Part C Chapter 4 Drommedaris Street Hybrid Flood Alleviation Concept Note

Prepared by AIVIA for Drakenstein Municipality and the GIZ

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Abbreviations

BA – Basic Assessment

CAPEX – Capital Expenditure

CCAP - Climate Change Action Plan

CFRPS - Community Flood Risk Perception Study

DFFE – Department of Forestry, Fisheries and the Environment

DM - Drakenstein Municipality

DWS - Department of Water and Sanitation

EA – Environmental Authorisation

EAP - Environmental Impact Assessment Practitioner

ECO - Environmental Control Officer

ECSA - Engineering Council of South Africa

EIA - Environmental Impact Assessment

EPWP - Expanded Public Works Programme

FAES – Flood Alleviation Ecosystem Services

HGM - Hydrogeomorphic

HFA - Hybrid Flood Alleviation

IDP - Integrated Development Plan

KPA – Key Performance Area

KPIs - Key Performance Indicators

LCA - Landscape Character Assessment

LiDAR – Light Detection and Ranging

MMC - Members of the Mayoral Committee

NEMA – National Environmental Management Act

NbS – Nature-based Solutions

NGO - Non-governmental Organisation

NPO - Non-profit Organisation

OHSA – Occupational Health and Safety Act

OPEX – Operational Expenditure

PCSWMM – Personal Computer Storm Water Management Model

PDO - Pre-determined Objective

PES – Present Ecological State

PPP – Public-Private Partnerships

PSOC – Personnel Specification Occupational Classification

SACPLAN – South African Council for the Planners

SAGC - South African Geomatics Council

SDBIP - Service Delivery and Budget Implementation Plan

SDF - Spatial Development Framework

SDG – Sustainable Development Goals

SOP - Standard Operating Procedure

DM SSN – Drakenstein Municipality Smart Safety Network

TLB – Tractor-Loader-Backhoe

WET-Health – Wetland Health

WULA – Water Use Licence Application

Project Summary: Drommedaris Street

Project rationale, objectives and approach of project

The Mbekweni Catchment is drained by the Mbekweni, Kleinbosch and Dal Rivers, which discharge into the Berg River.

The Dal River also flows through the southern edge of the site, after crossing over the to the Mbekweni Catchment from the Groenheuwel Catchment, flowing east to west through a largely undeveloped area. The Dal River flows the south of the site. Flowing east to west through a largely undeveloped area upstream of the urban edge, it passes across Beets Street and Jan van Riebeeck Drive, and through the Mbekweni residential area to meet with the site boundary on the north-east corner. After the section of the Dal River between Jan van Riebeeck Drive and the railway is referred to as the Drommedaris Canal.

The Drommedaris Street Hybrid Flood Alleviation Project is located in Ward 16 of Drakenstein Municipality's Mbekweni Catchment. Designated as Green Space in the Spatial Development Framework (SDF), the project proposal recommends a combination of stormwater management approaches with recreational and ecological benefits. The project includes the construction of a deep water treatment pond, wetland terraces and swales to effectively manage stormwater, reduce flood risk, support biodiversity, and improve water quality. The project achieves flood attenuation through nature-based and hybrid infrastructure, as well as the promotion of healthy communities. The raised sports field, bird-watching island, and integrated pathways enhance community experience through the creation of a distinct site identity and sense of place.

The 100-year status quo flood extents indicates that the low-lying residential area adjacent next to Drommedaris Street faces high levels of flood exposure. The area may experience flood depths of up 2 m for the 100-year return period, which is mainly concentrated in the area between the railway line and Drommedaris Street where the informal settlement is currently located.

The Drommedaris Street intervention includes:

- Water treatment ponds and wetlands system,
- Raised sports fields,
- Entrance gateways to the sports fields,
- Swales,
- Berm with pedestrian pathways,
- Proposed road to connect to Drommedaris Street,
- Bird-watching Island,
- Marsh planting, and
- Solid waste management.

The flood risk reduction benefit of the proposed intervention at the Drommedaris Street site is that the modelled flood depths will be reduced compared to the current situation, specifically in the area between the railway line and Drommedaris Street. The reduction in flood depths in this area is expected to range between 0.25m to 0.5m. The optimisation of the proposed intervention to further enhance attenuation capacities and functionality at the Drommedaris Street site could result in further flood risk reduction, specifically in the residential areas.

Drommedaris Street

- Roads
- Watercourses
- Urban Edge (2024)
- Catchment Boundaries
- Site Boundary
- Affected Erven

Wetlands

- Channelled valley-bottom
- Depression
- Floodplain
- Seep
- 100yr Floodline
- Ward Boundaries

Alignment With Municipal Objectives

The project aligns with all municipal objectives. It is particularly relevant to Strategic Objective 4, given the strong alignment with maintenance and provision of infrastructure for sustainable service delivery.

Municipal Strategic Objective	Alignment
To ensure good governance and compliance.	X
To ensure financial sustainability to meet statutory requirements.	X
To ensure an efficient and effective organisation supported by a competent and skilled workforce.	X
To provide and maintain the required physical infrastructure and to ensure sustainable and affordable services	X
To plan, promote investment and facilitate economic growth.	X
To facilitate, support and promote social and community development.	X

Key Performance Areas (KPAs) and Pre-Determined Objective (PDOs)

Key Performance Areas (KPAs) refer to the areas within the business unit for which an individual or group is logically responsible. Pre-Determined Objectives (PDOs) are the areas identified as important or crucial, where a result will assist in the achievement of the set objectives or goal (DM IDP, 2024:67).

It is recommended that this project be located within **KPA 4: Infrastructure and Services**, under **PDO 23: Transport, Roads, and Stormwater. This is directly aligned with the Strategic Objective *to provide and maintain the required physical infrastructure and to ensure sustainable and affordable services.***

Estimated total project cost

The following table provides a summary of the estimated costs associated with the project.

Cost Category	CAPEX vs OPEX	Total Amount (ZAR)
Planning and Design Cost	CAPEX	9 906 297,64
Construction and Implementation Costs	CAPEX	105 666 792,00
Operation and Maintenance Costs	OPEX	2 842 335,84
Miscellaneous Costs	CAPEX/OPEX	350 000,00
Grand Total		**118 765 425,48**

The estimated total project costing is based on information available at the time of developing the concepts. The Planning and Design costs must be further refined upon the final determination of the specialist studies required. Construction and Implementation Costs as well as Monitoring and Maintenance Costs will be further refined based on the detailed designs. As the engineering design development progresses, refined estimates can be prepared by the Quantity Surveyor / Cost

Estimating Consultant. This would consider local and context specific considerations for the various items.

Drakenstein's Prioritisation Project and Capital Expenditure Criteria

CRITERIA FOR PRIORITISATION		
	Is **legislation regulating this project?**	
1	Legislation regulates this project. A non-exhaustive list of national legislation is provided. The Constitution of the Republic of South Africa, 1996; The National Water Act, 1998 (Act No. 36 of 1998); The National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998); The Municipal Systems Act, 2000 (Act No. 32 of 2000); The Disaster Management Act, 2002 (Act No. 57 of 2002); The Water Services Act, 1997 (Act No. 108 of 1997), Spatial Planning and Land Use Management Act (Act No. 16 of 2013), Climate Change Act (Act No. 22 of 2024); Republic of South Africa (2000). Promotion of Equality and Prevention of Unfair Discrimination Act. Act No 4 of 2000. Chapter 5, Section 28; Additional provincial and local legislation and by-laws may also be applicable.	**Y**
	Will this project **enhance service delivery (roads and storm water, electricity, water, sanitation, and refuse)?**	
2	This project will enhance service delivery (roads and storm water, water, sanitation, and refuse). **Service delivery through stormwater management and Sustainable Urban Drainage Systems (SUDS):** The project seeks to achieve flood risk reduction benefits through the development of hybrid flood alleviation interventions- leveraging nature-based solutions as complementary to more conventional 'grey' service delivery approaches. SUDS present an approach to stormwater and runoff management that aims to reduce downstream flooding, enhance infiltration into the ground, remove pollution, improve the quality of stormwater, reduce pollution in water bodies, and improve biodiversity. SUDS encourages natural drainage processes by circulating water back into the water cycle rather than just collecting and detaining it, recognising the importance of it as a resource. The processes identified in the project constitutes SUDS which focuses on managing flow quantity, quality, amenity, and biodiversity. In addition, the interventions can form a natural part of open spaces in a settlement and contribute to the quality of the environment and the aesthetics of a neighbourhood (DHS, 2019). The project therefore serves to facilitate more resilient stormwater management services, and also serves to protect communities and municipal and private infrastructure through flood risk reduction. The slowing of water through the site will serve to protect the surrounding areas from flooding.	**Y**

CRITERIA FOR PRIORITISATION		
	The project also proposes the **raising of Drommedaris Street** as an *alternative option* to creating the north-south berm on the western edge of the site, which can serve to create a multi-functional roadway. The existing road is currently well utilised by the Mbekweni community and would serve to improve the connectivity in the catchment. The project includes a network of ponds and treatment wetlands with the aim to **achieve water quality improvement outcomes**. This is particularly beneficial given the poor quality of water in this area. The DM HFA PCSWMM results (AIVIA, 2024) show that the Drommedaris Street's current flooding situation for the 100-year return period the low-lying residential area adjacent to Drommedaris Street is exposed to flooding. The area could experience flood depths of up 2 m under the 100-year flood scenario and this is mainly concentrated in the area between the railway line and Drommedaris Street where the informal settlement is currently located. **It is therefore essential that flood alleviation measures be introduced in this area to alleviate flood risk.** The site will include a **solid waste management strategy** including **public refuse bins** to be collected at regular intervals, particularly along pedestrian pathways, within the park and at the sports fields. The development of the site therefore contributes to improved solid waste management, improving the health of communities and the cleanliness of the City. In its current state. The site is currently used for illegal dumping, and the development of the site into an actively used open space may yield the benefits of active and passive surveillance.	
	Is this **project an essential service?**	
3	This project is an essential service. The project supports essential service delivery functions related to roads, stormwater, water, sanitation and refuse removal. It will also provide essential community facilities and supports the reduction of flood risk experienced by the community. The **Drommedaris Canal** modelling results show that the Canal does not have sufficient capacity to contain and convey the 100-year flood. Trenches have been formed to convey stormwater to reduce the flooding of nearby roadway to maintain accessibility. As a low point within the landscape, this area is prone to constant flooding and overtopping of channels. The informal settlement at the outlet of the Drommedaris Canal is vulnerable to flooding and is characterised by **flood depths up to 2.5 m deep,** as identified by the DM HFA Flood Risk Assessment (AIVIA 2024).	**Y**

CRITERIA FOR PRIORITISATION		
	It is therefore essential that flood alleviation measures be introduced in this area to alleviate flood risk.	
4	Will the execution of this project **stimulate investment in the local economy?**	
	The project will lead to the creation of permanent and temporary jobs linked to Planning and Design, Construction and Implementation, and Operation and Maintenance phases of the project. The improved urban environment and showcasing of successful implementation with community buy-in may also serve to improve investor confidence in the area. The estimated level of investment in the planning, design, and construction phase of this project is expected to create approximately **223 indirect jobs in the national economy**, stemming from the input materials required for the project. **Expected expenditure will induce about 340 jobs** in the economy as project workers spend their wages. Many of these jobs will be in Drakenstein if local suppliers are used. It is estimated that this investment will yield 1.68 times the initial amount, resulting in **a contribution to the national economy of about R200 million**. Wages paid by construction firms during the construction phase will also stimulate economic activity and lead to investment.	**Y**
5	Will this project **enhance the quality of life our local community and be for the benefit of the local community?**	
	The project aims to enhance the quality of life the local community and be for the benefit of the local community. Flood Risk Reduction will serve as a direct benefit to improve the health, safety and well-being of surrounding communities. Recreational benefits are achieved through the incorporation of sports fields and pedestrian movement routes. The community noted that restorative and sporting spaces are required and suggested that pleasant and well-maintained open spaces would provide recreational and religious benefits that are much needed by the community. The incorporation of signage along pathways and entrances can further enhance the education and awareness opportunities to be attained through the development of the site.	**Y**
6	Will this **project lead to permanent job creation?**	
	The project components will include opportunities for job creation for local communities during the construction phases and operation and maintenance phases. The operation and maintenance in relation to the open spaces, landscaping, solid waste management, play area equipment and the stormwater ponds will require on-going human resource contributions. This may include the involvement of community members in voluntary project stewardship, the leveraging of the	

CRITERIA FOR PRIORITISATION		
	enhanced public works programme (EPWP), as well as other job creation opportunities. Secondary effects of expenditure in the local economy will also create permanent jobs in the local and national economy. A high-level estimate of permanent direct and induced jobs is provided in the job estimates. The proposed intervention at the Drommedaris site is expected to create approximately 2 permanent jobs in maintenance from the following jobs: Foreman, Mower operators, Planters, Driver and General worker. It is important to note that the 2 permanent jobs are a collection of fractions of jobs, therefore, there are more job types than jobs. The level of investment estimated in the planning, design, and construction phases of this project will create an estimated 223 indirect jobs in the national economy, from the supply of inputs required for the project. It is anticipated that the estimated level of expenditure will induce 340 jobs in the economy as project workers spend their wages. Many of these will be in Drakenstein if local suppliers are used. See also the Job Creation Potential Section C4.7.	
7	Is this project labour intensive/ will this project lead to **temporary job creation?**	
	The project components will include opportunities for job creation for local communities during the construction phases and operation and maintenance phases. The operation and maintenance in relation to the open spaces, landscaping, solid waste management, play area equipment and the stormwater ponds will require on-going human resource contributions. This may include the involvement of community members in voluntary project stewardship, the leveraging of the enhanced public works programme (EPWP), as well as other job creation opportunities. Secondary effects of expenditure in the local economy will also create permanent jobs in the local and national economy. A high-level estimate of permanent direct and induced jobs is provided in the job estimates. The proposed intervention at the Drommedaris site is expected to create an estimated 33 job-years in the design and construction phases. In the design phase, the eight temporary job years created will nearly all be highly skilled positions in professional firms (Engineering, Landscape Architecture, Planning, Scientific Services). All these positions will qualify as green jobs. In the construction phase, the 25 job-years created will include three highly skilled job years, eleven semi-skilled job years and ten low-skilled job-years. All of these will also be green jobs except 6 semi-skilled jobs, which will consist of guards for 24-hour site security. The two maintenance jobs would be created, both would be green jobs in this intervention. Other expected semi-skilled jobs will be excavator operators, TLB operators, dump truck operators, planters, and gabion basket makers. See also the Job Creation Potential Section C4.7.	

