FRESHWATER RESOURCE VERIFICATION FOR THE PROPOSED SWELLENDAM HOUSING AND BULK SEWER AND WATER PIPELINES, WESTERN CAPE

Prepared for

Eco Impact Legal Consulting (Pty) Ltd

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Prepared by:	**Scientific Aquatic Services**
Report authors:	**K. Marais (Pri. Sci. Nat)**
	C. du Preez
Report reviewer	**S. van Staden (Pr. Sci. Nat)**
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Scientific Aquatic Services CC
CC Reg No 2003/078943/23
Vat Reg. No. 4020235273
PO Box 751779
Gardenview
2047
Tel: 011 616 7893
Fax: 086 724 3132
E-mail: admin@sasenvgroup.co.za

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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.
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.
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".
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas
Gleying:	A soil process resulting from prolonged soil saturation which is manifested by the presence of neutral grey, bluish or greenish colours in the soil matrix.
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.
Hydromorphy:	A process of gleying and mottling resulting from the intermittent or permanent presence of excess water in the soil profile.
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Obligate species:	Species almost always found in wetlands (>99% of occurences).
Seasonal zone of wetness:	The zone of a wetland that lies between the Temporary and Permanent zones and is characterised by saturation from three to ten months of the year, within 50cm of the surface
Temporary zone of wetness:	The outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year.
Watercourse:	In terms of the definition contained within the National Water Act, 1998 (Act 36 of 1998) 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:	"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."
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.

1. INTRODUCTION

In December 2018 Scientific Aquatic Services (SAS) were requested to undertake a field verification in which the wetlands associated with the Swellendam Housing development, comprising of 950 residential erven as well as community facilities and mixed use development on the remaining extent of erf 1, Swellendam, hereafter referred to as the "study area" were considered. Additionally, existing water and sewer pipelines and stormwater attenuation facilities required upgrading and a new access road to the study area is required. All activities are hereafter referred to as the "development".

In order to identify all freshwater resources that may potentially be impacted by any future proposed development, a 500m "zone of investigation" around the development, in accordance with General Notice 509 of 2016 as it relates to the National Water Act, 1998 (Act 36 of 1998) (NWA), was used as a guide in which to assess possible sensitivities of the receiving environment. This area – i.e. the 500m zone of investigation around the study area – was assessed at a desktop level only and will henceforth be referred to as the "Investigation Area" (Figure 1 and Figure 2).

A desktop study was compiled with all relevant information as presented by SANBI's Biodiversity Geographic Information Systems (BGIS) website (http://bgis.sanbi.org) as well as the National Freshwater Ecosystem Priority Areas (NFEPA) database, followed by a delineation, using desktop methods that include the use of available digital satellite imagery, of all the freshwater resources situated within the study area as well as the investigation area. Following this, a field verification assessment was undertaken to ground truth all results.

1.2 Assumptions and Limitations

- The ground-truthing and delineation of the freshwater resource boundaries and the assessment thereof, are confined to a single site visit undertaken on the 11th of January 2019 of the development area. All freshwater resources identified within the investigation area were delineated in fulfilment of Regulation GN509 of the National Water Act, 1998 (Act 36 of 1998) using various desktop methods including the use of topographic maps, historical and current digital satellite imagery and aerial photographs. These resources were not ground-truthed, however, the general surroundings were considered during the desktop assessment;
- The purpose of this verification was to confirm the delineations and classifications of the report undertaken by Nicolaas Hanekom (2018) and therefore the report does not include any additional calculations for the Present Ecological State or the Ecological Importance and Sensitivity as this was undertaken by Hanekom (2018). All delineations were undertaken using various desktop methods with spot verifications on site;
- Global Positioning System (GPS) technology is inherently somewhat inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur, however, the delineations as provided in this report are deemed appropriately accurate to fulfil the authorisation requirements;
- Freshwater resources and terrestrial 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 resource boundaries may occur. However, if the DWAF (2008) method is followed, all assessors should get largely similar results; and
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. However, the delineations as provided in this report are deemed appropriately accurate to provide guidance for any future development plans.

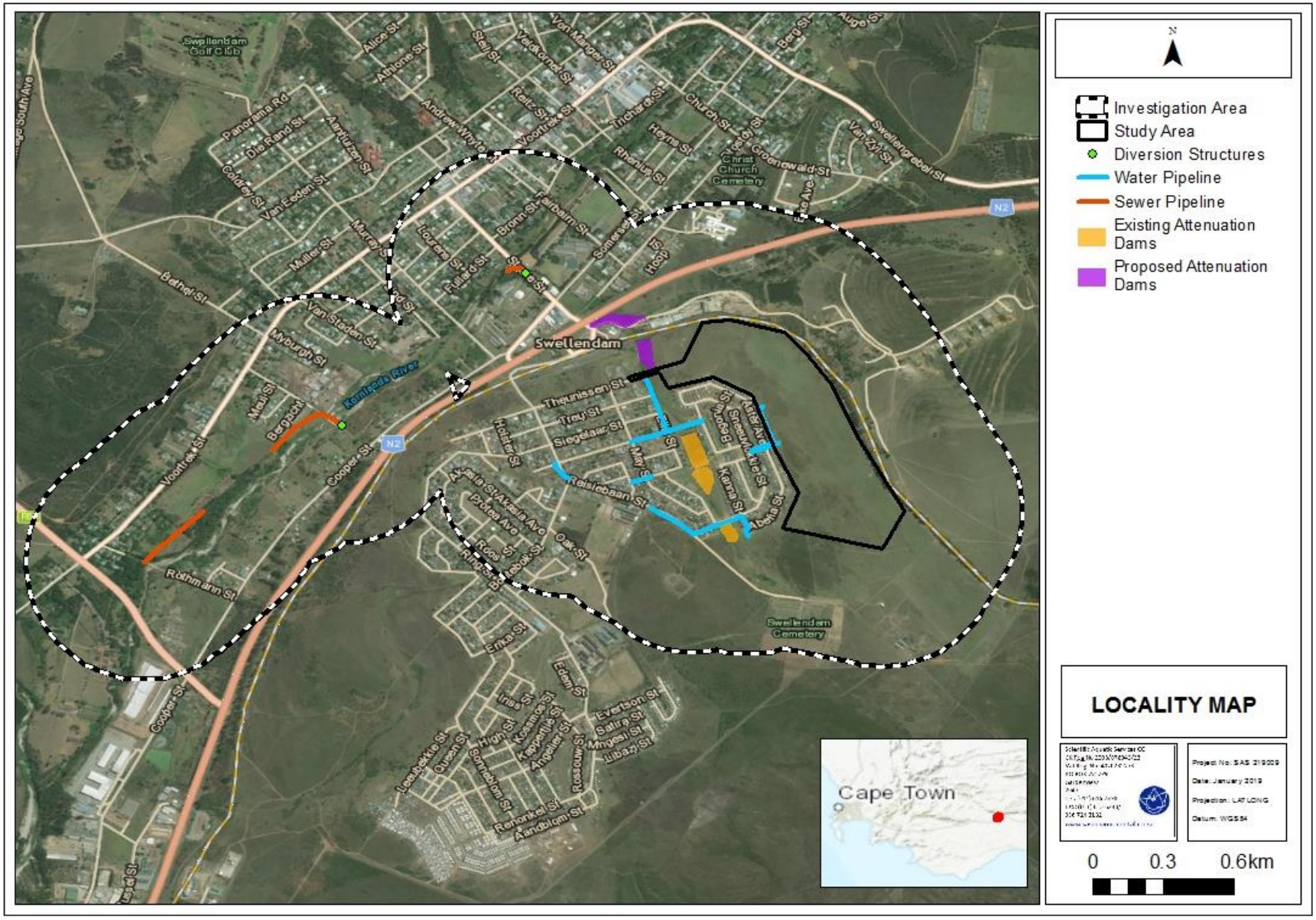

Figure 1: Digital satellite image depicting the development in relation to the surrounding areas.

