

SITE DRAINAGE

TS 2.10.09

GENERIC ELECTRICITY SUBSTATION DESIGN MANUAL
FOR CIVIL, STRUCTURAL AND BUILDING ENGINEERING

SECTION NO : 09

TITLE : SITE DRAINAGE

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1 INTRODUCTION

1.1 PURPOSE AND SCOPE

- 1.1.1 This technical specification TS 2.10.09 defines National Grid's requirements in respect of site drainage at new and existing (i.e. retrofit) electricity substations and other relevant operational sites. It shall also apply, as appropriate and via agreement, to third party assets installed on National Grid owned land.
- 1.1.2 This specification forms part of a suite of documents, TS 2.10.xx, which define design requirements (including mandatory prescriptive and functional requirements and/or performance characteristics) relating to new build and existing 'Civil, Structural and Building Engineering' assets forming part(s) of substation construction projects. Refer to TS 2.10.00 for general introduction and description of the respective parts of the series.
- 1.1.3 These design requirements shall be used in conjunction with the construction specification which is included in the TS 3.10.xx series of documents. Refer to TS 3.10.00 for general introduction.
- 1.1.4 This specification shall be applied in conjunction with all relevant National Grid standards as appropriate. The Level 1 and 2 Specifications for substations, TS 1 and TS 2.01, cover major requirements.

PART 1 – PROCEDURAL

2 BASIS OF DESIGN

2.1 Principles

- 2.1.1 Refer to TS 2.10.01 Oil Containment, for supplementary drainage requirements in and around plant areas containing oil.
- 2.1.2 Where appropriate and not in conflict with the other parts of the specification the drainage design shall consider the application of the Sustainable Drainage Systems (SUDS) techniques as promoted by the Construction Industry Research and Information Association (CIRIA).
- 2.1.3 Gradients shall be adequate to achieve the required minimum flow velocities for self cleansing. In the absence of more detailed analysis this shall be assumed as 0.75 m per second.

2.2 Assessment of Design Run-Off Flows

- 2.2.1 In the design of the Site Drainage system, run off flows shall be calculated in accordance with CIRIA C736, i.e.:
 - a) The preferred method of estimating the rainfall depths is to use the depth-duration-frequency rainfall model contained on the Flood Estimation Handbook (FEH) CD-ROM (CEH, 2000), which provides location specific rainfall totals for given durations and return periods.
 - b) However, as a first estimate, it may be appropriate to refer to Figure 4.2 of CIRIA C736, which provides average annual rainfall depths and those for the 24-hour and eight day 10 per cent AEP events.
- 2.2.2 Volumetric flow shall be determined using the Wallingford Procedure or other established method. Run off from permeable areas such as those surfaced with stone chippings may normally be excluded as making negligible contribution to peak flows. Due consideration shall be given to the quantities of water discharged by a BWCU and other pumps.

3 INTERFACE REQUIREMENTS

3.1 Earthing

3.1.1 The designer shall ensure that all equipment and materials are installed in accordance with the earthing requirements outlined in TS 3.01.02 'Earthing'.

3.1.2 All exposed metallic pipework shall be earthed.

3.2 Foul Drainage

3.2.1 Foul drainage shall connect into the public sewage system wherever possible. Otherwise permanently manned sites shall be served by a suitably sized sewage treatment works and all other sites shall be provided with a cesspool (minimum capacity 9000 litres) fitted with a float switch and high level alarm.

3.3 Third party drainage

3.3.1 Wherever possible drainage systems under the responsibility of or carrying discharges from, third parties shall not be installed on land owned by National Grid. Otherwise such systems and all other systems that can be located outside of the operational perimeter (e.g. surface water ditches and culverts) shall be located outside of the operational perimeter.

3.4 Vehicle loading

3.4.1 Unless specified otherwise access covers shall be rated in accordance with their locations as defined in TS 2.10.05 Access Covers / Ducts / Trenches Access Covers section above.

3.4.2 Pipework shall be satisfactory for the vehicle loading applied above and adjacent to its position, as defined in TS 2.10.08 Roadworks and Surfacing. Proposals for pipe protection slabs in lieu of adequate cover shall be agreed with National Grid.

3.5 Surface water

3.5.1 Surface Water from the access road and car parking area shall drain to the adjacent stone surfacing.

INFORMATIVE: There is no specific requirement for the car parking area to drain via an oil separator as indicated in TS 2.10.01 Oil Containment provided a site management system is in place that ensures plant, equipment or vehicles containing significant quantities (nominally 200 litres or more) of possible pollutant (e.g. oil) will not be located in that area.

4 ELEMENT DESIGN REQUIREMENTS

4.1 Sampling Chambers

4.1.1 Sampling chambers shall be provided at the following locations:

- a) Immediately downstream of every Oil Separator;
- b) Upstream of every Penstock;
- c) At or before the final discharge point. Where the discharge is consented the location shall be agreed with the Environment Agency otherwise it shall be at an accessible location between the outfall and the last manhole chamber before the outfall.

4.1.2 Wherever practicable, sampling facilities associated with Penstocks shall be incorporated into Penstock chambers.

4.1.3 Sampling Chambers shall be of sufficient size to allow collection from flowing (not accumulated) water. Where possible this shall be facilitated by incorporating a 100mm level difference between the inlet and outlet pipes i.e. inlet 100mm higher than the outlet.

