1172 SUBSOIL AND FOUNDATION DRAINS

1 GENERAL

1.1 RESPONSIBILITIES

Objectives

General: Provide subsoil and foundation drains, as documented.

Performance

Requirements: Construct the works shown on the drawings or directed all in conformance with *0161 Quality (Construction)*.

1.2 CROSS REFERENCES

Worksections

Requirement: Conform to the following:

- *0136 General requirements (Construction).*
- *0152* Schedule of rates – supply projects.
- *0161 Quality (Construction).*
- *0167 Integrated management.*
- *1101 Control of traffic.*
- *1112 Earthworks (Roadways)*.
- *1171 Subsurface drainage.*

1.3 REFERENCED DOCUMENTS

Standards

General: The following documents are incorporated into this worksection by reference:

AS 1289	Methods of testing soils for engineering purposes.
AS 1289.5.4.1-2007	Soil compaction and density tests—Compaction control test—Dry density ratio, moisture variation and moisture ratio.
AS 1289.5.6.1-1998	Soil compaction and density tests - Compaction control test - Density index method for a cohesionless material

Other publications

AUSTROADS

AGPT10-2009	Guide to Pavement Technology Part 10 – Subsurface drainage.

1.4 INTERPRETATION

Abbreviations

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

- CI: Cast Iron.
- HDPE: High Density Polyethylene.

Definitions

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

- Foundation drains: For drainage of seepage, springs and wet areas within and adjacent to the foundations.
- Panel drain: Corrugated flat plastic pipe.
- Selected material zone: The top part of the Upper zone of formation in which material of a specified higher quality is required.
- Subsoil drains: For drainage of ground water and/or the pavement in cuttings.

1.5 SUBMISSIONS

Approval

Submissions: To the Superintendent's approval.

Documents

Submit the following for approval:

- Filter materials: Refer to **WITNESS POINTS**.
- Calculations: Survey set out of works including quantity calculations.
- Components: Submit technical details of:
  - . Geotextiles to *1171 Subsurface drainage.*
  - . Pipes and fittings to *1171 Subsurface drainage.*
- Execution details: Refer to **WITNESS POINTS**.

~~Design: [complete/delete]~~

~~Manuals: [complete/delete]~~

- Detailed records and Work-as-Executed drawings.

~~Samples: [complete/delete]~~

~~Evidence of type tests: [complete/delete]~~

~~Warranties: [complete/delete]~~

1.6 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

Item/Clause title	Requirement	Notice for inspection	Release by
EXECUTION			
Subsoil / Foundation drains - Pipes	Submit bedding of compacted filter material laid to line and grade	3 working days before next activity	*Principal Certifying Authority*
Subsoil / Foundation drains - Excavation	Inspect excavation	1 working day prior to filling	*Principal Certifying Authority*

WITNESS POINTS table – On-site activities

Item/Clause title	Requirement	Notice for inspection
MATERIALS		
General - Filter material	Type of filter material	3 working days before ordering material
EXECUTION		
General - Location	Mark location of drains consistent with drawings or directions	7 days prior to commencing works
Subsoil / Foundation drains - Pipes	Lay on compacted bed to documented line and level	1 working day before filling
Subsoil drains - Backfilling,	Backfilling to documented level and relative compaction	1 working days before covering with geotextile
Foundation drains - Backfilling	Backfilling to documented level and relative compaction	1 working days before covering with geotextile
Geotextile - Installation	Placement of fabric conformance	1 working day before filling
Geotextile - Installation	Ensure exposure periods are within the constraints	Progressive
Cleanouts – Field testing	Perform flushing test	3 working days from completion

2 PRE-CONSTRUCTION PLANNING

2.1 SCHEDULING

Programming the works

General: Program the works as follows:

- Plan sequence of activities.
- Address time and program sequence of **HOLD POINTS** and **WITNESS POINTS**.