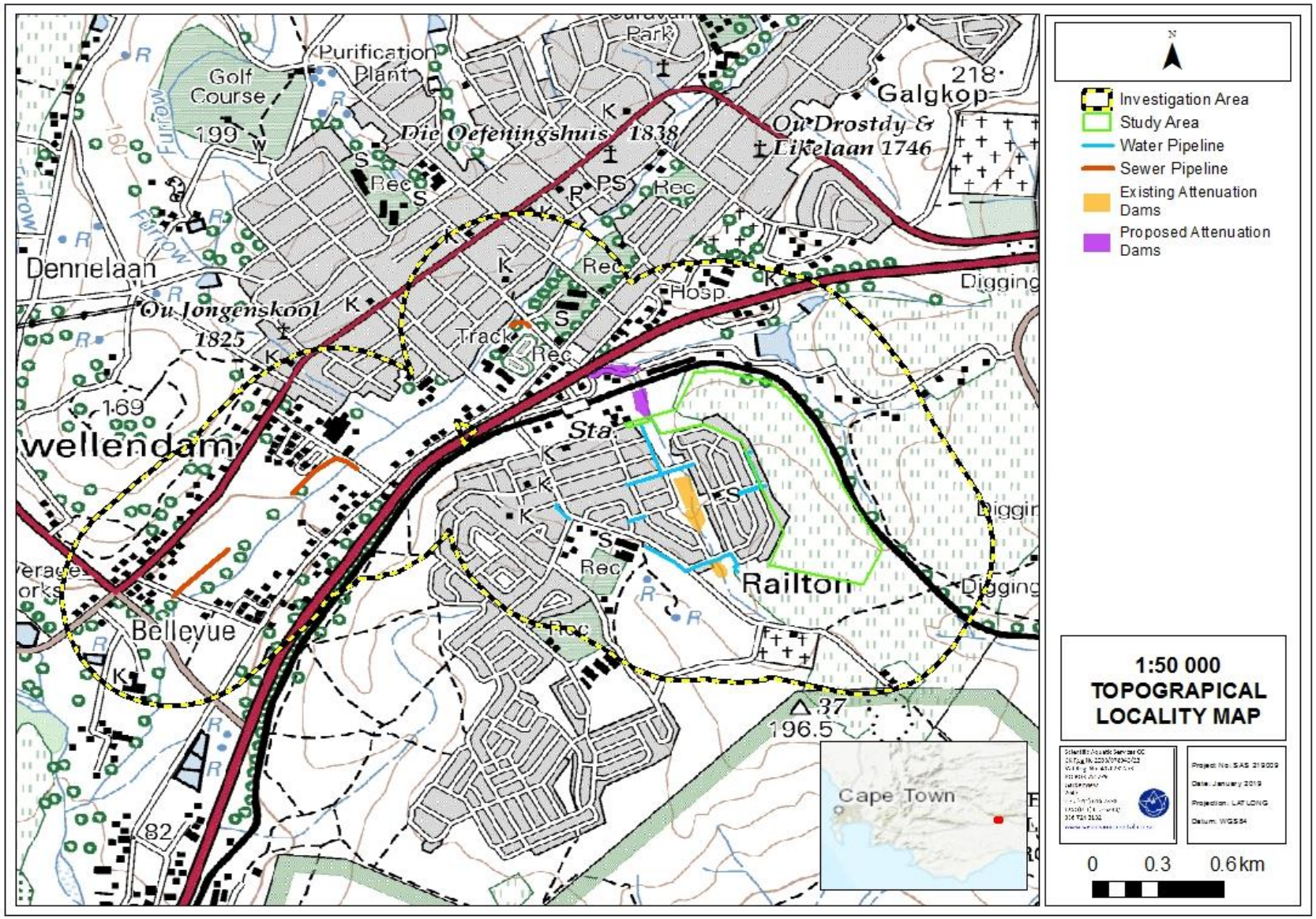

Figure 2: Location of the development depicted on a 1:50 000 topographical map, in relation to surrounding areas.

2. RESULTS

2.1. Desktop Findings

Use was made of aerial photography, digital satellite imagery, and available provincial and national wetland databases to identify points of interest prior to the field survey. Wetland features often display a diversity of digital signatures that can be used to assist the field verification.

On review of the historical imagery dating back to 1960, the Kroonlands River, a tributary to the Klip River can be clearly identified, as indicated by the blue arrow in Figure 3 below as well as a watercourse to the west of the study area, as indicated by the white arrow in Figure 3 below.

Figure 3: Historical imagery (1960) of the study area (Estimated location of the study area indicated by red block (Flight Plan 02585 of Job 444))

The following table contains data accessed as part of the desktop assessment and presented as a "dashboard style" report below (Table 1). It is important to note that although all data sources used provide useful and often verifiable, high quality data, the various databases used do not always provide an entirely accurate indication of the subject property's actual site characteristics at the scale required to inform the environmental authorisation and/or water use authorisation processes, however, this information is considered to be useful as background information to the study. This data was therefore used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance during the site-specific field verification survey.

Table 1: Desktop data relating to the characteristics of the watercourses associated with the development.

Aquatic ecoregion and sub-regions in which the study area is located				Detail of the study area in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database	
Ecoregion	Southern Coastal Belt			FEPACODE	The majority of the investigation area (with the exception of the most eastern portion of the investigation area) is located within an important upstream sub-quaternary catchment.
Catchment	Breede				
Quaternary Catchment	H70B			NFEPA Wetlands (Figure 4)	According to the NFEPA Database no wetland features are located within the study area. However, the sewer pipeline segments are located within a large natural floodplain system, within the western portion of the study area. This floodplain is considered to be in a moderately modified condition (WETCON = C). A channelled valley bottom wetland is also located just outside and just north of the study area. A portion of this wetland is considered to be natural, albeit largely modified (WETCON Z2), however a large extent thereof is considered artificial. A small artificial wetland flat is being traversed by the most southern water pipeline segment. Other wetland flats (also considered to be artificial) are located within the central southern portion of the investigation area.
WMA	Breede				
subWMA	Lower Breede				
Dominant characteristics of the Southern Coastal Belt Ecoregion Level II (24.03) (Kleynhans *et al.,* 2007)					
Level II Code	22.04				
Dominant primary terrain morphology	Closed Hills, mountains with moderate and high relief				
Dominant primary vegetation types	South and South West Coast Renosterveld; Central Mountain Renosterveld; Limestone fynbos; Mountain Fynbos; Dune Thicket; Patches Afromontane Forest				
Altitude (m a.m.s.l)	0-700; 700-1500 (limited)			Wetland Vegetation Type	The majority of the investigation area is situated within the Southern Silcrete Fynbos (Endangered) Wetland Vegetation Type. The area where the NFEPA Database identified a floodplain wetland, is classified as the East Coast Shale renosterveld (Critically Endangered) Wetland Vegetation Type. The threat status is provided by Mbona *et al* (2014).
MAP (mm)	300 to 1000				
Coefficient of Variation (% of MAP)	<20 to 40				
Rainfall concentration index	<15 to 50			NFEPA Rivers (Figure 5)	As per the NFEPA database, no rivers are located within the investigation area, however, the digital satellite imagery did identify the Koornlands River to be located within the western portion of the study area, correlating to the locality of the floodplain wetland as identified by the NFEPA Database. The Klip River is located approximately 200m west of the investigation area, draining in a north to south direction. The Keurbooms River confluences with the Klip River approximately 900m from the western edge of the investigation area. The Klip River drains into the Bree River which is approximately 3km south of the investigation area. According to the NFEPA Database, these rivers are considered moderately modified (WETCON: C).
Rainfall seasonality	Winter to all year				
Mean annual temp. (°C)	10 to 20				
Winter temperature (July)	4 – 20				
Summer temperature (Feb)	18 – 30				
Median annual simulated runoff (mm)	10 to >250				
Ecological Status of the most proximal sub-quaternary reach (DWS, 2014)				Importance of the study area according to the Western Cape Biodiversity Spatial Plan (2017) (Figure 6)	
Sub-quaternary reach	H70B-09198 (Klip River)	H70A-09213 (Bree River)	H70B-09251 (Bree River)	According to the Western Cape Biodiversity Spatial Plan (2017), the most eastern portion of the investigation area, within the eastern portion of the study areas and an area within the most western portion of the investigation area, is considered to be Critical Biodiversity Areas (CBA's). CBA's are areas of high biodiversity and ecological value and need to be kept in a natural or near-natural state, with no further loos of habitat or species. An area within the eastern portion of the study area (corresponding to where a floodplain wetland has been identified by the NFEPA Database) is	
Proximity to study area	located approximately	approximately 900m from the western edge of	approximately 3km south of the		

Aquatic ecoregion and sub-regions in which the study area is located				Detail of the study area in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database
	200m west of the investigation area	the investigation area	investigation area	considered to be an Ecological Support Area (ESA). These areas are important in supporting the functioning of CBA's and are often vital for delivering ecosystem services. Some segments of the sewer pipeline are located within ESAs. Other Natural Areas (ONA's) is also located within several portions of the investigation area, and specifically with the study area. These are areas that have not been identified as a priority in the current biodiversity spatial plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructure functions. The Western Cape Biodiversity Spatial Plan (2017) identified one large non-perennial wetland system, located within the western portion of the investigation area. This corresponds to the floodplain wetland identified by the NFEPA Database.
Assessed by expert?	Yes	Yes	Yes	
PES Category Median	E (Seriously Modified)	D (Largely modified)	C (Moderately modified)	
Mean EI Class	Moderate	Moderate	Moderate	
Mean ES Class	Very High	High	High	
Stream Order	2	4	4	
Default Ecological Class (based on median PES and highest EI or ES mean)	A (Very High)	B (High)	B (High)	

CBA = Critical Biodiversity Areas; DWS = Department of Water and Sanitation; EI = Ecological Importance; ES = Ecological Sensitivity; ESA = Ecological Support Area; m.a.m.s.l = Meters Above Mean Sea Level; MAP = Mean Annual Precipitation; NFEPA = National Freshwater Ecosystem Priority Areas; PES = Present Ecological State; WMA = Water Management Area

