



Flood Risk and SuDS: An Introduction

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Manage/
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Introduction

- Established in 1968
- Turnover of £12m+
- 100+ qualified technical staff
- 7 Offices: Hull (Head Office)
 Leeds
 Lincoln
 Scarborough
 Sheffield
 Teesside
 York

Core Services

- Civil Engineering – Drainage (FRA, DIA. S104)
 - Highways (S38, S278)
- Structural Engineering
- Temporary Works
- Building Surveying – Party Wall, CDM
- Geotechnical & Environmental
- Heritage



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Flood Risk and Drainage Guidance

Government

- National Planning Policy
- Find the location – Flood Map for Planning–GOV.UK
- National Minimum Standards for SuDS
- Codes for Adoption

Lead Local Flood Authority

- Strategic Flood Risk Assessment
- Minimum Development Control Standards for Flood Risk

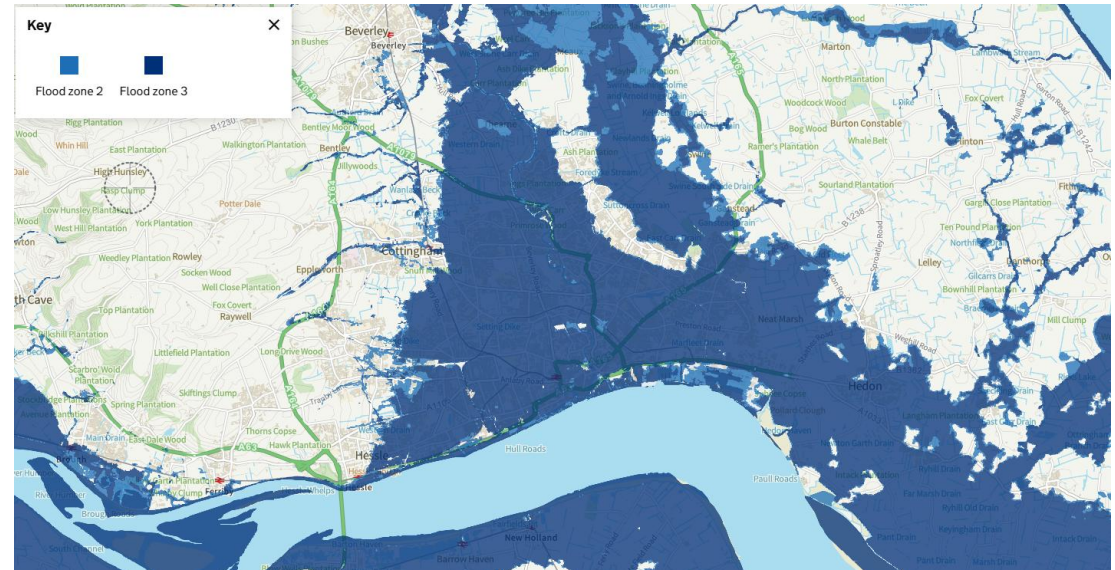
Internal Drainage Boards

- Specific byelaws

Water Authorities and NAVs

- Specific standards

Flood Risk – Maps and Zones



Learn more about this area's flood risk

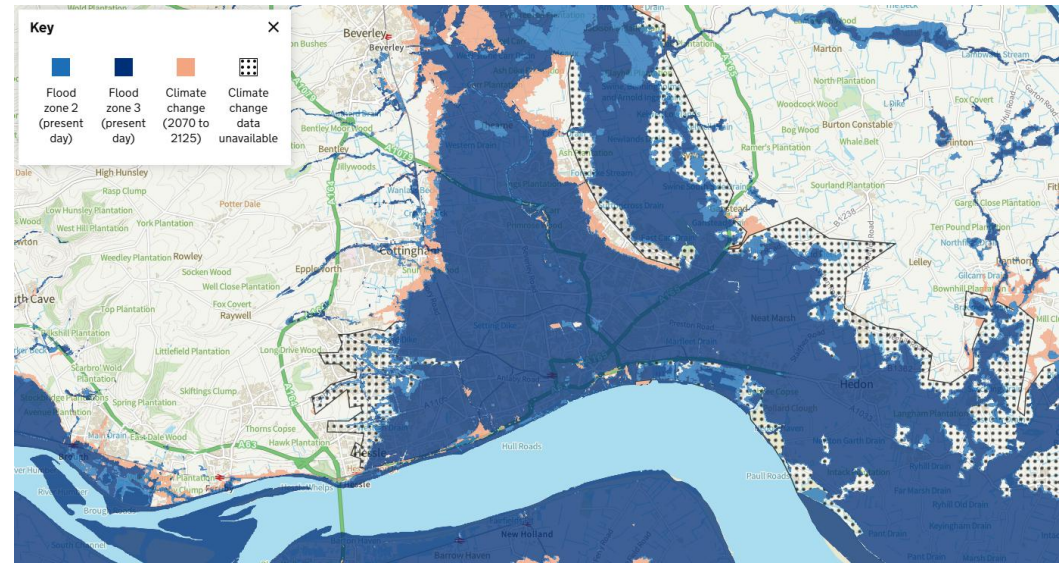
Select the type of flood risk information you're interested in. The map will then update.

Flood risk:

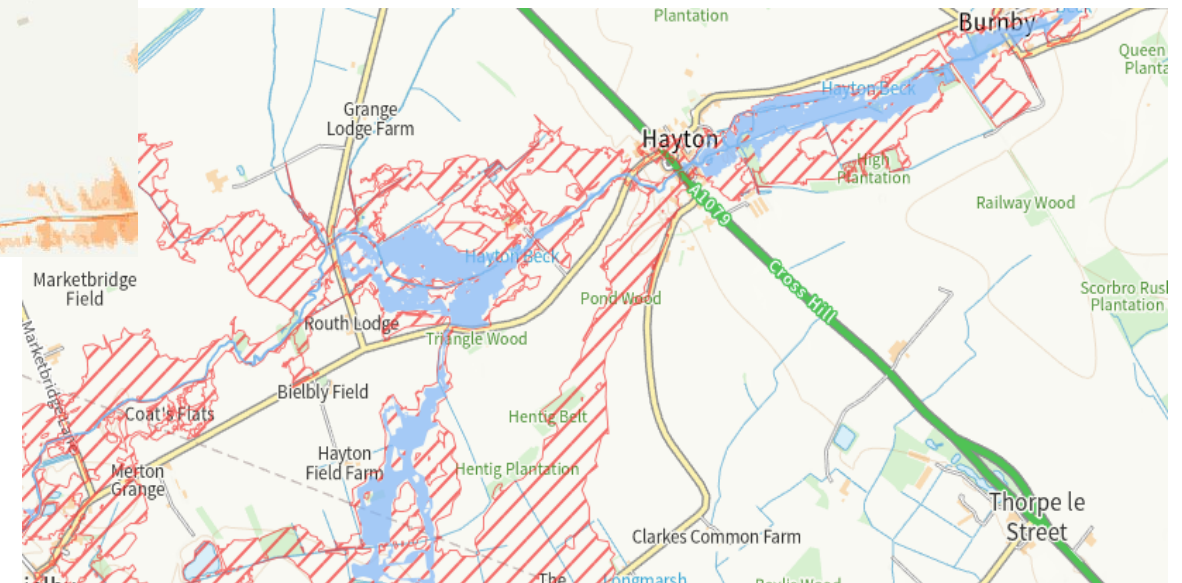
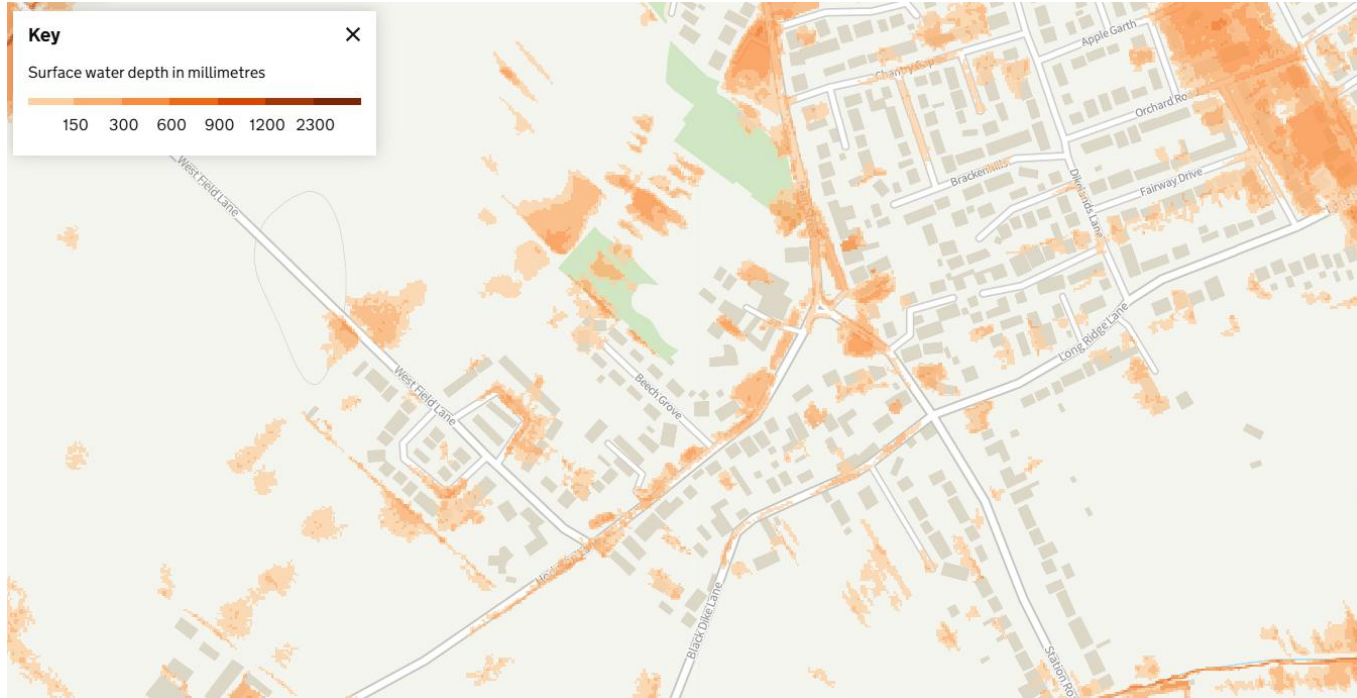
Location:

