NEW SOUTH WALES

DEVELOPMENT DESIGN SPECIFICATION

D7

EROSION CONTROL AND STORMWATER MANAGEMENT

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
1	Subclause (b) – relating to NSW State Legislation. Replace "Water Act 1912" with Water Management Act 2000"	D7.03	M	GA	Sep 01
2	Add new Subclause(6) relating to Design Certification	D7.05	A	GA	Oct 00
3	Subclause (3) relating to Design Criteria for level spreaders – Replace "1% for 8m" with "1% for 6m"	D7.13	M	GA	Oct 00
4	Add new Subclause(4) relating to standard drawing for level spreaders	D7.13	A	GA	Oct 00
5	Add new clause relating to Guidelines for preparing Erosion and Sediment Control Plans / Soil and Water Management Plans.	D7.23	A	GA	Oct 00
6	Add new Clause relating to Council's Development Control Plan	D7.24	A	GA	Oct 00
7	Add new Appendix D7		A	GA	Oct 00

EROSION CONTROL AND STORMWATER MANAGEMENT

GENERAL

D7.01 SCOPE

1. Virtually all construction activity which requires the disturbance of the soil surface and the existing vegetation, naturally predisposes the construction site to erosion. This in turn leads to sediment loss in the resultant run-off water. ***Erosion***

2. Since such soil disturbance is a necessary part of development, it is essential therefore to develop measures which reduce the erosion hazard of any particular construction activity. Having done that, it is necessary to control run-off water, which carries the sediment, in such a way as to reduce the amount of that sediment leaving the site to an acceptable level. ***Reduce Sedimentation***

3. After construction is complete and the site fully rehabilitated, permanent water quality control structures and features commence their role. These include trash racks, gross pollutant traps, wet retention basins and the creation of, or increase in size of wetlands. ***Water Quality***

D7.02 AIMS

1. Limit/minimise the amount of site disturbance. ***Site Disturbance***

2. Isolate the site by diverting clean upstream "run-on" water around or through the development where possible. ***Diversion Works***

3. Control runoff and sediment movement as its point source rather than at one final point. ***Point Source***

4. Stage earthworks and **progressively revegetate** the site where possible to reduce the area contributing sediment. This in turn increases the efficiency and effectiveness of the entire sediment control system while decreasing the number and size of controls required. ***Progressive Revegetation***

5. Provide an effective major stormwater system economical in terms of capital, operational and maintenance costs, incorporating water quality controls. ***Major Stormwater***

6. Retain topsoil for effective revegetation works. ***Topsoil***

7. Locate sediment control structures where they are most effective and efficient. ***Sediment Structures***

D7.03 REFERENCE AND SOURCE DOCUMENTS

(a) Council Specifications

DQS	-	Quality Assurance Requirements for Design [1]
D5	-	Stormwater Drainage Design[2]
C211	-	Control of Erosion and Sedimentation[3]
C273	-	Landscaping[4]

(b) NSW State Legislation

Protection of the Environment Operations Act, 1997[5]
Dams Safety Act, 1978[6]
Soil Conservation Act, 1938[7]

Water Management Act 2000[8]

(c) ACT Government Publications

Design Manual for Urban Erosion and Sediment Control - July 1988[9]
"Protecting the Murrumbidgee from the Effects of Land Development"[10]
"Guidelines for Erosion and Sediment Control on Building Sites"[11]
Implications for Building Construction[12]
Pollution Control on Residential Building Sites (Brochures)[13]
Field Guide – Erosion and Sediment Control[14]
Australian Journal of Soil and Water Conservation – Vol 3, Number 1[15]

(d) State Authorities

NSW Department of Housing
- Managing Urban Stormwater, Soils and Construction, 3rd Ed. Aug. 1998.[16]

Roads and Traffic Authority
- Erosion and Sedimentation Design Considerations.[17]

Soil Conservation Service
- Erosion and Sediment Control – Model Policy and Code of Practice (Discussion Paper).[18]

NSW Department of Land and Water Conservation (DLWC)
- Urban Erosion and Sediment Control[19].

State Environmental Planning Policy No.14 - Coastal Wetlands.[20]

D7.04 PLANNING AND CONCEPT DESIGN

1. Assess the physical characteristics and limitations of soils, landform and drainage of the site and plan the subdivision accordingly. ***Site Characteristics***

2. A concept design shall be submitted with the development application to Council for all developments. This will assist in assessing the impact of the development on the site. ***Concept Design Submission***

D7.05 DETAILED DESIGN

1. After development consent is given, erosion and sediment control/water management plan shall be submitted to Council as part of the detailed engineering design. This plan shall give all details for erosion, sediment and pollution controls and shall be site specific and not a generalisation of erosion control philosophy. It may also form part of the contract specifications for a contractor to comply with during construction. ***Site Specific***

2. Detailed engineering designs shall include scaled drawings (no larger than 1:1000) and detailed specifications/diagrams which can be readily understood and applied on site by supervisory staff. All Drawings shall be in accordance with the minimum drafting requirements in the Specification for QUALITY ASSURANCE REQUIREMENTS FOR DESIGN.

Items to be included, but not limited to, shall be:

- existing and final contours
- the location of all earthworks including roads, areas of cut and fill and re-grading
- location of access haulage tracks and borrow pits
- location and design criteria of erosion and sediment control structures
- location and description of existing vegetation
- proposed vegetated buffer strips and "no access" areas

- location of critical areas (vegetated buffer strips, drainage lines and structures, water bodies, unstable slopes, flood plains and seasonally wet areas)
- type and location of diversion works to direct uncontaminated run-on around areas to be disturbed
- revegetation program
- procedures for maintenance of erosion and sediment control
- details for staging of works

Approval

3. No site works shall commence prior to approval of the detailed engineering design. All works are to be carried out in accordance with the approved erosion and sedimentation control/water management plan. Its implementation must be supervised by personnel with appropriate qualifications and/or experience in soil conservation on construction sites.

Additional Works

4. The erosion and sedimentation control/water management plan and its associated control measures shall be constantly monitored, reviewed and modified as required, by the Developer, to correct any deficiencies. Council has the right to request changes if, in its opinion, the measures that have been put in place are inadequate.

Example Design

5. If required, examples of proposed subdivisions detailing locations of water quality structures, sediment and erosion control devices may be obtained from Council and used as a guide when preparing an erosion and sedimentation control/water management plan.

Design Certification

6. Drawings shall bear the signature of the design consultant and shall where required by the Council be certified as complying with the appropriate design specification (D7). The certificate shall be in the format detailed in Annexure DQS-A of the Specification for QUALITY ASSURANCE REQUIREMENTS FOR DESIGN along with Design Checklist 9 for Erosion and Sedimentation Control Plans.

EROSION CONTROL

D7.06 BUFFER ZONES

Filters

1. Buffer zones are corridors of vegetation adjacent to waterways or disturbed areas. The vegetation filters suspended solids and reduces the nutrient levels in run-off. Wetlands, stream and rivers adjacent to construction sites shall be protected by buffer zones.

Performance

2. Buffer zone performance increases as catchment area and slope gradient decreases. Thirty-metre-wide buffer zones generally provide adequate protection.

Slope %	Buffer Width in Metres
2	15
4	20
6	30
8	40
10	50
12	60
14	70

3. Buffer zones can reduce the need for other erosion and sediment control measures. However, contaminated water in a concentrated form will require treatment both at its sources point and final disposal. ***Contaminated Water***

4. A fence shall be used to exclude traffic from buffer zones to prevent damage to the vegetation, particularly during any construction phase. ***Fencing***

D7.07 "NO ACCESS" AREAS

1. It is Council's Policy to conserve as much existing vegetation in new developments as possible. ***Conserve Vegetation***

2. The landscape plan shall incorporate as much existing native vegetation as possible.

3. The "no access" fence locations shall be shown on the detailed engineering design. These locations will be approximate only as machinery type, topography etc will determine actual on site location. ***No Access***

4. Fenced areas shall be clearly signposted "No Access Area".

D7.08 DIVERSION WORKS

1. Diversion works may be in the form of earth drains and banks, haybales, sand bags or even pipelines and may be permanent or temporary. ***Diversion Types***

2. Such techniques are used to divert the upstream run-on water around the site. Such flows shall discharge to a formal drainage point or open areas where level spreader banks should ensure a broad water spread. ***Discharge Point***

3. Pipelines may also be used to convey such run-on through the development site, and discharge the flow to a formal drainage point/dissipater if necessary. Such pipelines may also form part of the overall final drainage system. ***Pipelines***

4. Design of the diversion system should suit the following:-

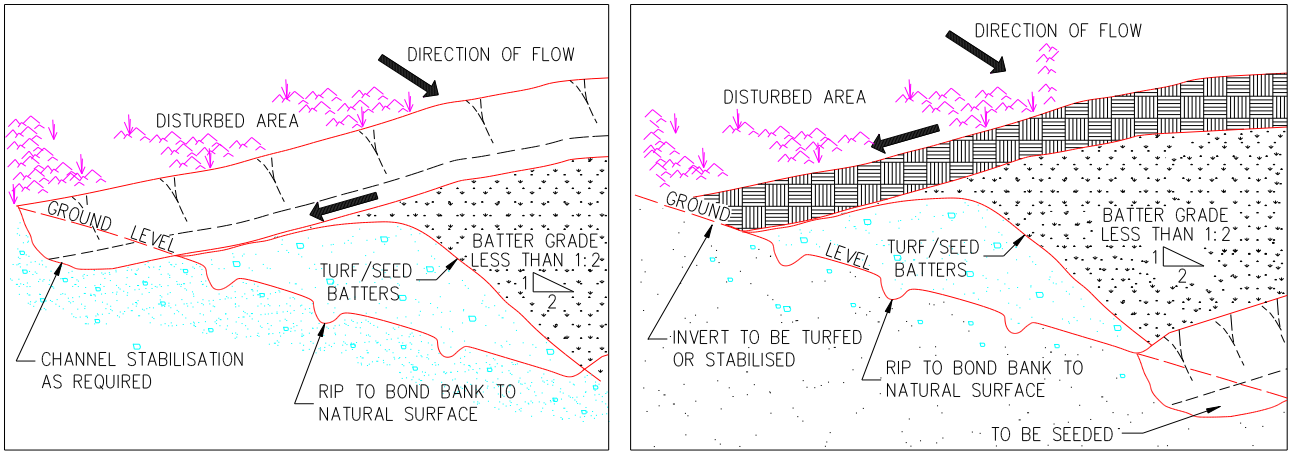
   (a) The drain should preferably be dish shaped with batter grades of less than 2:1 ***Drain Shape***

