

TRANSPORT FOR NSW (TfNSW)

QA SPECIFICATION R31

VERTICAL WICK DRAINS

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VERTICAL WICK DRAINS

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VERSION FOR: DATE:

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FOREWORD

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REVISIONS TO PREVIOUS VERSION

This document has been revised from Specification TfNSW R31 Edition 1 Revision 0.

All revisions to the previous version (other than minor editorial and project specific changes) are indicated by a vertical line in the margin as shown here, except when it is a new edition and the text has been extensively rewritten.

PROJECT SPECIFIC CHANGES

Any project specific changes are indicated in the following manner:

- (a) Text which is additional to the base document and which is included in the Specification is shown in bold italics e.g. ***Additional Text***.
- (b) Text which has been deleted from the base document and which is not included in the Specification is shown struck out e.g. ~~Deleted Text~~.

TfNSW QA SPECIFICATION R31

VERTICAL WICK DRAINS

1 GENERAL

1.1 SCOPE

This specification sets out the requirements for the supply and installation of vertical wick drains.

1.2 STRUCTURE OF THE SPECIFICATION

This Specification includes a series of annexures that detail additional requirements.

1.2.1 Project Specific Requirements

Project specific details of work are shown in Annexure R31/A.

1.2.2 Measurement and Payment

The method of measurement and payment must comply with Annexure R31/B.

1.2.3 Schedules of HOLD POINTS and Identified Records

The schedules in Annexure R31/C list the **HOLD POINTS** that must be observed. Refer to Specification TfNSW Q for the definition of **HOLD POINTS**.

The records listed in Annexure R31/C are **Identified Records** for the purposes of TfNSW Q Annexure Q/E.

1.2.4 Planning Documents

The PROJECT QUALITY PLAN must include each of the documents and requirements listed in Annexure R31/D and must be implemented.

In all cases where this Specification refers to the manufacturer's recommendations, these must be included in the PROJECT QUALITY PLAN.

1.2.5 Referenced Documents

Unless specified otherwise or is specifically supplied by the Principal, the applicable issue of a referenced document, is the issue current at the date one week before the closing date for tenders, or where no issue is current at that date, the most recent issue.

Standards, specifications and test methods are referred to in abbreviated form (e.g. AS 2350). For convenience, the full titles are given in Annexure R31/M.

1.3 DEFINITIONS

The terms "you" and "your" mean "the Contractor" and "the Contractor's" respectively.

The following definitions apply to this Specification:

- Wick drains** A prefabricated synthetic geocomposite drain which, when installed vertically in soil strata, acts as a drainage medium having the following characteristics:
- (i) ability to permit porewater in the soil to seep into the drain; and
 - (ii) ability to transmit collected porewater along the length of the drain.
- O₉₅** Geotextile Opening Size corresponding to 95% by mass of a single size soil which would pass the stated opening size. This is usually referred to as the Equivalent Opening Size or EOS.
- O₅₀** Geotextile Opening Size corresponding to 50% by mass of a single size soil which would pass the stated opening size.
- Q** In Plane Discharge (Flow) Capacity in litres per hour determined using ASTM D4716.

2 MATERIAL REQUIREMENTS

2.1 GENERAL

Wick drains must consist of a plastic core and a geotextile filter. Wick drains may be manufactured as a single unit or the filter may be wrapped around the core, and overlapped and sealed to contain the core.

Wick drains must be made from polyethylene, polyester, polypropylene or other synthetic material or combination of such materials. Unless otherwise specified on the Drawings, wick drains must be 95 mm to 100 mm wide and 3 mm to 8 mm thick.

Manufacture wick drains from materials which are tough and flexible enough to retain their integrity when subjected to the stresses imposed during storage, installation and subsequent ground settlements.

Wick drains must be able to conform to soil deformation without buckling or crimping of the core.

2.2 GEOTEXTILE FILTER REQUIREMENTS

The filter jacket for wick drains must be a non woven geotextile which:

- (a) has been previously proved effective under similar soil conditions;
- (b) is in all cases able to prevent excessive migration of soil particles into the core; and
- (c) has a permeability not less than that of the surrounding soil.

The geotextile filter must comply with the opening size requirements specified in Annexure R31/A.

2.3 DISCHARGE CAPACITY REQUIREMENTS

The in-plane discharge (flow) capacity of wick drains (Q) must not be less than 40 litres per hour when tested in accordance with ASTM D4716 under a hydraulic gradient of 1 and at a lateral confinement test pressure of 250 kPa.