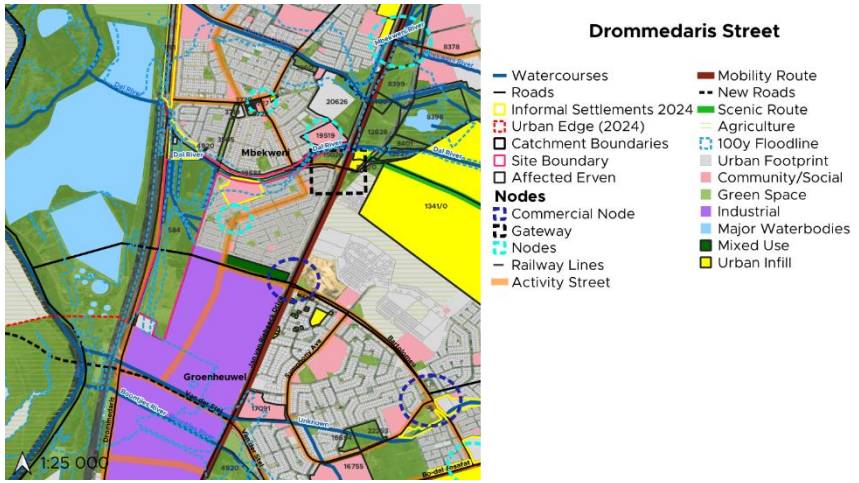
CRITERIA FOR PRIORITISATION		
8	**Will this capital expenditure / project generate significant additional revenue for the municipality?**	
	The project is not likely to generate significant additional revenue for the municipality. However, the components of the project provide essential basic services to communities and aims to respond to the need for flood risk reduction in the area. As such, the benefit of this project includes the protection of municipal and private infrastructure, the protection of livelihoods and community assets, and may result in cost savings due to improved infrastructure maintenance and management. This infrastructure does not sit in any of the trading services departments and is therefore not a direct revenue generator. Some elements may have access charges, but these revenues will be small. They are likely to have operating cost reduction impacts on both water services and solid waste services. Natural water treatment services provided by these interventions will reduce water treatment costs for water abstracted from the Berg River. The net effect is likely an increased surplus or reduced deficit in water services and solid waste management and reduced operating costs in stormwater management.	**N**
9	Will this **project improve the aesthetic appearance of the city / town?**	
	The project seeks to achieve an improved urban realm and placemaking to support the functionality and improvement of the urban environment. The site was identified as having a polluted floodplain landscape character, and therefore the active use of this area as an open space for the public good will serve to improve the character of the area, and in so doing, the use of this area can promote its upkeep by the surrounding communities, including promotion of passive surveillance to reduce illegal dumping. This should also be supported by a targeted solid waste management strategy.	**Y**
10	Will the execution of this project **contribute to the social upliftment of the community?**	
	Recreational benefits are achieved through the incorporation of sports fields, a play park and pedestrian movement routes above the berm. The community noted that sports fields are needed and will be used by the community. The activation of the site can also offer job creation opportunities for surrounding communities.	
11	Does this project comply with the **developmental directions of the municipality's spatial development framework?**	
	The project aligns with the developmental directions of the municipality's spatial development framework.	**Y**

CRITERIA FOR PRIORITISATION		
	Land use change will have a significant impact on catchment hydrology and flood risk. Development is associated with an increase in impermeable surfaces which will contribute to increased runoff and peak discharges in the absence of attenuation interventions. Activating this area though the development of **multi-functional open spaces** aligns with the municipal SDF, which has designated this area for Green Space which will allow for the protection and active use of green space. The protection of green space will also assist in ensuring that current sites earmarked for green/open space **remain undeveloped** and able to serve as permeable surfaces. **The studies undertaken as part of this DM HFA Programme design further demonstrate that that the land is not suitable for human habitation, and the active use of this space can also assist to guard against settlement on this property.**	
12	**Must this project be implemented now?**	
	The project is essential to achieve the required flood risk reduction outcomes necessary to alleviate flooding. See also Point 2 in this table.	**Y**
13	**Is there a time factor involved for this capital expenditure / project that will negatively influence any other capital expenditure / project or foreign investment in infrastructure?**	
	The project forms part of the broader Drakenstein Municipality Hybrid Flood Alleviation Programme, and this project was identified as part of the Stage 1 Priority/ Catalytic Projects.	**Y**

C4.1.Informants: Drommedaris Street HFA Project

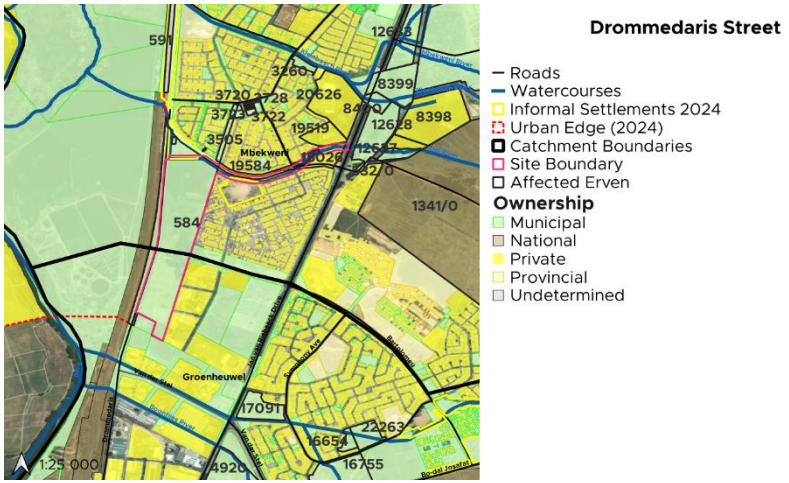
Urban Context

The project site is located within the 2024 Urban Edge in an area earmarked in the **SDF for Green Space** and is located within **Ward 16** (2021 Wards). The site splits across the catchment boundaries of the **Mbekweni and Groenheuwel Catchments**, with the division running parallel to Bartolomeu Street. The Paarl Bird Sanctuary and Wastewater Treatment Works are located west of the site across the railway line. This site is located within the 1:20yr, 1:50yr and 100yr floodline. The site's boundary is accessible along Drommedaris Street although there is no public access through the site. There is a **visual connection to the Hawequas and Paarl Mountain ranges**. There is lack of visual connection between the site as a floodplain and the Paarl Bird Sanctuary (as an area of visual sensitivity) because of the raised railway line and its supporting vertical infrastructure in the landscape. Despite the areas of *Typha capensis* growth, the site still has an exposed and expansive character. The dominance of the railway line and overhead powerlines within the landscape create a **utilitarian sense of place**. The landscape has visible pollution in the form of rubble and solid waste dumping, as well as sewage and decomposing organic matter. **Drommedaris Street appears to be well used by pedestrians** and less so by vehicles. Despite this, the site feels unsafe as it is a large tract of land out of sight from nearby settlements. Although highly polluted, there is still remnant indigenous wetland vegetation and birdlife (likely due to the proximity to the bird sanctuary).



Part C Chapter 4 Map 1. The site in the context of the DM SDF

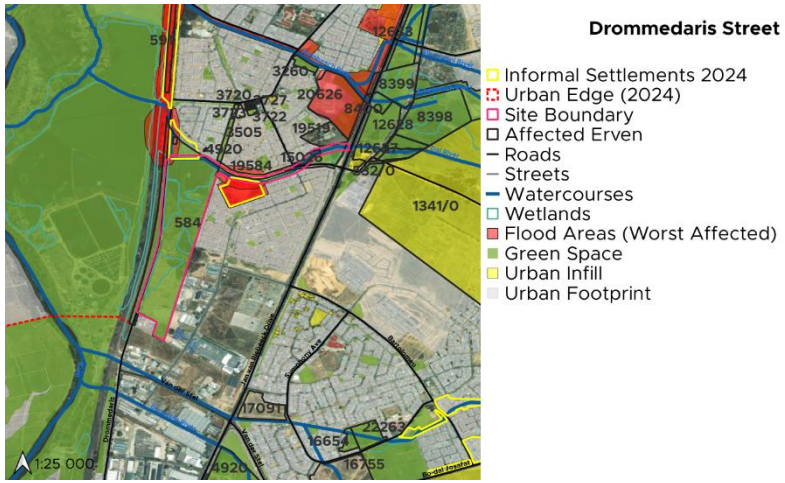
The site is located on **Erf 584** and is approximately **23 hectares in size and municipal-owned**.



Part C Chapter 4 Map 2. Land Ownership

In July 2024, a Community Flood Risk Perception Study (Community Flood Risk Perception Study Report (Phase 2) AIVIA, 2024) was undertaken with community members from wards (9, 11, 12, 16, 19, 21, 22, 24, 25, and 28 – based on the DM 2021 ward boundaries). Community Flood Risk Perception is defined as the understanding of **community and individual experiences of flooding including the causes, impacts and perspectives on required flood alleviation interventions** and as such, the fieldwork findings of the study are inherently subjective. As part of this session, community members were asked to identify the areas where they personally experienced the worst flooding impacts. They were then asked to identify any other flooding areas they were aware of. This data was mapped during the participation sessions and subsequently digitised. The areas identified by the CFRPS participants are shown in Part C Chapter 4 Map 3 and reflect the experiences of the community (and are therefore subjective and based only on the views of the participants of the session).

The site is located south of the Drommedaris and Unathi informal settlements. The area east of the site north of Bartolomeu is a residential neighbourhood characterised by subsidised housing. While the residential areas upstream include the presence of 'backyarders', limited information is available on their location and the impact on service delivery. The area south of Bartolomeu is predominantly industrial in nature. Participants of the CFRPS noted that Drommedaris Street (and the informal settlement) is one of the worst flooding areas in Mbekweni. This aligns with the findings of the Flood Risk Assessment flood extents (AIVIA, 2024), which showed that the informal settlement at the outlet of the Drommedaris Canal is vulnerable to flooding and is characterised by flood depths up to 2.5 m deep.



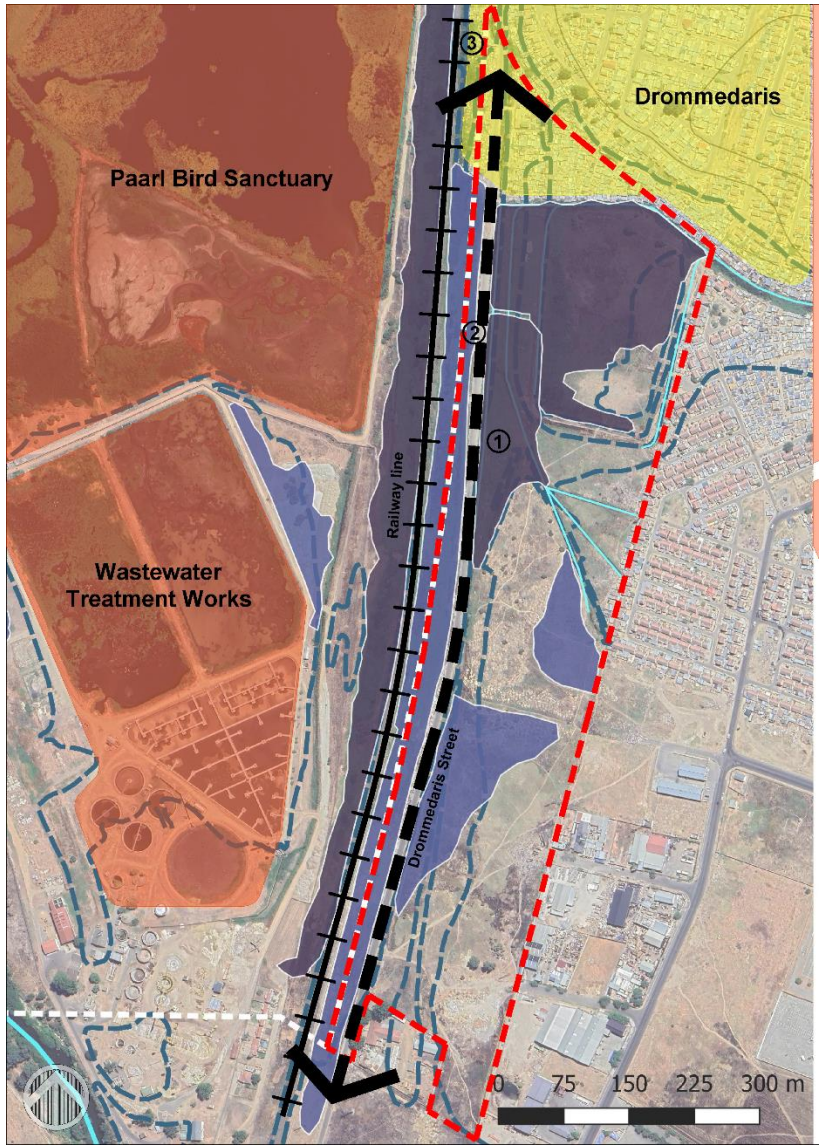
Part C Chapter 4 Map 3. Flood Areas identified by CFRPS Participants

Landscape Character Assessment

The DM HFA LCA identified this area as having a **"Polluted Floodplain"** character type.

Dominant landcover & Landscape elements include:

- Polluted waterways and along vegetated road edges,
- Growth of large reeds,
- Adjacent railway line (acts as a berm/barrier),
- Fragmented floodplain,
- Informal settlement nearby (Drommedaris and Unathi), and
- Low air quality (sewer odour).



Part C Chapter 4 Map 4. LCA: Character Area Map

Part C Chapter 4 Image 1. Photograph showing the irrigation dam with large Eucalyptus trees and the dam previously serviced surrounding farmsteads.

Part C Chapter 4 Image 2. After heavy rains, Drommedaris Street was flooded - reduced accessibility between the informal settlement and the industrial area.

Part C Chapter 4 Image 3. This section of low elevation was flooded between dwellings and the railway line.

Part C Chapter 4 Image 4. ***Typha capensis (Bulrush)***

Being at a low elevation in the floodplain, this area is seasonally wet and would benefit from the **re-instating of wetland vegetation**. A wetland would provide habitat and **increase biodiversity within the area by connecting with the existing Paarl Bird Sanctuary**. Due to the **extremely poor water quality (established through discussions with the DM), this area could benefit from dedicated constructed treatment wetlands**. There is an opportunity to **create multi-functional areas** that could be of benefit to the community (e.g. sports fields) and serve as attenuation facilities.

Part C Chapter 4 Image 5. *Zantedeschia aethiopica* (Arum Lily)

Watercourses, Wetlands and Flood Risk

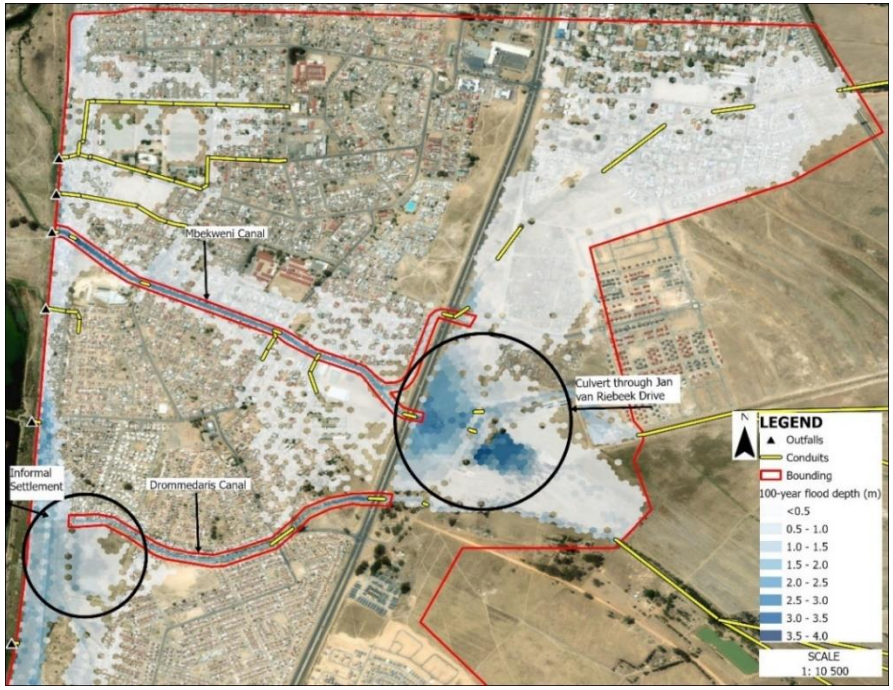
Rivers and Stormwater Infrastructure

The Dal River also flows through the southern edge of the site, after crossing over the to the Mbekweni Catchment from the Groenheuwel Catchment, flowing east to west through a largely undeveloped area. The Dal River flows the south of the site. Flowing east to west through a largely undeveloped area upstream of the urban edge, it passes across Beets Street and Jan van Riebeeck Drive, and through the Mbekweni residential area to meet with the site boundary on the north-east corner. After the section of the Dal River between Jan van Riebeeck Drive and the railway is referred to as the Drommedaris Canal.

The **Drommedaris Canal** modelling results show that the Canal does not have sufficient capacity to contain and convey stormflows under 100-year return period flood scenario. Trenches have been formed to convey stormwater to reduce flooding of the nearby roadway to maintain accessibility. As a low point within the landscape, this area is prone to constant flooding and overtopping of channels.

The informal settlement at the outlet of the Drommedaris Canal is vulnerable to flooding and is characterised by **flood depths up to 2.5 m deep according to the DM HFA Flood Risk Assessment (AIVIA 2024)**.

The railway line is raised and fragments the floodplain between the Paarl Bird Sanctuary and the existing flat landscape and prevents the natural flow of the water to the west. There is an informal settlement (Drommedaris and Unathi) to the north of the site suggesting a **risk of encroachment of dwellings into frequently flooded areas of the site. This informal settlement is likely to severely impact the river's water quality** due to lack of service delivery to informal settlements.



Part C Chapter 4 Map 5. Mbekweni catchment zoomed in (100-year flood)

Wetlands

Wetlands offer three flood alleviation ecosystem services (FAES) – namely Flood Attenuation, Streamflow Regulation, and Water Quality Enhancement, where the following ratings apply:

- 0 = absence;
- 1 = poor;
- 2 = moderate;
- 3 = high;
- 4 = very high.

These FAES differ in relation to the position of the wetland relative to the overall catchment. In the DM HFA Programme, the catchments were each divided into upper, middle and lower reaches. The FAES also differ depending on the type of wetland, as different wetland types are able to offer different levels for each respective FAES. The ability of a specific wetland to provide the three FAES in relation to their location in the catchment is detailed in the Ecological, Infrastructure and Infrastructure Assessment (AIVIA, 2024), where the rating of the potential for supply of ecosystem services by a wetland or river, based on hydrogeomorphic (HGM) type, and climatic setting (humid to sub-humid, and semi-arid) is explained. For this study, all scores apply to wetlands and rivers in good condition and the process was adapted from WET-EcoServices Version 2 (Kotze et al., 2020).

