

1102 CONTROL OF EROSION AND SEDIMENTATION (CONSTRUCTION)

1 GENERAL

1.1 RESPONSIBILITIES

Objectives

General: Provide the works and implement measures to control erosion and sedimentation, as documented and in accordance with the approved Environmental Management Plan.

Performance

~~Requirements: [complete/delete]~~

Design

Requirements: Design the control measures for erosion and sedimentation to comply with statutory requirements. Preclude any potential hazard to persons or property.

~~Designer: [complete/delete]~~

~~Authority requirements: [complete/delete]~~

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- 0136 General requirements (Construction).
- 0152 Schedule of rates – supply projects.
- 0161 Quality (Construction).
- 0167 Integrated management.
- 0257 Landscape – roadways and street trees.
- 1101 Control of traffic.
- 1111 Clearing and grubbing.
- 1112 Earthworks (Roadways).
- 1121 Open drains, including kerb and channel (gutter).

1.3 REFERENCED DOCUMENTS

The following documents are incorporated into this worksection by reference:
Institute of Public Works Engineering Australia (IPWEA) - Local Government Salinity Management Handbook 2002 a resource guide for the public works professional.

1.4 STANDARDS

The following documents are incorporated into this worksection by reference:

~~Documents: [complete/delete]~~

1.5 INTERPRETATION

Abbreviations

General: For the purposes of this worksection the following abbreviations apply:

CEMP: Environmental Management Plan.

ESCP: Erosion and Sediment Control Plan.

NTU: The units of turbidity from a calibrated nephelometer are called Nephelometric Turbidity Units.

SWMP: Soil and Water Management Plan.

Definitions

General: For the purposes of this worksection the following definitions apply:

- Erosion: The wearing away of land by the action of rainfall, running water, wind, moving ice or gravitational creep. Soil detachment (erosion) occurs when the erosive forces exceed the soil's resistance, causing the soil particles to move.
- Sediment: Sediment is the result of erosion, and consists of small detached soil particles. It occurs when the transportation of detached soil particles ceases or slows and the soil particles fall out of suspension.

1.6 SUBMISSIONS

Approval

Submissions: To the Superintendent's approval.

Documents

- Contractors Environmental Management Plan (CEMP).
- Soil and Water Management Plan (SWMP).
- Erosion and Soil Control Plan (ESCP).
- Program for coordination of work schedules including order of works and timing.

Drawings

- Access and haulage tracks.
- Borrow pits and stock areas.
- Compound areas.
- Features of the site.
- Relevant construction details.

Calculations

- Survey of embankments.

~~Manuals: [complete/delete]~~

~~Technical data: [complete/delete]~~

~~Type tests: [complete/delete]~~

~~Type test results: [complete/delete]~~

~~Prototypes: [complete/delete]~~

~~Samples: [complete/delete]~~

~~Warranties: [complete/delete]~~

1.7 HOLD POINTS AND WITNESS POINTS

Notice

General: Give notice so that the documented inspection and submissions may be made to the **HOLD POINT table** and the **WITNESS POINT table**.

HOLD POINTS table

Clause/subclause	Requirement	Notice for inspection	Release by
PRE-CONSTRUCTION PLANNING			
Contractors Environmental Management Plan (CEMP) - General	Submit CEMP with detailed section plans for each catchment area and site section	7 days before site disturbance on each section	<i>Principal Certifying Authority</i>
EXECUTION			
Erosion and sedimentation control measures - Stockpile sites	Proposed stockpile locations	7 days before site disturbance or material delivery	<i>Principal Certifying Authority</i>
Earthworks – Embankments and sediment removal	Survey information for volume measurement	3 working days before embankment construction or sediment removal	<i>Principal Certifying Authority</i>