   (b) If a piped system is selected its design capacity shall be a minimum of the capacity nominated in the Specification for STORMWATER DRAINAGE DESIGN. ***Pipe Capacity***

5. Diversion works are designed to carry peak flows at non-erosive velocities in bare soil, vegetated or lined drains/banks. ***Peak Flows***

6. Generally, the channel should be lined with turf. However, where velocities are designed in excess of 2m per second, non erosive linings such as concrete, geotextiles, grouted rock etc or velocity reducers (check dams etc) are required. ***Non-Erosive Linings***

7. Typical arrangements of diversion drains and banks are shown in Figure D7-1.



DIVERSION DRAIN DIVERSION BANK

Figure D7-1 - Diversion Drains/Banks

D7.09 DROP DOWN DRAINS

1. These are temporary or permanent drains, which divert concentrated run-off down slopes such as road batters without causing erosion. They usually consist of a dished earth drain smoothly shaped, consolidated and lined with a variety of materials or they may be a flexible/rigid pipe or half pipe. ***Lined Drains***

2. Drop down drains consisting or rigid, or flexible, pipes are very effective as a temporary measure during road construction used in association with an earth windrow (or bund wall) along the top edge of the batter. Run-off flowing along the windrow is directed to the pipe by which water is conveyed down the batter. It is a simple matter to extend the pipe as the batter rises. ***Piped Drains***

3. Drop down drains shall have sufficient capacity for a minimum 1 in 5 year peak flow without eroding. Energy dissipators may be required to reduce the flow velocity at the outlet of the drop down drain. ***Capacity***

D7.10 STOCKPILES

1. Location of stockpiles shall be indicated on the approved engineering Drawings.

2. Stockpile sites shall be located: ***Location***

   (a) Clear of existing or proposed drainage lines.

   (b) Clear of areas likely to be disturbed during construction.

   (c) Clear of the drip zone of trees.

   (d) Preferably on reasonably flat areas.

3. Stockpiles must be protected from erosion and sediment loss by: ***Erosion Protection***

   (a) The installation of diversion works.

   (b) The use of silt fences, haybales etc or other approved controls on the downstream side.

   (c) Compaction.

   (d) Revegetation if left exposed for longer than 30 days (refer to the Construction Specification for LANDSCAPING for seed mix).

4. Site topsoil shall be isolated from subsoil material in separate stockpiles. ***Separate Stockpiles***

D7.11 SEDIMENT BASINS/TRAPS/DAMS

1. Sediment traps are either permanent or temporary sediment control devices that intercept sediment and run-off usually at the final discharge point of the site. ***Sediment Control***

2. They are formed by excavation and/or by constructing embankments. ***Construction***

3. There are two types, wet and dry basins. ***Types***

4. Preferably sediment traps shall not be located directly upstream of residential areas. ***Location***

5. Basin design must meet the following: ***Design Criteria***

   (a) Volume/capacity of the trap shall be 250m^3/ha of disturbed site including the building areas.

   (b) An allowance of 50m^3/ha is required if diversion controls are not used to direct clean upstream water from outside the site away from construction areas.

   (c) The capacity shall be measured below the invert of the lowest incoming flow. Otherwise pipelines and associated works will be affected.

   (d) A secondary or emergency stabilised spillway must be provided to prevent overtopping of the structure. This shall be directed to a safe overland flow path.

   (e) The basin shall have a minimum of 0.5 metres freeboard above the level of the spillway.

   (f) The basin shall be surrounded by a manproof fence with lockable gates.

   (g) An all weather access must be provided to the basin for maintenance.

   (h) The basin shall have an arbitrary length to width ratio of between 2 and 3:1. This encourages soil particle settlement. The entry and exit points should be located at the opposite ends of the basin.

   (i) If this is not possible some form of approved baffles shall be installed to minimise short circuiting of the flow.

   (j) Discharge of the basin shall be via a perforated riser encapsulated by a filter device for a dry basin. Wet basins shall be flocculated by dosing with gypsum and pumped.

(k) Internal basin batters shall be a maximum of 3:1 and external batters a maximum of 2:1.

(l) All disturbed areas including batters shall be topsoiled and seeded.

6. Permanent wet basin designs slightly vary from the above. Refer to the Stormwater Management Section of this Specification. ***Permanent Wet Basins***

D7.12 SEDIMENT TRAPS/ BARRIERS FOR MINOR CATCHMENTS

1. These are silt retention/filtering structures of a temporary nature used in situations where the catchment does not exceed 0.5ha. ***Filtering Structures***

2. Such sediment traps/barriers generally consist of: ***Barrier Types***

(a) silt fences

(b) hay bales

(c) “blue metal” groynes/sausages

(d) filter fabric located beneath stormwater grates

(e) gabions

(f) or a combination of the above.

3. The choice of material and type of treatment will depend on the size of the catchment the location and the structure being treated such as: ***Location of Structure***

(a) surface inlet pits

(b) kerb inlet pits

(c) catch drain disposal areas

(d) culvert inlets and outlets

(e) minor construction/earthwork sites

(f) check dams/velocity reducers etc.

D7.13 LEVEL SPREADERS

1. Level spreaders are outlets or "sills" having a level cross section. They convert erosive channelised flows into non-erosive sheet flow. ***Convert Flows***

2. Level spreaders can only be used to dissipate flows from small catchments. The area below the outlet should be stable and of even cross section so that the water will not re-concentrate into channels. ***Location***

3. To reduce flow velocity before the spreader, the channel grade shall not exceed 1 per cent for a minimum of 6 (six) metres. The outlet or "sill" width depends on contributing catchment, slope and ground conditions. The minimum width should be four metres, and the maximum width 25 metres. Final discharge should be over a level surface, which may require stabilising by turfing or seeding and fertilising or perhaps lining with a geotextile fabric or something similar. ***Design Criteria***

4. Standard Drawing SD 5-3 (Source: NSW Department of Housing, Soil and Water Management for Urban Development, 1998) in Appendix D7 gives details of level spreaders. ***Standard Drawing***

D7.14 THE LOCATION OF SHAKEDOWN AREAS AND ACCESS STABILISATION

1. Access to construction sites shall be limited to a maximum of two locations. ***Number of Accesses***

2. Such access locations shall require Council approval. ***Location Approval***

3. Shakedown areas or access stabilisation shall comprise a bed of aggregate on filter cloth or a metal bar cattle grid located at any point where traffic enters or leaves a construction site. Stabilised accesses reduce or eliminate tracking of sediments onto public rights of way or streets. Should such tracking occur the contaminants must be swept off the road way each day or before rain. Clean off draw bars etc after dumping and before starting journey. ***Types***

4. If a shaker grid is used, this should be so placed as to ensure the vehicles when crossing the grid have sufficient speed to "shake the mud" or other contaminants such as gravel from the vehicle. It must not be placed where the vehicle is slowing to enter a roadway. Cattle grids shall be a minimum length of 7 metres. ***Cattle Grid***

5. A stabilised access comprises a vehicular pathway suitably constructed to facilitate the collection of any site debris in order to prevent such material leaving the site. Stabilised accesses are generally used on small sites. The entrance shall be at least 15 metres long with a minimum width of 3 metres for a one way entrance and 6 metres for a two-way entrance. ***Stabilised Access***

6. Surface water flowing to the street entrance/exit must be piped under the access, or a berm constructed to direct surface flow away from the exit. ***Flow Control***

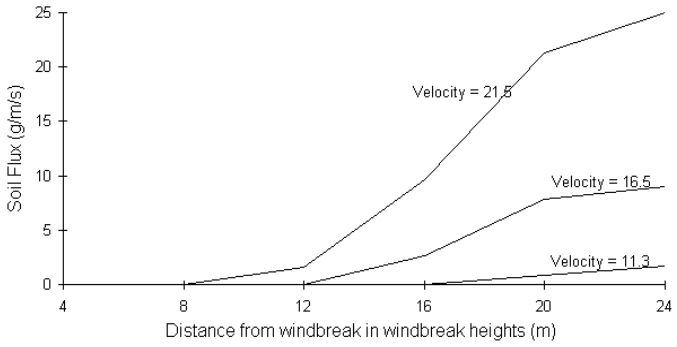
D7.15 WIND EROSION/DUST CONTROL

1. Research has demonstrated average dust emission rates of over 2½ tonnes per hectare per month at urban construction sites. This erosion rate is unacceptable. ***Erosion Rate***

2. Various measures are available to minimise such emissions, including:- ***Treatments***

   (a) limiting the area of lands exposed to erosive forces through phasing works/progressive revegetation and/or provision of a protective ground cover and/or keeping the ground surface damp (not wet); and/or

   (b) on building sites, installing a barrier fence on the windward side - effective to a distance of 15 times its height, assuming an acceptable soil flux of 5 grams per metre per second. See Figure D7-2.



Effect of distance from windbreak on soil loss, wind blowing at less than 90 to the windbreak.

Figure D7-2 - Pollution Control

D7.16 REQUIREMENTS FOR BUILDING SITES

1. The clearing of vegetation and preparation of building pads is to be undertaken in the last stages of the development when the majority of the site has been effectively revegetated. ***Site Clearing***

2. When the development calls for the construction of a number of buildings, the sediment trap/s and other appropriate sediment controls shall remain operational. ***Development Control***

3. Cross/catch drains shall be installed on long or steep unpaved driveways, disposing run-off to stable areas. ***Driveway Control***

4. Where a majority of the lot is disturbed the following controls or measures shall be undertaken: ***Lot Control***

   (a) Silt fences, located around the downstream sides of the lot.

   (b) Sediment traps/barriers to be provided to all on-site and adjacent stormwater inlets.

   (c) Only one site access to be provided. This may require treatment to prevent soil being tracked from the site.

   (d) All subsurface drainage for roofing must be in place prior to the installation of the roof and gutter so downpipes can be immediately connected.

