

# Master Specification

## Part RD-EW-C1

### Earthworks

September 2024



**Government of South Australia**  
Department for Infrastructure  
and Transport

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## RD-EW-C1 Earthworks

### 1 General

- a) This Master Specification Part specifies the requirements for the construction of earthworks, including proof rolling, treatment of Unsuitable Material, excavation, the construction of fill, verges, levees, catch drains, earth side drains and swales, including:
- i) the documentation requirements, as set out in section 2;
  - ii) the materials for earthworks, as set out in section 3;
  - iii) the site preparation requirements, as set out in section 4;
  - iv) the proof rolling requirements, as set out in section 5;
  - v) the excavation requirements, as set out in section 6;
  - vi) the requirements for the preparation of the existing surface under fill and the subgrade in cut, as set out in section 7;
  - vii) the geotextile requirements, as set out in section 8;
  - viii) the fill construction requirements, as set out in section 9;
  - ix) the requirements for the completed surface of the subgrade and batters, as set out in section 10;
  - x) the treatment of Constructed Surface, as set out in section 11;
  - xi) the test procedures, as set out in section 12;
  - xii) the Hold Point requirements, as set out in section 13; and
  - xiii) the verification requirements and records, as set out in section 14.
- b) The construction of earthworks must comply with the Reference Documents, including:
- i) AGRD Part 3: Geometric Design;
  - ii) AS 1152 Specification for test sieves;
  - iii) AS 1289 Methods of testing soils for engineering purposes;
  - iv) Department Test Procedures (available from [https://dit.sa.gov.au/standards/test\\_procedures](https://dit.sa.gov.au/standards/test_procedures));
  - v) Excavation Work Code of Practice - Safe Work Australia; and
  - vi) Excavation Work Code of Practice - SafeWork SA.

## 2 Documentation

### 2.1 Construction Documentation

In addition to the requirements of PC-CN3 “Construction Management”, the Construction Documentation must include:

- a) an Earthworks Management Plan that includes (as applicable):
- i) calculations of earthworks quantities (in m<sup>3</sup> solid), material classifications in accordance with section 3.1, and a mass - haul diagram;
  - ii) assumed bulking factors;

- iii) a table showing the estimated quantities of material excavated from the Site, imported and spoiled;
  - iv) the nominated dump site;
  - v) overview of plant proposed to be used;
  - vi) details of the relevant Inspection and Test Plans;
  - vii) a methodology for managing any industrial by-products or recycled material used as fill;
  - viii) where existing asphalt or stabilised pavement is to be recycled insitu, the methodology for breaking the material down and compaction in accordance with the requirements of section 3.2b);
  - ix) a methodology for placement and compaction of material (including management of moisture content), including for general fill, oversize material and Type D material; and
  - x) details of proposed haulage routes and copies of any relevant agreements with councils;
- b) where not provided as part of the Design Documentation, a dewatering plan in accordance with the requirements of RD-EW-D1 “Design of Earthworks for Roads”;
  - c) where not provided as part of the Design Documentation, a blast strategy in accordance with the requirements of RD-EW-D1 “Design of Earthworks for Roads”;
  - d) the methodology for monitoring to verify that the verification and testing requirements required by section 14 have been achieved during construction;
  - e) where industrial by-products or recycled material are proposed to be used, the evidence and procedures required by section 3.2a);
  - f) the proposed initial layer thickness and the plant to be used for compaction required by section 8.4f); and
  - g) the slashing frequency and herbicide application for weed control as required by section 11.4c).

## 2.2 Quality Management Records

In addition to the requirements of PC-QA1 “Quality Management Requirements” or PC-QA2 “Quality Management Requirements for Major Projects” (as applicable), the Quality Management Records must include:

- a) calculations to verify the Weighted Plasticity Index (WPI) as required by Table RD-EW-C1 3-1;
- b) the results of all testing undertaken in accordance with section 12;
- c) the verification records required by Table RD-EW-C1 14-1; and
- d) results of all earthworks performance monitoring required by RD-EW-D1 “Design of Earthworks for Roads”.

## 3 Materials for earthworks

### 3.1 Material classification

Subject to section 3.3, earthworks material must be classified in accordance with Table RD-EW-C1 3-1. The material classifications must be provided as part of the Earthworks Management Plan.