Extent of flooding from rivers or the sea

● High ● Medium ● Low ● Very low 📍 Location you selected

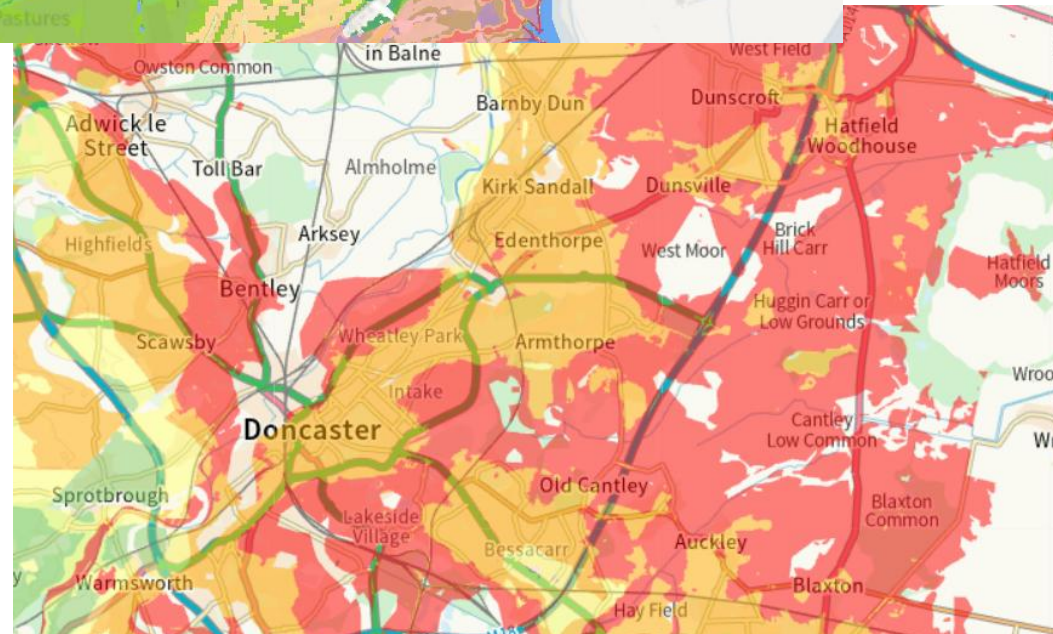
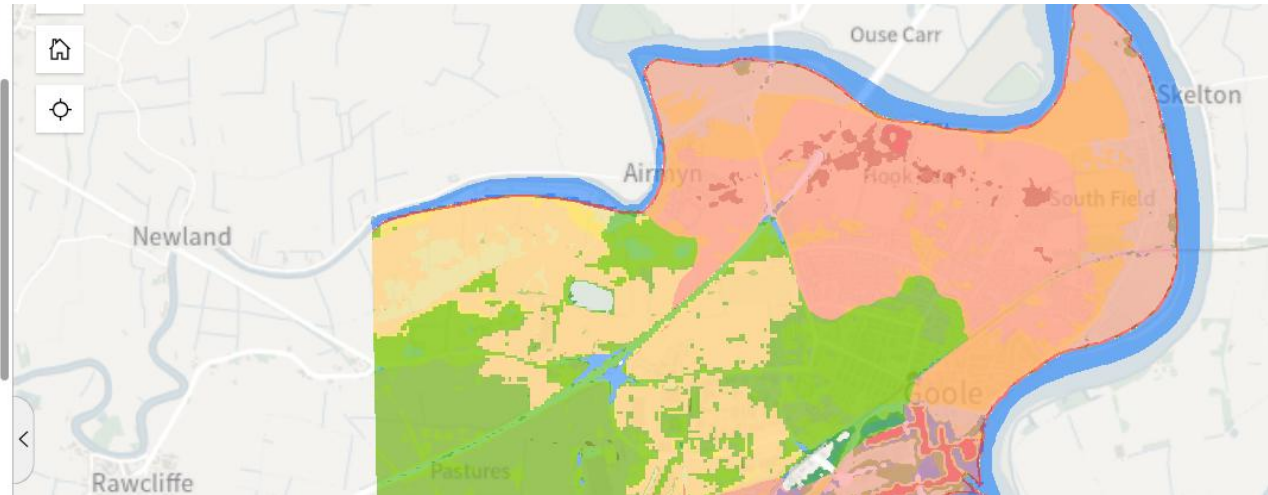
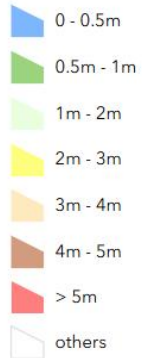


Flood Risk – Surface Water, Reservoirs, Groundwater, Water Mains, Sewerage



Strategic Flood Risk Assessments

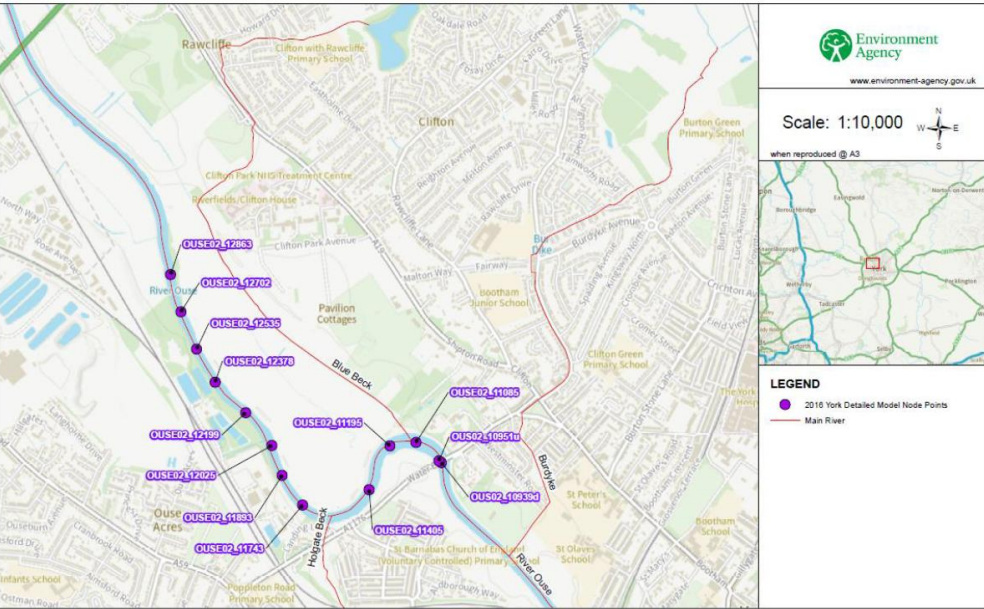
Goole SFRA (Level 2) Max Depth



- SFRA Level 1 (2026)
- Doncaster Borough
- Site Allocations
- Risk of Flooding from Surface Water
- Groundwater Flood Map
- 0
- 1
- 2
- 3
- 4
- Flood Zones
- Residual Flood Risk Zone