D7.17 EXTERNAL SITE REQUIREMENTS

1. Sediment control devices or stabilising works shall be provided outside construction sites where necessary or as directed by the Superintendent. ***Necessary Controls***

2. Where increased stormwater run-off is likely to accelerate erosion of any downstream watercourse, the necessary remedial work shall be provided concurrently with other sediment and erosion requirements. ***Accelerate Erosion***

3. Where sediment is likely to be transported from the site, all immediate downstream drainage inlets shall have appropriate controls installed. ***Downstream Controls***

4. If such works require entry onto private property, written permission shall be obtained prior to the entry and commencement of such works. ***Written Permission***

5. All disturbed areas on private property to be reinstated to original condition and to the satisfaction of the owner. ***Reinstated***

STORMWATER MANAGEMENT

D7.18 GENERAL

1. Most developments mean a change in land use and is usually accompanied by a decline in stormwater quality. This applies to the long term as well as during the short term construction phase. The main components required to enhance stormwater quality are as follows:- ***Main Components***

(a) Buffer Zones and Filter Strips, being grassed, or similarly treated areas to facilitate the natural assimilation of water pollutants and reduce run-off.

(b) Gross Pollutant Traps (GPT) designed to intercept litter and debris to maintain visual quality in downstream waterways, and to reduce the coarse sediment load on downstream water management structures.

(c) Wet Retention Ponds are permanent sediment ponds designed to allow particulate matter to settle out. They operate under both sedimentation and macrophyte regimes. Note that a large proportion of nutrients adhere to the sediments, and therefore settle out. Other nutrients are removed by macrophytic vegetation as part of the food chain.

(d) Wetland (Nutrient) Filter to enhance the removal of fine sediment and nutrients from stormwater run-off, and are largely dependent on biochemical removal mechanisms (ie, nutrients taken up as part of the plant food chain).

2. Excess nutrients (N,P) lead to eutrophication of waterways. This can cause uncontrolled growth of algae, water weeds etc, which can deplete oxygen levels, kill resident flora and fauna, and reduce recreational appeal. However waterways do have a natural capacity to assimilate nutrients in small to moderate amounts as initial flows have. ***Excess Nutrients***

3. It is essential to treat the "first flush" of stormwater as these initial flows from urban areas have relatively high pollutant loads. Such heavy pollution results from significant areas of impervious surfaces, which do not assimilate pollutants such as, dust, fertilisers, pesticides, detergents, etc to the same extent as occurs in more rural environments. ***First Flush***

D7.19 WET RETENTION BASINS/PONDS

1. Basins designed for water quality control should maximise the extent of settling. In general quiescent conditions and infiltration should be maximised. ***Maximise Infiltration***

2. A wet retention basin can be located either on-line or off-line as shown in Figure D7-3. Its capacity however needs to be considerably greater if it is located on-line. The wet retention basin usually has some form of energy dissipation at the inlet or a sufficient length-to-width ratio (greater than 2:1) to prevent short circuiting of flow across the pond, although its shape may vary considerably. The pond may vary in size, but it usually has a minimum surface area of about 1 per cent of the total catchment area. At a depth of 2.5 metres, this provides a storage volume approximately equal to the maximum total run-off from a 1 in 1 year storm. Basins may be installed as smaller multiple units (in series) or as large single units. ***Location and Size***

3. Other design guides that will make the basin efficient in removing particles and provide for public safety, include the following. ***Basin Efficiency***

(a) The minimum depth should be not less than 1.5 metres with an average depth of 2.5 metres. This discourages macrophyte growth in the deeper portions of the pond and also the breeding of mosquitos.

(b) The basins should have side slopes of approximately 1 in 8. This provides for safety and encourages microphyte growth around edges facilitating nutrient uptake.

(c) The maximum velocity through the pond based on a 1 in 1 year storm should not exceed 0.3 metres per second (at 2.5 metres depth, this is the maximum practical flow velocity at which optimum sediment removal can be achieved).

(d) A minimum freeboard of 0.3 metres should be provided between a restricted discharge outlet for the pond and a storm overflow weir. This discharge outlet should be designed so that the weir overtops on average three times per year.

(e) Inlet and outlet structures should be located at extreme ends of the basin, with short circuiting of flow further minimised by the use of baffles.

4. Basins should be constructed prior to the commencement of any site clearing or construction works, and should be de-silted when the level of sediment reduces the average water depth to less than 1.5 metres. ***Construction and Maintenance***

5. (a) It may be desirable for the designer of an urban retention basin to incorporate an outlet device that enables dewatering of the basin. This simplifies de-silting, enabling earthmoving equipment to be used for de-silting operations. ***Outlet Design***

(b) An all weather access track shall be provided to the basin for maintenance works. ***Access Track***

6. It is generally necessary to incorporate a gross solids trap and trash rack facility on major discharges into the retention basin. This prolongs the life of the basin and prevents the accumulation of litter. ***Trash Racks***

7. Basins should be surrounded by buffer zones, typically comprising grassed foreshores of not less than 20 metres between the nearest development and the basin. This allows for some infiltration of drainage from developments, permits the drainage authority scope to develop aesthetic surrounds and reduces the likelihood of over the fence dumping of rubbish. ***Buffer Zones***

8. The settling velocity of particles should service as the basis for design. This, of course, can only be found by conducting standard settling tests or from a knowledge of local soil characteristics. The surface area of the required basin can then be determined from design settling velocities (Randall et al 1982). ***Particle Settling***

9. Wet retention basins are regarded as impoundments and normal dam safety requirements should be met. A dam may be prescribed under the Dams Safety Act, 1978, depending on the recommendations of the NSW Dams Safety Committee. A dam is normally prescribed if it is: ***Basin Classification***

(a) 10 metres or more in height and has a storage capacity of more than 20 megalitres; or

(b) 5 metres or more in height and has a storage capacity of 50 megalitres or more.

10. If the wet retention basin is a prescribed dam, the Dams Safety Committee will maintain an interest in the dam, will seek information from its owner and will require that reports be prepared on the dam and submitted to the Committee. ***Dam Safety Committee***

D7.20 TRASH RACKS

1. Trash racks are usually permanent structures which intercept trash and other debris to protect the aesthetic and environmental quality of water. Where appropriate, construct them upstream of all permanent retarding basins and/or wetlands which have a capacity greater than 5,000 cubic metres, and elsewhere as required by Council. ***Environmental Quality***

2. Generally, their design criteria should ensure:- ***Design Criteria***

(a) vertical bar screens with bar spacing of 65mm clear;

(b) the length of the rack is consistent with the channel dimension and cause minimal damage when overtopped;

(c) they are as large as practicable while considering all other design criteria – a maximum height of 1.2 metres is suggested;

(d) a structure which remains stable in at least the 20 year ARI event, and is unlikely to cause flooding on adjacent lands as a result of the rack becoming completely blocked in the 100 year ARI event (analysis should include investigation of backwater effects and any consequent flooding);

(e) the structure drains by gravity to a dry condition; and

(f) adequate access for maintenance and which permits the use of mechanical equipment.

3. Where associated with outlet structures for small sediment basins or constructed wetlands, they can be relatively simple in design. ***Associated Structures***

4. Trash racks may be incorporated in the design of gross pollutant traps. ***Gross Pollutant Trap***

5. Trash racks shall be checked periodically and all debris and silt removed. ***Maintenance***

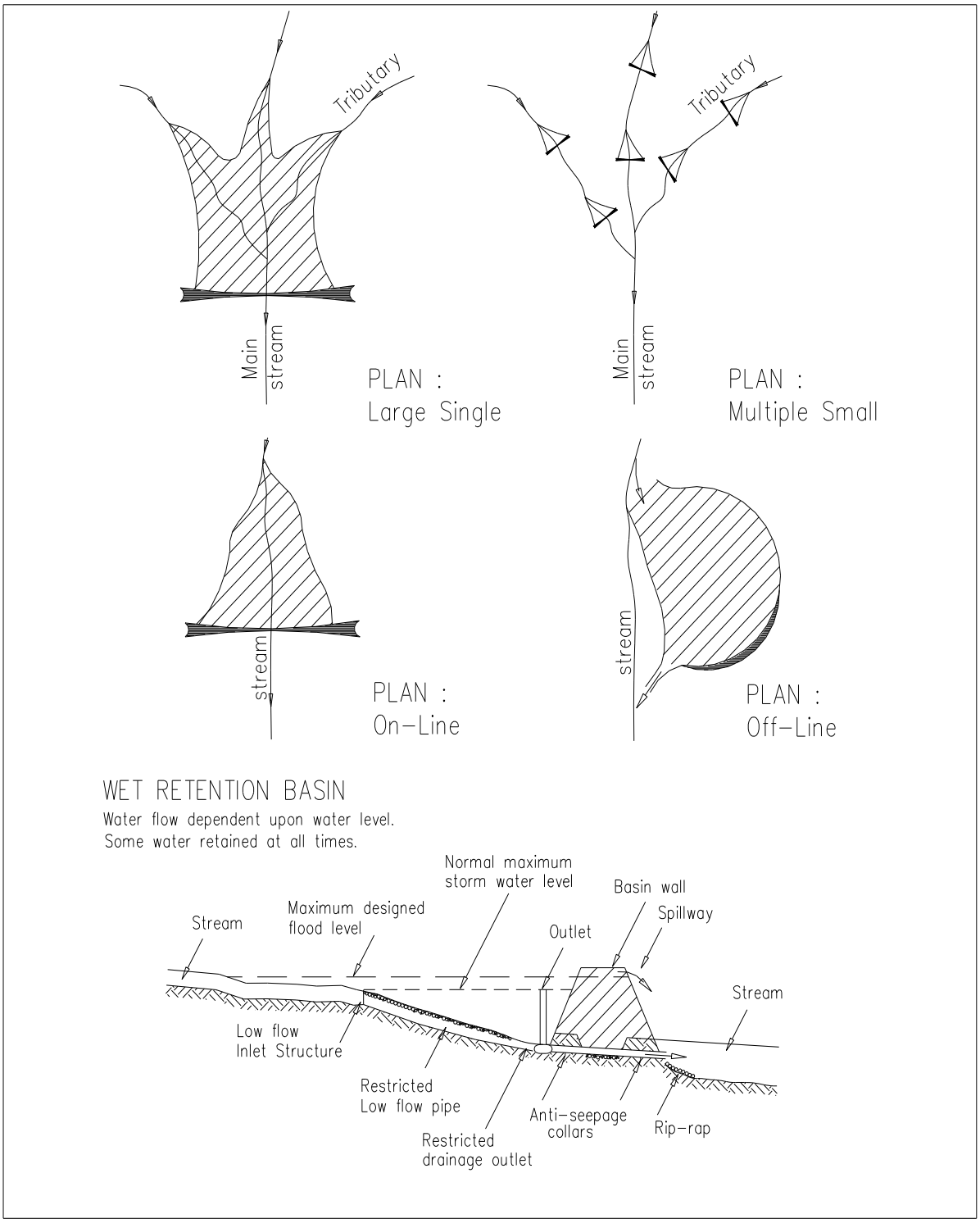


Figure D7-3 - Configuration and Design of Wet Retention Basins

D7.21 GROSS POLLUTANT TRAPS

Description

1. Gross pollutant traps (GPTs) are permanent structures used to trap coarse sediments, trash, litter, and other floating materials. Usually, they are located upstream of constructed wetlands and receiving waters. They consist of an energy dissipater at the upper end, concrete sediment trap and trash rack at the lower end. Sometimes a "mini" wetland is incorporated at the downstream end.

