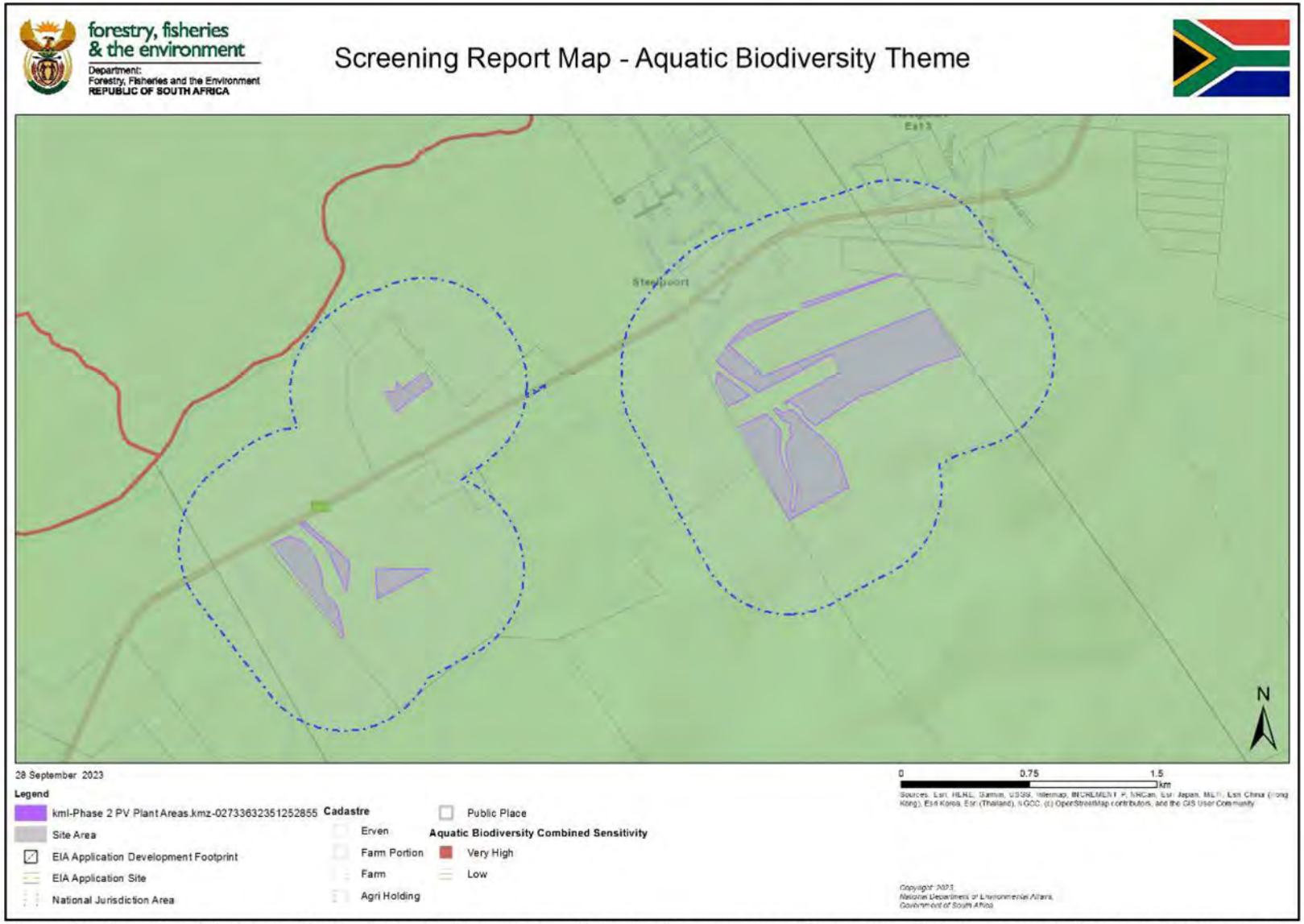


Figure 8: Map of relative aquatic biodiversity theme sensitivity for the proposed Samancor Tubatse Phase 2 Solar Development's study area and investigation area according to the National Web-Based Environmental Screening Tool (Accessed 2023).

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 Rivers traversing the various assessment areas were obtained. The study area is associated with the Steelpoort River and the applicable SQR Points are as follows (Figure 7):

- B41J – 00563 (Steelpoort River);
- B41J – 00576 (Steelpoort River).

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 Steelpoort 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 wider area.

	B41J – 00563 (Steelpoort River)	B41J – 00576 (Steelpoort River)
Amphilius uranoscopus	X	X
Barbus anoplus	X	X
Barbus neefi	X	X
Barbus paludinosus		X
Barbus trimaculatus	X	X
Barbus unitaeniatus	X	X
Chiloglanis paratus	X	X
Chiloglanis pretoriae	X	X
Chiloglanis swierstrai	X	X
Clarias gariepinus	X	X
Labeo cylindricus	X	X
Labeo molybdinus	X	X
Labeobarbus marequensis	X	X
Oreochromis mossambicus	X	X
Opsaridium peringueyi	X	X
Pseudocrenilabrus philander	X	X
Tilapia sparrmanii	X	X

Table 3 - Invertebrates previously collected from or expected at the various SQR monitoring points associated with the wider area.

	B41J – 00563 (Steelpoort River)	B41J – 00576 (Steelpoort River)
Aeshnidae		X
Ancylidae	X	X
Baetidae > 2 sp	X	X
Belostomatidae	X	X
Caenidae	X	X
Ceratopogonidae	X	X
Chironomidae	X	X
Coenagrionidae	X	X
Corduliidae	X	X
Corixidae	X	X
Culicidae	X	X
Dytiscidae	X	X
Elmidae/dryopidae	X	X
Empididae	X	X
Gerridae	X	X
Gomphidae	X	X
Gyrinidae	X	X
Heptageniidae	X	X
Hirudinea	X	X
Hydracarina	X	X
Hydraenidae	X	
Hydrometridae	X	X
Hydrophilidae	X	X
Hydropsychidae 2 sp	X	X
Hydroptilidae	X	X
Leptoceridae	X	X
Leptophlebiidae	X	X
Libellulidae	X	X
Lymnaeidae	X	X
Muscidae	X	X
Naucoridae	X	X
Nepidae	X	X
Notonectidae	X	X
Oligochaeta	X	X
Perlidae	X	X
Philopotamidae	X	
Physidae		X
Pleidae	X	X
Potamonautidae	X	X
Prosopistomatidae		X
Simuliidae	X	X
Tabanidae	X	X
Thiaridae		X
Tipulidae	X	X
Tricorythidae	X	X
Turbellaria	X	X
Veliidae/mesoveliidae	X	X

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

	B41J – 00563 (Steelpoort River)	B41J – 00576 (Steelpoort River)
Synopsis		
PES Category Median	Largely Modified (Class D)	Largely Modified (Class D)
Mean EI class	High	High
Mean ES class	High	High
Length	19.54	17.08
Stream order	3	3
Default EC[4]	B (High)	B (High)
PES Details		
Instream habitat continuity MOD	Moderate	Small
RIP/wetland zone continuity MOD	Moderate	Moderate
Potential instream habitat MOD activities	Serious	Large
Riparian/wetland zone MOD	Moderate	Large
Potential flow MOD activities	Large	Moderate
Potential physico-chemical MOD activities	Serious	Large
EI Details		
Fish spp/SQ	16	17
Fish average confidence	2.5	4.41
Fish representivity per secondary class	High	High
Fish rarity per secondary class	Very High	Very High
Invertebrate taxa/SQ	43	47
Invertebrate average confidence	4.12	3.26
Invertebrate representivity per secondary class	High	Very High
Invertebrate rarity per secondary class	High	Very High
EI importance: riparian-wetland-instream vertebrates (excluding fish) rating	High	High

	B41J – 00563 (Steelpoort River)	B41J – 00576 (Steelpoort River)
Habitat diversity class	Very Low	Very Low
Habitat size (length) class	Low	Low
Instream migration link class	High	Very High
Riparian-wetland zone migration link	High	High
Riparian-wetland zone habitat integrity class	High	Moderate
Instream habitat integrity class	Low	Moderate
Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500m	Very High	High
Riparian-wetland natural vegetation rating based on expert rating	High	High
ES Details		
Fish physical-chemical sensitivity description	Very High	Very High
Fish no-flow sensitivity	Very High	Very High
Invertebrates physical-chemical sensitivity description	Very High	Very High
Invertebrates velocity sensitivity	Very High	Very High
Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes description	High	High
Stream size sensitivity to modified flow/water level changes description	Low	Low
Riparian-wetland vegetation intolerance to water level changes description	Low	Low

[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.

4 RESULTS: FRESHWATER ECOSYSTEM ASSESSMENT

4.1 Freshwater Ecosystem Characterisation and Delineation

The assessment has confirmed the presence of nine (9) freshwater ecosystems associated with the study and investigation areas. The majority of the freshwater ecosystems are non-perennial drainage lines (DLs), along with the Steelpoort River and its associated riparian zone:

- Two non-perennial drainage lines are located in very close proximity to Site 2B, with parts site 2B extending into their delineated extents, and a further two DLs are located in the upstream catchment of these DLs to the south of Site 2B;
- A DL drains between Sites 3C and 4B, entering the investigation area to the south and drainage northwards into the Steelpoort River;
- A short reach of a tributary DL to the DL that drains between Sites 3C and 4B is located in the far south-western part of the investigation area;
- Two DLs are located in the northern part of the investigation area, to the north of the R555 road; and
- Two small portions of the Steelpoort River's riparian zone are located in the far northern part of the investigation area.

The freshwater ecosystems identified were classified according to the Classification System (Ollis *et al.*, 2013) as Inland Systems. The freshwater ecosystems fall within the Eastern Bankenveld Aquatic Ecoregion and the Central Bushveld Group 7 WetVeg (wetland vegetation) group, classified by Mbona *et al.* (2015) as "Least Threatened". At Levels 3 (Landscape Unit) and 4 (HGM Type) of the Classification System, the systems were classified as per the summary in Table 2, below.

Table 5: Characterisation at Levels 3 and 4 of the Classification System (Ollis *et al.*, 2013) of the freshwater ecosystems associated with the Samancor Tubatse Phase 2 Solar Development study and investigation areas.

Freshwater Ecosystem HGM Type	Level 3: Landscape unit	Level 4: Hydrogeomorphic (HGM) Type
River (including Episodic Drainage Lines)	Valley floor—the base of a valley, situated between two distinct valley side-slopes, where alluvial or fluvial processes typically dominate.	Linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water. A river is taken to include both the active channel and the riparian zone as a unit.

The development sites and associated Investigation Area are all located in the context of the wider Steelpoort River valley. In the context of the wider Sekhukhuneland area the layered, basic igneous rocks of the Bushveld Complex give rise to a series of arcuate parallel ridges of high relief. The primary drainage in this context is superimposed across these ridges and the Steelpoort River follows the path of the Steelpoort (lineament) fault line (Partridge *et al,* 2010). The Steelpoort River along with other rivers in this region is generally very steep, to steep in river longitudinal profile with a narrow to medium valley cross-sectional profile (Partridge *et al,* 2010). Accordingly local tributary drainage lines are generally very short in length displaying relatively small catchments – as is displayed in the investigation area. The nature of slope, substrate (with bedrock outcropping in many areas and relatively shallow soils), along with the relatively dry climate of the area, all entail that these tributary drainage lines are typically episodic, characterised by surface flows only in response to precipitation events of sufficient duration and intensity. Owing to the naturally occurring presence of woodland in the wider area (the study area falls within the Sekhukhune Plains Bushveld terrestrial vegetation type), vegetation within the riparian zones of the drainage lines is predominantly woody, comprising of a mix of trees and smaller shrubs with a grassy understorey.

Figure 9 – A reach of the drainage line that runs between Sites 3C and 4B that is characterised by bedrock outcropping in a part of the reach where the terrain drops steeply.

The Steelpoort River has a well-developed riparian zone while the non -perennial tributaries have riparian zones which vary from moderately to weakly developed depending on the position in the landscape as well as the effects of geological characteristics and geomorphological processes at play. Three of the DLs in the investigation area are first or second order drainage systems – entailing that they form the head of the drainage system at a local scale into which no other streams flow. The DLs around which the Site 2B areas are arranged drain a very small catchment on the northern slopes of the hilly ground to the south of Steelpoort and the DL to the west of the smelter's brine dams drains an even smaller catchment. The DL that drains between Sites 3C and 4B is a higher order stream system, draining a small to medium-sized catchment, rising in the mountainous area to the south of the Smelter. The DL is impounded at the Tubatse Dam. This dam is fed by water piped from the Steelpoort River and at times water from the dam is released into the downstream DL, resulting in flows within certain reaches that would not otherwise be present (Figure 9).

Figure 10 – A reach of the Steelpoort River close to the investigation area characterised by a run, with flanking woody riparian vegetation.

The Steelpoort River is a much larger regional river. The river is naturally characterised by a wooded riparian zone that extends laterally beyond the macro-channel bank of the river. The river channel in the vicinity of the investigation area is characterised by a series of runs with limited bedrock outcropping occurring in the channel. Beyond the macro-channel banks, lateral flow channels covered in *Phragmites mauritianus* reedbeds are present in some areas.

The southern boundary of the riparian zone of the river typically grades to a band of dense microphyllous thicket or more open woodland, depending on the nature of the underlying substrate. The physical and vegetative structure of the riparian zone of the river is being physically altered in certain reaches within the vicinity of the investigation area by illegal excavation of sand and associated removal of woody vegetation, particularly on the northern bank of the river.

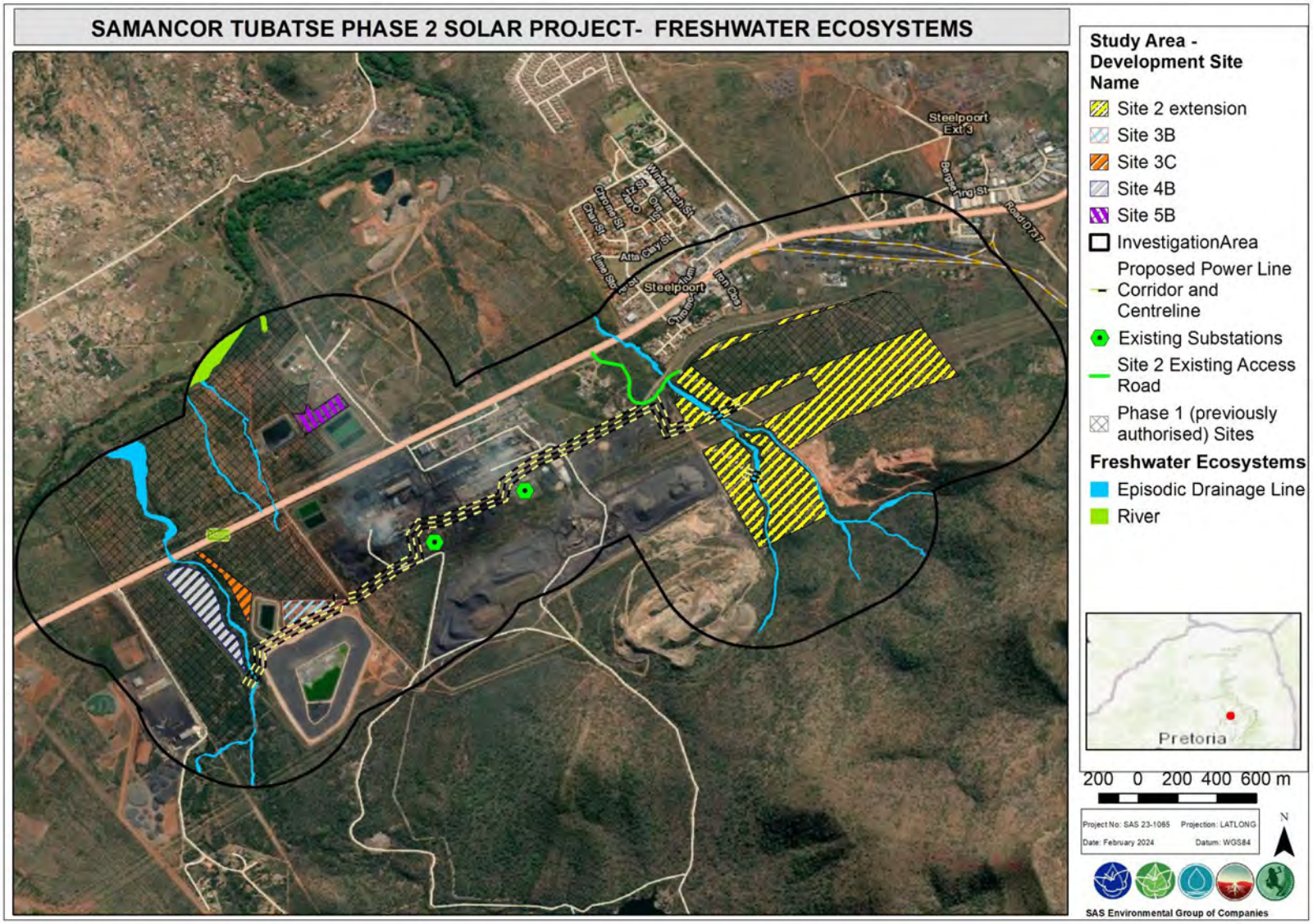


Figure 11: Delineated freshwater ecosystems associated with the proposed Samancor Tubatse Phase 2 Solar Development study area and associated investigation area.