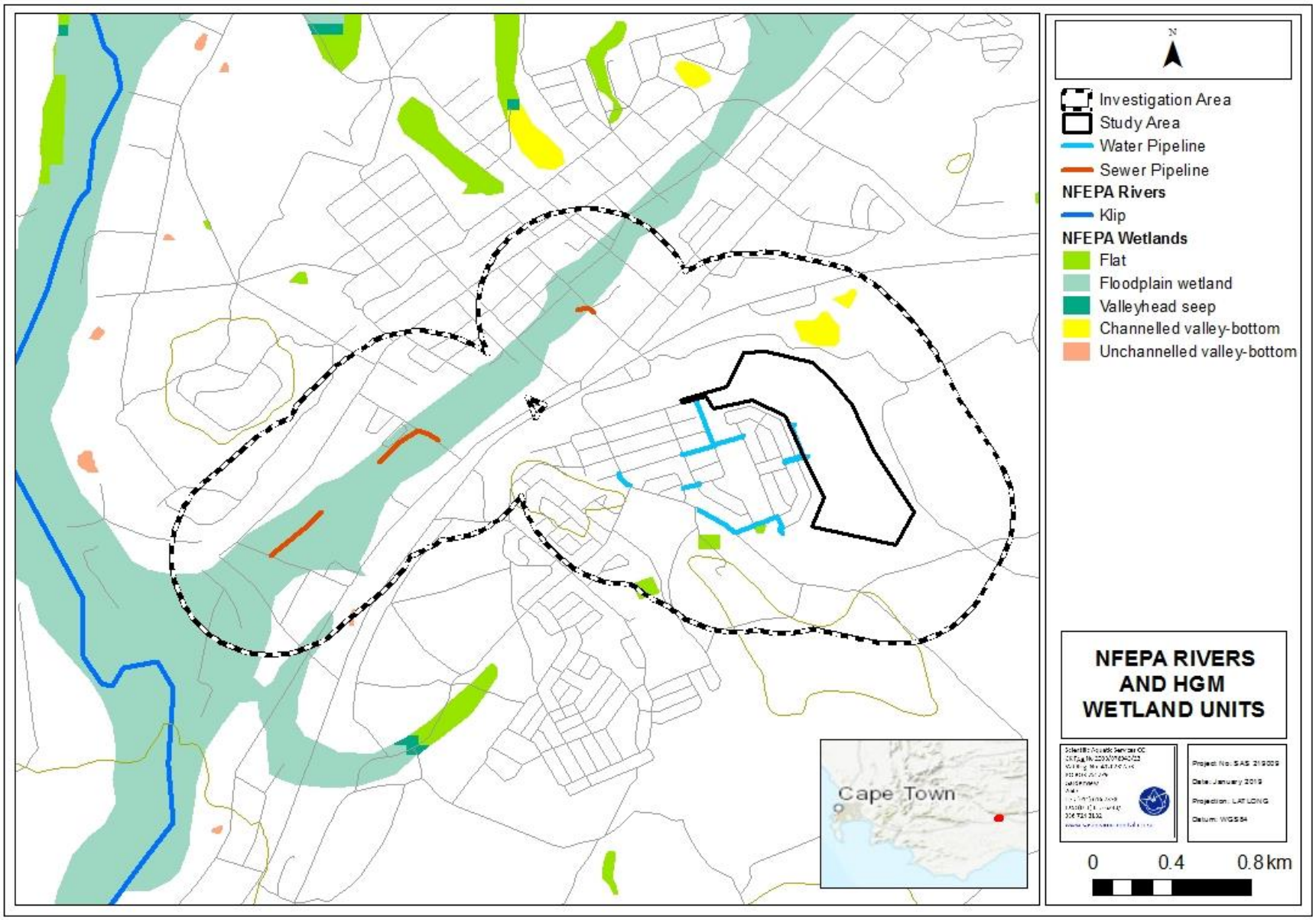

Figure 4: Wetland Units within the development and investigation zone according to the NFEPA database (2011).

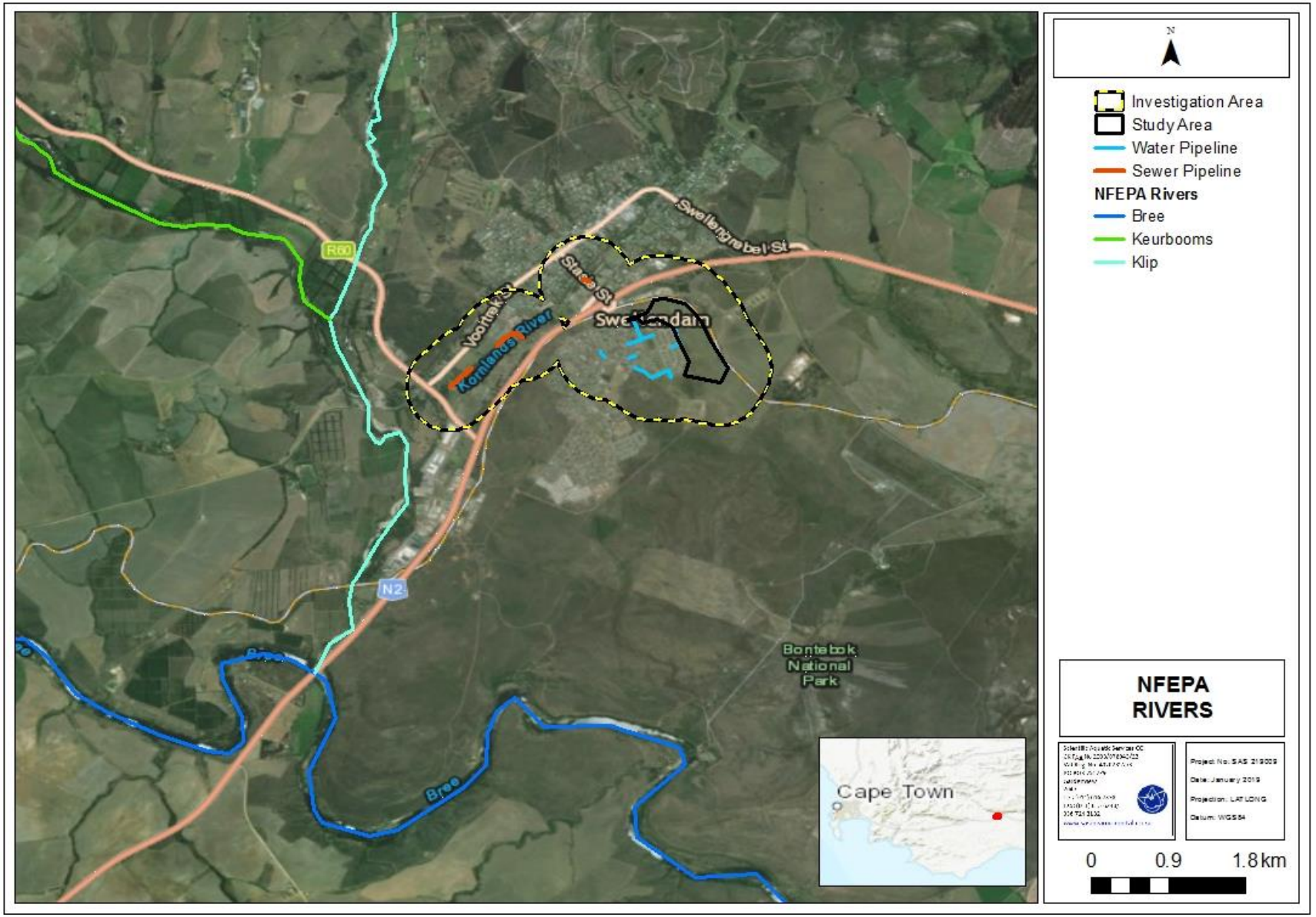

Figure 5: NFEPA listed Rivers in relation to the development and associated investigation area according to the NFEPA database (2011).