Applications

2. These traps have restricted application and each should be justified on individual merits. They have high construction costs and are generally unable to trap silt and clay sized particles other than in relatively small storm events (eg, one year ARI, critical duration storm event). Nevertheless, in some specialised situations their use might be justified, especially where a significant proportion of the bed load consists of particles coarser than 0.04mm (sandy soils) and/or where their construction/maintenance cost can be justified when compared with more conventional sediment retention basins.

Definition

3. GPTs can be defined as major or minor:

   (a) major gross pollutant traps can be located on major floodways and waterways to intercept medium to high flows; and

   (b) minor, enclosed gross pollutant traps can be located at heads of major floodways and/or where stormwater discharges into floodways or water bodies.

Sediment Interception

4. Design traps to intercept at least 75 per cent of sediment with a grain size of 0.04mm or greater under average annual runoff conditions. Further, ensure peak flow velocities are less than 0.3 metres per second in the 1 year ARI storm event, and taking into account any likely backwater effect from a blocked trash rack.

Capacity

5. The structure should have sufficient capacity and stability to discharge the inlet flow with the trash rack fully blocked without flooding adjacent properties.

Maintenance Requirement

6. Ensure GPTs are capable of gravity drainage to a dry condition for periodic cleaning and maintenance if at all possible.

D7.22 WETLANDS

Depth and Batters

1. Wetlands used for improvement of urban run-off quality can be either natural or artificial. They necessarily have to be shallow. Growth of emergent aquatic plants (reeds, etc) should be encouraged by using sideslopes of very low gradient (1 in 8 or less). A large percentage (greater than 25 per cent) of any permanent water should be less than 1 metre deep. The remainder of any open water should have a depth of not greater than 2 metres which will allow submerged plant growth. Figure D7.4 shows a typical wetland arrangement.

SEPP No 14

2. Where wetlands are natural, the provisions of State Environmental Planning Policy No 14 - Coastal Wetlands, should be consulted. This policy protects wetlands from clearing, construction of levees, draining and filing, but does not prevent wetlands being used for run-off control, provided safeguards and operation control ensures their continued viability.

Efficiency

3. Wetlands, like retention basins, operate more effectively when higher contact time between the pollutants and the biota of the wetland is provided. Thus, like retention basins, wetlands will be more efficient when used in conjunction with upstream flow retardation basins that will maintain run-off closer to pre-development levels.

Water Levels

4. A structure should be included to allow manipulation of water levels in the wetland. This will enable control of microphyte, insect populations and facilitate dredging.

5. Where possible, small islands or shoals should be constructed in the upstream areas of the wetland to reduce water velocities, prevent short circuiting and promote aquatic plant growth. ***Short Circuiting***

6. The performance and life of wetlands, like wet retention basins, will suffer if they are not protected from trash and large particles. It is therefore recommended that trash racks/gross sediment/pollution traps be installed upstream of the wetland. ***Wetland Protection***

7. Wetlands need to be surrounded by a buffer at least 20 metres wide in order to:- ***Buffer Zones***

   (a) Restrict access to maintenance vehicles by the installation of an all weather track with a lockable device.

   (b) Acts as an infiltration area for surface run-off.

   (c) Provide flood protection and secondary assimilation of pollutants.

8. These areas are best planted with vegetation native to the area, but they can be used as grassed areas and an aesthetic feature. ***Native Vegetation***

9. Work in the ACT indicates rates of removal of phosphorous and particles in wetlands are higher than for wet retention basins. ***Results***

10. In designing wetlands, it is recommended that, as an interim guide, the surface area of the wetlands be a minimum of 0.5 per cent of the catchment, which it serves. If wetlands are used in conjunction with wet retention basins, this percentage can be proportionately lowered by allowing for the surface area of the installed wet retention basin. ***Surface Area***

11. In open water zones, rooted emergent macrophytes appear to be more efficient than substrate microphytes (plants that are attached to the bottom of the water but which do not emerge). This is because the emergent aquatic plants act as an oxygen pump, taking oxygen from the atmosphere into their roots and eventually into the water and so making it available for bacteria and attached algae which grow on the roots on the emergent plants. In the crushed rock zones, emergent aquatic plants are the only types of macrophytes that will grow. These plants will also act as oxygen pumps, and facilitate biological uptake of nutrients and the breakdown of organic matter by bacteria, which grow on their roots. ***Microphyte Types***

12. A variety of plant species should be planted in artificial wetlands to achieve efficient colonisation and maximise pollutant removal. Establishment of plants should be through transplantation of seedlings during spring and early summer. ***Revegetation***

13. Wetlands will serve other purposes than just improving a quality of urban run-off. They will serve to attract a large range of biota and bird habitat. In areas where they have been installed, they have become an aesthetic feature. Indeed, this may present problems as surrounding communities may resist efforts by the controlling authority to de-silt the wetland. ***Aesthetic Feature***

14. To minimise mosquito problems, limit expanses of water with more than 50 per cent shading and ensure no sections of water become isolated from the main body. ***Insect Problems***

15. Islands are highly beneficial as wildlife refuges, especially for birds. Their design should consider the effects on changes in water tables. ***Wildlife Refuge***

16. Stock ponds with selected native fish to improve the water quality (not for sport), especially species which will control mosquito larvae and select zooplankton in preference to phytoplankton. Avoid use of fish which are bottom feeders. ***Native Fish***

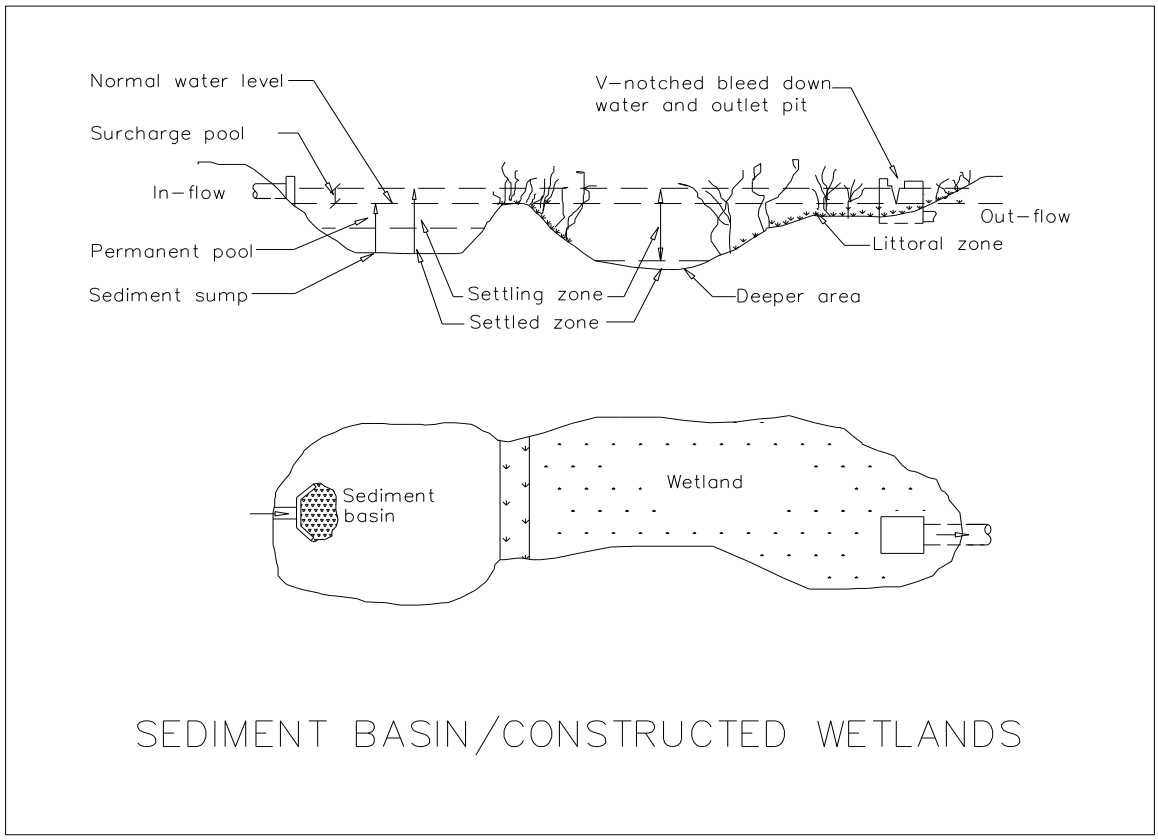


Figure D7-4 - Sediment Trap/Constructed Wetland

SPECIAL REQUIREMENTS

D7.23 GUIDELINES FOR PREPARING EROSION & SEDIMENT CONTROL PLAN / SOIL AND WATER MANAGEMENT PLAN.

Detailed guidelines on various methods, practices and devices for controlling erosion and sedimentation can be found in many of the publications listed in Clause D7.03.

Model Soil and Water Management Plans

Model Soil and Water Management Plans for Residential Dwellings, Medium-Density Development and Subdivision Development can be found in the publication by the Department of Housing, Managing Urban Stormwater –Soils and Construction, 1998 (Ref 16).

A drawing of a Model Soil and Water Management Plan for Medium density Development and Standard Drawings relating to the Plan is provided in Appendix D7 (Source: Managing Urban Stormwater, Soils and Construction, 1998)

A summary of Erosion and Sediment Control Techniques detailed in the Road Design Guide – Section 8 Erosion and Sedimentation) RTA, 1993(Ref 17) is also provided in Appendix D7

D7.24 COUNCIL'S DEVELOPMENT CONTROL PLAN

Council's Development Control Plan No.17 relates to Erosion and Sediment Control. Developers are advised to refer to this document to determine the requirements of this policy.