This provides guidance on the nature of intervention that might be required to rehabilitate, restore or protect the wetlands to enable them to offer the maximum FAES as they would if they were in good condition.

The actual condition of the wetland is also known, based on the DM HFA Ecological Assessment, which used the rapid Level 1A WET-Health assessment protocol (MacFarlane et al., 2020) to determine the **Present Ecological State of the hydrology, geomorphology, water quality and vegetation of the wetlands in the three catchments forming part of the DM HFA**. The method is based on the hydrogeomorphic (HGM) approach to wetland typing, providing a PES score for a wetland within each of the four condition modules – hydrology, geomorphology, water quality and vegetation - and a combined overall score for wetland health. The PES score provides a quantitative measure of the extent, magnitude and intensity of deviation from the reference or unimpacted condition, and places the wetland in a wetland health category, A – F. The Level 1A WET-Health assessment uses land cover as a surrogate for the severity or magnitude of an impact, where this is assumed to be linked to land use.

Part C Chapter 4 Table 1. Present Ecological State categories used to define the overall health or integrity of a wetland (from MacFarlane et al., 2020). Colour-coding is according to the River EcoStatus Monitoring Programme of DWS.

CATEGORY	PES SCORES (%)	DESCRIPTION
A	**90 – 100**	Unmodified, natural.
B	**80 – 89**	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.
C	**60 – 79**	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats and biota may have taken place.
D	**40 – 59**	Largely modified. A large change in ecosystem processes and loss of natural habitats and biota has occurred.
E	**20 – 39**	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognisable.

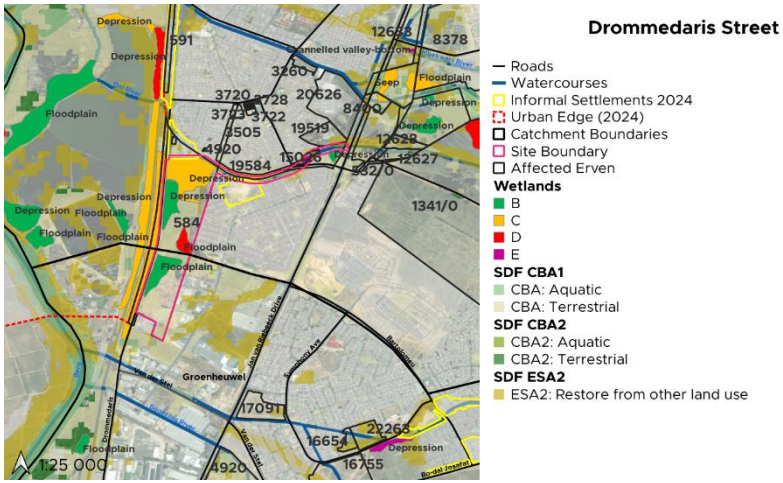
CATEGORY	PES SCORES (%)	DESCRIPTION
F	**0 – 19**	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.

The site contains the following wetlands:

- **Depression Wetlands:** A depression wetland is a wetland with closed (or near-closed) elevation contours, which increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates. **Depression wetlands in an ideal state play a moderate to intermediate (2.5) role in flood attenuation services.** Two depression wetlands are located in the site boundary:
    - A depression wetland in the north of the site, with a PES of C (moderately modified).
    - A depression wetland immediately south of the depression wetland in the north, with a PES of B (largely natural), suggesting that the wetland to the north provides a buffer that protects this depression wetland.
- **Floodplain wetlands:** Three floodplain wetlands are located in and adjacent to the site boundary. Floodplain wetlands provide Very high flood attenuation potential (4); Very poor stream regulation (0.5); and Moderate to high water quality enhancement (2.5).
- Floodplain wetland located north of Mbekweni's southern catchment boundary and the desire line connecting Bartolomeu Street and Drommedaris Street to the west: With a PES grade of B, this wetland is largely modified.
- Floodplain wetland located in the Groenheuwel Catchment, south of Mbekweni's southern catchment boundary and the desire line connecting Bartolomeu Street and Drommedaris Street to the west: This floodplain wetland has a PES grade of B, indicating that it is largely natural.
- Floodplain wetland located along the western boundary of the site, between Drommedaris Street and the Railway: This wetland is moderately modified (PES C).

Part C Chapter 4 Table 2. Flood Alleviation Ecosystem Services Provided by wetlands in relation to the project site based on optimal condition. (Ecological, Infrastructure and Land Use Report, AIVIA, 2024).

HGM types:	Ecosystem services:		
	Flood attenuation	Streamflow regulation	Water quality regulation
Depression	2	1	2
	2.5	0.5	1.5
Floodplain wetland	3.5	1	3
	4	0.5	2.5



Part C Chapter 4 Map 6. Wetlands and Watercourses

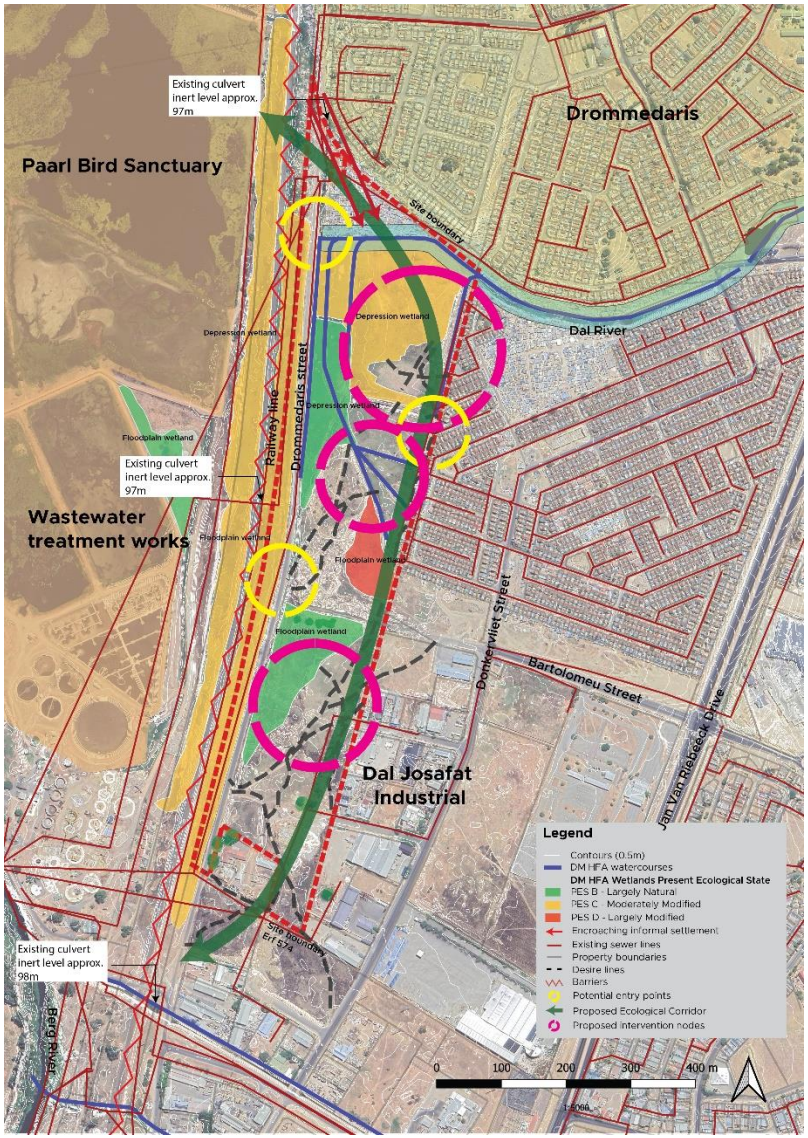
Informants Summary

The informants Map is shown in Part C Chapter 4 Map 1Part C Chapter 4 Map 7 and is also provided in an Appendix to this report The project site is located on erf 584 in **Ward 16, within the Mbekweni Catchment. The project site is named after Drommedaris Street, which forms the western boundary of the site**. The Cape – Wellington **railway line** runs parallel to Drommedaris Street on the east of Drommedaris Street, and between these structuring elements lies a **floodplain wetland**. **To the north-east of the site are the** Drommedaris and Unathi Informal Settlements.

A residential area is located on the **east of the site** in the north, and beneath the residential area to the south is the Dal Josaphat Industrial Area. The **Dal River** passes through the site. It flows from the east in the upper areas of the catchment upstream of the urban edge, passing through the **Beets Street Project Site**, then crossing over Jan van Riebeeck, until it meets with the site's north-eastern boundary.

The Dal River includes challenges of **solid waste and effluent accumulation and the presence of alien invasive species along certain stretches**. **River management activities** for the stretch of the Dal River between Beets Street Project Site to the Drommedaris Street Project site will offer an opportunity to support other flood alleviation interventions within this programme.

The findings of the Flood Risk Assessment noted that the Drommedaris Canal (Dal River, entering the site on the north-eastern area) modelling results show that the Canal **does not have sufficient capacity to contain and convey the 100-year flood**. The PCSWMM results for the current period 1:100 year return period showed that the informal settlement at the outlet of the Drommedaris Canal is vulnerable to flooding and is characterised by flood depths up to 2.5 m deep according to the DM HFA Flood Risk Assessment (AIVIA 2024). This aligns with the findings from the Community Flood Risk Perception Study, where the **Drommedaris and Unathi informal settlements north of the site boundary were identified by the participants of the CFRPS as one of the worst perceived flooding areas in Mbekweni.**



Part C Chapter 4 Map 7. Informants Map

There are three channels which drain the Mbekweni area. Consideration should be given to creating more meandering channels (rather than the current straight lines) to increase the time that water is retained in a future constructed wetland area.

There is **therefore a need for flood attenuation in this area**, echoing the strategy already identified in the Drommedaris SWMP (Drommedaris SWMP 2015) which noted the need to **reduce the effects of flooding in Drommedaris and Mbekweni by providing additional retention storage in the catchment and the modification of some of the existing canals and culverts.**

The encroachment of the informal settlements, together with the presence of backyard dwellers, are a cause for concern in terms of **water quality given the current access to basic services as well level of service available to these communities. The CFRPS participants also identified the need for improved access to basic services including solid waste management, recognition of land scarcity in the face of their housing needs, and the need for safe sports facilities and recreational areas.**

The site, which is designated for **green space in the Drakenstein SDF, includes 5 wetlands, specifically floodplain and depression wetlands.**

The different types of wetlands are associated with different performance ratings for flood alleviation ecosystem services. The flood alleviation ecosystem services assessed in this project include flood attenuation, streamflow regulation and water quality. For each wetland type, these services were rated from 1-4, with 3 being 'high FAES' for a particular service, and 4 being very high**.**

Floodplain and depression wetland types typically provide good to very good flood attenuation FAES when in optimal condition, and the rehabilitation and restoration of these wetlands should form a central part of the further development of the sites concept. Given the role of **floodplain wetlands in flood attenuation (scoring 4/4 for this FAES) and water quality enhancement**, as **well as the role of depression**

wetlands in with a moderate to intermediate role in flood attenuation, their protection is critical. **The floodplain and depression wetlands located on the site vary in condition (see Informants Map) from largely natural with a Present Ecological State (PES) of B, to PES D indicating that the wetland is largely modified. However, there is an opportunity to restore, rehabilitate and protect these wetlands in the design of solutions for the site.**

Given the alignment of the site with the SDFs green space designation, the need for **flood attenuation, and the protection and restoration of wetlands to optimise** their FAES, the site presents an opportunity for a series of constructed wetlands (see Informants Map). **To enhance the urban environment, the site also offers the opportunity to incorporate sports fields and play areas. The concept for the site should take cognisance of the existing desire lines (shown on the Informants Map).**

This site is located in a particularly low-lying area, and a constructed wetland will serve to support reduction of flood exposure for residences adjacent to the sites, and aid in improving wetland function and reducing risk from polluted stormwater channels. There have been incidents of sewage spills on the site, and the potential of reoccurrence poses risks for human/environmental **Improved water quality will have benefits for downstream users along the Berg River and alleviate pressure on the WWTW.**

Due to the need for a combination of flood alleviation improved water quality management, this area could benefit from a dedicated network of constructed wetlands with a water treatment function. There is an opportunity to support water quality improvement through the implementation of constructed wetlands and use of reed beds, and green maturation ponds (or similar interventions) to improve the water quality before the water enters the Berg River. A wetland would provide habitat and **increase biodiversity within the area by connecting with the existing Paarl Bird Sanctuary**.

The upgrading of the informal settlements in this area presents an opportunity to assist with stormwater infrastructure maintenance, and the national policy objectives of the Upgrading of Informal Settlements Programme including **Health and Security**. A further opportunity is the Upgrading of Drommedaris Street and Unathi informal settlements.

Key Opportunities

- Opportunity for the development of flood attenuation infrastructure in the form of wetlands and ponds throughout the site (see Informants Map)
- Alignment with SDF Green Space objectives, combined with the opportunity for wetland restoration and introduction of constructed wetlands (See informants map – pink dashed circles)
- Opportunity to improve water quality through the introduction of ponds and vegetation
- Opportunity for play and recreation areas to enhance the urban environment and respond to the need for recreational spaces identified by the participants of the CFRPS (see informants map – pink dashed nodes)
- The creation of a gateway to the site to improve urban legibility (see yellow dashed nodes on the informants map)
- Opportunity to create an ecological corridor that can create connectivity with the site and the Paarl Bird Sanctuary
- Address basic service delivery including solid waste management.
- Support River Management of the Dal River
- The upgrading of the informal settlements in this area to assist with stormwater infrastructure maintenance.

- Upgrading of Drommedaris Street to act in place of a Berm and offer additional mobility and accessibility benefits along this well-used pedestrian route

Being at a low elevation in the floodplain, this area is seasonally wet and would benefit from the **re-instating of wetland vegetation**. A wetland would provide habitat and **increase biodiversity within the area by connecting with the existing Paarl Bird Sanctuary**. Due to the **extremely poor water quality, this area could benefit from dedicated constructed treatment wetlands**. There is also an opportunity to **create multi-functional areas** that could be of benefit to the community (e.g. sports fields) and serve as attenuation facilities.

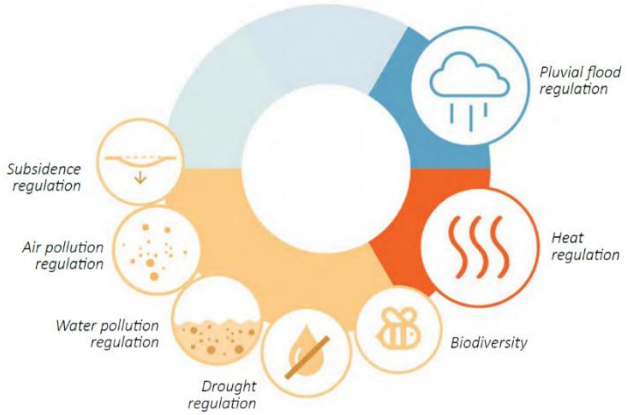
C4.2.Concept Design: Drommedaris Street HFA Project

The **Dal River** also flows the north of the site, after flowing east to west through a largely undeveloped area upstream of the urban edge, where it passes across Beets Street and Jan van Riebeeck Drive, and through the Mbekweni residential area to meet with the site boundary on the north-east corner.

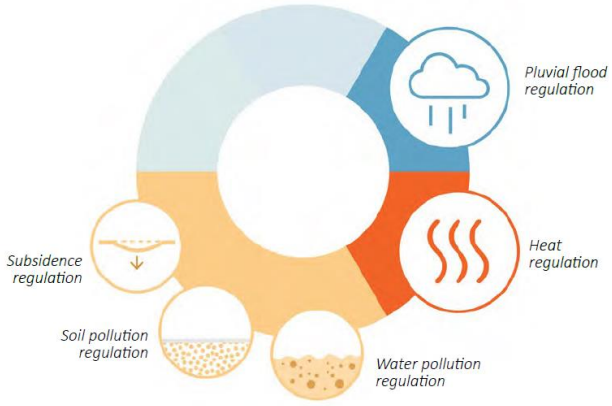
The **Drommedaris Canal** modelling results show that the Canal does not have sufficient capacity to contain and convey stormflows under the 100-year return period flood scenario. Trenches have been formed to convey stormwater to reduce flooding of the nearby roadway to maintain accessibility. As a low point within the landscape, this area is prone to constant flooding. The informal settlement along the outlet of the Drommedaris Canal is vulnerable to flooding and is characterised by **flood depths up to 2.5 m deep as outlined by the DM HFA Flood Risk Assessment (AIVIA 2024)**.

Water enters the site through existing stormwater channels. The concept aims to divert water from the Dal River into the site through a series of wetlands to both slow the flow of water and also achieve improved water quality through planting of typha reed beds.

