EON Consulting

R21 Bulk Water Supply Pipeline: Construction Storm Water Management Plan

Ekurhuleni Metropolitan Municipality

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1. Introduction

Eon Consulting was appointed by the Ekurhuleni Metropolitan Municipality (EMM) for the Water Use Licence Application (WULA) for a new licence application in accordance with the National Water Act, Act No 36 of 1998, as amended. The water use licence is for a bulk water supply pipeline traversing a wetland in the area of 9th Street, Bredell, Kempton Park. The pipeline will be constructed using trenchless technology (horizontl drilling) in the water course.

The applicant has a current WUL (Water Use Licence) for the larger part of the project and the license was issued as per license no: 03/A21A/C1/2174 with file no: 16/2/7/A210/D13 dated 22/02/2013. The Department of Water and Sanitations (DWS) indicated during a site meeting on 19 February 2015 that an application for a new WUL is necessary for this specific crossing as it was not covered in the aforementioned WULA.

This Constructon Storm Water Management Plan (CSWMP) has been requested by the DWS as part of the new application that has been submitted for the WULA. This CSWMP will form part of the Environmental Management Programme (EMPr) that will be used by the contractor on site namely Qubekela Projects cc, as a guiding document during the construction of the pipeline.

2. Project Background

An Environmental Authorisation (EA) was granted by the Gauteng Department of Agriculture and Rural Development (GDARD) under the referecence GAUT: 002/09-10/N0294 dated 10 Novemeber 2010. This EA was for the construction of a water supply system for the R21 corridor and surrounding areas which including a 22 Mega L bulk storage reservoir and booster pump station to supply water to the pump station zone, bulk water supply line to the reservoir ans bulk water supply network from the reservoir to the Witfontein and Glen Erasmia Township as well as the booster pump station and reservoir will be located along First Road.

This water use application is in response to an amendment to the original EA (GAUT: 002/15-16/E0087) approved of the addition of 30m hugh 2ml pressure tower and the alignment of the line from the pump station to the pressure tower and the area west of the R21 with additon of a 710mm pipleine from the Randwater Connenction to the reservoir.

2.1. Locality Map

As per **Figure 1** below, the study area is located approximated 4km east of the Glen Marais surburb and 3km north-east of the Bredell surburb.

