WELLINGTON INDUSTRIAL PRECINCT

ERF 34, WELLINGTON

STORMWATER MANAGEMENT PLAN

JULY 2017

Drakenstein Local Municipality
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Stormwater Management Plan

For
WELLINGTON INDUSTRIAL PRECINCT
ERF 34, WELLINGTON

Issue and Revision Record

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1. INTRODUCTION

In December 2015, Knight Piésold Consulting Engineers were appointed by our Client, Drakenstein Municipality, as the Project Managers for the team to conduct specialist studies and obtain development rights approval for the extension of the Wellington Industrial Park. The team consists of Town Planner – RTJ Consulting, Urban Designer – MLS Urban Design, Environmental Consultant – Chand Environmental, Environmental Heritage Consultant – Melanie Attwell, Landscape Architect – MALA, Traffic Engineering Consultants – Gibb, Legal Advisors – STBB and Civil Engineering Consultants – Knight Piésold Consulting Engineers. As part of our Civil Engineering appointment we are to investigate and compile a Stormwater Management Plan for the planned Extension of the Wellington Industrial Park on Erf 34 Wellington. This report is to be included in the Site Development Plan approval application.

2. *EXISTING SITE CONDITIONS*

2.1 LOCATION

Wellington is situated in the Berg River valley, in the Cape Winelands approximately 13 km north of Paarl. The town is located in a scenic rural area located at the foot of the Groenberg mountain range. The study area for the Wellington Industrial Precinct (Erf 34) covers an area of approximately 355ha and is located to the south- west of the Wellington CBD.

The site is located within the Wellington Urban Edge and is bordered by the Berg River to the west and south, the R44 (Champagne Street) to the north and a railway line to the east.

The adjacent land uses to the east of the site include an industrial area adjacent to the railway line and the residential areas of Mbekweni and Newton. The land uses to the south and west of the site, on the opposite banks of the Berg River, are predominantly agriculture, being specifically vineyards. The land uses to the north of the site are also dominated by agriculture and agri-industrial activities (bottling plant and whiskey distillery). Annexure A indicates the location of the site at present, and its current uses.

2.2 STUDY AREA

The site is at an elevation of about 100 MAMSL and is relatively flat, as a large portion of it lies within the floodplain of the Berg River. The site lies to the east of a large meander of the Berg River which has almost completely been modified by urban activities. It is occupied by the existing light industrial park (Phase1), an unlined municipal waste disposal site for Wellington, the Wellington Wastewater Treatment Works, the historic sewage sludge ponds and industrial effluent ponds for the Mossop Western Tanning operations. The nearest residential areas are Mbekweni and Newton, which are located east across the railway line from the study area.

A portion of the Wellington Golf Course is situated in the north-eastern corner of the site. A pallet manufacturing facility is situated close to the entrance of the waste disposal site and the premises of the local animal welfare organization (the SPCA) are located nearby.

Direct access to the site is limited to two access roads off the R44, Champagne Road, namely Oudebrug Street (west) and Interpace Street (east). The intersections are controlled with stops on Oudebrug and Interpace Streets. Ouderbrug is a surfaced road, but Interpace is unsurfaced. Oudepont Street, located parallel to Champagne Street, connects the two.

2.3 TOPOGRAPHY, GEOMORPHOLOGY AND VEGETATION

The rocks of Malmesbury Group form intergranular and fractured aquifers that are secondary in character and owe their water-bearing properties to both fracturing and weathering. The recharge to the aquifer at the site is expected to be limited. Borehole yields are also likely to be low. Groundwater levels at the site have also previously been recorded as shallow with measurements of depth to groundwater in boreholes located in the vicinity of the WWTW ranging between 2.9m and 5.4m. The regional direction of groundwater flow was interpreted to be in a northerly to north- westerly direction and towards the river.

Water seepage was encountered in only one trial hole during the geotechnical survey, where water ingress was observed at 1.50m. As the regional water table is expected to be at a greater depth, the origin of the water is probably seepage from a settling/evaporation pond situated 25m to the north.

Perched water conditions will occur during periods of high or prolonged rainfall, mainly during the winter months, at the interface between surface colluvial or alluvial silt and the underlying silty clay or rock horizons.

The historical vegetation types that would have covered the study area include Swartland Alluvium Fynbos (over 95% of the area) and Swartland Shale Renosterveld (remaining 5% of the land). The north-eastern portion of the site reveals a granite soil component, which indicates that Swartland Granite Renosterveld may have also occurred here.