There are several functions and benefits associated with the components of the concept. Part C Chapter 4 Figure 1 provides a summary of the functions associated with Open Green Spaces, given that the improvement and activation of existing green spaces to function as effective recreation spaces are a primary focus of the project. Part C Chapter 4 Figure 2 shows the functions of bioretention areas, which *'can be adapted to a variety of urban environments. It can take many forms and shapes for different functions and contexts. Bioretention basins, vegetated swales, rain gardens, retention ponds, infiltration trenches, and detention ponds are some examples of bioretention systems. Depending on the stormwater volume to be collected, a water retention area can be either dry or wet.' (World Bank, 2021: 141).*



Part C Chapter 4 Figure 1. Functions of Open Spaces (Source: World Bank, 2021).



Part C Chapter 4 Figure 2. Functions of bioretention areas including detention ponds/ stormwater attenuation facilities (Source: World Bank, 2021).

The Drommedaris Street Hybrid Flood Alleviation Project combines stormwater management with recreational and ecological benefits. The deep pond, wetland terraces, and infiltration trenches effectively manages and treats stormwater and reduce flood risk and improve water quality. The raised sports field, bird-watching island, and integrated pathways enhance community engagement and promote environmental awareness. The project provides a multifunctional landscape that addresses flood risk, supports biodiversity, and offers recreational opportunities for the local community.

Once water leaves the site toward the Berg River in the west, it is intended that the water will have an improved quality due to the treatment wetlands situated in line with existing stormwater channels.

Concept Design Community Workshops were held on 17 October and 18 October 2024, where community participants were given the opportunity to provide input to the concepts. The input is reflected in the discussion of the concepts in this section, and where possible these have been reflected in the updated concept design or the description of the components linked thereto.

The Drommedaris Street Concept

The Drommedaris Street Concept Plan is shown in Part C Chapter 4 Map 8 and is also provided in an Appendix to this report.

The concept for the Drommedaris Street Site includes the following key components, which are explained further in the next section of the report:

- Water Treatment Pond and Wetland System
- Raised Sports Fields
- Entrance gateways to the sports fields
- Swales
- Berm with Pedestrian Pathways
- Bird-Watching Island
- Marsh Planting
- Proposed Road to Connect to Drommedaris Street
- Solid Waste Management

MBEKWENI CATCHMENT

Drommedaris Street
Landscape Concept Plan

1:2000 on A1 or 1:4000 on A3
Date: 30 October 2024

0 100 200 300 400m

DRAKENSTEIN MUNISIPALITEIT • MUNICIPALITY • UMASIPALA

AVIA

C40 CITIES FINANCE FACILITY

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

ARLA Consulting Landscape Architects

Components of the Concept Layout Design

The site is rectangular in shape with the length of the site running north-south along Drommedaris Street in the West. The site is split across the Mbekweni and Groenheuwel Catchment, with the Mbekweni section in the north (northern section) and the Groenheuwel section in the south (southern section).

Northern Section of the site (Mbekweni Catchment)

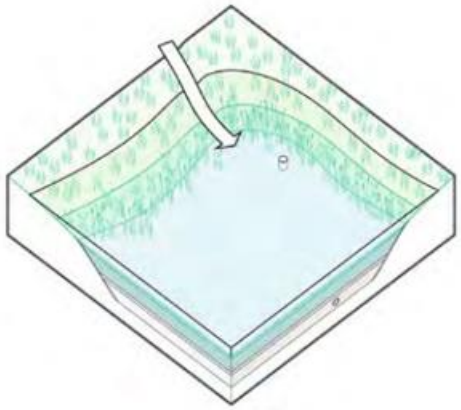
Water Treatment Pond and Wetland System

As part of the flood attenuation system, a deep pond is proposed in the **north-eastern corner of the site** as water enters from the Dal River. This pond is designed to hold excess stormwater during heavy rainfall events, acting as a retention basin to prevent downstream flooding. A low-flow diversion is proposed from the Dal River. Water will flow into the site via the low-flow diversion from the Dal River via an energy dissipater in line with the low-flow diversion into the pond toward Typha reed beds. The ponds will be integrated with a series of Typha reed beds for water treatment. The water flow will be directed from the pond through the reed beds and allowed to move through a terraced wetland toward a **polishing wetland in the north-west of the site.** The objective is to improve the quality of water re-entering the channel after passing though the site. The pond and wetlands are separated by berms, which also serve to act as pedestrian pathways. These terraces are designed to absorb and filter stormwater through high and low marsh areas, planted with nutrient-absorbing vegetation suited for Sustainable Urban Drainage Systems (SUDS).

The eastern edge of the site includes also two sports fields situated immediately south of the water treatment pond.

A second water treatment pond / area is then located south of the sports fields where water enters the site via existing stormwater channels. As with purification pond in the north of the site, water passes an energy dissipator and moves through a series of typha reed beds to improve water quality. Water passes through treatment wetlands in the south and the centre of the site before reaching the **polishing wetland in the north-west of the site** before existing the site toward the Berg River.

The northern section includes depression and floodplain wetlands, and the implementation of this project will serve to protect and enhance the quality of these wetlands and their flood alleviation ecosystem services.



Part C Chapter 4 Figure 3. Illustration of a Constructed Wetland (World Bank, 2021).

Part C Chapter 4 Figure 4. An example of a constructed wetland.

Part C Chapter 4 Figure 5. Example of a wetland park from Minghu Wetland Park, Shanghai, China (https://www.archdaily.com/590066/minghu-wetland-park-turenscape).

Part C Chapter 4 Figure 6. An example of a wetland park from Minghu Wetland Park, Shanghai, China (https://www.archdaily.com/590066/minghu-wetland-park-turenscape).

Community Participation Inputs

The community supported this intervention and proposed the idea of having a food garden and growing 'imfino" (a species of wild spinach), and 'iyeza' (herbs that can be used for medicinal purposes). It was emphasised that if the community embraces the importance of the intervention, they will protect it. Additionally, the community suggested planting indigenous vegetation around the site, which would promote community ownership and responsibility. Initially, the food garden was proposed in the north-east corner of the site by the typha reed bed but was resolved that the garden would be located where there is cleaner water.

Key community ideas and inputs:

- Creation of a community food garden.

Raised Sports Fields:

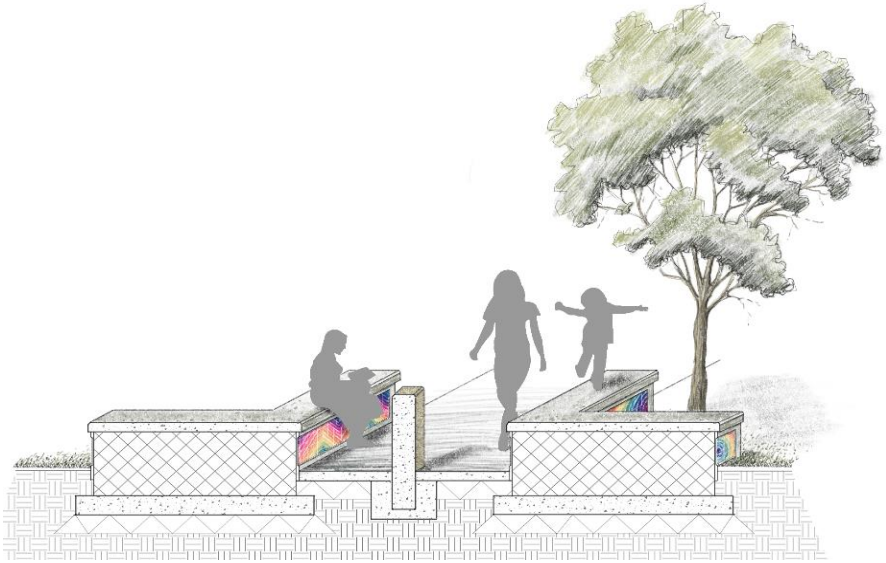
Raised sports fields are proposed in the northern section of the site, next to the water treatment pond, ensuring that the field remains elevated above to avoid inundation during low to medium stormflows. This design allows the field to remain functional for recreational activities even during wet periods. The raised position of the field helps to reduce the risk of waterlogging while integrating it into the overall stormwater management system of the site. Swales will be located around the sports field.

Part C Chapter 4 Figure 7. Raised Sports Field

The inclusion of two sports fields in the design may unlock land earmarked for sports fields outside of the site boundary for alternative forms of development, which can aid to respond to the challenge of land scarcity experienced in the catchment.

Entrance gateways to the sports fields

Entrance gateways to the sports fields/ attenuation facilities are proposed on the north-eastern edge of the site, next to the sports facilities for ease of access.



Part C Chapter 4 Figure 8. Example of an entrance

Swales

Swales will be situated around the sports fields. Swales are shallow grass-lined/vegetated channels used for stormwater drainage and infiltration (DHS, 2019). The channels typically comprise of flat bases, sloped sides and are usually dry during non-rainfall periods. These provide alternative drainage interventions to hard-lined roadside gutters and pavements, offering aesthetic and recreational advantages. Additionally, the vegetated cover protects soil from wind and water erosion, reduces

runoff rates and enhances water quality through filtration processes, with the potential to capture nutrients (DHS, 2019).

Part C Chapter 4 Figure 9. Planted swale at Mitchells Plain Hospital

Community Participation Inputs – Sports fields:

The development of raised sports fields was supported by the community as a variety of sports including soccer, netball and rugby are played by the residents, and the community and sports clubs would make use of the field. The community also noted that the proposed sports fields may attract sponsors and tournaments that originate from the Mbekweni area.

Key **community ideas and inputs:**

- Ensure adequate lighting for the nighttime
- Mobile or temporary structures for seating
- Removal of dumping areas
- One soccer field and one netball field proposed
- Beautification of the site to promote use

Berms with Pedestrian s:

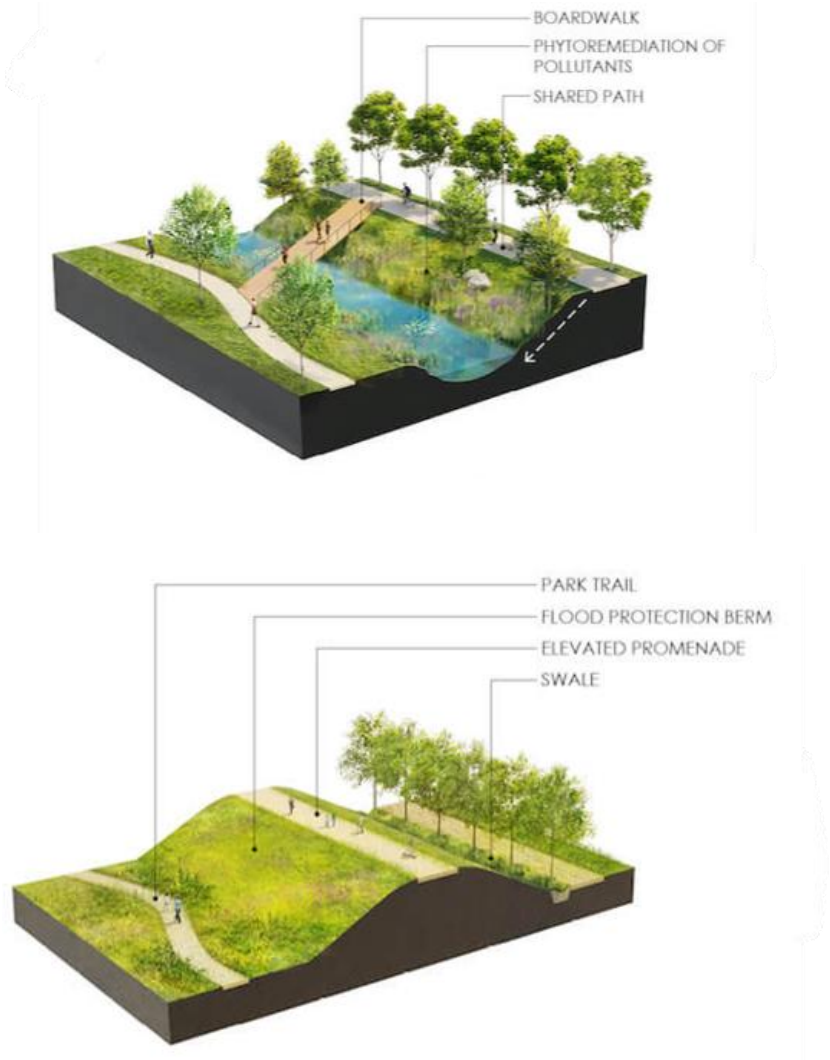
The concept includes the proposed construction of berms providing additional flood protection by controlling water flow during storms. The berms will also feature pathways, allowing public access to different parts of the site, promoting both functional flood management and recreational use. The berm can be considered as the primary design option as reflected on the concept design.

Part C Chapter 4 Figure 10. Berm with pathways.

An alternative option is the upgrading and raising of Drommedaris Street. This will then act as a berm itself and prevent the important access road to be inundated during extreme events. It will also serve to achieve broader mobility and connectivity outcomes as the road is already well used by pedestrians. Pedestrian pathways promote access and the connection between the key nodes and features. A pedestrian pathway is proposed on the southern end of the site, connecting the features of the site. These pathways will enhance public access to green spaces while ensuring the area remains functional for flood management during rainy periods**. The pathway is envisaged to include lighting as well as signage.**

There is one proposed pedestrian pathway route located on the southern end of the site, around the proposed wetland margin and ephemeral marsh areas.

Part C Chapter 4 Figure 11. Example of a pedestrian pathway.



Part C Chapter 4 Figure 12. Illustration of Pedestrian Pathways (Tzifa, A., & Nikolaidou, S. 2020).

Community Participation Inputs

During the engagements with the community, it was noted by the participants that the community members cross through the drier areas of the Drommedaris site, which is mainly towards the south of the site. They cross from Drommedaris Street along the west to the shops along the east of the site. Generally, pathways are not currently used. The community explained that once pathways are developed and beautified, the community will make use of them, and this intervention was supported.

Key community ideas and inputs:

- Ensuring adequate lighting to promote safety
- Creating aesthetically pleasing walkways to promote use of the intervention
- Elimination of illegal dumping

Proposed Road to Connect to Drommedaris Street

This road extension is proposed to activate the area and facilitate improved circulation and passive surveillance.

Southern Section of the site (Groenheuwel Catchment)

The southern section of the site includes a floodplain wetland which has very high flood attenuation potential and is currently in a largely natural state. The project therefore provides an opportunity to protect this important wetland.

Bird-Watching Island:

A raised island is proposed within the wetland, specifically designed for bird hides and bird-watching activities. This island will provide a unique recreational opportunity while supporting local wildlife habitat creation within the wetland system.

Part C Chapter 4 Figure 13. Bird Watching Island at the Liesbeek River.

Marsh Planting:

Extensive higher marsh planting will be included throughout the site, particularly around the wetland areas and swales. These plants are chosen for their ability to absorb nutrients and improve water quality while supporting local biodiversity. Ephemeral planting will also be included around the wetlands and swales and these plants are adapted to periodic flooding and drying, variable salinity, and unstable sediment.

Part C Chapter 4 Figure 14. Higher Marsh Planting at Rietvlei Wetland Reserve.

Solid Waste Management

The site will include public refuse bins to be collected at regular intervals, particularly along pedestrian pathways, within the park and at the sports fields. The cleaning of the site may make use of local labour through programmes such as the Expanded Public Works Programme (EPWP).

Litter traps have not been integrated into the concept design as litter traps are vulnerable to vandalism, which can compromise their effectiveness and require additional maintenance. People can intentionally dispose of trash into the trap and steal materials (e.g. metal) from the trap, damaging it. The water treatment ponds located at the points where water enters the site wis anticipated to fulfil a forebay function which will support solid waste from entering and being distributed across the site through water flow.

Community Participation Inputs – Solid Waste

Solid waste management was noted by the community members to pose a major risk to the intervention. The community emphasised the removal of dumping sites and the beautification of the Drommedaris site as key to its success, as a cleaner and more aesthetically pleasing environment will attract community members and reduce crime (and criminal hiding spots). There was a proposal to add skips to the site but there was disagreement around this as waste is not collected consistently enough resulting in people burning the waste resulting in the skips being damaged and causing leaks. The community consensus was that the DM should provide sufficient refuse bags to be collected consistently, to promote solid waste management.

