
MULILO TOTAL HYDRA STORAGE PROJECT

EROSION MANAGEMENT PLAN

1. PURPOSE AND SCOPE

Purpose: Provide early information on how the Contractor intends to manage erosion so that it can be incorporated in the rehabilitation plan.

Scope: Mulilo Total Hydra Storage Project, De Aar, Northern Cape Region of South Africa.

2. SITE LOCATION

The proposed project would take place on the farm De Aar 180, portion 1 (Remaining Extent) in De Aar, Northern Cape, South Africa. The site lies approximately 5 km to the East of De Aar.

3. CIVIL & STRUCTURAL DESIGN

The Solar plant uses an optimised single-axis tracker, consisting of PV modules attached to North-South oriented rectangular torque tubes. The PV modules are physically mounted to the galvanized steel torque tube by the means of clips insuring ground connection from the module frames to the structure. Each tube is supported by a set of piers placed in the ground in a concrete foundation (Concrete piles) or directly (driven piers). String Inverters will be mounted to the solar tracker structure and concrete plinths will be used for central inverters and MV transformers. Concrete foundations will be used for the buildings, containers, and substation components.

Main philosophy used for Civil Works is "Light on Land" (LoL) and the objective is to respect the existing Site conditions, avoiding unnecessary soil disturbance. Design is to adapt the product to the original slope of the ground as far as possible whilst considering the resultant impact to the original environmental site conditions.

4. EROSION CONTROL

The Contractor shall take all reasonable measures to limit erosion and sedimentation due to the construction activities. Where erosion and/or sedimentation, whether on or off the Site, occurs despite the Contractor complying with the foregoing, rectification shall be carried out in accordance with details specified by the ECO. Where erosion and/or sedimentation occur due to the fault of the Contractor, rectification shall be carried out to the reasonable requirements of the ECO.

Any runnels or erosion channels developed during construction or during the defects liability period shall be backfilled and compacted. Stabilisation of cleared areas to prevent and control erosion shall be actively managed. Consideration and provision shall be made for various methods, namely, brush cut packing, mulch or chip cover, straw stabilising (at a rate of one bale / 20 m² and rotovated into the top 100 mm of the completed earthworks), watering, soil binders and anti-erosion compounds, mechanical cover or packing structures (e.g. Hessian cover).

Traffic and movement over stabilised areas shall be restricted and controlled, and damage to stabilised area shall be repaired and maintained to the satisfaction of the Engineer.

- The design is to identify the areas where vegetation clearance is necessary. Natural vegetation will be retained wherever possible and vegetation clearance will be restricted to only the areas needed for the execution of the works and rocks shall not be removed unless necessary for the safe movement of construction vehicles and the installation of equipment, keeping disturbance to a minimum to reduce the loss of material by erosion.
- Erosion control is to be implemented on any cleared areas where wind or water erosion is potentially a problem. The topsoil and vegetation are to be disturbed as little as possible by keeping “green areas” and controlling traffic.
- Crushing shall be favoured over uprooting to promote regeneration and prevent unnecessary erosion. Where uprooting is necessary, mechanical methods shall be favoured and cleared areas shall be stabilised as soon as possible.
- Off-road vehicle movement destroys vegetation and creates erosion problems. Vehicle movement during construction shall therefore be planned for within the design phase to ensure maximum protection of vegetation. No vehicular or pedestrian access will be permitted into natural areas beyond the demarcated boundary of the work area.
- Light equipment is to be utilised for access and deliveries into areas of unstable soils and in areas where erosion is evident wherever possible.
- Traffic flow, both vehicular and pedestrian, shall be strictly prohibited in areas outside of the designated work areas. In addition, once construction has been completed within a section, this section shall be deemed restricted.

4.1. EROSION PROTECTION

- Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and Work Areas.
- Retain natural trees, shrubbery, and grass species wherever possible.
- Do not permit vehicular or pedestrian access into natural areas beyond the demarcated boundary of the Work Area.
- Avoid access into seasonally wet areas and / or turf soils during and immediately after rainy periods, until such a time that the soil has dried out.
- Utilise only light equipment for access and deliveries into areas of unstable soils, in areas where erosion is evident, and at stream and river embankments, as far as reasonably practicable.
- Limit vehicular access to rocky outcrops and ridges.
- Institute adequate sedimentation control measures at river crossings and when excavation or disturbance within riverbanks or the riverbed takes place.
- Address erosion donga crossings as river crossings, applying soil erosion control and bank stabilisation procedures as specified by the ECO.