Table RD-EW-C1 3-1 Material type

| Type                                                       | A                                                               | B                                                               | C                                                                    | General fill                              | Oversize                  | D              |
|------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------------------|---------------------------|----------------|
| Material type                                              | Sand-clay, sand, rubble, quarry or pit overburden or by-product | Sand-clay, sand, rubble, quarry or pit overburden or by-product | Sand-clay sand, clay, rubble, quarry or pit overburden or by-product | In accordance with the Contract Documents | Refer note <sup>(3)</sup> | Other material |
| Max. particle size (mm)                                    | 75                                                              | 106                                                             | 150                                                                  | 150                                       | 500                       | 500            |
| Particle size distribution (% passing)                     |                                                                 |                                                                 |                                                                      |                                           |                           |                |
| 75 mm                                                      | 100                                                             | -                                                               | -                                                                    |                                           | -                         | -              |
| 37.5 mm                                                    | 80-100                                                          | 80-100                                                          | 80-100                                                               | In accordance with the Contract Documents | <20                       | -              |
| 0.075 mm                                                   | 0-25                                                            | 0-35                                                            | 0-35                                                                 |                                           | -                         | -              |
| Max. plasticity index (PI) (%)                             | 12                                                              | 15                                                              | -                                                                    |                                           | -                         | -              |
| Max. linear shrinkage LS (%)                               | 6                                                               | 7                                                               | -                                                                    |                                           | -                         | -              |
| Max. WPI <sup>(1)</sup>                                    | 1,000                                                           | 1,200                                                           | 1,500                                                                |                                           | -                         | -              |
| Shrink-swell index I <sub>ss</sub> (%)                     | ≤0.4                                                            | ≤0.7                                                            | ≤1.1                                                                 |                                           | -                         | -              |
| Emerson class number                                       | -                                                               | -                                                               | >2                                                                   |                                           |                           |                |
| Mica, shale and similar laminated materials <sup>(2)</sup> | Not permitted                                                   | Not permitted                                                   | Not permitted                                                        | Not permitted                             | Not permitted             | Permitted      |

**Table notes:**

(1) The WPI is defined as the value of the PI multiplied by the % passing the 425 µm sieve. The Contractor must provide the calculations to verify the WPI as part of the Quality Management Records.

(2) Mica, shale and similar laminated materials, adherent coatings or other foreign material must not be present in form or sufficient quantity to produce adverse effect upon the usage and performance of the material.

(3) Oversize material does not meet Type A, B, or C criteria, but is capable of being compacted in accordance with Table RD-EW-C1 9-2.

(4) Organic material must not be present in structural fill.

### 3.2 Industrial by-products or recycled material

- Where the Contractor proposes to use industrial by-products or recycled material, evidence and any associated procedures must be provided as part of the Construction Documentation (which must comply with the associated Hold Point required by PC-CN3 "Construction Management") to demonstrate that the material will not cause any detrimental environmental effects and that it complies with the recycled material requirements of RD-PV-S1 "Supply of Pavement Materials".
- If existing asphalt or stabilised pavement is to be recycled insitu, the maximum particle size must not exceed 75 mm, and methodologies for breaking the material down and compaction must be provided as part of the Earthworks Management Plan.

### 3.3 Unsuitable Material

Earthworks materials must be classified as "**Unsuitable Material**" where they are unsuitable for the support of pavement or layers of fill, including materials which:

- exhibit deformation, rutting, softness, yielding, distress or instability under proof rolling or the loading from any construction machinery;



- b) contain soluble material such as gypsum or rock salt;
- c) are susceptible to scouring, is dispersive or has an Emerson class number 1 or 2; and
- d) contain topsoil, peat, or any organic material.

## 4 Site preparation

### 4.1 General

- a) The requirements of this section 4 are limited to the preparation of the site prior to the commencement of construction, which may include demolition of existing structures, clearing and grubbing and stripping of topsoil.
- b) Site preparation must be restricted to the minimum area practicable and must not take place outside the area defined by the plan area of the Works and Temporary Works relating to the earthworks (**Earthworks Footprint**), and an additional 1.0 m beyond that area.
- c) Clearing and grubbing and stripping of topsoil must not take place more than 14 days prior to the commencement of earthworks and must consider existing soil moisture conditions.

### 4.2 Topsoil stripping

- a) The Contractor must strip any topsoil present within the Earthworks Footprint.
- b) The depth of topsoil stripping must be 100 mm and topsoil must be stockpiled in accordance with PR-LS-C7 "Topsoil and Earthworks".