Both Swartland Alluvium Fynbos and Swartland Shale Renosterveld are listed as critically endangered vegetation types, or ecosystems. Both ecosystems are listed due to threatened plant species associations. Swartland Shale Renosterveld has an additional rating criterion pertaining to irreversible loss of habitat.

2.4 DRAINAGE

The area has a general slope to the north, but on the site itself, the slope is toward the river. It would appear that the railway line was built within an old historic channel of the Berg River as the topography along the eastern portion of the site drops down towards the railway line.

2.5 GEOLOGY AND SOILS

The Moorreesburg Formation, Swartland Sub-Group, takes up the largest surface area within the Malmesbury Group. The Moorreesburg Formation comprises phyllitic shales; greywackes which vary in grain size and maturity, and grey-green pelites. It is overlain by the Franschoek Formation which is characterized by feldspathic conglomerate and grit horizons within light grey sericitic arenite with intermittent shale beds.

Igneous rocks in the form of Cape granites occur within the area and one, Paarl Mountain, is situated about 13 kilometres south-east of the site. These granites are intrusive into Malmesbury Group and are responsible for the metamorphism of the Malmesbury shales to phyllites.

Alluvial deposits varying in width from less than 100m to more than 1km border the river courses throughout the area. The composition of the alluvium varies from predominately sandy, where it originated from Table Mountain sandstone, to mainly clayey where Malmesbury rocks were the source.

The lithologies of associated gravels vary correspondingly. Only fine sand and silt may be present in some cases or it may alternate with beds of gravel of variable thickness. Light coloured sandy alluvial deposits border major streams such as the Berg River. Extensive boulder beds flank the Berg River at the site under investigation and represent deposits from palaeo river channels. The boulders consist of predominantly quartzitic sandstone.

2.6 CLIMATE AND HYDROLOGY

The Tygerberg Weather Measuring Station was used to calculate runoff for the Wellington Industrial Area.

3. STORMWATER QUANTITY DESIGN

3.1 CONCEPTUAL DEVELOPMENT FRAMEWORK

Two alternatives for the Site Development Proposal for Erf 34, Wellington Industrial Park was prepared by MLS Consulting Urban Designers and RTJ Consulting Town Planners and Alternative 2 was approved by the Drakenstein council in May 2017.

The proposed development will consist of an extension to the existing built up industrial site with the addition of new erven to the area. The proposal also includes for 2 additional industrial estates and Mixed used areas in the form of business parks buffering the golf course.

Gross Leasable Areas for additional proposed development areas:

Additional Industrial - 9.504ha + 73.440ha + 72.000ha = 154.944ha

Mixed Use - 17.280ha + 37.440ha = 54.720ha

See *Annexure B: Approved Site Development Masterplan*

3.2 OBJECTIVES

Urbanisation has contributed to the deterioration of urban waters in the natural water cycle. Municipal objectives have been set to control stormwater runoff quantity and quality.
For the purpose of this report, the SDP was divided into 3 catchment areas (Annexure C) of which the following were calculated:

- The 24hr extended detention of the 1 year Rainfall Intensity 24hr storm event for the proposed development
- The volume of expected 1:50 year flood in order to ensure the downstream system will be able to handle the proposed extended development

See Annexure D: Overland Stormwater Flow and

See Annexure E: Detailed Calculations

3.3 AREA 1

24 HOUR STORM

The Rational Method was used to calculate the difference or additional amount of total run-off that would occur when comparing the post development run-off to the current run-off during the 1:1 year 24 hour storm event for the catchment area. This catchment includes all proposed infrastructure on the erf. The total **additional** stormwater run-off resulting from the post developed catchment area was calculated at **3 792.2m^3** for Area 1. It is required that this volume of water to be released over a 48 hour period.

1:50 YEAR STORM

The Rational Method was used to calculate the peak flow of the post development compared to the current catchment area for a 1:50 year storm event. The peak flow resulting from the post developed catchment was calculated to be **14.87m^3/s** (14 870ℓ/s). Thus can only be accommodated in a 2 100mm diameter pipe or channel/ culvert of 1.9m X 1.9m. The current outlet culvert being 1.5m x 1.8m (see picture No 4) cannot be increased, but by adding a 900mm dia outlet pipe or added culvert of 1m x 0.8m, there would be enough capacity at the outlet to accommodate the increased run-off during such a storm event.

ATTENUATION

The size and layout of the attenuation facility was based on the following criteria:
Accommodate 3 792.2m^3 of additional stormwater run-off for 1:1 year 24hr flood. This can be accommodated in a 1m deep pond of 62m x 62m or separate ponds depending on the property layout.