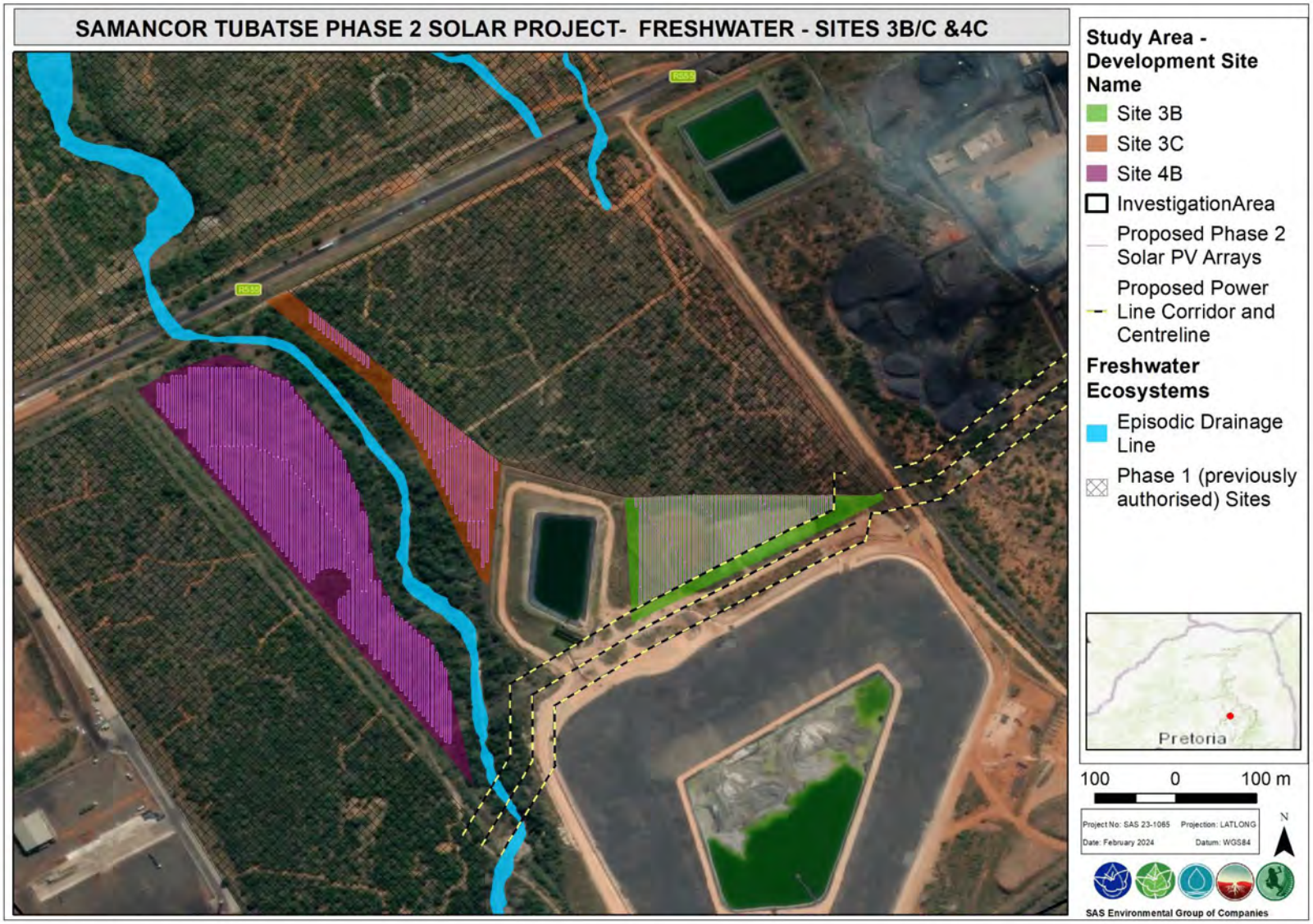


Figure 12 - Delineated freshwater ecosystems associated with the proposed Samancor Tubatse Phase 2 Solar Development study area and associated investigation area in the vicinity of Sites, 3B/ and 4B.

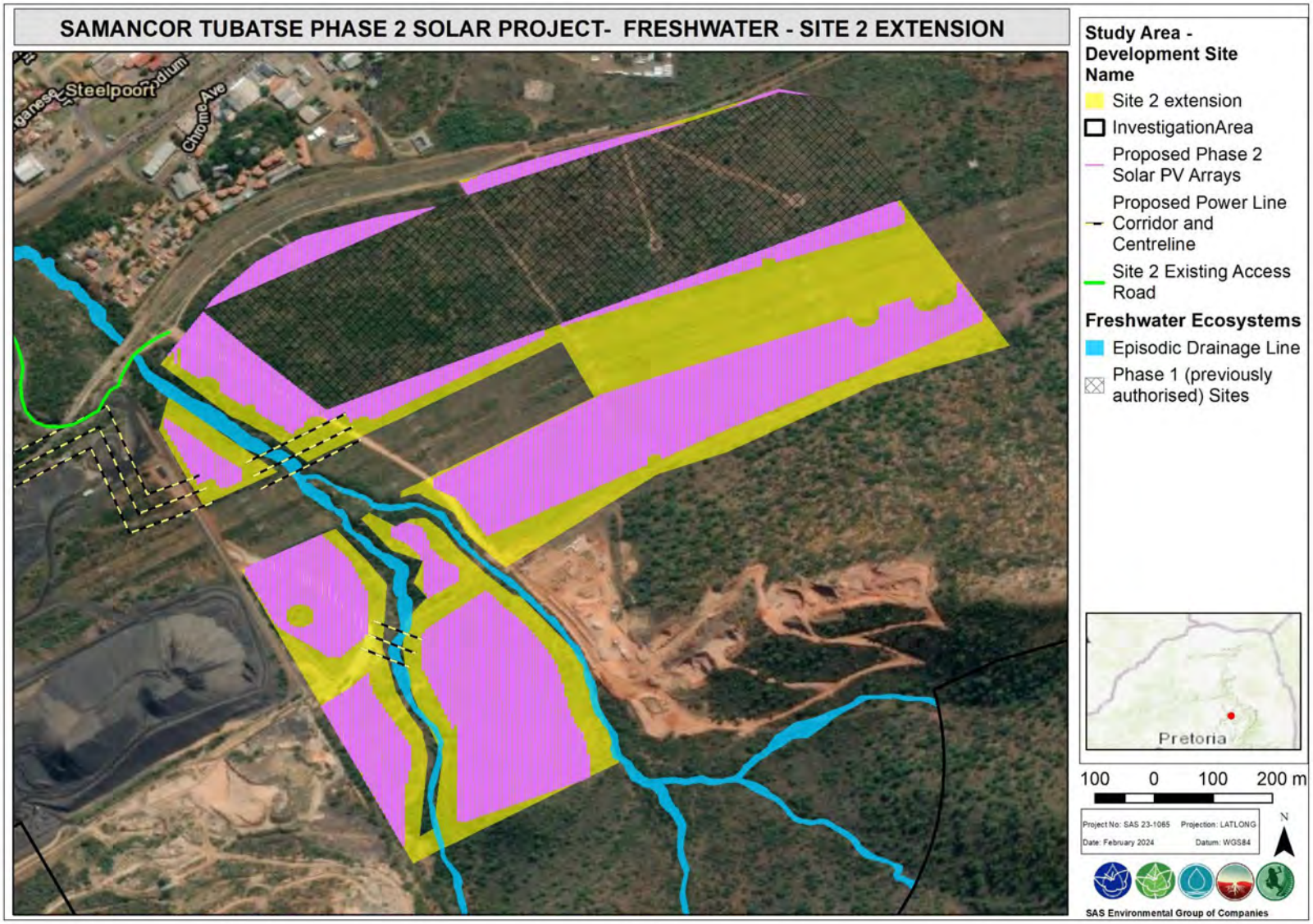
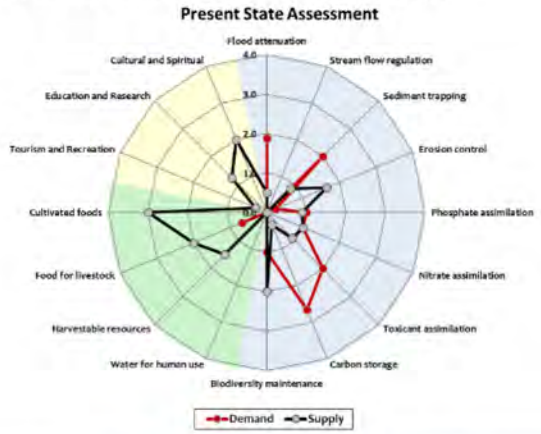


Figure 13: Delineated freshwater ecosystems associated with the proposed Samancor Tubatse Phase 2 Solar Development study area and associated investigation area in the vicinity of Site 2B.

4.2 Detailed Freshwater Assessment

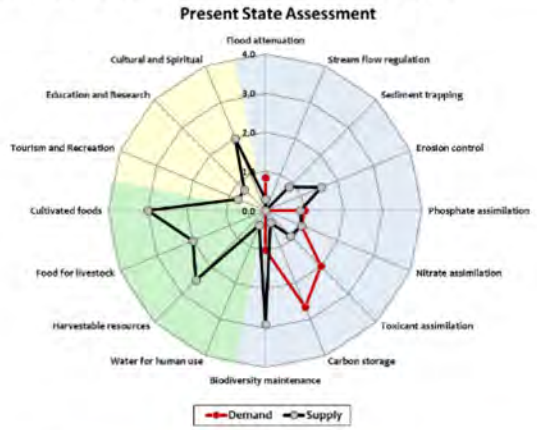
The dashboard-style table below summarises the findings of the field verification in terms of relevant aspects (hydrology, geomorphology, and vegetation components) of freshwater ecology of the potentially directly affected freshwater ecosystems. The details pertaining to the method of assessment used to assess the freshwater ecosystems are contained in Appendix C of this report. It should be noted that although water quality parameters are included in the method of assessment used, due to the episodic nature of the freshwater ecosystems, testing of these parameters could not be undertaken. The results of the assessments are presented in Tables 6 and 7 below.

Table 6: Summary of the assessment of the drainage line and tributary in the vicinity of Site 2B.

<table>
<tr><td colspan="2">Ecological & socio-cultural service provision graph:
 
</td><td rowspan="2"> 
Photograph notes: Top left: A shallow channel within the upper part of the reach that has incised into the underlying bedrock; Top right: View into the deeply incised macro channel in the lower parts of the reach that support areas of dense woody riparian vegetation; Bottom left: Vegetation clearing from the non-marginal parts of the riparian zone along the multiple power line servitudes that has left the substrate exposed and vulnerable to erosion; Bottom right: the furthest downstream part of the reach of the drainage line just upstream of the road and rail servitude that displays a high density of alien invasive plants.</td></tr>
<tr><td>Ecoservice provision</td><td>Cultivate Foods– Moderately Low, all other services – Low to Very Low
The reach of the drainage line and its tributary that have been assessed display a generally very low degree of ecological service provisioning. The only service provisioned to more than a low degree is cultivated foods, but this relates to supply more than demand. The overall low degree of ecosystem service provisioning is due to the highly channelised nature of the drainage line and its tributary, and the nature of the hydrology of the features which through their highly episodic nature offer little to no hydrological regulating services. The drainage lines are not designated as significant freshwater features in a bioregional conservation planning context. The drainage lines act as local movement corridors in a relatively largely transformed landscape but the hard barrier presented by the road and railway servitude at the downstream end of the reach significantly affects the links between the reach and the further downstream reaches. The wetland is in an area that is accessible and thus may be locally important for livestock grazing of cattle owned by nearby communities, but this is the only measurable socio-economic function provided.</td></tr>
<tr><td>PES/ discussion</td><td colspan="2">PES Category: C
The catchment of the drainage line and the tributary are overall in a natural condition, being located a hilly terrain that is naturally covered in dense woodland, however significant parts of the catchment area have been transformed by either mining activities or by slag dumps associated with the smelter. Thus the patterns and timing of flows from the catchment into the drainage lines are expected to be partly</td></tr>
</table>

	modified with a certain loss of catchment yield expected. Much of the reach of the drainage line and its tributary in the area assessed appears to consist of natural vegetation, with the steep vertical banks of the drainage line prohibiting access of people and livestock, but a large part of the reach assessed has been significantly vegetatively altered by the removal of all woody vegetation from the non-marginal parts of the riparian zone, resulting in exposure of substrate and subsequent development of rill and gulley erosion in these areas. At the furthest downstream parts of the reach the drainage line flows under an access road and a railway servitude, with the freshwater habitat in the footprint of these two linear features having been completely transformed.		
EIS discussion	**EIS Category: Low** The EIS of the reach of the drainage line and its tributary in the study area has been assessed to be "Low", with the only notable aspect of EIS being its ecological importance in a biodiversity support context, by acting as a local faunal and biota movement corridor. Hydro-functional importance (i.e., provisioning of services such as flood attenuation, sediment trapping, phosphate, nitrate and toxicant assimilation and erosion control) as supplied by the drainage lines is of much lower significance due to their hydrological characteristics as highly episodic features and as exacerbated by the highly incised channel. The reaches are largely limited in terms of socio-cultural services with only cattle grazing along parts of the reach being noted in terms of socio-economic service provision.	**REC, RMO & BAS Category**	**REC Category: C** **RMO: Maintain** **BAS: C (Maintain)** Since the reach has been assessed to be in a partly modified state with a low EIS rating, the ecological condition of the drainage lines must be maintained. This entails that landuse change in the catchment of the reach and within the reach itself should carefully consider the impact on the drainage lines to ensure that the ecological state does not become further degraded. Accordingly the recommendations made in Section 7 are important to ensure that realisation of the REC.
Watercourse drivers and receptors discussion (hydraulic regime, geomorphological processes, water quality and habitat and biota):			
The drainage line and its tributary represent one of the larger tributary drainage lines of the Steelpoort River in the wider area surrounding the Tubatse Ferrochrome Smelter having a slightly smaller catchment than the drainage line located to the south-west that drains between Sites 3 and 4. Like that drainage line, the Site 2B drainage line and its tributary rise in the hilly terrain to the east of the Smelter. Due to the relatively low rainfall and highly rocky nature of the substrate, overland flows that feed the drainage lines are only expected to generate episodic flows of short duration within the local drainage features in the landscape. The drainage line and its tributary are both highly incised, with the lower parts of the reach being characterised by very steep banks and a deep channel that has cut into the underlying bedrock. The dual factors of the elevated moisture levels associated with the drainage line and the protection offered by the steep macro channel sides has allowed the development of dense woody thickets that persist along parts of the reach. Where the channel could be accessed in the less incised upper parts of the reach, the channel bed was noted to be characterised by gravelly alluvial material. The reach was noted to be mostly geomorphologically stable with the only areas of erosion noted being along the power line servitudes that cross the drainage line as well as the downstream reaches of the tributary. Rill and gulley erosion have developed due to the exposure of substrate to sunlight and to livestock due the removal of woody vegetation by Eskom in the power line servitudes. In other parts of the reach assessed the combination of bedrock outcropping and a dense covering of woody vegetation prevent the further development of erosion. No surface water was present to assess surface water quality. As there is no wetland or aquatic habitat present within the reach no biota that is dependent on wetland or aquatic habitat is likely to be present within the reach. Rather the riparian vegetation is expected to be characterised by a similar biotic assemblage to the residual areas of thicket vegetation in the catchment of the reach.		
Extent of modification anticipated	The proposed solar arrays will encroach on the immediate catchment of the reach assessed, although the proposed 20m development exclusion buffer will remain undeveloped. Although not yet developed, the Phase 1 solar layout will be developed in part of the catchment of the lower part of the reach and thus it can be assumed that runoff and recharge from this part of the drainage line's catchment will be altered. While not physically affecting the drainage line and its delineated riparian habitat the Phase 2 development parcels that are located close to the drainage line will potentially further affect runoff and recharge to the drainage line. In this context the management of stormwater in both the construction and operation phases will be key to mitigating the impact of the proposed Phase 2 solar arrays. An overhead power line is proposed to cross the drainage line and its tributary in two locations, but the drainage line should be able to be singly spanned, thus ensuring no direct impacts on the drainage line.		
Risk Assessment Outcome & Business Case:			
LOW	As no part of the delineated extent of the riparian zone of the drainage line, its tributary and their associated 20m non-development buffer areas are proposed to fall within the solar array footprint, no direct impacts are envisaged, hence a low degree of risk is associated on these freshwater ecosystems with the development of the Site 2B land parcels. Due the nature of solar array development and construction that entails the likely complete clearing of all vegetation and in many cases bulk earthworks for levelling terrain, the runoff from the areas in the area footprint is likely to be permanently altered and the correct management and mitigation of stormwater is important to ensuring that indirect stormwater-related impacts do not adversely affect the downgradient drainage lines. Additionally, it is vitally important that the integrity of the non-development buffer area outside of the delineated riparian boundaries be kept intact with a appropriate vegetation basal cover throughout the lifespan of the development.		

Table 7: Summary of the assessment of the drainage line and tributary in the vicinity of Site 3B, 3C, 4B and 5B.

<table>
<tr><td colspan="2">Ecological & socio-cultural service provision graph:
 