Flood Risk – Flood Data

RFI/287094 Modelled Flood Level Node Point Location Map



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2016 York Detailed Model Undefended Results - RFI/2022/287034 (Level - mAOD, Flow - m ³ /s)																												
Node Point	Annual Exceedance Probability (AEP)																											
	50% AEP (1 in 2)		20% AEP (1 in 5)		10% AEP (1 in 10)		5% AEP (1 in 20)		3.33% AEP (1 in 30)		2% AEP (1 in 50)		1.33% AEP (1 in 75)		1% AEP (1 in 100)		1% AEP (1 in 100)+ 20% CC		1% AEP (1 in 100)+ 30% CC		1% AEP (1 in 100)+ 50% CC		0.5% AEP (1 in 200)		0.1% AEP (1 in 1000)			
	Leve l	Flow	Leve l	Flow	Leve l	Flow	Leve l	Flow	Leve l	Flow	Leve l	Flow	Leve l	Flow	Leve l	Flow	Leve l	Flow	Leve l	Flow	Leve l	Flow	Leve l	Flow	Leve l	Flow	Leve l	Flow
OUS02_1093 9d	9.53	375.57	9.86	434.92	10.0	473.01	10.2	510.07	10.3	533.08	10.5	562.04	10.6	586.05	10.7	600.06	11.3	607.06	11.4	607.06	11.6	614.07	12.2	616.07	11.0	605.08	11.7	608.08
OUS02_1095 1u	9.58	375.57	9.92	434.92	10.1	473.01	10.3	510.07	10.4	533.08	10.6	562.04	10.7	586.05	10.8	600.06	11.4	607.06	11.4	607.06	11.6	614.07	12.2	616.07	11.0	605.08	11.7	608.08
OUS02_110 95	9.61	373.09	9.95	431.78	10.1	468.06	10.3	504.07	10.4	525.08	10.6	552.04	10.7	574.05	10.8	587.06	11.4	596.06	11.4	596.06	11.6	601.07	12.3	603.08	11.1	591.09	11.7	595.09
OUS02_111 95	9.64	271.14	9.99	296.30	10.2	312.01	10.4	326.01	10.5	335.04	10.7	347.03	10.8	355.03	10.9	360.03	11.4	364.04	11.4	364.04	11.6	367.05	12.3	367.05	11.1	358.07	11.7	363.07
OUS02_114 05	9.66	192.09	10.0	195.01	10.2	198.05	10.4	203.01	10.5	203.01	10.7	205.02	10.8	208.03	10.9	209.03	11.4	213.04	11.4	213.04	11.6	213.04	12.3	217.05	11.1	210.09	11.8	215.09
OUS02_117 43	9.67	196.88	10.0	208.13	10.2	214.05	10.4	221.02	10.5	224.04	10.7	228.03	10.8	232.04	10.9	232.04	11.4	237.05	11.4	237.05	11.6	239.06	12.3	245.07	11.1	235.09	11.8	241.09
OUS02_118 93	9.67	198.22	10.0	206.01	10.2	214.05	10.4	221.02	10.5	225.04	10.7	230.03	10.8	234.04	10.9	234.04	11.4	239.05	11.4	239.05	11.6	242.06	12.3	249.07	11.1	237.09	11.8	244.09
OUS02_120 25	9.67	198.59	10.0	206.01	10.2	214.05	10.4	222.03	10.5	225.04	10.7	230.03	10.8	234.04	10.9	235.04	11.4	240.05	11.4	240.05	11.6	249.06	12.3	259.07	11.1	238.09	11.8	252.09
OUS02_121 99	9.67	198.93	10.0	206.01	10.2	214.05	10.4	222.03	10.5	225.04	10.7	230.03	10.8	234.04	10.9	235.04	11.4	240.05	11.4	240.05	11.6	249.06	12.3	259.07	11.1	238.09	11.8	251.09
OUS02_123 78	9.68	202.07	10.0	208.13	10.2	218.03	10.4	224.02	10.5	228.04	10.7	233.03	10.8	237.04	10.9	238.04	11.4	248.05	11.4	248.05	11.6	258.06	12.3	275.07	11.1	241.09	11.8	258.09
OUS02_125 35	9.68	204.99	10.0	212.07	10.2	222.04	10.4	231.03	10.5	236.04	10.7	243.03	10.8	249.04	10.9	254.04	11.4	285.05	11.4	285.05	11.6	297.06	12.3	321.07	11.1	287.09	11.8	300.09
OUS02_127 02	9.68	229.18	10.0	238.03	10.2	249.04	10.4	260.03	10.5	267.04	10.7	275.03	10.8	281.04	10.9	288.04	11.4	322.05	11.4	322.05	11.6	335.06	12.3	360.07	11.1	301.09	11.8	338.09
OUS02_128 83	9.69	247.29	10.0	240.05	10.2	250.04	10.4	260.03	10.5	267.04	10.7	275.03	10.8	282.04	10.9	287.04	11.4	322.05	11.4	322.05	11.6	335.06	12.3	359.07	11.2	302.09	11.8	338.09

Surface Water Drainage Principles #1: Collection for Re-use

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Surface Water Drainage Principles

#2: Infiltration

bre

DG 365
Revised 2016

Digest

Soakaway design

Stephen L Garvin

Digest 365 is one of the most widely used BRE publications, aiding designers to support planning and development applications. This edition of Digest 365 describes the design and construction procedures for soakaways, and explains how to calculate rainfall design values and soil infiltration rates. It also gives useful examples of how to design soakaways.

This revised edition includes important changes to recommendations and requirements which have been introduced since the last edition was published in 2007.

1 Introduction

Digest 365 on soakaway design was first published in 1991, replacing Digest 151. Digest 365 is widely used by designers to support planning and development applications.

This revised edition includes a number of important changes, including the following:

- recommendations by The Environment Agency on predicted climate change effects
- data on a return period of 100 years
- description of sustainable drainage systems (SUDS)
- flood management
- updated illustrations and new references
- glossary.

This revised edition retains the fundamental approach included in previous editions – the content has been updated rather than rewritten. However, the revision will ensure that Digest 365 remains fit for purpose.

This Digest describes design and construction procedures for soakaways, explains how to calculate rainfall design values and soil infiltration rates, and gives examples of designing soakaways. It provides data to facilitate designs for 10- to 100-year rainfall events (note that regulatory requirements may not be as onerous as 100-year events).

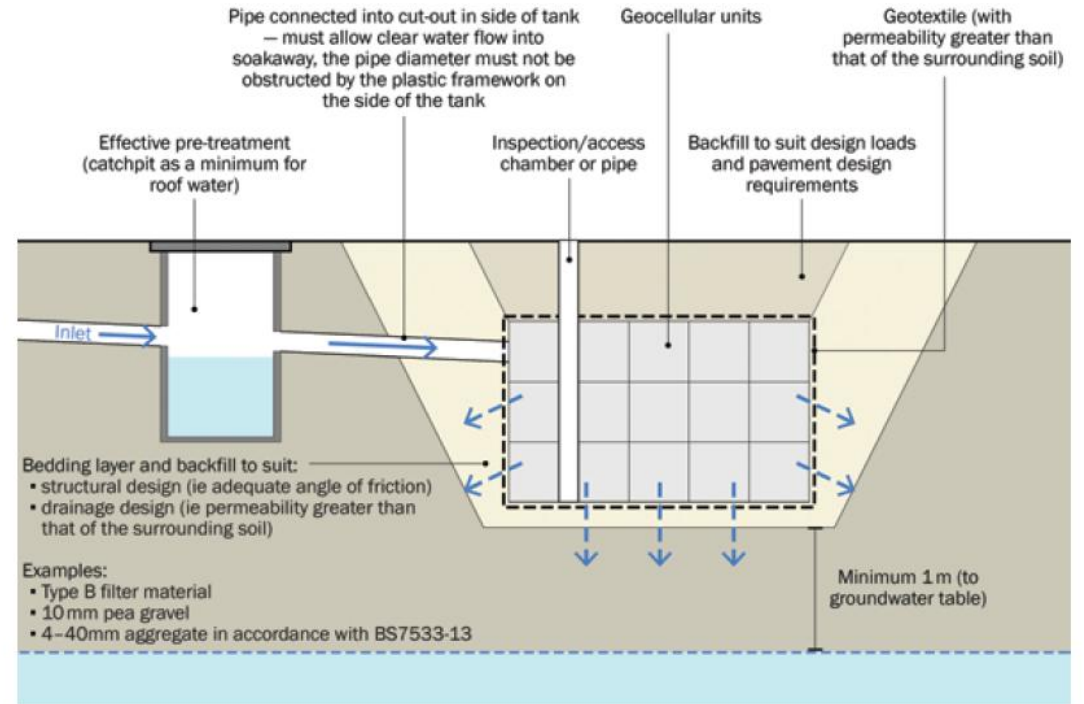
A traditional way of disposing of surface water from buildings and paved areas, soakaways are used remotely from a public sewer or watercourse. However, in recent years, soakaways have been used within urban, fully sewered areas to limit the impact on discharge of new upstream building works and to avoid the cost of upgrading sewers outside building developments. Increasingly soakaways are seen as a more widely applicable option alongside other means of surface water control and disposal in sustainable drainage.

