Valumax Properties (Pty) Ltd

Soshanguve South Extension 6
Kaalplaaspruit Bridge Crossing

PRELIMINARY BRIDGE DESIGN

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Executive Summary

Soshanguve South Extension 6 forms part of the Thorntree View Housing Development. This neighbourhood will house over three thousand families in low cost residences. Approximately one third of the development lies to the east of the Kaalplaaspruit watercourse. A bridge will be constructed in order to provide access to these properties. This report contains information on the proposed design and construction of the bridge in order to obtain a water use license for the river crossing.

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PRELIMINARY BRIDGE DESIGN

Part A General Matters

A.1 Project background

The Soshanguve South Extension 6 portion of the Thorntree View Development consists of 3092 residential, 6 school, 4 business and 28 institutional sites. A large area is zoned as public open space and forms part of the integrated greenbelt for the whole of Thorntree View.

Thorntree View is one of the focus area housing developments in the City of Tshwane. This development was part of the properties acquired by SAFDEV SSDC (Pty) Ltd in terms of an agreement signed with the joint liquidators of the previous developer (Soshanguve South Development company) on August 2002.

A.2 Project Team

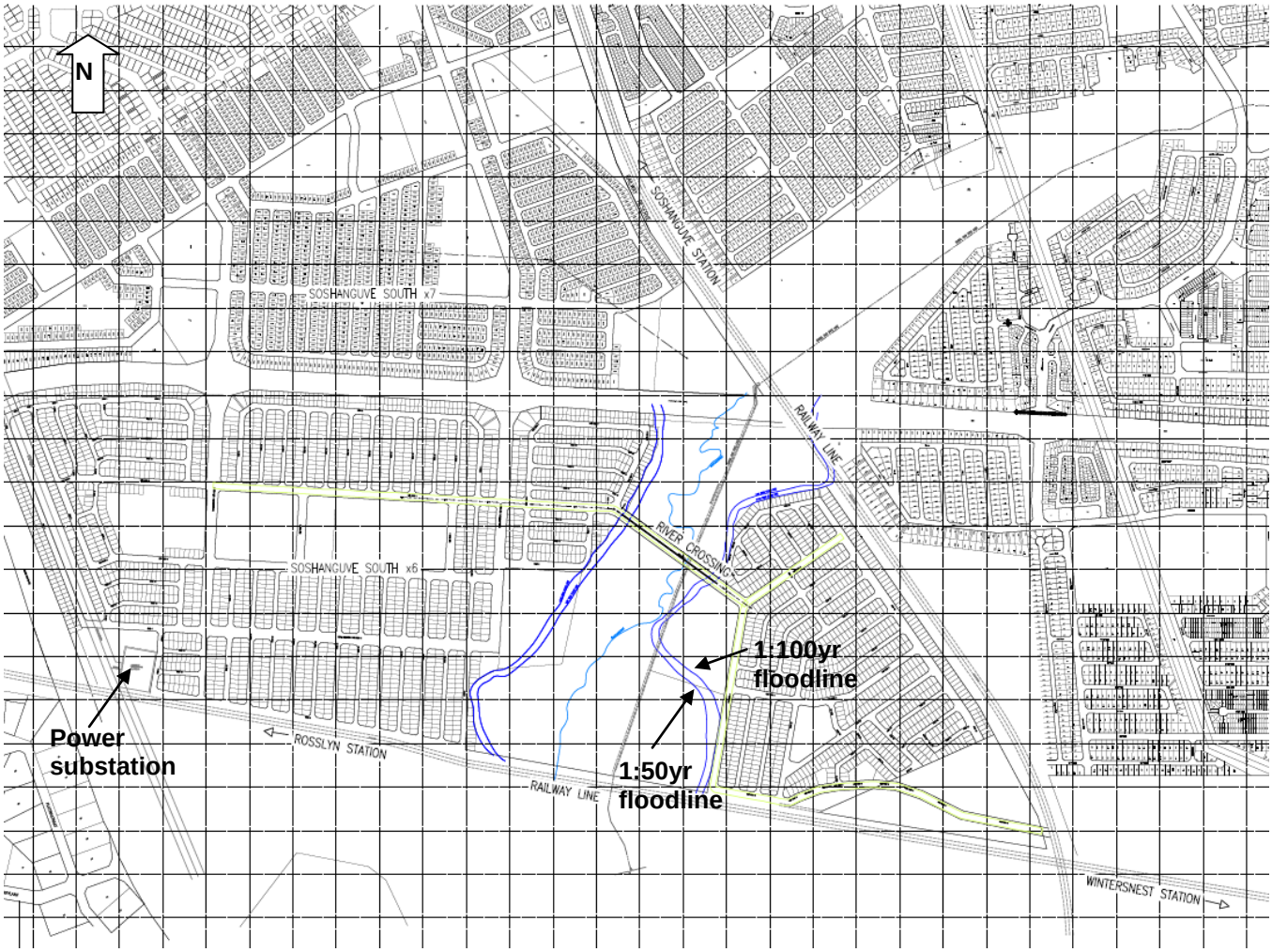
The following role players are involved in the management, planning, design and implementation of the Project.

