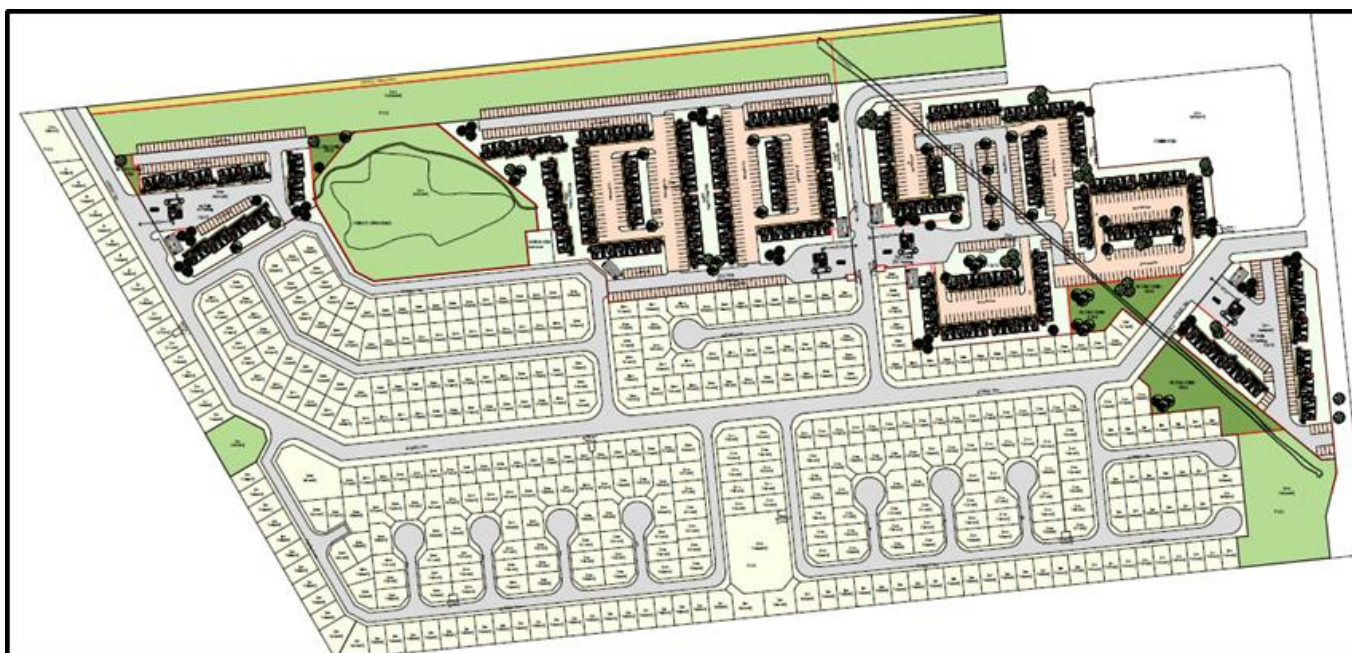




CONTRACT No. 776/1112:

**PROVISION OF CIVIL ENGINEERING SERVICES
FOR ERF 776, MONTCLAIR**

Stormwater Management Plan



Prepared for:

The Director
City of Cape Town
Transport, Roads & Stormwater Directorate
Roads and Stormwater Department
Catchment, Stormwater and River Management Branch

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LIST OF SUPPORTING DRAWINGS

Table 1 below consists of the list of drawings that supplement the Stormwater Management Plan in this report.

Table 1: Drawings

Drawing Number	Description of Drawing:
7165-G-07-P0	Stormwater Outfall Control Structure
7165-G-10-P0	Stormwater Detention Pond Layout & Details
7165-G-11-P0	Stormwater Detention Pond Cross Sections
7165-G-100-P0	Development Phases
7165-G-500-P1	Stormwater Management Plan
7165-G-501-P1	Pre-Development Contour Layout
M452/1 A	Stormwater Detention Ponds

SUMMARY AND PURPOSE OF REPORT

This report presents the proposed stormwater management facilities for the Stage 1 development of Erf 776 in Montclair, Mitchells Plain, which includes Development Phases 1 – 8 for Single Residential Erven and Public Open Space (POS). The stormwater control is an Extended Detention Pond that will be implemented to attain SUDS objectives stipulated by the City of Cape Town (CoCT): Catchment and River Management Branch. The planning, selection and design of the stormwater controls are the culmination of multiple discussions held between representatives of Bergstan South Africa and CoCT: Catchment and River Management Branch.