Soakaways are used to store the immediate surface water run-off from hard surfaced areas, such as roofs or car parks, and allow for efficient infiltration into the adjacent soil. They discharge their stored water sufficiently quickly to provide the necessary capacity to receive run-off from a subsequent storm. The time taken for discharge depends upon the soakaway shape and size, and the surrounding soil's infiltration characteristics.

Soakaways can be square, circular (conventional), or trench excavations. They can be filled with rubble, lined with brickwork, plastic cells, perforated pre-cast concrete ring units or any similar structure that collects rainwater and run-off. The structures are built to allow rainwater to infiltrate directly into the ground. Soakaways can also be deep bored.

There are times when a soakaway may not be an appropriate solution, eg in areas of ground that have low permeability, where surface water could be contaminated. The maximum seasonal water table should be above the base of the soakaway; contaminants in the ground could be mobilised, or in areas of instability.

Although the guidance in this Digest can inform design and construction of soakaways, further specialist advice will be required.



Surface Water Drainage Principles

#3: Watercourse



Surface Water Drainage Principles

#4: Surface Water Sewer

#5: Combined Sewer



SuDS

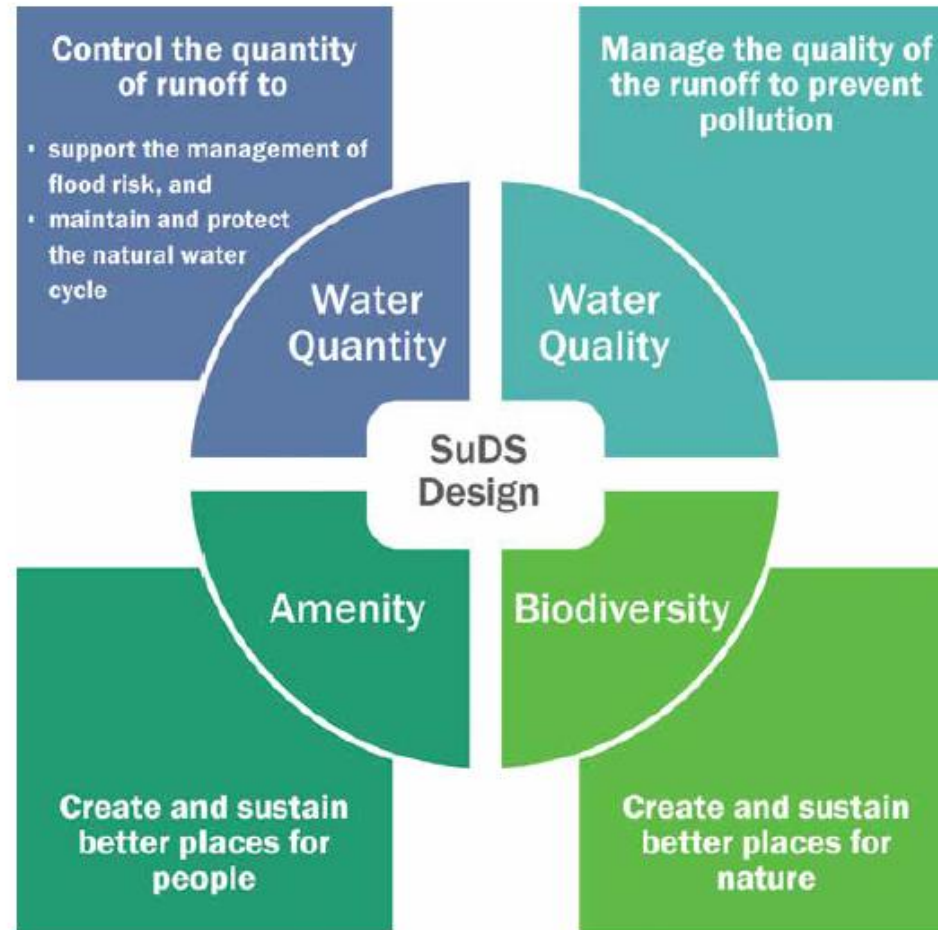
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The SuDS Manual