### 4.3 Clearing and grubbing

- a) Where vegetation is required to be removed, it must be carried out in accordance with PC-ENV2 "Environmental Protection Requirements".
- b) Loose material, rubbish and existing structures (including fences, retaining walls, concrete slabs, service pits, tree stumps, kerbing, abandoned services and obsolete underground drainage lines) within the zone of earthworks construction defined in section 4.1b) must be removed to a depth of not less than 300 mm below the:
  - i) subgrade level and batters in areas of cut; and
  - ii) stripped surface in areas of fill.
- c) Grubbed holes (and any area requiring filling due to the removal of a structure) must be backfilled with Type A material compacted and verified in accordance with the requirements of section 14.
- d) Grubbed holes must be inspected prior to backfilling which constitutes a **Hold Point**.

## 5 Proof rolling

- a) Proof rolling (the process of identifying any Unsuitable Material by moving heavy plant over the subgrade or existing surface and observing the resultant deformation in the underlying material. Material which is observed to move under the loading of the plant is deemed to be Unsuitable Material) must:
  - i) in fill, cover all of the existing underlying material which will be covered by fill;
  - ii) in cut, cover all of the formation;
  - iii) be carried out as soon as practicable, and in any case not later than 48 hours, after topsoil stripping / clearing and grubbing (in areas of fill) or completion of the formation (in areas of cut);

- iv) where soft ground conditions are present, be carried out after ground improvement processes (including placement of geogrid, ballast or working platforms) have been completed; and
- v) be undertaken prior to any hauling over the prepared area.
- b) The plant must move at walking pace when undertaking proof rolling.
- c) Except for small areas where the plant will not fit, proof rolling must be undertaken by a minimum of 3 passes of heavy plant which complies with the following:
  - i) a pneumatic multi-wheel roller with a mass >24t; or
  - ii) a fully loaded tandem truck or water cart of minimum 10 kl capacity which:
    - A. has ground contact pressure under either the front or rear wheels of not less than 450 kPa per tyre;
    - B. has a ground contact area which is not less than 0.035 m<sup>2</sup> per tyre, and
    - C. follows a rolling pattern that ensures the entire ground surface is subject to the specified number of passes.
- d) In small areas where the plant will not fit, at least 6 passes of the heaviest plant practicable must be used for proof rolling. A leg rammer may be used, but a plate compactor is not acceptable.
- e) For the purposes of this section 5, “pass” means the movement of the plant in a single direction. If the observation of deformation is inconclusive or the extent of Unsuitable Material is unclear, additional passes must be undertaken until a determination regarding the suitability of the material can be made.
- f) The Contractor must ensure that plant complying with the requirements of this section 5 is on site during all earthworks, fill, subgrade, and pavement operations.
- g) Proof rolling must not be carried out over any Utility Services without prior notification to the Utility Service Authority.

## 6 Excavation

### 6.1 General

- a) Excavation works must be carried out in compliance with:
  - i) RD-EW-C2 “Trench Excavation and Backfill”;
  - ii) Excavation Work Code of Practice - Safe Work Australia; and
  - iii) Excavation Work Code of Practice - SafeWork SA.
- b) Where excavation is carried out adjacent to existing sealed pavements, saw cutting or planing must be carried out to the full depth of the existing asphalt.
- c) Excavation by cold planing must be carried out in accordance with RD-BP-C1 “Cold Planing”.

### 6.2 Rock strength materials

- a) The application of the requirements in this section 6.2 is limited to projects where the Contractor is entitled to additional payment for rock excavation under the terms of the Contract Documents.
- b) Material will be deemed to be rock if the production rate specified in Table RD-EW-C1 6-1 cannot be achieved.



- c) The machine employed for rock excavation must be in good condition, with matching heavy duty, single tyne ripper or rock bucket fitted with rippers and operated by an experienced operator.
- d) If the Contractor considers that rock has been encountered and seeks payment pursuant to this section 6.2, a **Hold Point** will apply.

**Table RD-EW-C1 6-1 Excavation rates for rock strength materials**

| Plant (operating mass) | Excavation rate (m <sup>3</sup> (loose) per hour) |
|------------------------|---------------------------------------------------|
| Excavator (20 t)       | 30                                                |
| Crawler dozer (20 t)   | 150                                               |
| Excavator (60 t)       | 120                                               |

## 7 Preparation of the existing surface under fill and the subgrade in cut

### 7.1 General

This section 7 applies at the completion of clearing, grubbing and topsoil stripping conducted in accordance with section 4 in areas of fill and at the completion of excavation in cuts.