In particular, the report provides design features and Best Management Practices (BMPs) for the Extended Detention pond, which is to be constructed in the POS in the southeast of the site.

1. INTRODUCTION

1.1. DESCRIPTION OF SITE & ACCESS

The proposed development is a housing project funded by Communicare. The intention of the development is to provide entry-level affordable housing, of which there is significant demand and need for in the area.

The site is located in the Mitchell's Plain area and is surrounded by existing road and service infrastructure. The site is in close proximity to the Lentegeur Psychiatric Hospital, which is located south of the site and is bordered by Mandalay Railway Station in the north.

The site is accessed via Montclair Drive, which intersects Highlands Drive in Mitchell's Plain.



Figure 1: Locality of Development Site

1.2. APPROVAL FROM AUTHORITIES

Approval has been granted by the Planning & Building Development Management Department for land usage on the site that will accommodate:

- 405 Single Residential Erven
- 4 General Residential Erven (for flat units)
- 1 Commercial and 2 Civic & Community Sites

Individual applications to various departments within the City of Cape Town are currently in process to confirm adherence to conditions imposed by the above-referenced approval.

This report specifically addresses criteria pertaining to the application for approval from CoCT: Catchment and River Management Branch, which is required as part of the application for approval from the Roads and Stormwater department.

1.3. PHASED DEVELOPMENT APPROACH

Development of the site will be undertaken in a phased approach. The attached drawing (ref: 7165-G-100-P0) indicates the areas to be developed in each phase. Phase 1 and 2 will be launched simultaneously, with 100 Single Residential units targeted for construction. The developer aims to have commence construction within the First Quarter of 2013 (Q1-2013).

The Stormwater Management Plan for the site will be implemented in two stages:

- Stage 1: Phases 1 – 8 (Single Residential Erven and Public Open Space)
- Stage 2: Phases 9 – 12 (Social housing in General Residential Erven).

This report pertains to Stormwater Management Plan and Best Management Practices (BMPs) for Stage 1.

2. GEOLOGICAL PROFILE OF THE SITE

The soil profile is characterised by typical windblown sands, varying from fine to medium sand occurring at a depth of at least 1.0 metre below ground level. The clay/silt content is generally less than about 5%, but increases in depth up to about 10%. The Aeolian sand is non-cohesive, free-draining and readily compacts at the correct moisture content.

Calcrete has formed within virtually all of the profiles and varies from coarse gravels, to a hardpan layer of calcrete. The calcrete is encountered at highly variable depths below surface, but is generally found at lower elevation over the central and eastern parts of the site (i.e. at an elevation varying from about 29.5m to about 31m).

A perched water table occurs at the site near the interface between the highly permeable upper layer of Aeolian sand and the underlying hardpan calcrete layer. The water table occurs at a level ranging from about 29.15m on the eastern part of the site to 30.75 m (mean of 30.0 m) above mean sea level.

The site contains several minor depressions. Rain water accumulates within these depressions during winter, but they tend to dry out in the summer months, with the exception of the main wetland. The wetland, which occupies just over 9000m² in plan will be retained as “Private Open Space” and shall be completely fenced off from public access (ref: 7165-G-500-P1).

3. TOPOGRAPHY OF THE SITE

The site is located within Mitchells Plain drainage catchment. The existing contours on site generally fall from north to southeast. This enables the natural drainage of the site to occur in a south-to-southeasterly direction. A copy of the existing pre-development contours is provided in Drawing No. 7165-G-501-P0.

