# STORMWATER MANAGEMENT PLAN

## 1. PURPOSE

It is understood that activities associated with developments can impact negatively on drainage systems. By taking greater cognisance of natural hydrological patterns and processes it is possible to develop stormwater management systems in a manner that reduces these potentially negative impacts and mimic nature. The main risks associated with inappropriate stormwater management are increased erosion risk and risks associated with flooding.

This Stormwater Management Plan addresses the management of stormwater runoff from the development site and significant impacts relating to resultant impacts such as soil erosion and downstream sedimentation. The main factors influencing the planning of storm water management measures and infrastructure are:

» Topography and slope gradients;
» Placing of infrastructure and infrastructure design;
» Annual average rainfall;and
» Rainfall intensities;

The objective of the plan is therefore to provide measures to address runoff from disturbed and hardened portions of the site, such that they:

» Do not result in concentrated flows into natural watercourses, i.e. provision should be made for temporary or permanent measures that allow for attenuation, control of velocities and capturing of sediment upstream of natural watercourses.
» Do not result in any necessity for concrete or other lining of natural watercourses to protect them from concentrated flows off the development site if not necessary.
» Do not divert flows out of their natural flow pathways, thus depriving downstream watercourses of water.

This Stormwater Management Plan must be supplemented by a Stormwater Control Method Statement and design approved by the IDZ or municipality (as appropriate) prior to commencing with construction. This statement and design must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion.

## 2. STORMWATER MANAGEMENT PRINCIPLES

In the design phase, various stormwater management principles should be considered including:

- Prevent concentration of stormwater flow at any point where the ground is susceptible to erosion.
- Ensure compliance with all applicable regulations.
- Prevent off-site migration of contaminated storm water or increased soil erosion.
- Include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows.
- Promote the dissipation of storm water run-off through appropriate drainage measures.
- Reduce stormwater flows as far as possible by the effective use of attenuating devices (such as swales, berms, silt fences). As construction progresses, the stormwater control measures are to be monitored and adjusted to ensure complete erosion and pollution control at all times.
- Minimise the area of exposure of bare soils to minimse the erosive forces of wind, water and all forms of traffic.
- Ensure that development does not increase the rate of stormwater flow above that which the natural ground can safely accommodate at any point in the sub-catchments.
- Ensure that all stormwater control works are constructed in a safe and aesthetic manner in keeping with the overall development.
- Plan and construct stormwater management systems to remove contaminants before they pollute surface waters or groundwater resources. Implement the principle of separating clean and dirty run-off streams (typically from bunded areas or those areas associated with hydrocarbon storage or the facility substation).
- Contain soil erosion, whether induced by wind or water forces, by constructing protective works to trap sediment at appropriate locations. This applies particularly during construction.
- Avoid situations where natural or artificial slopes may become saturated and unstable, both during and after the construction process.
- Design and construct roads to avoid concentration of flow along and off the road. Where flow concentration is unavoidable, measures to incorporate the road into the pre-development stormwater flow should not exceed the capacity of the culvert. To assist with the stormwater run-off, gravel roads should typically be graded and shaped with a 2-3% crossfall back into the slope, allowing stormwater to be channelled in a controlled manor towards the natural drainage lines and to assist with any sheet flow on the site.
- Design culvert inlet structures to ensure that the capacity of the culvert does not exceed the pre-development stormwater flow at that point. Provide detention storage on the road and/or upstream of the stormwater culvert.
- Design outlet culvert structures to dissipate flow energy. Any unlined downstream channel must be adequately protected against soil erosion.
- Where the construction of a building causes a change in the vegetative cover of the site that might result in soil erosion, the risk of soil erosion by stormwater must be minimised by the provision of appropriate artificial soil stabilisation mechanisms or

revegetation of the area. Any inlet to a piped system should be fitted with a screen, or grating to prevent debris and refuse from entering the stormwater system.

» Preferably all drainage channels on site and contained within the larger area of the property (i.e. including buffer zone) should remain in the natural state so that the existing hydrology is not disturbed.

## 3.1. Engineering Specifications

This Stormwater Management Plan must be supplemented by a Stormwater Control Method Statement and design approved by the IDZ or municipality (as appropriate) prior to commencing with construction. This method statement and plan must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion, and illustrate the proposed stormwater control measures as prepared by the Civil Engineers and should be based on the underlying principles of this Stormwater Management Plan as well as any surface water flow modelling studies or geotechnical studies conducted. The following should be incorporated into the design/layout plan:

» Erosion control measures to be implemented before and during the construction and operational phases, including the final stormwater control measures (post construction).
» All temporary and permanent water management structures or stabilisation methods must be indicated.
» The drainage system for the site should be designed to specifications that can adequately deal with a 1:50 year intensity rainfall event or more to ensure sufficient capacity for carrying storm waters around and away from infrastructure.
» Procedures for stormwater flow through a project site need to take into consideration both normal operating practice and special circumstances. Special circumstances in this case typically include severe rainfall events.
» An on-site Engineer or Environmental Officer must be responsible for ensuring implementation of the erosion control measures on site during the construction period.
» The EPC Contractor holds ultimate responsibility for remedial action in the event that the approved stormwater plan is not correctly or appropriately implemented and damage to the environment is caused.

During the construction phase, the contractor must prepare a Stormwater Control Method Statement to ensure that all construction methods adopted on site do not cause, or precipitate soil erosion and shall take adequate steps to ensure that the requirements of this Stormwater Management Plan are met before, during and after construction. The designated responsible person on site, must be indicated in the Stormwater Control Method Statement and shall ensure that no construction work takes place before the relevant stormwater control measures are in place.

An operation phase Stormwater Control Method Statement should also be designed and implemented by the Civil Engineers and appropriate construction staff (as applicable) prior to the operational phase commencing, if not already suitably addressed by the mitigations implemented as part of construction Stormwater Control Method Statement, with a view to preventing the passage of concentrated flows off hardened surfaces and onto natural areas. This method statement should similarly ensure the following aspects are addressed:

» Ensure the statement complies with all applicable regulations.
» Prevent off-site migration of contaminated storm water or increased soil erosion.
» As applicable, to include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows.
» Promote the dissipation of storm water run-off through appropriate drainage measures.