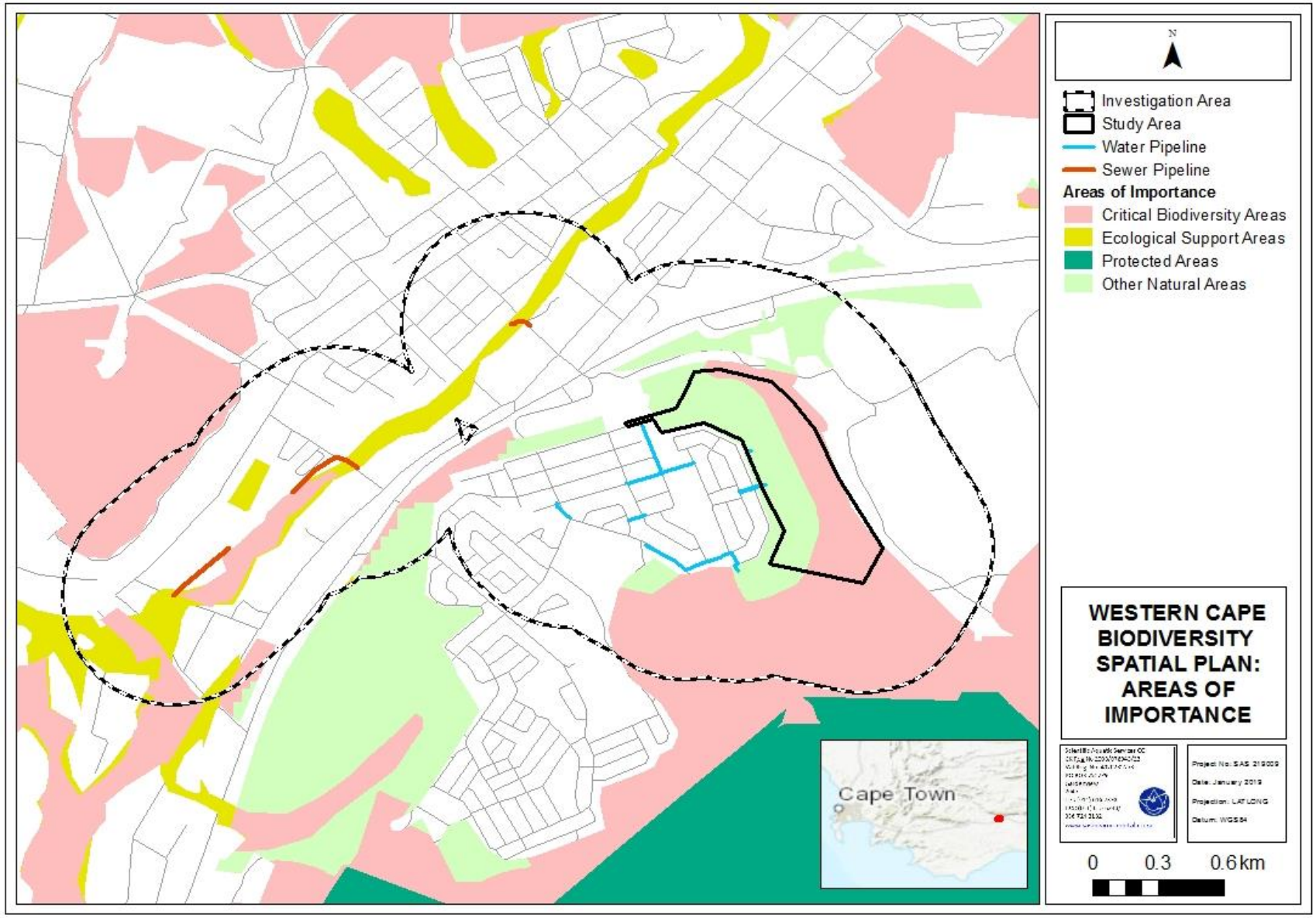

Figure 6: Wetland and Terrestrial CBA and ESAs according to the Western Cape Biodiversity Spatial Plan (2017).

2.2. Site Verification Results

A site visit was undertaken on the 11th of January 2019, during which the presence of any areas representing with wetland characteristics as defined by the DWAF (2008) or watercourses as defined by the National Water Act, 1998 (Act 36 of 1998) were identified. The following indicators assist in determining the presence of a watercourse within the study area:

- Terrain units are used to determine in which parts of the landscape a watercourse (including wetlands) was most likely to occur;
- Obligate and facultative wetland species such as *Typha capensis, Pennisetum macrourum* or *Phragmites australis* could be used in conjunction with terrain units as well as the point where a distinct change in the vegetation composition was observed to define the outer boundary of any wetland resources. Obligate species are almost always found in a freshwater feature (>99% of occurrences) while facultative species are usually found in a freshwater feature (76%-99% of occurrences) but are also occasionally found in areas not associated with wetlands or rivers and often in areas of disturbance;
- Surface water and/or saturated soils can be used to determine if there is a permanent zone and to define the outer boundaries (temporary zone) of the wetland; and
- Soil form indicators are used to determine the presence of soils that are associated with prolonged and frequent saturation and a fluctuating water table within 50 cm of the land surface.

It should be noted that in order for an area to be identified as a wetland, at least two (2) of the above indicators should be present (*Pers Comm Prof. F. Ellery*).

3. KEY OBSERVATIONS

1. The study area is approximately 33 hectares in extent and is located just south of the N2 highway. No watercourses were identified within the study area, however, a Channelled Valley Bottom Wetland was identified approximately 300m to the west of the study area (Figure 6). This system was identified as a non-perennial river by Hanekom (2018).

2. The proposed new access road, an extension of Theunissen Street is proposed, and two new attenuation ponds within the identified Channelled Valley Bottom Wetland. Similarly, water pipelines will be upgraded within Sofietjies Street, Ellis Street, September Street and Reisiebaan Street within the existing residential area to the west of the study area, two of these portions cross the identified Channelled Valley Bottom Wetland (Figure 7).

3. Three segments of the bulk sewer pipeline will be upgraded on Station Street (85m in length), Lombard Street (328m in length) and from Rothman Street in a north eastern direction (300m in length). The segments are located within 100m of or will cross the Kroonlands River (Figure 8).

The following table provides a summary of the findings as they relate to Figure 7 and 8 below. Each Section under discussion is numbered in accordance with that presented in Figure 7.

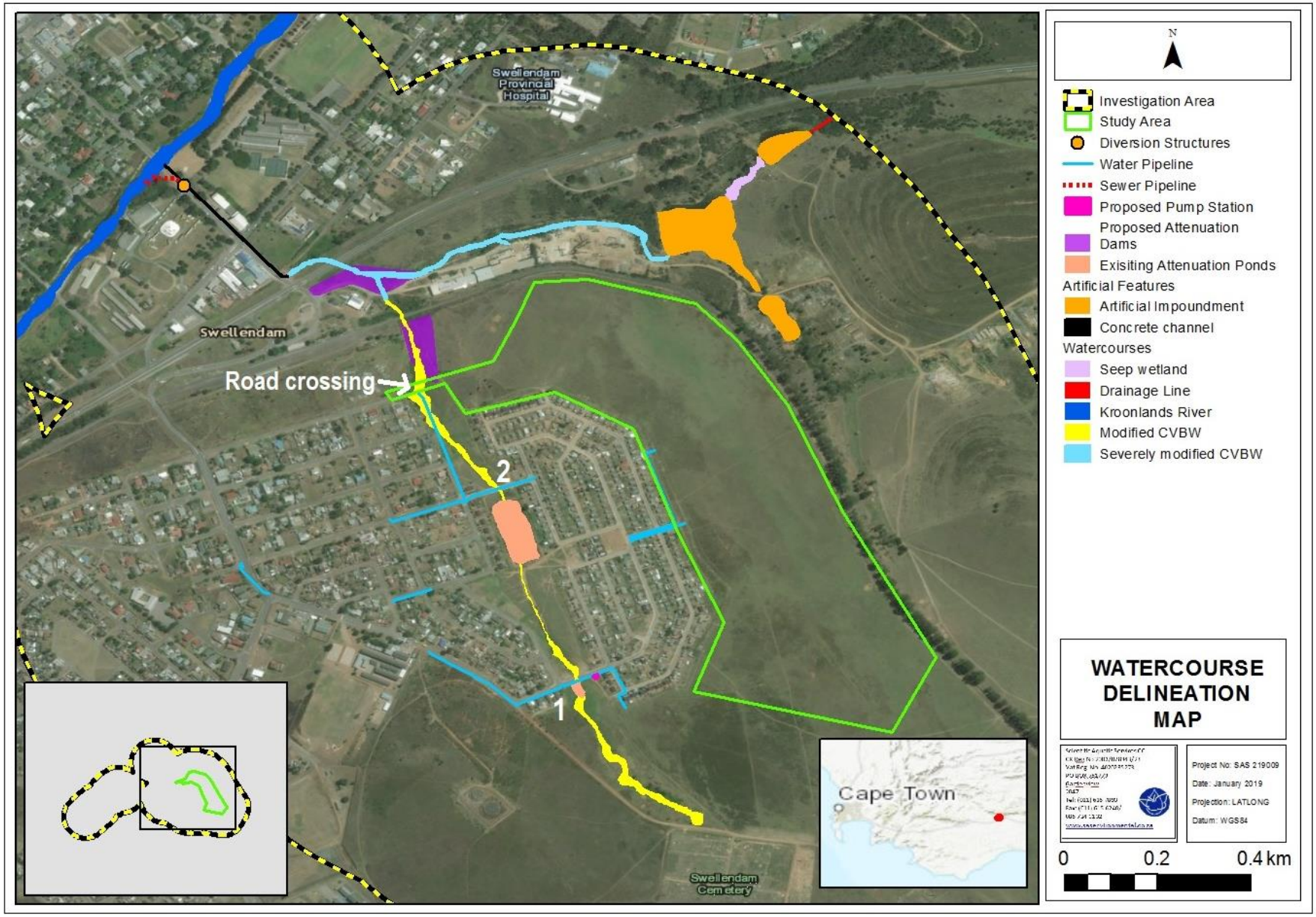

Figure 7: Delineation map for the freshwater features associated with the study area, water pipelines, access road crossing and attenuation facilities.