### 7.2 Assessment and treatment of existing material

- a) Prior to the placement of fill or pavement, the Contractor must arrange for a joint inspection and joint survey of the ground surface for the purpose of identifying Unsuitable Material, the foundation surface condition, and the bed design elevation.
- b) The joint inspection and survey required by section 7.2a) constitutes a **Hold Point**.
- c) The joint inspection and survey required by section 7.2a) must be undertaken in the form of a visual assessment and by proof rolling of the relevant areas of ground surface in accordance with section 5. The Contractor must trim the relevant areas of ground surface prior to proof rolling.
- d) Where the proof rolling required by section 7.2c) is conducted in areas of cut, the Contractor must excavate and trim the earthworks to within 50 mm of the final subgrade level before undertaking proof rolling.
- e) Prior to placing fill or pavement, any Unsuitable Material identified must be:
  - i) removed and replaced with suitable compacted material; or
  - ii) treated (including by installing geotextile or stabilising the material),
 and proof rolling must be repeated over the relevant area in accordance with section 5.
- f) To make the subgrade fit for its intended purpose:
  - i) any filling required must be placed with a minimum thickness of 150 mm;
  - ii) where the material underlying a fill is either existing pavement or the existing formation of an unsealed road, the area must be scarified and Type A material placed such that the thickness of loose material is not less than 150 mm, prior to compaction in accordance with section 9;
  - iii) following proof rolling or treatment in accordance with this section 7, the Contractor must ensure that water does not pond on the surface and the earthworks material properties do not deteriorate; and
  - iv) the placement of fill must be carried out within 48 hours of the proof rolling required by section 7.2c). If fill placement does not occur within 48 hours an additional proof roll must be carried out to confirm the subgrade is still acceptable.

## 8 Geotextiles

### 8.1 General

- a) This section 8 applies where the earthworks design incorporates geotextiles for the purpose of filtration, drainage, or separation.
- b) Subject to the requirements of this section 8, geotextiles must be supplied in accordance with RD-EW-S1 "Supply of Geotextiles" and must be placed in accordance with the manufacturer's instructions.

### 8.2 Site preparation over soft soils

- a) Prior to placement of geotextiles, the relevant portion of the Site must be prepared by clearing and grading the relevant area, and must include the removal of all sharp objects and large stones.
- b) Geotextiles must be placed without puncture or tears and must be covered by relevant construction materials or suitable protective sheeting within 48 hours of placement.
- c) Geotextiles used in trench drains must be placed so as to conform loosely to the shape of the trenches. The geotextile must fully envelop the drainage material in the trench.

### 8.3 Initial layer thickness requirements for separation applications

The minimum required initial layer thickness for fill material placed directly over the geotextile must meet the requirements of Table RD-EW-C1 8-1.

**Table RD-EW-C1 8-1 Minimum initial layer thickness**

| Nominal maximum fill particle size D85 (mm) | Minimum initial layer thickness (mm)                                |
|---------------------------------------------|---------------------------------------------------------------------|
| <150                                        | The largest of 3 times maximum fill particle size or 200 mm minimum |
| 150 - 225                                   | 450 mm                                                              |
| 225 - 400                                   | 2 times maximum fill particle size                                  |

### 8.4 Joining

- a) Joining of geotextiles must be by overlap or by sewing.
- b) Where joining of geotextiles is conducted by overlap:
  - i) the minimum overlap of geotextiles must be 500 mm; and
  - ii) where the geotextile is used for drainage blankets the encapsulated overlap must be at least 1 m.
- c) The following requirements apply to the sewing of geotextile joins:
  - i) seam type: J seam or double J seam;
  - ii) stitch type: double thread lock stitch and 2 lines of stitching must be used; and
  - iii) thread type: polyester thread 300 tex (minimum).
- d) Where the Contract Documents require the measurement of geotextiles for payment purposes, the measurement must be based on the final surface area covered, with no allowance for any overlaps.
- e) Inspection of the joints constitutes a **Hold Point**. Fill material must not be placed over the geotextile until this Hold Point has been released.
- f) The proposed initial layer thickness and the plant to be used for compaction must be provided as part of the Construction Documentation.

## 8.5 Filling over installed geotextile

- a) Construction equipment must not stand or travel directly on the laid geotextile.
- b) Cover material which complies with the requirements of Table RD-EW-C1 8-1 must be placed over the geotextile prior to construction equipment travelling over the area concerned.
- c) Rock armour placed directly on the geotextile must be placed with a drop height not exceeding 1.0 m or otherwise in accordance with the manufacturer's specification.
- d) The mechanical equipment must be selected and operated so as not to cause rupture of the geotextile. Vibratory and heavy compaction plant must not be used on the initial lifts of filling material.