3 MATERIALS

3.1 GENERAL

Filter material

Description: Type A or Type B filter material to *1171 Subsurface drainage* capable of placing and compaction in the specific location and as shown on the drawings. This is a **WITNESS POINT**.

Geotextiles and pipes

Conform to: *1171 Subsurface drainage*.

4 EXECUTION

4.1 PROVISION FOR TRAFFIC

General

Control of traffic: Conform to the following:

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

4.2 ESTABLISHMENT

Location

Layout: As shown on the drawings or as directed by the Superintendent. This is a **WITNESS POINT**.

Existing underground services

Excavation: Do not excavate by machine within 1 m of existing underground services.

Location: DIAL 1100 BEFORE YOU DIG is a free service, from anywhere in Australia, of locating underground pipe and cables (possible within two working days). See www.1100.com.au.

4.3 SUBSOIL DRAINS

Order of construction

Sequence: Construct subsoil drains as soon as possible after necessary earthworks are completed in the area of the drain.

Ground water: Where stabilisation of the subgrade is required, construct subsoil drains after completion of stabilisation except where excessive ground water is encountered, construct drain prior to stabilisation of the subgrade.

Excessive groundwater: Where a selected material zone is documented and excessive ground water is encountered, install subsoil drains in two stages as follows:

- Stage 1: Install standard subsoil drains below the base of the cutting prior to placement of select material in the selected material zone.
- Stage 2: Extend subsoil drain to top of the selected material zone after placement of selected material.

Excavation

Requirements: To *1171 Subsurface drainage*.

Specified level: The bottom of the trench must not be more than 50 mm below the specified level of the invert of the pipe.
Smooth: Ensure the bottom and sides of the excavation are smooth with no protrusions that will damage the geotextile fabric.
Grade: Excavate the bottom of the trench to the same grade as the design pavement surface in the direction of the trench.
Minimum grade: If required increase the trench depth to provide a minimum grade of fall in the trench of 0.5%.
Prevent ponding: Excavate the bottom of the trench to prevent localised ponding of water occurs.
Over-excavation: If the trench is excavated below the documented level, backfill the trench to the documented level with non-porous subgrade material compacted to a relative compaction of at least 95% (Standard compaction) as determined by AS 1289.5.4.1.
Two stage construction: If a subsoil drain is constructed in two stages, carry out the excavation for Stage 2 after placement and compaction of the Selected Material Zone or the stabilised subgrade layer. Excavate the Stage 2 trench to the same line and width as the Stage 1 trench and to a depth to provide a clean, full contact with the filter material placed in Stage 1. Dispose of all excavated material to waste or incorporate into fills.
Inspection: To ensure the excavation conforms with the shape, grade line, filling and compaction and removal of any protrusions. This is a **HOLD POINT**.

Pipes

Bedding: 50 mm thick compacted filter material laid to the documented line and grade. This is a **HOLD POINT**.
Filter material type: As shown on the drawings or as directed by the Superintendent.
Pipe: Place centrally within the trench on the crushed aggregate the 100 mm diameter corrugated slotted plastic piping or corrugated flat plastic piping as shown on the drawings.
Tolerance: Deviation < 100 mm from the documented line. This is a **WITNESS POINT**.
Joints: Minimise joints in the pipeline.
Joint construction: Proprietary external joint coupling. Fit the inlet end of the pipe with a proprietary PVC cap.

Backfilling

Filter material: Backfill the trench with filter material to the documented level.
Layers: Place and compact the filter material in layers with a maximum compacted thickness of 300 mm. Tamp around and over the pipe to avoid damage or disturbance to the pipe.
Upper section of the trench: Backfill above the level documented for filter material backfill, with selected free draining backfill material, conforming to the requirements of *1112 Earthworks (Roadways).*
Compaction: Compact cohesionless filter material to a Density Index of 70% determined by AS 1289.5.6.1 for the full depth of the backfill. This is a **WITNESS POINT**.