WITNESS POINTS table

Clause/subclause	Requirement	Notice for inspection by the Superintendent
EXECUTION		
Erosion and sedimentation control measures - Control measures	Diversion and catch drains - constructed and lined before the adjacent ground is disturbed and the excavation is commenced	3 working days before ground disturbance
	Areas of erodible material not approved for clearing or disturbance clearly marked, fenced off or protected against disturbance	3 working days before the adjacent ground is disturbed
Erosion and sedimentation control measures - Access and exit areas	Decontamination - shake-down or other methods for the removal of soil materials from motor vehicles	7 days before site disturbance
Cleaning - Sedimentation control structures	Cleaning out of permanent sedimentation control structures	3 working days before proposed clean out
Temporary erosion and sedimentation control - General	Provide temporary erosion and sedimentation control measures	7 days before site disturbance
Temporary erosion and sedimentation control - Control measures	Provide temporary sediment traps and trash barriers	3 working days before ground disturbance
Temporary erosion and sedimentation control - Maintenance	Provide access roads for inspection and maintenance sedimentation control works	Progressive
Temporary erosion and sedimentation control - Removal	Removal of temporary erosion and sedimentation control works	3 working days before each stage of progressive removal

2 PRE-CONSTRUCTION PLANNING

2.1 CONTRACTORS ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

General

Minor works: Prepare a CEMP covering erosion and sedimentation control.

Major works: Prepare a SWMP including both CEMP and ESCP.

~~Approval criteria: [complete/delete]~~

Site sections: At least seven days before the natural surface is disturbed on each of these sections, submit a CEMP for that section. Superimpose the plan on the drainage drawings of the works. This is a **HOLD POINT**.

Responsibility: The Contractor has the responsibility to provide whatever measures are required for the effective erosion and sedimentation control at all times.

Responsibilities

Adherence: Adhere to the approved CEMP. Submit a revised CEMP for approval seven days in advance of an intended variation from the approved plan.

Salinity prevention: In known salt affected areas, seek advice from the relevant land and water resource authority to ensure that the proposed CEMP conforms to the current

salinity prevention measures outlined in the IPWEA publication, *Local Government Salinity Management Handbook*.

Minimising erosion

Objective: To minimise the quantity of soil lost during construction due to land clearing and earthworks.

Content: Provide documentation and program scheduling to address the following:

- Minimum land clearance, particularly of areas of highly erodible soils and steep slopes prone to water and wind erosion.
- Progressive revegetation and mulching, as each site section is complete.
- Coordination of work schedules for multiple contractors, to avoid delays resulting in disturbed land remaining unstabilised.
- Time schedules for the construction of structures and the implementation of measures to control erosion and sedimentation. Where possible, program the work to avoid seasonal intense rain storms.
- An order of works based upon construction and stabilisation of all culverts and surface drainage works, at the earliest practical stage.
- A Time schedule to address **HOLD POINTS** and **WITNESS POINTS**.

Documentation: Implement ahead of, or in conjunction with clearing and grubbing operations (as required by *1111 Clearing and grubbing*) all permanent and temporary erosion and sedimentation control measures, including the control measures.

Site sections: For implementation divide the site into sections based on the catchment area draining to each permanent drainage structure in the works and based on the area bounded by the road reserve. **Site section information:** Provide diagrams indicating the following:

- Access and haulage tracks.
- Borrow pits and stockpile areas.
- Compound areas, such as Contractor's facilities and concrete batching areas.
- Features of the site, including contours and drainage paths.
- Relevant construction details of all erosion and sedimentation control structures.

2.2 SOIL AND WATERMANAGEMENT PLAN - SUPPLEMENT

General

Objective: To minimise the generation of contaminated stormwater.

Content: Provide documentation to address the following:

- Minimising the quantity of uncontaminated stormwater entering cleared areas.
- Establishing cut-off or intercept drains to redirect stormwater away from cleared areas and sloping to stable (vegetated) areas or effective treatment installations.
- Reducing water velocities.

Preparation

Expertise: Employ an experienced consultant to design, document and technically report on the implementation of the plan and submit details of experience.

Environmental assessment: Identify and obtain information on any relevant environmental impact that may be caused by the works.

Risk assessment: Identify and quantify risks and remedial action that may arise from the construction of the works.

Sediment controls

Objective: To minimise the impact of contaminated water on receiving waters.

Content: Provide documentation to address the following:

- Installing erosion and sediment control measures before construction where possible.
- Identifying drainage lines and install control measures to handle predicted stormwater and sediment loads generated in the mini catchment.

- Designing erosion and sediment run-off control measures appropriate to the site conditions to handle storm events with 2 year ARI with intensity of 6 hours, for temporary structures, and 50 year ARI, for permanent structures.
- Preparing an inspection, maintenance and cleaning program for sediment run-off control structures.
- Creating contingency plans for unusual storm events.
- Planning for the continual assessment of the effectiveness of sediment control measures.