Developer	Safdev SSDC (Valumax Properties) Rosewood House, Ground Floor 33 Ballyclare Drive Ballywoods Office Park, Bryanston Mr Koos Toebes (011) 463-8823
Local Authority	City of Tshwane Metropolitan Municipality PO Box 14013 Lyttelton 0140 Kenneth Maswiagala (012) 358-7900
Town and Regional Planners	Van Zyl & Benade 29 Selati Street Ashley Gardens Pieter van Zyl 082 5596371
Geotechnical Engineering	E.G.E.S cc Trading as GeoGroup PO Box 604 Fourways 2055 Dr D Butrick (011) 469 0854
Traffic Engineering	Technoworld Consulting Engineers PO Box 12530 Hatfield 0028 Mr Pieter Kruger (012) 998 3541

Civil Engineering Services	Bigen Africa Services (Pty) Ltd PO Box 29 The Innovation Hub 0087 Mr L D Jacobs (012) 842 8700

A.3 Project locality

Soshanguve South Extension 6 strategically located north of the Rosslyn Industrial area, northwest of the CBD of Pretoria and is within the Municipal borders of the City of Tshwane Metropolitan Municipality (CTMM). The proposed bridge structure is located in the Kaalplaaspruit floodline northwest of the intersection between the Rosslyn-Wintersnest and the Mabopane-Akasiaboom railway lines.



Part B Natural Environment

Section B1 Topography and Surveys

The project site has uncultivated (shallow soil) lands, covered by veld grasses. Climate of the site is typical for the Highveld region and characterised by warm to hot summers and mild winters. Rainfall occurs predominantly in summer with little to no rainfall in the winter months. The average annual rainfall is around 700 mm and occurs mainly in the form of thundershowers.

The site lies at a mean altitude of around 1500 m AMSL and falls from south to north-west and north east at gradients varying from 0.2% to 5%. A Spoornet railway line forms the eastern boundary of the site and the western boundary of the site borders the K63 provincial road. There is an existing power substation in the southwestern corner of the proposed development.

Kaalplaasspruit and the area between its associated 1:50 and 1:100 year floodlines will be spanned by the proposed bridge. The floodplain currently forms a broad greenbelt area. This band of undevelopable land divides the Soshanguve South Extension 6 township site in two areas. Around two-thirds of Soshanguve South Extension 6 is located west of the green area, and the remaining third lies east of the river. The eastern section of the development is currently inhabited by residents of an informal settlement (Plastic View).

Section B2 Geological and Geotechnical Aspects

The geotechnical investigation completed in January 2007 (Report No. 06/115/1 by Schwartz, Tromp and Associates Consulting Geotechnical Engineers) divides the site into four main geotechnical zones. The crossing will be between in the vicinity of test pits 54 and 55, which mainly lie in Zones 2 and 4. Experience with installing services at Soshanguve South Extension 6 has indicated that the bridge development site should contain a lot of rock – more than anticipated in the geotechnical report. Refer to the following page for a diagram indicating the locality of each zone. A summary is given below:

Zone	Description
Zone 2 (Waterlogged)	This zone is represented by a drainage channel and associated alluvial soils. The extent of the floodline will determine the area to be excluded from development. Potential heaving shrinkage movements in excess of 30mm are expected.
Zone 4 (Locally)	This zone covers most of the Soshanguve South Ext 6 site. Potential heaving shrinkage movements of greater than 30mm are expected within the reworked residual norites. Localised areas of scattered rock outcrop are expected.