</td><td rowspan="2"> 
Photograph notes: Top left: The channel and riparian zone in the northern, furthest downstream parts of the reach near the R555 road; Top right: View downstream along a part of the reach where bedrock outcrops in the riparian zone ; Bottom left: Cobble bed channel bed with flanking riparian vegetation; Bottom right: Flow within the channel in October 2022 emanating from the discharge from the upstream Tubatse Dam.</td></tr>
<tr><td>Ecoservice provision</td><td>Biodiversity Maintenace – Moderate, Cultivated Foods – Moderately Low; Harvestable Resources – low; all other services – Very Low
The most important aspect of the ecoservice provision relates to biodiversity maintenance. Although not assessed to be provisioned to more of a moderate degree, the reach and the wider drainage line provides an important local ecological movement corridor between the downstream Steelpoort River and the hilly largely undeveloped terrain to the south. Freshwater-related biodiversity maintenance is limited by the absence of perennial flows in the drainage line. The supply of most provisioning services (e.g. food for livestock and harvestable resources) is much greater than the demand. Conversely the demand for certain regulating services is greater than the ability of the drainage line to provide these due to the absence of palustrine wetland habitat and the generally episodic nature of the drainage line.</td></tr>
<tr><td>PES/ discussion</td><td colspan="2">PES Category: B/C
The catchment of the drainage line is largely natural, being located in mountainous undeveloped terrain in which the natural vegetation has been largely retained. Thus the patterns and timing of flows from the catchment into the drainage line is expected to be largely natural. However the Tubatse Dam is located upstream of the reach and accordingly prevents natural runoff from reaching the downstream reaches. The Tubatse Dam is fed by water extracted from the Steelpoort River and water is periodically released from the dam, as observed at the end of the dry season in early October 2022. This management of flow releases from the dam has altered the natural seasonal profile of the drainage line.</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">The reach of the drainage line in the study area is located within an access restricted area and accordingly the riparian vegetation has not been altered by landuse-related degrading factors such as overgrazing and woody vegetation removal The riparian vegetative state of the drainage line is accordingly largely natural, however the marginal zone of the drainage line is expected to reflect a slightly altered vegetative composition in line with the altered hydrological regime with a suspected increase in the abundance of hydrophytes, in particular the sedge Cyperus sexangularis.
The geomorphological state of the drainage line was noted to be highly stable with no active erosion noted..</td></tr>
<tr><td>EIS discussion</td><td>EIS Category: Low
The EIS of the reach of the drainage line and in the study area has been assessed to be "Low", with the only notable aspect of EIS being its ecological importance in a biodiversity support context and at a landscape scale, by acting as a local faunal and biota movement corridor and being located in an access restricted area with riparian vegetation in a largely natural state. Hydro-functional importance (i.e., provisioning of services such as flood attenuation, sediment trapping, phosphate, nitrate and toxicant assimilation and erosion control) as supplied by the drainage line is of lower significance due to its hydrological characteristics as a naturally highly episodic feature, but the reach provides an important local source of water to biota during periods in which flows are released from the upstream Tubatse Dam. The reach is largely limited in terms of socio-cultural function due to its location in an access restricted area.</td><td>REC, RMO & BAS Category</td><td>REC Category: B/C
RMO: Maintain
BAS: B/C (Maintain)
Since the reach has been assessed to be in a largely natural to partly modified state with a low EIS rating, the ecological condition of the drainage line must be maintained. This entails that landuse change in the catchment of the reach and within the reach itself should carefully consider the impact on the drainage line to ensure that the ecological state does not become further degraded. Accordingly the recommendations made in Section 7 are important to ensure that realisation of the REC.</td></tr>
<tr><td colspan="4">Watercourse drivers and receptors discussion (hydraulic regime, geomorphological processes, water quality and habitat and biota):</td></tr>
<tr><td colspan="4">The drainage line is characterised by a relatively large catchment that extends into the mountainous undeveloped area to the south of the Smelter complex. Due to the relatively low rainfall and highly rocky nature of the substrate, overland flows that feed the drainage lines are only expected to generate episodic flows of short duration. As detailed above the Tubatse Dam located upstream of the reach has altered the hydrology of the reach assessed by capturing flows from the upper catchment and then by being associated with periodic discharges of abstracted water into the downstream reach. These factors have altered the hydrology of the reach by creating extended periods of flow in the naturally episodic system that do not correlate to periods of rainfall.
The drainage line drops sharply in elevation from the Tubatse Dam to the lower-lying reaches in the vicinity of the study area at the interface between the Steelpoort Valley footslopes and the valley bottom. The reach assessed occurs in this setting and although it is characterised by a shallower longitudinal profile than the upstream reaches is nonetheless characterised by steep drops in elevation along parts of the reach, particularly where the drainage line runs across an outcropping of highly resistant bedrock that forms a small waterfall when the drainage line is flowing. Most of the reach of the drainage line is characterised by a bedrock base and in many places the sides of the narrow thread channel that characterises the reach are comprised of rock. Despite the prevalence of bedrock along the reach a narrow channel bed is present that is characterised by a mix of gravel and cobbles. The dominance of bedrock largely limits erosion which is absent along the reach.
The reach is naturally characterised by a woody riparian zone with large trees located along the entire length of the reach. As described above the marginal zone is largely characterised by graminoids with a dense grassy understorey and Cyperus sexangularis being dominant along pools and on the margins of the active channel.
At the time of the original assessment of the drainage line (in support of the Phase 1 Solar Development EIA) no surface water was present to assess surface water quality, but observations at other times when the drainage line was flowing revealed a high degree of algal growth in the flowing water which is suggestive of a very high nutrient load and low levels of oxygen in the water discharged from the dam .
As there is no permanent wetland or aquatic habitat present within the reach no biota that is dependent on wetland or aquatic habitat is likely to be present within the reach. Rather the riparian vegetation is expected to be characterised by a similar biotic assemblage to the residual areas of thicket vegetation in the catchment of the reach.</td></tr>
<tr><td>Extent of modification anticipated</td><td colspan="3">The proposed solar arrays on Sites 3B&C and 4B will encroach on the immediate catchment of the reach assessed, although the proposed 20m development exclusion buffer will remain undeveloped. Although not yet developed, the Phase 1 solar layout (in the form of the already approved Sites 3 and 4) will be developed in part of the immediate catchment of the reach and thus it can be assumed that runoff and recharge from this part of the drainage line's catchment will be altered. While not physically affecting the drainage line and its delineated riparian habitat the Phase 2 development parcels that are located close to the drainage line will potentially further affect runoff and recharge to the drainage line and will further reduce a natural buffer of vegetation that would have been retained in the Phase 1 development. In this context the management of stormwater in both the construction and operation phases will be key to mitigating the impact of the proposed Phase 2 solar arrays. An overhead power line is proposed to cross the drainage line, but the drainage line should be able to be singly spanned, thus ensuring no direct impacts on the drainage line.</td></tr>
<tr><td colspan="4">Risk Assessment Outcome & Business Case:</td></tr>
<tr><td>LOW</td><td colspan="3">As no part of the delineated extent of the riparian zone of the drainage line, its tributary and their associated 20m non-development buffer areas are proposed to fall within the solar array footprint, no direct impacts are envisaged, hence a low degree of risk is associated on these freshwater ecosystems with the development of the Site 2B land parcels. Due the nature of solar array development and construction that entails the likely complete clearing of all vegetation and in many cases bulk earthworks for levelling terrain, the runoff from the areas in the area footprint is likely to be permanently altered and the</td></tr>
</table>

	correct management and mitigation of stormwater is important to ensuring that indirect stormwater-related impacts do not adversely affect the downgradient drainage lines. Additionally, it is vitally important that the integrity of the non-development buffer area outside of the delineated riparian boundaries be kept intact with an appropriate vegetation basal cover throughout the lifespan of the development.

4.3 Freshwater Buffers

In order to offer a measure of protection to freshwater ecosystems in the study and investigation areas, non-developable buffer areas are necessary to be designated around all freshwater ecosystems in the study area. According to Macfarlane *et al.* (2015) the definition of a buffer zone is variable, depending on the purpose of the buffer zone, however in summary, it is considered "a strip of land with a use, function or zoning specifically designed to protect one area of land against impacts from another". Buffer zones are considered important to provide protection of basic ecosystem processes (in this case, the protection of wetland ecological services), reduce impacts on water resources arising from upstream activities (e.g. by removing or filtering sediment and pollutants), provision of habitat for aquatic and wetland species as well as for certain terrestrial species, and a range of ancillary societal benefits (Macfarlane *et. al,* 2015). It should be noted however that buffer zones are not considered to be effective mitigation against impacts such as hydrological changes arising from stream flow reduction, impoundments or abstraction, nor are they considered to be effective in the management of point-source discharges or contamination of groundwater, both of which require site-specific mitigation measures (Macfarlane *et. al,* 2015).

In 2023 Scientific Aquatic Services was appointed by Royal HaskoningDHV on behalf of Samancor Chrome Ltd to undertake an assessment / refinement of the freshwater ecosystem buffers on certain of the PV Plant development sites at the Tubatse Solar PV Plant (Phase 1). SAS accordingly applied the Buffer Zone Guidelines for Wetlands, Rivers and Estuaries (MacFarlane and Bredin, 2017) to determine whether an altered freshwater buffer could be accommodated. The scientific buffer Guideline tool was applied to the two freshwater ecosystems that are located on or in close proximity to three (3) of the Phase 1 development sites – Sites 3,4 and 5:

- The Steelpoort River which drains to the north of the northern boundary of Site 5; and
- The non-perennial drainage line that drains northwards between Sites 3 and 4, and to the north of the R555 provincial road through Site 5 (before flowing into the Steelpoort River).

Due to their differing physical characteristics, the scientific buffer tool was separately applied to the Steelpoort River and the non-perennial drainage line. It is important to note that the initial freshwater assessment for the Phase 1 development had applied a buffer / development exclusion area for all freshwater ecosystems in the study and investigation areas of 32m from the outer boundary of the delineated riparian zone of the respective river / drainage line.

The buffer guideline provides an Excel™ based Buffer Zone Tool to determine suitable buffer zone requirements. The tool includes a rapid desktop tool for determining potential aquatic impact buffer zone requirements together with a site-based tool for determining buffer zone requirements for rivers, wetlands and estuaries. Central to the tool is a buffer model, which is populated automatically from the data inputted. This is based on best available science and is used to generate buffer zone recommendations as part of the assessment process. The buffer assessments were determined using site-based parameters using data previously collected for the freshwater ecosystems in the study area and based on an assessment conducted on Site 5 on the 09th of June 2023. Table 8 details the results of the refined buffer assessment.

Table 8 – Development Exclusion Buffers as recommended by the buffer tool for the Steelpoort River and the Site 3,4 and 5 drainage line.

Freshwater Ecosystem	Construction phase buffer	Operational Phase buffer	Final aquatic impact buffer
Steelpoort River	20m	20m	**20m**
Drainage Line – Sites 3,4 and 5	20m	20m	**20m**

The results of the study designated a 20m development exclusion buffer to the two freshwater systems. The outcomes of the study can be applied to the current Phase 2 EIA phase freshwater study. Whilst not located in close proximity to any of the Phase 2 development sites, the Steelpoort River is partly located in the investigation area, but the non-perennial drainage line that runs between Sites 3 and 4 is located in relatively close proximity to Sites 3B&C and Site 4B. Accordingly the buffers can be applied to this study. The drainage line and tributary draining to the south-west of the Phase 1 Site 2 and which drains between certain of the newly proposed Site 2B development parcels was not assessed in the buffer refinement study, but as detailed in Section 4.2 above, these drainage lines have very similar characteristics to the drainage between Sites 3 and 4 and thus the 20m non-development buffer has been extrapolated to the Site 2 drainage lines.

It should be noted that although unlikely to be affected by the Phase 2 development, the two first order drainage lines located on the Phase 1 development Site 5 (to the west of the Phase 2 5C development site) have been authorised by the Phase 1 development's Water Use Authorisation to be canalised and straightened, thus these two drainage lines will cease to be natural freshwater ecosystems. Due to this authorised transformation, development exclusion buffers are not deemed to be necessary for these two drainage lines.

The non-development buffers are indicated in Figures 14-16 below.

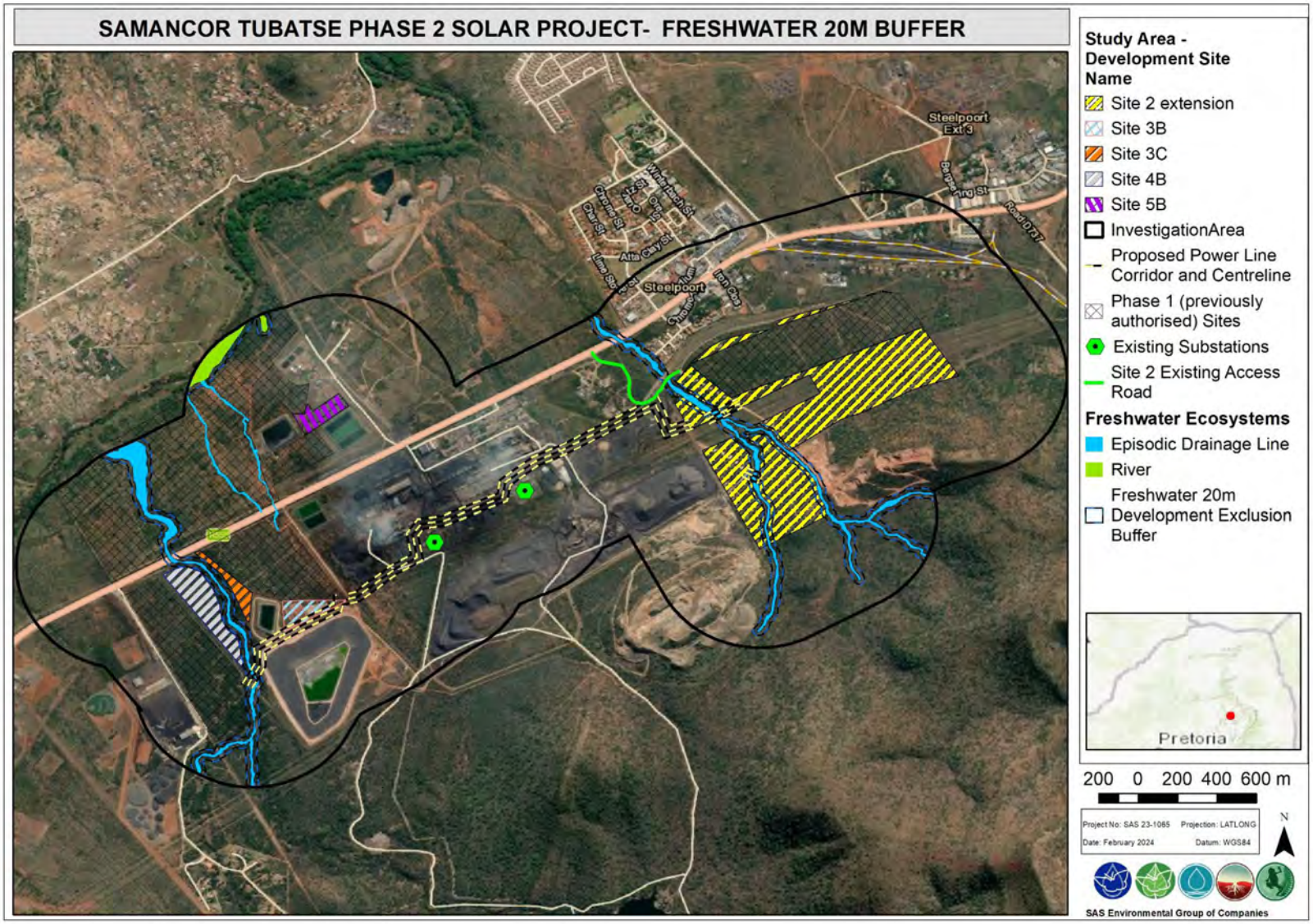


Figure 14 – 20m development exclusion buffer of freshwater ecosystems associated with the proposed Samancor Tubatse Phase 2 Solar Development study area and associated investigation area.

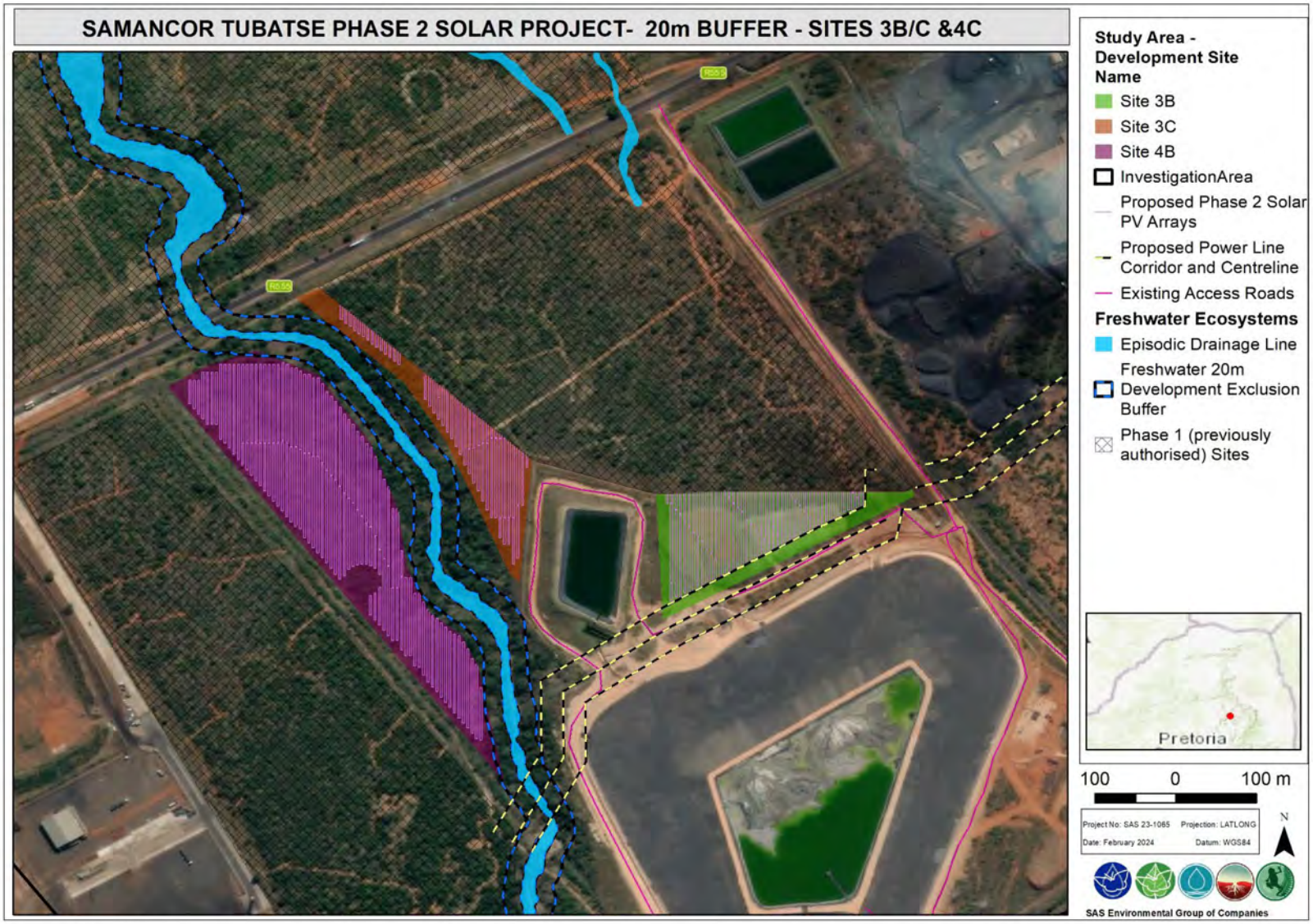


Figure 15 – 20m development exclusion buffer of freshwater ecosystems in the vicinity of Sites 3B/C and 4B associated with the proposed Samancor Tubatse Phase 2 Solar Development study area and associated investigation area.

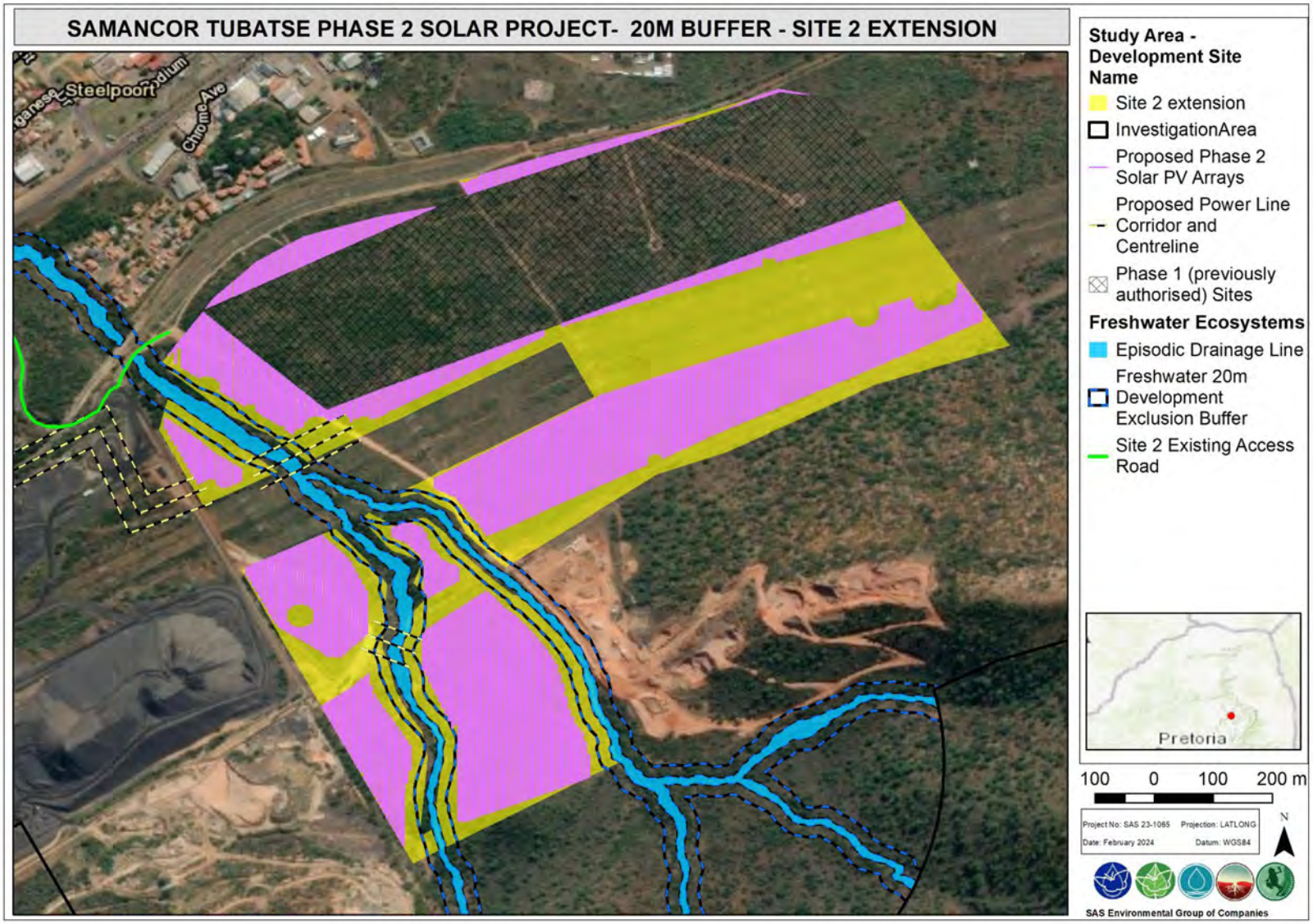


Figure 16: 20m development exclusion buffer of freshwater ecosystems in the vicinity of Site 2B associated with the proposed Samancor Tubatse Phase 2 Solar Development study area and associated investigation area.