2.4 PRODUCT CONFORMITY

Provide a Certificate of Compliance from the Supplier of each batch of wick drains to verify that the wick drains comply with the requirements of the Contract. The certificate must include the manufacturer's name and the date and place of manufacture.

The certificate must not be based on tests carried out more than six months before delivery.

If requested, provide to the Principal samples of the wick drains.

3 PACKAGING, DELIVERY AND STORAGE

Wick drains must be supplied in rolls and securely packed in light proof wrappings.

Deliver wick drains to the site at least 14 days prior to the commencement of installation.

Wick drains must be stored under protective cover or wrapped with a waterproof, opaque UV protective sheeting to avoid damage prior to installation.

Do not store wick drains directly on the ground or in a manner in which they may be affected by heat. The method of storage must be in accordance with the recommendations set out by the manufacturer.

Clearly label the protected wick drains showing the manufacturer, the type of wick drains and the batch identification number.

4. CONSTRUCTION

4.1 GENERAL

Submit to the Principal your Method Statement which must include the following:

- (a) Details of wick drains, including manufacturer's literature and Certificate of Compliance;
- (b) Details of installation equipment, methods of installation of wick drains, mandrels and drain anchors and method of recording depth of installation;
- (c) Procedure for assessing the rake of wick drain installation equipment to ensure that specification tolerance is achieved;
- (d) Sequence of construction of wick drains; and
- (e) Details of your previous experience of installation of wick drains using similar drains and installation equipment.

Submission of the Method Statement constitutes a **HOLD POINT**.

HOLD POINT

Process Held:	Commencement of installation of wick drains.
Submission Details:	At least 10 working days before the commencement of installation of wick drains, submit to the Principal your Method Statement, including the details stated in Clause 4.1.
Release of Hold Point:	The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

Provide wick drains with an outer casing or mandrel of rhomboidal or rectangular cross section for the purpose of installation. Also provide wick drains with an anchor in accordance with Clause 4.5.

Mandrels must possess adequate strength and stiffness and be suitably guided during penetration into the ground. The cross sections of mandrels must be as small as practicable. As a guide, the circumference of mandrels must not exceed 0.45 m.

4.2 SITE PREPARATION**4.2.1 Clearing and Grubbing**

Where specified under the Contract, carry out clearing and grubbing of the embankment foundation area defined for wick drain installation in accordance with Specification TfNSW G40. Fill or trim round furrows or undulations exceeding 0.3 m deep. Grass and topsoil may be left in place to minimize disturbance to the vegetation root system or underlying soil profile.

4.2.2 Working Platform

Where specified under the Contract or as shown in the Drawings, construct a working platform at the designated area prior to wick drain installation.

This working platform comprises the following:

- (a) a bottom layer of non woven geotextile complying with Strength Class C and Filtration Class 1 of Specification TfNSW R63;
- (b) biaxial geogrid layer(s) placed above the geotextile; and
- (c) a drainage blanket layer of thickness 700mm (–0 mm, +100 mm), consisting of material meeting the following properties:

Property of Drainage Banket for Wick Drains Installation	Criterion (% by mass)
Percentage passing 4.75 mm sieve	90 – 100
Percentage passing 1.18 mm sieve	40 – 85
Percentage passing 300 µm sieve	2 – 30
Percentage passing 150 µm sieve	0 – 7
Percentage passing 75 µm sieve	0 – 3

The requirements for drainage blanket stated in Specification TfNSW R44 do not apply to drainage blankets provided for the purpose of wick drain installation.

The drainage blanket layer must extend past the outer edges of the base of the embankment to provide a clear drainage path across the whole foundation area.

Place and spread the drainage blanket material in such a way to avoid segregation and to ensure that it is not contaminated with foreign materials. This layer may be placed without compaction.

4.3 INSTALLATION

Install wick drains at the locations shown on the Drawings, and through the working platform into the underlying soil to the required depths.

Each wick drain must be installed in one continuous length without joints, and with minimum disturbance to the surrounding ground and smearing of soil around the drain.

The installation equipment must incorporate provision for adjustment of the rake of the mandrel. Do not install wick drain if the rake of the mandrel and supporting leaders exceeds 1 in 100. Check and record the rake of the mandrels for the wick drains installed along the three adjacent rows at both sides of the proposed instrumentation lines.

The installed locations of wick drains at the ground surface must be within 100 mm of the specified locations on plan and the rake of the drains must be within 2% from the vertical.

The depth of wick drains must be as shown on the Drawings or as directed by the Principal based on the resistance of the soil to penetration during installation. Notify the Principal immediately of any sudden change in the penetration resistance to the mandrel.

4.4 PREBORING

Prebore holes at locations where the soil conditions could impede the installation of wick drains.