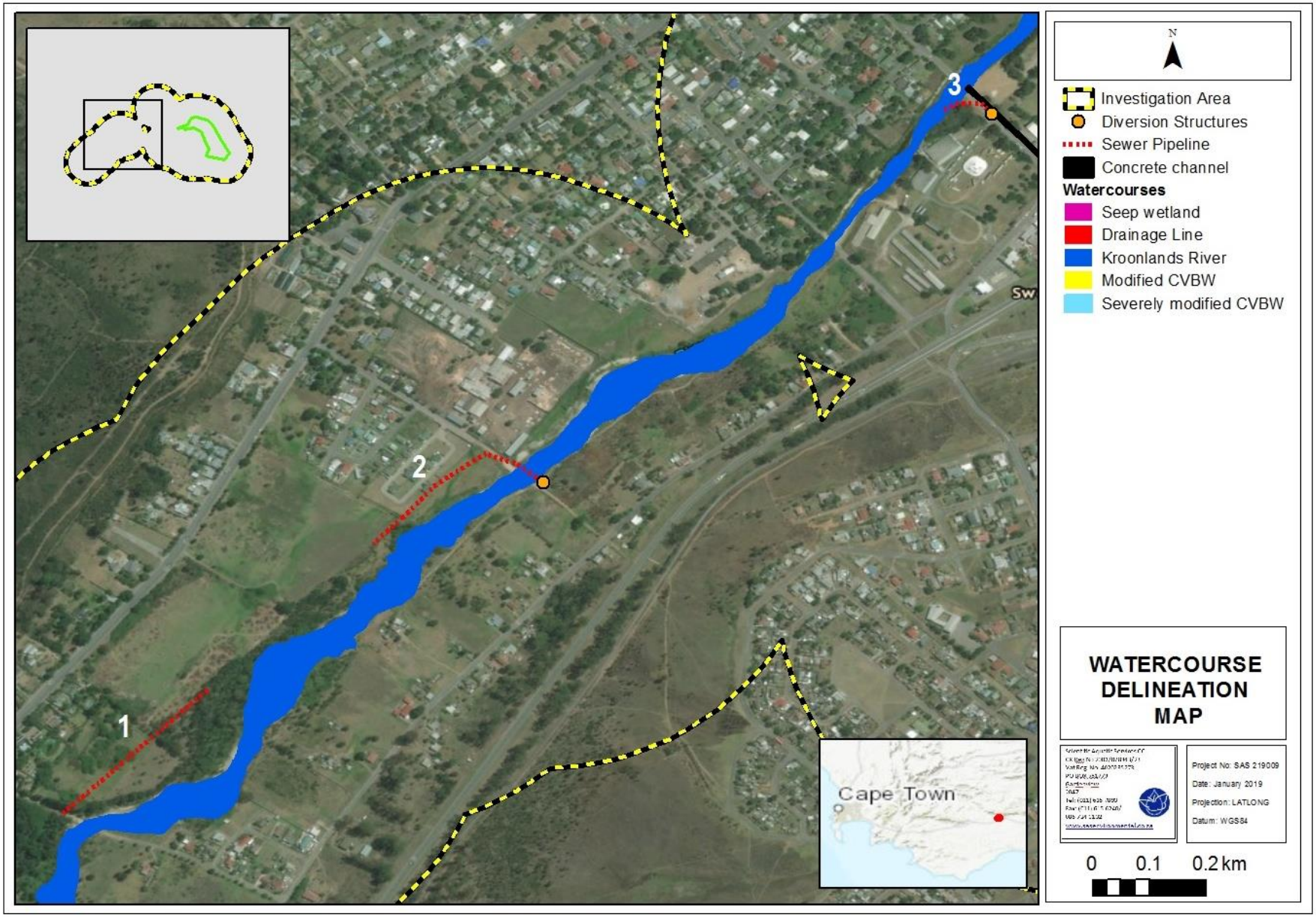

Figure 8: Delineation map for the freshwater features associated with the sewer pipeline and investigation zone.

Table 2: Summary of site findings for each of the relevant development activities.

Water Pipeline (Figure 7) Only 2 segments of the water pipelines were noted to cross the Channelled Valley Bottom Wetland, however, trenching will be undertaken within the existing road reserve and thus the impact will be of limited significance.
Watercourse identified: Modified Channelled Valley Bottom Wetland.
Segment 1  A Modified Channelled Valley Bottom Wetland (CVBW) was identified to traverse the existing residential area, approximately 300m to the west of the study area. An existing road crosses the CVBW and a pipe culvert has been installed. In communication with the local residents, the area upstream of Riesiebaan Street is affected by ponding during the rainy season and water is diverted downstream through the pipe culverts. Obligate species included *Cyperus marginatus, Juncus effusus, Paspalum distichum and Typha capensis.* Soil samples, although limited in depth due to the rocky nature of the area, indicated mottling indicative of a wetland feature. A new pump station is also proposed approximately 30m to the east of the delienated CVBW.

Segment 2




An existing attenuation pond was noted upstream of Sofietjie Street, within the CVBW. This was likely created as part of the stormwater management for the existing residential area. The proposed pipeline will cross the system within the existing road reserve and as such impacts on the CVBW can be considered minimal. Scouring was noted at the pipe culvert outlet on the downstream section due to the pipe not being installed at base leve of the wetland featurel. Obligate species within the attenuation pond as well as downstream included *Cyperus textilis, Juncus effusus, Typha capensis*, *Cyperus margintus and Panicum repens*.

Proposed road crossing (Figure 7)

Proposed expansion of Theunissen Street and construction of a new culvert crossing to provide additional access to the study area.

Watercourse identified: Modified Channelled Valley Bottom Wetland.


Extensive grazing was identified throughout the entire system. A gravel road has already been developed through the UCVBW and does not have any culverts. Obligate species identified included *Juncus effusus, Paspalum distichum, Panicum repens and Typha capensis.*

New attenuation ponds (Figure 7).

Watercourse identified: Modified Channelled Valley Bottom Wetland and severely modified Channelled Valley Bottom Wetland.

Two sites were identified to be utilised as additional attenuation areas for the new housing development. A smaller attenuation pond will be located within the modified CVBW, approximately 80m north of the propooed access road, directly south of the railway line (refer to top two photos). An additional, larger attenuation pond is proposed approximately 90m north of the railway line, south of the N2 highway (refer to bottom two photos). This attenuation pond will be created at the existing culvert below the N2 and will encompass the confluence of the modified CVBW and the severely modified CVBW that is located to the north of the study area. Obligate species identified included *Juncus effusus, Paspalum distichum, and Typha capensis* and ponding of water was noted within the severely modified CVBW, and included aquatic waterblommetjies (*Aponogeton distachyos).*

Sewer Pipeline (Figure 8)

Existing pipeline to be upgraded. New pipeline will be bolted to culverts when crossing the Kroonlands River. Remaining portions to be open trenched.

Watercourse identified: Kroonlands River and associated riparian zone.

Segment 1


Segment 1 is approximately 300m in length and is situated within a servitude on a private property. The pipeline is approximately 30m north of the Kroonlands River and runs in a north eastern direction. Obligate species associated with this portion of the Kroonlands River included *Persicaria lapathifolia, Arundo donax (*Category 1b listed Alien and Invasive species) and *Cortaderia selloana.*

Segment 2


Segment 2 is approximately 328m in length, is situated parallel to the Kroonlands River, approximately 25m to the north west before turning southwards along Lombard Street, crossing the Kroonlands River over the existing culvert bridge. An existing pipeline is visibly attached to the concrete culverts (refer to figure above). Obligate species identified within this portion of the river included *Persicaria lapathifolia, Arundo donax (*Category 1b listed Alien and Invasive species), *Typha capensis* and *Cyperus marginatus.*

Segment 3


Segment 3 is approximately 85m in length and is located alnong the northern embankment of the Kroonlands River before turning southwards onto Station Road. An existing pipeline is visibly attached to the bridge crossing over the river (refer to figure above). Residential erven were ntod to encroach onto the buffer zone surrounding the Kroonlands river. Obligate species identified within this portion of the river included *Persicaria lapathifolia, Cyperus marginatus and Panicum repens.*

4. LEGISLATIVE REQUIREMENTS AND CONSTRAINTS ANALYSIS

The following legislative requirements were considered during the assessment.

a) National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA);
b) National Water Act, 1998 (Act 36 of 1998) (NWA); and
c) General Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act 36 of 1998).