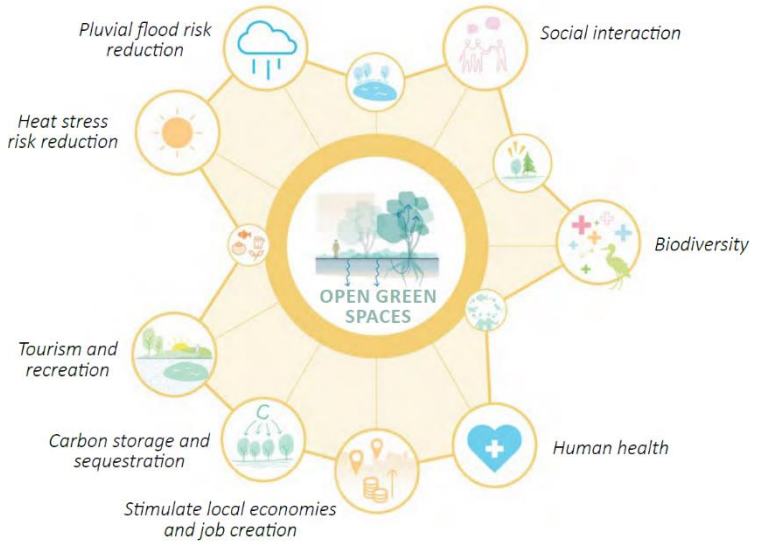
Key community ideas and inputs:

- Frequent distribution and collection of refuse bags by the DM.

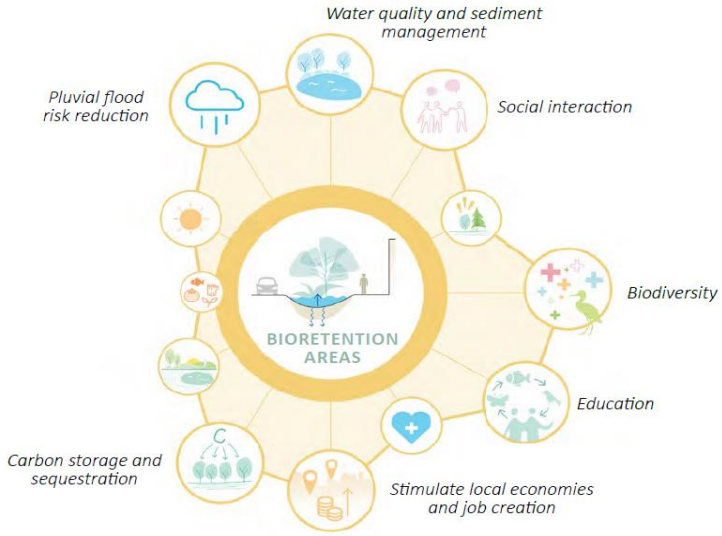
C4.3.Benefits and Impact Potential: Drommedaris Street HFA Project

The primary objective and benefit to be achieved from this project is Flood Risk Reduction, aligned to the overarching programme objective of building flood resilience. It is critical that flood risk reduction measures are not developed in isolation from the broader urban and natural environment and community context. As such, these four **interrelated** areas – **1) Flood Risk Reduction, 2) Urban Management and Open Space Optimisation**, 3) **Adaptation and Climate Resilience**, and 4) **Community Empowerment and Participation** are identified as four broad groups of benefits that should be sought to give effect to the programme objectives at the project level.

A multitude of benefits can be achieved via the creation and enhancement of open green spaces and bioretention areas. These are summarised in Part C Chapter 4 Figure 15 and Part C Chapter 4 Figure 16, and are further explained in the context of this project.



Part C Chapter 4 Figure 15. Benefits of Open Green Spaces (Source: World Bank, 2021).

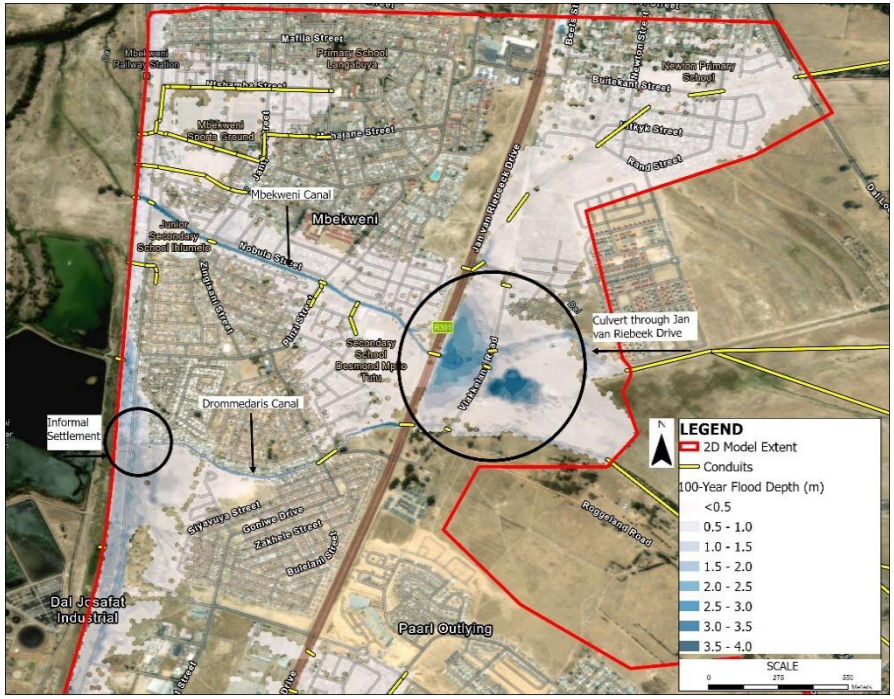


Part C Chapter 4 Figure 16. Benefits of Bioretention Areas (Source: World Bank, 2021).

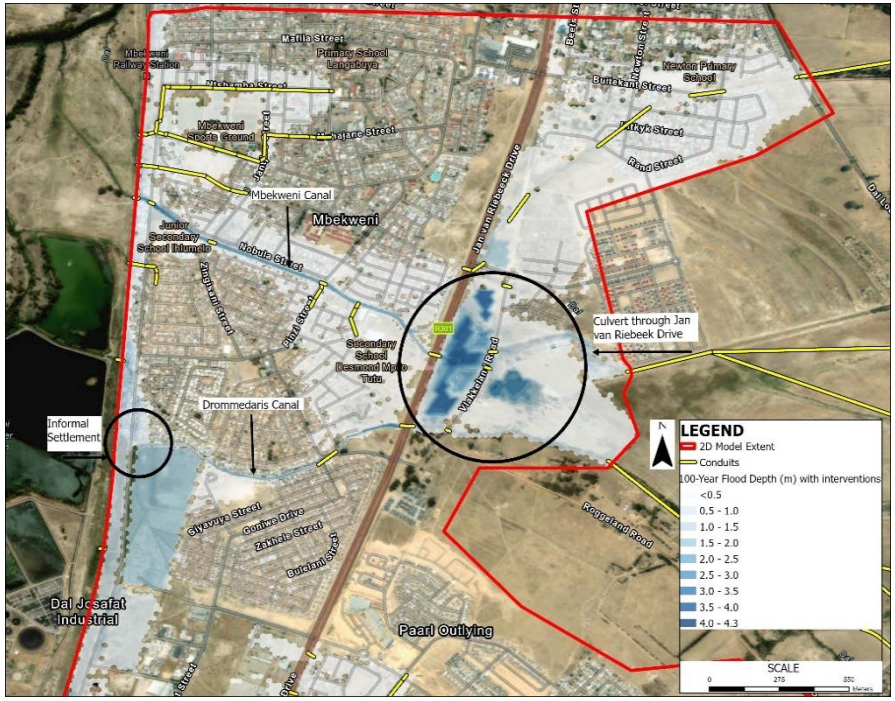
Improved Stormwater Management and Flood Risk Reduction Potential

The Drommedaris Street current flood exposure based on the Status Quo PCSWMM, indicates that the low-lying residential areas near the Drommedaris and Mbekweni canal outlets are susceptible to flooding. The flooding occurs due to the flat topography and the limited capacity of the culverts beneath the railway line to convey water. This low-lying area is located between the railway line and Drommedaris Street and consists predominantly of an informal settlement.

The proposed intervention at the Drommedaris Street site will function as large off-channel attenuation facility which has a 2m high berm along its perimeter, significantly reducing the flood exposure of the areas noted above. The intention is for the flows from the Canal to discharge into the attenuation facility and then be slowly released back into the Drommedaris Canal and into the Berg River via the railway culverts.



Part C Chapter 4 Map 9. Current Flood Extent (1:100yr)

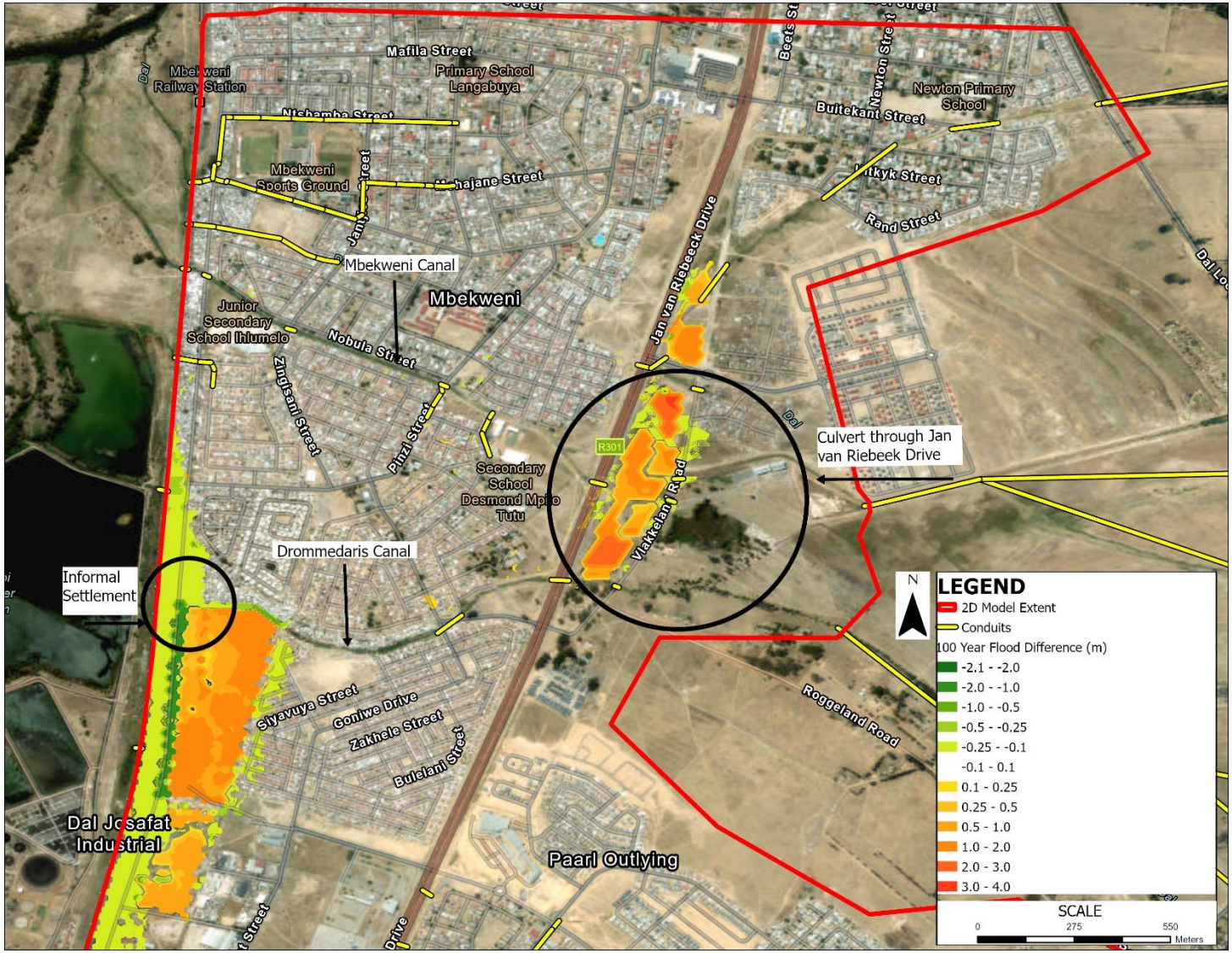


Part C Chapter 4 Map 10. Flood Extent (1:100yr) after intervention

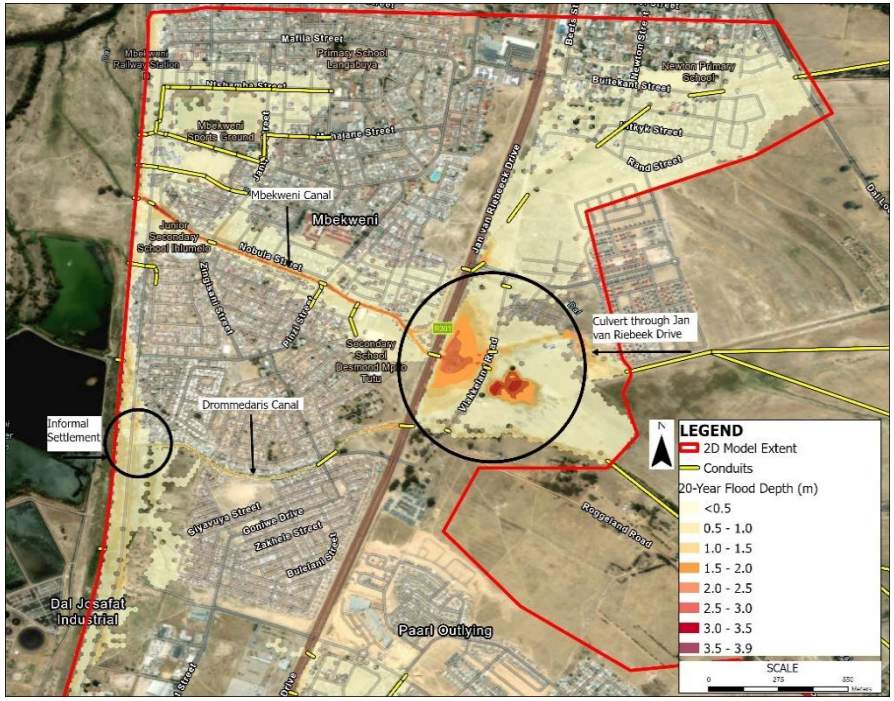
The Drommedaris Street status quo for the 100-year flood indicates that the low-lying residential area adjacent next to Drommedaris Street is susceptible to flooding. The area could experience flood depths up 2m in the 100-year flood and this is mainly concentrated at the area between the railway line and Drommedaris Street where the informal settlement is located.

The impact of the proposed intervention at Drommedaris Street is that the flooding depth is reduced compared to the current situation, specifically in the area between the railway line and Drommedaris Street. This can be seen in Part C Chapter 4 Map 11 which shows the modelled decrease in flood depths (*light* green to *dark* green) and increase in flood depth (*yellow* to red). The reduction in flood depths in this area ranges from 0.25m to 0.5m.

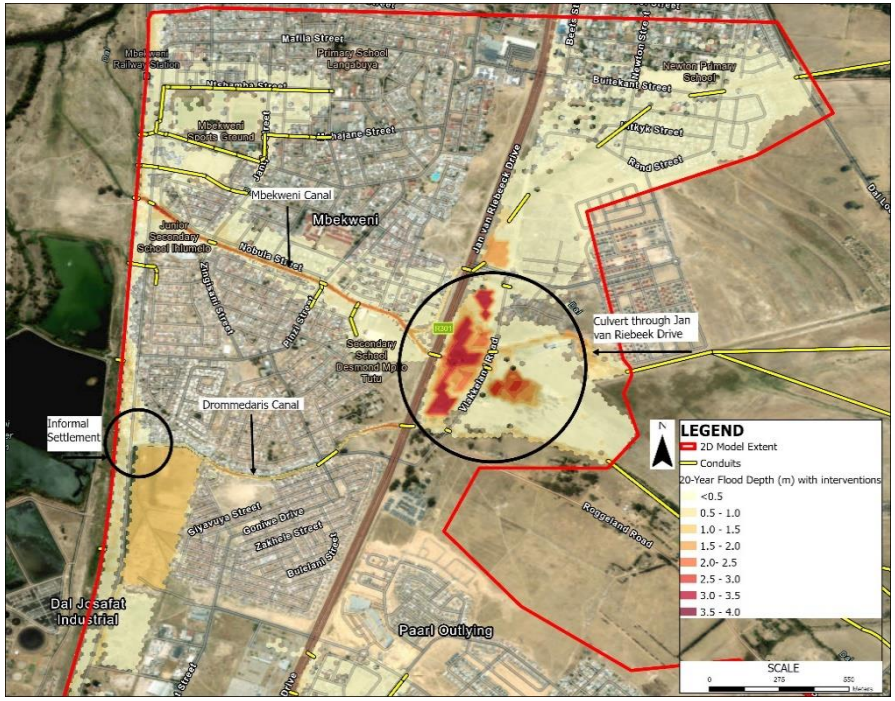
The increased flood depths presented on the map are aligned with the proposed attenuation interventions anticipated due to increased stormwater storage capacity to be generated on the proposed sites. The optimisation of the proposed attenuation capacity and function of the Drommedaris Street intervention could result in the further reduction of flood exposure, specifically in the residential areas.