APPENDIX D7

1. **SOIL & WATER MANAGEMENT PLAN FOR MEDIUM DENSITY DEVELOPMENT**
(Source: - Department of Housing – Managing Urban Stormwater, Soils and Construction- 1998)

2. **STANDARD DRAWING SD4-1 (STOCKPILES)**
(Source: - Department of Housing – Managing Urban Stormwater, Soils and Construction- 1998)

3. **STANDARD DRAWING SD5-2 (EARTH BANK – LOW FLOW)**
(Source: - Department of Housing – Managing Urban Stormwater, Soils and Construction- 1998)

4. **STANDARD DRAWING SD5-3 (EARTH BANK – HIGH FLOWS)**
(Source: - Department of Housing – Managing Urban Stormwater, Soils and Construction- 1998)

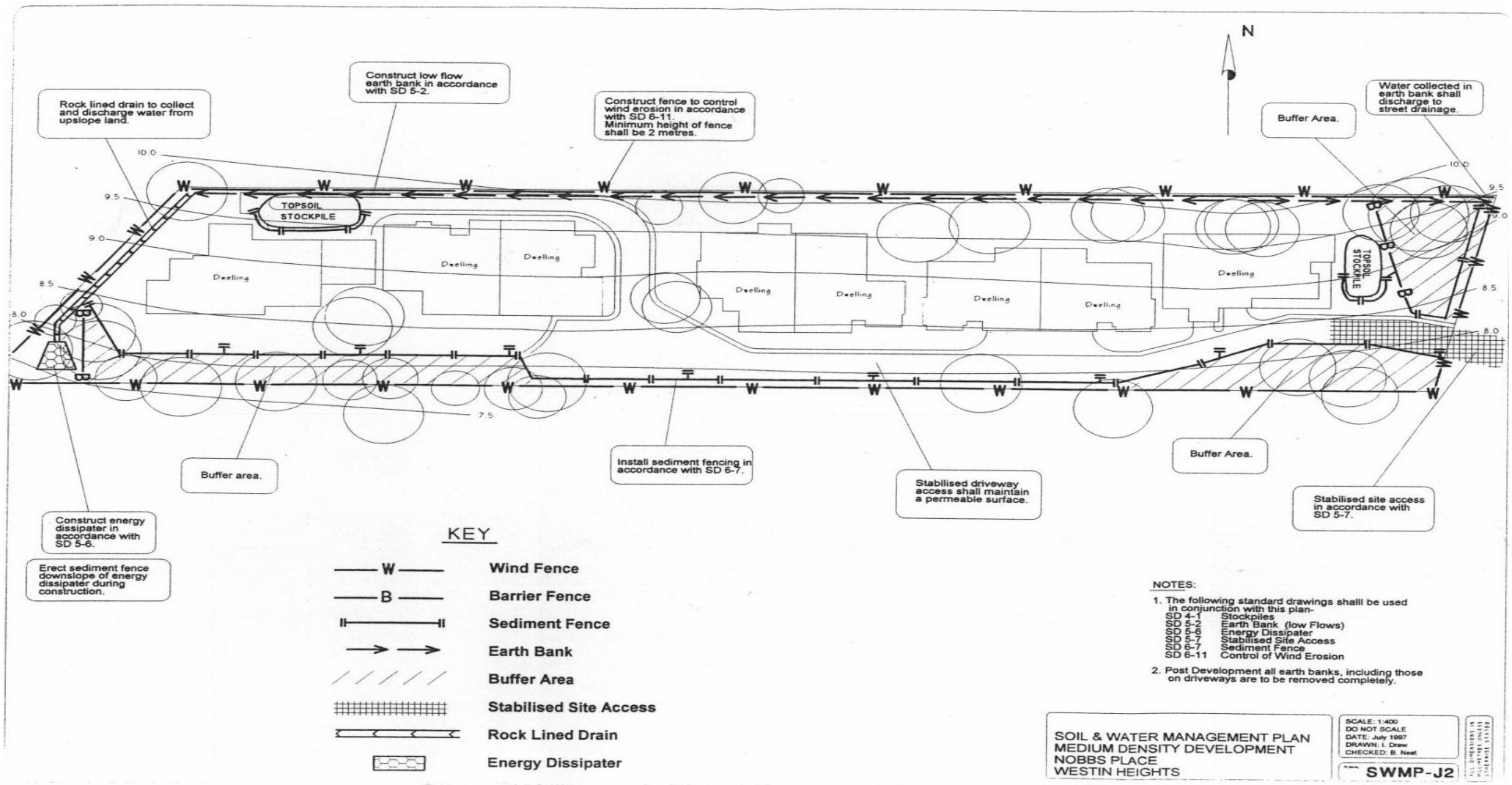
5. **STANDARD DRAWING SD5-6 (ENERGY DISSIPATER)**
(Source: - Department of Housing – Managing Urban Stormwater, Soils and Construction- 1998)

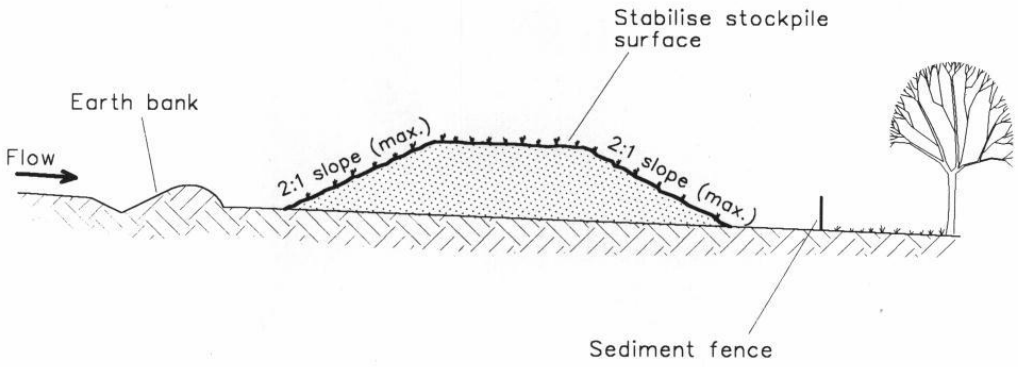
6. **STANDARD DRAWING SD5-7 (STABILISED SITE ACCESS)**
(Source: - Department of Housing – Managing Urban Stormwater, Soils and Construction- 1998)

7. **STANDARD DRAWING SD6-7 (SEDIMENT FENCE)**
(Source: - Department of Housing – Managing Urban Stormwater, Soils and Construction- 1998)

8. **STANDARD DRAWING SD6-11 (CONTROL OF WIND EROSION)**
(Source: - Department of Housing – Managing Urban Stormwater, Soils and Construction- 1998)

9. **SUMMARY OF EROSION AND SEDIMENT CONTROL TECHNIQUES.**
(Source:- Roads and Traffic Authority , Road Design Guide, Section 8- 1993)

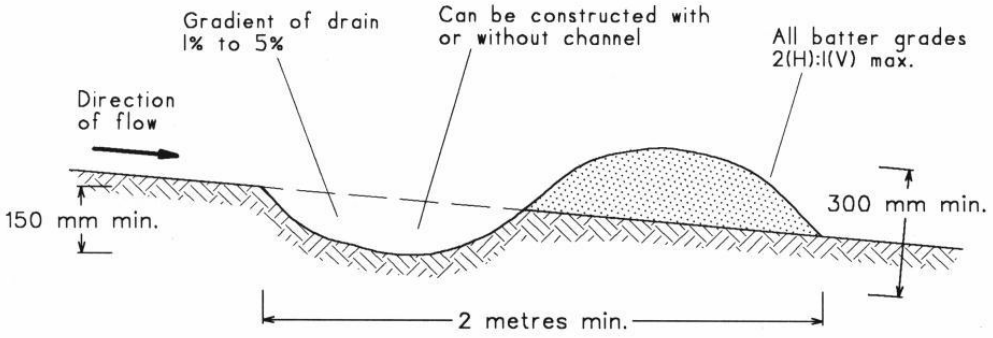

N
Rock lined drain to collect and discharge water from upslope land.
Construct low flow earth bank in accordance with SD 5-2.
Construct fence to control wind erosion in accordance with SD 6-11. Minimum height of fence shall be 2 metres.
Buffer Area.
Water collected in earth bank shall discharge to street drainage.
TOPSOIL STOCKPILE
Dwelling
Buffer area.
Install sediment fencing in accordance with SD 6-7.
Stabilised driveway access shall maintain a permeable surface.
Buffer Area.
Stabilised site access in accordance with SD 5-7.
Construct energy dissipater in accordance with SD 5-6.
Erect sediment fence downslope of energy dissipater during construction.
KEY
W Wind Fence
B Barrier Fence
Sediment Fence
Earth Bank
Buffer Area
Stabilised Site Access
Rock Lined Drain
Energy Dissipater
NOTES:
1. The following standard drawings shall be used in conjunction with this plan-
SD 4-1 Stockpiles
SD 5-2 Earth Bank (low Flows)
SD 5-6 Energy Dissipater
SD 5-7 Stabilised Site Access
SD 6-7 Sediment Fence
SD 6-11 Control of Wind Erosion
2. Post Development all earth banks, including those on driveways are to be removed completely.
SOIL & WATER MANAGEMENT PLAN
MEDIUM DENSITY DEVELOPMENT
NOBBS PLACE
WESTIN HEIGHTS
SCALE: 1:400
DO NOT SCALE
DATE: July 1997
DRAWN: I. Draw
CHECKED: B. Neat
SWMP-J2



Construction Notes

1. Locate stockpile at least 5 metres from existing vegetation, concentrated water flows, roads and hazard areas.
2. Construct on the contour as a low, flat, elongated mound.
3. Where there is sufficient area topsoil stockpiles shall be less than 2 metres in height.
4. Rehabilitate in accordance with the SWMP/ESCP.
5. Construct earth bank (Standard Drawing 5-2) on the upslope side to divert run off around the stockpile and a sediment fence (Standard Drawing 6-7) 1 to 2 metres downslope of stockpile.