5 LEGISLATIVE REQUIREMENTS

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

- Constitution of the Republic of South Africa, 1996[5];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended (NEMA);
- Environmental Impact Assessment Regulations, 2014, (GNR 982 in GG 38282 of 4 December 2014) as amended;
- The National Water Act, 1998 (Act No. 36 of 1998) as amended (NWA);
- Government Notice 4167 (GN 4167) as published in the Government Gazette 49833 of 08 December 2023 as it relates to the National Water Act, 1998 as amended (Act No. 36 of 1998).

5.1 Legislative Zones of Regulation

Certain articles of legislation related to the above Acts and legislation impose potential zones of regulation on freshwater ecosystems in both a national and provincial context. The Zones of Regulation (ZoR) are not necessarily development exclusion zones (refer to Section 4.3 above for the recommended development exclusion buffer, rather areas in which EIA and Water Use Authorisation legislative tools have been introduced for the protection and sustainable use of freshwater resources by requiring that certain types of activities within a freshwater ecosystem, or within a certain distance of a freshwater ecosystem require authorisation. The definition and motivation for a regulated zone of activity for the protection of freshwater ecosystems can be summarised as follows:

[5] 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.

Table 9: Articles of Legislation and the relevant zones of regulation applicable to each article.

Regulatory authorisation required	Zone of applicability
Water Use Authorisation Application in terms of the National Water Act, 1998 (Act No. 36 of 1998) as amended.	Government Notice 4167 as published in the Government Gazette 49833 of 08 December 2023 as it relates to the National Water Act, 1998 (Act No.36 of 1998) as amended. In accordance with GN 4167, a regulated area of a watercourse in terms of water uses as listed in Section 21l and 21(i) is defined as: • **the outer edge of the 1 in 100-year flood line 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;** • **in the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m distance from the edge of a watercourse where the edge of the watercourse (excluding flood plains) is the first identifiable annual bank fill flood bench; or** • In respect of a wetland, a 500 m radius around the delineated boundary (extent) of any wetland, including pans.
Listed activities in terms of the EIA Regulations (2014), as amended[6].	**Activities of Listing Notice 1 (GN 983) of the National Environmental Management Act, 1998 (Act No.107 of 1998) EIA regulations, 2014 (as amended):** **Activity 12** *The development of—* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or* *(ii) infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs—;* ***a) within a watercourse;*** *b) in front of a development setback;* *c) if no development setback exists, within **32 metres of a watercourse**, measured from the edge of a watercourse.* **Activities of Listing Notice 3 (GN 324) of the National Environmental Management Act, 1998 (Act No.107 of 1998) EIA regulations, 2014 (as amended) applicable to Limpopo .** ***Activity 14**:* *The development of—* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 10 square metres; or* *(ii) infrastructure or structures with a physical footprint of 10 square metres or more;* *where such development occurs—;* ***a) within a watercourse;*** *b) in front of a development setback;* *if no development setback exists, within **32 metres of a watercourse**, measured from the edge of a watercourse* *(f) Limpopo -i. Outside urban areas:* *(ff) Critical biodiversity areas or **ecosystem service areas** as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans.*

[6] Note – only listing notice activities that are associated with a zone of regulation are detailed in this table. This does not exclude the applicability of other potentially applicable activities that relate to the freshwater environment (e.g., Listing Notice 1 Activity 19) or any other applicable listing notice activity to the proposed development.

Due to the sole occurrence of non-wetland freshwater HGMs in the study and investigation areas, a 100m GN4167-related ZoR will apply to the freshwater ecosystems in the study and investigation areas, with the exception of the Steelpoort River and the drainage line that drains between Sites 3 and 4; 1:100 year floodlines were delineated for these freshwater ecosystems as part of the Tubatse Solar ("Phase 1") EIA and thus the floodlines need to be used as the applicable GN4167 Zone or Regulation for these freshwater ecosystems.

In terms of the NEMA EIA Regulations, due to the proposed development of new infrastructure and structures, both Listing Notice 1 Activity 12 and Listing Notice 3 Activity 14 which are associated with a 32m Zone of Regulation could apply to the proposed development (should the activity trigger the 100m^2 threshold and the 10m^2 threshold within an ESA for LN1 Activity 12 and LN3 Activity 14 respectively.

In terms of the NEMA EIA Regulations, a 32m ZoR would apply in terms of Activity 12 and in terms of Activity 12 of Listing Notice 3 (due to the designation of certain parts of the study and investigation areas as an ESA). It is important to note that this 32m ZoR is not the same as a development exclusion buffer, as discussed in Section 4.3 above.

The applicable zones of regulation for the proposed Samancor Tubatse Phase 2 Solar Development can be summarised as follows:

- 32 m Zone of Regulation (NEMA EIA Regulations);
- 100 m Zone of Regulation (GN4167) for certain of the EDLs; and
- The delineated 1:100 year floodline for the Steelpoort River and EDL draining between Sites 3C and 4B.

The respective zones of regulation as stipulated above are depicted in Figures 17-19 below.

In terms of enviro-legal process requirements relating to the freshwater environment, several freshwater-related triggers as detailed above would require environmental authorisation in terms of the EIA Regulations of 2014 as amended and the Listing Notices associated with the EIA Regulations. The freshwater-related listed activities fall under Listing Notices 1 and 3 and would require a Basic Assessment Process to be undertaken but as certain Listing Notice 2 activities will be triggered by the proposed solar (renewable energy) development a scoping and EIA process will be required to be undertaken.

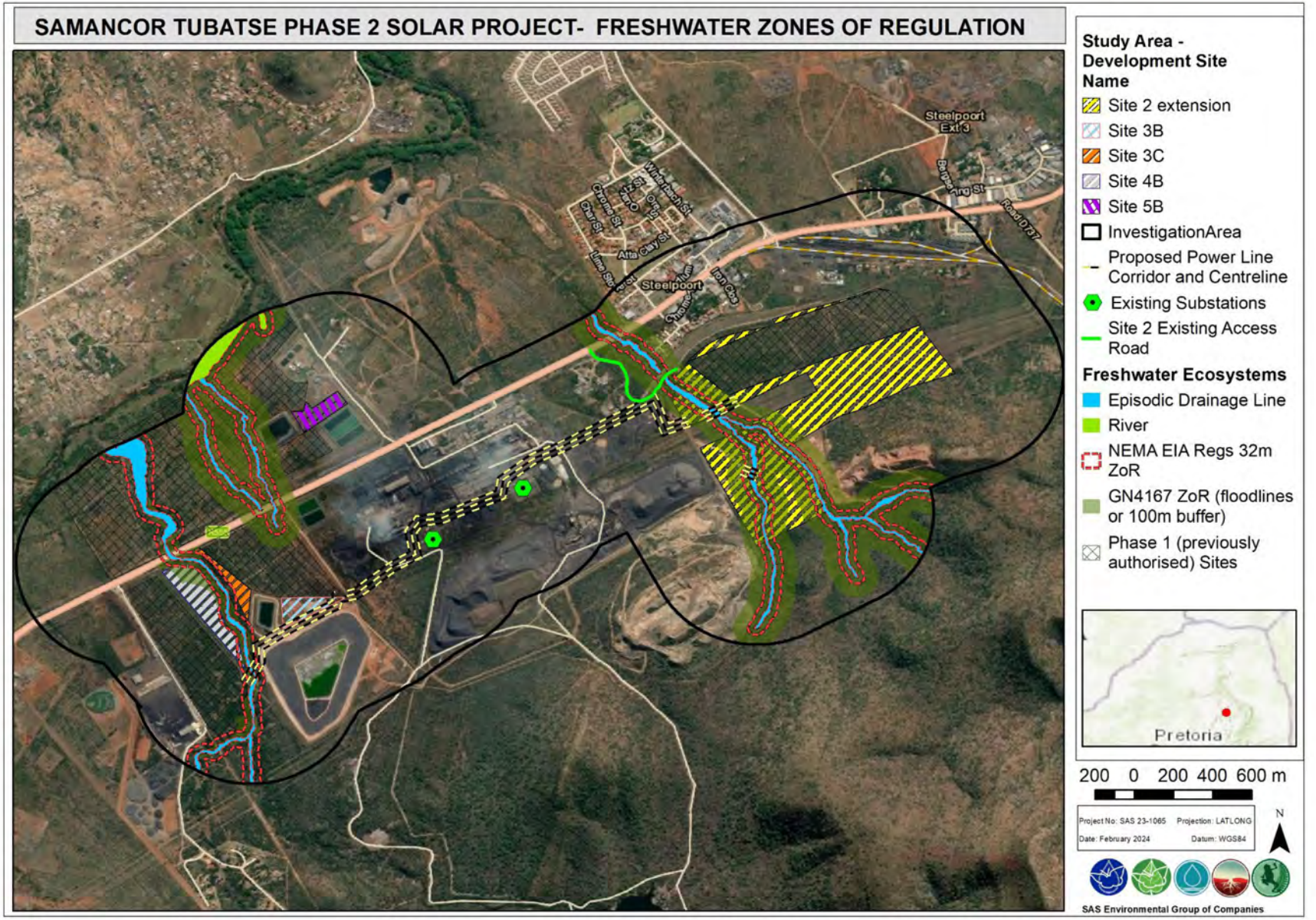


Figure 17: Conceptual presentation of the zones of regulation applicable to the Samancor Tubatse Phase 2 Solar Development in relation to the delineated freshwater ecosystems.

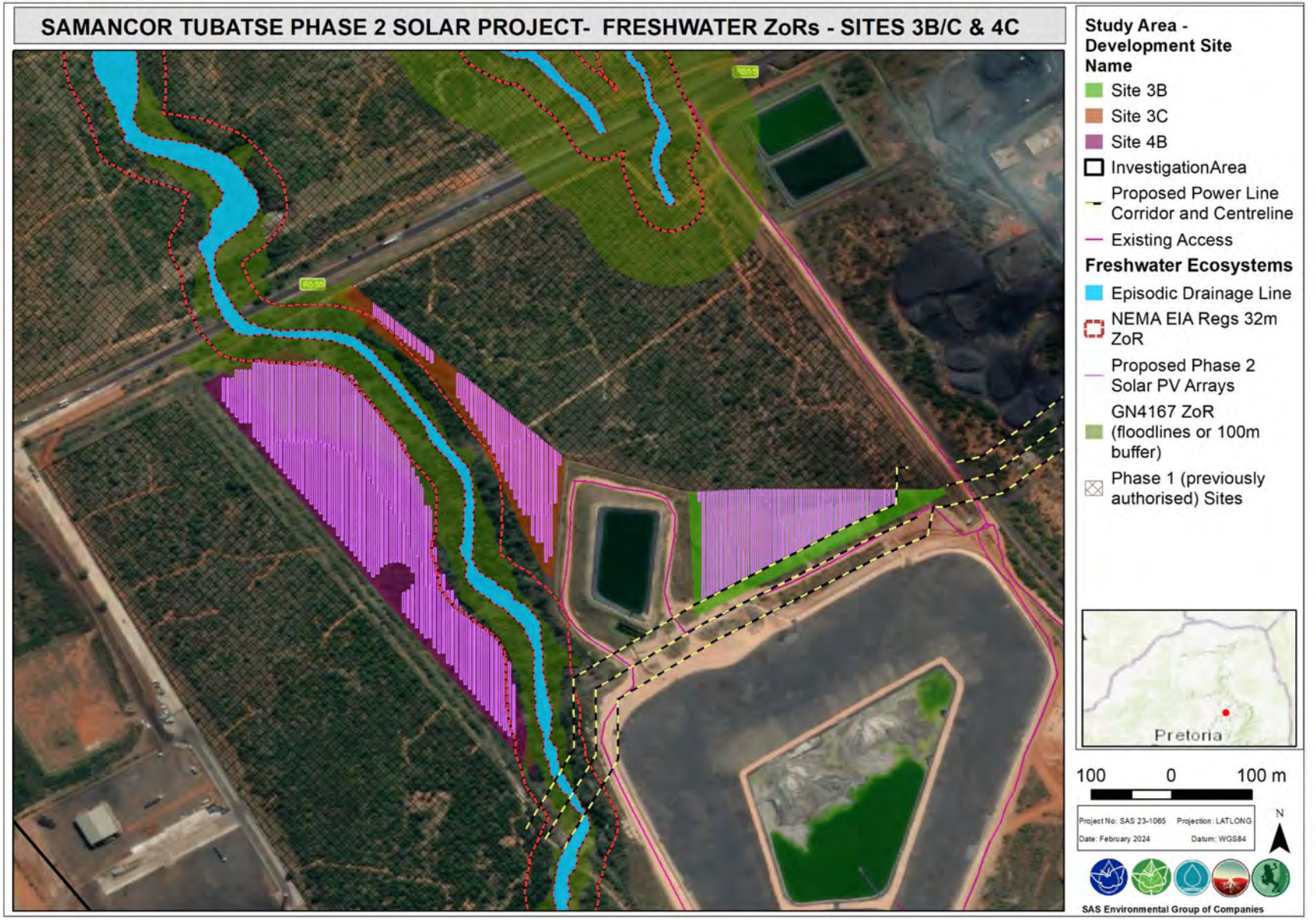


Figure 18: Conceptual presentation of the freshwater zones of regulation applicable to the Samancor Tubatse Phase 2 Sites 3B/C and 4B.

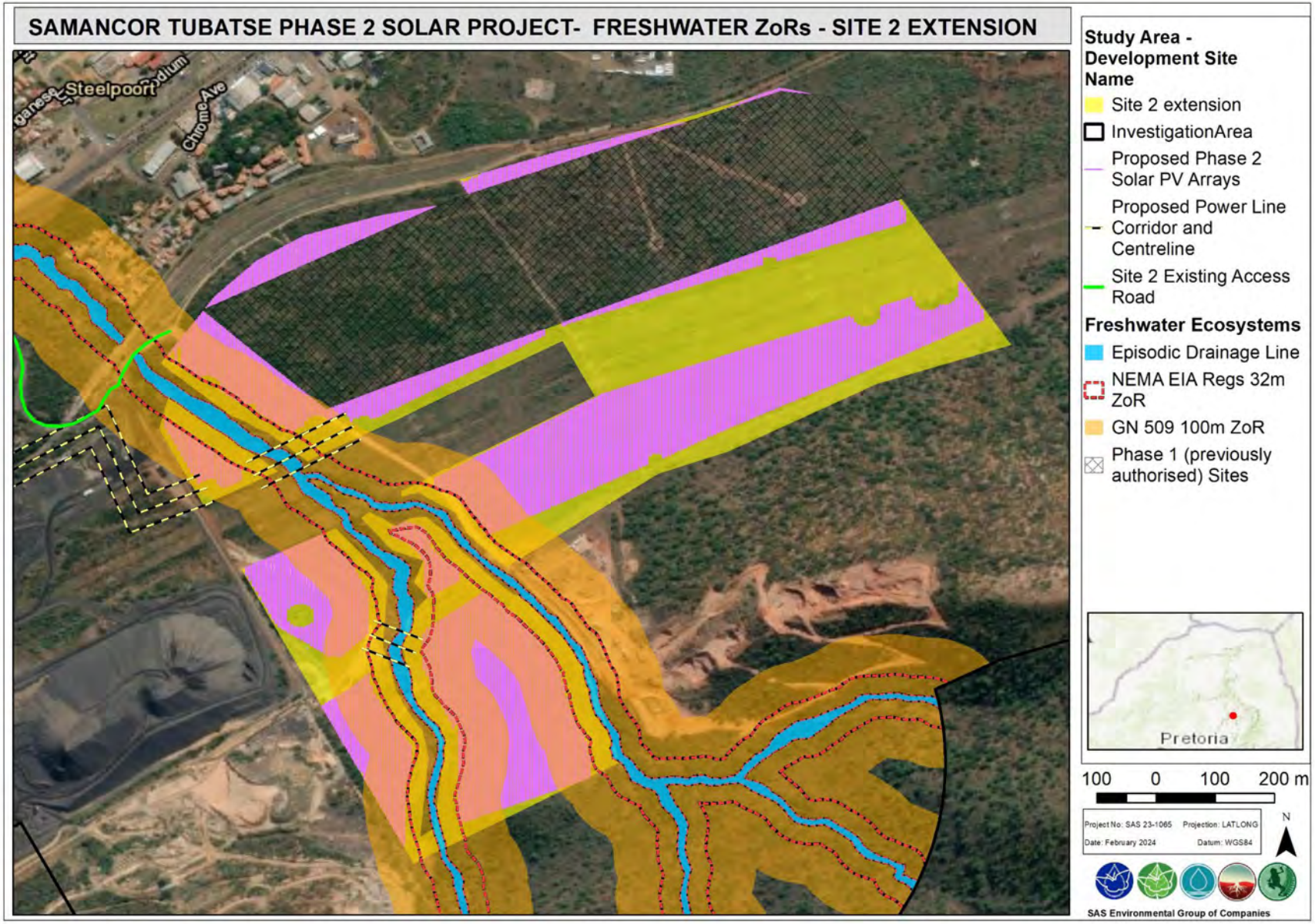


Figure 19: Conceptual presentation of the freshwater zones of regulation applicable to the Samancor Tubatse Phase 2 Site 2B.