De-watering work sites

Objective: To ensure that de-watering operations do not result in turbid water entering natural waterways.

Content: Provide documentation to address the following with regard to de-watering by pumping:

- Treating contaminated water if the turbidity exceeds 30 NTU.
- Only pump water into natural waterways that does not exceed regulatory water quality standards.
- Pumping water, wherever practical, to vegetated areas of sufficient width to remove suspended soil, or to sediment control structures.
- Monitoring turbidity hourly, if discharge is to a natural waterway.

Dust control

Objective: To ensure there is no health risk or loss of amenity due to emission of dust to the environment.

Content: Provide documentation to address the following:

- Suppressing dust by watering.
- Installing wind fences.

Management of stockpiles and batters

Objective: To manage soil stockpiles so that dust and sediment in run-off are minimised.

Content: Provide documentation to address the following:

- Minimising the number of stockpiles, and the area and the time stockpiles are exposed.
- Separating soil and overburden stockpiles.
- Locating stockpiles away from drainage lines, at least 10 m away from natural waterways and where least susceptible to wind erosion.
- Designing stockpiles and batters with slopes no steeper than 2H:1V.
- Stabilising stockpiles that will remain bare for more than 28 days by covering with mulch, anchored fabrics or seeding with sterile grass.
- Establishing sediment controls around unstabilised stockpiles and batters.

Working in waterways and floodplains

Objective: To minimise stress on aquatic communities when working in a waterway.

Content: Provide documentation to address the following:

- Planning in-stream works to minimise contact time.
- Establishing special practices to minimise impacts on the waterway and disturbance of the banks.
- Stabilising the banks and the in-stream structures so they do not contribute to the sediment load.
- Maintaining minimum flows to ensure the viability of aquatic communities. Ensure the free passage of fish.
- Designing crossings that do not contribute to the sediment load.
- Preparing a contingency plan for severe rainfall events.
- Preparing a reinstatement plan for work in a stream that could alter the waterway structure.

3 EXECUTION

3.1 PROVISION FOR TRAFFIC

General

Control of traffic: Conform to the following:

- Conform with *1101 Control of traffic*.
- Conform with **Traffic Guidance Scheme** in *1101 Control of traffic*.

3.2 EROSION AND SEDIMENTATION CONTROL MEASURES

Control measures

Construction: To the CEMP and the drawings.

Requirement: Provide erosion and sedimentation control measures to include, but not limited to, the following:

- The installation of permanent drainage structures before the removal of topsoil and before the commencement of earthworks for formation within the catchment area of each structure.
- The prompt completion of all permanent and temporary drainage works, once commenced, to minimise the period of exposure of disturbed areas.
- The construction of diversion and catch drains to divert uncontaminated runoff from outside the site, clear of the site. Construct and line catch drains before the adjacent ground is disturbed and the excavation is commenced. This is a **WITNESS POINT**.
- To provide for the passage of uncontaminated water through the site without mixing with contaminated runoff from the site.
- The provision of contour and diversion drains across exposed areas before, during and immediately after clearing and the re-establishment and maintenance of these drains during soil removal and earthworks operations.
- The provision of sediment filtering or sediment traps, ahead of and in conjunction with earthworks operations, to prevent contaminated water leaving the site.
- The restoration of the above drainage and sedimentation control works on a day to day basis to ensure that no disturbed area is left without adequate means of containment and treatment of contaminated water.
- The limitation of areas or erodible material exposed at any time to those areas being actively worked. Clearly mark, fence off or otherwise protect any areas not approved for clearing or disturbance. This is a **WITNESS POINT**.
- The minimisation of sediment loss during construction of embankments by means such as temporary or reverse superelevations during fill placement, constructing berms along the edge of the formation leading to temporary batter flumes and short term sediment traps.
- The progressive revegetation of the site, in accordance with *0257 Landscape - Roadways and street trees*.

Stockpile sites

Location: Areas pre-approved for such use.

Protection: Provide a 5 m buffer zone to between stockpile sites and any stream or flow path. Protect all stockpiles from erosion and contamination of the surrounding area by use of the measures approved in the CEMP. This is a **HOLD POINT**.

Access and exit areas

Decontamination: Include shake-down or other methods approved for the removal of spoil materials from construction plant or vehicles. This is a **WITNESS POINT**.