STOCKPILES SD 4-1

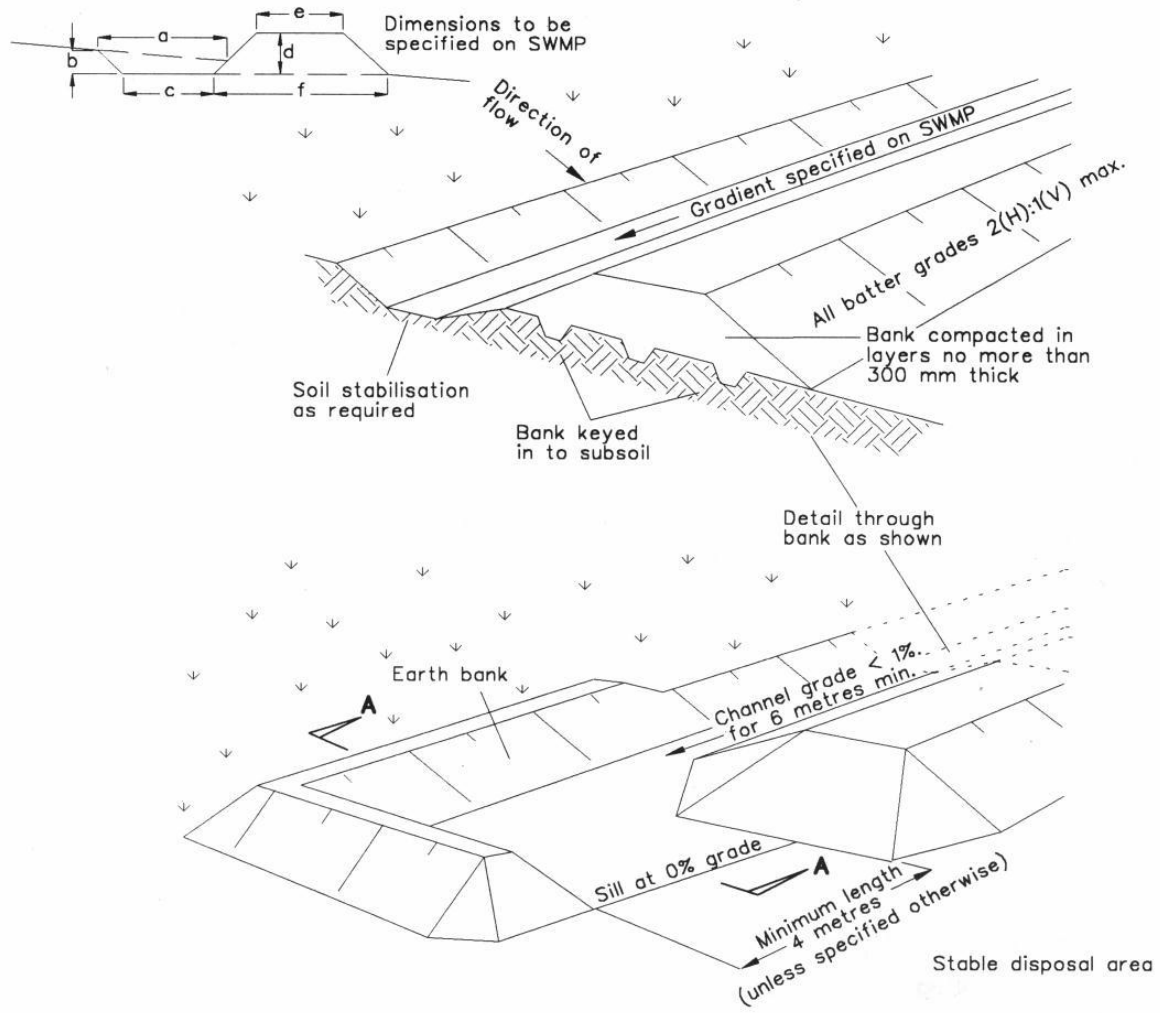


NOTE: Only to be used as temporary bank where maximum upslope length is 80 metres.

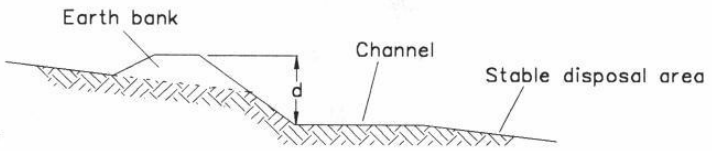
Construction Notes

1. Construct with gradient of 1 per cent to 5 per cent.
2. Avoid removing trees and shrubs if possible.
3. Drains to be of circular, parabolic or trapezoidal cross section not V-shaped.
4. Earth banks to be adequately compacted in order to prevent failure.
5. Permanent or temporary stabilisation of the earth bank to be completed within 10 days of construction.
6. All outlets from disturbed lands are to feed into a sediment basin or similar.
7. Discharge runoff collected from undisturbed lands onto either a stabilised or an undisturbed disposal site within the same subcatchment area from which the water originated.
8. Compact bank with a suitable implement in situations where they are required to function for more than five days.
9. Earth banks to be free of projections or other irregularities that will impede normal flow.

EARTH BANK (LOW FLOW) SD 5-2



Level Spreader (or Sill)

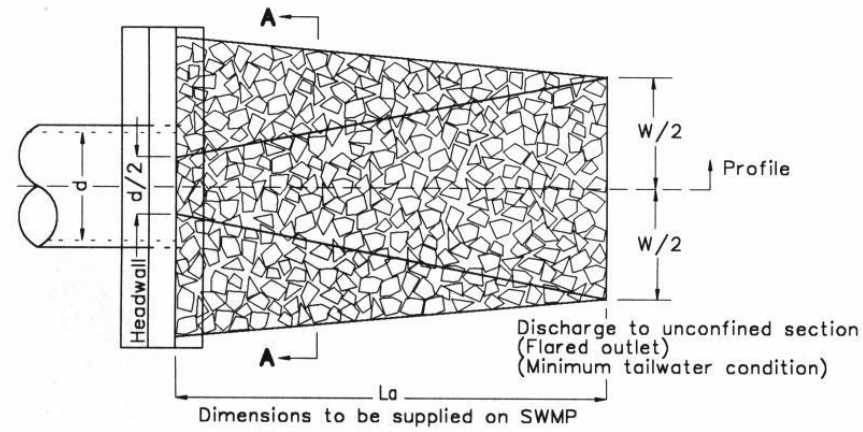


Section AA

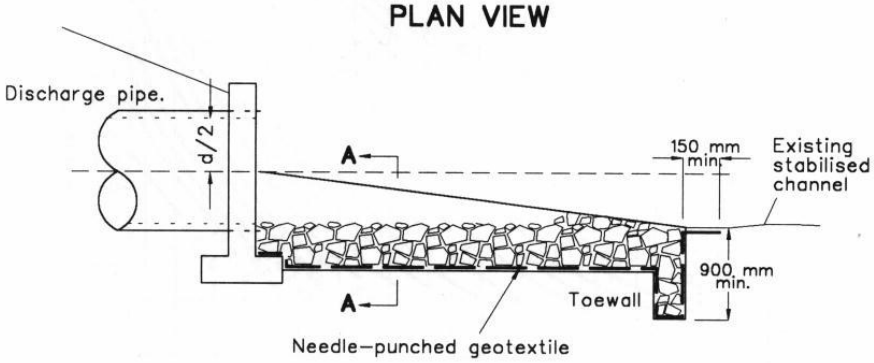
Construction Notes

1. Construct along gradient as specified.
2. Avoid removing trees and shrubs if possible.
3. Drains to be of parabolic or trapezoidal cross section as opposed to V-shaped.
4. Earth banks to be adequately compacted in order to prevent failure.
5. Permanent or temporary stabilisation of the earth bank to be completed within 10 days of construction.
6. All outlets from disturbed lands are to feed into a sediment basin or similar.
7. Discharge runoff collected from undisturbed lands onto either a stabilised or an undisturbed disposal site within the same subcatchment area from which the water originated.
8. Compact with a suitable implement in situations where they are required to function for more than five days.
9. Earth banks to be free of projections or other irregularities that will impede normal flow.

