



**STORMWATER MANAGEMENT
PROTOCOLS
&
RECOMMENDATIONS**

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STORMWATER MANAGEMENT PROTOCOLS

It is a requirement of the development that all construction activities within the estate comply with the Environmental Management Plan (EMP) and thus the contractor is to take cognizance of all aspects of the EMP whilst performing his construction activities. This document is supplementary to the EMP and the control measures set out herein are not to be considered all encompassing as the contractor will also have to adapt his control measures to the onsite conditions.

All Stormwater must be controlled on site. The following acts as a guideline only and the responsibility remains with the owner of each site to ensure that all controls are put into place to control washaways during the construction process.

All stormwater control plans must have details regarding the "During Construction" management of storm water on site. All specifications must be noted in detail and sketch form. The implementation and the ongoing management of these controls will be monitored by ZREHOA. Penalties will be incurred where these have not been constructed according to the detailed plan issued by the engineers, causing any damages to neighboring properties.

1. During Construction Stormwater Controls :

The site is sloping and the sands are erodable and thus adequate controls to reduce stormwater run-off velocities and potential erosion damage are to be implemented and kept in place throughout the construction phase and the contractor must ensure that all control measures are continually maintained in good effective working order. Prior to any machine moving on site adequate rows of stormwater flow reduction check berms i.e. silt fencing and/or sand bagging must be erected to protect the site.

A screen attached to bonnox fencing must be erected on top of the banks immediately after platforms and final cuts are established and confine only the workable area needed by the contractor. All areas outside the screen attached to bonnox fencing are to be planted to final specifications where possible. The top 50mm of soil, (or as specified by the engineer) must be stripped and stock piled on one side of the site. This is to be spread over all banks on the exterior of the site once the perimeter shade cloth fencing has been erected.

As soon as the fencing has been erected, the builder is to install all sandbagging and other controls (i.e. silt fencing, strip sodding, earthberms, etc) required "During Construction."

All stormwater controls must be in accordance with the Stormwater Management plan approved by ZREDRC. Where necessary and/or under instruction from ZREDRC, additional controls must be implemented immediately.

All silt traps, berms, agricultural trenches, drains, roads, etc must be maintained immediately after any damage is done (within 24 hours).

All areas that incur damage during rain storms are to be rehabilitated as soon as the area in question has dried out sufficiently to allow work to take place. All remedial fill is to be adequately benched into the existing soil mass and compacted to 95% Mod AASHTO.

All stormwater channeled off the site must be directed in such a manner as not to cause damage to common / neighboring grounds.

The permanent stormwater control reticulation should be installed as early as possible in the construction phase. Any stormwater directed into the estate system in the development must have controls in place to trap any sediment from getting into the estate stormwater system. Where applicable this can be achieved by forcing runoff through a succession of silt catches e.g. Silt fences. All precaution must be taken to ensure sediment / run-off does not end up in estate common ground, neighboring properties, dams, ponds or wetlands.

It is essential that all completed embankments and large open areas are topsoiled and planted with vegetation as soon as practical on completion. **In this instance, the banks are to be shaped as required by the Client and then handed over to the landscape contractor to carry out the planting. It is recommended that a full coverage of sods staked to the embankment is used.**

The contractor is to take note of vulnerable points after all precipitation and reinforce the stormwater control measures in these areas.

At the end of each working day the access route onto the site must be protected by sandbagging, to prevent the flow of stormwater and silt onto or off the site.

2. **Permanent Stormwater Controls (post construction completion) :**

The permanent stormwater control measures must be in compliance to the Approved Engineers Stormwater Management Plan for permanent Stormwater Management. All sites are to ensure that stormwater is directed into either approved soakaways or where available into the estate stormwater network.

Where tying into the existing estate stormwater network, the builder is to obtain the approval of the ZREHOA prior to commencing with the installation.

Open channels must be designed to contain all run-off on site. No stormwater is to be channeled onto a neighboring property.

All terraces and open areas must be shaped to ensure that there are no localized low spots where water can concentrate and cause damage.

All temporary stormwater controls should be kept in place until such time as they are made redundant by the final constructed features and/or until such time that the vegetation has established itself to an extent where the soil is bound in matrix. **The building contractor must maintain the measures during his construction process.**

The reticulation must be maintained in a clear open state to allow run-off to flow unhindered. All vegetation is to be maintained in such a manner that stormwater entrances do not become over grown and blocked. Grass cuttings are to be removed from the site to prevent them entering the pipes.

Stormwater Control Recommendations

- 1) Control : **Silt Fencing**
Installation : The fence must be a total of at least 450mm in height (300mm above ground, 150mm buried to decrease the risk of undermining).
These must be erected as a three-row sieving method. Each row of fencing must be at most 1.5mm apart.
Poles at 1m intervals are to be tied to the fences in order to keep it upright
All care must be taken to ensure that silt movement does not run around this fence. Wing walls of this fence must be created, alternatively sandbags wing walls (see # 5) may be used to control and attenuate the water through the silt fence.
Uses : Trap sediment whilst in movement
To break the force of the water movement and decrease its weight
Composition : Biddum, 80% Shade cloth, Grass Mat ®
Management : These must be cleaned of sediment and checked for damages regularly. An excessive build-up of silt against this fence will force too much weight upon it and cause it to collapse. Additionally, weak points or damages will allow silt to flow through without being sieved and thus render the control obsolete.