6 FRESHWATER SENSITIVITY VERIFICATION

The protocol for the assessment of freshwater and aquatic biodiversity prepared in support of the Department of Forestry, Fisheries and Environment (DFFE) (previously the Department of Environmental Affairs (DEA)) National Web-based Environmental Screening Tool (2020), provides the criteria for the assessment and reporting of impacts on aquatic/freshwater biodiversity for activities requiring Environmental Authorisation (EA). For the aquatic / freshwater biodiversity theme, the requirements are for sites which support various levels of biodiversity. The relevant aquatic / freshwater biodiversity theme in the National Web-based Environmental Screening Tool (2020) has been provided by the South African National Biodiversity Institute (SANBI). Based on the sensitivity rating, a suitably qualified specialist must prepare the relevant report or opinion memorandum which is to be submitted as part of the EA application.

According to the guidelines, an applicant intending to undertake an activity on a site identified as being of "very high sensitivity" for an aquatic biodiversity theme must submit an Aquatic Biodiversity Impact Assessment, or if the area is identified as being of "low sensitivity" then an Aquatic Biodiversity Compliance Statement must be compiled and submitted to the competent authority. It is noted, however, that during a site survey undertaken by a suitably qualified freshwater ecologist should the sensitivity be determined different from that assigned by the screening tool (i.e. that a high risk to the regional aquatic biodiversity or freshwater ecosystems in the area is likely even though it is assigned as a "low" sensitivity, or if it is assigned a high sensitivity, however, the proposed development risks are deemed low) then the relevant assessment approach must be followed based on the site survey results and not the screening tool allocation.

As part of the process of the background information gathering, the screening tool was applied to the study and investigation areas. According to the screening tool, the study area and investigation area of the Samancor Tubatse Phase 2 Solar Development is located within areas of low aquatic/ freshwater biodiversity significance (Figure 7).

The only area of very high freshwater aquatic sensitivity as associated with the study area environs is the Steelpoort River. Although not detailed by the screening tool as the river is indicated to fall outside the investigation area, this designation is likely to reflect the importance of the river as a fish support area and being in a moderately modified state.

Based on the site verification undertaken by Scientific Aquatic Services and the findings thereof presented in this report, the designation of very high sensitivity to the Steelpoort River by the DFFE Screening Tool is supported and not disputed. In reality two sections of the river's riparian zone (as delineated in the Phase 1 freshwater study) encroach into the investigation area and these two components of the investigation area are verified to be of very high freshwater sensitivity.

The designation of low sensitivity to the remainder the study and investigation area is partly disputed; the drainage lines that form tributaries of the Steelpoort River cannot be designated as having low aquatic biodiversity (freshwater) sensitivity. This is due to their direct hydrological connectivity to the Steelpoort River, which means that impacts affecting these features could affect the downstream section of the Steelpoort River. Accordingly the management of these drainage lines needs to consider the sensitivity of the Steelpoort River and accordingly the delineated extent of these features needs to be considered to be of high freshwater sensitivity.

Under the Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity, (GN320 of March 2020), for areas of very high aquatic biodiversity sensitivity an Aquatic Biodiversity Assessment must be produced. Such a reporting approach (scoping and EIA-phase freshwater reports) have accordingly been compiled.

Please refer to the site sensitivity verification report contained in Appendix H.

7 ASSESSMENT OF IMPACTS

This section presents the significance of potential impacts on the freshwater ecology of the freshwater ecosystems. In addition, it indicates the required mitigatory measures needed to minimise the perceived impacts of the proposed activities and presents an assessment of the significance of the impacts taking into consideration the available mitigatory measures and assuming that they are fully implemented.

7.1 DWS Risk assessment - analysis

7.1.1 Consideration of impacts and application of mitigation measures

Following the assessment of the freshwater ecosystems associated with the proposed PV facility, the DWS prescribed Risk Assessment Matrix (as prescribed by GN 4167 of December 2023) was applied to ascertain the significance of perceived impacts on the key drivers and receptors (hydrology, water quality, geomorphology, habitat and biota) of these freshwater ecosystems.

The points below summarise the considerations taken when applying the DWS Risk Assessment Matrix (2023):

- The DWS Risk Assessment Matrix (2023) was applied assuming that a high level of mitigation will be implemented, thus the results, provided in this report presents the perceived impact significance ***post-mitigation***;
- In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the DEA *et al.* (2013) would be followed, i.e. the impacts would first be avoided, minimised if avoidance is not feasible, rehabilitated as necessary and offset if required; and
- Most impacts are considered to be easily detectable, with the exception of potential contamination of surface and groundwater which will require some effort. Assessing these potential impacts falls outside of the scope of this freshwater ecosystem study.

7.1.2 Risk Assessment discussion of anticipated ecological impacts

There are four key ecological impacts on the wetlands that are anticipated to occur namely,

- Loss of wetland habitat and ecological structure;
- Changes to the sociocultural and service provision;
- Impacts on the hydrology and sediment balance of the freshwater ecosystems; and
- Impacts on water quality.

Various activities and development aspects may lead to these impacts, however, provided that the mitigation hierarchy is followed, some impacts can be avoided or adequately minimised where avoidance is not feasible. The mitigation measures provided in this report have been developed with the mitigation hierarchy in mind, and the implementation and strict adherence to these measures will assist in minimising the significance of impacts on the receiving environment.

A summary of the DWS Risk Assessment Matrix applied to the proposed development activities, is provided in the table below, whilst a comprehensive outcome of the risk assessment is presented in Appendix G.

Table 10: Summary of the results of the DWS risk assessment matrix applied to the freshwater ecosystems associated with the proposed Tubatse Solar Phase 2 development.

Phase	Activity	Impact	Risk Rating	Mitigation measures
Pre-construction Phase	Potentially inappropriate planning of stormwater management for the project.	•Alteration of hydrology and geomorphology of receiving freshwater ecosystems and resulting degradation of freshwater habitat through poor stormwater design.	L	•Stormwater management off the solar panel arrays and other hard surfaces must not adversely affect downgradient freshwater ecosystems. Accordingly a stormwater management plan must be developed for the development that ensures that stormwater drainage inputs to the freshwater ecosystems mimic the current baseline as far as possible. In order to achieve this, it is strongly recommended that the principles of SuDS be implemented into stormwater design and attenuation on the development site. The use of SuDS-compliant features such as bioswales to manage stormwater will further assist in preventing significant impacts on the hydrological functioning of the freshwater ecosystems, reduce the risk of flooding during high flow periods and reduce the risk of increased erosion in the downgradient drainage lines. Furthermore, SuDS features vegetated with indigenous wetland or riparian species can assist with water polishing and trapping hydrocarbons from stormwater run-off from access roads before this is released into the downgradient drainage lines. The following is deemed applicable for the construction of the SuDS: 1.All SuDS-related attenuation facilities must be constructed through excavation of the in-situ material, sloped to a ratio not steeper than 3:1 and lined with rocks and cobbles to assist with energy dissipation and prevent sedimentation and erosion as well as improve the aesthetic appeal of the SuDs; 2.SuDs-related attenuating features must be vegetated with indigenous obligate and facultative species suitable for seasonal saturation. This will assist with energy dissipation and prevent sedimentation and erosion as well as improve habitat provision. 3.Cobbles / rip rap must be placed on all outlet structures and indigenous vegetation established to bind the soil of the bed, to prevent erosion and assist with energy dissipation. This will also promote diffuse flow and decrease the velocity of water released downgradient towards the drainage lines. At no point must erosion or gully formation be allowed as this will have an impact on the water dispersal which could potentially reduce the extent and functionality of the riparian systems in the long-term; 4.All materials used to construct the attenuation features must not generate toxic leachates or lead to significant changes in pH or dissolved salt concentrations. This also applies to the swales installed from where stormwater will be released into the downgradient drainage lines; 5.Since runoff form the area will be defined as clean runoff no plastic lining is necessary nor may be used as part of the attenuation pond construction as this has various ecological impacts, with special mention of impacts to faunal assemblages; 6.With regards to concrete works for the outlet structures (including concrete aprons, reno mattresses, gabions, headwalls, etc., as applicable), see control measures related to concrete works below. These must ideally be constructed during the drier winter months to reduce the potential for impacts on downgradient freshwater ecosystems.

	Clearing of Vegetation and Terrain Levelling (Bulk Earthworks) within the catchments of the drainage lines.	•Transformation of vegetation associated with freshwater ecosystems as well as associated habitat and ecosystem services as a result of indirect impacts; •Transportation of construction materials can result in disturbances to soils, and increased risk of sedimentation/erosion; and •Soil and stormwater contamination from oils and hydrocarbons originating from construction vehicles. •Earthworks and the associated disturbed soil could be potential sources of sediment, which may be transported in runoff into the downgradient freshwater ecosystem areas. This is particularly pertinent in this project areas as the soils are prone to erosion; •Exposure of soil, leading to increased runoff, and erosion, and thus increased sedimentation of the freshwater ecosystems; •Increased sedimentation of the freshwater ecosystems, leading to smothering of the vegetation and aquatic biota associated with the freshwater ecosystems; and •Proliferation of alien and/or invasive vegetation as a result of disturbances.	L	• The construction site must be fenced prior to the start of site clearing to prevent any accidental clearing of vegetation or construction impacts from adversely impacting areas outside of the approved development footprint (layout). •All construction and site clearing should ideally take place during the dry season to limit potential impacts to downgradient drainage lines as a result of construction activities; •An Environmental Control Officer (ECO) must be appointed in order to ensure all water related aspects are adequately mitigated for the duration of the construction phase. •All development footprint areas to remain within the approved development area and vegetation clearing to be limited to what is essential within those approved footprints; •Retain as much indigenous vegetation as possible; •Where clearing of vegetation at a large scale (i.e. in the solar panel array footprints) is to be undertaken, no large-scale indiscriminate clearing of vegetation from the entire footprint must be undertaken. Rather blocks of vegetation must be systematically cleared of vegetation to avoid the creation of large volumes of dust and to control stormwater runoff during construction; •All vegetation removed as part of the site clearing activities (specifically where large areas need to be cleared) must be transported from the construction site (may not be stockpiled) and disposed of at a registered waste disposal facility; •During and after clearing regular spraying of non-potable water or the use of chemical dust suppressants, that are approved for use near freshwater ecosystems must be implemented to reduce dust and to ensure no smothering of vegetation within the adjacent freshwater ecosystems occurs from excessive dust settling. It is recommended that a suitably qualified specialist be consulted for approval of the product and conditions for use; •The freshwater ecosystems and their 20m non development buffers must be strictly maintained as no-go areas. No construction vehicles, nor construction personnel or vehicles may traverse through these freshwater ecosystems; •Existing roads must be utilised to gain access to sites; •All vehicle re-fuelling is to take place in specifically designated re-fuelling areas that must be located outside of the GN 4167 ZoR; and •No vegetation may be removed from the non-development buffer surrounding the freshwater ecosystems where no infrastructure is planned, as this vegetation provides a natural buffer zone around the freshwater ecosystems which plays a role in dispersing surface runoff into the freshwater ecosystems, and thus prevents sedimentation and erosion thereof.

Phase	Activity	Impact	Risk Rating	Mitigation measures
	Construction of surface infrastructure associated with the proposed development within the catchments of the drainage line reaches e.g. solar panel arrays and other associated infrastructure.	•Earthworks and excavations could be potential sources of sediment, which may be transported as runoff into the downgradient freshwater ecosystem areas; •Disturbances of soils leading to increased alien vegetation proliferation within the terrestrial buffer zone surrounding the freshwater ecosystems, with the potential to affect the freshwater habitat; •Altered runoff patterns within the local catchment of the freshwater ecosystems, potentially leading to increased erosion and sedimentation of the receiving freshwater environment; •Potential impacts on the water quality of surface water runoff (when present) which may potentially enter the downgradient freshwater ecosystems and contamination of soils due to concrete casting; and •Potential of backfill material entering the freshwater ecosystems, increasing the sediment loads therein.	L	•During construction of infrastructure regular spraying of non-potable water or the use of chemical dust suppressants, that are approved for use near freshwater ecosystems must be implemented to reduce dust and to ensure no smothering of vegetation within the adjacent freshwater ecosystems occurs from excessive dust settling. It is recommended that a suitably qualified specialist be consulted for approval of the product and conditions for use; **With regards to excavation activities:** •During excavation activities, topsoil must be stockpiled separately from other material outside the delineated extent of the freshwater ecosystems and their associated 20m development exclusion buffer; •Excavated materials must not be contaminated, and it must be ensured that the minimum surface area is taken up by any stockpiled materials. The mixture of the lower and upper layers of the excavated soil must be kept to a minimum, so as for later use as backfill material after construction has commenced; •Suitable drainage must be ensured within construction areas (including contractor laydown areas, material storage facilities, etc.) in order to ensure that water does not pond or drain in a concentrated manner into the downgradient freshwater ecosystems. Consideration must be given to ensuring that stormwater is allowed to diffusely spread across the landscape, by ensuring adequate surface roughness of the surrounding terrestrial/freshwater area; •No concentrated runoff from the surface infrastructure construction areas must enter the freshwater ecosystems. This must be achieved by installing silt traps or placing hay bales downgradient of the construction footprint (until suitable basal vegetation cover has been restored) to ensure no sediment laden or concentrated runoff generates from the construction footprint; and •It is highly recommended that an alien vegetation management plan be compiled during the planning phase and implemented concurrently with the commencement of construction. **With regards to concrete mixing on site:** Concrete and cement-related mortars can be toxic to aquatic life. Proper handling and disposal must minimise or eliminate discharges into the freshwater ecosystems. High alkalinity associated with cement, can dramatically affect and contaminate both soil and ground water. The following measures must be adhered to: •Fresh concrete and cement mortar must not be mixed near the freshwater ecosystems. Mixing of cement may be done within the construction camp, however, may not be mixed on bare soil, and must be within a lined, bound or bunded portable mixer. Consideration must be given to the use of ready mix concrete; • No mixed concrete may be deposited directly onto the ground within the freshwater ecosystems (outside of the designated area) or associated riparian habitat. A batter board or other suitable platform/mixing tray is to be provided onto which any mixed concrete can be deposited whilst it awaits placing; •A washout area must be designated outside of the freshwater ecosystems, and wash water must be treated on-site or discharged to a suitable sanitation system; •Cement bags must be disposed of in the demarcated hazardous waste receptacles and the used bags must be disposed of through the hazardous substance waste stream and

Phase	Activity	Impact	Risk Rating	Mitigation measures
				•Spilled or excess concrete must be disposed of at a suitable landfill site. Chain of custody documentation must be provided. **With regards to backfilling of excavated areas:** •Stockpiled material must be used as backfill material; •All excavated areas must be backfilled to the natural ground level with excavated material; and •Soil must be suitably compacted, and all construction material must be removed from the site upon the completion of construction or used in the rehabilitation process.
	Installation of the power line towers (support structures) and stringing of the proposed power line across the respective drainage lines.	•Disturbances of soil leading to potential impacts to the freshwater ecosystem vegetation, increased alien vegetation proliferation in the footprint areas, and in turn to altered freshwater ecosystem habitat; •Mixing of concrete for tower supports which if transported by runoff or dumped into the drainage lines could be harmful to biota and freshwater habitat; and •Altered runoff patterns, leading to increased erosion and sedimentation of the freshwater ecosystems.	L	•During excavation activities, soil must be stockpiled upgradient of the excavated area. Mixture of the lower and upper layers of the excavated soil should be kept to a minimum. This soil must be used to backfill the pits (support structures), immediately after installation of the support structures and/or other infrastructure; •Material used as bedding material (at the bottom of the excavated pit) should be stockpiled as close as possible to the support structures footprint area. Once the pit has been excavated, the bedding material must be placed directly within the pit, rather than stockpiling it alongside the pit; •When the power line is strung between the support structures, no vehicles may indiscriminately drive through the drainage lines, use must be made of the existing access roads. Stringing must be done manually as far as possible, or by means that do not require physical access into the freshwater features. **Please see above for control measures for concrete mixing on site:** **With regards to backfilling of the concrete encasing (applicable to the construction of the powerline);** •Soil removed for excavating the pit should be used as backfill material; •All excavated pits must be compacted to natural soil compaction levels to prevent the formation of preferential surface flow paths and subsequent erosion. Conversely, areas compacted as a result of construction activities must be loosened to natural soil compaction levels; • Any remaining soil following the completion of backfilling of the pits is to be spread out thinly surrounding the installed support structures (outside of the delineated freshwater ecosystems) to aid in the natural reclamation process; and • The construction footprint must be limited to the pit area. The area must be rehabilitated after the completion of the construction phase, including AIP control undertaken until basal vegetation cover is achieved.

Construction Phase	Development and construction of new roads within the immediate catchments of freshwater ecosystems, involving: •Site preparation prior to construction activities including movement of construction equipment / vehicles within the freshwater ecosystems and removal of vegetation; •Ground-breaking, excavations and concrete works in the catchments of the drainage lines.	•Earthworks and exposure of soil could result in sedimentation of the freshwater ecosystems, which may be transported as runoff into the downgradient freshwater ecosystem areas and may smother vegetation associated with the freshwater ecosystem areas; and •Proliferation of alien and/or invasive vegetation as a result of disturbances.	L	•For the proposed internal access roads the construction footprint must be limited to a 10m wide construction Right of Way that includes the road footprint; •The clearing of vegetation within the road construction footprint area must be kept to a minimum to avoid unnecessary disturbance within the active channel; •Any removed vegetation must be stockpiled outside of the delineated boundary of the drainage lines and their associated 20m buffer area. Stockpiles must be placed on the upgradient side of the construction RoW. The footprint areas of these stockpiles must be kept to a minimum, and may not exceed a height of 2 m. Should the vegetation not be suitable for reinstatement after the construction phase or be alien/invasive vegetation species, all material must be disposed of at a registered garden refuse site and may not be burned or mulched on site; •All construction material (with specific mention of prefabricated culvert structures) must be stockpiled in the laydown area and must only be imported to the construction site when required; •Reno-mattresses or riprap must be installed at the outlet side of any culvert structures to ensure energy dissipation and prevent concentrated runoff into the downgradient freshwater buffer area. The reno mattress/riprap must be installed flush with the culvert outlet. •The disturbed part of the construction RoW outside of the road footprint must be revegetated with suitable indigenous vegetation to prevent the establishment of alien vegetation species and to prevent erosion from occurring; •Control of alien invasive vegetation must be undertaken as for other construction areas on the site; and •All existing alien and invasive vegetation must be removed. All material must be disposed of at a registered garden refuse site and may not be burned or mulched on site. •See above regarding excavation; •See above for control measures specific to concrete works.