## 9 Fill construction

### 9.1 General

- a) Subject to section 9.2b), fill material must be placed and compacted uniformly in layers in accordance with the requirements set out in Table RD-EW-C1 9-1.
- b) The Contractor may propose layer thicknesses greater than specified in Table RD-EW-C1 9-1. The Contractor will need to demonstrate through trials that the proposed placement and compaction methodology is able to achieve compaction through the entire layer. Acceptance of greater layer thicknesses will constitute a **Hold Point**. The placement and compaction of the relevant fill must not occur until the Hold Point has been released.

Table RD-EW-C1 9-1 Fill construction

| Maximum particle size of fill material (mm) | Layer thickness (mm loose)                                                                              | Compaction                                 | Moisture content when compacted                   |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------|--------------------------------------------|---------------------------------------------------|
| 150 or less:<br>Types A, B and C            | 150 to 200                                                                                              | In accordance with section 14              | OMC $\pm$ 2%                                      |
| 150 or less:<br>General Fill                | 150 to 200                                                                                              | In accordance with the Contract Documents. | In accordance with the Contract Documents         |
| >150                                        | Minimum layer thickness of one and a half times the maximum particle size, or 300, whichever is greater | In accordance with Table RD-EW-C1 9-2      | In accordance with the Earthworks Management Plan |

### 9.2 Placement of oversize material

- a) Material with a maximum particle size of 150 mm or more must:
  - i) not be placed within 500 mm of the underside of the pavement;
  - ii) have the top surface of the material blinded with Type A or B material to fill surface voids before the placement of subsequent layers; and
  - iii) be compacted using of vibrating drum rollers in accordance with Table RD-EW-C1 9-2.
- b) Where the Contractor proposes compaction specifications for oversized material that does not comply with Table RD-EW-C1 9-2, an alternative compaction specification must be proposed, which will constitute a **Hold Point**. The placement of oversized material must not commence until the Hold Point has been released.

**Table RD-EW-C1 9-2 Compaction of oversize material**

| Minimum roller operating mass (t) <sup>(1)</sup> | Maximum layer thickness | Minimum number of passes |
|--------------------------------------------------|-------------------------|--------------------------|
| 5                                                | 300                     | 6                        |
| 10                                               | 500                     | 6                        |
| 12.5                                             | 750                     | 6                        |

**Table notes:**

(1) The minimum static mass on the vibrating drum must be 4.5 t.

### 9.3 Placement of general fill

- a) General Fill must be placed and compacted in accordance with the requirements specified in the Contract Documents.
- b) Compaction of general fill must be determined by standard compaction in accordance with Table RD-EW-C1 12-1.

### 9.4 Placement of Type D fill

Where Type D materials are permitted, it must be placed and compacted in accordance with the Earthworks Management Plan to achieve a stable fill.

### 9.5 Miscellaneous

- a) All filling must be supervised by a qualified civil / geotechnical engineer or experienced earthworks site supervisor to address any issues related to fill construction.
- b) Where new embankment fill is to be placed against an existing surface which is steeper than 3 horizontal to 1 vertical, benching within the existing surface must be carried out to allow placement of fill in layers. The width of benches must be 1.0 m minimum and must be constructed at 0.5 m vertical intervals to create a stepped surface.
- c) The Contractor must maximise the usage of suitable material excavated from the Site, which may involve double handling, to minimise the requirement for imported fill.
- d) Any noise mounds must not contain material with a particle size greater than 150 mm and must contain more than 20% finer than 0.075 mm particle size. Regardless of the requirements of section 9.1, fill in noise mounds may be compacted in layers up to 300 mm loose depth.
- e) During construction surface grades must be cut to allow for drainage of surface water to low points where removal of water is possible in a timely manner to prevent softening of subgrade soils or destabilisation of nearby cuttings and retaining structures.

## 10 Completed surface of the subgrade and batters

- a) The levels of points not detailed on the drawings must be determined by linear interpolation. The surface must be constructed to within the tolerances specified in section 14 at all interpolated and discrete points.
- b) Where the Contract Documents include lines, grades, cross sections, levels, dimensions, and tolerances, they do not include an allowance for a layer of topsoil.
- c) The slope of all batters must be even and consistent from top to bottom and free from abrupt changes in level. Tops of batters must be rounded over the width shown on the Design Drawings to reduce erosion.
- d) Where batter slopes are not shown on the Design Drawings, the finished surface of the batters must comply with AGRD Part 3: Geometric Design, and the following requirements:
  - i) the surface must not impede the free flow of water;
  - ii) ponding of water must not occur;

- iii) the invert level in table drains must be  $\geq 300$  mm below the surface at the edge of formation; and
- iv) the shape of shoulders at road junctions and access points to adjoining properties must be maintained.
- e) The Contractor must ensure that subgrade has a tight dense surface and does not deteriorate after proof rolling or verification testing. Completed sections of subgrade must be maintained in a well-drained condition.
- f) Where the subgrade occurs in rock, the excavated surface must be blinded with subbase material and graded, shaped and compacted to produce a tight dense surface.