4. PROPOSED STORMWATER DRAINAGE

The stormwater outfall for the site is a 1200mm dia closed pipe outlet (Ref: 7165-G-010-P0) that connects to the Mitchells Plain Stormwater and Culvert System. Stormwater is conveyed in this system via a series of ponds and pipes (Ref: 452/1 A). An existing open channel falls in a southeasterly direction on site and discharges into the 1200mm dia outlet. The bulk of this

channel will be converted to a closed culvert system that will discharge into a detention pond in the southeastern Public Open Space.

The proposed stormwater system for the Erf 776 development forms integral part of the road and urban planning layout. The system rests on three legs, namely the minor system, the major system and an emergency system.

Minor system: The 2-year RI 6h storm will be conveyed in the underground pipe system. Overland flows between catch-pits shall not exceed 200m.

Major System: The difference between the 2-year and 50-year RI 6h storm will be conveyed in the road prism, with depth not exceeding 150 mm within the road reserve width. The Extended Detention Pond attenuate peak flows and act as a sediment control and treatment facility for all flows exiting the site.

Emergency System: An emergency spillway will extend from the southern boundary of the detention facility towards Lentegeur Psychiatric Hospital. The spillway corridor is currently obstructed by a solid boundary wall, which will need to be modified to include a slotted opening so as to allow for conveyance of overflows from the site.

5. SUSTAINABLE URBAN DRAINAGE OBJECTIVES

Table 2 indicates areas of compliance that are relevant to the current development. Because the outflow from the site discharges directly into a piped system, the control of quantity and runoff rates exiting the site is not a requirement. The proposed detention pond however is large enough to comply with additional non-compulsory criteria. This is verified by the information presented in both Table 2 below and Annexure A.

Table 2: Sustainable Urban Drainage Objectives

SUDS Objectives	Description of Objective	Greenfield Developments Requirements	Requirement for current Development (Yes / No)	Notes	Criteria met?
Improve the quality of runoff	Remove pollutants through the use of BMPs to infiltrate, capture and/or treat runoff	Reduction of post-development annual stormwater pollutant load discharged from development site: SS – 80% reduction TP – 45% reduction	Yes	Design storm event for water quality treatment: ½-year RI, 24h storm (24mm) Treatment Vol required: 1060m ³ to meet criteria	✓

Table 2: (Continued): Sustainable Urban Drainage Objectives

SUDS Objectives	Description of Objective	Greenfield Developments Requirements	Requirement for current Development (Yes / No)	Notes	Criteria met?
Control quantity and rate of runoff	Protect the stability of downstream channels	24-hour detention of the 1-year RI, 24h storm event	No	Detention Vol required: 2450 m ³ to meet criteria	✓
	Protect downstream properties from fairly frequent nuisance floods	Up to 10-year peak flow reduced to pre-development levels	No	Desired peak flow: 215m ³ /s See Outflow hydrograph in Annexure A	✓
	Protect floodplain developments and floodplains from adverse impacts of extreme floods	Up to 50-year peak flow reduced to pre-development levels	No		x

Source: Management of Urban Stormwater Impacts Policy (March 2009, Ver 1.1)

The pollutant removal capacity of the proposed pond is presented below in Table 3.

Table 3: Water Quality Performance: Pollutant Removal Capacity for Extended Detention Ponds

Pollutants	Total Suspended Solids (TSS)	Hydrocarbons	Total Phosphorus (TP)	Total Nitrogen (TN)	Faecal Coliforms	Heavy Metals
Pollutant Removal Performance *	80%	30 – 60%	50%	30%	50 – 70%	40 – 90%
CoCT Requirements **	80%		45%			
Compliance with minimum requirements	✓	N/A	✓	N/A	N/A	N/A

* Source: The Georgia Stormwater Management Manual: Volume 2: Technical Handbook (1st Ed)

** Source: Management of Urban Stormwater Impacts Policy (March 2009, Ver 1.1)

The proposed pond meets minimum requirement criteria of the City of Cape Town from A SUDS approach.