Part C Layout and Planning

Section C1 Bridge location

The Kaalplaasspruit divides the Soshanguve South Extension 6 development in two sections, east and west of the river. A bridge will be necessary for vehicles and pedestrians, as well as certain services, to cross the river. The Department of Water Affairs requires that a water use license should be obtained when development work could potentially interfere with natural watercourses. They also require that a bridge should be built so that the structure does not cause damming upstream and thereby influence the township's floodlines.

The proposed bridge structure is located in the Kaalplaaspruit floodline northwest of the intersection between the Rosslyn-Wintersnest and the Mabopane-Akasiaboom railway lines. Coordinates for the bridge's westernmost and easternmost ends are:

- West: (90 728.073; 2 833 028.069) (25° 36' 6.48" South; 28° 5' 48.5" East)
- East: (90 941.049; 2 832 847.177) (25° 36' 1.44" South; 28° 5' 40.9" East)

Section C2 Bridge dimensions

Dimensions of the bridge were determined by taking the distance spanned between the western and eastern 1:100 floodline as its length – the bridge approaches will not influence the floodline. The width is sufficient to accommodate a single lane carriageway in each direction with room for services, a sidewalk and guardrails. The clear height above the riverbed through the chosen river section was determined by calculating the area required under the culverts to let the current river flow through. Extensive fill will be required on top of the culverts in order to attain the minimum road slope gradient of 0.67% prescribed by the City of Tshwane, which lifts the road surface level further from the riverbed level.

The bridge dimensions following preliminary design are as follows:

- Length: 260m
- Height: Average height: 2.5m
  Maximum height: 4.3m (deepest section on riverbed to top road level)
- Width: 10m.

Section C3 Bridge construction

The Kaalplaasspruit bridge will be constructed from rows of precast concrete culverts packed perpendicular to the flow direction of the river to facilitate flow through the sections.

Vegetation and topsoil will be removed from the crossing point. Excavation will be done to rock level where an even base must be prepared before the culvert floor slabs are packed. It is important that the bedding material, in which the culverts are set, is firm and supports the culvert base slabs evenly. Backfill around the culverts will be compacted during construction. The fill material should be clean and free of debris, vegetation and topsoil.

The culvert invert gradient should be the same as the natural streambed to minimise erosion and silting problems. Possible foundation settlement should be countered by cambering the culvert to ensure positive drainage.

Headwalls will be provided at the culvert entry and exit. These headwalls retain earthfill and improve the hydraulic capacity for culverts as well as protection against turbulence. Erosion protection will be provided directly upstream and downstream of the bridge in the form of gabions and/or reno mattresses.

Fill on top of the culvert construction is used to attain the municipality's minimum road gradient requirements. The soil structure will also help to distribute loads across the culverts and avoid point loads. Once the fill has been compacted, the road layerworks will be constructed and compacted and the road surfacing, construction of sidewalks and guardrails can be completed.

Section C4 Hydraulic details

Hydraulic data was received from the City of Tshwane's Roads and Stormwater department. The only information they had available are the flood peaks at the railway line just south (upstream) of the propsed bridge, as well as two kilometres further east (downstream) where the Kaalplaasspruit crosses the R80 (Mabopane Highway).

Cross Section	**1:50 year runoff**	**1:100 year runoff**
Railway Line (1km upstream)	125m^3/s	160m^3/s
R80 – Mabopane Highway (2km downstream)	155m^3/s	200m^3/s

Flood routing calculations of the Kaalplaasspruit's catchment area were completed by Bigen Africa using the current development scenario to verify the data received from CTMM. Both the Alternative Rational Method and the Standard Design Flood method were used. The results from the Alternative Rational Method will be used for the final culvert design and backwater calculations.