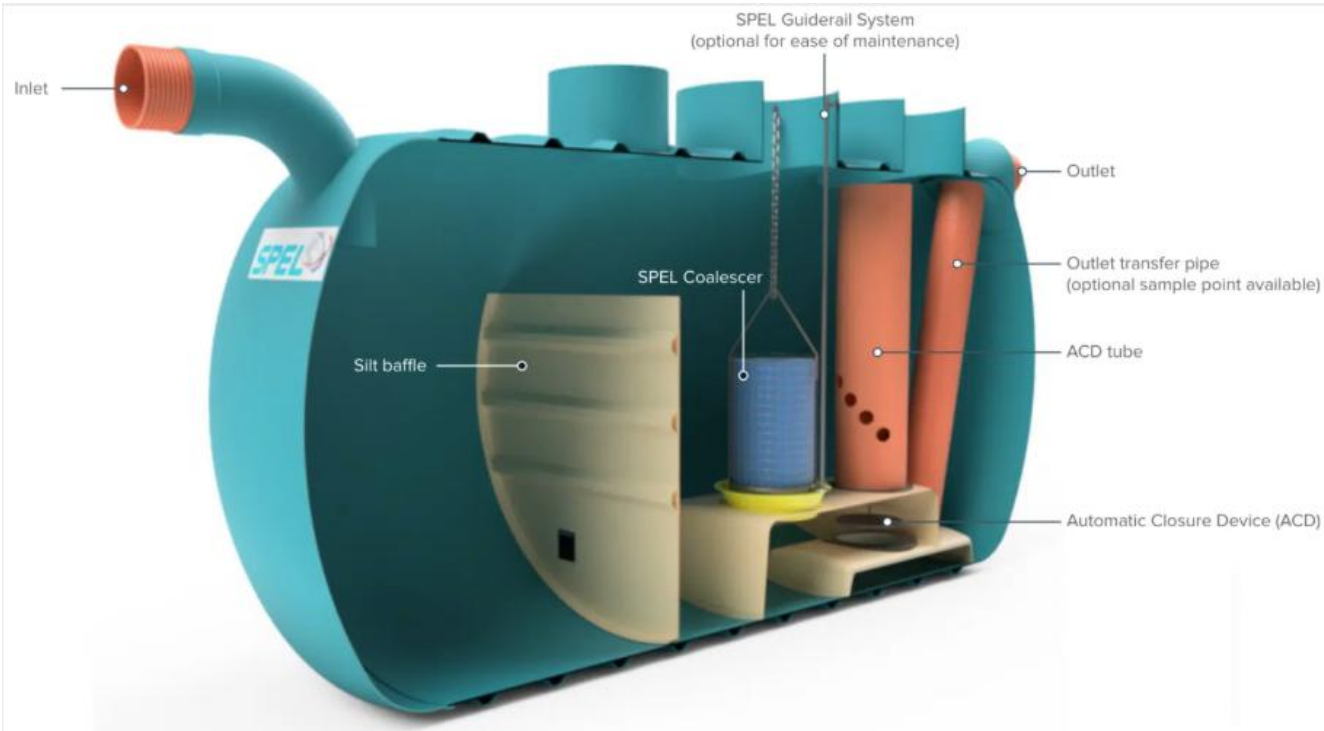


SuDS

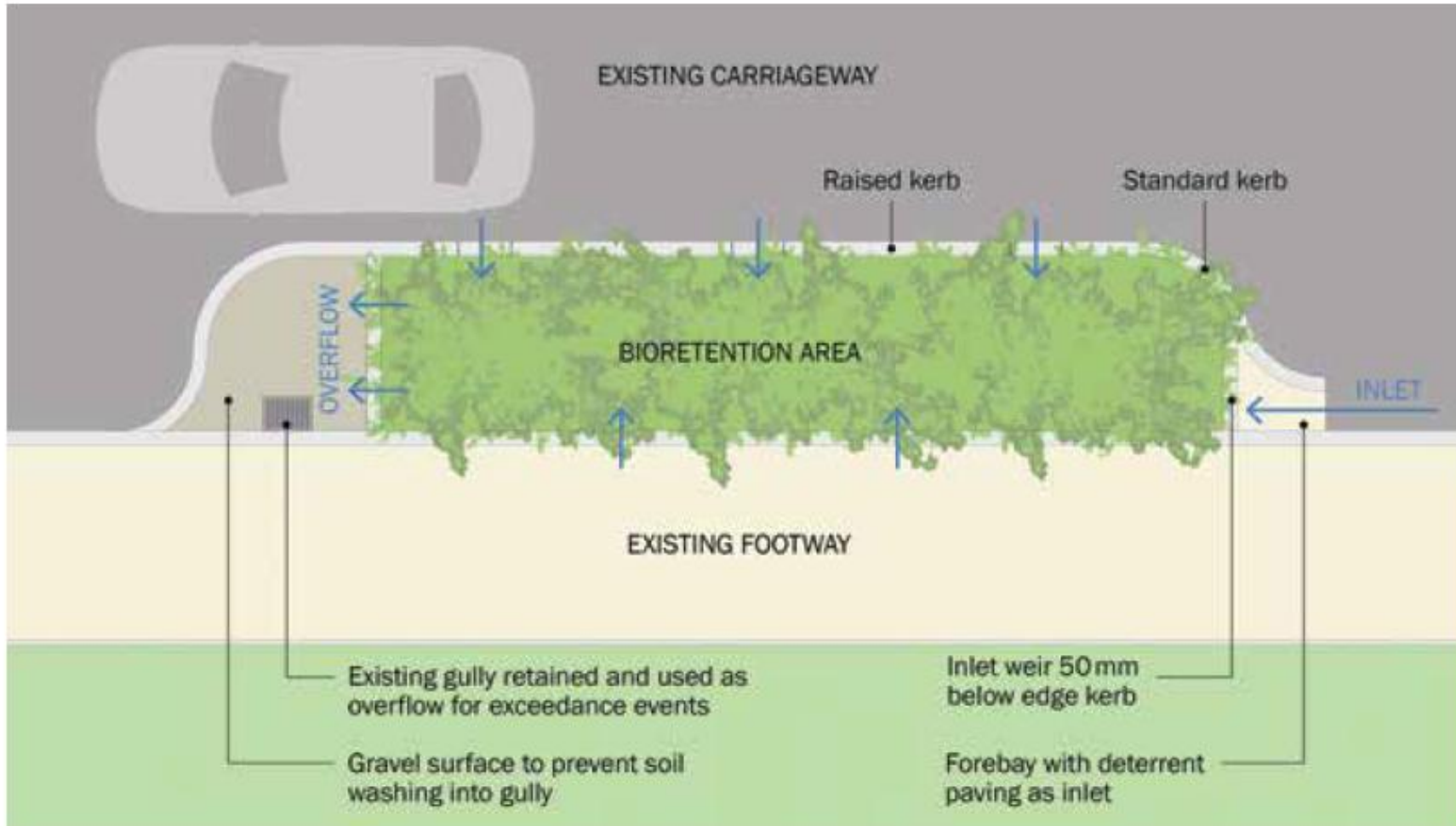
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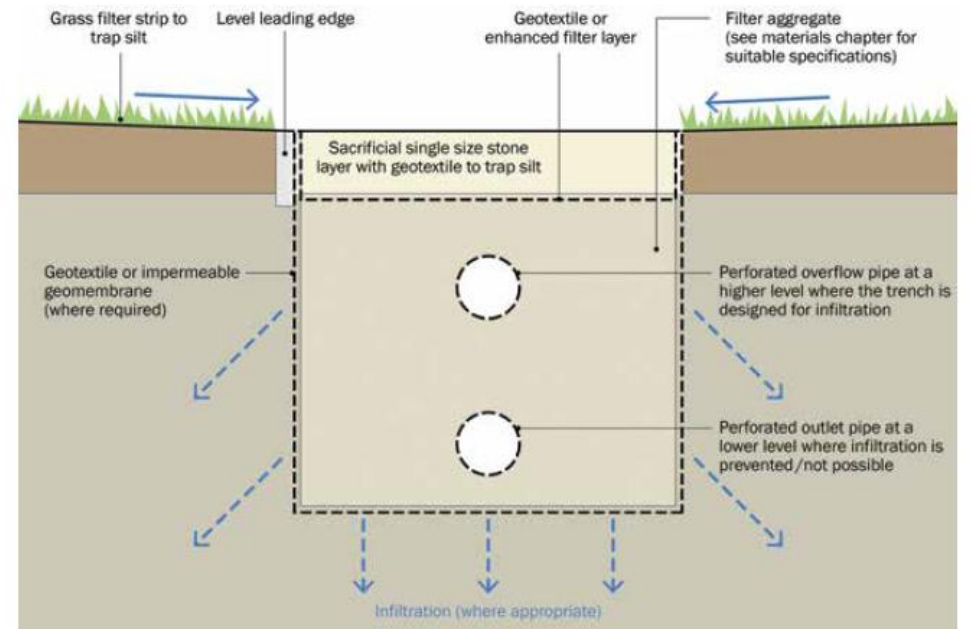
SuDS – Interceptors