- Do not allow erosion to develop on a large scale before effecting repairs. When in doubt, seek advice from the ECO.
- Repair all erosion damage as soon as possible and in any case not later than six months before the termination of the Maintenance Period to allow for sufficient rehabilitation growth.
- In general, slopes steeper than 1(V):3(H) or slopes where the soils are by nature dispersive or sandy, must be stabilised. The ECO will specify a solution in terms of the most appropriate approved method and technology. One or more of the following methods may be required:
 - Topsoil covered with a geotextile , plus a specified grass seed mixture.
 - A 50:50 by volume rock: topsoil mix 200mm thick, plus specified grass seed mixture.
 - Logging or stepping (logs placed in continuous lines following the contours).
 - Earth or rock-pack cut-off berms.
 - Benches (sandbags).
 - Packed branches.
 - Ripping and / or scarifying along the contours.
 - Stormwater berms.

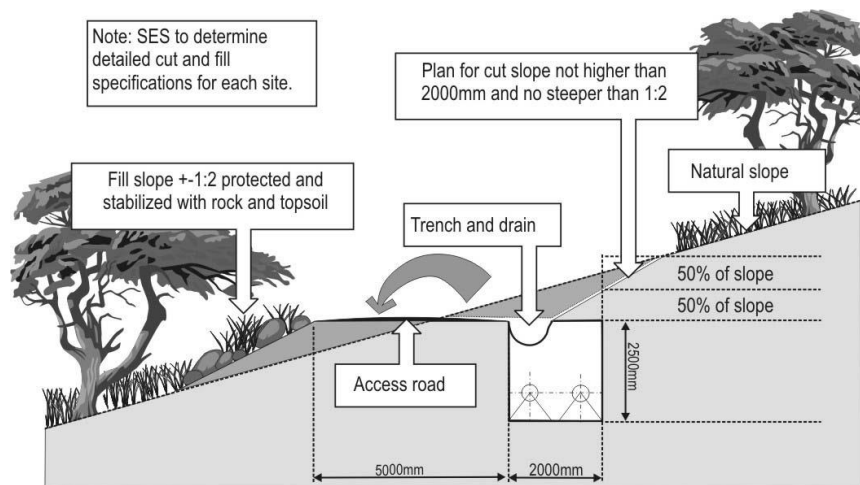


Figure 1: Typical application of erosion control while working on slopes.

- Near vertical slopes of 1(V):1(H) or 1(V):2(H) must be stabilised using hard structures, preferably with a natural look, and with facilities allowing for plant growth. The ECO will specify a solution in terms of the most appropriate approved method and technology. One or more of the following methods may be required:
 - Retaining walls (loffel or otherwise).
 - Stone pitching.
 - Gabions.
 - Shotcrete.
- Protect the slopes of all river diversions. One or more of the following methods may be used, as specified by the ECO:
 - Sandbags.

- Reno mattresses.
- Plastic liners and / or coarse rock (undersize rip-rap).
- Wherever possible, especially in sensitive areas, use rubber dams as river diversions.
- During the course of construction, the ECO may identify additional slopes in need of stabilisation and will specify actions in terms of the most appropriate approved method and technology.

4.2. TOPSOIL CONSERVATION

- Ahead of all construction, borrowing and quarrying, strip the entire available topsoil layer¹. Stockpile separately from overburden (subsoil and rocky material).
- In the absence of a recognisable topsoil layer, strip the uppermost 300mm of soil.
- Co-ordinate Works to limit unnecessarily prolonged exposure of stripped areas and stockpiles. Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area.
- Strip and stockpile herbaceous vegetation, overlying grass, and other fine organic matter along with the topsoil.
- Do not strip topsoil when it is wet.
- Store stripped topsoil in an approved location and in an approved manner for later reuse in the rehabilitation process.
- Stockpile topsoil stripped from different sites separately, as reapplication during rehabilitation must preferably be site specific. If necessary, keep a stockpile register.
- Do not mix topsoil obtained from different sites.

4.3. DE-BUSHING AND DE-STUMPING

- Obtain permission from the ECO to proceed with debushing. Only debush specified areas.
- Utilise the method of debushing most appropriate for the environment and species in question. Favour mechanical rather than chemical methods wherever possible.
- Wood obtained from de-bushing and de-stumping remains the property of the landowner and must be stockpiled in areas designated by him and approved by the ECO.
- Dispose of remaining plant material and stumps as solid waste. Upon approval by the ECO, the plant material may be buried on site. Specifications for topsoil stripping, backfilling of excavations and rehabilitation will apply in this regard.
- Only carry out de-stumping upon instruction by the ECO. In all other instances trees must be cut as close as possible to the ground level and roots retained (for soil binding and habitat creation).

¹ To be indicated by the ECO as referenced in the Environmental Impact Assessment or Project Screening Exercise, whichever is relevant.