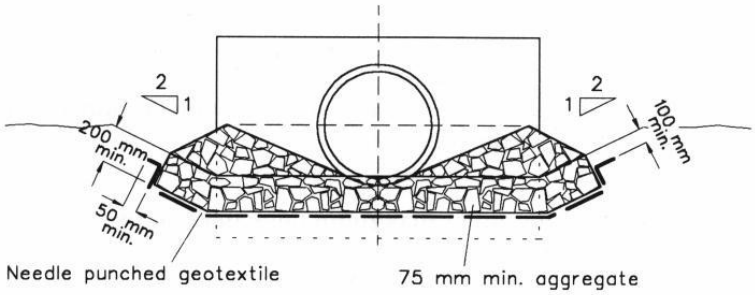
EARTH BANK (HIGH FLOWS) SD 5-3



PLAN VIEW



PLAN VIEW

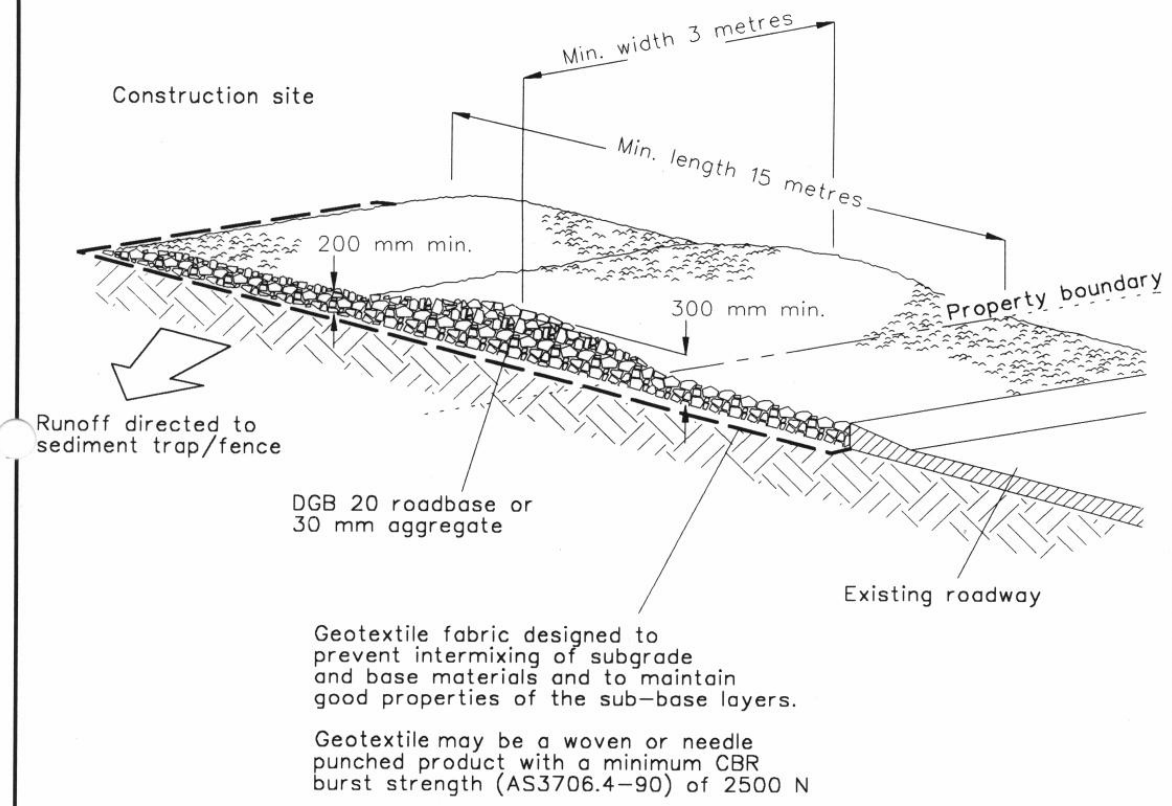


CROSS SECTION AA

Construction Notes

1. Subgrade fill to be compacted to the density of the surrounding undisturbed material.
2. Ensure that concrete or riprap used for energy dissipater or outlet protection conforms to the grading limits specified on the SWMP/ESCP.
3. Ensure that the geotextile does not sustain serious damage by preparing a smooth, even foundation.
4. Repair minor damage to the geotextile before spreading any aggregate. For repairs, patch one piece of fabric over the damage, making sure that all joints and patches overlap more than 300 mm.

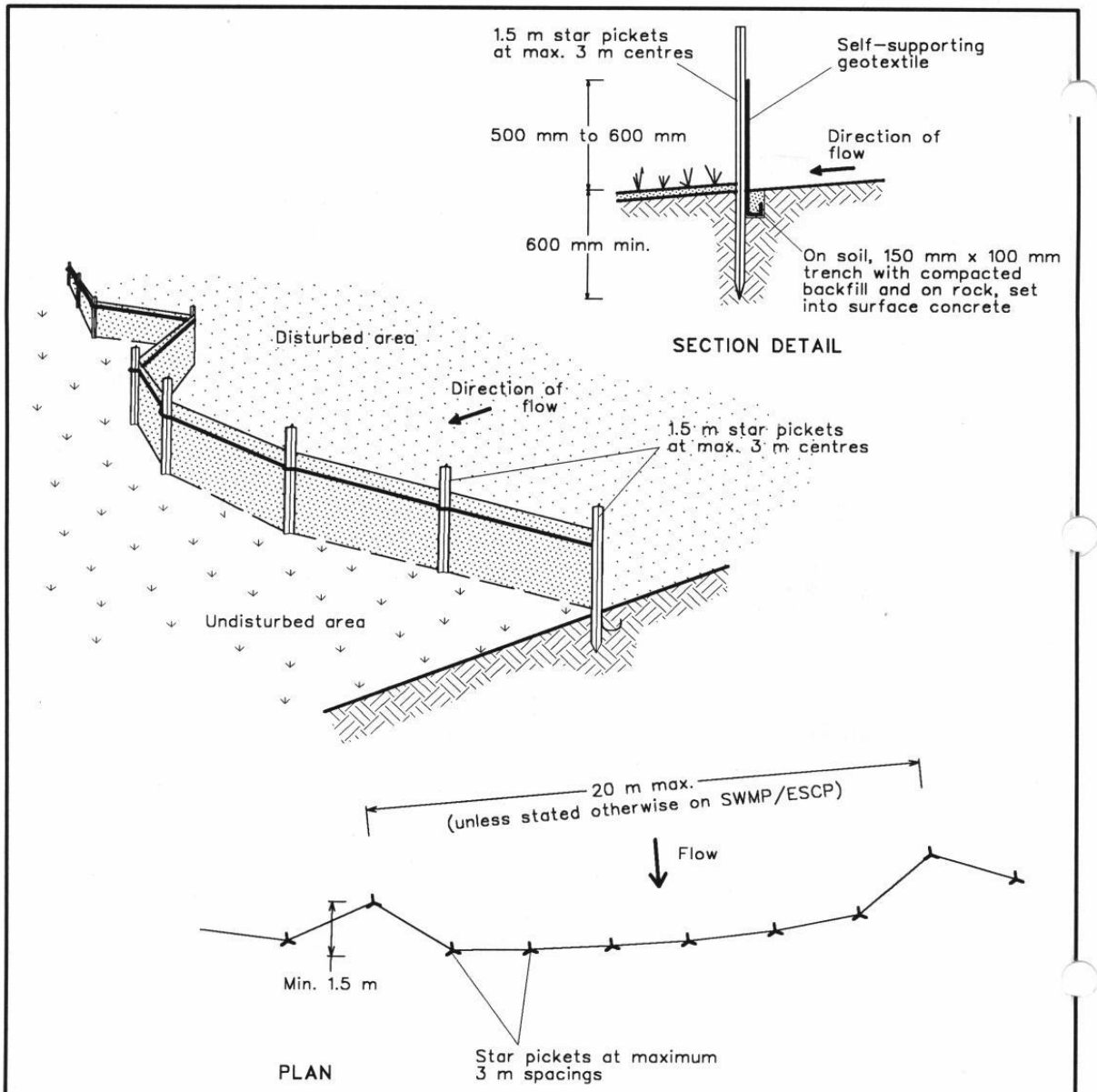
ENERGY DISSIPATER SD 5-6



Construction Notes

1. Strip topsoil and level site.
2. Compact subgrade.
3. Cover area with needle-punched geotextile.
4. Construct 200 mm thick pad over geotextile using roadbase or 30 mm aggregate. Minimum length 15 metres or to building alignment. Minimum width 3 metres.
5. Construct hump immediately within boundary to divert water to a sediment fence or other sediment trap.

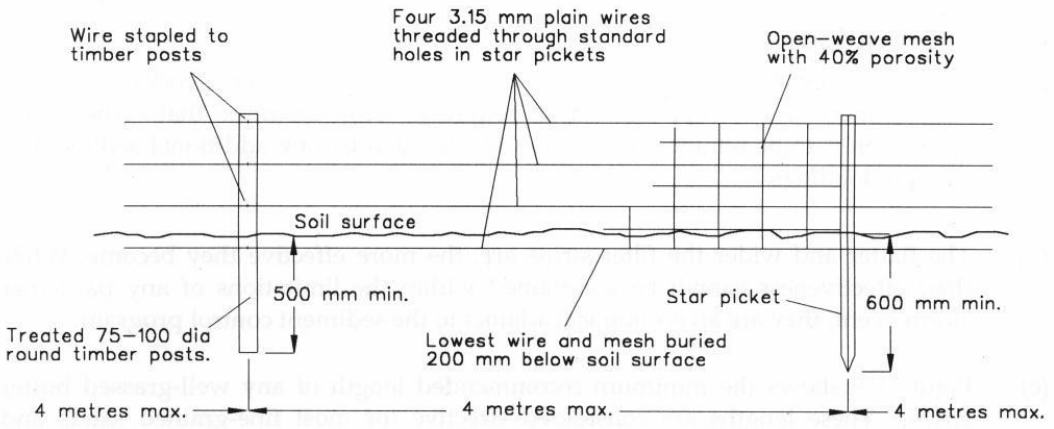
STABILISED SITE ACCESS SD 5-7

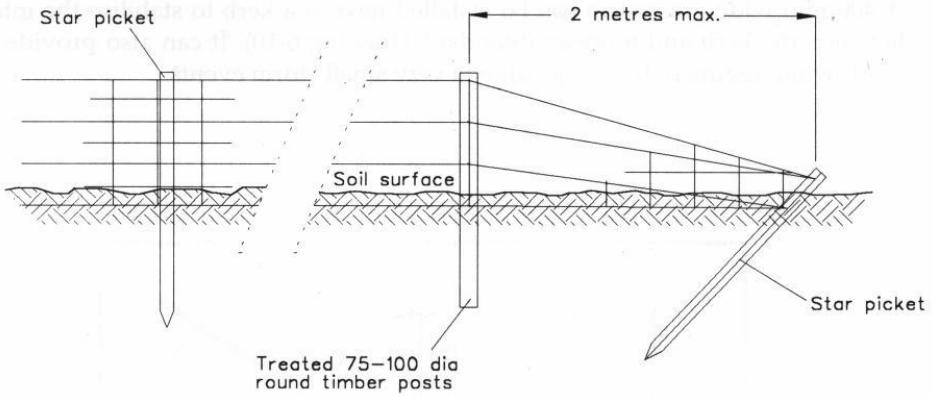


Construction Notes

1. Construct sediment fence as close as possible to parallel to the contours of the site.
2. Drive 1.5 metre long star pickets into ground, 3 metres apart.
3. Dig a 150 mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.
4. Backfill trench over base of fabric.
5. Fix self-supporting geotextile to upslope side of posts with wire ties or as recommended by geotextile manufacturer.
6. Join sections of fabric at a support post with a 150 mm overlap.

SEDIMENT FENCE SD 6-7



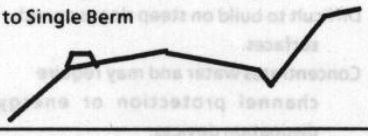
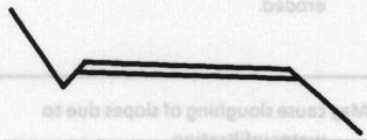
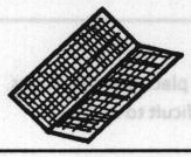


Construction Notes

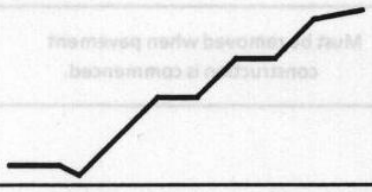
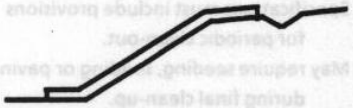
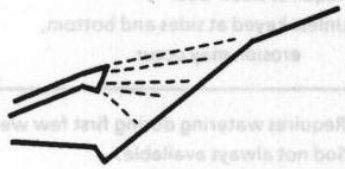
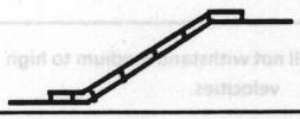
1. Install fence to height and location as specified on SWMP/ESCP.
2. Cut a channel 200 mm deep along the fence line.
3. Place wire and light resistant, open-weave polymer mesh with 40% porosity on prevailing wind side of fence.
4. Fasten mesh to all wires using ring fasteners at 100 mm -150 mm intervals on top wire and 300 mm intervals on other wires.
5. Use one 75 mm -100 mm dia. treated round timber post every 20 metres.
6. Star pickets to be fitted with safety caps.