Phase	Activity	Impact	Risk Rating	Mitigation measures
Operational phase	Operational presence of a solar PV development within the catchments of the respective drainage lines.	•Permanent alteration of patterns and timing of flows and recharge to the receiving drainage lines due to the levelling or parts of their catchments and the permanent removal of vegetation from the solar PV footprints that could alter the hydrological regimes of the drainage lines and cause degradation of riparian habitat; •Altered runoff patterns in the catchment of the drainage lines that could lead to creation of erosion within the buffer areas and within the drainage lines themselves.	L	•The maintenance of a 20m development exclusion area (buffer) around all freshwater ecosystems is critical to buffering the drainage lines from the effects of the loss of vegetation cover and long term alteration of infiltration and resultant runoff capacity of parts of the catchments of the drainage lines within the solar array footprint. •It is accordingly strongly recommended that the buffer zones and drainage lines be fenced into the solar development to protect the integrity of the drainage lines and associated buffer areas; •If technically possible, it is recommended that herbaceous (grassy) vegetation be allowed to become re-established in the footprint of the solar arrays, thereby preventing soils under the solar panels from being permanently exposed, which would render them more vulnerable to erosion, and which render the soils less permeable and thus reducing the infiltration capacity of the soils. It is recommended that a grassy layer be allowed to grow within the array footprints, or within certain parts of the array footprint to improve infiltration of runoff and to trap surface runoff during precipitation events; •As detailed for pre-construction above, it is critical that an operational SWMP that incorporates the principles of SuDS be developed and implemented; •Stormwater discharge into the downgradient buffer areas must be made as diffuse as possible and designed in a manner that promotes the infiltration of stormwater runoff into the soils on the site.
	Operational maintenance of the development (including washing of panels and the maintenance of the power line, especially in the vicinity of the drainage lines).	•Disturbance to soil and ongoing erosion as a result of periodic maintenance activities; and •Altered water quality (if surface water is present) as a result of increased availability of pollutants.	L	•Maintenance activities must be confined to the developed footprint of the solar energy facility which must be fenced off to prevent accidental access into the adjacent freshwater ecosystems (riparian zones); •A formal waste management and disposal system must be implemented at the solar energy facility; •No indiscriminate movement of construction equipment through the drainage lines must be permitted during standard operational activities or maintenance activities. Use must be made of the existing freshwater ecosystem crossings only; and •Vehicles used in the development site must be regularly washed (on a non-permeable surface or off-site) to avoid the dispersal of seeds on any alien or invasive species into the freshwater ecosystems and their associated buffer areas; •Monitoring for the establishment for alien and invasive vegetation species must be undertaken, specifically in the solar panel array footprints. Should alien and invasive plant species be identified, they must be removed and disposed of as per the development's alien and invasive species control plan and the area must be revegetated with suitable indigenous vegetation. •Should erosion be noted in the footprint of the arrays that may potentially impact on a freshwater ecosystem, the area must be rehabilitated by infilling the erosion gully and revegetation thereof with suitable indigenous vegetation;

Phase	Activity	Impact	Risk Rating	Mitigation measures
				•The surface infrastructure areas must be inspected to ensure that no concentrated runoff from these areas form erosion gullies leading to erosion and sedimentation of the receiving freshwater ecosystems. Should these impacts be noted, these gullies/preferential flow paths must be infilled with in situ material and appropriately stabilised and/or revegetated.
	Operational stormwater control and management of stormwater attenuation facilities on the development site.	•Potential pollutants and toxicants entering the downgradient drainage lines if attenuation facilities are not properly maintained; •Potential changes to the water retention pattern, timing and flows within the downgradient drainage lines if attenuation facilities are not properly maintained and thereby become ineffective; •Potential exacerbation of existing erosion and development of new erosion, along with concomitant increased sedimentation within the downgradient drainage lines as a result of the increased stormwater discharge causing increased scour and velocity if the attenuation features are not properly maintained.	L	•Regular inspection of the stormwater outlet structures must be undertaken (specifically after large storm events) in order to monitor the occurrence of erosion. If erosion has occurred, it must immediately be rehabilitated through stabilisation of the embankments and revegetation; •All channels and open swales must be regularly cleaned, and all outlet structures (if any) checked to ensure there is no debris/blockages.
	Operation and maintenance of the proposed internal access roads located on the development sites in the	•Concentrated runoff from the road crossings leading to erosion and subsequent sedimentation of the freshwater ecosystems (increase in the sediment load) and turbulent	L	•No indiscriminate movement of maintenance equipment or vehicles through the freshwater ecosystems must be permitted during standard operational activities or maintenance activities. Use must be made of the existing road accesses to the development parcels only; •Unnecessary disturbances on the margins of the newly developed roads must be avoided; •Vehicles used in the development site must be regularly washed (on a non-permeable surface or off-site) to avoid the dispersal of seeds on any alien or invasive species into the freshwater ecosystems;

Phase	Activity	Impact	Risk Rating	Mitigation measures
	catchments of the drainage lines (where applicable).	flows when surface water is present. Litter and spills (e.g. oils, hydrocarbons) could be washed off the road surface by stormwater and could pollute downgradient areas, including the downgradient drainage lines.		•Hot spots for the accumulation of debris and excess sediment must be identified and when necessary, debris/excess sediment must be removed by hand to prevent future flooding and potential damage to infrastructure; •Routine maintenance of the roads must be undertaken to ensure that no concentration of flow and subsequent erosion occurs due to the road crossings/instream infrastructure. Such maintenance activities must specifically be undertaken after high rainfall events; •Stormwater runoff from the roads must be monitored, to ensure it does not result in erosion of the freshwater ecosystems. Stormwater must be allowed to diffusely spread across the landscape, by ensuring adequate surface roughness in the freshwater feature (through vegetation and rocky areas); •During periodic maintenance activities of the roads, monitoring for erosion must be undertaken; and •Should erosion be observed, caused by the road crossings/instream infrastructure, the area must be rehabilitated by infilling the erosion gully and revegetation thereof with suitable indigenous vegetation. Use can also be made of rocks collected from the surrounding area to infill any area prone to erosion (however, these must be sustainably sourced not taken from the surrounding freshwater ecosystems including rivers in the local area).
DECOMMISSIONING	Removal of all surface infrastructure from the project area.	•Disturbance of soil and vegetation that established within the decommissioning area.	L	•No indiscriminate movement of construction equipment in the freshwater ecosystems and buffer zones surrounding the freshwater ecosystems may be permitted. Use must be made of the existing roads during the decommissioning phase; •All surface infrastructure must be decommissioned. All materials must be removed from the freshwater ecosystems (where applicable) and may be stored/ stockpiled temporarily outside of the delineated extent of the freshwater ecosystems, whereafter it must be removed from site and disposed of at a registered disposal facility; •High flood peaks from the decommissioning footprint areas can be mitigated by ensuring that no concentrated runoff from the surface infrastructure area and subsequent cleared area enters the freshwater ecosystems. The velocity of surface water flow from these areas must be reduced by ensuring that the vegetation in the buffer area surrounding the freshwater ecosystems is intact or by the strategic placement of silt traps of hay bales as a means to obstruct flow but still allow flow to percolate at a reduced velocity and encourages a diffuse flow pattern. In this regard it is recommended at an alien and invasive plant species management plan be implemented during the decommissioning phase to specifically prevent the spread of any such species into the sensitive ecological areas; •Areas where surface infrastructure have been decommissioned and removed must be suitably compacted/ripped and revegetated to ensure that no erosion occurs which may contribute to the sediment load of the freshwater ecosystems; •Should erosion gullies be noted, these areas must be rehabilitated by infilling them with suitable soil and ensuring the area is vegetated. The increased surface roughness will discourage concentrated flow paths to develop and ensure diffuse flow patterns;

Phase	Activity	Impact	Risk Rating	Mitigation measures
				•Should road crossings be decommissioned, road footprint areas within a freshwater feature must be levelled to the same level and shape as that of the upstream and downstream reaches. This will ensure a continuous bed level and prevent any concentration of surface flow from occurring; •Channel banks associated with the freshwater ecosystems must be suitably rehabilitated (shaped end revegetated) to prevent any erosion from occurring; •All bare areas in the investigation area, specifically where vegetation was initially cleared for surface infrastructure components) must be ripped and be revegetated within suitable indigenous vegetation species; •Follow up revegetation must take place where initial revegetation is not successful; and •Post-closure monitoring of the freshwater ecosystems (for a period of 3 years), with specific mention of the invasion of alien vegetation species) is recommended to be undertaken.

All of the activities associated with the construction, operation and decommissioning of the proposed solar facility pose a "Low" risk significance to the freshwater ecosystems within the study and investigation areas, provided that all construction and operational phase mitigation and control measures are implemented. It is imperative that the integrity of the 20m development exclusion buffers be maintained through all development phases. It is also important to note that the development will be located within the immediate catchment areas of the drainage lines and thus stormwater management in both construction and operational phases is highly important. The intervening area between the panels and the site boundaries can be used for the development of soft stormwater attenuation facilities (e.g. bioswales) as part of the implementation of stormwater controls that incorporate the principles of Sustainable Drainage Systems (SuDS) for the development. Such stormwater infrastructure must be kept out of the 20m development exclusion buffer except in instances where this buffer area has been transformed by pre-development factors.

In addition, all mitigation measures as stipulated in the above table, must be implemented to prevent any edge effects and cumulative impacts from occurring on the freshwater ecosystems within the study and investigation areas.

Assuming that strict enforcement of cogent, well-developed mitigation measures takes place, the significance of impacts arising from the proposed solar energy facility are likely to be reduced during the construction and operational phases assuming that a high level of mitigation takes place. Additional "good practice" mitigation measures applicable to a project of this nature are provided in **Appendix I** of this report.

7.2 Impact Rating Matrix

Table 11: Impact Assessment - Vegetation Clearing and Construction of Infrastructure

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** Construction of the solar power facility utilising the current layout – i.e. developing the entire area of the development site, including clearing of vegetation and bulk earthworks and construction of infrastructure **Impact:** Direct transformative impact in parts of the catchments of freshwater ecosystems, as well as potential impacts related to other construction-related activities including uncontrolled movement of vehicles and other construction machinery.	**Without**	2	1	2	2	-7	Moderate Negative
		With	2	1	1	1	-5	Low Negative
		Key mitigation measures: ▪ Clearing of areas to be completed in a phased manner; ▪ Clearing and construction must be restricted to the approved footprint; ▪ Construction staff / machinery must not enter any freshwater ecosystems outside of the site footprint; ▪ Implementation of rehabilitation efforts; ▪ Minimisation of vegetation clearing associated with power line crossings.						
Operation	**Aspect:** Operation of the solar power plant utilising the current layout. **Impact:** Direct transformative / degradative impact of parts of the immediate catchments of the freshwater ecosystems leading to alteration of patterns and timing of inflows to the downgradient freshwater ecosystems.	**Without**	2	3	2	2	-9	Medium Negative
		With	1	3	1	1	-6	Low Negative
		Key mitigation measures: ▪ Ensuring the integrity of buffer zones adjacent to drainage lines; ▪ Ensuring power line servitudes across riparian corridors and buffer zones are not indiscriminately kept clear of all woody vegetation.						

Table 12: Impact Assessment - Stormwater management and runoff-related impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	**Aspect:** Construction of the solar power plant utilising the current layout that would result in exposure of soils. **Impact:** Exposed soil could be eroded with stormwater transported sediment and other potential toxicants into the downgradient drainage lines. The large-scale removal of vegetation would change runoff patterns potentially resulting in increased volumes of runoff into downgradient drainage lines.	**Without**	2	1	2	2	-7	Medium Negative
		With	2	1	1	1	-5	Low Negative
		Key mitigation measures: ▪ Clearing of areas to be completed in a phased manner ▪ Implementation of Stormwater Control Measures on the construction site ▪ The integrity of the buffer must be retained in the construction phase.						
Operation	**Aspect:** Operation of the solar power plant utilising the current layout. **Impact:** Long term impact to downgradient drainage lines if appropriate operational stormwater controls are not installed and maintained. .	**Without**	2	3	2	2	-9	Moderate Negative
		With	2	3	1	1	-7	Moderate Negative
		Key mitigation measures: ▪ Implementation of an operational SWMP that incorporates the principles of SuDS to ensure that pre-impact patterns and timing of recharge to the drainage lines are maintained as far as possible; ▪ Retaining a layer of grassy vegetation under the panels if technically possible to safeguard soil against erosion and to promote infiltration; ▪ Effective management of stormwater infrastructure to ensure its efficacy.						

7.3 Cumulative Impacts

Freshwater ecosystems within the wider area of the wider Sekhukhuneland area and in the context of the Steelpoort-Dwars River platinum mining belt are under continued threat due a variety of factors primarily related to increasing mining activities which are responsible for transformation of large areas of land, including freshwater ecosystems. Other landuses which, in the long term, may prove to be unsustainable include communal ranging of livestock, as well as urban expansion typically result in transformative impacts on freshwater ecosystems. Development of renewable energy infrastructure, including solar energy facilities can also form part of the cumulative impact on freshwater ecosystems. Other factors such as existing linear infrastructure (roads and railways) as well as climate change also exert impacts on the freshwater ecosystems in the wider area.

The development of the Tubatse Solar Phase 1 development has already been authorised, and although construction has not commenced, Samancor Chrome intends to develop both Phase 1 and Phase 2 in order to acquire 100MW of power. Assuming that the Phase 1 development sites are constructed, these will exert a further impact on the freshwater ecosystems within the study area, considering factors such as the change in vegetation cover, as well as potential risks to the sediment balance and pattern flow and timing of water in the landscape associated with the development and the formalisation of certain of the EDLs on the Phase 1 Site 5.

Should the development of the Samancor Tubatse Phase 2 Solar Development impact freshwater resources, this will result in a cumulative impact on the freshwater ecosystems in a wider area, especially at a quaternary catchment or smaller catchment area level. It is however notable that increased sediment inputs are at least partially offset by the reduction in sediment input created by the De Hoop Dam that is located along the Steelpoort River upstream of the development site. The implementation of mitigation measures to avoid impacts (that are detailed in Section 7 above) will negate the creation of a significant cumulative impact.

8 CONCLUSION

Scientific Aquatic Services (SAS) (Pty) Ltd was appointed to conduct a freshwater ecological assessment as part of the Environmental Impact Assessment (EIA) for the proposed Samancor Tubatse Phase 2 Solar Development. The proposed development consists of various development sites, certain of which are located in close proximity to freshwater ecosystems. The results of the identification of freshwater ecosystems indicated that eight (8) non-perennial drainage lines are located in the investigation area, as well as two small portions of the riparian zone of the Steelpoort River. The Site 2B development areas are located in close proximity to two drainage lines, but no part of the physical development footprint extends into the delineated extent of the drainage lines or an associated 20m development exclusion buffer. The results of the detailed assessment of freshwater ecosystems located in the vicinity of the Site 2B and Sites 3B&C and 4B development areas are summarised in the table below:

Table 13: Summary of results of the field assessment as discussed in Section 5.

Freshwater Ecosystem	Present Ecological State (PES) / Ecostatus	Ecoservices	Ecological Importance and Sensitivity (EIS)	Recommended Ecological Category / Recommended Management Objective / Best Attainable State
Site 2B Drainage Line	Riparian PES Category C (Moderately Modified)	Moderately Low to Very Low	Low	REC Category: C BAS Category: C RMO: Maintain
Site 3/4 Drainage Line	Riparian PES Category B/C (Largely Natural /Moderately Modified)	Moderate to Very Low	Low	REC Category: B/C BAS Category: B/C RMO: Maintain

Following the detailed assessment of freshwater ecosystems, the DWS Risk Assessment Matrix (as contained within GN 4167 of December 2023) was applied to determine the significance of impacts of the proposed Tubatse Phase 2 Solar development on the receiving freshwater environment. All activities associated with the construction, operation and decommissioning of the proposed PV facility pose a "Low" risk significance to the freshwater ecosystems within the study and investigation areas. To a large degree the assessment of low risk is due to the exclusion of the drainage line reaches and a 20m development exclusion buffer around their delineated extents from the development footprint. Two power line crossings are proposed, but it is likely that with careful planning the freshwater drainage lines can be fully spanned. It is however highly important that all mitigation measures be fully implemented and that the integrity of the 20m development exclusion area be protected through all development phases. It is also critical that responsible stormwater controls be designed and implemented with the inclusion of SuDS principles being of vital importance.

Based on the strict proviso that all mitigation measures specified in this report be implemented, it is the professional opinion of the freshwater ecologist that the proposed development can be considered acceptable and be able to be granted environmental and water use authorisation.

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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 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.

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APPENDIX B – Legislation

LEGISLATIVE REQUIREMENTS

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.
National Environmental Management Act (NEMA) (Act No. 107 of 1998)	The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in 2017, 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 Water Act (NWA) (Act No. 36 of 1998)	The National Water Act (NWA) (Act 36 of 1998) 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).
National Environmental Management: Biodiversity Act (2004) (Act 10 of 2004) (NEMBA)	**Ecosystems that are threatened or in need of protection.** (1) (a) The Minister may, by notice in the Gazette, publish a national list of ecosystems that are threatened and in need of protection. *(b)* An MEC for environmental affairs in a province may, by notice in *the Gazette*, publish a provincial list of ecosystems in the province that are threatened and in need of protection. (2) The following categories of ecosystems may be listed in terms of subsection (1): *(a)* critically endangered ecosystems, being ecosystems that have undergone severe degradation of ecological structure, function or composition as a result of human intervention and are subject to an extremely high risk of irreversible transformation; *(b)* endangered ecosystems, being ecosystems that have undergone degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems; (c) vulnerable ecosystems, being ecosystems that have a high risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems or endangered ecosystems; and *(d)* protected ecosystems, being ecosystems that are of high conservation value or of high national or provincial importance, although they are not listed in terms of paragraphs *(a)*, *(b)* or (c).
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	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 unauthorized 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.

to the National Environmental Management Biodiversity Act, 2004 (Act No 10 of 2004)	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.
Government Notice 4167 as published in the Government Gazette 49833 of 08 December 2023 as it relates to the NWA (Act 36 of 1998) as amended	GN 4167 outlines the parameters and process of a General Authorisation (GA), which replaces the need to apply for a licence in terms of Section 40 of the NWA, provided that the water use is within the limits and conditions of the GA. The notice replaces GN 509 of 2016. The GA sets out the need to determine the regulated area of a watercourse, as well as the degree of risk posed by an activity/ies related to a particular water use. In accordance with GN 4167 of December 2023, the regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as: a) the outer edge of the 1 in 100-year flood line 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; b) in the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m distance from the edge of a watercourse where the edge of the watercourse (excluding flood plains) is the first identifiable annual bank fill flood bench; or c) In respect of a wetland, a 500 m radius around the delineated boundary (extent) of any wetland, including pans. The GA only applies to the use of water in terms of Section 21(c) and (i) of the NWA where the risk class is LOW as determined through the application of the Risk Matrix as prescribed in the Notice. The GA also does not apply where other Section 21 water uses are triggered, does not apply for most sewage infrastructure and pipelines carrying hazardous materials, water uses associated with hazardous materials, water uses associated with water and wastewater treatment works, and for most mining-related water uses. The GA may be exercised as follows: i) Section 21(c) or (i) water use activities that are determined to pose a LOW Risk as determined through the application of the Risk Matrix as prescribed in the Notice can be undertaken subject to the general conditions of the GA; ii) Section 21(c) or (i) water use activities set out in Appendix D1 of the Notice can be undertaken without being subject to the requirement of a risk assessment and subject to the general conditions of the GA. Such water use activities in Appendix D1 include inter alia emergency river crossings, fence erection, solar renewable infrastructure that has no direct impact on watercourses and mini-scale hydropower developments; iii) Prescribed water use activities undertaken by certain State Owned Entities as detailed in Appendix D2 of the Notice can be undertaken without being subject to the requirement of a risk assessment and subject to the general conditions of the GA; iv) Maintenance work associated an 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 can be undertaken ; v) River and stormwater management activities including maintenance of infrastructure as contained in a river management plan or similar management plan, may be

	conducted subject to the approval of such a plan by the relevant DWS regional office or catchment management agency; vi) Rehabilitation of wetlands or rivers where such rehabilitation activities has a LOW risk class as determined through the Risk Matrix can be conducted; and vii) Emergency work arising from an emergency situation and or incident associated with the persons' existing lawful water use entitlement can be undertaken, provided that all work is executed and reported in the manner prescribed in the Emergency protocol contained in Appendix C of the GA. 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.
National Environmental Management: Waste Act, No 59 of 2008 (NEMWA)	NEMWA, which reforms the law regulating waste management in order to protect the health and the environment by providing reasonable measures for the prevention of pollution; provides for national norms and standards for regulating the management of waste by all spheres of government and provides for the licensing and control of waste management activities.