6. DESIGN PARAMETERS

Guidelines and methodologies from the Georgia Stormwater Manual (Volume 1 & 2) were used to select, size and design the stormwater control structure and associated features. An overview of the system and its functioning is provided below:

- Discharge from the piped system and excess overland flows from the roadways will be conveyed to the forebays for pre-treatment.
- Retention of water in the forebays will be achieved by the gabion weir walls and allow for sedimentation.

- Slow drainage of water withheld in the forebays will take place by filtration through the gabion walls, which will prevent long-term ponding of water.
- Overflow from the forebays will be conveyed by the Armorflex channel, which will minimise erosion in the secondary pond.
- The secondary pond will retain up to the 1-year RI, 24 hour storm. Extended detention of water in the pond will be achieved by the throttled 160mm dia outlet.
- 2 orifices on the outlet structure are positioned above the 1-year RI 24 hour flow level and have sufficient capacity to convey the 2-year RI, 6 hour flow into the 1200mm pipe outlet.
- The detention pond has capacity to store the excess between the 2-year and 50-year storm volume.
- Emergency overflow slots in the solid boundary wall of Lentegour Psychiatric Hospital will allow for draining away of flows greater than the 50-year storm.

Design Criteria and Standards

Site Area:	13,4 ha
Mean Annual Precipitation:	636mm
Storm Type:	IDF,
Measured impervious area:	55%
Required treatment volume:	1060m ³
Required pretreatment volume:	188m ³
Existing grade along open channel:	0.002m/m

Stormwater Management

The assumption has been made that stormwater originating from north and northeast of site is treated and attenuated as per the Mitchells Plain Stormwater Master plan (KFD Wilkinson Consulting Engineers, 1998) before being conveyed to Erf 776 (Ref: Drawing No. M452/1A).

Outlet Control:

Outlet Types:	Multi-stage: 160mm dia pipe; 2 x 1200mm x 500mm orifices
Required max outlet flow (for 24hr drawdown):	25LPS (160 dia outlet)
Max Weir/Orifice overflow:	699LPS x 2 (1200mm x 500mm openings)

Features of Pond (Ref: 7165-G-07-P0)

Capacity:	4400m ³
Surface Area:	5700m ²
Average depth:	1200mm

7. BEST MANAGEMENT PRACTICES

A list of BMPs to be incorporated with the construction of the stormwater control structure listed below.

