

SuDS Construction Specification Clauses

1. Existing Specification Clauses

The common construction specifications are:

- National Building Specification (NBS);
- Specification for Highway Works (SfHW);
- Civil Engineering Specification for the Water Industry (CESWI).

None of these currently include specific clauses for SuDS construction. However they do contain clauses for most of the common construction activities and materials used in SuDS, or provision for including them.

The different items will be found in different parts of each of the standard specifications, but this is not unusual for any item of construction (e.g. a car park surface and associated drainage would call upon Series 500, 600 and 700 of the Specification for Highway Works).

The following table summarises some of the features of the different specifications.

Table 1.1: Construction Specification Examples and Suitability for SuDS

Specification	Comments
Civil Engineering Specification for the Water Industry	<p>Not freely available</p> <p>Commonly used by water engineers</p> <p>Not commonly used by landscape professionals</p> <p>Robust specification for earthworks and pavement materials</p> <p>Generic specifications rather than specific products.</p>
National Building Specification	<p>Refers to SfHW for a lot of earthworks materials and aggregates</p> <p>Not very robust for earthworks or some other drainage items</p> <p>Not freely available</p> <p>Commonly used by architects and landscape architects</p> <p>Tends to rely on stating a particular product (ie not performance based)</p>
Specification for Highway Works	<p>Freely available</p> <p>Well established and understood by Highways Authorities and many developers and engineers</p> <p>Not commonly used by landscape professionals</p> <p>Robust specification for earthworks and pavement materials</p> <p>Generic specifications rather than specific products.</p>

2. Example SuDS Specification

2.1 Base specification

The base specification shall be the Specification for Highway Works (latest Edition) published by the Highways Agency, supplemented by the following requirements.

2.2 General clauses

2.2.1 Erosion protection

The Contractor is responsible for preventing erosion of the sustainable drainage system until all the vegetation within it is fully established. This is to be achieved by protecting the side slopes and base of swales, wetlands and other areas where water flows with fully biodegradable matting.

If erosion occurs in any part of the systems the Contractor shall repair these areas to the satisfaction of the Client.

2.3 Planting

2.3.1 Limitations on planting

Planting is to be carried out between April and September. Seeding and turfing is to be undertaken in spring or autumn in suitable weather conditions. The contractor shall obtain the approval of the client to undertake planting, seeding or turfing.

Plant stock should be sourced from approved nurseries that only grow native species of local provenance to avoid the introduction of alien species.

Topsoil is not to be placed within 300mm of the permanent water level in the wetland. Wetland plants are to be directly planted into the subsoil.

Fertilisers and pesticides are not to be used.

2.3.2 Swale planting

The following planting mix shall be provided in the swale:

10% - *Iris pseudacorus* (Water Iris)

10% - *Carex riparia* (Great Pond Sedge)

10% - *Carex Nigra* (Common Sedge)

10% - *Carex acutiformis* (Lesser Pond Sedge)

50% - *Sparganium erectum* (Branched Bur-Reed)

10% - *Typha angustifolia* (Lesser Reed Mace)

In the grassguard system, the topsoil shall be carefully hand rammed into the voids leaving a 25mm space at the top. The seeds shall be mixed with the topsoil and placed in the 25mm void and lightly compacted.

The edges of the swales should be seeded with a normal amenity grass mix with a wildflower component.

2.3.3 Wetland planting

The following planting mix shall be provided in the forebay area:

- 10% - *Iris pseudacorus* (Water Iris)
- 10% - *Carex riparia* (Great Pond Sedge)
- 10% - *Carex Nigra* (Common Sedge)
- 10% - *Carex acutiformis* (Lesser Pond Sedge)
- 50% - *Sparganium erectum* (Branched Bur-Reed)
- 10% - *Typha angustifolia* (Lesser Reed Mace)

The following planting shall be provided in the wetland and areas:

- 10% - *Agrostis stolonifera* (Creeping Bent Grass)
- 10% - *Apium nodiflorum* (Fools Water Cress)
- 20% - *Filipendula vulgaris* (Meadowsweet)
- 10% - *Glyceria fluitans* (Floating Sweet Grass)
- 10% - *Myosotis scorpioides* (Water Forget-me-not)
- 10% - *Mentha aquatica* (Water Mint)
- 10% - *Nasturtium officinale* (Watercress)
- 10% - *Persicaria amphibian* (Amphibious Bistort)
- 10% - *Veronica beccabunga* (Brooklime)

The wetland plants are to be planted at a density of 5 plants per m².