## 11 Treatment of the Constructed Surface

### 11.1 General

- a) For the purpose of this section 11 “Constructed Surface” means any location within the Site where the ground surface is disturbed or altered, excluding a hard surface such as pavement, footpath, compacted rubble or exposed bedrock.
- b) The Contractor must:
  - i) apply treatments to Constructed Surfaces as required to meet the requirements of the Contract Documents; and
  - ii) comply with this section 11 until Completion.
- c) Material placed near the surface of batters (including imported topsoil) must exhibit sufficient properties such that:
  - i) the surface is highly resistant to surface scour and erosion;
  - ii) in cuts, any material which becomes detached is prevented from reaching the road shoulder; and
  - iii) there is no undermining or destabilisation of any existing batter slopes or structures.
- d) The Contractor must repair any surface scour and erosion that occurs prior to the establishment of permanent or temporary stabilisation or revegetation.

### 11.2 Cut-off drains

- a) Subject to section 11.2b), cut off drains must not be used.
- b) Where the Design Drawings specify cut off drains, open trench trapezoidal drains must be constructed and maintained on the top of batters for the full length of the cutting prior to commencement of excavation in cuttings.

### 11.3 Spreading of topsoil

- a) Spreading of topsoil and imported topsoil must be in accordance with PR-LS-C7 “Topsoil and Earthworks”.
- b) Topsoil spread must be stabilised.
- c) Heavy compaction of topsoil must be avoided where landscape treatments are to be installed.
- d) Any remaining site-won topsoil stockpiles must be rounded off with batters of maximum slope of 6 horizontal to 1 vertical. All site-won topsoil approved for use in landscaped areas must be used before any topsoil is imported.

## 11.4 Weed control

- a) The Contractor must control all declared and environmental weeds on the Constructed Surface.
- b) Weed control must be undertaken in accordance with PR-MA-M1 “Herbaceous and Woody Weed Control”.
- c) The Contractor must provide the slashing frequency or herbicide application (including chemical used and application rate) for weed control as part of the Construction Documentation.

## 11.5 Surface treatment

- a) Where details of the treatment of the Constructed Surface are not provided in the Contract Documents, the Contractor must determine all procedures and associated details necessary for ensuring that the surface treatment for the Constructed Surface is successful for the relevant Design Life of the treatment, and must specify these procedures (such as the method of seedbed preparation / sowing and fertiliser application), which will constitute a **Hold Point**.
- b) Treatments applied to the Constructed Surface must comply with the following:
  - i) landscape design must comply with PR-LS-D1 “Landscape and Urban Design”;
  - ii) planting must comply with PR-LS-C2 “Planting”;
  - iii) hydroseeding and direct seeding must comply with PR-LS-C6 “Hydroseeding and Direct Seeding”;
  - iv) maintenance of plants must comply with PR-LS-M1 “Maintenance of Plants”; and
  - v) maintenance of seeded areas must comply with PR-LS-M2 “Maintenance of Hydroseeded and Direct Seeded Areas”.

## 12 Test procedures

The Contractor must carry out testing in accordance with the requirements of this Master Specification Part, including the Reference Documents and the test procedures listed in Table RD-EW-C1 12-1. Results of the testing must be provided as part of the Quality Management Records.

**Table RD-EW-C1 12-1 Test procedures**

| Test                                          | Test procedure                                                                                                                                                                                                                                        |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sampling of soil, aggregates and rocks        | TP 226 Sampling of Soil, Aggregates and Rocks                                                                                                                                                                                                         |
| Preparation of samples                        | AS 1289.1 Methods of testing soils for engineering purposes - Sampling and preparation of soils                                                                                                                                                       |
| Site selection by stratified random technique | AS 1289.1.4.2 Methods of testing soils for engineering purposes - Sampling and preparation of soils - Selection of sampling or test sites - Stratified random number method                                                                           |
| Field density: nuclear method                 | AS 1289.5.8.1 Methods of testing soils for engineering purposes - Soil compaction and density tests - Determination of field density and field moisture content of a soil using a nuclear surface moisture - Density gauge - Direct transmission mode |
| Moisture content: oven drying method          | AS 1289.2.1.1 Methods of testing soils for engineering purposes - Soil moisture content tests - Determination of the moisture content of a soil - Oven drying method (standard method)                                                                |
| Moisture content: microwave method            | AS 1289.2.1.4 Methods of testing soils for engineering purposes - Soil moisture content tests - Determination of the moisture content of a soil - Microwave-oven drying method (subsidiary method)                                                    |