CONTROL OF WIND EROSION SD 6-11

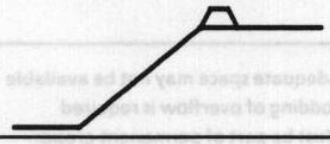
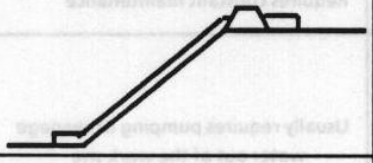
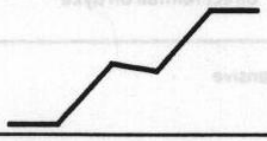
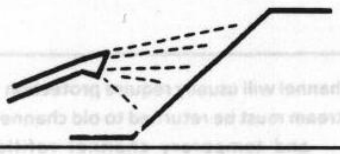
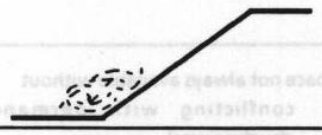
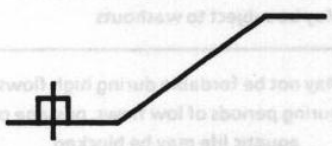
APPENDIX 8.1 SUMMARY OF EROSION AND SEDIMENTATION CONTROL TECHNIQUES

TECHNIQUE	ADVANTAGES	DISADVANTAGES
1. Roadway Surface		
Crowning to Ditch or Sloping to Single Berm 	Directs surface water to protected channel. Minimises erosion.	None - Should be part of good construction procedures.
Compaction	The final lift of each day's work should be compacted and bladed to drain to a ditch or berm.	None - Should be part of good construction procedures.
Aggregate Cover 	Minimises surface erosion. Permits construction traffic during adverse weather. May be used as part of permanent base construction.	Requires reworking and compaction if exposed for long periods. Loss of surface aggregates can be anticipated.
Seed/Mulch	Minimises surface erosion.	Must be removed when pavement construction is commenced.
2. Roadway Channels		
Sediment Traps / Straw Bale Filters 	Can be located as required to collect sediment during construction. Clean-out can usually be done by the equipment on-site.	Little guidance on spacing and size. Sediment removal may be difficult. Specifications must include provisions for periodic clean-out. May require seeding, sodding or paving during final clean-up.
Check Dams 	Maintains low velocities. Catches sediment. Can be constructed of logs, rock, timber, masonry or concrete.	Close spacing on steep grades. Requires clean-out. Unless keyed at sides and bottom, erosion may occur.
Sodding 	Easily placed, minimum preparation. Can be repaired during construction. Immediate protection. May be used on sides of lined channels to increase capacity.	Requires watering during first few weeks Sod not always available. Will not withstand high velocity or severe abrasion from sediment load.
Seeding with Mulch and Matting 	Usually least expensive. Effective for channels with low velocities. Easily placed in small quantities by inexperienced personnel.	Will not withstand medium to high velocities.
Paving, Riprap, Rubble	Effective for high velocities. May be part of the permanent erosion control features.	Cannot always be placed when needed due to construction traffic and final grading and dressing. Initial cost is high.

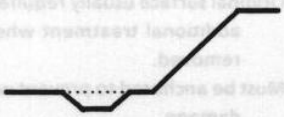
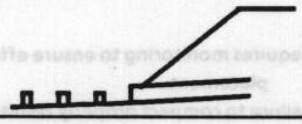
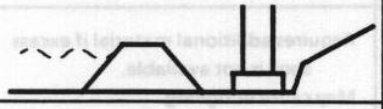
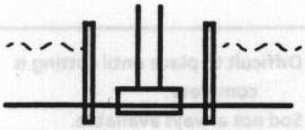
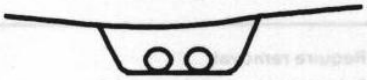
APPENDIX 8.1 SUMMARY OF EROSION AND SEDIMENTATION CONTROL TECHNIQUES *(continued)*

TECHNIQUE	ADVANTAGES	DISADVANTAGES
3. Cutting Slopes		
Berm at Top of Cutting 	Diverts water from cutting. Collects for slope drains or lined channels. May be constructed prior to excavation.	Access to top of cutting. Difficult to build on steep slopes or rock surfaces. Concentrates water and may require channel protection or energy dissipation devices.
Diversion Dyke 	Collects and diverts water at selected location reduces erosion potential. May be incorporated in permanent drainage system.	Access for construction. May be continual maintenance problem if not lined. Disturbed material or berm easily eroded.
Benching 	Slows velocity of runoff. Collects sediment. Provides access to slope for seeding, mulching and maintenance. Collects water for slope drains or may divert to natural ground. Assists in establishing vegetation.	May cause sloughing of slopes due to water infiltration. Requires additional ROW. May not be possible in unsuitable material. Requires maintenance to be effective. Increases excavation quantities.
Slope Drains 	Prevents erosion of slope. Can be part of temporary or permanent system. Can be constructed or extended as excavation progresses.	Requires other structure to collect water. Permanent construction not always compatible with other project work. Usually requires some type of energy dissipation.
Seeding/Mulching 	Contributes to a grassed slope. Mulch provides temporary erosion protection until grass is rooted. Temporary or permanent seeding may be used. Mulch should be anchored. Larger slopes can be seeded in stages if smaller equipment is used.	Difficult to schedule high production units for small increments. Success depends largely on season. May require supplementary watering.
Sodding 	Provides immediate protection. Can be used to protect adjacent property from sediment and turbidity.	Difficult to place until embankment is complete. Sod not always available. May be expensive.
Riprap, Rock Mattresses or Hard Sealing 	Provides immediate protection for high risk areas and under structures. Sealing may be pre-cast or cast-in-situ.	Expensive. Difficult to place on high slopes. May be difficult to maintain.

APPENDIX 8.1 SUMMARY OF EROSION AND SEDIMENTATION CONTROL TECHNIQUES *(continued)*

TECHNIQUE	ADVANTAGES	DISADVANTAGES
3. Cutting Slopes (continued)		
Temporary Cover (Plastic Sheeting, Geotextiles etc)	Easily placed and removed. Useful for providing some degree of protection for high risk areas.	Provides only temporary protection. Original surface usually requires additional treatment when cover is removed. Must be anchored to prevent wind damage.
4. Embankment Slopes		
Berms at Top of Embankment 	Prevents runoff running down face. Collects runoff for slope drains or channels. Can be placed as part of the normal construction operation.	Requires monitoring to ensure effective placement. Failure to compact properly results in failure of berm. Sediment build up.
Slope Drains 	Prevents runoff running down face. Can be full or half pipe, pre-cast sections, rock mattresses, or other materials. Can be extended as construction progresses. Can be either temporary or permanent.	Energy dissipator required at outlet. Removal of temporary drain may disturb growing vegetation.
Embankment Berms or Benches 	Reduces velocity of slope runoff. Collects sediment. Provides access for maintenance. Collects water for slope drains. Can be used to spoil excess material.	Requires additional material if excess spoil is not available. May cause sloughing. Additional ROW may be needed.
Seeding/Mulching 	Can decrease slope exposure if applied at appropriate time. Mulch that is cut in or otherwise anchored will collect sediment.	Difficult to place until cutting is complete. Sod not always available. May be expensive.
5. Protection of Adjacent Property		
Brush Barriers 	Use slashing and logs from clearing operation. May be covered and seeded later. Eliminates need for burning or disposal of cleared material.	May be considered unsightly in urban areas.
Straw Bale Barriers 	Bales readily available in most areas. When properly installed and maintained, they filter sediment and some turbidity from runoff.	Require removal. Subject to damage by vandals. Flow is slow through straw, requiring considerable area. May introduce unwanted species of vegetation.

APPENDIX 8.1 SUMMARY OF EROSION AND SEDIMENTATION CONTROL TECHNIQUES *(continued)*

TECHNIQUE	ADVANTAGES	DISADVANTAGES
4. Embankment Slopes (continued)		
Sediment Traps 	Collects much of the sediment from embankment slopes and channels Inexpensive Can be cleaned and expanded to meet need	Do not remove all sediment and turbidity Space not always available Require constant maintenance Usually need to be removed
Energy Dissipators 	Minimises erosion away from project Slows velocity, permits sediment deposition and collection downstream	May collect debris Require special design Can be expensive May be quite large structures
Level Spreaders 	Converts concentrated channel or pipe flow back to sheet flow Avoids channel easements and construction off project Simple to construct	Adequate space may not be available Sodding of overflow is required Must be part of permanent erosion control effort Requires constant maintenance
6. Protection of Stream		
Construction Dyke 	Permits work to continue during normal stream stages	Usually requires pumping of seepage water out of the work site Subject to erosion from stream and from direct rainfall on dyke
Cofferdam 	Work can be continued during most anticipated stream conditions Clear water can be pumped directly back into stream No material deposited in stream	Expensive
Temporary Stream Channel Change	Prepared channel keeps flow away from construction	Channel will usually require protection Stream must be returned to old channel and temporary channel refilled when finished
Riprap	Easy to stockpile and place Can be installed in increments as needed	Can be expensive
Temporary Culverts for Haul Roads 	Minimises turbulence and turbidity Provides uninterrupted route for fish Normal flow can be provided by pipes, higher flows can pass over roadway	Space not always available without conflicting with permanent structure work Larger pipe sizes may be expensive May be subject to washouts
Rock Lined Low-Level Crossing 	Minimises stream turbidity Inexpensive May also serve as a channel flow check or sediment trap	May not be fordable during high flows During periods of low flows, passage of aquatic life may be blocked

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