The edges of the forebay and wetland should be seeded with a normal amenity grass mix with a wildflower component.

2.4 Membranes for lining

The membrane for lining the wetland and swale shall meet the following requirements:

Type: Cold applied single layer robust welded flexible membrane, suitable for waterproofing to structures and for water containment.

PROPERTY	VALUE	TEST METHOD
Thickness mm +/- 10%	1.0	ASTM D-751
Density g/cm ³ Min	0.9	ASTM D-792
Tensile Stress @ Break Min N/mm ²	18	ASTM D-638
Elongation@ Break %	> 700	ASTM D-638
Puncture Resistance Min N	150	FTMS 101C
		Method 2065
Tear Resistance Min N	60	ASTM D-1004

Dimensional Stability% Change Max	+/- 2.0	ASTM D-1204
		1 Hr @ 100°C
Stress Crack Resistance	100%	ASTM 5397
Volatile Loss 5%	0.2	ASTM D-1203
Loss Max		Method A
Ozone Resistance	No Cracks	ASTM D-1149
Carbon Black Content	2 - 3 %	ASTM 1603
Moisture Vapour g/m ² /day	< 0.1	ASTM E96
Methane Permeability	0.11g/m ² /day/atm	European standard
Methane Transmission Rate	1.8 x 10 ⁻⁹ m ³ /m ² /s/atm	BRE
Permeability Coefficient	1.8 x 10 ⁻¹²	
Application temperature of the membrane shall be greater than 4°C.		
Primer not required.		
Number of layers : One (1).		
Laps - minimum 120 mm.		
Jointing: Shall be generally formed using twin seam fusion welding in accordance with manufacturers' recommendations.		
Extrusion welding shall be accepted only in areas where twin seam welding is in appropriate.		

2.4.1 Workmanship Generally

Pre laying checks: Surface acceptability. Before laying check that substrate surfaces are : -

- a) Structurally sound.
- b) Free from ridges and undulations.
- c) Surface dry.
- d) Cleaned of loose and extraneous material.

Construction Acceptability:

Before laying check that construction allows membrane continuity to be maintained.

Laying Membrane:

Membrane to be installed by qualified operatives recommended by membrane manufacturer and/or prefabricated into panels where appropriate to suit site requirements.

Laid strictly in accordance with manufacturers' recommendations.

Apply membrane firmly to substrate ensuring that trapped air is removed as application proceeds. Overlap and bond consecutive sheets as specified using recommended twin wedge hot air jointing methods to ensure full bonding at laps.

When temperature is 4°C and falling, a hot air pre-heat system of welding shall be adopted.

Protection Generally:

Protect finished sheeting adequately where necessary to prevent puncturing during following works. Cover sheeting with permanent overlying construction as soon as possible. Immediately prior to covering check for damage and repair as necessary.

Penetrations:

All penetrations through the membrane shall be sealed with proprietary water resistant preformed cloaks. The cloaks shall be compatible with the membrane and approved by The Engineer.