4.1.4 The inlet pipe to sampling chambers shall extend into the chamber by at least 50mm.

4.2 Penstocks

4.2.1 For material requirements refer to TS 3.10.02 Section 2.130 Valves and Penstocks.

4.2.2 Penstocks shall be provided at the following locations:

- a) All positions where any drainage systems enter or exit National Grid operational land to allow discharges into and out of the site to be controlled and if necessary isolated in case of accidental contamination to these systems.
- b) Immediately upstream of each Oil Separator to allow it to be isolated in the event of an abnormal incident and to facilitate maintenance of the Oil Separator.
- c) Immediately downstream of each Oil Separator before any other chambers or connections from any third party drainage systems, to enable the separator to be isolated from the possibility of back flows during maintenance. Where back flows from third party drainage or tidal flows will impact on the functionality of the separator a non-return valve shall also be installed.

4.2.3 Penstocks shall be designed to withstand the maximum pressure due to downstream flows or back flows from upstream drainage systems or controlled waters. This includes emergency and flood conditions as appropriate.

4.2.4 Keys for Penstocks shall be prominently positioned as near to the Penstock as possible, within the substation perimeter fence. A spare set of keys shall be provided and kept at a location defined by National Grid.

4.3 Headwalls

4.3.1 Headwalls shall be provided at all positions where a drainage system discharges into open waters. These shall be agreed with the Statutory Undertaker for the open waters.

4.3.2 A designated access route to the discharge point shall be identified and constructed. Stepped access shall be provided to one side of the headwall to allow visual inspection of the flow and to facilitate actions in the event of an emergency. Guardrails shall be provided across the top and down the sides of the headwall to prevent falls and to aid access and egress. Where the headwall is sited adjacent to deep or fast flowing water a stop rail shall be provided.

4.3.3 Where pipe diameters are in excess of 300mm measures shall be taken to prevent unauthorised access e.g. by use of bar screens etc. These measures shall be taken into account when considering the hydraulic performance of the outfall.

4.3.4 Where the drainage system outfalls into a watercourse, consideration shall be given to providing protection from bank erosion around the headwall. In addition, where the expected velocity of the flow is expected to be high, energy dissipating structures such as baffle blocks on the apron shall be provided to mitigate the effect of erosion of the riverbed. Erosion of the opposite bank should also be considered and protection measures installed where necessary.

4.3.5 Design solutions should follow the best practice guidance on erosion around outfalls provided in Chapter 8 of the Fluvial Design Guide published by the Environment Agency.

4.4 Access covers

- 4.4.1 Refer to TS 2.10.05 Access Covers / Ducts / Trenches for design requirements for access covers.

4.5 Earth link pits

- 4.5.1 Wherever possible earth link pits shall be designed to be free draining in order to minimise joint/connection maintenance.

PART 2 – REFERENCES, DEFINITIONS AND DOCUMENT HISTORY

5 REFERENCES

5.1 Her Majesty's Stationary Office

The Environmental Protection Act 1990

The Water Industry Act 1999

Waste Management – The Duty of Care - A code of practice.

The Water Resources Act 1991

Environment Act 1995

5.2 National Grid

PS(T) 095 Flood Mitigation Policy

TS 1 Ratings and General Requirements for Plant, Equipment and Apparatus for the National Grid System

TS 2.01 Substations

TS 2.02 Switchgear for the National Grid System

TS 2.03 Power Transformers and Reactors

TS 2.10.XX Generic Electricity Design Manual for Civil, Structural and Building Engineering

TS 3.10.XX Generic Technical Specification for Civil, Structural and Building Engineering

TS 3.01.02 Earthing

TP 135 Management of Drawings (Electricity Assets)

TP 137 The Implementation of Construction (Design and Management) Regulations (CDM) 2007

TP188 Transmission Construction Electricity – Design Management

5.3 Other

Road Note 35 – Guide for engineers to the design of storm sewer systems, Transport Research Laboratory

DIN 19580 – 'Drainage channels for vehicular and pedestrian areas - Durability, mass per unit area and evaluation of conformity'

Environment Agency Fluvial Design Guide

6 DEFINITIONS

Controlled Waters: All watercourses, lakes, lochs, canals, inland and coastal waters and water contained in underground strata (or groundwater).

Oily Water Drainage System: The components of any closed drainage system - pipes, manholes, catchpits, Penstocks, Oil Separators, pumps, BWCUs, sumps, sampling chambers etc. – intended to manage Oil contaminated water.

Penstock: A control valve or similar device designed to isolate sections of a drainage system

Site Drainage: Run-off water either contaminated or likely to be contaminated with Oily matter.

Surface Water: Rainwater from roofs, roads, and clean yards with negligible risk of contamination with Oil or chemicals etc.

Wallingford Procedure: A design and analysis procedure for urban drainage networks produced by HR Wallingford and the Institute of Hydrology in 1981.

7 AMENDMENTS RECORD

Issue	Date	Summary of Changes / Reasons	Author(s)	Approved By (Inc. Job Title)
1	April 2017	New Document Replaces DH 10 & to comply with Eurocodes and General updates	Gibson Bhunu	EEPIG

8 IMPLEMENTATION

8.1 Audience Awareness

Audience	Purpose Compliance (C) / Awareness (A)	Notification Method Memo / letter / fax / email / team brief / other (specify)
Electricity Transmission Owner	A	e-mail
UK Construction	A	e-mail/Eurocodes Launch
Construction Delivery Units	C	Eurocodes Launch

8.2 Training Requirements

Training Needs N/A / Informal / Workshop / Formal Course	Training Target Date	Implementation Manager
Eurocodes Launch	25 May 2017	Phil Clements

8.3 Compliance

This document is essentially a reproduction of existing information previously available in DH10. Consequently compliance is generally regarded as ongoing and retrospective application unnecessary in the main. Minor exceptions to this principle shall be incorporated into the works wherever possible and where not National Grid shall be advised via the appropriate project design management routes.

8.4 Procedure Review Date

5 years from publication date.

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