SuDS Bio-Retention

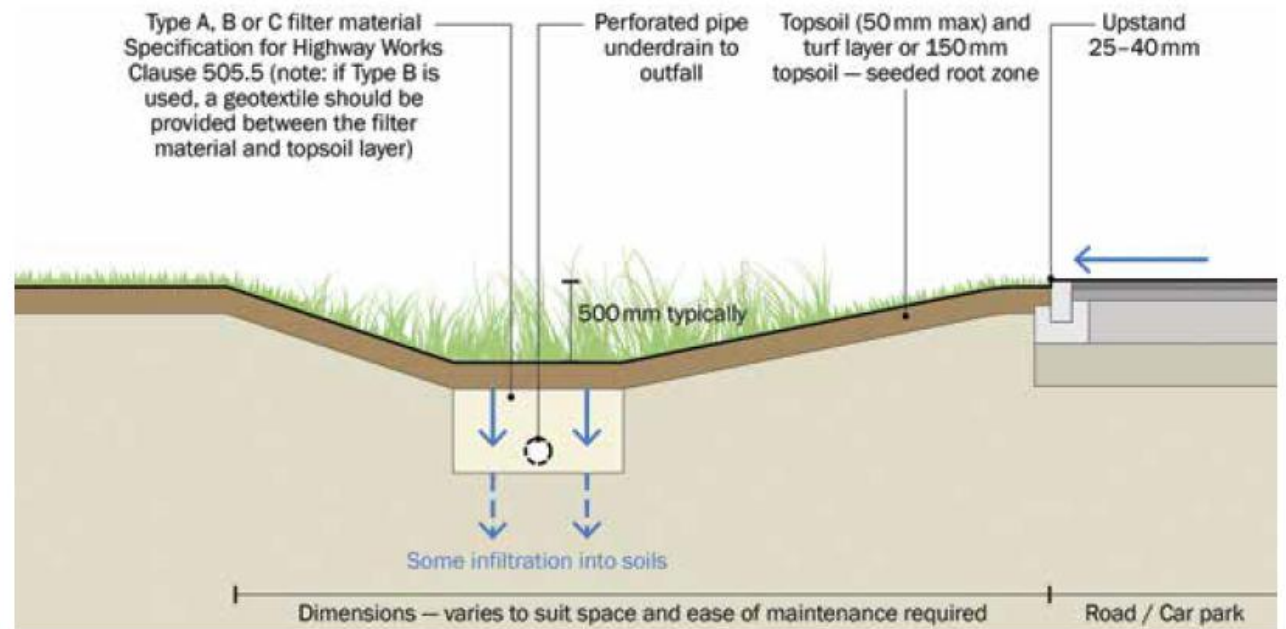


SuDS Filter Trenches



SuDS – Swales

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Deliver/



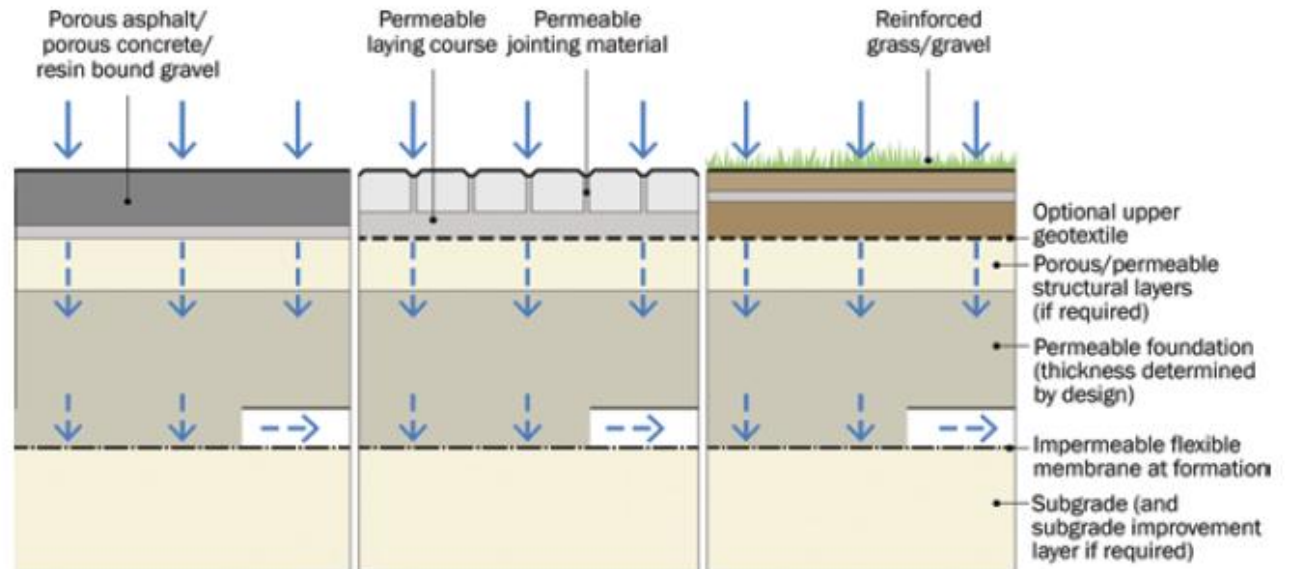
SuDS Permeable Paving



ROSMEAD STREET
ORIGINAL ROAD



ROSMEAD STREET
ARTIST IMPRESSION



SuDS – Rosmead Street

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Manage/
Deliver/



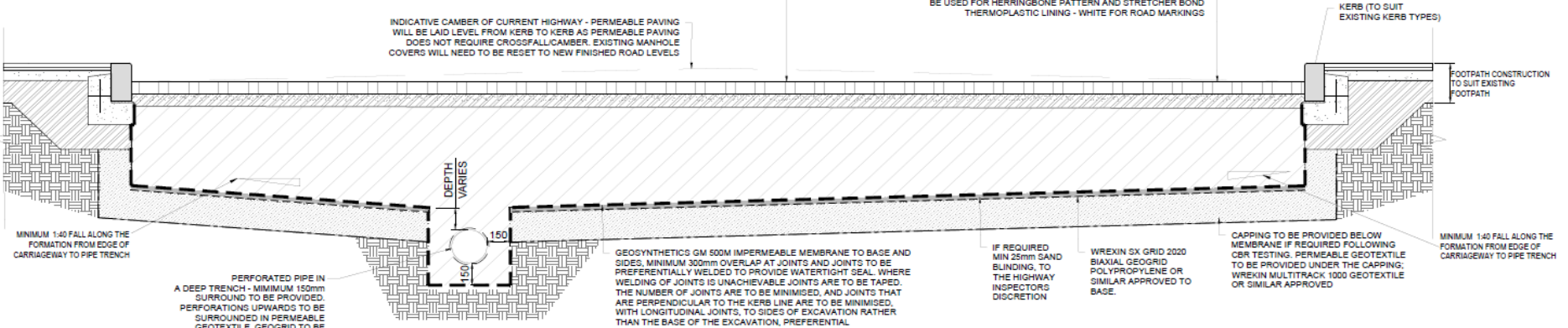
NOTE: CONSTRUCTION MATERIALS AND DEPTHS BASED ON TABLE 20.10 OF CIRIA SUDS MANUAL V2; USING A TRAFFIC LOAD CLASS CATEGORY 6 (BS 7533) - TYPICAL APPLICATION OF LOAD CLASS CATEGORY 6 INCLUDES ADOPTABLE HIGHWAYS. THIS INDICATES MINIMUM VALUES THAT CORRESPOND WITH THICKNESS FROM CALCULATIONS USING ICP1 (2011).

ROAD CONSTRUCTION -
SURFACING: 80mm THICK PERMEABLE BLOCKS
LAYING COURSE: 50mm DEPTH OF 2-5mm BEDDING AGGREGATE
PERMEABLE PAVING AGGREGATE TO BS EN 13242:2002
BASE COURSE: 90mm DEPTH AC32 (REFER TO CORING INSTALLATION NOTE)
SUB-BASE: TYPE 3 POROUS AGGREGATE (TO ACHIEVE MINIMUM 30% INTERNAL Voids). SEE CBR TABLE FOR DEPTH, MINIMUM DEPTH REQUIRED FOR ATTENUATION: 50mm
CAPPING: MIN 300mm OF CAPPING REQUIRED WHERE CBR IS <2%, SEE CBR TABLE FOR FURTHER INFORMATION

PERMEABLE BLOCKS TO BE LAID:
• 90° HERRINGBONE PATTERN
• 2 BLOCK WIDE STRETCHER ADJACENT TO KERBS
• SOLDIER PATTERN AT CHANGE OF ROAD SURFACE AT ENDS OF ROAD
• 2 BLOCK WIDE STRETCHER BOND LAID AROUND MANHOLE COVERS
BRETT OMEGA FLOW BLOCK PAVING, BRINDLE IN COLOR (ALTERNATIVE COLOUR CHOICE AUTUMN GOLD, BURNT OAK CHARCOAL OR NATURAL) TO BE USED FOR HERRINGBONE PATTERN AND STRETCHER BOND THERMOPLASTIC LINING - WHITE FOR ROAD MARKINGS

CORING INSTALLATION NOTE: AC REFERS TO ASPHALT CONCRETE (AC 32 DENSE 40/60 TO BS EN 13108-1). PRIOR TO THE INSTALLATION OF THE PAVING UNITS THE AC SHALL BE CLEANED TO REMOVE MUD AND DETRITUS, CORED OR PERFORATED WITH 75MM DIAMETER HOLES ON A 750MM ORTHOGONAL GRID. THE HOLES ARE TO BE FILLED WITH TYPE 3 OR THE LAYING COURSE AGGREGATE

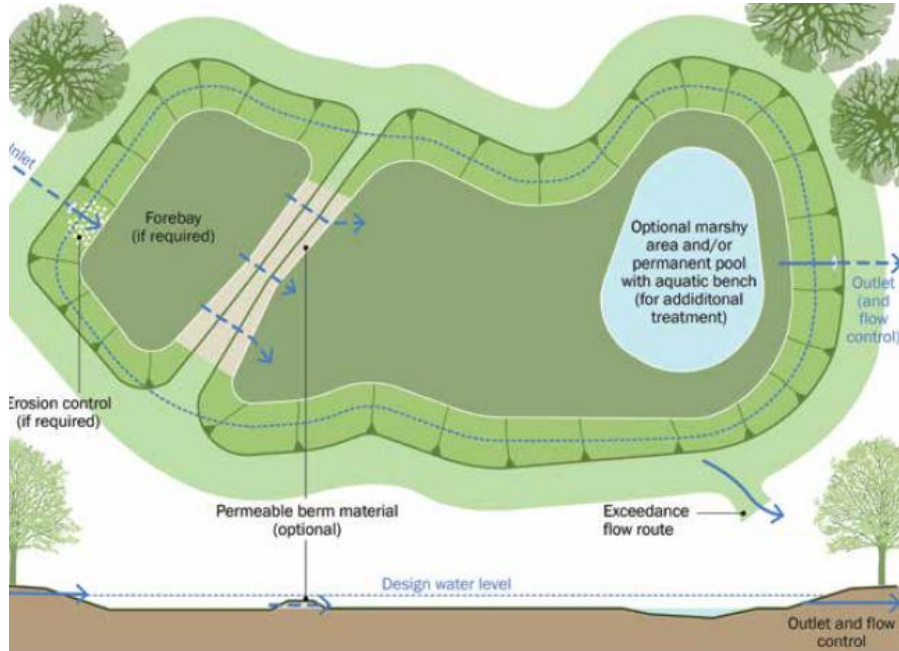
INDICATIVE CAMBER OF CURRENT HIGHWAY - PERMEABLE PAVING WILL BE LAID LEVEL FROM KERB TO KERB AS PERMEABLE PAVING DOES NOT REQUIRE CROSSFALL CAMBER. EXISTING MANHOLE COVERS WILL NEED TO BE RESET TO NEW FINISHED ROAD LEVELS