3.3 EARTHWORKS

Permanent erosion and sedimentation control basins

Planned levels: Construct earthworks for permanent erosion and sedimentation control basins to the documented levels and dimensions shown on the drawings or such levels and dimensions as determined by the Superintendent.

Site preparation: Clear the entire storage and embankment foundation area of permanent erosion and sedimentation control basins in accordance with *1111 Clearing and grubbing*. Strip topsoil and any unsuitable material under embankments to conform with *1112 Earthworks (Roadways)*.

Embankments and sediment removal

Embankments: To *1112 Earthworks (Roadways)*.

Survey information: If payment for embankment construction or sediment removal is on a Schedule of Rates basis provide survey information sufficient to subsequently measure the volume of the constructed embankment and sediment removal. This is a **HOLD POINT**.

3.4 INLETS, SPILLWAYS AND LOW FLOW OUTLETS

Sedimentation control basins and sediment traps

Rock mattresses: Construct inlets and spillways using rock filled woven galvanized steel mattresses and geotextile. Install the rock filled mattresses to conform with the requirements for rock filled wire mattress and geotextile in *1121 Open drains, including kerb and channel (gutter)*.

Plastic pipe outlet: Install a low flow outlet consisting of a 150 mm diameter plastic pipe in the locations shown on the drawings. No extra payment will be made for this work which forms part of the construction of the sedimentation control basin.

3.5 DROP INLET SEDIMENT CONTROL

Permanent traps

Timing: Construct permanent drop inlet sediment traps and inlet control banks, on completion of gully pits as shown on the drawings. These permanent drop inlet sediment traps and inlet control banks are additional to the temporary sedimentation control measures that may be required during construction of the gully pits.

Purpose: Construct the inlet control banks as required to prevent the surface flows bypassing the gully pits. The drop inlet sediment traps are to remove sediment from the surface flow before it enters the drainage system.

Sediment traps and control banks: Conform to the following:

- Construct the drop inlet sediment traps with the associated inlet control banks to consist of at least two courses of sandbags containing a 10:1 sand/cement mix as shown on the drawings.
- Key the bags at least 25 mm into the surface, dampen sufficiently to ensure hydration of the cement and tamp lightly to provide mechanical interlock between adjacent bags.

3.6 CLEANING

Sedimentation control structures

Timing: Clean out permanent sedimentation control/structures, whenever the accumulated sediment has reduced the capacity of the structure by 50% or more, or whenever the sediment has built up to a point where it is less than 300 mm below the spillway crest.

This is a **WITNESS POINT**.

Pay item criteria: Clean out due to failure to provide or maintain specified erosion **Control Measures**, will not be included in pay items.

Removal of sediment: Remove accumulated sediment from permanent sedimentation control structures, in such a manner as not to damage the structures.

Disposal: Remove the sediment to a nominated soil stockpile site or dispose in such locations that the sediment will not be conveyed back into the construction areas or into watercourses.

Access: Provide and maintain suitable access to permanent sedimentation control structures, to allow cleaning out in all weather conditions.

Completion

Cleaning: Clean all permanent sedimentation control structures, prior to Practical Completion of the Works.

3.7 TEMPORARY EROSION AND SEDIMENTATION CONTROL

General

Continuous control: Ensure that effective erosion and sedimentation control is provided at all times during the contract. Remove and/or reinstate any temporary or redundant control works at appropriate times during the contract.

Runoff: Prior to dispersing any runoff must be free of pollutants as defined in the relevant legislation. Disperse clean runoff to stable areas or natural water courses.

Control: Provide temporary erosion and sedimentation control measures where the natural surface is disturbed by construction, including roads, depot and stockpile sites. This is a **WITNESS POINT**.

Maintenance: Provide and maintain slopes, crowns and drains on all excavations and embankments to ensure satisfactory drainage at all times. Do not allow water to pond on the works unless such ponding is part of an approved CEMP.

Control measures

Temporary drains: Control runoff from areas exposed during the work by construction of temporary contour drains and/or temporary diversion drains, which take the form of a channel constructed across a slope with a ridge on its lower side. They may require progressive implementation and frequent alteration as the work progresses.