Part C Chapter 4 Map 11. Difference in Current Flood Extent vs After Intervention Flood Extent (1:100yr)



Part C Chapter 4 Map 12. Current Flood Extent (1:20yr)

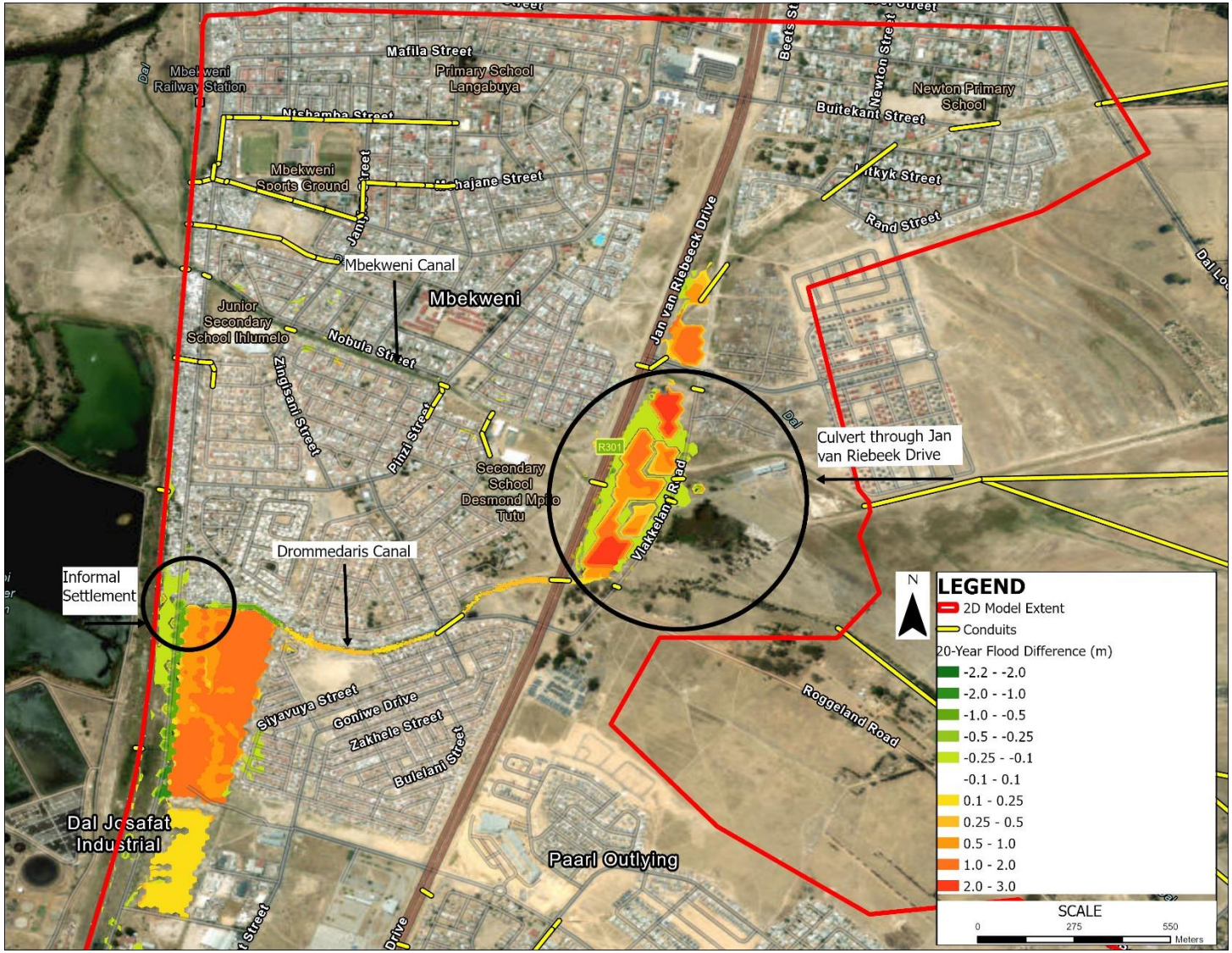


Part C Chapter 4 Map 13. Flood Extent (1:20yr) after intervention

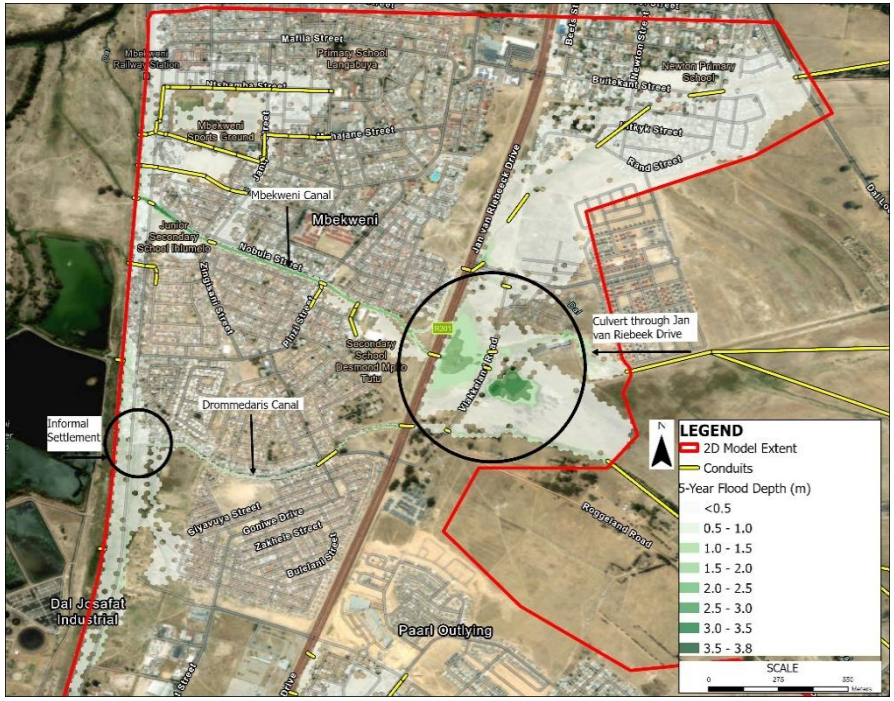
The Drommedaris Street status quo for the 20-year flood indicates that the low-lying residential area adjacent next to Drommedaris Street is susceptible to flooding. The area could experience flood depths up 1.5m in the 20-year flood and this is mainly concentrated at the area between the railway line and Drommedaris Street where the informal settlement is located.

The impact of the proposed intervention at Drommedaris Street is that the modelled flood depths will be reduced compared to the current situation, specifically in the area between the railway line and Drommedaris Street. This can be seen in Part C Chapter 4 Map 14 which shows the decrease in flood depth (*light* green to *dark* green) and increase in flood depth (*yellow* to red). Increases in flood depth within the attenuation interventions are anticipated due to increased water storage. The reduction in flood depths in this area could be in the order of 0.25m.

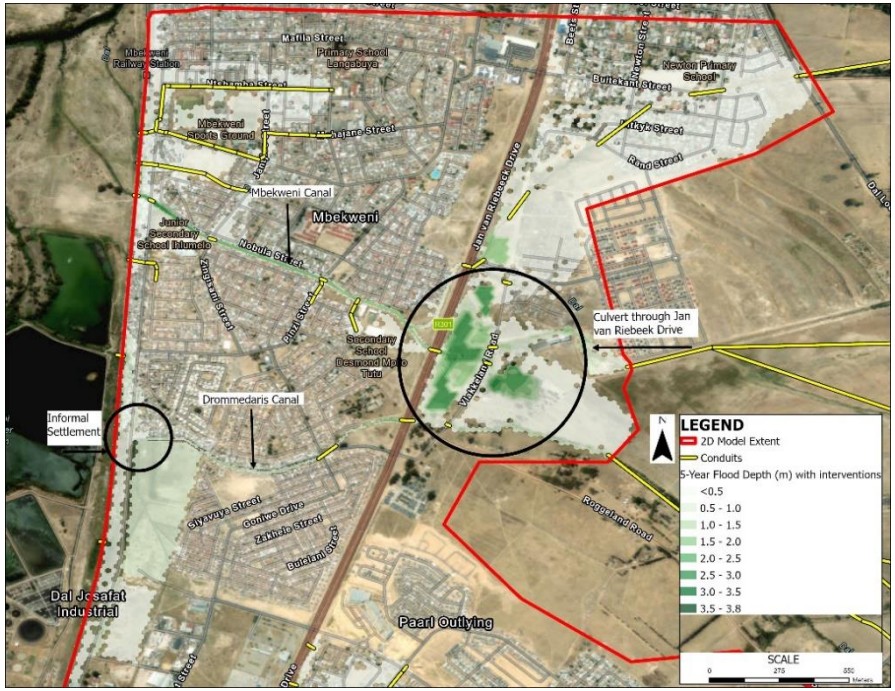
The increased flood depths presented on the map are aligned with the proposed attenuation interventions anticipated due to increased stormwater storage capacity to be generated on the proposed sites. The optimisation of the proposed attenuation capacity and function of the Drommedaris Street intervention could result in the further reduction of flood exposure, specifically in the residential areas.



Part C Chapter 4 Map 14. Difference in Current Flood Extent vs After Intervention Flood Extent (1:20yr)



Part C Chapter 4 Map 15. Current Flood Extent (1:5yr)

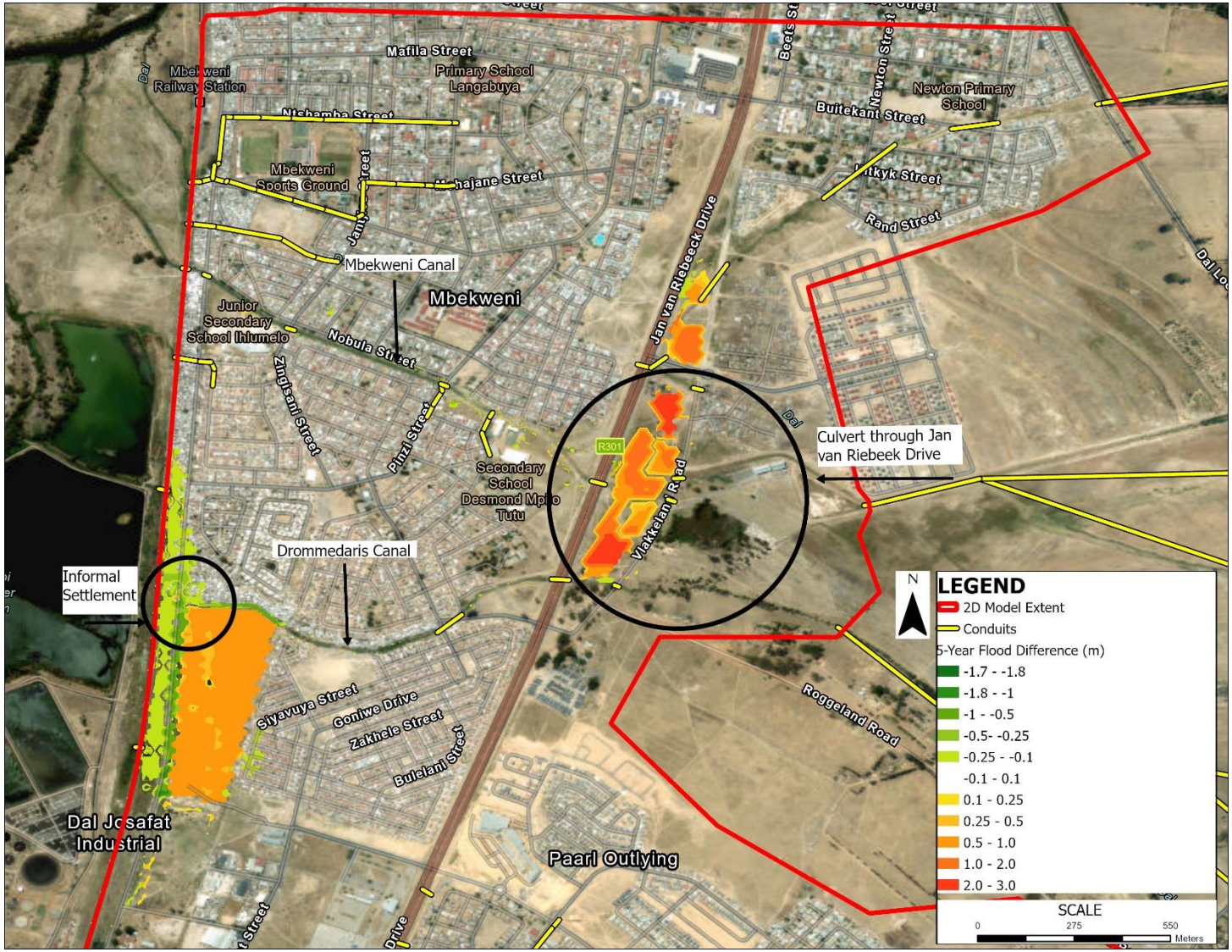


Part C Chapter 4 Map 16. Flood Extent (1:5yr) after intervention

The Drommedaris Street status quo for the 5-year flood indicates that the low-lying residential area adjacent next to Drommedaris Street is susceptible to flooding. The area could experience flood depths up 1.0m in the 5-year flood and this is mainly concentrated at the area between the railway line and Drommedaris Street where the informal settlement is located.

The impact of the proposed intervention at Drommedaris Street is that the modelled flood depths will be reduced compared to the current situation, specifically in the area between the railway line and Drommedaris Street. This can be seen in Part C Chapter 4 Map 17 which shows the decrease in flood depth (*light* green to *dark* green) and increase in flood depth (*yellow* to red). Increases in flood depth within the attenuation interventions are anticipated due to increased water storage. The reduction in flood depths in this area could be 0.25m up to 0.5m.

The increased flood depths presented on the map are aligned with the proposed attenuation interventions anticipated due to increased stormwater storage capacity to be generated on the proposed sites. The optimisation of the proposed attenuation capacity and function of the Drommedaris Street intervention could result in the further reduction of flood exposure, specifically in the residential areas.



Part C Chapter 4 Map 17. Difference in Current Flood Extent vs After Intervention Flood Extent (1:5yr)

Urban Management and Open Space Optimisation

Recreation and Accessibility for all users

The site is accessible to the informal and low-income areas of Mbekweni, and it is anticipated that the site will be well utilised. The entrance points are located at several points across the site to maximise physical accessibility for surrounding communities. During the detailed design of the site components, **universal accessibility principles should be applied to ensure that the site accommodates all non-motorised transport users and people with physical disabilities.** Recreational benefits are achieved through the incorporation of sports fields and pedestrian movement routes.

National Strategic Framework on Universal Design and Access - Principles of Universal Design:

- **Equitable use -** Design that is useful and marketable to persons with diverse access needs.
- **Flexibility in use** - Design that accommodates a wide range of individual preferences and access needs
- **Simple and intuitive use** - Design that is easy to understand regardless of the user's experience, knowledge, language, skills or concentration level (in loco use)
- **Perceptible information** - Design that communicates necessary information effectively to the user regardless of ambient conditions or the users sensory access needs
- **Tolerance for error** - Design that minimises hazards and adverse consequences of accidental or unintended actions
- **Low physical effort** - Design that can be used efficiently and comfortably and with a minimum of fatigue or struggle
- **Size and space for approach and use** - Design that provides appropriate size and space for approach, reach, manipulation and use regardless of the user's body size, posture or mobility

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Spatial Alignment and Improved Land Use Management

Land use change will have a significant impact on catchment hydrology and flood risk. Development is associated with an increase in impermeable surfaces which will contribute to increased runoff and peak discharges in the absence of attenuation interventions. Activating this area though the development of **multi-functional open spaces** aligns with the municipal SDF, which has designated this area for Green Space will allow for the protection and active use of green space. The protection of green space will also assist aid in ensuring that current sites earmarked for green/open space **remain undeveloped** and able to serve as permeable surfaces. **The studies undertaken as part of this DM HFA Programme design further demonstrate that that the land is not suitable for human habitation, and the active use of this space can also assist to guard against settlement on this property.**

Service delivery through stormwater management and Sustainable Urban Drainage Systems (SUDS)

The project seeks to achieve flood risk reduction benefits through the development of hybrid flood alleviation measures- leveraging nature-based solutions as complementary to more conventional 'grey' service delivery approaches. SUDS present an approach to stormwater/runoff management that aims to reduce downstream flooding, enhance infiltration into the ground, remove pollution, improve the quality of stormwater, reduce pollution in water bodies, and improve biodiversity. SUDS encourage natural drainage processes by circulating water back into the water cycle rather than just collecting and detaining it, recognising the importance of water as a resource. The processes identified in this section constitutes SUDS which focuses on managing flow quantity, quality, amenity, and biodiversity. In addition, interventions can form a natural part of open spaces in a settlement and contribute to the quality of the environment and the aesthetics of a neighbourhood (DHS, 2019). The project therefore serves to facilitate more resilient stormwater management services, and also serves to protect communities and municipal and private infrastructure through flood risk reduction. The slowing of water through the site will serve to protect the surrounding areas from flooding and back-flooding.