APPENDIX C – Method of Assessment

1. Desktop Study

Prior to the commencement of the field assessment, a background study, including a literature review, was conducted in order to determine the ecoregion and Ecostatus of the larger aquatic system within which the freshwater ecosystems present or in close proximity of the study area are located. Aspects considered as part of the literature review are discussed in the sections that follow.

1.1 National Freshwater ecosystem Priority Areas (NFEPA, 2011)

The NFEPA project is a multi-partner project between the Council of Scientific and Industrial Research (CSIR), Water Research Commission (WRC), South African National Biodiversity Institute (SANBI), DWA, South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). The project responds to the reported degradation of freshwater ecosystem condition and associated biodiversity, both globally and in South Africa. It uses systematic conservation planning to provide strategic spatial priorities of conserving South Africa's freshwater biodiversity, within the context of equitable social and economic development.

The NFEPA project aims to identify a national network of freshwater conservation areas and to explore institutional mechanisms for their implementation. Freshwater ecosystems provide a valuable, natural resource with economic, aesthetic, spiritual, cultural and recreational value. However, the integrity of freshwater ecosystems in South Africa is declining at an alarming rate, largely as a consequence of a variety of challenges that are practical (managing vast areas of land to maintain connectivity between freshwater ecosystems), socio-economic (competition between stakeholders for utilisation) and institutional (building appropriate governance and co-management mechanisms).

The NFEPA database was searched for information in terms of conservation status of rivers, wetland habitat and wetland features present in the vicinity of or within the study area.

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

The freshwater ecosystems encountered within the study area 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
		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[7] (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.

[7] 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.

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, 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).

3. 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

Impact category	Description	Impact score range	Present State category
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.

4. Freshwater ecosystem 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".[8] The assessment of the ecosystem services supplied by the identified freshwater ecosystems 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;

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

- 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 ecosystems. 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 ecosystems.

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

5. 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 freshwater ecosystem types, a tool was developed using criteria from both WET-Ecoservices (Kotze, *et, al*, 2009) and earlier 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

6. 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 ecosystem (sections above), with the objective of either maintaining, or improving the ecological integrity of the freshwater ecosystem in order to ensure continued ecological functionality.

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

PES			Ecological and Importance Sensitivity (EIS)			
			Very High	High	Moderate	Low
	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 unacceptable (Malan and Day, 2012) and therefore, should a freshwater ecosystem fall into one of these PES categories, an REC class D is allocated by default, as the minimum acceptable PES category.**

A freshwater ecosystem may receive the same class for the REC as the PES if the freshwater ecosystem 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 ecosystem.

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

7. 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 C8 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

4. Index of 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 C3 below.

Table C10: 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

8. Freshwater ecosystem delineation

The freshwater ecosystem 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 freshwater ecosystem, 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 considered:

- topography associated with the freshwater ecosystem;
- 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).

APPENDIX D – Risk Assessment Methodology

For the proponent 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 the 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;
- **Environmental impacts** are the consequences of these impacts 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 wellbeing, 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;
- **Intensity** 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 scale** refers to the geographical scale of the impact; and
- **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 intensity, spatial scale and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 75. The likelihood of the impact occurring is determined by assigning a likelihood score of between 20% and 100%. 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[9].

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, 1998 (Act No. 107 of 1998) 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.

"RISK ASSESSMENT KEY" (Based on DWS 2023 publication: Section 21 c and i water use Risk Assessment Protocol) GN4167 of December 2023 published in Government Gazette 49833 of 8 December 2023) (p208).

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

Table D1: Intensity (What is the intensity of the impact on the resource quality - hydrology, water quality, geomorphology, biota?)

Negative impacts	
Negligible / non-harmful; no change in PES	0
Very low / potentially harmful; negligible deterioration in PES (<5% change)	+1
Low / slightly harmful; minor deterioration in PES (<10% change)	+2
Medium / moderately harmful; moderate deterioration in PES (>10% change)	+3
High / severely harmful; large deterioration in PES (by one class or more)	+4
Very high / critically harmful; critical deterioration in PES (to E/F or F class)	+5
Positive impacts	
Negligible; no change in PES	0
Very low / potentially beneficial; negligible improvement in PES (<5% change)	-1
Low / slightly beneficial; minor improvement in PES (<10% change)	-2
Medium / moderately beneficial; moderate improvement in PES (>10% change)	-3
Highly beneficial; large improvement in PES (by one class or more) and/or increase in protection status	-4
Very highly beneficial; improvement to near-natural state (A or A/B class) and/or major increase in protection status	-5

*PES of affected watercourses must be considered when scoring Impact Intensity

Table D2: Spatial Scale (How big is the area that the activity is impacting on, relative to the size of the impacted watercourses?)

Very small portion of watercourse/s impacted (<10% of extent)	1
Moderate portion of watercourse/s impacted (10-60% of extent)	2
Large portion of watercourse/s impacted (60-80%)	3
Most or all of watercourse/s impacted (>80%)	4
Impacts extend into watercourses located well beyond the footprint of the activities	5

Table D3: Duration (How long does the aspect impact on the resource quality?)

Transient (One day to one month)	1
Short-term (a few months to 5 years) OR repeated infrequently (e.g. annually) for one day to one month	2
Medium-term (5 – 15 years)	3
Long-term (ceases with operational life)	4
Permanent	5

Table D4: Likelihood of impact (What is the probability that the activity will impact on the resource quality?)

Improbable / Unlikely	20%
Low probability	40%
Medium probability	60%
Highly probable	80%
Definite / Unknown	100%

Table D5: Rating Classes.

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 29	(L) Low Risk	Acceptable as is or with proposed mitigation measures. Impact to watercourses and resource quality small and easily mitigated, or positive.
56 – 169	M) Moderate Risk	Risk and impact on watercourses are notable and require mitigation measures on a higher level, which costs more and require specialist input. Licence required.
170 – 300	(H) High Risk	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.

NOTE: A Low Risk class must be obtained for all activities to be considered for a GA

Table D6: Calculations.

Intensity = Maximum Intensity Score (negative value for positive impact)	MAX = 5
Severity = Intensity + Spatial Scale + Duration (<Intensity - Spatial Scale - Duration> for positive impact)	MAX = 15 (MIN = -15 for +ve impacts)
Consequence = Severity X Importance rating	MAX = 75
Significance\Risk = (Consequence X Likelihood) X (100/75)	MAX = 100

APPENDIX E – 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 the 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 is possessed by an organisation;
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[10]. 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 wellbeing, 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; **Extent** refers to the spatial extent, i.e. 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.
    - **Intensity** refers to the degree to which the impact affects the receiving environment, as well as natural, cultural and social functions and processes.
    - **Probability** of occurrence is the likelihood that any given impact will occur.
    - **Significance** is determined by the sum of the ratings assigned to Extent, Duration and Intensity and Probability **(Significance = E + I + D + P)**.

The significance of the impact is then assessed by rating each variable numerically **(Significance = E + I + D + P)** 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 values for significance of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary[11].

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.

[10] The definition has been aligned with that used in the ISO 14001 Standard.
[11] Some risks/impacts that have low significance will however still require mitigation.

Table F1: Descriptive criteria for the rating of impacts and significance of impacts (Royal HaskoningDHV Pty Ltd, 2018).

Descriptive criteria		
Nature	**Category**	
Extent (E)	Categories 1 – 4	
	1	Footprint / site
	2	Local (within a radius of 2 kms of site)
	3	Regional
	4	National
Duration (D)	Categories 1 – 4	
	1	Short (less than five years)
	2	Medium term (5-15 years)
	3	Long term (15-30 years)
	4	Permanent
Intensity (I)	Categories 1 – 4	
	1	Low
	2	Moderate
	3	High
	4	Very High
Probability (P)	Categories 1 – 4	
	1	Improbable
	2	Probable
	3	Highly Probable
	4	Definite
IMPACT : Cumulative		
Extent (E)		
Duration (D)		
Intensity (I)		
Probability (P)		
Significance	**Significance = E + D + I + P**	
	Minimum value of 4, maximum of 16	
	Status determines if positive / negative	
	Neg (13 - 16 points) NEGATIVE VERY HIGH	Permanent and important impacts. The design of the site may be affected. Intensive remediation is needed during construction and/or operational phases. Any activity which results in a "very high impact" is likely to be a fatal flaw.
	Neg (10 - 12 points) NEGATIVE HIGH	These are impacts which individually or combined pose a significantly high negative risk to the environment. These impacts pose a high risk to the quality of the receiving environment. The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment.
	Neg (7 - 9 points) NEGATIVE MODERATE	These are impacts which individually or combined pose a moderate negative risk to the quality of health of the receiving environment. These systems would not generally require immediate action but the deficiencies should be rectified to avoid future problems and associated cost to rectify once in HIGH risk. Aesthetically and/or physically non-compliance can be expected over a medium term. In this case the impact is medium term, moderate in extent, mildly intense in its effect and probable. Mitigation is possible with additional design and construction inputs.

	Neg (4 - 6 points) **NEGATIVE LOW**	These are impacts which individually or combined pose a deleterious or adverse impact and low negative risk to the quality of the receiving environment, and may lead to potential health, safety and environmental concerns. Aesthetically and/or physical non-compliance can be expected for short periods. In this case the impact is short term, local in extent, not intense in its effect and may not be likely to occur. A low impact has no permanent impact of significance. Mitigation measures are feasible and are readily instituted as part of a standing design, construction or operating procedure.
	0 **Neutral**	Impact is neither beneficial nor adverse. These are impacts which cannot be classified as either positive or negative or classified as null and void in the case of a negative impact being adequately mitigated to a state where it no longer renders a risk.
	Pos (4 - 6 points) **POSITIVE LOW**	These are impacts which individually or combined pose a low positive impact to the quality of the receiving environment and health, and may lead to potential health, safety and environmental benefits. In this case the impact is short term, local in extent, not intense in its effect and may not be likely to occur. A low impact has no permanent impact of significance.
	Pos (7 - 9 points) **POSITIVE MODERATE**	These are impacts which individually or combined pose a moderate positive effect to the quality of health of the receiving environment. In this case the impact is medium term, moderate in extent, mildly intense in its effect and probable.
	Pos (10 - 12 points) **POSITIVE HIGH**	These are impacts which individually or combined pose a significantly high positive impact on the environment. These impacts pose a high benefit to the quality of the receiving environment and health, and may lead to potential health, safety and environmental benefits. In this case the impact is longer term, greater in extent, intense in its effect and highly likely to occur. The effects of the impact may affect the broader environment.
	Pos (13 - 16 points) **POSITIVE VERY HIGH**	These are permanent and important beneficial impacts which may arise. Individually or combined, these pose a significantly high positive impact on the environment. These impacts pose a very high benefit to the quality of the receiving environment and health, and may lead to potential health, safety and environmental benefits. In this case the impact is long term, greater in extent, intense in its effect and highly likely or definite to occur. The effects of the impact may affect the broader environment.

APPENDIX F – Results of Field Investigation

PRESENT ECOLOGICAL STATE (PES), ECOSERVICE PROVISION AND ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS) RESULTS

Table F1: Presentation of the results of the PES assessments applied to the assessed reaches of the drainage line and tributary in the vicinity of Site 2B (left) and drainage line located between Site 3B/C and 4B (right)

RIPARIAN IHI	
Base Flows	0.0
Zero Flows	0.0
Moderate Floods	0.0
Large Floods	0.0
HYDROLOGY RATING	**0.0**
Substrate Exposure (marginal)	1.5
Substrate Exposure (non-marginal)	1.5
Invasive Alien Vegetation (marginal)	2.0
Invasive Alien Vegetation (non-marginal)	2.0
Erosion (marginal)	0.5
Erosion (non-marginal)	0.0
Physico-Chemical (marginal)	0.0
Physico-Chemical (non-marginal)	0.0
Marginal	2.0
Non-marginal	2.0
BANK STRUCTURE RATING	**2.0**
Longitudinal Connectivity	2.5
Lateral Connectivity	1.0
CONNECTIVITY RATING	**1.9**
RIPARIAN IHI %	**73.7**
RIPARIAN IHI EC	**C**
RIPARIAN CONFIDENCE	**2.9**

RIPARIAN IHI	
Base Flows	1.5
Zero Flows	-1.0
Moderate Floods	-1.0
Large Floods	-0.5
HYDROLOGY RATING	**0.9**
Substrate Exposure (marginal)	0.5
Substrate Exposure (non-marginal)	0.5
Invasive Alien Vegetation (marginal)	0.0
Invasive Alien Vegetation (non-marginal)	0.5
Erosion (marginal)	0.5
Erosion (non-marginal)	1.0
Physico-Chemical (marginal)	0.0
Physico-Chemical (non-marginal)	0.0
Marginal	0.5
Non-marginal	1.0
BANK STRUCTURE RATING	**0.8**
Longitudinal Connectivity	2.0
Lateral Connectivity	0.5
CONNECTIVITY RATING	**1.4**
RIPARIAN IHI %	**80.0**
RIPARIAN IHI EC	**B/C**
RIPARIAN CONFIDENCE	**2.9**

Table F2: Presentation of the results of the Ecoservices assessment applied to drainage line and tributary in the vicinity of Site 2B

		Present State			
ECOSYSTEM SERVICE		Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	0.5	1.9	0.0	Very Low
	Stream flow regulation	-	-	#VALUE!	#VALUE!
	Sediment trapping	0.9	2.0	0.4	Very Low
	Erosion control	1.6	0.3	0.3	Very Low
	Phosphate assimilation	0.9	1.0	0.0	Very Low
	Nitrate assimilation	1.0	1.0	0.0	Very Low
	Toxicant assimilation	0.9	2.0	0.4	Very Low
	Carbon storage	0.3	2.7	0.2	Very Low
	Biodiversity maintenance	2.0	1.0	1.0	Low
PROVISIONING SERVICES	Water for human use	0.0	0.0	0.0	Very Low
	Harvestable resources	1.5	0.0	0.0	Very Low
	Food for livestock	2.0	0.7	0.8	Low
	Cultivated foods	3.0	0.0	1.5	Moderately Low
CULTURAL SERVICES	Tourism and Recreation	0.3	0.0	0.0	Very Low
	Education and Research	1.3	0.0	0.0	Very Low
	Cultural and Spiritual	2.0	0.0	0.5	Very Low

Table E3: Presentation of the results of the Ecoservices assessment applied to the drainage line located between Sites 3B/C and 4B

		Present State			
ECOSYSTEM SERVICE		Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	0.3	0.8	0.0	Very Low
	Stream flow regulation	-	-	#VALUE!	#VALUE!
	Sediment trapping	0.9	0.0	0.0	Very Low
	Erosion control	1.5	0.0	0.0	Very Low
	Phosphate assimilation	0.9	1.0	0.0	Very Low
	Nitrate assimilation	1.0	1.0	0.0	Very Low
	Toxicant assimilation	0.9	2.0	0.4	Very Low
	Carbon storage	0.3	2.7	0.2	Very Low
	Biodiversity maintenance	2.9	1.0	1.9	Moderate
PROVISIONING SERVICES	Water for human use	0.4	0.0	0.0	Very Low
	Harvestable resources	2.5	0.0	1.0	Low
	Food for livestock	2.0	0.0	0.5	Very Low
	Cultivated foods	3.0	0.0	1.5	Moderately Low
CULTURAL SERVICES	Tourism and Recreation	0.8	0.0	0.0	Very Low
	Education and Research	0.8	0.0	0.0	Very Low
	Cultural and Spiritual	2.0	0.0	0.5	Very Low

Table E4: Presentation of the results of the EIS for the drainage line and tributary in the vicinity of Site 2B (left) and drainage line located between Site 3B/C and 4B (right)

Ecological Importance and Sensitivity			Site 2B DL	Site 3 / 4 DL
			Score (0-4)	Score (0-4)
Biodiversity support			A (average)	A (average)
			1	1.67
Presence of Red Data species			0.5	1
Populations of unique species			0.5	1
Migration/breeding/feeding sites			2.0	3
Landscape scale			B (average)	B (average)
			0.8	1.6
Protection status of the wetland			1	3
Protection status of the vegetation type			1	1
Regional context of the ecological integrity			1	2
Size and rarity of the wetland type/s present			0.5	1
Diversity of habitat types			0.5	1
Sensitivity of the wetland			C (average)	C (average)
			0.83	0.83
Sensitivity to changes in floods			0.5	0.5
Sensitivity to changes in low flows/dry season			1.5	1
Sensitivity to changes in water quality			0.5	1
Hydro-Functional Importance			Score (0-4)	Score (0-4)
Regulating & supporting benefits	Flood attenuation		1	1
	Streamflow regulation		0.5	0.5
	Water Quality Enhancement	*Sediment trapping*	1	1.5
		Phosphate assimilations	0	0
		Nitrate assimilation	0	0
		Toxicant assimilation	1	1
		Erosion control	3	3
	Carbon storage		0.5	1.5
Direct Human Benefits			Score (0-4)	Score (0-4)
Subsistence benefits	*Water for human use*		0	0
	Harvestable resources		1	1
	Cultivated foods		0	0
Cultural benefits	*Cultural heritage*		0	0
	Tourism and recreation		0	0
	Education and research		0	0

APPENDIX G – Risk Assessment Outcome

Phase	Activity	Impact	Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating (without mitigation)	Confidence level
			Abiotic Habitat (Drivers)			Biota (Responses)											
			Hydrology	Water Quality	Geomorphology	Vegetation	Fauna										
PRE-CONSTRUCTION (DESIGN)	Potentially inappropriate planning of stormwater management for the project	•Alteration of hydrology and geomorphology of receiving freshwater ecosystems and resulting degradation of freshwater habitat through poor stormwater design..	2	3	2	1	1	**6**	3	4	**13**	**2**	**26**	40%	**10.4**	L	Medium