3.4 AREA 2

24 HOUR STORM

The Rational Method was used to calculate the difference or additional amount of total run-off that would occur when comparing the post development run-off to the current run-off during the 1:1 year 24 hour storm event for the catchment area. This catchment includes all proposed infrastructure on the erf. The total **additional** stormwater run-off resulting from the post developed catchment area was calculated at **2 151.2m^3** for Area 2. It is required that this volume of water to be released over a 48 hour period.

1:50 YEAR STORM

The Rational Method was used to calculate the peak flow of the post development compared to the current catchment area for a 1:50 year storm event. The peak flow resulting from the post developed catchment was calculated to be **$3.86m^3/s$** (3 860ℓ/s). The contours cause Area 2 to drain into two separate directions. 35% of the runoff drains towards the west, increasing the runoff of the 1:50 year storm event for Area 1. The run off for Area 1 was calculated to be $14.87m^3/s$. Add 35% of Area 2 would and this brings the total runoff to **16.158 m^3/s.** In order for this to be accommodated, the open channel running along Champagne Street towards the river should be approximately 2m x 2m to have enough capacity.

The remaining 65% drains towards the east, where current outlet consisting of 4 x 1 200mm dia pipes would have enough capacity to accommodate the increased run-off of 2 392l/s during such a storm event.

ATTENUATION

The size and layout of the attenuation facility was based on the following criteria:

Accommodate 2 $151.2m^3$ of additional stormwater run-off for 1:1 year 24hr flood. This can be accommodated in a 1m deep pond of 46m x 46m or separate ponds depending on the property layout.

3.5 AREA 3

24 HOUR STORM

The Rational Method was used to calculate the difference or additional amount of total run-off that would occur when comparing the post development run-off to the current run-off during the 1:1 year 24 hour storm event for the catchment area. This catchment includes all proposed infrastructure on the erf. The total **additional** stormwater run-off resulting from the post developed catchment area was calculated at **5 $082.3.2m^3$** for Area 3. It is required that this volume of water to be released over a 48 hour period.

1:50 YEAR STORM

The Rational Method was used to calculate the peak flow of the current-development catchment that is the same as the pre-development. The peak flow resulting from the catchment was calculated to be **$8.95m^3/s$** (8 950ℓ/s).

ATTENUATION

The size and layout of the attenuation facility was based on the following criteria:

Accommodate 5 082.3.2m^3 of additional stormwater run-off for 1:1 year 24hr flood. This can be accommodated in a 1m deep pond of 72m x 72m or separate ponds depending on the property layout.

The calculations for Area 3 was based on the assumption that 100% of the area will be hardened even though the building lines has not been defined yet and this is dependant on the buffer zones that will be determined from the close out of the landfill sites. Building regulations are also currently being drawn up, therefore the pond dimensions suggested above will more than likely be reduced during detail design stage.

4. STORMWATER QUALITY DESIGN

4.1 OBJECTIVES

In addition to the quantity control of stormwater, the quality of the stormwater needs to be controlled. The *Management of Urban Stormwater Impacts Policy* has various Sustainable Urban Drainage System (SUDS) objectives in order to control the quality of runoff of stormwater. These objectives requires:

- 80% reduction of Total Suspended Solids (TSS) and
- 45% reduction of Total Phosphorous (TP).

4.2. PROPOSED STORMWATER INFRASTRUCTURE

The freshwater specialist has reverted with information on the discharge of stormwater into the wetlands:

- For the central draining areas: The wetland areas within the eco-corridor are seasonal wetlands and should remain as such – thus no direct discharge of stormwater into these wetlands should occur. Stormwater detention dams could however potentially be constructed within the corridor that could link to these wetland areas to form more of a feature within the corridor.
- For the northern draining portion: Some of the wetland areas incorporated into the golf course are artificial and more permanently wet thus could receive stormwater runoff. It is very likely that the golf course would be happy for the additional water

- For the southern draining areas: Much of this wetland area is more permanently wet and already receives some discharge of treated wastewater so stormwater runoff into this area, with some pre-treatment would be fine.

