

# REPORT

## **Stormwater Management Plan**

### Culvert Replacements

Client: KwaZulu-Natal Department of Transport

Reference: T&PN/AR001F0.1

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## **1 INTRODUCTION & OBJECTIVE**

The primary objective of the report is to outline the stormwater management plan for culvert replacements for road rehabilitation projects. The objectives include the following:

- Protecting all life and property from damages by floods and stormwater;
- Protecting the water resources in the catchment areas from pollution and siltation;
- Protecting and enhancing the watercourses locally and downstream;
- Conserving the natural flora and fauna in the environment; and
- Preventing soil erosion by wind and water.

This report has been prepared to provide details of the generic analysis to ensure that adequate drainage measures are implemented to promote the dissipation of stormwater run-off, during and after construction.

### **1.1 Environmental Concern**

Poor stormwater management can result in stormwater becoming contaminated. This can also result in flooding, erosion and damage to the environment and public property. Soil erosion through poor stormwater management can result in loss of valuable topsoil, damage to public property through slope destabilization, collapsing of banks and in extreme cases, mudslides.

Erosion can also result in silt depositions in watercourses and wetlands adding to the existing silt problem. Exposed soils are vulnerable to erosion by wind and water. Soil erosion is more likely to occur in summer months due to higher rainfall and temperatures causing shrinkage and collapse of soils.

Soils are particularly vulnerable to erosion during construction as they are exposed to the elements while changes in surface runoff patterns due to construction activities.

## **2 METHODOLOGY**

The main aim of the proposed stormwater system is to conserve the natural drainage system around the road alignment.

The existing stormwater system consists of natural water ways, including streams, and seasonal wetlands. The system includes existing devices constructed to control the stormwater. The existing has drainage structures that forms part of this stormwater system.

The management of stormwater runoff has been planned to militate against the effects of increased water runoff from hardened areas and to control the movement of sand and silt.

Roads and associated embankments have been designed to ensure free surface drainage.

The proposed stormwater system will be dependent on factors such as the topography (natural and artificial slopes), the zoning of the site and the natural soil conditions.

Silt and trash traps will need to be provided within the stormwater system to ensure that the water quality is not compromised. Open ditches, drains and channels should be used instead of pipes, where conditions permit. To prevent erosion of the channels, where the flow velocities are high, an appropriate lining should be provided to protect these channels. Types of lining include natural vegetation, stone pitching and reinforced concrete linings.

The proposed road rehabilitation should not adversely impact the environment within its footprint and the surrounding areas by means of erosion and sediment deposition. The frequency of flooding and the runoff volume will increase unless adequate provisions are made to maintain the current natural rate of stormwater attenuation and infiltration in the catchment areas.

The proposed storm water system will have mitigation measures against road drainage and also cross drainage, with the aim of eliminating blockage and to reduce erosion. Stone pitching and gabion structures have been designed in such a way that water velocities are reduced as much as possible.

## 2.1 Stormwater Design Philosophy

The design methodology used for the stormwater is in accordance with The South African National Roads Agency SOC Limited (SANRAL) Drainage Manual 6th Edition. The stormwater design also complies with the KZN: DOT Standard Specifications, KZN: DOT Drainage manual and KZN: DOT standard drawings.

## 3 STORMWATER MANAGEMENT

Stormwater management encourages the engineer and contractor to conduct the following aspects:

- i. Maintaining adequate ground cover at all times and in all areas to negate erosion caused by wind, water and vehicular traffic:
  - Preventing the concentration of stormwater runoff where the soil is susceptible to erosion;
  - Adding devices to reduce the stormwater flows to acceptable levels;
  - Ensuring that the development does not increase the stormwater flow above that of which the natural ground can safely accommodate;
  - Ensuring that the construction of the stormwater devices is carried out in safe and aesthetic manner;
  - Preventing pollution of water ways and water features;
  - Containing soil erosion during construction; and
  - Avoiding conditions where the embankments may become saturated and unstable.
- ii. Poor stormwater management can result in the stormwater becoming contaminated and can also result in erosion, pollution and flooding. These issues are discussed further in following sub items.

### 3.1 Environmental Management & Mitigation Measures

#### 3.1.1 Erosion control

Suitable erosion control measures shall be implemented at stormwater discharge points, exposed areas and high embankments. These measures may include the following options:

- Sand bags on trenches (trench breakers);
- Bunds or grips adjacent to watercourses;
- Technologies similar to Soil Saver on embankments;
- Planting of indigenous vegetation on embankments;
- Minimise clearing and grubbing to necessary sections within the road reserve; and
- Over-wetting, saturation and unnecessary runoff during dust control, curing and irrigation activities will be avoided.

Sandbag berms will be placed at regular intervals on all steep slopes and on the trench line before and after backfilling in order to minimise erosion and the discharge of contaminated storm water runoff into water courses.

If there is a scour risk or risks that potholes may form on the existing roads, it can be managed by using suitable gravel to temporarily repair the scouring or potholes.

### **3.1.2 Pollution**

Pollution and or contamination of the surface water and stormwater must be well controlled. This can be achieved by managing activities such as:

- Mixing concrete on wooden boards in a plastic lined and leak-proof area;
- Removing all surplus material from the watercourse;
- Reducing spills of hazardous substances (e.g. Fuel);
- Opening of frequent chutes on long steep grades with unlined drains;
- Ensuring that banks are re-vegetated as soon as construction work is completed;
- Avoid water contamination by construction as well as general traffic; and
- Containing the first-flush runoff, collectively or individually.

The stormwater system must be maintained to remove and reduce debris that may pose any pollution risk.

### **3.1.3 Flooding**

The proposed culvert replacement will not increase the stormwater runoff significantly as it is existing roads that are being rehabilitated. Adequate attenuation of flood runoff will be provided as the latter may possibly increase downstream flood damage.

The design of the stormwater system addresses the above issues and was designed as such that the post-development flood risks are not greater than the pre-development flood risks.

## **4 CONCLUSION**

The contractor shall prepare a stormwater control plan that will ensure that all construction methods adopted on site do not cause, or precipitate, soil erosion. The contractor shall take adequate steps to ensure that the requirements of the stormwater management plan are met before, during and after construction. The contractor shall ensure that no construction activity commences before the stormwater control measures are in place and approved by the engineer on site.