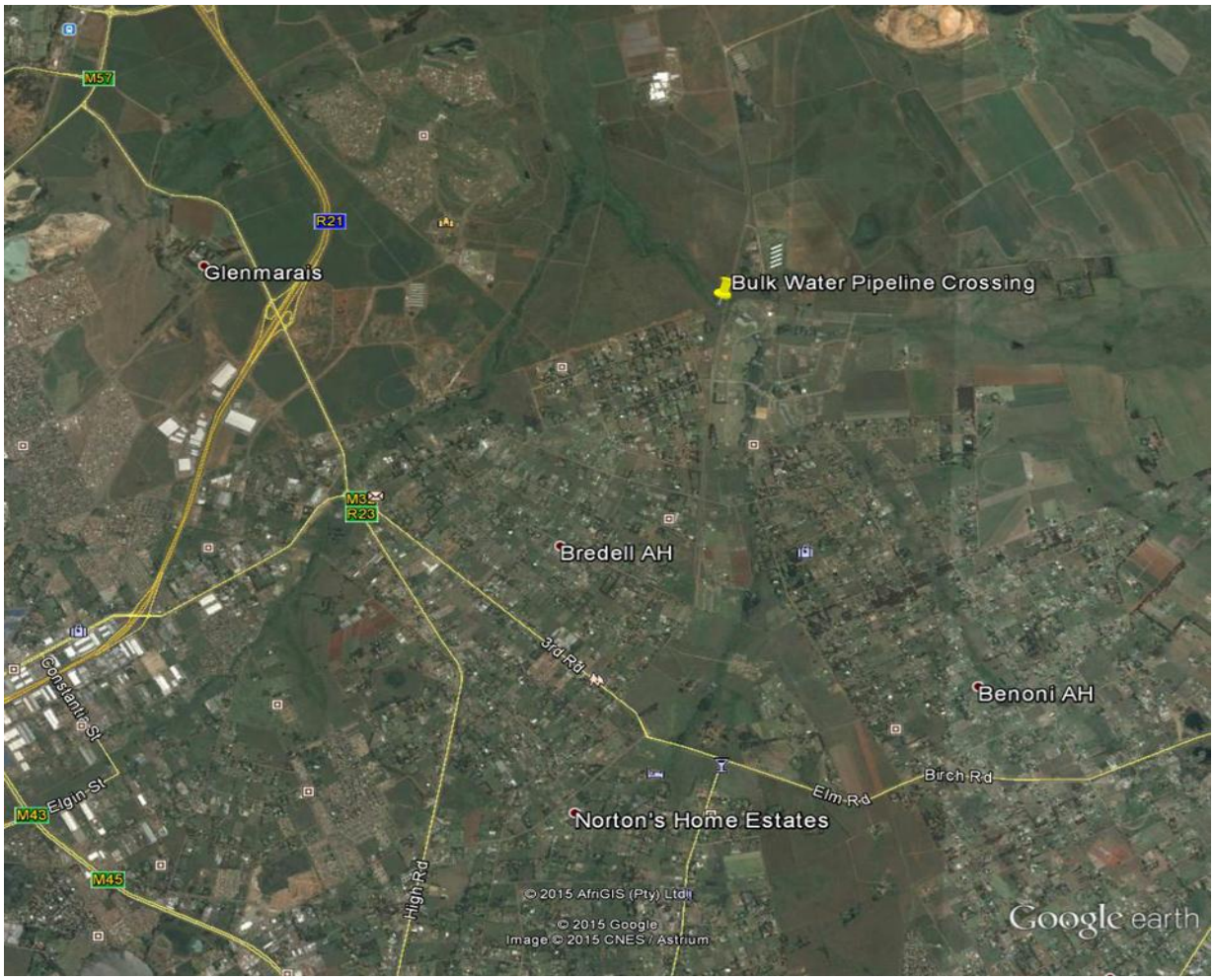

Figure 1: Project Locality Map

The main concerns are that the development activities will be done in close proximity to a wetland area, and due to the length of the drilling, this task will be there for a certain length of time. The wetland is situated in a somewhat urbanised area characterised by increased surface hardening which results in increased runoff. In addition, the wetland is traversed by tar roads as well, which contribute to increase water input within the wetland.

Based on the National Freshwater Ecosystems Priority Areas (NFEPA) database, there is the presence of one river, traversing the study area, namely the Rietvlei. The river is classified as a PES Class C and its condition is categorised as D. The Rietvlei River is not a flagship river. According to the NFEPA database the wetland is classified as a channel bottom wetland. The construction area is not very steep, but has a gentle gradient towards the lowest point in the wetland (Refer to Figure 2).

Figure 2: Digital satellite image depicting the location of the study area in relation to surrounding areas

3. Construction Storm Water Management Plan objectives

The objectives of this CSWMP is to define and illustrate the manner in which Qubekela Projects cc, should implement the controls and mitigation procedures indicated in this plan.

The objectives of the CSWMP are as follows:

- Ensure compliance with legislative requirements from a surface water perspective;
- Manage the concentrated flow to prevent downstream erosion and the impact on surface water quality;
- Manage water quality (prevent sediment load and potential hydrocarbon pollution from entering water course); and
- Implement mitigation measures to minimise potential impacts.

4. Storm Water Management Plan objectives

The objectives of the storm water management plan are to:

- Ensure compliance with legislative requirements from a surface water perspective
- Manage the concentrated flow to prevent downstream erosion and the impact on surface water quality
- Manage water quality (prevent sediment load and potential hydrocarbon pollution from entering water courses)
- Implement mitigation measures to minimise potential impacts.