Placemaking and improvement to the aesthetic appearance of the city

The project seeks to achieve an improved urban realm and placemaking to support the functionality and improvement of the urban environment. The site was identified as having a polluted floodplain landscape character, and therefore the active use of this area as an open space for the public good will serve to improve the character of the area. This is also expected to promote its upkeep by the surrounding communities, including promotion of passive surveillance to reduce illegal dumping.
Implementation should also be supported by a targeted solid waste management strategy.

Ecological Restoration and Rehabilitation and Water Quality Improvement

The concept incorporates the existing wetland areas and will aim to achieve the optimal condition of these waterbodies to in turn achieve the optimal flood alleviation ecosystem potential for these wetlands, including **achieving the FAES benefits of channelled valley bottom wetlands (high) and depression wetlands.** The stormwater ponds and wetlands can also serve to improve water quality. The project includes a network of ponds and treatment wetlands with the aim to **achieve water quality improvement outcomes**. This is particularly beneficial given the poor quality of water in this area.

Education and awareness

The incorporation of outdoor classrooms can further enhance the utility and optimisation of public space.

Urban Cooling and Air Quality

In urban areas, green infrastructure such as parks, green roofs, and urban wetlands help to cool surrounding areas by providing shade and reducing the urban heat island effect. This improves air quality and liveability, creating more pleasant environments for residents while also reducing energy demand for cooling.

Carbon Sequestration

Nature-based solutions, particularly those involving reforestation and wetland restoration, act as carbon sinks, helping to mitigate climate change by sequestering carbon dioxide from the atmosphere. This not only supports local climate goals but also contributes to global efforts to reduce greenhouse gas emissions.

Solid Waste Management

Improved solid waste management aims to support a clean and healthy environment and limit the maintenance requirements arising from blockages of stormwater infrastructure resulting from litter.

Adaptation and Climate Resilience - Toward a climate resilient pathway

Drakenstein's Climate Change Action Plan (CCAP) includes a series of climate change objectives. The Drommedaris Street Hybrid Flood Alleviation Project will support the following DM climate change objectives:

- **Water security and efficiency**
- **Climate resilient and low carbon development**
- **Biodiversity and ecosystem management**
- **Public health**
- **Disaster management**
- **Building response capacity through improved coordination and awareness**

In addition, the DM HFA identified the following core requirements for responsiveness to projected climate change:

- **Responsiveness to the changing catchment hydrology**
- **Responsiveness more extreme drought and flood cycles**
- **Responsible land use management to protect ecological infrastructure and enhance urban permeable surfaces**

The Drommedaris Street Hybrid Flood Alleviation Project is responsive to these requirements, whereby the hybrid solutions for the project includes:

Wetland Restoration/Construction, to improve resilience to droughts and floods: Wetlands act as natural water storage areas, absorbing and holding water during periods of excessive rainfall. In times of drought, they maintain local moisture levels, helping to stabilise surrounding ecosystems. **The creation of stormwater ponds and the utilisation of sports fields provide a similar benefit, providing** climate change adaptation benefits through storage and absorption capabilities at times of heavy rainfall, reducing peak flows and decreasing flood risk while also improving water quality. These interventions also provide adaptation benefits at times of drought as they increase infiltration and groundwater recharge, while also providing water storage potential.

Improved drainage networks and riverbank rehabilitation, to improve resilience to address changing catchment hydrology: In urban areas, hybrid measures include upgrading drainage systems while integrating natural features such as bio-swales and permeable surfaces that manage water flow more sustainably. At the Drommedaris Street site, the proposal incorporates the principles of Sustainable Urban Drainage in the design through hybrid, nature-based solutions. Wetland terraces surrounding the pond will absorb and filter stormwater through high and low marsh areas which will provide climate change adaptation benefits through a decrease in peak flows and reduce flood risk, while also enhancing water quality and providing carbon sequestration benefits.

The active use and protection of open space and the retaining of permeable surfaces in urban areas is responsive to the need for sound land use management that will have a positive impact on the hydrology of the catchment and achieve carbon sequestration benefits.

Sustainable Development Goals

The Drommedaris Street interventions align with the following Sustainable Development Goals (SDGs):

- SDG 6: Clean Water and Sanitation – through flood alleviation and stormwater management
- SDG 11: Sustainable Cities and Communities – through green infrastructure, increased climate resilience and the development of community recreational spaces
- SDG 13: Climate Action – Climate change adaptation through flood risk reduction
- SDG 15: Life on Land – Ecological restoration and the planting of vegetation and enhancement/ development of green infrastructure

Illustrated through the above-listed SDGs, the site has high sustainable development potential that promotes climate change adaptation through a reduction in flood risk. The project has been developed allowing for an expansion of the Drommedaris Street site intervention in upstream parts of the Berg River Catchment, to promote flood alleviation benefits downstream.

Community empowerment, participation and governance

The project will offer direct benefits to the local community given its strategic location and the intended use of this site as a recreational and green space to serve residential communities on the east of Jan van Riebeeck Drive. The project offers the opportunity for meaningful engagement across a range of stakeholders.

- **Ward Councillors and Ward Committees:** These municipal structures should be leveraged as intermediaries with local communities and to support the attainment of community accountability.

- **NGOs and NPOs:** The NGO and NPO sectors should be mobilised to support the project, and consideration should be given to the establishment of a community programme to facilitate 'eyes on the street'. In Mbekweni, community organisations such as **Vuka Mbekweni and Mbekweni Eco-Club** have been identified as key stakeholders that could serve to support the meaningful engagement of the community within the developmental process.

- **Youth and adult education and awareness** should be facilitated. Schools and other educational institutions could be encouraged to visit the site for educational purposes, supported by appropriate signage with educational materials. The schools in closest proximity to the site are **Desmond Tutu Secondary School and Dalwiede Primary School.**

- **Job Creation Potential:** Project implementation will provide opportunities for job creation for local communities during the construction phases and operation and maintenance phases.
  While the construction phase job creation is set to be applicable only in the short term, the operation and maintenance in relation to the open spaces, landscaping, solid waste management, play area equipment and the stormwater ponds will require on-going human resource contributions. This may include the involvement of community members in voluntary project stewardship, the leveraging of the enhanced public works programme (EPWP), as well as other job creation opportunities. See also the Job Creation Potential Section C4.7.

C4.4.Project Lifecycle Stages and Duration: Drommedaris Street HFA Project

The following sections provide an overview the typical phases of a project including:

- **Planning and Design of the Project**
- **Construction and implementation**
- **Operation and Maintenance**

This Section also provides an overview of the typical studies that may be required in relation to the Drommedaris Street project.

The typical phases of a project lifecycle include:

Planning and Design of the project

This includes detailed feasibility studies, and the detailed design of the project. Importantly, this phase in the project lifecycle should see the meaningful engagement of potential project beneficiaries (local communities) to ensure that they are adequately engaged in the ideation of solutions so that the stakeholder input is a key informant to the project components.

The following activities typically form part of this Phase:

Feasibility Study and Initial Assessments

A **Basic Assessment** or full **Environmental Impact Assessment**. This may also include other specialist studies across a range of disciplines. The final list of specialist studies required should be determined during the feasibility study process, and can be guided by the Department of Forestry, Fisheries and Environment's (DFFE) Screening Tool. **The results of the screening tool are contained in Appendix: Drommedaris Street DFFE Screening Tool Results.**

The environmental application (BA or EIA) as well as the Land Use Application forming part of the Permitting and Regulatory Approvals) will include a legally required public participation process. In order to maximise the opportunity for participatory planning, it is proposed that the project include additional stakeholder engagement (beyond the legally required public participation processes) to engage community members on a continuous basis in order to continue to the engagement process that has commenced in the design of the DM HFA Programme though the Community Flood Risk Perception Study (July 2024), and the Concept Design Community Workshop (October 2024).

Engineering design and planning

This will include the detailed design of the proposed hybrid flood alleviation infrastructure and other elements of the site layout.

Landscape Design and Planning

Landscape design and planning of hard and soft surfaces and river rehabilitation components of the site layout will be designed as part of this process.

Permitting and Regulatory Approvals

This refers to the relevant approvals necessary to proceed with the development. This will typically include **Land Use Applications (See Land Use Appendix) –** The details

of the land use application can be determined during the preapplication meeting with the municipality, and the land use approval is typically contingent upon the completion of all specialist studies. The regulatory approvals will also include a **Water Use Licence Application (WULA).** The nature of the project is likely to trigger a full WULA (as opposed to a General Authorisation). From time to time, the WULA process triggers additional specialist studies.

Additional approvals could be required throughout various phases, and specifically highlighted at this point in the sequence due to the development and environmental approvals that will likely be necessary from with the municipality and from the relevant competent authorities.

Part C Chapter 4 Table 3. Specialist studies required for the Project (subject to refinement) as part of the Planning and Design Phase of the Project

Feasibility Study and Assessment	
Environmental Authorisation (EA) (Basic Assessment or Environmental Impact Assessment)	Assumes a Basic Assessment. Detailed requirements to be determined by the competent authority. Full EIA will incur a greater cost. Specialist studies may include those listed below. The specialist studies will require confirmation from the local authority.
Geotech Investigation	
Topographical Surveys	
Urban Planning and Landscape Architecture	
Traffic Impact Assessment or Statement	Will require a Traffic Impact Statement.
Heritage Impact Assessment	
Visual Impact Assessment (Level 3)	
Terrestrial Biodiversity Assessment	
Freshwater Impact Assessment (Aquatic Biodiversity Assessment Report)	
Constructed wetland technical assessment and planning (Treatment Wetland Specialist)	Will inform the Aquatic Biodiversity Assessment Report
Botanical Assessment	

Feasibility Study and Assessment	
Waste Management Impact Assessment	
Detailed Flood Study	
Stakeholder Engagement/Consultation Services	Mobilisation and community meetings. Excludes the engagements forming part of the EA or Land Use Application Process. Assumes 80-120 days of professional time.
Project Management (Feasibility Studies and Assessments)	
Engineering and Design	
Stakeholder Engagement/Consultation Services and Socio-economic Assessment	Mobilisation and community meetings. Excludes the engagements forming part of the EA or Land Use Application Process. Socio-economic Assessment can also be included.
Project Management (Engineering and Design)	
Water Use Licence (WULA)	A full WULA is assumed.
Land Use Application(s)	Detailed requirements (and therefore cost) to be determined based on requirements set out by the local authority
Project Management (Permitting and Regulatory Approvals)	
Detailed Design (Landscape Architectural Design)	
Tender Documentation (Landscape Architectural Design)	

Feasibility Study and Assessment	
Project Management (Landscape Architecture)	

Construction and Implementation

This refers to the on-site construction of infrastructure and the delineation of space through landscaping, planting and movement corridors.

The following activities typically form part of this Phase:

- Site Preparation
- Construction of Infrastructure (e.g. levees, storm drains)
- Installation of Nature-Based Solutions (e.g. wetlands, green infrastructure)
- Planting and Vegetation
- Materials and Equipment
- Transport and Logistics
- Construction Supervision and Oversight

For this project, the following components were incorporated into the cost estimates:

- Earthworks
- Erosion protection
- Flood walls / dykes
- Culverts and outlets
- Landscaping
- Site establishment
- Professional fees (Site staff)
- Contingencies

Operation and Maintenance

Critical to the long-term success of the project, operation and maintenance efforts will be required from a wide range of stakeholders. This may include the involvement of community members though voluntary project stewardship, the leveraging of the Enhanced Public Works Programme (EPWP), as well as other job creation opportunities.

The following activities typically form part of this Phase:

- Maintenance of Infrastructure (e.g. stormwater systems)
- Maintenance of Nature-Based Solutions (e.g. replanting, erosion control)
- Reporting and Evaluation
- Labour Costs (Monitoring & Maintenance)

This also includes:

- Legal and Insurance Costs
- Administrative and Overhead Costs

Project Duration

The project location is on municipal-owned and managed public open space. It is estimated that the project construction and implementation can be completed by year 3. It Is recommended that a detailed phasing plan be developed during the detailed design of the project. The starting year will be dependent upon the prioritisation of the DM HFA Stage 1 projects to be undertaken by the Drakenstein Municipality.

Project Phase	Y1	Y2	Y3	Y4	Y5
Planning and Design:					
Construction and Implementation					
Operation and Maintenance (on-going)					
Stakeholder Engagement and Community Participation					

C4.5.Institutional Capacity, Alignment and Resource Requirements: Drommedaris Street HFA Project

Projects related to transformative adaptation and integrated planning are multi-disciplinary – requiring the buy-in and investment from a wide range of municipal and other stakeholders to achieve successful implementation and long-term project sustainability. Part C Chapter 4 Table 4 sets out the typical resources required during each phase of the project. This list is not exhaustive.

Part C Chapter 4 Table 4. Anticipated specialist inputs during the project lifecycle phases

Resource	Typical Role	Planning and Design	Construction and Implementation	Operation and Maintenance
Project Manager (Professionally registered engineer/ Professionally registered urban planner / Professionally registered construction project manager)	Oversee the delivery of the project, may require professionally registered engineer or urban planner (Detailed Design); Professionally Registered Engineer or Construction Project Manager (Construction and Implementation)			
Professionally Registered Environmental Impact Assessment Practitioner (EAP)	Undertake EIA or BA; coordination of relevant specialist studies; Undertake and oversee the WULA process.			
Environmental Control Officer (ECO)	An EAP may also be required for Environmental Compliance during construction and operation phases.			
Professionally Registered Geotechnical Engineer (ECSA)	Geotechnical investigations			

Resource	Typical Role	Planning and Design	Construction and Implementation	Operation and Maintenance
Professionally Registered Land Surveyor (SACG)	Conduct topographical survey			
Professionally Registered Town Planner (SACPLAN)	Oversee site design, provide urban planning specialist input, conduct the land use application, provide project management or support services to the project manager.			
Professional Registered Engineers (ECSA)	Detailed flood study (stormwater engineer); Roads Engineer (Traffic Impact Assessment)			
GIS Specialist	Undertake mapping and spatial analysis			
Heritage Practitioner	Heritage Impact Assessment and associated studies			
Professionally Registered Landscape Architect	Visual Impact Assessment			
Ecologist	Terrestrial Biodiversity Impact Assessment; Freshwater Impact Assessment			
Ichthyologist	Specialist study in relation to fish			
Treatment Wetland Specialist	Provision of technical details of the design of treatment wetlands			
Botanist	Botanical Assessment			

Resource	Typical Role	Planning and Design	Construction and Implementation	Operation and Maintenance
Waste Management Specialist	Waste Management Impact Assessment			
Public Participation Professional	Mobilisation and community meetings. Excludes the engagements forming part of the EA or Land Use Application Process. Socio-economic Assessment can also be included.			

In addition to the requirements listed in the table above, which will typically be supplied by specialists, the DM will require the internal institutional capacity to support the successful delivery of the project through its lifecycle phases. The recommendation is therefore that this team be formed on the basis of the Departments, Divisions, and Sections that formed part of the DM HFA Programme design. This will therefore include, but not be limited to, the following:

Part C Chapter 4 Table 5. Recommended Municipal representation and roles

Municipal Representation	Typical Role
Environmental Manager/ EAP	Programme Co-ordinator; Environmental Expertise, Guidance on Land Use Application
Roads and Stormwater Engineer	Municipal Project Manager, Rodas and Stormwater Division, Guidance on Land Use Application, Construction Project Management
Spatial Planner	Spatial planning inputs, Guidance on Land Use Application
Land Use Planner	Land Use Planning inputs, Guidance on Land Use Application

Municipal Representation	Typical Role
Supply Chain Management Practitioner	Support with Supply Chain related activities in the procurement of services and materials
Water and Sanitation Engineer	Provide inputs on water and sanitation related matters
Parks section representative	Guidance and support in relation to the establishment of public parks and sport facilities, input and oversight of operation and maintenance of planting and fields.
Solid Waste Management	Responsible for the planning and operation of a site-based solid waste management strategy
EPWP, Projects, Programmes and Funding	
Portfolio Councillors	
Ward Councillors and Committee Members	Support to mobilise the community.