Phase	Activity	Impact	Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating (without mitigation)	Confidence level
			Abiotic Habitat (Drivers)			Biota (Responses)											
			Hydrology	Water Quality	Geomorphology	Vegetation	Fauna										
CONSTRUCTION	Clearing of Vegetation and Terrain Levelling (Bulk Earthworks) within the catchments of the drainage lines.	Transformation of vegetation associated with freshwater ecosystems as well as associated habitat and ecosystem services as a result of indirect impacts; •Transportation of construction materials can result in disturbances to soils, and increased risk of sedimentation/erosion; and •Soil and stormwater contamination from oils and hydrocarbons originating from construction vehicles. •Earthworks and the associated disturbed soil could be potential sources of sediment, which may be transported in runoff into the downgradient freshwater ecosystem areas. This is particularly pertinent in this project areas as the soils are prone to erosion; •Exposure of soil, leading to increased runoff, and erosion, and thus increased sedimentation of the freshwater ecosystems; •Increased sedimentation of the freshwater ecosystems, leading to smothering of the vegetation and aquatic biota associated with the freshwater ecosystems; and •Proliferation of alien and/or invasive vegetation as a result of disturbances.	3	3	2	2	2	6	3	2	11	2	22	50%	11	L	Medium

Phase	Activity	Impact	Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating (without mitigation)	Confidence level
			Abiotic Habitat (Drivers)			Biota (Responses)											
			Hydrology	Water Quality	Geomorphology	Vegetation	Fauna										
	Construction of surface infrastructure associated with the proposed development within the catchments of the drainage line reaches e.g. solar panel arrays and other associated infrastructure	• Earthworks and excavations could be potential sources of sediment, which may be transported as runoff into the downgradient freshwater ecosystem areas; •Disturbances of soils leading to increased alien vegetation proliferation within the terrestrial buffer zone surrounding the freshwater ecosystems, with the potential to affect the freshwater habitat; •Altered runoff patterns within the local catchment of the freshwater ecosystems, potentially leading to increased erosion and sedimentation of the receiving freshwater environment; •Potential impacts on the water quality of surface water runoff (when present) which may potentially enter the downgradient freshwater ecosystems and contamination of soils due to concrete casting; and •Potential of backfill material entering the freshwater ecosystems, increasing the sediment loads therein.	2	3	2	2	1	6	3	2	11	2	22	50%	11	L	Medium

Phase	Activity	Impact	Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating (without mitigation)	Confidence level
			Abiotic Habitat (Drivers)			Biota (Responses)											
			Hydrology	Water Quality	Geomorphology	Vegetation	Fauna										
	Installation of the power line towers (support structures) and stringing of the proposed power line across the respective drainage lines.	• Disturbances of soil leading to potential impacts to the freshwater ecosystem vegetation, increased alien vegetation proliferation in the footprint areas, and in turn to altered freshwater ecosystem habitat; •Mixing of concrete for tower supports which if transported by runoff or dumped into the drainage lines could be harmful to biota and freshwater habitat; and •Altered runoff patterns, leading to increased erosion and sedimentation of the freshwater ecosystems.	2	2	1	2	2	4	2	2	8	2	16	40%	6.4	L	Medoim

Phase	Activity	Impact	Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating (without mitigation)	Confidence level
			Abiotic Habitat (Drivers)			Biota (Responses)											
			Hydrology	Water Quality	Geomorphology	Vegetation	Fauna										
	Development and construction of new roads within the immediate catchments of freshwater ecosystems, involving: •Site preparation prior to construction activities including movement of construction equipment / vehicles within the freshwater ecosystems and removal of vegetation; •Ground-breaking, excavations and concrete works in the catchments of the drainage lines.	• Earthworks and exposure of soil could result in sedimentation of the freshwater ecosystems, which may be transported as runoff into the downgradient freshwater ecosystem areas and may smother vegetation associated with the freshwater ecosystem areas; and •Proliferation of alien and/or invasive vegetation as a result of disturbances.	2	2	2	2	1	**4**	2	2	**8**	**2**	**16**	40%	**6.4**	L	Medium
OPERATIONAL	Operational presence of a solar PV development within the catchments of the respective drainage lines.	•Permanent alteration of patterns and timing of flows and recharge to the receiving drainage lines due to the levelling or parts of their catchments and the permanent removal of vegetation from the solar PV footprints that could alter the hydrological regimes of the drainage lines and cause degradation of riparian habitat; •Altered runoff patterns in the catchment of the drainage lines that could lead to creation of erosion within the buffer areas and within the drainage lines themselves.	2	2	2	1	1	**4**	3	5	**12**	**2**	**24**	100%	**24**	L	High

Phase	Activity	Impact	Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating (without mitigation)	Confidence level
			Abiotic Habitat (Drivers)			Biota (Responses)											
			Hydrology	Water Quality	Geomorphology	Vegetation	Fauna										
	Operational maintenance of the development (including washing of panels and the maintenance of the power line, especially in the vicinity of the drainage lines).	Disturbance to soil and ongoing erosion as a result of periodic maintenance activities; and •Altered water quality (if surface water is present) as a result of increased availability of pollutants.	1	1	1	1	1	**2**	2	4	**8**	**2**	**16**	30%	**4.8**	L	Medium
	Operational stormwater control and design of stormwater attenuation facilities on the development site.	•Potential pollutants and toxicants entering the downgradient drainage lines if attenuation facilities are not properly maintained; •Potential changes to the water retention pattern, timing and flows within the downgradient drainage lines if attenuation facilities are not properly maintained and thereby become ineffective; •Potential exacerbation of existing erosion and development of new erosion, along with concomitant increased sedimentation within the downgradient drainage lines as a result of the increased stormwater discharge causing increased scour and velocity if the attenuation features are not properly maintained.	3	2	1	2	1	**6**	2	4	**12**	**2**	**24**	40%	**9.6**	L	Medium

Phase	Activity	Impact	Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating (without mitigation)	Confidence level
			Abiotic Habitat (Drivers)			Biota (Responses)											
			Hydrology	Water Quality	Geomorphology	Vegetation	Fauna										
	Operation and maintenance of the proposed internal access roads located on the development sites in the catchments of the drainage lines (where applicable).	•Concentrated runoff from the road crossings leading to erosion and subsequent sedimentation of the freshwater ecosystems (increase in the sediment load) and turbulent flows when surface water is present. Litter and spills (e.g. oils, hydrocarbons) could be washed off the road surface by stormwater and could pollute downgradient areas, including the downgradient drainage lines.	1	2	2	1	1	**4**	2	4	**10**	**2**	**20**	50%	**10**	L	Medium
DECOMMISSIONING	Removal of all surface infrastructure from the project area.	• Disturbance of soil and vegetation that established within the decommissioning area.	2	2	1	2	1	**4**	2	2	**8**	**2**	**16**	50%	**8**	L	Low

APPENDIX H – Site Sensitivity Verification Report

FRESHWATER ECOSYSTEM SITE SENSITIVITY VERIFICATION REPORT FOR THE PROPOSED SAMANCOR PHASE 2 SOLAR DEVELOPMENT NEAR STEELPOORT, LIMPOPO PROVINCE.

Introduction

According to the "Protocols for the Assessment and Minimum Criteria for Reporting on identified Environmental Themes ("the Protocols") published in Government Gazette No. 43110 on 20 March 2020 and Government Gazette No. 43855 on 30 October 2020, the Environmental Assessment Practitioner (EAP) must verify the current use of the site in question and its environmental sensitivity as identified by the Screening Tool to determine the need for specialist inputs in relation to the themes included in the Protocols. The Protocols are allowed for in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) ("NEMA"). The Protocols must be complied with for every new application for Environmental Authorisation that is submitted after 9 May 2020.

This document serves as the Site Sensitivity Verification Report for the aquatic biodiversity theme for the proposed Samancor Phase 2 Solar Project near Steelpoort in the Limpopo Province. The proposed Samancor Phase 2 Solar Project requires environmental authorisation in terms of the NEMA EIA Regulations (2014), as amended and a Water Use Authorisation (WUA).

Study Area

The proposed Samancor Phase 2 Solar Project is located close to the Samancor Tubatse Ferrochrome Smelter, close to the town of Steelpoort in the Limpopo (Figure E1). The proposed Samancor Phase 2 Solar Project is located in close proximity to the R555 provincial road. The study area (development site) consists of various land parcels, including an additional Site 2 development area (Site 2B), Site 3B, 3C, 4B and 5C.

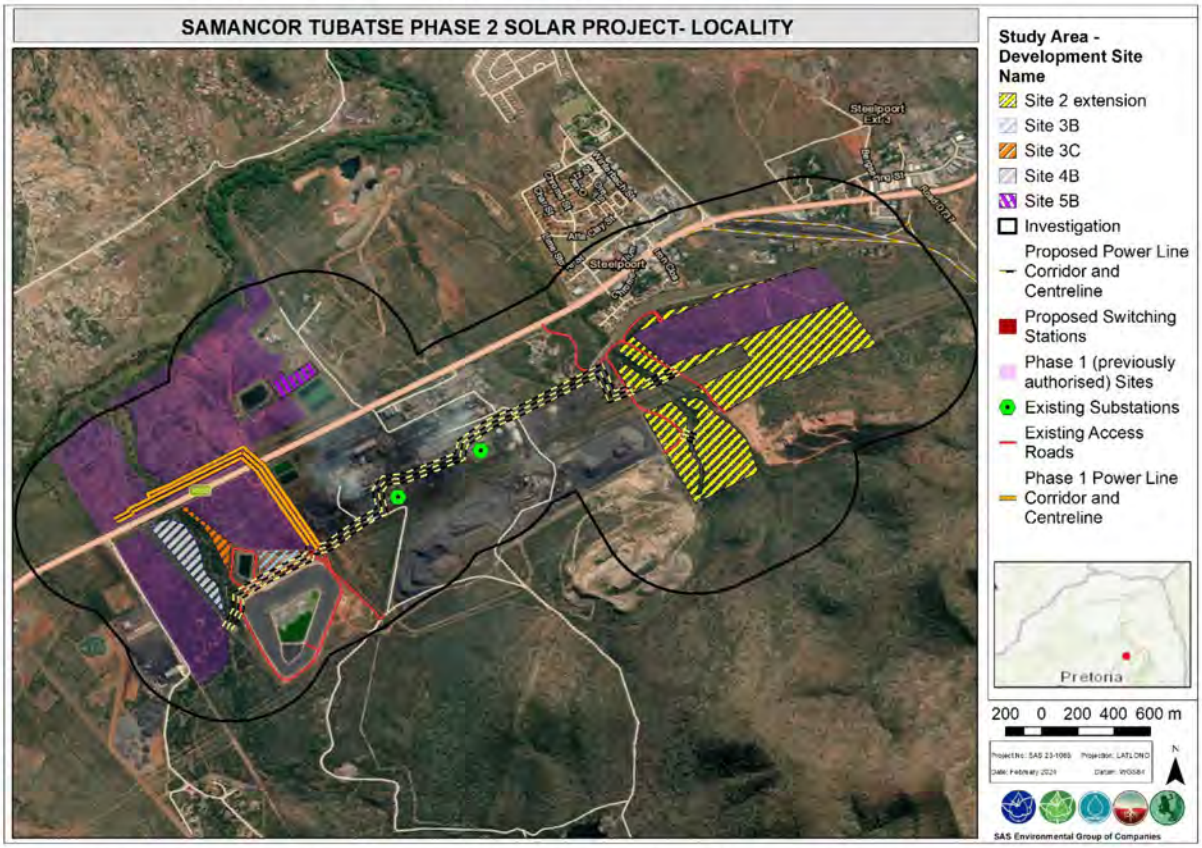

Figure E1: Digital satellite image depicting the location of the proposed Samancor Phase 2 Solar Project study area and associated investigation area in relation to the surrounding area.

This Freshwater Ecosystem site sensitivity verification report relates to a Screening Tool Report (STR) completed for the site in September 2023.

Site Verification Methodology

Information from the in-field delineation and detailed assessment of freshwater ecosystems in the study and investigation areas as part of the freshwater ecological assessment for the Tubatse Solar (Phase 1) development (SAS, 2021).

Aquatic Biodiversity Site Verification

The table below provides information regarding the outcome of the Screening Tool in terms of the aquatic biodiversity theme sensitivity associated with the proposed project as well as a brief summary of the outcome of the freshwater ecosystem specialist report in response.

Table E1: Aquatic Biodiversity Theme Sensitivity analysis for the proposed project.

Environmental Theme	Applicable Protocol	Response
Aquatic Biodiversity Sensitivity Rating, the study area and investigation area of the Samancor Tubatse Phase 2 Solar Development is located within areas of **low aquatic biodiversity** / freshwater sensitivity. The Steelpoort River which is located just outside of the investigation area is designated as being of very high sensitivity. *Requiring a Freshwater Compliance Statement.* **Verified Sensitivity**: the designation of very high sensitivity to the Steelpoort River by the DFFE Screening Tool is supported and not disputed. In reality two sections of the river's riparian zone as delineated encroach into the investigation area. **The designation of low sensitivity to the remainder the study and investigation area is partly disputed;** the **EDLs that form tributaries of the Steelpoort River have been designated as high sensitivity** features due to their direct hydrological connectivity to the Steelpoort River. **Remainder of study and investigation areas: low.**	Protocol for the specialist assessment and minimum report content requirements for environmental impacts on aquatic biodiversity (GN 320 of March 2020).	Due to presence of very high aquatic biodiversity features in close proximity to certain parts of the development sites, a freshwater ecosystem assessment has been undertaken.

APPENDIX I – General "Good Housekeeping" Mitigation Measures

General construction management and good housekeeping practices

Latent and general impacts which may affect the freshwater ecosystem ecology and biodiversity will include any activities which take place in close proximity to the proposed servitude that may impact on the receiving environment. Mitigation measures for these impacts are highlighted below and are relevant to the freshwater ecosystem identified in this report:

Development footprint

- All development footprint areas should remain as small as possible and should only encroach into the freshwater ecosystem if considered absolutely essential;
- The boundaries of footprint areas, including contractor laydown areas, are to be clearly defined and it should be ensured that all activities remain within defined footprint areas. Edge effects will need to be extremely carefully controlled;
- Planning of temporary roads and access routes should avoid freshwater ecosystem areas and be restricted to existing or pre-approved access roads and should not traverse the freshwater ecosystem;
- Appropriate sanitary facilities must be provided for the life of the repair and maintenance phase and all waste removed to an appropriate waste facility;
- All hazardous chemicals as well as stockpiles should be stored on bunded surfaces and have facilities constructed to control runoff from these areas;
- It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage;
- No fires should be permitted in or near the construction area; and
- Ensuring that an adequate number of waste and "spill" bins are provided will also prevent litter and ensure the proper disposal of waste and spills.

Vehicle access

- All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into the topsoil;
- In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practised near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss; and
- All spills should they occur, should be immediately cleaned up and treated accordingly.

Vegetation

- Proliferation of alien and invasive species is expected within any disturbed areas. Whilst not considered severe at this time, the vegetation component within the freshwater ecosystem environment is already transformed. However, alien invasive species are opportunistic, and where disturbances do occur, they will promulgate; therefore, these species should be eradicated and controlled to prevent their spread beyond the project footprint. Alien plant seed dispersal within the top layers of the soil within footprint areas, that will have an impact on future rehabilitation, has to be controlled;
- Removal of the alien and weed species encountered within the freshwater ecosystem must take place in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) and Section 28 of the National Environmental Management Act, 1998 (Act No. 107 of 1998); and
- Species-specific and area-specific eradication recommendations:
    - Footprint areas should be kept as small as possible when removing alien plant species; and

- No vehicles should be allowed to drive through designated sensitive freshwater ecosystems areas during the eradication of alien and weed species.

Soils

- Sheet runoff from compacted areas should be slowed down by the strategic placement of berms;
- It is considered ideal that activities occur within the current season (low rainfall) to minimise impacts of sedimentation;
- As much vegetation growth as possible (of indigenous floral species) should be encouraged to protect soils;
- Temporary stockpiling of excavated material from trenches can be retained alongside trenches, as required for backfilling. Any soil to be stockpiled for longer than a month should be moved to a designated stockpile area, as approved by the Environmental Control Officer (ECO);
- All soils compacted during the repair and maintenance phase should be ripped and profiled; and
- A monitoring plan for the development and the immediate zone of influence should be implemented to prevent erosion and incision.

Rehabilitation

- Construction rubble must be collected and disposed of at a suitable landfill site; and
- All alien vegetation in the footprint area, as well as the immediate vicinity of the proposed work area, should be removed.

APPENDIX J – 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)

Paul da Cruz BA (Hons) (Geography and Environmental Studies) (University of the Witwatersrand)

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:	[redacted]
Postal code:	Cell: [redacted]
Telephone:	Fax: [redacted]
E-mail:	[redacted]
Qualifications	[redacted]
Registration / Associations	[redacted]

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.

[redacted]

Signature of the Specialist

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

I, Paul da Cruz, 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 sand, clay, fluorspar
2. Linear developments (energy transmission, telecommunication, pipelines, roads)
3. Minerals beneficiation

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF PAUL DA CRUZ

PERSONAL DETAILS

Position in Company	Senior Ecologist
Joined SAS Environmental Group of Companies	2022

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Certificated Scientist at South African Council for Natural Scientific Professions (SACNASP)
Registered Environmental Assessment Practitioner (EAP) with the Environmental Assessment Practitioners Association of South Africa (EAPASA)
Member of the South African Wetland Society (SAWS)

EDUCATION

Qualifications

BA (Hons) (Geography and Environmental Studies) (University of the Witwatersrand)	1998
BA (Geography) (University of the Witwatersrand)	1997

Short Courses

Taxonomy of Wetland Plants (Water Research Commission)	2017
Advanced Grass Identification (Frits van Outshoorn)	2010
Grass Identification (Frits van Outshoorn),	2009
Soil Form Classification and Wetland Delineation; (TerraSoil Science)	2008

AREAS OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana
International – United Kingdom (England and Scotland); USA

DEVELOPMENT SECTORS OF EXPERIENCE

1. Renewable energy (Wind and solar)
2. Linear developments (energy transmission, telecommunication, pipelines, roads, border infrastructure)
3. Nature Conservation and Ecotourism Development
4. Commercial development
5. Residential development
6. Environmental and Development Planning and Strategic Assessment
7. Industrial/chemical; Non-renewable power Generation

KEY SPECIALIST DISCIPLINES

Legislative Requirements, Processes and Assessments

- EIA / BA Applications
- Environmental Authorisation Amendments
- EMPr Compilation
- Environmental Compliance Monitoring (Environmental Auditing)
- Environmental Screening Assessments and Listing Notice 3 Trigger Identification / Mapping
- Strategic Environmental Assessments and Environmental Management Frameworks
- EIA / Specialist Study Peer Review

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 Assessments in support of Environmental Screening Assessments, Precinct Planning & SEA
- Wetland Construction (Compliance) Monitoring

Biodiversity Assessments

- Avifaunal Assessments
- Strategic Biodiversity Assessment

Visual Impact Assessment

- Visual Impact Assessments

GIS / Spatial Analysis

- GIS Spatial Analysis and Listing Notice 3 mapping.