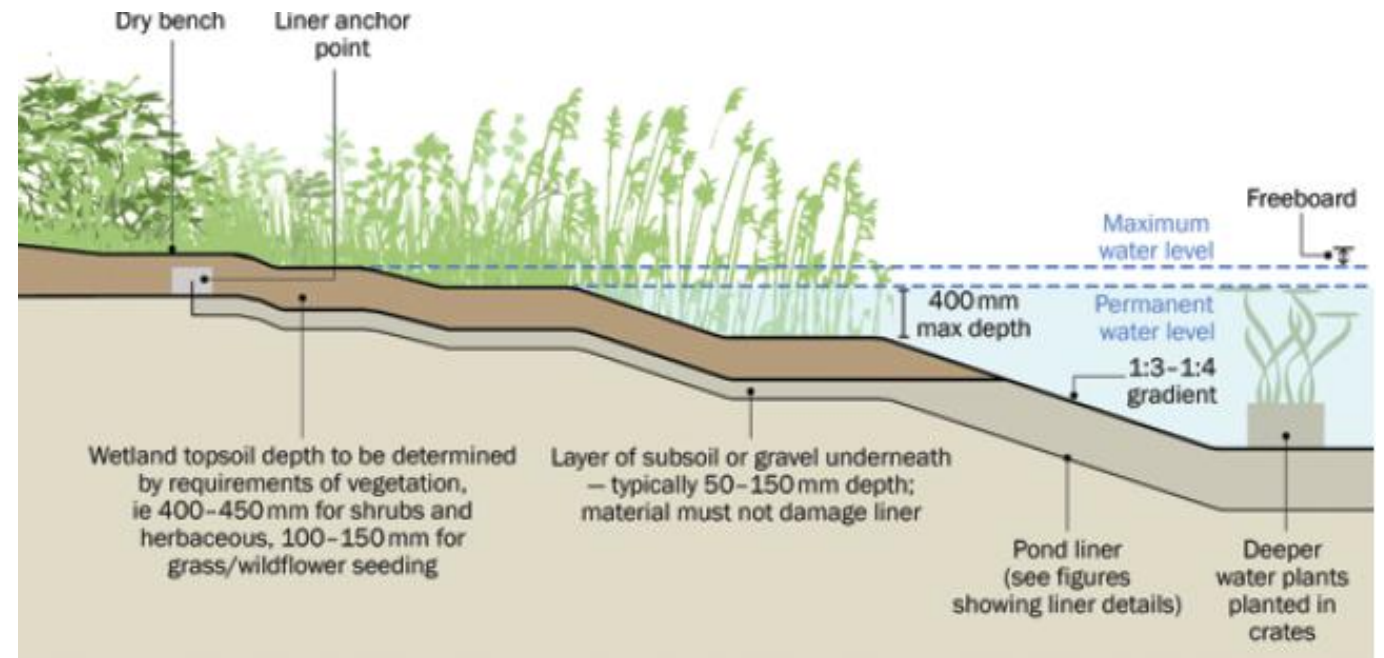
SECTION THROUGH PERMEABLE PAVED ROAD BUILD-UP (INDICATIVE)
SCALE 1:20

SuDS – Basin

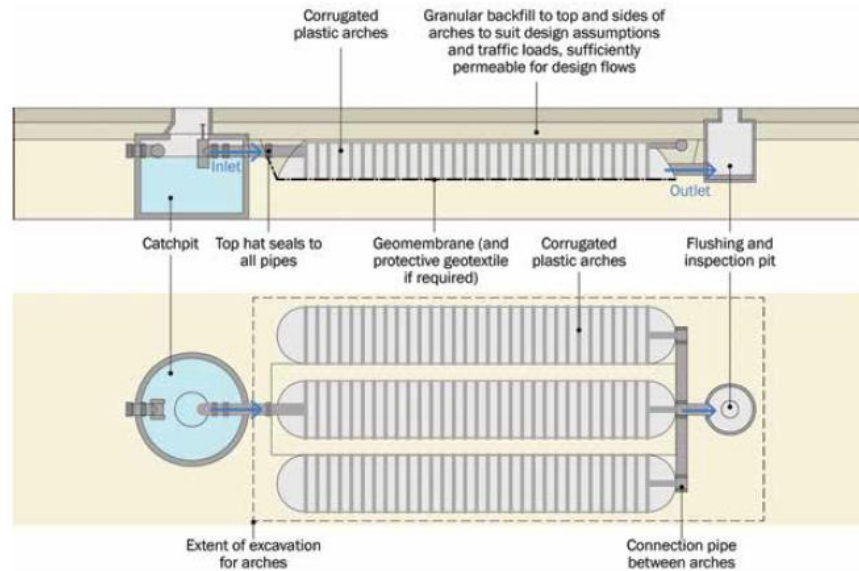
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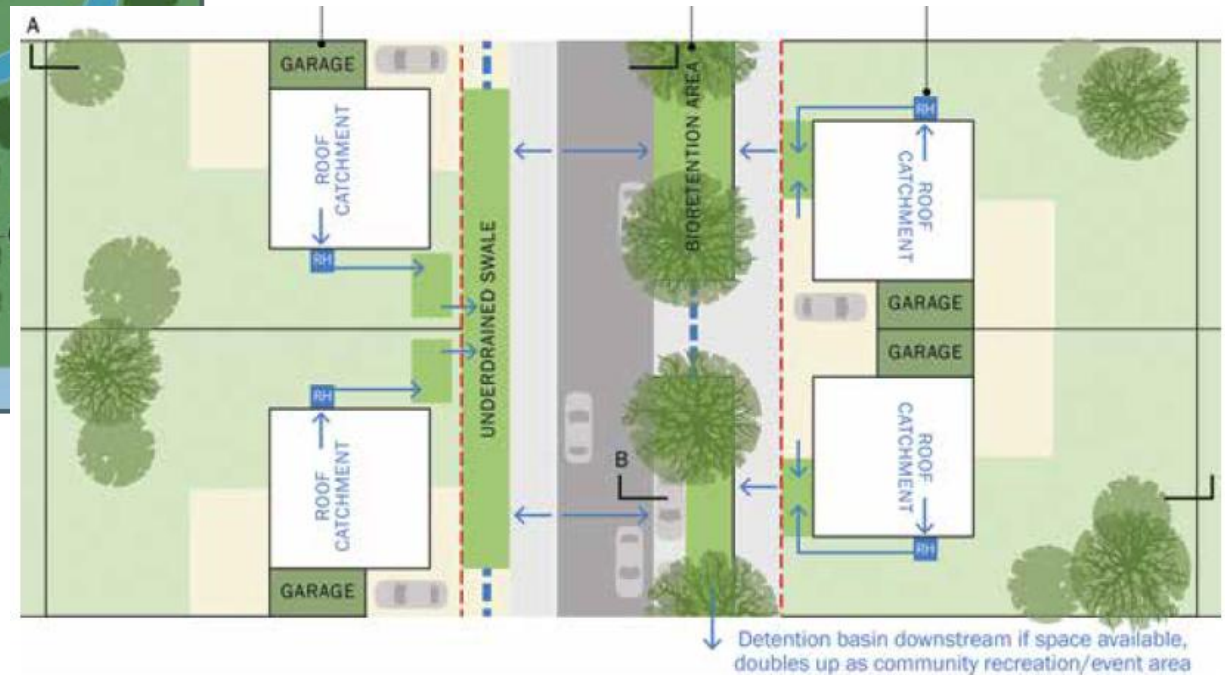
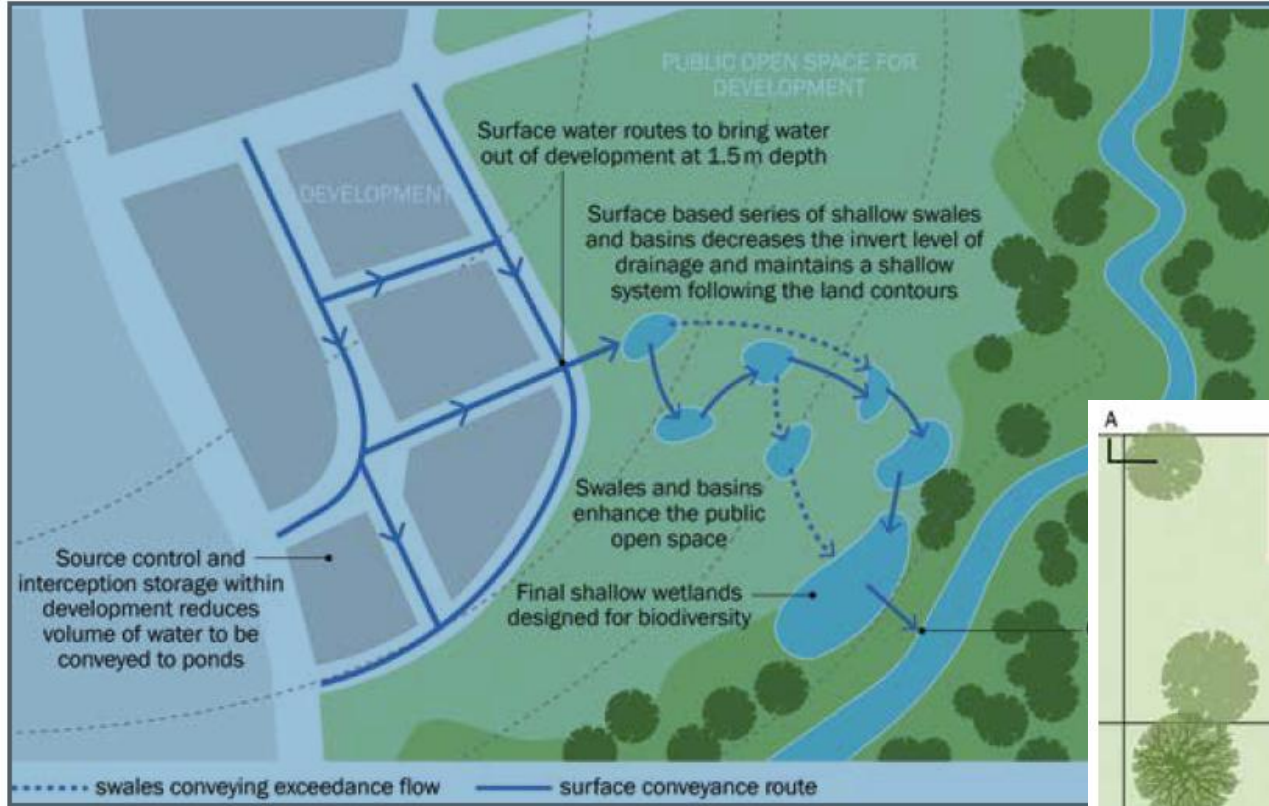
SuDS – Ponds