Part C Chapter 4 Table 6. Suggested Stakeholders and Roles

Other stakeholders	Typical Role
Provincial Government	Competent Authority for relevant permitting and approvals
National Government	Department of Water and Strategy

Other stakeholders	Typical Role
NGOs	Intermediary Support

In order to achieve the mainstreaming and integration of this project, the following additional recommendations are offered:

- Programme Coordination role should be fulfilled by the Environmental Section
- Project Management for each of the Stage 1 DM HFA Priority Project should be championed by Stormwater Management and be situated within the stormwater management plan.

The coordinator and Project Manager should also develop a project specific operation plan to develop detailed roles and responsibilities for each of the identified stakeholders. The way forward should include:

- Adopting the DM HFA Programme as part of the Stormwater Master Plan
- Assigning the programme to a KPA 4 and PDO 23
- Development of a detailed Implementation Plan for each of the Stage 1 DM HFA Projects, and aligning the project with additional PDOs
- Development of a detailed Scheule of responsibilities per stakeholder at all stages of the project lifecycle
- Ensuring on-going community engagement and participatory planning

Alignment With Municipal Objectives:

The project aligns will all municipal objectives. It is particularly relevant to Strategic Objective 4, given the strong alignment with infrastructure provision.

Part C Chapter 4 Table 7. Project Alignment with Municipal Strategic Objectives

Municipal Strategic Objective	Alignment
To ensure good governance and compliance.	X
To ensure financial sustainability to meet statutory requirements.	X
To ensure an efficient and effective organisation supported by a competent and skilled workforce.	X
To provide and maintain the required physical infrastructure and to ensure sustainable and affordable services	X
To plan, promote investment and facilitate economic growth.	X
To facilitate, support and promote social and community development.	X

Key Performance Areas (KPAs) and Pre-Determined Objectives (PDOs)

KPAs refer to the areas within the business unit for which an individual or group is logically responsible. PDOs are the areas identified as important or crucial, where a result will assist in the achievement of the set objectives or goal (DM IDP, 2024:67).

It is recommended that this project be located within **KPA 4: Infrastructure and Services**, under **PDO 23: Transport, Roads, and Stormwater. This is directly aligned with the Strategic Objective *to provide and maintain the required physical infrastructure and to ensure sustainable and affordable services.***

C4.6.Cost Estimates: Drommedaris Street HFA Project

This section provides cost estimates for the Drommedaris Street HFA Project. These estimates are based on the draft concepts and are indicative fees only. The construction and implementation costs are dependent on the outcomes of the Design and Planning process. The detailed costing of the Design and Planning process will be dependent upon the outcomes of the preapplication meeting and the requirements for feasibility studies, approvals and licenses as set out by the relevant competent authorities. *It is important to note that a Quantity Surveyor / Cost Estimating Consultant should be appointed to determine more accurate Construction and Implementation Costs. This would take into account local and context specific considerations for the various items. As the engineering design development progresses, refined estimates can be prepared by the Quantity Surveyor / Cost Estimating Consultant.*

Part C Chapter 4 Table 8. Estimated project costing

DROMMEDARIS STREET COSTING		
Design and Planning Costs		
Item Description	**Estimated Cost (ZAR)**	**Comments (if any)**
Feasibility Study and Initial Assessments	2 472 751,60	
Detailed Engineering Designs and Tender Documentation	5 913 361,64	No complexity factor has been applied
Detailed Landscape Architectural Design and Tender Documentation	1 223 184,40	
Permitting and Regulatory Approvals	297 000,00	
Subtotal	**9 906 297,64**	

DROMMEDARIS STREET COSTING

Construction and Implementation Costs

Item Description	Estimated Cost (ZAR)	Comments (if any)
Earthworks	27 286 500,00	1m imported fill over entire site area
Erosion protection	7 650 000,00	
Flood walls/dykes	-	
Culverts and outlets	3 000 000,00	
Hard landscape works	5 510 700,00	Multi-purpose courts, Pedestrian pathway
Soft landscape works	8 894 500,00	Multi-purpose field, Meadow grasses
Riverine rehabilitation	10 555 200,00	Typha reed beds, Constructed wetland, Polishing wetland, Berm/ riverine vegetation
Total (1)	62 896 900,00	
Site establishment	12 579 380,00	20% of Total (1)
Total (2)	75 476 280,00	
Professional fees	15 095 256,00	20% of Total (2)
Contingencies	15 095 256,00	20 %
Subtotal	**105 666 792,00**	

Operation and Maintenance Costs

Item Description	Estimated Cost (ZAR)	Comments (if any)
Maintenance of Infrastructure (e.g. stormwater systems)	2 113 335,84	Recurring maintenance costs (Annual)
Maintenance of Nature-Based Solutions (e.g. replanting, erosion control)	579 000,00	Cost for the first year. The first year of maintenance would be the most intensive, thereafter (especially once 80% plant cover has been achieved) maintenance cost should reduce by one third.

DROMMEDARIS STREET COSTING		
Reporting and Evaluation	150 000,00	Annual reviews, audits
Subtotal	**2 842 335,84**	

Other Miscellaneous Costs

Item Description	Estimated Cost (ZAR)	Comments (if any)
Community Awareness, Skills Transfer and Education Campaigns	**350 000,00**	Detail of scope/cost to be defined at the discretion of the local authority
Subtotal	**350 000,00**	

Grand Total	118 765 425,48

Total Estimated Cost (Summary)

TOTAL ESTIMATED COST (SUMMARY) - DROMMEDARIS STREET		
Cost Category	**Total Amount (ZAR)**	**CAPEX vs OPEX**
Planning and Design Cost	9 906 297,64	CAPEX
Construction and Implementation Costs	105 666 792,00	CAPEX
Operation and Maintenance Costs	2 842 335,84	OPEX
Miscellaneous Costs	350 000,00	CAPEX/OPEX
Grand Total	**118 765 425,48**	

Additional notes

The Design and Planning costs for the engineering design and tender documents can be split according to the ECSA guideline on Civil engineering projects (here): refer to Table 1 in the document.

Cost of the Works		**Basis of Fee Calculation**		**Total (Primary fee plus secondary fee)**
For projects up to R850 000		**Lump Sum or Time Basis**		
Where the cost of the works:		**Primary fee**	**Secondary fee**	
Exceeds	**But does not exceed**			
850 000	1 899 000	106 300	15%	
1 899 000	9 347 000	237 400	12%	
9 347 000	19 066 000	982 400	10.5%	
19 066 000	47 372 000	1 857 000	9.5%	
47 372 000	94 960 000	4 121 400	7%	
94 960 000	572 000 000	7 065 000	6.5%	
572 000 000		33 233 200	6%	

The portion of what is included in the design stage and what is included in the construction stage can be determined by using ECSA guidelines again (here) for civil engineering projects. These are as follows in terms of the engineering design split. Stage 1-4 could be classified as engineering design and then Stage 5 and 6 is the construction monitoring and close-out of the project.

Stage	Stage of Services Civil: Engineering Projects:	Typical percentage points for each stage
1	**Inception**	5
2	**Concept and Viability**	25
3	**Design Development**	25
4	**Documentation and Procurement**	25
5	**Contract Administration and Inspection**	15
6	**Close-Out**	5
		100%

C4.7.Job Creation Potential: Drommedaris Street HFA Project

This section of the report provides an analysis of the Job Creation Potential for the Project.

The table shows the temporary and permanent jobs created by the project, temporary jobs are measured in job years, which are defined in the table, while permanent jobs are counted as jobs. An assessment is made of the jobs created as to how many constitute green jobs, in terms of the DFFE's definition. as well as the job-years. The table also provides an estimate of direct Jobs per skill level, as well as indirect and induced jobs, for the given level of investment estimated. The job seekers are based on the Drakenstein Municipality's database of job seekers dated to October 2024.

Part C Chapter 4 Table 9. Job Creation Potential.

DROMMEDARIS STREET DM HFA PROJECT										
Site: Drommedaris			**Total direct jobs**	**Direct Jobs per skill level** *Direct jobs are the extra jobs created in the delivery (design, construction/development) of an output and the operation of that output for the duration of its expected life. These direct jobs can be both temporary and permanent.*						**Estimated investment**
	Component	**Disciplines**		**Skilled (PSOC Level 3 and 4)**	**Semi-skilled (PSOC Level 2)**	**Low-skilled (PSOC level 1)**	**Green skilled**	**Green semi-skilled**	**Green low-skilled**	

DROMMEDARIS STREET DM HFA PROJECT										
Temporary *A temporary job means an employment opportunity created, for a limited time span, typically during the design and development of the infrastructure, project of program.* **(Job years)** *A job-year is a measure of the proportion of time a job is created for. One job year means one job for one year.*	Planning and design	Civil engineering (multiple disciplines), Landscape architects, Planner, EIA practitioner, Technical environmental specialists, Lawyer, Geotechnical engineer, Surveyor, Electrical engineer, Quantity surveyor	8	8	0	0	8	0	0	R9 906 297.64
Temporary (Job years)	Construction and implementation	Civil engineer, Landscape architect, Planner, Scientific specialist, OHSA officer, EC officer, Quantity surveyor, Site manager, Foreman, Site agent, Excavator operator, TLB Operator, Dump truck operator, Planter, Gabion basket maker, Carpenter, Security, General worker	25	3	11	10	3	5	10	R105 666 792.00

DROMMEDARIS STREET DM HFA PROJECT										
Permanent *Means a full-time equivalent position which endures beyond the development phase of the intervention, through the expected useful life of the infrastructure, plan or program.*	Maintenance and miscellaneous	Foreman, Mower operators, Planters, Driver, General worker	2	0	1	1	0	1	1	R3 192 335.84
Total			35	12	12	11	12	5	11	R 118 765 425.48
Jobseekers in ward			1239							
Jobseekers in ward and adjacent ward			3612							
Indirect jobs *Indirect jobs are the jobs created to supply inputs into the output creation to provide inputs that the project requires.*			223							
Induced jobs *Induced jobs are the jobs created in all sectors by the increase in household spending created by the wages paid in the direct jobs and indirect jobs created, following the initial increase in demand in the given sector.*			340							

DROMMEDARIS STREET DM HFA PROJECT	
Discussion	• The proposed intervention at the Drommedaris site is expected to create an estimated 33 job-years in the design and construction phases, along with an estimated 2 permanent jobs in maintenance. In the design phase, the eight temporary job years created will nearly all be highly skilled positions in professional firms (Engineering, Landscape Architecture, Planning, Scientific Services). All these positions will qualify as green jobs. • In the construction phase, the 25 job-years created will include three highly skilled job years, eleven semi-skilled job years and ten low-skilled job-years. All of these will also be green jobs except 6 semi-skilled jobs, which will consist of guards for 24-hour site security. The two maintenance jobs would be created, both would be green jobs in this intervention. Other expected semi-skilled jobs will be excavator operators, TLB operators, dump truck operators, planters, and gabion basket makers. • There is a significant database of job seekers for the ward (16) and adjacent wards (17, 12, 9, 22, 4, 13, 11) where the Drommedaris Site Intervention will take place, with over 1,000 jobs seekers. Low-skilled jobs could therefore be sourced entirely from these areas, providing an opportunity to upskill workers into the roles of security guard, planter, and gabion basket maker. • The level of investment estimated in the planning, design, and construction phases of this project will create an **estimated 223 indirect jobs in the national economy**, from the supply of inputs required for the project. It is anticipated that the estimated level of **expenditure will induce 340 jobs in the economy** as project workers spend their wages. Many of these will be in Drakenstein if local suppliers are used. • **It is estimated that this investment will yield 1.68 times the initial amount of income for the economy, resulting in economic contribution of nearly R 200 million to the national economy.** Improved quality of public space through this intervention could potentially contribute to stimulating higher value commercial and industrial development in the surrounding area. • This infrastructure does not fall under any of the trading services departments and is therefore not a direct revenue generator. Some elements may have access charges (such as braai facilities, and bird-watching facilities) but these revenues will be small. They are likely to have operating cost reduction impacts on both wastewater services and solid waste services. Increased litter trapping mechanisms provided by the intervention will also reduce damage to wastewater infrastructure and the cost of ad hoc waste removal elsewhere in the stormwater system and in the municipality. The net effect is likely an increased surplus or reduced deficit in wastewater services and solid waste management, alongside reduced operating costs in stormwater management.

C4.8. Barriers and Risks: Drommedaris Street HFA Project

The following register summarises the risks identified across the various phases of the project. The risks and mitigation measures should be refined as part of further design phases.

Part C Chapter 4 Table 10. Barriers and Risks

Phase of project lifecycle	Risk	Mitigation Measures
Planning and Design	**Community:** Lack of community buy-in and support.	• Community participation during all phases of the project. • Consideration of the development of social compact. • Mobilisation of NGOs and NPOs to support the initiatives. • Ward Councillor and Ward Committee mobilisation to ensure an understanding of the local context and to promote meaningful engagement with community members.
Planning and Design	**Community:** Lack of meaningful engagement.	• Community participation during all phases of the project. • Ward Councillor and Ward Committee mobilisation to ensure an understanding of the local context and to promote meaningful engagement with community members. • Hosting events to raise awareness on the project.
Planning and Design	**Community:** The community might not perceive the need for the project as they may prioritise their need for housing	• Development of alternate housing for the community where necessary, and transparency about this process to community members. • Gaining community buy-In through participation during all phases of the project, to gain community trust and illustrate project benefits.
Planning and Design	**Political:** Political acceptance.	• Gaining political buy-in through engagement with relevant political stakeholders, and explaining the potential project impact and benefit.

Phase of project lifecycle	Risk	Mitigation Measures
Planning and Design	**Institutional:** Lack of transversal collaboration.	• Defining roles within each department for undertaking the project, and development Key Performance Indicators (KPIs) to create accountability for these responsibilities. • Development of Standard Operating Procedures (SOPs) for each of the relevant department to provide a clear overview of their roles and responsibilities.
Construction and Implementation	**Safety and security**: There is potential for safety and security concerns posed to workers during the construction and maintenance of the project.	• Ensuring the presence of law enforcement during construction and implementation to mitigate potential safety and security concerns. • Involvement of the Drakenstein Municipality Smart Safety Network (DM SSN) to enhance security on site.
Operation and Maintenance	**Solid wate management**: Solid waste dumping, potentially due to 'backyarders' not being calculated when planning how much solid waste management services is required.	• SOPs to be developed for the Solid Waste Management Department, outlining roles and responsibilities. • Counting/ estimation of 'backyarders' in need of services to be supplied. • Placement of skips at the site, however, this may come with challenges as children will not be able to each the skip and dogs may tear open rubbish bags. • Raising public awareness around illegal dumping.
Operation and Maintenance	**Safety and Security**: Risk of Drowning	• Ensuring adequate lighting, particularly around posing a drowning hazard • Ensuring the presence of law enforcement at the site. • Mobilising community/ neighbourhood watches at the site. • Patrols at the site to be undertaken by law enforcement officers.
Operation and Maintenance	**Safety and Security**: Vandalism and theft of intervention materials.	• Ensuring the presence of law enforcement at the site. • Mobilising community/ neighbourhood watches at the site. • Patrols at the site to be undertaken by law enforcement officers.

Phase of project lifecycle	Risk	Mitigation Measures
		• Involvement of the Drakenstein Municipality Smart Safety Network.
Operation and Maintenance	**Safety and Security**: High crime area and community members might not feel safe at this site.	• Improve the visibility of the area. • Ensuring the presence of law enforcement at the site. • Mobilising community/ neighbourhood watches at the site. • Patrols at the site to be undertaken by law enforcement officers. • Involvement of the Drakenstein Municipality Smart Safety Network.
Operation and Maintenance	Social acceptance/ ownership	• Involvement of Mayoral Committee Members (MMCs) in the project to enhance communication to community members, to provide local knowledge and to provide a representation of community members and concerns. • Development of Public-Private Partnerships (PPP) to develop a sense of ownership. • Inclusion of the project in budgeting processes. • Enhance job creation potential for community members as part of the operation and maintenance of the intervention. • Host events to spread knowledge and awareness on the project. • Building partnerships with industrial areas.
Funding	Cost of implementation and ongoing maintenance	• Integration of the project into the Service Delivery and Budget Implementation Plan (SDBIP) to receive priority funding allocation and increased visibility to potential funders. • Integration of the project into the IDP and SDF.
Funding	Securing OPEX funding of several funding cycles	• Integration of the project into the Service Delivery and Budget Implementation Plan (SDBIP) to receive priority funding allocation and increased visibility to potential funders. • Integration of the project into the IDP and SDF.
Land invasion	Potential for land invasion	• Ensuring the presence of law enforcement at the site.

Phase of project lifecycle	Risk	Mitigation Measures
		• Mobilising community/ neighbourhood watches at the site. • Patrols at the site to be undertaken by law enforcement officers.
Competing Land Uses	The site may have competing land uses by various stakeholders.	• Gaining political buy-in. • Incorporation of the project into the SDF.

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