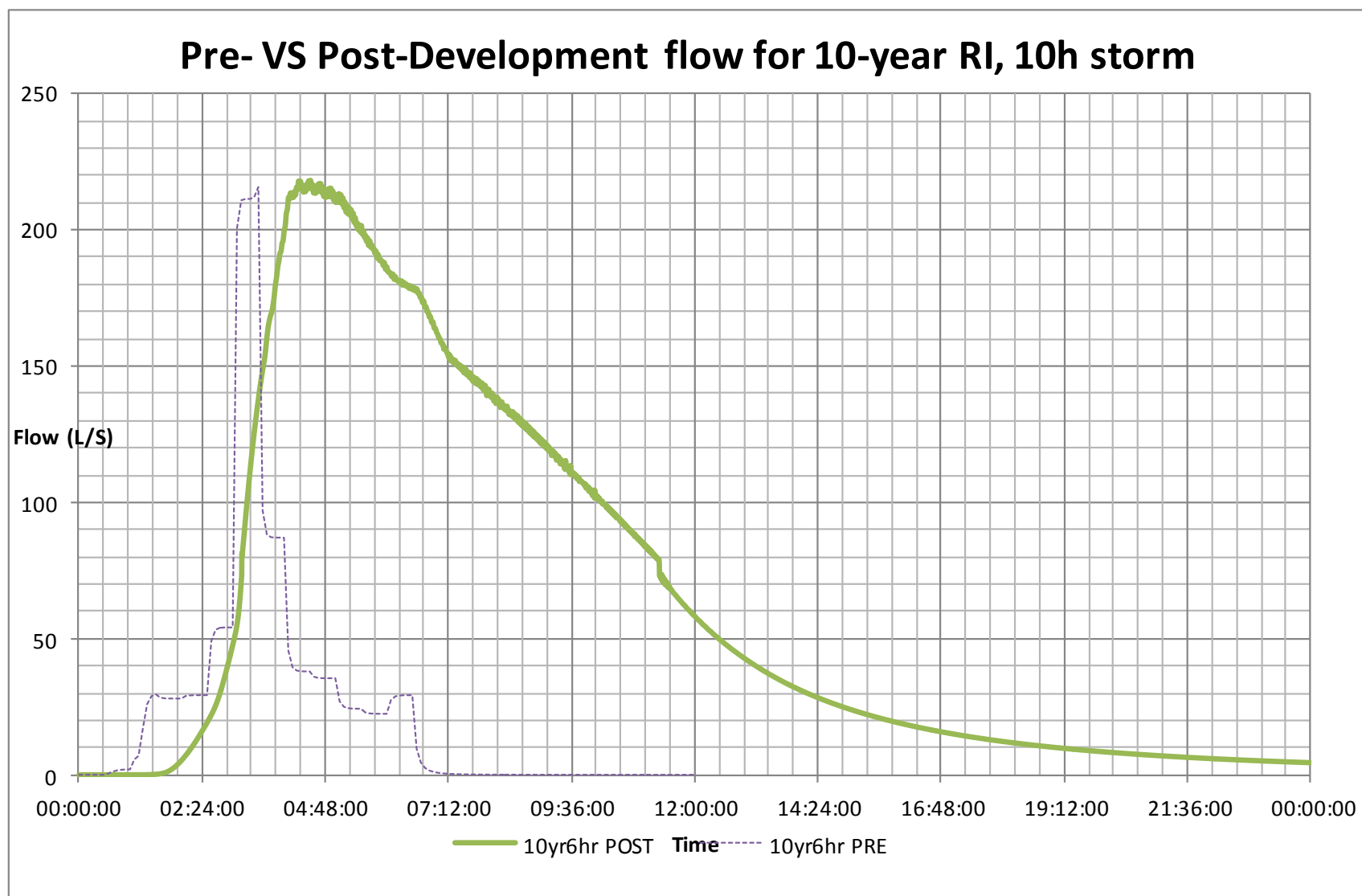
- Side slopes of detention pond will be limited to grades of 1:3. Slopes are to be stabilized using Cynodon Dactylon ('fynkweek') sods
- Two forebays (Forebay A & B) sized for 180m³ and 120m³ respectively will be constructed to facilitate sediment control (Ref: 7165-G-07-P0).
- Forebay weir walls to be composed of gabion boxes to allow for filtration of pre-treated volumes and prevent long-term standing water and mosquito pests.
- Low-flow Armorflex channels to extend from weir walls of forebays to collect and transport trickle flows to the stormwater outlet
- Level indicators to be installed in forebays to provide an indication of when accumulated sediment needs to be periodically removed.
- Maintenance access roads to be constructed for forebays to allow for periodic maintenance of structures.
- Indigenous vegetation to be used for landscaping of detention pond. Cynodon dactylon to be exclusively installed.
- The outlet control of the pond allows for 24 hour extended detention of 2450m³, which is double the requirement for water quality treatment for the site.
- Future flat sites in later development phases will make use of porous paving to manage treatment of stormwater at source.
- Existing 9000m² of wetlands to be retained shall be fenced off during construction. Signage to be erected near wetland to inform community of the functional purpose of wetland.

8. CONCLUSION

The proposed ED detention pond is capable of treating four times the required capacity of runoff that will be generated by the land to be developed in Phases 1 – 8. The detention facility will also attenuate up to 10-year reoccurrence interval storms to pre-development peak flows. The proposed design meets all CoCT criteria. BMPs outlined in this report will be implemented during construction phases.

9. REFERENCES

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Notes: Pre-development flows are compared to post-development flows with a 4400m³ detention facility.