5. Stormwater Management Principles

1. Storm water should not be allowed to be concentrated or to flow down cut or fill slopes or along the pipeline route without erosion protection measures.
2. Line overflow and scour channels with stone pitching along their length and at their points of discharge must be present to prevent erosion. The point of discharge must be at a point where there is dense natural grass cover. This area must have a minimum of 90% grass coverage at a minimum height of 150 mm.
3. Channels must not discharge straight down contours. They must be aligned at such angles to the contours that they have the least possible gradient.
4. Any point of overland discharge must be located at least 50 m away from any water course.
5. In general, at steep slopes or where soil is dispersive or sandy, it must be stabilised. The following methods are advised:

    5.1. Topsoil covered with a geotextile plus a seeded grass mixture for rehabilitation purposes
    5.2. Benches formed by sand bags
    5.3. Ripping and/or scarifying along the contours to promote ground water infiltration
    5.4. Storm water berms: earth or rock-pack cut-off berms.

6. The disturbance of steep slopes, for example by removing vegetation, may result in slope instability and erosion. All slopes that are disturbed during construction shall immediately be stabilised to prevent erosion. Storm water runoff from the stockpile sites (additional backfilling materials and stored topsoil) and surrounding areas shall not run freely into the surrounding environment, or create “ponding” or accumulation of water. Stockpiles shall be stabilised if signs of erosion are visible. Erosion control measures such as silt fences must be placed around the stockpiles.
7. Runoff from the site itself shall be free from oil, waste and litter. This shall be ensured by securing any hazardous substance containers in order to prevent runoff and by cleaning up any refuse and construction material from the site on a regular basis.
8. High-risk works must be scheduled for a drier time of year.
9. Silt fences are temporary, permeable barriers of geotextile installed in a trench and supported by star pickets or wooden posts. Silt fences should only be used in areas of sheet flow. They are not suitable for use in concentrated flow. They are most effective in removing coarse particulates from runoff, however they have no filtering capacity of fine or dispersive soils. A silt fence may be thought of as a leaky dam. Sediment is treated in two ways:

    9.1. The velocity of runoff is slowed to a point at which it no longer has sufficient energy to hold particles in suspension. This is achieved through a damming of runoff behind the silt fence. When the runoff no longer has energy to hold particles in suspension, the particles are able to drop out of the water column by gravity. This is how the majority of sediment is removed by a silt fence.
    9.2. Some filtration also occurs as runoff passes through the silt fence.

10. Silt fences should be inspected regularly to ensure that:

    10.1. Runoff is not passing under or around the fence (if installed properly this shouldn't be a problem)
    10.2. The silt fence hasn't been knocked over as a result of runoff flows or wind
    10.3. The silt fence hasn't detached from posts
    10.4. No damage has occurred as a result of works on site or due to interference by members of the public.

11. Silt fences require de-silting (removal of collected sediment) when sediment has built up to 1/3 the height of the measure, or when the built up sediment is preventing the silt fence from working effectively. This generally requires the silt to be shovelled out from behind the fence and deposited in a stabilized area of the site away from runoff flows. It shouldn't be placed up-slope or next to the silt fence where it will be washed straight back into the silt fence. It also shouldn't be placed down-slope of the silt fence.
12. A sediment basin/settlement pond is designed to slow down the velocity of runoff as it ponds in the sediment basin. The velocity is decreased to a state where sediment drops out of the water column by gravity. This system will be necessary on sites with fine or dispersive soil, where other sediment retention devices are not capable of capturing the sediment.
13. Stockpiles must not be located next to watercourses or wetlands. It is also advisable not to locate a stockpile beneath the drip line of vegetation.
14. Surface water flows must be captured through a series of drainage ditches to prevent water entering excavations or eroding exposed surfaces. The flows must be controlled with settlement ponds, sediment traps and other hydraulic features to reduce water velocity (thereby reducing erosive power) as well as maximise infiltration and evaporation and to remove as much sediment as possible.
15. The level of silt in runoff during construction shall be regularly monitored and if it is excessive in any area, this can be managed by providing straw bales locally around the problem areas. These will filter the runoff and trap silt.
16. Silt runoff from stockpiles and excavated spoil heaps can be contained through the placement of geotextile silt fences, mats or straw bales on the downhill side of the stockpile. Stockpiles will be covered with plastic sheeting or geotextile materials to prevent erosion through heavy rainfall.
17. All settlement ponds must be regularly inspected and maintained to ensure their effectiveness. All excess silts will be removed and disposed of within site earthworks.