It is important to note that in terms of the definition of a watercourse as per the National Water Act, 1998 (Act 36 of 1998), all of the natural watercourses within the development area will be regulated by Section 21(c) and (i) as well as the applicable zones of regulation. All of the watercourses that will persist under normal conditions will thus require further authorisation from the Department of Environmental Affairs and Development Planning (DEA&DP) and the Department of Water and Sanitation (DWS).

According to Macfarlane *et al.* (2015) the definition of a buffer zone is variable, depending on the purpose of the buffer zone, however, it is considered to be “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 to be important to provide protection of basic ecosystem processes (in this case, the protection of aquatic and 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).

Legislative requirements were taken into consideration when determining suitable zones of regulation for the freshwater resources. The definition and motivation for a regulated zone of activity as well as buffer zone for the protection of the freshwater resource can be summarised as follows:

- **Activity 12** of Listing Notice 1 (GN 327) of the NEMA EIA regulations, 2014 (as amended) states that:
  The development of:
  (xii) Infrastructure or structures with a physical footprint of 100 square meters or more;

  Where such development occurs—
  a) Within a watercourse;
  b) In front of a development setback; or
  c) If no development setback has been adopted, within 32 meters of a watercourse, measured from the edge of a watercourse.

- **Activity 19** of Listing Notice 1 (GN 327) of the NEMA EIA regulations, 2014 (as amended) states that:
  The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock more than 10 cubic metres from a watercourse

- In accordance with GN509 of 2016 as it relates to the National Water Act, 1998 (Act 36 of 1998), a regulated area of a watercourse for section 21(c) and 21(i) is defined as:
  a) the outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;
  b) in the absence of a determined 1 in-100year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or
  c) A 500 m radius from the delineated boundary (extent) of any wetland or pan.

Since no natural watercourses were identified within the study area, no development setbacks were deemed relevant, however, the Channelled Valley Bottom Wetland associated with the water pipelines, attenuation ponds and road crossing required a 500m Zone of Regulation (ZoR) and is located within 300m of the study area. Similarly, a 100m zone of regulation was implemented around the Kroonlands River (Figure 9 and 10). Consultation and authorisation with the Department of Water and Sanitation, the custodians of water resources in South Africa, will therefore be required for all activities associated with the development to ascertain the potential risk of the development to the Channelled Valley Bottom Wetlands and the Kroonlands River (refer to Table 3 for risk outcomes and Figures 9 and 10 below).

It should further be noted that activities within the 32m Zone of Regulation as well as the proposed activities within the watercourse in accordance with the National Environmental Management Act, 1998 (Act 107 of 1998) will potentially trigger an environmental authorisation from the Department of Environmental Affairs and Development Planning (DEA&DP).

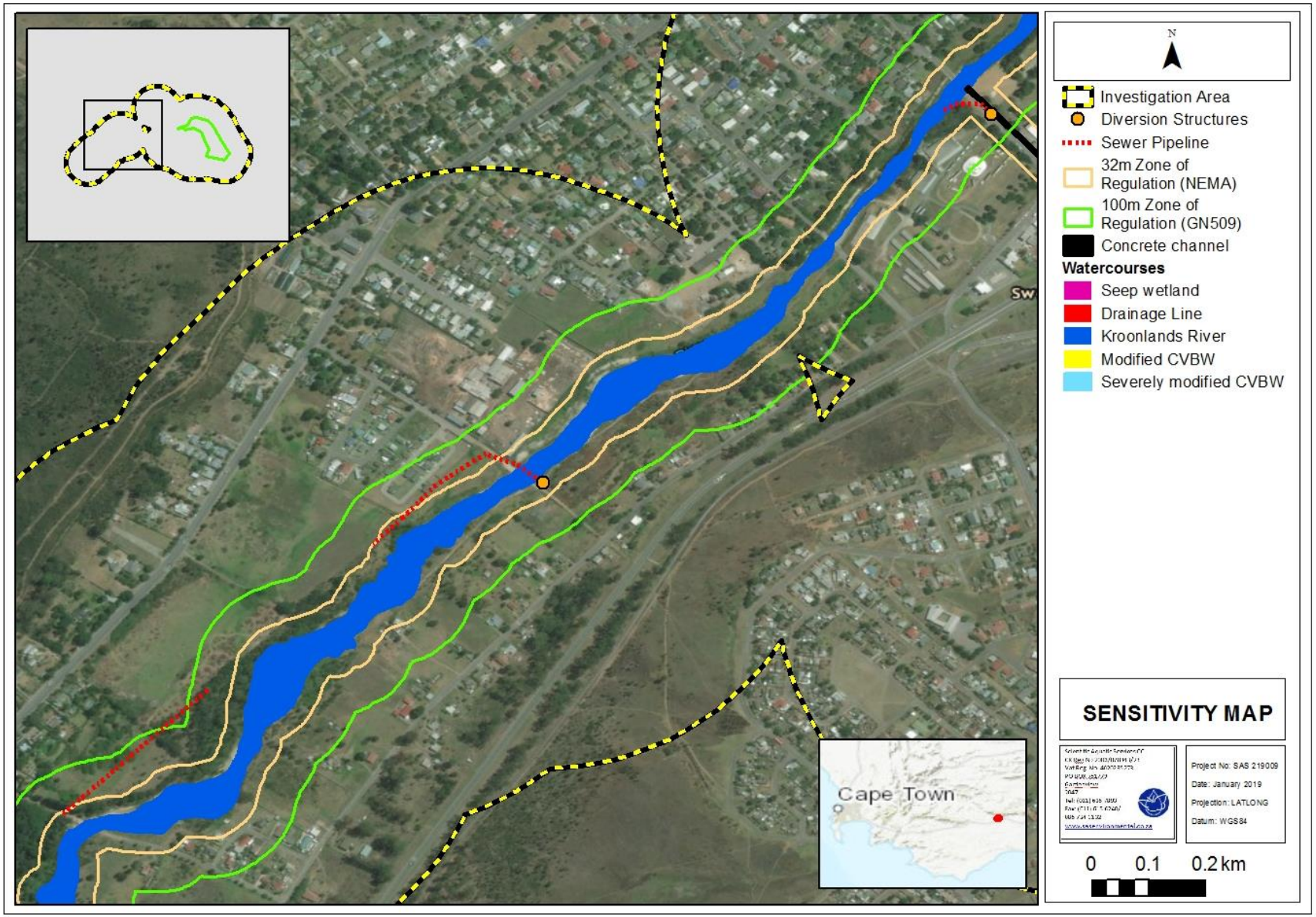

Figure 9: Applicable Zones of Regulation in accordance with the NWA and the NEMA associated with the sewer pipelines and the associated investigation area.