The stormwater run-off resulting from the Industrial section for **Area 1** of the erf will enter a piped system via catchpits and subsoil drains into the detention pond or ponds. From there it will follow the current route as per the Stormwater from the existing industrial site. This route consists of a Stormwater discharge opposite the fuel station in Champagne street within the road reserve (picture 1), an open channel on the southern side of Champagne street (picture 2) followed by a culvert (picture 3) and finally exits at a 1.5m x 1.8m culvert on the northern side of Champagne street (picture 4). From there the stormwater runs along an earth drain parallel to Champagne street towards the river (pictures 5, 6). Some stormwater is being diverted through the waterblommetjie dams on the adjacent private farmland. During the duelling of Champagne road the stormwater channel will also have to be upgraded and moved into the road reserve. This will have to be discussed with Provincial Administration during detail design. The stormwater channel is currently in the road reserve but the location can vary, partially running into privately owned farmland. If the channel cannot be incorporated into the road design, negotiations with the farm owner need to take place in order to register a servitude and to discuss the stormwater inlet into the waterblommetjie dams.

The stormwater run-off resulting from the Business Park section for **Area 2** of the erf will enter a piped system via catchpits and subsoil drains into the detention pond or ponds. 35% of Area 2 falls towards the west and ultimately runs in the road reserve, on the southern side, along Champagne street in an earth drain (pictures 7 and 8). From there the 35% of runoff from Area 2 joins the runoff from area 1 at the channel/culvert crossing Champagne road (pictures 2 and 3) then follows the same route of runoff onwards.

The remaining 65% of runoff falls towards the west and crosses Champagne street next to Stokery Road (picture 9). From there the stormwater runs along the western side of Stokery Road and makes its way towards the Berg river. Some water is being diverted into the detention ponds of the distillery as they use the water in cooling processes (pictures 10 and 11). From there it overflows again and run towards the Northern end of the Berg river (pictures 12, 13 and 14).

No pictures are currently available for Area 3. Area 3 needs to be shaped during the detail design stage as there is currently a high point causing some runoff towards the railway line. Some earthworks will shape the site to fall towards to river. Stormwater run-off resulting from the Industrial section for **Area 3** of the erf will enter a piped system via catchpits and subsoil drains into the detention pond or ponds. Water will be discharged at the detention pond and run towards the Berg river in grassed or earth drains.

4.3. TOTAL SUSPENDED SOLIDS (TSS)

The Georgia manual must be used during detail design as a guideline to determine the percentage reduction in TSS, using the proposed stormwater controls. Even though the Georgia manual is designed for a non South African area, it was noted that as long as the characteristics of the structural control that are specified are met, the quality control will be acceptable.

The use of ponds for Areas 1, 2 and 3 together with the open grass channel as structural controls for this site should meet the Stormwater Policy SUDS objective, which state that the total suspended solids of stormwater run-off must be reduced by 80% before the run-off enters the municipal stormwater drainage system or in this case into the river. The use of detention pond and grass channel as structural controls should satisfy this TSS removal requirement. *The Georgia Manual's Stormwater Quality Site Development Review Tool* must be used to determine the TSS reduction during detail design.

4.4 TOTAL PHOSPHORUS (TP)

The Stormwater Policy SUDS objective states that the total phosphorus (TP) present in the stormwater run-off must be reduced by 45% before the run-off enters the municipal stormwater system. During final design the *Georgia Manual's Stormwater Quality Site Development Review Tool* must be used to determine the TP reduction per Release area.

5. MAINTENANCE OF STORMWATER INFRASTRUCTURE

In order for the proposed stormwater infrastructure to function efficiently constant maintenance will be required. A recommended Maintenance Schedule should be implemented by the proposed developments' Body Corporate for the recommended ponds at each area of the Development.

6. CONCLUSIONS AND RECOMMENDATIONS

Stormwater run-off from the catchment area will be accommodated with the proposed stormwater infrastructure. The capacity and out flows of the new pond will reduce peak flows from the site, therefore providing necessary protection to downstream infrastructure. The quality of the stormwater runoff will be controlled by the pond and stormwater channels.

See Annexure D for the proposed Overland Stormwater Flow

We are therefore of the opinion that development on this site will not adversely affect downstream infrastructure and properties, if the proposed stormwater infrastructure is implemented and maintained.

Yours faithfully

Sonet Gerber
Pr. Tech Eng

REFERENCES:

- The *City of Cape Town's Management of Urban Storm water Impacts Policy*
- *The Georgia Stormwater Management Manual*
- *The South African National Roads Agency Limited. (2006). Drainage Manual Fully Revised 5^{th} Edition*
- *Adamson P.T. (1983). Technical Report TR 102. Southern African Storm Rainfall*
- *Strategic Environmental Assessment for the Extension of Wellington Industrial Precinct. Compiled by Worley Parsons RSA (Pty) Ltd for Drakenstein Municipality. September 2014*