5.1. Emergency measures

Any erosion that occurs during a heavy rainfall event shall be remedied at the expense of the project budget. This shall include clean-up of the silt deposited and filling up of erosion channels that may form. Any runnels or erosion channels developed during construction or during the defects liability period shall be backfilled and compacted.

5.2. Dewatering of channels

Storm water ingress and/or ground water ingress into excavated channels must be dewatered in line with the principles stated in Section 5. Dewatering from channels will require de-sedimentation as water pumped from excavated areas contain high levels of silt.

5.3. Rehabilitation (revegetation) of exposed areas

The Contractor shall ensure that the clearance of vegetation is restricted to that required to facilitate the execution of the works. Site clearance shall occur in a planned manner, and cleared areas shall be stabilised as soon as possible. All impacted areas shall be rehabilitated (soil loosened and re-vegetated) once work has been completed and prior to leaving the site. On steep areas, the geotextiles should be applied to ensure the stability of the revegetated area.

5.4. Wetland protection

The wetland area will be barricaded off to avoid any vehicular movement leading to soil compaction or other forms of potential damage that would expose the wetlands to storm water erosion or silting.

Sheets supported by wooden poles must enclose the exposed/excavated soil. These will trap loose soil and minimise the effect of storm water washing silt into the wetland.

5.5. Entry and exit points onto tarred roads

Construction vehicles entering and exiting the construction area from tarred roads could convey and deposit mud on the road, which will be washed into the storm water system during rain events and lead to siltation of water bodies.

It is advisable to place gravel on the entry/exit point of the construction site in order to reduce the amount of mud/soil clinging to tyres.

Should soil be deposited on the tar road at the entry/exit points, it should be cleaned up on a daily basis.

6. Storm water management plan implementation

6.1. Phase 1: Planning

Before construction commences the Resident Engineer (RE) and Environmental Control officer (ECO) should inspect the construction area in order to:

1. Identify areas that are to be fenced off to prevent vehicle access
2. Identify steep slope areas susceptible to erosion
3. Identify areas susceptible to sediment generation and runoff
4. Identify areas to install settling ponds and storm water and channel dewatering points
5. Identify areas to place top soil stock piles
6. Identify areas requiring silt fences
7. Identify areas requiring storm water berms
8. Identify areas requiring storm water cut-off drains
9. Identify sources of potential storm water pollution (such as fuel storage areas etc.) and compile storm water management measures to prevent storm water contamination and storm water entering storage areas.

6.2. Phase 2: Implementation

The RE must implement the required measures as identified during Phase 1. The ECO must check the effectiveness of the measures before allowing construction to proceed

6.3. Phase 3: Control during construction

During construction, the ECO must inspect the storm water control measures to ensure their effectives.

The RE must assign responsibility to a construction staff member to do daily inspections of silt fencing, siltation levels in sediment ponds, etc.

During an extreme rainfall event, the RE and ECO must inspect the site to identify problems and implement emergency measures.

6.4. Phase 4: Inspection after rehabilitation

On conclusion of construction (portion by portion) rehabilitation measures must be implemented, which include:

- Ripping of compacted areas
- Reseeding/revegetation
- Placing of storm water berms to prevent erosion during the establishment of vegetation.

The ECO must sign off the rehabilitation measures

6.5. Phase 5: On-going monitoring of rehabilitated areas

After severe rainfall, the rehabilitated areas must be inspected to ensure that they remain stable.

Regular monthly inspections must be carried out during the rainy season and three-monthly during the dry season. Post rehabilitation inspections must be carried until the revegetated areas have been securely established.