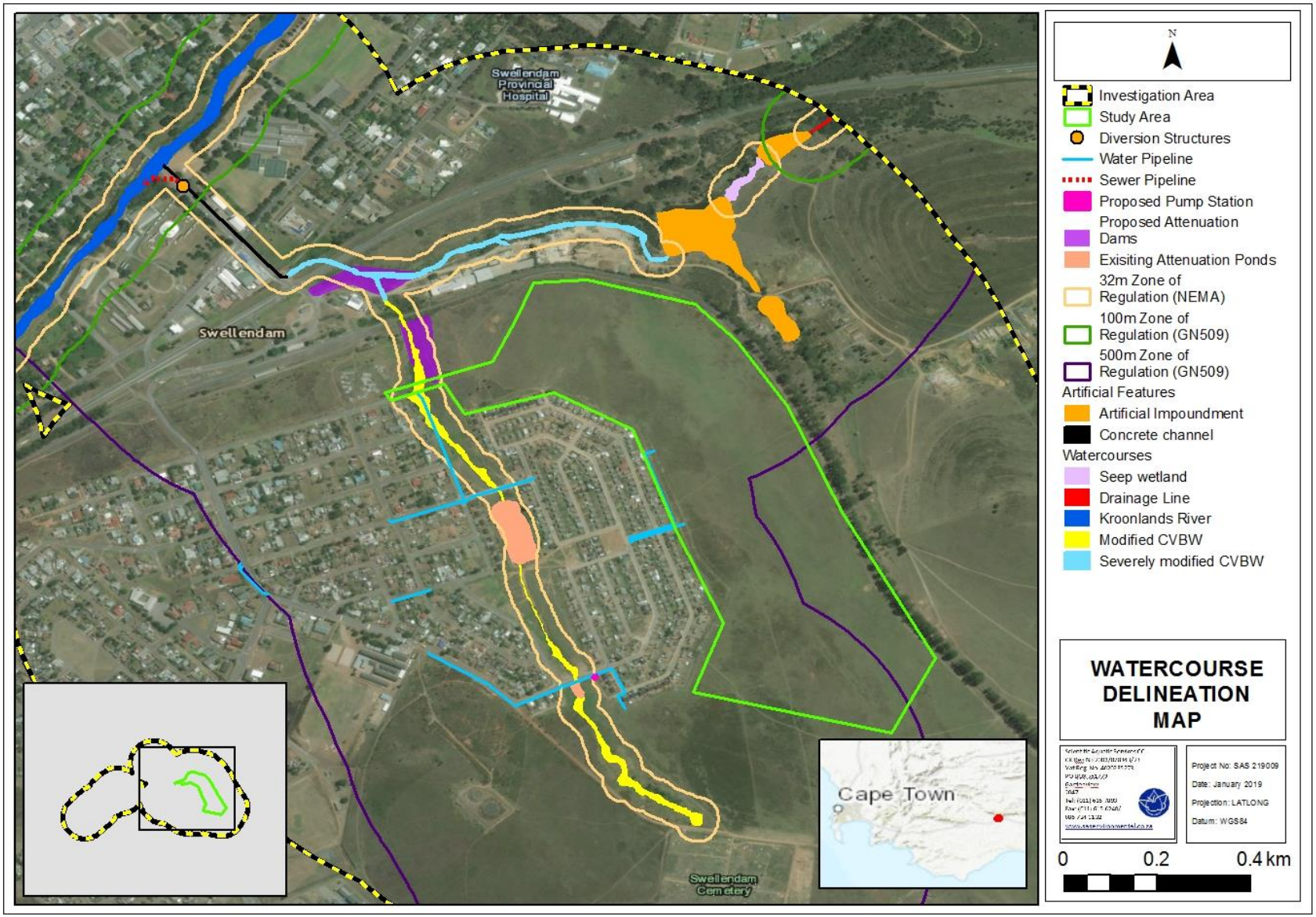

Figure 10: Applicable Zones of Regulation in accordance with the NWA and the NEMA associated with the study area, water pipelines, access road and attenuation facilities and the associated investigation area.

5. RISK ASSESSMENT

Following the assessment of the freshwater resources, the DWS specified Risk Assessment Matrix (as promulgated in GN509 of 2016) was applied to ascertain the significance of risk associated with the individual activities on the key drivers and receptors (hydrology, water quality, geomorphology, habitat and biota) of the freshwater resources within the development area. The points below summarise the considerations undertaken:

- The DWS risk assessment was applied assuming that all listed mitigation measures are implemented, thus the results of the DWS risk assessment 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* would be followed, i.e. the impacts would first be avoided, minimised if avoidance is not feasible, rehabilitated as necessary and offset if required;
- The activities and the associated risks they pose are all highly site specific, not of a significant extent relative to the area of the freshwater resources assessed, and therefore have a limited spatial extent (i.e. within the investigation zone). The exception are risks to water contamination, however if the system is well managed, this risk is considered very low;
- While the operation of the proposed pipelines will be a permanent activity, the construction thereof is envisioned to take no more than a few months. However, the frequency of the construction impacts may be daily during this time; and
- Most impacts are considered to be easily detectable, with the exception of contamination of surface and groundwater which will require some effort.

5.1. Impact Assessment Discussion

There are five key ecological risks on watercourses that were assessed, namely:

- Loss of freshwater feature habitat and ecological structure resulting in impacts to biota;
- Changes to the socio-cultural and service provision;
- Impacts on the hydrology and sediment balance of the freshwater features;
- Impacts on water quality; and
- Proliferation of alien and invasive plant species.

The proposed housing development will fall within 500m of the Channelled Valley Bottom Wetland and therefore consideration must be given to the potential risks of the development to the system. Similarly, two segments of the proposed water upgrade will traverse the CVBW within an existing road, a new access road will be developed as well as two new attenuation ponds within the CVBW. Furthermore, a new pump house will be developed within 32m of the CVBW.

The proposed sewer upgrade will traverse the Kroonlands River, however, segment 1 of the bulk sewer upgrade is located approximately 30m north of the river and all crossings over the Kroonlands River will be undertaken by bolting the pipe to the existing bridges (Segments 2 and 3) the risks associated with the construction and operational phases are considered to be Low. Consideration must, however, be given to the operational phase of the sewer pipelines as there is a potential risk that untreated effluent may enter the watercourse, which has the potential to increase the concentration of salts, nitrate and toxic ammonia concentrations, as well as *Escheria coli* and increased biological oxygen demand within the system and may lead *to* eutrophication, as well as anoxic conditions, leading to biodiversity simplification and the excess production of hydrogen sulphide gas.

The proposed water pipeline upgrades will traverse the CVBW within two existing road crossings. It is assumed that open trenching will be undertaken, however, the existing pipeline is located within the road and thus the trenching activities will have a limited impact on the surrounding wetland feature. It is

however recommended that directional drilling be considered for all pipeline upgrades associated with a watercourse as this method significantly reduces the impacts on the receiving freshwater environment.

The results of the risk assessment are summarised in Table 3 below, including key mitigation measures for each activity that must be implemented in order to reduce the current impacts. Although GN509 of 2016 makes allowance for activities with a low risk scoring to be generally authorised, the construction, installation or maintenance of any sewerage pipelines are excluded and will therefore require a full Water Use Licence Application (WULA) regardless of the risk outcomes. Similarly, should any other activities within the same property be considered a Moderate or high risk, a full WULA from the DWS will be required.

Table 3: Risk Assessment outcomes for the proposed development activities.

Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Confidence level	Control Measures
CONSTRUCTION PHASE									
STUDY AREA – PROPOSED HOUSING DEVELOPMENT, ACCESS ROAD AND STORMWATER									
Site clearing prior to commencement of construction activities associated with the study area.	· Exposure of soils, leading to increased runoff and erosion, and thus increased sedimentation of the watercourse; · Increased sedimentation of the watercourse, leading to smothering of biota and potentially altering surface water quality; · Potential proliferation of alien and invasive species; and · Decreased ecoservice provision.	· Loss of habitat and ecological structure resulting in impacts on vegetation and biota. Potential risks to water quality. · Proliferation of alien and invasive spp. · Changes to ecological and socio-cultural service provision. · Changes to hydrological function and sediment balance.	1	3	13	**39**	**L**	**HIGH**	· Contractor laydown areas and stockpiles to be established outside of all watercourses. Special care must be taken with the CVBW. The delineated watercourse must be marked as a No-go area and access must be prohibited. · Although no watercourses were identified within the study area, it is recommended that as much indigenous vegetation be retained within the planned open space areas to assist with soil stability and reduce dust. · Sustainable Urban Drainage (SUDs) should be developed as part of the development where earth stormwater swales are developed and direct stormwater run-off to the attenuation facilities. As far as possible piping stormwater should be avoided. · No indiscriminate movement of construction vehicles any of the watercourses is allowed. Use must be made of existing crossings only. Vehicles to be serviced at the contractor laydown area and all re-fuelling is to take place outside of all relevant zones of regulation. · Care must be taken to ensure that all concrete mixing is done on batter boards or within suitably bunded areas and no cement laden run-off may enter into the CVBW or Kroonlands River. · All works associated with the sewer and water pipelines as well as the access road and attenuation facilities must be planned for the drier summer months. The CVBW is likely to have thick mud during the wet season due to the high clay content of the soils, thus movement of construction equipment required for re-sloping of the attenuation facilities and installation of culverts may prove challenging and result in unnecessary impacts to the watercourse. · An alien and invasive control plan must be implemented for the construction and operational phases of the development to prevent proliferation of AIPs (specifically *Acacia saligna* which was identified in the surrounding area) into the nearby watercourses. · The delineated CVBW should be clearly demarcated with danger tape or another appropriate mechanism by an ECO and marked as a 'no-go' area.
Site clearing prior to commencement of construction activities associated with the sewer and water pipelines and pump house.			**2**	**4**	**11**	**44**	**L**	**HIGH**	
Site clearing prior to commencement of construction activities associated with new access road and attenuation facilities.			4	8	9	**72**	**M**	**HIGH**	
Construction activities associated with the housing development, within 500m of the CVBW.	· Disturbances of soils leading to increased alien vegetation proliferation, and in turn to further altered freshwater habitat; and · Altered runoff patterns and alteration to flow patterns, leading to increased erosion and		2	4	9	**54**	**L**	**MODERATE**	

Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Confidence level	Control Measures
Proposed new access road over the CVBW for the housing development	sedimentation of freshwater habitat.		5	8	14	**112**	**M**		· Box culverts should be installed within the CVBW and not pipe culverts. Box culverts allow for better dissipation of water across the wetland feature and allows for movement of aquatic and faunal species that may utilise the habitat. · Surveying of the upstream and downstream areas is required in order to ensure the base of the culvert is correctly designed so that water flows through the culvert and does not undercut and flow below or result in scouring to the downstream habitat (as can be seen with the upstream pipe culvert associated with Sofietjie Street). Should a step be required a suitable cascade structure must be installed and grouted pitching implemented below the cascade wall along with placement of packed rock and/or cobbles to ensure energy dissipation and prevent erosion. · Reno mattresses should be installed at the end of the culvert concrete aprons as scour protection. <u>Concrete mixing on site:</u> · No mixed concrete may be deposited outside of the designated construction footprint. · A batter board mixing trays and impermeable sumps should be provided, onto which any mixed concrete can be deposited whilst it awaits placing. · All wet concrete areas must be contained so as to prevent any contaminated runoff into the watercourse during the curing process. At no point may dirty water be dirty pumped into the watercourse from the construction area. · Concrete spilled outside of the demarcated area must be promptly removed and taken to a suitably licensed waste disposal site. <u>Post Construction</u> · Rock and/or cobbling should take place for at least 2m upstream and downstream of the culvert crossing for energy dissipation and to create a riffle and improve habitat diversity. · All embankments disturbed by the construction activities should be re-sloped to a 1:3 ratio or the largest slope possible to tie into the surrounding embankments and revegetated with indigenous riparian vegetation.

Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Confidence level	Control Measures
									· Erosion and sediment build up must be monitored until all vegetation has re-established. · Prior to the contractor leaving the site, a suitably qualified freshwater ecologist should sign off that construction and rehabilitation has taken place. At this point the freshwater ecologist should highlight any defects to be rectified.
Stormwater Management for the proposed housing development site · Utilisation of existing attenuation ponds and development of two new attenuation ponds within the CVBW.	· Development of new attenuation facilities within the watercourse. · Ensuring hydrological connectivity to downstream reaches and suitability of existing stormwater infrastructure.	· Changes to habitat and ecological structure resulting in impacts on vegetation and biota. · Proliferation of alien and invasive spp. · Changes to hydrological function and sediment balance.	4	6	13	**78**	**M**	**MODERATE**	· The proposed attenuation ponds are located within the CVBW. An outlet structure must be provided in any walls to allow for throughflow of water throughout the seasons. · The larger attenuation pond proposed near the N1 must be designed to function as a wetland habitat. All existing gullies should be rectified, and water should be allowed to dissipate across the attenuation area before leaving the area via the box culvert under the N1. Water from the modified CVBW associated with the residential area as well as the channel from the upstream dam associated with the eastern severely modified CVBW must be accounted for. · All embankments disturbed by the construction activities should be re-sloped to a 1:3 ratio or the largest slope possible to tie into the surrounding embankments and revegetated with indigenous riparian vegetation. · Indigenous wetland vegetation growth should be encouraged within all attenuation facilities and alien and invasive vegetation must be controlled.
WATER AND SEWER PIPELINES									
Ground-breaking: associated with the excavation of trenches within existing road reserve and fastening of pipeline to existing bridges.	· Disturbances of soils leading to increased alien vegetation proliferation, and in turn to further altered freshwater habitat; and · Altered runoff patterns and alteration to flow patterns, leading to increased erosion and sedimentation of freshwater habitat.	· Impacts on the hydrology and sediment balance of the river Changes to ecological and socio-cultural service provision. · Changes to hydrological function and sediment balance.	2	5	11	**55**	**L**	**HIGH**	<u>Open trenching within close proximity to a watercourse:</u> · The trenching nearby the watercourses, within the existing servitude (sewer pipeline) and road reserve (water pipeline) must be undertaken during the drier summer months. Pre-construction planning is therefore imperative in order to meet this timeframe. · No open trenching should be undertaken within the watercourses. All sewer pipelines are to be bolted to the existing culverts and all water pipelines must remain within the existing road reserve where pipe culverts have already been installed for hydrological connectivity to the downstream reaches. · Excavated materials should be stockpiled and may not exceed 2m in height to minimise impact on the seedbank. Mixing of the lower and upper layers of the

Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Confidence level	Control Measures
Installation of water and sewer pipeline via open trenching, including: a) Mixing and casting of concrete (required for the sewer pipeline); b) Placement of bedding material within the excavated trench underneath the pipelines; c) Backfilling of trench, where after it will be compacted; and d) Miscellaneous activities by construction personnel.	· Erosion of the exposed trenches; · Potential sedimentation of the watercourse; · Potential impacts on water quality and contamination of soils within the watercourse; · Potential of backfill material to enter the watercourse, increasing the sediment load within the watercourse; · Potential for over-compaction of soils within the watercourse, disrupting the growth medium of the freshwater vegetation.	· Loss of habitat and ecological structure resulting in impacts on vegetation and biota. · Potential risks to water quality.	3	5	11	**55**	L	HIGH	excavated soil should be kept to a minimum, so as for later usage as backfill material. · All exposed soils must be protected for the duration of the construction phase with a suitable geotextile (e.g. Geojute or hessian sheeting) in order to prevent erosion and sedimentation of the watercourse in close proximity to these stockpiles. · After the trench has been excavated, a bedding layer (such as clean gravel) should be placed and where existing roads have been opened, the surface should be re-tarred. <u>Backfilling of the trenches:</u> · All open trenches should be backfilled immediately after pipes have been installed; · Trenches should be backfilled with the stockpiled excavated materials in layers, up to 150mm below the natural ground level, after which the topsoil is replaced (to the stream bed level) and re-worked and the removed vegetation is reinstated as part of the rehabilitation of the site.
e) Potential spillage from construction equipment.	Possible contamination of freshwater soils and surface water, leading to reduced ability to support biodiversity	Potential risks to water quality.	2,75	4,75	8	**38**	L	HIGH	· Suitable waste disposal facilities should be provided; · These facilities should regularly be emptied and taken to a registered waste disposal facility; · If waste/spillage has entered the watercourse and caused a decrease in the water quality of the watercourse, these spills should immediately be cleared and the water within the watercourse treated as per the instruction of the ECO.
OPERATIONAL PHASE									
Operation and maintenance activities associated with the housing development,	Possible contamination of freshwater soils and increased toxicants into	· Proliferation of alien and invasive spp. · Potential risks to water quality.	2	4	9	**36**	L	HIGH	· An alien vegetation management plan should be developed and implemented and managed for all open space areas as well as the CVBW and associated attenuation facilities.

Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Confidence level	Control Measures
access road and attenuation facilities within 500m of a CVBW.	the downstream watercourses.								· As much indigenous terrestrial vegetation should be included into the landscape plan for the open space areas. This is especially true as open space areas will likely be utilised by the local community as grazing for livestock.
Operation and maintenance of the sewer and potable water pipeline.	Potential failure of infrastructure, resulting from blockages or leakages.	Vehicular access to the sewer or water pipeline resulting in: · Soil compaction · Vegetation degradation · Soil and stormwater contamination from oils and hydrocarbons. Contamination of the watercourse with additional sewage effluent resulting in: · Increased concentration of salts, nitrate and toxic ammonia concentrations, as well as counts of *Escheria coli*; · Potential eutrophication of the system, including anoxic conditions, leading to biodiversity simplification and the excess production of	5	8	12	**96**	**M**	**MODEARTE**	· Both the water and sewer pipeline and all manholes must be pressure tested for integrity upon the completion of construction. · It is recommended that the managing authority test the integrity of the pipelines at least once every five years or more often should there be any sign or reports of a leak. · Should a blockage occur all possible steps are to be taken to prevent the pollution (specific to the sewer pipeline) of the watercourse during repair, including the placement of sheeting around the manhole used for access as well as containment barrels for any effluent withdrawn. · No vehicles are permitted to drive through any watercourses. Any maintenance works must be undertaken by foot or the relevant authorisations obtained beforehand. · On repair of any leaks, all excavated areas must be backfilled, and alien vegetation proliferation must be monitored until basal cover has been established.

Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Confidence level	Control Measures
		hydrogen sulphide gas; · Increased alien and invasive species encroachment; and · Potential health risk to downstream users.							

6. CONCLUSION

Based on the findings of the study, the following is recommended:

1. This verification is in agreement with the findings of the report compiled by Hanekom (2018) that no watercourses were identified within the study area, however, the system classified as a non-perennial river by Hanekom (2018) was identified as a Channelled Valley Bottom Wetland. This system is associated with 2 segments of the water pipeline, the new access road as well as the two new proposed attenuation facilities, located approximately 300m west of the study area. Two of the three segments of the sewer pipeline to be upgraded will cross over the Kroonlands River and its associated riparian zone by being bolted to the existing bridges.
2. A 500m Zone of Regulation and a 100m Zone of Regulation in accordance with General Notice 509 of 2016, as it relates to the National Water Act, 1998 (Act 36 of 1998) are associated with the Channelled Valley Bottom Wetland and the Kroonlands River and its associated riparian zone respectively.
3. Consideration must be given to the potential risks of the development as summarised in Table 3 of this report, whereby the overall impacts of the development are considered to be moderate. As such, the relevant authorisations from the Department of Water and Sanitation and the Department of Environmental Affairs and Development Planning must be obtained prior to commencement of any works.

We trust we have interpreted your requirements correctly. Please do not hesitate to contact us if there are aspects of this document that you would like to discuss further.

Yours Faithfully,

Digital Documentation Not Signed for Security Purposes

Kim Marais
Pr. Sci. Nat 117137/17

Co-Author (Desktop Background Information): Christel du Preez

Reviewed by: Stephen van Staden (Pr.Sci.Nat)

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