Two stage construction plug

Protection: Protect the filter material placed at the top of Stage 1 from scour and/or contamination by covering with a 50 mm thick plug of select fill material with a maximum particle size of 25 mm. Compaction: Compact the select fill material to a relative compaction of 95% as determined by AS 1289.5.4.1.
Remove and replace: Remove this plug, any contaminated filter material and any select material covering, replace with filter material and compact to 95% relative compaction.

4.4 FOUNDATION DRAINS

Order of construction

Sequence: Construct foundation drains after completion of clearing and stripping operations, and before the commencement of embankment construction.

Excavation and pipes

Requirements: To *1171 Subsurface drainage* and **Subsoil drains**.

Backfilling

Filter material: Backfill the trench with filter material to the documented level.
Layers: Place and compact the filter material in layers with a maximum compacted thickness of 300 mm. Tamp around and over the pipe to avoid damage or disturbance to the pipe.
Upper section of the trench: Backfill above the level documented for filter material backfill with suitable free draining backfill material.
Compaction: Compact cohesionless filter material to a Density Index of 70% determined by AS 1289.5.6.1 for the full depth of the backfill. This is a **WITNESS POINT**.

4.5 GEOTEXTILE

Location

Extent: As shown on the drawings or as directed by the Superintendent.
Location: At the interface between the filter material and adjoining materials.

Installation

Placement: Cover the bottom and sides of the trench with sufficient free fabric to wrap around the completed drain. Conform to the shape of the trench with minimal wrinkles, folds or air voids between fabric and trench, but not stretched on the soil. This is a **WITNESS POINT**.
Joints: Provide laps of 500 mm at joints in the fabric.
Program: Ensure the period between initial laying out and final cover of the geotextile with drainage backfill layer does not exceed 14 days. Where possible place geotextiles just ahead of construction works and cover with materials within 48 hours. This is a **WITNESS POINT**.
Damage: Take all reasonable care to ensure that the geotextile is not damaged during installation and backfilling operations.
Remove and replace: Any geotextile fabric exposed for longer than 14 days must be removed and replaced at no extra cost.

4.6 OUTLET STRUCTURES

Discharge and salinity prevention

Subsurface drainage pipes: Connect discharge into gully pits or to outlet structures as shown on the drawings or as directed.
Salinity prevention: Discharge on the downhill side of the embankment or in the cut area so as to reduce the risk of recharge to the subsurface water table. This is a **WITNESS POINT**.

Outlets

Location intervals: 150 m maximum.

Rodent proofing

Method: Secure outlets, including those discharging into gully pits, with galvanised wire netting to conform with the drawings.

Erosion control

Method: Locate the outlet so that erosion of the adjacent areas does not occur and/or protect the outlet by the placement of selected stone or approved similar treatment.
Locations: Provide marker posts to indicate the location and assist maintenance.

Outlet pipe

Type: Provide unslotted outlet pipes from curtain drains.

Levels: Ensure no point in an outlet pipe is higher than the pipe at the end of the curtain drain.

Concrete

Specification for outlet structures: Concrete to *0319 Minor concrete works*.

4.7 CLEANOUTS

Location

Details: As shown on the drawings. Do not locate pits in unsealed shoulders, drain inverts or on batter faces.

Location: At the commencement of each run of subsoil drain line and at intervals of approximately 100 - 140 m to conform with AGPT10.

Type

Clean out: Supply the standard Cl caps as shown on the drawings.

Field testing

Method: After completion of backfilling, pump clean water into the cleanout at the commencement of each run until only clean water discharges at the outlet.

Flushing: The minimum rate of flow of flushing water at the inlet must be 100 l/min. This is a **WITNESS POINT**.

4.8 MARKING OF DRAINS

Completion

Records: Keep a detailed record of all trench drain installations. Mark 'Work-as-Executed' drawings of the completed drainage system. Submit within 28 days of completion of the works.

Mark: Markings location and type to conform with the relevant State Road Authority and AGPT10-09.

Pegs: Treated or painted timber 75 mm diameter with 600 mm of post above ground level. Do not use the colour white.