	Storm water Quality Management – Construction Phase
Purpose	To provide site management procedures to control the severity and extent of soil erosion and pollutant transport during the earthworks and construction phase.
Performance criteria	Water discharged from the site must have no detrimental impacts on water quality and the environment during the construction phase. The quality of discharge from the site must comply with the following: • No increase in suspended solids within surface waters downstream of the construction site. • Suspended solids released from controlled sediment basin outflows must be no greater than 20 mg/L (as per the criteria of the general authorisation) • Oils and grease – no visible films or odour • Litter – no visible litter washed from the site.
Responsibility	The Construction Contractor will be responsible for the implementation of the storm water management plan (SWMP) during the course of all construction activities.
Implementation strategy	General site litter must be cleaned up on a weekly basis, prior to anticipated heavy rainfall and after significant rainfall events. Landscaping activities and revegetation must occur as soon as practical after completion of earthworks and construction activities within the immediate area, and must achieve a minimum 70% coverage of all erodible surfaces. Only appropriate fertilisers should be used. The storage and handling of flammable and combustible liquids is managed in accordance with relevant SANS codes. A detailed erosion and sediment control plan (ESCP) must be submitted to, and approved by the ECO prior to site establishment and commencement of vegetation clearing or soil disturbance within each subdivision stage.
Monitoring	Erosion and sediment control (ESC) measures must be inspected daily by the site manager (or nominated representative) during periods of runoff-producing rainfall, and desilted, repaired and amended as appropriate to maintain the water quality standards. a) **Daily site inspections**, during periods of runoff-producing rainfall must include: • All drainage, erosion and sediment control measures • Occurrences of excessive sediment deposition (whether on-site or off-site) • All site discharge points. b) **Weekly site inspections** must include: • All drainage, erosion and sediment control measures • Occurrences of excessive sediment deposition (whether on-site or off-site) • Occurrences of construction materials, litter or sediment placed, deposited, washed or blown from the site, including deposition by vehicular movements • Litter and waste receptors • Oil, fuel and chemical storage facilities.

	Storm water Quality Management – Construction Phase
	c) Site inspections immediately prior to anticipated runoff-producing rainfall must include: • All drainage, flow diversion, erosion and sediment control measures; d) Site inspections immediately following runoff-producing **rainfall** must include: • De-watering points of sediment ponds • Sediment deposition within sediment ponds and the need for its removal • All drainage, erosion and sediment control measures • Occurrences of excessive sediment deposition (whether on-site or off-site) • Occurrences of construction materials, litter or sediment placed, deposited, washed or blown from the site, including deposition by vehicular movements • Occurrences of excessive erosion, sedimentation, or mud generation around the site. e) In addition to the above, **monthly site inspections** must include: • Surface coverage of finished surfaces (both area and percentage cover) • Health of recently established vegetation • Required future site clearing, earthworks and site/soil stabilisation.
Auditing	The ECO must carry out ESCP reviews on a monthly basis.
Corrective action	After any identification of incident or failure, the source/cause must be located immediately and the following measures implemented: • Build-up of sediment off the site – the material must be collected and disposed of in a manner that will not cause ongoing environmental nuisance or harm; then on-site ESC measures amended, where appropriate, to reduce the risk of further sedimentation. • Excessive sediment build-up on the site – collect and dispose of material, then amend up-slope drainage and/or erosion control measures as appropriate to reduce further occurrence. • Severe or excessive rill erosion – investigate cause, control up-slope water movement, re-profile surface, cover dispersive soils with a minimum 100 mm layer of non-dispersive soil, and stabilise with erosion control blankets and vegetation as necessary. • Off-stream erosion – fill rills, vegetate and install velocity control measures. • In-stream erosion – consult an appropriate hydraulic/waterway consultant for advice. • Poor vegetation growth or soil coverage – plant new vegetation and/or mulch as required. Newly planted and previously planted areas may require supplementary watering and replanting. • Silt fence failure – replace and monitor more frequently. Regular failures may mean that the sediment fence location, alignment or installation may need to be amended.
Reporting	The ECO will submit monthly reports during the construction to the Competent Authority.

Table 1: Storm Water Quality Management during the construction phase

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