Contour drains: Provide contour drains across the natural surface at approximately the same elevation. Immediately after a construction site is cleared, intercept and divert runoff from the site to nearby stable areas at non-erosive velocities. Construct as follows:

- Contour drains, as shown on the drawings, formed with a grade of not less than 1% or greater than 1.5% and spaced at intervals of not less than 20 m or greater than 50 m, depending on the erodibility of the exposed soil.

Diversion drains: Provide diversion drains across haul roads and access tracks when such roads and access tracks are identified as constituting an erosion hazard due to their steepness, soil erodibility or potential for concentrating runoff flow, constructed as follows:

- Formed to intercept and divert runoff from the road or track to stable outlets.
- Spacing of diversion drains not greater than that required to maintain runoff at non-erosive velocities.

Temporary sediment traps: Provide devices during construction to remove sediment from runoff flowing from areas of 0.5 ha or more before the runoff enters stormwater drainage systems, natural water courses or adjacent land. This is a **WITNESS POINT**.

Trash barriers: Provide and maintain trash barriers to prevent debris from entering natural watercourses.

Batter protection: Take all necessary action to protect batters from erosion during the contract. Minimise scour of newly-formed fill batters during and after embankment construction by diverting runoff from the formation away from the batter until vegetation is established.

Maintenance

Maintenance and inspection: Inspect all temporary erosion and sedimentation control works after each rain period and during periods of prolonged rainfall. Rectify any defects revealed by such inspections immediately. Clean, repair and augment, as required, the works, to ensure effective erosion and sedimentation control thereafter.

Access: Provide and maintain access from within the road reserve, or from other acceptable locations, for clearing out sedimentation control works. This is a **WITNESS POINT**.

Removal

Timing: Remove all temporary erosion and sedimentation control works when revegetation is established on formerly exposed areas before the end of the contract. Remove from the site or otherwise dispose, all materials and components used for the temporary erosion and sedimentation control works. This is a **WITNESS POINT**.

4 MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

General

Payments made to the Schedule of Rates: To 0152 Schedule of rates – supply projects, this worksection, the drawings and Pay items **1102.1** to **1102.5** inclusive.

Lump Sum prices: Not acceptable for any item other than **Pay Item 1102.1**.

Unpriced items: For each unpriced item listed in the Schedule of Rates, make due allowance in the prices of other items.

Methodology

The following methodology will be applied for measurement and payment:

- Clearing and grubbing is measured and paid in accordance with 1111 Clearing and grubbing.
- Landscaping works are measured and paid in accordance with 0257 Landscape – roadways and street trees.
- Topsoil stripping and removal of unsuitable material are measured and paid in accordance with 1112 Earthworks (Roadways).

4.2 PAY ITEMS

Pay items	Unit of measurement	Schedule rate scope
1102.1 Temporary erosion and sedimentation control	Lump sum	All costs associated with the installation, maintenance, inspection and removal of the temporary erosion and sedimentation control measures in accordance with Temporary erosion and sedimentation control inclusive and the drawings.
1102.2 Earthworks for permanent erosion and sedimentation control basins	m ³ . The volume will be determined by calculation using the end area method.	All costs associated with compacted embankment constructed in accordance with Earthworks for permanent erosion and sedimentation control basins and the drawings. The schedule rate to cover the excavation of material from within the sedimentation control basin and embankment construction required under Earthworks for permanent erosion and sedimentation basins and will be an average rate for all types of materials. The cost of excavating and transporting material for embankment construction and obtained from within cuttings or from borrow will be included in the

Pay items	Unit of measurement	Schedule rate scope
		schedule rate for General Excavation in 1112 <i>Earthworks (Roadways)</i> .
1102.3 Inlets, spillways and low flow outlets for sedimentation control basins	m ² of horizontal surface area	All costs associated with the rock filled mattress constructed in accordance with Inlets, spillways and low flow outlets for sedimentation control basins and sediment traps and the drawings.
1102.4 Drop inlet sediment traps and inlet control banks	'Each' drop	All costs associated with drop inlet sediment trap including inlet control bank constructed in accordance with Drop inlet sediment control and the drawings.
1102.5 Cleaning of permanent sedimentation structures	m ³ of in-place sediment	All costs associated with sediment removal from the structure in accordance with Cleaning sedimentation control structures . The volume of sediment removed will be determined by survey or by methods approved by the Superintendent. The schedule quantity is a provisional quantity.