| Test                                                    | Test procedure                                                                                                                                                                                              |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Maximum dry density: standard compaction <sup>(1)</sup> | AS 1289.5.1.1 Methods of testing soils for engineering purposes - Soil compaction and density tests - Determination of the dry density/moisture content relation of a soil using standard compactive effort |
| Maximum dry density: modified compaction                | AS 1289.5.2.1 Methods of testing soils for engineering purposes - Soil compaction and density tests - Determination of the dry density/moisture content relation of a soil using modified compactive effort |
| Maximum dry density: 3 point method                     | TP 164 Determination of the Dry Density/Moisture Content Relation of a Soil - 3 Point Method                                                                                                                |
| Dry density ratio                                       | TP 320 Compaction Control Test - Dry Density Ratio, Moisture Variation and Moisture Ratio                                                                                                                   |
| Emerson class number                                    | AS 1289.3.8.1 Methods of testing soils for engineering purposes - Soil classification tests - Dispersion - Determination of Emerson class number of a soil                                                  |
| Particle size distribution                              | TP 134 Particle Size Distribution - Standard Method of Analysis by Sieving                                                                                                                                  |
| Plasticity index (PI)                                   | TP 141 Calculation of the Plasticity Index of a Soil (Standard Method)                                                                                                                                      |
| Linear shrinkage (LS)                                   | AS 1289.3.4.1 Methods of testing soils for engineering purposes - Soil classification tests - Determination of the linear shrinkage of a soil - Standard method                                             |
| Shrink-swell index ( $I_{ss}$ )                         | AS 1289.7.1.1 Methods of testing soils for engineering purposes - Soil reactivity tests - Determination of shrinkage index of a soil - Shrink-swell index ( $I_{ss}$ )                                      |

**Table notes:**

(1) Used for general fill only.

## 13 Hold Points

Table RD-EW-C1 13-1 details the review period or notification period, and type (documentation or construction quality) for each Hold Point referred to in this Master Specification Part.

**Table RD-EW-C1 13-1 Hold Points**

| Section reference | Hold Point                                                                                                                                                 | Documentation or construction quality | Review period or notification period |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|--------------------------------------|
| 4.3d)             | Inspection of grubbed holes prior to backfilling                                                                                                           | Construction quality                  | 24 hours notification                |
| 6.2d)             | Notification that rock has been encountered                                                                                                                | Construction quality                  | 24 hours notification                |
| 7.2b)             | Notice prior to a joint inspection and joint survey of existing surface                                                                                    | Construction quality                  | 24 hours notification                |
| 8.4e)             | Inspection of the joining of geotextile and initial layer thickness                                                                                        | Construction quality                  | 24 hours notification                |
| 9.1b)             | Proposal to adopt a layer thickness greater than specified in Table RD-EW-C1 9-1                                                                           | Documentation                         | 5 Business Days review               |
| 9.2b)             | Proposal to adopt compaction specifications for oversized material that does not comply with Table RD-EW-C1 9-2                                            | Documentation                         | 5 Business Days review               |
| 11.5a)            | Submission of procedures to demonstrate that the surface treatment for the Constructed Surface is successful for the relevant Design Life of the treatment | Documentation                         | 5 Business Days review               |



## 14 Verification requirements and records

The Contractor must supply written verification as part of the Quality Management Records that the requirements listed in Table RD-EW-C1 14-1 have been complied with.