SuDS – Buried Storage



SuDS – Layout



Drainage Design

Alan Wood & Partners		Page 1
Omega 2	Proposed Development	
Monks Cross Drive	Sessay, Thirsk	
York YO32 9GZ	Hydraulic Calculations	
Date 30/05/2022	Designed by LC	
File Drawnet 3.0.MDX	Checked by CD	
Micro Drainage	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales			
Return Period (years)	1	PIMP (%)	100
MS-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	1.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	3.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.350
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	0.10
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT (mm)	DIA (mm)	Section Type	Auto Design
S1.000	12.743	0.025	500.0	0.035	1.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S1.001	11.522	0.023	500.0	0.023	0.00	0.0	0.600	o	225	Pipe/Conduit	🟢
S1.002	17.574	0.035	500.0	0.012	0.00	0.0	0.600	o	225	Pipe/Conduit	🟢
S1.003	9.438	0.019	500.0	0.022	0.00	0.0	0.600	o	225	Pipe/Conduit	🟢
S1.004	11.812	0.024	500.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	🟢
S1.005	5.351	0.011	500.0	0.007	0.00	0.0	0.600	o	225	Pipe/Conduit	🟢
S1.006	5.367	0.070	76.7	0.008	0.00	0.0	0.600	o	225	Pipe/Conduit	🟢
S2.000	12.480	0.132	94.5	0.016	1.00	0.0	0.600	o	150	Pipe/Conduit	🔴

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	1.48	28.000	0.035	0.0	0.0	0.0	0.44	7.8	4.7
S1.001	50.00	1.81	27.900	0.058	0.0	0.0	0.0	0.58	23.0	7.9
S1.002	50.00	2.32	27.876	0.070	0.0	0.0	0.0	0.58	23.0	9.5
S1.003	50.00	2.59	27.841	0.092	0.0	0.0	0.0	0.58	23.0	12.5
S1.004	50.00	2.93	27.822	0.097	0.0	0.0	0.0	0.58	23.0	13.1
S1.005	50.00	3.09	27.799	0.104	0.0	0.0	0.0	0.58	23.0	14.1
S1.006	50.00	3.15	27.788	0.112	0.0	0.0	0.0	1.49	59.4	15.2

SIMPLE INDEX APPROACH: TOOL



HW shall not be liable for any direct or indirect damage claims, loss, cost, expense or liability howsoever arising out of the use or impossibility to use the tool, even when HW has been informed of the possibility of the same. The user hereby indemnifies HW from and against any damage claims, loss, expense or liability resulting from any action taken against HW that is related in any way to the use of the tool or any reliance made in respect of the output of such use by any person whatsoever. HW does not guarantee that the tool's functions meet the requirements of any person, nor that the tool is free from errors.

- The steps set out in the tool should be applied for each inflow or "runoff area" (ie each impermeable surface area separately discharging to a SuDS component).
 - The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.
 - Relevant design examples are included in the SuDS Manual Appendix C.
 - Each of the steps below are part of the process set out in the flowchart on Sheet 3.
 - Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.
- DROP DOWN LIST RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP
USER ENTRY USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL.

STEP 1A: Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

This step requires the user to select the appropriate land use type for the area from which the runoff is occurring

If the land use varies across the "runoff area", either:

- use the land use type with the highest Pollution Hazard Index
- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment.

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop-down list.

Runoff Area Land Use Description	Pollution Hazard Index	Total Suspended Solids	Pollution Hazard Index	Means	Hydrocarbons	DESIGN CONDITIONS
Standard commercial and/or delivery sites	Medium	0.7	0.6	0.7		1 2
Landuse Pollution Hazard Index	Medium	0.7	0.6	0.7		

This description is not appropriate for housing yards, farm yards, waste management sites, or other land incorporating zones.

STEP 2A: Determine the Pollution Mitigation Index for the proposed SuDS components

This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component

If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B

The step should be applied to evaluate the water quality protection provided by proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (ie: in England and Wales it will include compliance that allow any amount of infiltration, however small, and hence infiltration is not specifically accounted for in the design).

If you have been made responsible for the components that are not required:

If the proposed component is bespoke and/or a proprietary treatment product and not generically described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the row below the drop-down list.

SuDS Component Description	Pollution Mitigation Index	Total Suspended Solids	Means	Hydrocarbons	DESIGN CONDITIONS
Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop-down list.					1 2 3

SuDS components can only be assumed to filter.

Design and Construction Guidance for foul and
surface water sewers offered for adoption
under the Code for adoption agreements for
water and sewerage companies operating
wholly or mainly in England ("the Code")

Approved Version 2.3
11 November 2023

Adoption

Engineer/
Manage/
Deliver/

- S104 Water Industry Act
- Codes for Adoption
 - Yorkshire Water
 - New Assets and Variations (NAV)
- S38 Highways Act

New Appointments and Variations (NAVs)

What is a NAV?

New appointments and variations (NAVs) are limited companies which provide a water and/or sewerage service to customers in an area which was previously provided by the incumbent monopoly provider.

A **new appointment** is made when a limited company is appointed by Ofwat to provide water and/or sewerage services for a specific geographic area. A new appointee has the same duties and responsibilities as the previous statutory water company.

A **variation** is where an existing appointed company (an "appointee") asks Ofwat to vary its appointment so it can extend the areas it provides services to.

A NAV, therefore, involves **one company replacing another as the appointee** for a specific geographic area.

More information can be found about [getting a new appointment or variation](#).

Opportunities and Constraints

Opportunities

- Reduced flood risk
- Quality
- Quantity
- Bio-diversity
- Amenity
- Conveyance and storage

Constraints

- Space
- Management and maintenance
- Long term cost
- Long term risk

A Last Thought – Foul Water Drainage

- Similar design surface water and SuDS
- S104 Water Industry Act Adoption
- Codes for Adoption
 - Yorkshire Water, Anglian Water
 - New Assets and Variations (NAV)
- Pre-Planning Enquiry (old and new)
- Wastewater Treatment Works & Capacity
 - AMP8
 - Overflows
 - Capacity
 - Refusal



Questions and Discussion

- eng@alanwood.co.uk
- james.gibson@alanwood.co.uk
- 07808 940756