The diameter of the prebored hole must not exceed 300 mm.

HOLD POINT

Process Held.	Preboring holes (when required).
Submission Details.	Details of method and depth of preboring, method of removal and disposal of materials from the wick drain site to prevent contamination of the holes and method of prevention of ingress of water and ensuring safety.
Release of Hold Point.	The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

Do not leave prebored holes open for more than 48 hours and cover any holes left open for more than 7 hours to prevent ingress of water and to avoid endangering people.

After the installation of a wick drain, backfill the prebored hole within 24 hours with clean dry sand from the bottom of the hole to the ground surface. Ensure that no voids are formed. Tamp down the sand at the ground surface to a level slightly above the surrounding ground to ensure discharge of water without ponding.

4.5 ANCHORING AND FINISHING

Anchor each vertical drain at the specified depth by securing the wick drain to a disposable shoe or by any other technique approved by the Principal.

After the mandrel is fully withdrawn, and the wick drain is anchored at the specified depth, the wick drain must be cut off above the surface and secured at the surface by suitable means so that the wick drain remains vertical and straight after backfilling.

ANNEXURE R31/B – MEASUREMENT AND PAYMENT

B1 MEASUREMENT AND PAYMENT

Payment will be made for all costs associated with completing the work detailed in this Specification in accordance with the following Pay Items, except for:

- (a) Clearing and Grubbing, which must be in accordance with Specification TfNSW G40; and
- (b) Geotextile and Geogrid, which must be in accordance with TfNSW R44.

Where no specific pay items are provided for a particular item of work, the costs associated with that item of work are deemed to be included in the rates and prices generally for the Work Under the Contract.

Unless otherwise specified, a lump sum price for any of these items will not be accepted.

Pay Item R31P1 – Vertical Wick Drains

The unit of measurement must be the linear metre of wick drain installed from the bottom of the wick drain to existing natural ground surface or the top surface of the drainage mat where provided.

The schedule rate must cover all costs involved in the supply and installation of the wick drains including preboring.

Pay Item R31P2 – Drainage Blanket for Wick Drains Working Platform

The unit of measurement must be the cubic metre of drainage blanket material placed. The volume must be determined by specified thickness, measured area and calculation.

The schedule rate must cover all activities associated with the supply, stockpiling, testing, transportation and placing of material in the drainage blanket.

ANNEXURE R31/C – SCHEDULES OF HOLD POINTS AND IDENTIFIED RECORDS

Refer to Clause 1.2.3.

C1 SCHEDULE OF HOLD POINTS

Clause	Description
4.1	Submission of Method Statement
4.4	Preboring holes (when required)

C2 SCHEDULE OF IDENTIFIED RECORDS

The records listed below are Identified Records for the purposes of TfNSW Q Annexure Q/E.

Clause	Description of Identified Record
2.4	Certificate of compliance
4.3	Conformity records for wick drain installation

ANNEXURE R31/D – PLANNING DOCUMENTS

Refer to Clause 1.2.4.

The following documents are a summary of documents that must be included in the PROJECT QUALITY PLAN. The requirements of this Specification and others included in the Contract must be reviewed to determine additional documentation requirements.

The information to be supplied by you as part of the PROJECT QUALITY PLAN must include, but not be limited to, the following:

- (a) Details of wick drains, including manufacturer's literature and Certificate of Compliance (Clauses 2.4 and 4);
- (b) Details of method of packaging, delivery and storage (Clause 3);
- (c) Details of installation equipment, methods of installation of wick drains, mandrel and drain anchors and method of recording depths of installation (Clause 4.1);
- (d) Procedure for assessing the rake of wick drain installation equipment to ensure that specification tolerance is achieved (Clauses 4.1 and 4.4);
- (e) Sequence of construction of wick drains (Clause 4.1);
- (f) Details of your previous experience of installation of wick drains using similar drains and installation equipment (Clause 4.1); and
- (g) Details of method of preboring holes (Clause 4.4).

ANNEXURES R31/E TO R31/L – (NOT USED)

ANNEXURE R31/M – REFERENCED DOCUMENTS

Refer to Clause 1.2.5.

TfNSW Specifications

TfNSW G40	Clearing and Grubbing
TfNSW Q	Quality Management System
TfNSW R44	Earthworks
TfNSW R63	Geotextiles (Separation and Filtration)

Australian Standards

AS 3706.7	Determination of Pore-size Distribution – Dry-sieving Method
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ISO Standards

ISO 12956	Determination of the Characteristic Opening Size
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ASTM Standards

ASTM D4716	Standard Test Method for Determining the (In-plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
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