5. SURFACE WATER AND STORM WATER MANAGEMENT

The site is generally flat to gentle sloping and annual rainfall is low - the design considers the data obtained from the pluviometric map of South Africa for a 20 year return period. The site is located away from the ecologically sensitive “no-go” areas including a buffer area greater than 50m; all possible wetland (including pans) and riparian (including ephemeral drainage lines) features fall outside of the work area. Access roads are positioned in such a way that no clearing within no-go areas is required and definite drainage areas are avoided.

“Irish Bridges” will be distributed strategically at several points to allow for the continuity of the natural flow and water passage. The Irish Bridge will consist of a concrete platform that permits the continuity of the rain flow over the designed roads; the elevation in these areas will be lower to allow the water to flow easily across the roads. Surface runoff will be collected by a system of drainage swales, but additional drainage ditches may be required in locations where there are no proposed roadways to conduct flow to the Irish Bridge flow passages.

- No water may be abstracted from any surface water body for the purpose of construction unless permitted in terms of the Contract, or specifically authorised by the ECO .
- Ensure that water abstraction points (i.e. from rivers) do not degrade or erode as a result of leaking pipes, spills, muddy conditions or washaways. Rectify problems as soon as they arise.
- Monitor water consumption and ensure that all possible use is accounted for and areas of waste are identified (i.e. water used for surface wetting, for batching, at the crusher plant, for potable supply etc.).
- Repair identified leaks and address issues of water wastage as soon as these are identified.
- Ensure that water usage at batching plants and crusher plants is regulated - maintain the proper moisture content and avoid waste.
- Where possible, recycle water on the construction site.
- Avoid over-wetting, saturation and unnecessary runoff during dust control activities and irrigation.
- Do not drain, fill or alter in any way, any wetland or drainage line, including the riverbanks unless this forms part of the construction Works, or upon specific instruction by the ECO.
- Do not allow surface water or storm water to be concentrated, or to flow down cut or fill slopes or along pipeline routes without erosion protection measures being in place.
- Line overflow and scour channels with stone pitching along their length and at their points of discharge to prevent soil erosion. The point of discharge should preferably be at a point where there is dense natural grass cover.
- Ensure that channels do not discharge straight down the contours. These must be aligned at such an angle to the contours that they have the least possible gradient.
- Locate any point of overland discharge at least 50m away from any river, stream or drainage way.
- Where possible, undertake river diversions outside of the rainy season.
- Ensure that Reserve releases (i.e. for sustained downstream ecological requirements and basic human needs) are catered for throughout the construction of dams and impoundments. The minimum requirement is that the Reserve be released during and after construction.
- For long term construction sites, accommodate 1:10 year floods in all temporary infrastructure (i.e. drifts, diversions etc.).

- Where possible, only initiate impoundment once all environmental work within the dam basin has been completed.

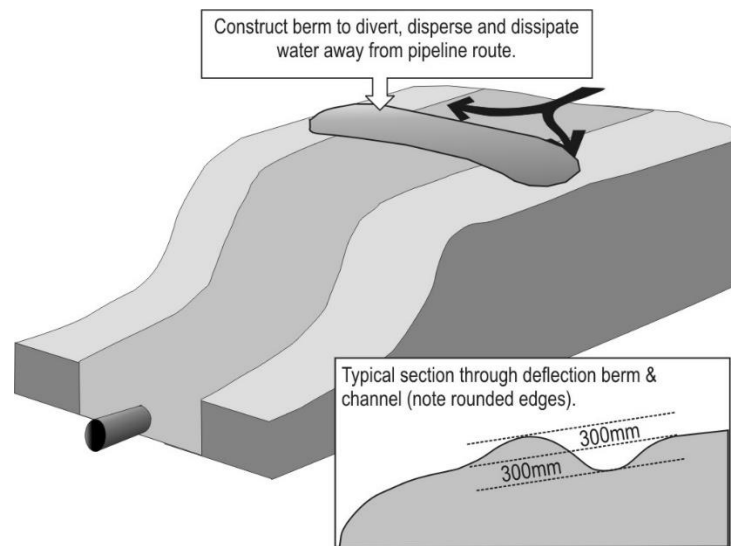


Figure 2: Typical application of a deflection berm to avoid erosion of a pipeline route

- Should any drainage pipes be required, a standard riprap lined ditch for erosion control is to be installed for the end-of-pipe energy dissipation.
- Degradation or erosion as a result of leaking pipes, spills, muddy conditions, or washaways shall be taken into account when designing any water abstraction points. Any leaks identified must be repaired immediately.
- Cleared areas and stockpiles of aggregates or soil is to be protected in such a way that erosion or sediment inputs to ecologically sensitive areas during rainfall is prevented.
- Access to wet areas after rainy periods is to be avoided until such a time as the soil has dried out.
- Water is to be recycled during the construction phase wherever possible.

End