2.5 Geotextiles

Protection of membranes

The geotextiles to be used in the system to protect liners and act as filters shall meet the following requirements;

Type:			
Heavy Duty Geotextile Fleece. Non-woven, needle punched, polypropylene.			
Typical physical properties shall be;			
PROPERTY	TEST METHOD	UNIT	VALUE
mass per unit area	BS EN 965:1995	g/sq.m	300
Thickness under load 2kPa	BS EN 964-1:1995	mm	3.8
CBR Puncture resistance	BS EN ISO12236	kN	2000
CBR displacement	BS EN ISO12236	mm	81
Tensile Strength (min) at max. load m.d.	BS EN ISO10319	kN/m	9
Tensile Extension(max) at max. load m.d.	BS EN ISO10319	%	180
Water Transmittivity at 100mm head(min)	BS EN ISO10319	l/sq.m/s	135
Breakthrough Head	BS EN ISO10319	mm	nil
Coefficient of permeability	BS EN ISO10319	m/s	5 x 10 ⁻³
Apparent opening size90% finer	BS6906 Pt 2 1989	microns	90 to 300

Laying generally:

Filter/protection geotextile shall be laid continuously as detailed in the contract drawings. Overlaps shall be a minimum of 300mm

2.6 Filtration

Type 4/20 material for use in swale underdrains

Material to BS EN 13242

Material to comprise crushed carboniferous limestone rock or concrete.

Properties	Category to BS EN 13242
Grading	Grading 4/20, Gc 85 – 15, GTc 20/17.5
Fines content	f4
Shape	FI20
Resistance to fragmentation	LA30
Durability: — Water absorption to BS EN 1097-6:2000, Clause 7 — For WA > 2 %, magnesium sulphate soundness	WA242 MS18
Resistance to wear	MDE20
Acid-soluble sulphate content:	AS0.2
Total sulphur:	< / = 1 % by mass
Leaching of contaminants	Crushed concrete should meet the requirements of the Environment Agency Waste Acceptance Criteria for inert waste when tested in accordance with BS EN 12457-3.

Type 2/6.3 material

Material to BS EN 13242. Material to comprise crushed carboniferous limestone rock or concrete

Properties	Category to BS EN 13242
Grading	Grading 2/6.3, Gc 80
Fines content	f4
Shape	FI20
Resistance to fragmentation	LA30
Durability: — Water absorption to BS EN 1097-6:2000, Clause 7 — For WA > 2 %, magnesium sulphate soundness	WA242 MS18
Resistance to wear	MDE20
Acid-soluble sulphate content:	AS0.2
Total sulphur:	< / = 1 % by mass
Leaching of contaminants	Crushed concrete should meet the requirements of the Environment Agency Waste Acceptance Criteria for inert waste when tested in accordance with BS EN 12457-3.

2.7 Root zone mix for swale

The rootzone mix shall comprise a 70/30 mix of sand/topsoil.

The topsoil shall meet the requirements of British Standard BS 3882:1994 Specification for Topsoil.

Sand shall meet the following requirements:

Grading:

Sieve size (mm)	% passing
5.00	89 to 100
2.36	65 to 100
0.3	5 to 50
0.063	< 4

Saturated hydraulic conductivity - > 220mm/h

Total porosity - > 30% v/v

PH – 6.5 to 8.5

2.8 Grass reinforcement system to swale sides

Grid to comply with the general manufacturing and testing requirements of BS6717.

2.9 Soil to wetland base

The soil placed on the base and sides of the wetland shall be topsoil in accordance with Clause Q28/340.

Topsoil shall be compacted to remove large voids and produce a coherent mass whilst preventing over compaction.

2.10 Tolerances

The sides slopes of the swale should have a longitudinal and transverse tolerance of 10mm in 3m to promote sheet flow from the drained surface down the slope to prevent erosion occurring.

2.11 Contractor design elements

The wet well pumping station at end of swale is to be designed by the contractor in accordance with Sewers for Adoption (latest edition) including chamber, inlet and outlet, pumps and controls. The pumps provided are to provide a capacity of at least 94 l/s with a duty and standby pump provided.

Provision is to be made in the pumping station to add lime dosing equipment at a later date if required.

The wet well should be designed so that it traps and prevents floating debris (sawdust and woodchip) from entering the pumps and a means of removing the debris provided.