ID plate: Attach an identification plate to the marker post or pit lid.

4.9 LIMITS AND TOLERANCES

The limits and tolerances applicable to this worksection are summarised in **Summary of limits and tolerances table**.

Summary of limits and tolerances table

Activity	**Limits/Tolerances**	**Worksection Clause/ subclause**
Excavation		
- Trench Grade	≥ 0.5%	**Subsoil drains**
- Compaction	> 95% (Standard compaction)	**Subsoil drains**
Laying of pipe		
Alignment	Deviation < 100 mm from the documented line at any point	**Subsoil drains**
Subsoil drain backfill		
- Layer thickness	300 mm max	**Subsoil drains**
- Compaction - Filter material Backfill material	70% Density Index for cohesionless material.	
	100% (Standard compaction)	**Subsoil drains**
Outlet spacing	150 m max	**Outlets**

Activity	Limits/Tolerances	Worksection Clause/ subclause
Cleanout spacing	100 - 140 m approx	**Cleanouts**
Foundation drain backfill		
Backfilling - Layer thickness	300 mm max	**Foundation drains**
- Compaction Filter material Backfill material	70% Density Index for cohesionless material. > 95% (Standard compaction)	**Subsoil drains** **Foundation drains**

5 MEASUREMENT AND PAYMENT

5.1 MEASUREMENT

General

Payments made to the Schedule of Rates: To *0152 Schedule of rates – supply projects*, this worksection, the drawings and Pay items 1172.1 to 1172.6 inclusive.
Lump Sum prices: Not acceptable.
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:

- Filter material and outlet structures: To conform with *1171 Subsurface drainage*.
- Backfill material (other than filter material): To conform with this worksection and not *1112 Earthworks (Roadways)*.

5.2 PAY ITEMS

Pay items	Unit of measurement	Schedule rate scope
1172.1 Excavation for subsoil and foundation drains	m^3 - Calculated from width, depth and length of the trench as shown on the drawings, directed by the Superintendent and determined at the time of excavation. - The sides of the trench are taken as vertical.	All costs associated with: - Setting out and associated survey work. - Excavation of all types of material – separate rates for earth or rock are not acceptable. - Replacement for over excavation for any reason. - Control of stormwater run-off, temporary drainage and erosion and sedimentation control. - The disposal of material from drain excavation. - The schedule quantity is a provisional quantity.
1172.2 Subsoil drain pipe—100 mm dia slotted corrugated plastic pipe	Linear metre - Measured along the length of the pipe.	All costs associated with: - Supply and laying of the subsoil pipe including connections, markers, fittings and seamless tubular filter fabric where documented.

Pay items	Unit of measurement	Schedule rate scope
		- The schedule quantity is a provisional quantity.
1172.3 Subsoil drain pipe—corrugated flat plastic pipe	Linear metre - Measured along the length of the pipe.	All costs associated with: - Supply and laying of the subsoil pipe including connections, markers, fittings and seamless tubular filter fabric where documented. - The schedule quantity is a provisional quantity.
1172.4 Supply, placement and compaction of backfill material (other than filter material) for subsoil and foundation drains	m^3 - Calculated from width, depth and length of compacted backfill in the the trench as shown on the drawings, directed by the Superintendent and determined at the time of excavation. - The sides of the trench are taken as vertical.	All costs associated with: - Supply, placement and compaction of documented material. - The schedule of quantity is a provisional quantity.
1172.5 Supply and placement of geotextile	m^2 - Area covered by geotextile as measured on site.	All costs associated with: - Supply, placement and securing of the geotextile material. - No additional payment for additional geotextile used in lap joints. - The schedule quantity is a provisional quantity.
1172.6 Cleanout structures	Each - Cleanout structure constructed in conformance with the drawings.	All costs associated with: - Construction of cleanout structures including the supply and installation of standard cast iron lids and the recording of cleanout locations in conformance with *1171 Subsurface drainage*. - The schedule quantity is a provisional quantity.