- 2) Control : **Instant Lawn**
Installation : This can be used as either full instant lawn or strip sods. Instant lawn can be costly and unless stipulated on the Final Landscape Plan, cannot be used as a permanent planting

solution. Strip sods must be placed at most 1.5m apart in order for this to be effective. These must be pegged if used on steep embankments and require soil preparation (i.e. compost) and frequent watering in order to grow.

Uses : For use on steep banks, used in conjunction with the final landscape planting, will decrease the risk of sheet movement on steep banks.

Composition : Must be a ZREHOA Approved Grass.

Management : Requires lots of water. Soil displacement over grass sods will result in the grass dying. Ensure adequate controls above this method are in place.

3) Control : **Horizontal Poles (Banks)**

Installation : Placed in a herringbone order

Must be pegged to hold the poles in position

A soil Berm must be created and mildly compacted above the pole set-up in order to decrease the risk of undermining.

Uses : To slow down run-off, to decrease / minimize the risk of sheet movement

Composition : Various (Gum poles, wattle, bamboo, etc)

Management : These must be checked to see that they are stable. May become dangerous if large logs roll. Soil berms must be checked and repaired after rains.

4) Control : **Drainage Pipes**

Installation : Used in conjunction with sandbagging (see # 5) or earthberms (see # 6)

Placed from the top of a platform at a low/weak point

Pipe to run down the bank to a flat area or into the stormwater system

A break pressure wall or pipe, sandbag wall (herringbone formation) is to be created so as to break the velocity of the water movement. Ideally the pipe should release water in a sheet flow and with as little velocity as possible.

Silt fencing must be placed in three rows (see # 1) in order to sieve any sediment.

All water on platforms must be directed to the pipe by means of trenching or sandbags, unless placed at low point. Sandbags must be placed as a 'wall' structure in order to create physical barrier to direct the water to the outfall pipe.

Uses : To alleviate the hazard of water ponding

To minimize the risk of berms breaking and damages as a result of ponding.

To attenuate and control stormwater away from workable areas

Composition : P.V.C. piping (various sizes – min 175mm). Shade cloth fence (min 80%) Sandbags or earthberms.

Management : Ongoing management of sandbags, fencing and pies, checks for blockages in the pipe that will render this control obsolete.

5) Control : **Sandbagging:**

Installation : Must be used as a means of walling and attenuating water only

Must be placed in brick formation side by side and then the second row placed against the first for added strength.

Must not be used to pond water on large areas

Uses : For attenuating water in the movement towards drainage pipes and permanent stormwater systems.

Also for the use of breaking pressure and can be used to slow down sheet movement on banks if placed in herringbone fashion.

Composition : Plastic, Hessian, nylon bags

Management: Clearing / removing silt build-up regularly, replacement of damaged bags. Plastic preferred, less likely to become damaged and longer lasting.

6) Control : **Earth-berms**

Installation : These must be constructed at least 1m in width and at least 750mm in height
All earth-berms must be completed

These must be placed at least 1m away from the edge of an embankment

Uses : Attenuating water to outfall pipes or into the permanent stormwater system only

This is not a means for damming water. Ponding water can become very destructive.

Composition : Soil – compacted

Management: Cleaning / removing silt build-up regularly. Re-establishment of damaged berms

7) Control : **Small Trenches with Small Earth-berms**

Installation : These can be created horizontally across the sheet movement of water

Trenches are to be dug a minimum depth of 300mm wide and must be created the full length across the effected area. The berm must be placed on the down side to create further height and must be compacted.

Uses : Small trenches with small earth-berms on the down side / slope can be useful for slowing down sheet movement on semi-flat areas and catching soil in the trenches.

Composition : Soil only

Management: Any dropped sediment in the trenches must be removed within 24 hours of damage done re-establishment of damaged berms

8) Control : **Agricultural Trenches**

Installation : These must be cut back into the angle of the slope and have a full of a least 20 degrees. They must be constructed at least 1.2m wide and be used in conjunction with other forms of controls (i.e. silt fencing, catch pits, etc) in order to slow down the rate of force and deposit soil at intervals. Silt fences must be erected in these trenches at maximum intervals of every 5m. Berms on the down slope must be compacted and they should be at least 450mm wide and 300mm high. Agricultural Trenches should be constructed around the full perimeter of the site or wherever water attenuation is required. It must be constructed in such a way as to allow water to move to an area where the water (less the soil) will be managed by the estate (i.e. dams, ponds, catch pits, etc).

Uses : Predominantly for use on larger projects. Only for attenuation purposes ponding in these trenches may cause more damage if the berms were to break.

Composition : Trenching and small berms

Management: Continual management is required. Trenches must be cleared of sediment within 24 hours of every rainfall. Clogging and silt build up will lead to ponding and restrict the flow of the water.