Method	**1:50 year runoff**	**1:100 year runoff**
Alternative Rational Method	193.67m^3/s	251.92m^3/s
Standard Design Flood	110.83m^3/s	138.75m^3/s

Section C5 Preliminary design drawings

The preliminary design drawings and catchment layout for the project can be found on the next pages.

Part D Project Management

Section D1 Programme and Phasing

The construction of the bridge will commence as soon as the Water Use License is granted by the Department of Water Affairs. Since Gauteng is a summer rainfall season, it will be best to do construction in the dry winter season so that flooding will be least likely to occur during construction. It is anticipated that construction should take between 6 and 8 months.

Construction of the bridge will be supervised by Bigen Africa Services, on behalf of the developer Valumax Properties. Prism Environmental Management Services has been appointed as environmental consultant on the project from the planning phase and will advise the project team on environmental issues, as well as to administrate and monitor the implementation of required environmental measures.

Once construction is complete, the river crossing will be handed over to the City of Tshwane's Roads and Stormwater Department who will be responsible for operations and maintenance of the bridge structure. This includes keeping the culvert sections clean and free of debris that could potentially cause damming upstream of the bridge.

Section D2 Construction Method Statements

As discussed earlier, through careful timing of the project's construction phase, environmental impact (which includes the erosion of disturbed riverbanks) can be limited by ensuring that construction does not occur during the rainy season. Clearing and grubbing will take place directly before construction commences and material should be stockpiled at an approved site. Stockpiles may not be located in the floodplain and should in no way interfere with natural water drainage pathways. Silt traps must be installed downstream of the construction area to catch any silt loosened and released into the watercourse as a result of construction activities.

The contractor should establish site at an approved location outside the 1:100 year floodplain and should also not be situated in an area where the slopes are greater than 1 in 3. The premises should be kept clean with acceptable sanitation and waste disposal facilities. Construction routes must be clearly defined. Storage areas should be clearly demarcated and fenced. Drainage of the camp should be designed properly to prevent ponding on the camp site. Once complete, the site must be reinstated to the same state as before construction.

Construction plant and heavy vehicles should be restricted to specific planned routes. These vehicles must be kept in a roadworthy condition so as not to spill oil or other contaminating substances into the watercourse. Any servicing or oil change must take place at a remote location with the necessary drip trays in place. If necessary, teams must be employed to clean up any spillage of harmful materials.

Construction workers will receive basic training on awareness of their environment. Training topics will include how to limit disturbance to sensitive areas, waste management and the prevention of water pollution where the existing Kaalplaasspruit watercourse is concerned. Health and Safety management will also be done strictly on this site. This will ensure the safety of construction workers as well as the residents in the area surrounding (and downstream of) the construction site.

During construction, regular environmental inspections will be performed that will focus on the protection of environmentally sensitive areas, development impact and compliance with all applicable environmental conditions stipulated by the water use license. Site inspections will allow the environmental consultant to liaise directly with construction personnel to ensure that the outcome of the works will be satisfactory from an environmental point of view.

A daily site diary is a standard requirement on any of the Thorntree View development sites. On this project it will be no different and notes will be kept of work locations, activities, times, conversations or other relevant information that may be of environmental interest, both positive and negative. The contractor, environmental consultant and site supervision team are all to take photographs of environmental mitigation measures, construction activities or other areas of interest both positive and negative for their records. Any minor nonconformances and associated actions required to be undertaken by construction personnel must also be recorded.

In terms of the installation of culvert sections, the new thoroughfare should provide the same passage area for the watercourse as the existing channel width. In this way, the structure will not cause or aggravate flooding. Culvert alignment should match the watercourse alignment i.e. water should still flow parallel to its natural route. The culvert base slope should match the natural riverbed slope, with consideration of the watercourse stability.

Scour and erosion control measures will be designed and installed. Sealing of surfaces under the bridge or gabion (erosion protection) structures should be avoided.

Once the project is complete, rehabilitation of the floodplain will commence. Indigenous plants must be used if there is any flora that needs to be replanted.

Section D3 Alternatives Considered

Various concepts were considered in the initial planning phase for the bridge crossing. A low-level crossing that spans the 1:100 year floodlines was the most economical solution. Several size combinations on culvert sections were evaluated. The design drawings are attached.