**Table RD-EW-C1 14-1 Verification requirements**

| Section reference | Subject                        | Property                                    | Test procedure                                                                                                                                                                                                                                                                                                                    | Test frequency                                                                      | Acceptance limits                                                                                 |
|-------------------|--------------------------------|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| 3.1               | Fill material properties       | Grading                                     | a) TP 134 Particle Size Distribution - Standard Method of Analysis by Sieving; and<br>b) AS 1152 Specification for test sieves.                                                                                                                                                                                                   | One test per Work Lot                                                               | In accordance with Table RD-EW-C1 3-1                                                             |
|                   |                                | Plasticity index (PI)                       | TP 141 Calculation of the Plasticity Index of a Soil (Standard Method)                                                                                                                                                                                                                                                            | One test per Work Lot                                                               | In accordance with Table RD-EW-C1 3-1                                                             |
|                   |                                | Linear shrinkage (LS)                       | AS 1289.3.4.1 Methods of testing soils for engineering purposes - Soil classification tests - Determination of the linear shrinkage of a soil - Standard method                                                                                                                                                                   | One test per Work Lot                                                               | In accordance with Table RD-EW-C1 3-1                                                             |
|                   |                                | Emerson class number                        | AS 1289.3.8.1 Methods of testing soils for engineering purposes - Soil classification tests - Dispersion - Determination of Emerson class number of a soil                                                                                                                                                                        | One test per day's production                                                       | Classified as Emerson class number 3 or higher                                                    |
|                   |                                | Shrink-swell index ( $I_{ss}$ )             | AS 1289.7.1.1 Methods of testing soils for engineering purposes, Method 7.1.1: Soil reactivity tests - Determination of shrinkage index of a soil - Shrink-swell index                                                                                                                                                            | One test per Work Lot                                                               | In accordance with Table RD-EW-C1 3-1                                                             |
|                   |                                | WPI                                         | In accordance with section 3                                                                                                                                                                                                                                                                                                      | One test per Work Lot                                                               | In accordance with Table RD-EW-C1 3-1                                                             |
| 8, 9, 10 and 11   | Earthworks levels and position | Variation in subgrade level                 | In accordance with PC-S11 "Site Surveys"                                                                                                                                                                                                                                                                                          | In accordance with PC-S11 "Site Surveys"                                            | Within +0, - 40 mm of design level                                                                |
|                   |                                | Variation in lateral position               | In accordance with PC-S11 "Site Surveys"                                                                                                                                                                                                                                                                                          | In accordance with PC-S11 "Site Surveys"                                            | Within $\pm 50$ mm of design level                                                                |
|                   |                                | Variation of reduced levels of fill batters | In accordance with PC-S11 "Site Surveys"                                                                                                                                                                                                                                                                                          | In accordance with PC-S11 "Site Surveys"                                            | Within $\pm 75$ mm of design level                                                                |
|                   |                                | Variation of reduced levels of open drains  | In accordance with PC-S11 "Site Surveys"                                                                                                                                                                                                                                                                                          | In accordance with PC-S11 "Site Surveys"                                            | Within $\pm 50$ mm of design level with the proviso that open drains must be self-draining        |
| 9                 | Earthworks compaction          | Type A material in top 150 mm of fill       | a) TP 320 Compaction Control Test - Dry Density Ratio, Moisture Variation and Moisture Ratio; and<br>b) AS 1289.5.2.1 Methods of testing soils for engineering purposes, Method 5.2.1: Soil compaction and density tests - Determination of the dry density/moisture content relation of a soil using modified compactive effort. | 1 test per 500 m <sup>2</sup> with a minimum of 4 tests per Work Lot <sup>(1)</sup> | a) Compaction: not less than 95% Modified Compaction; and<br>b) Moisture Content: OMC $\pm 2\%$ . |

| Section reference | Subject | Property                                         | Test procedure                                                                                                                                                                                                                                                                                                                    | Test frequency                                                                                                            | Acceptance limits                                                                                 |
|-------------------|---------|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
|                   |         | Type A material other than in top 150 mm of fill | a) TP 320 Compaction Control Test - Dry Density Ratio, Moisture Variation and Moisture Ratio; and<br>b) AS 1289.5.2.1 Methods of testing soils for engineering purposes, Method 5.2.1: Soil compaction and density tests - Determination of the dry density/moisture content relation of a soil using modified compactive effort. | 1 test per 400 m <sup>3</sup> or part thereof with a minimum of 4 tests per Work Lot <sup>(1)</sup>                       | a) Compaction: not less than 92% Modified Compaction; and<br>b) Moisture Content: OMC $\pm 2\%$ . |
|                   |         | Type B and C material                            | a) TP 320 Compaction Control Test - Dry Density Ratio, Moisture Variation and Moisture Ratio; and<br>b) AS 1289.5.2.1 Methods of testing soils for engineering purposes, Method 5.2.1: Soil compaction and density tests - Determination of the dry density/moisture content relation of a soil using modified compactive effort. | 1 test per 400 m <sup>3</sup> of compacted material or part thereof with a minimum of 4 tests per Work Lot <sup>(1)</sup> | Compaction: not less than 90% Modified Compaction<br>Moisture Content: OMC $\pm 2\%$              |
|                   |         | General Fill                                     | TP 320 Compaction Control Test - Dry Density Ratio, Moisture Variation and Moisture Ratio                                                                                                                                                                                                                                         | 1 test per 400 m <sup>3</sup> of compacted material or part thereof with a minimum of 4 tests per Work Lot <sup>(1)</sup> | In accordance with the Contract Documents                                                         |

**Table notes:**

(1) Every layer must be tested.