Sandown Pathfinder
Technical Report

September 2022

from Southern Water

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Document History

Revision	Purpose	Originated	Reviewed	Authorised	Date
V1.0	Draft Issue for comment	PMG/EF	AP/LM	NM	12/8/2022
V2.0	Updated after comments	EF	PMG	NM	26/9/2022

Executive summary

The wastewater recycling facility at Sandown Wastewater Treatment works (WwTW) was built in the late 1990's as a result of the Seaclean Wight strategy to centralise wastewater treatment for the major conurbations on the Island. The driver for this was the revised bathing water directive and the Urban Wastewater Treatment Directive which required enhanced wastewater treatment.

The Sandown WwTW catchment covers the largest geographical area in the Southern Water region and a large number of storm overflows are attributed to the Sandown WwTW catchment As a whole this catchment has the highest number of storm overflow releases in our baseline year of 2020. For ease of description the catchment is split into eight physically separate urban areas which all pump to the WwtW: Fishbourne; Yarmouth & Freshwater; Bembridge; Newport, Cowes; Sandown & Shanklin; Ryde and Ventnor.

As a whole, this catchment has the highest number of Storm overflow releases in our baseline year of 2020. Therefore, it has been targeted as a pathfinder catchment to trial a number of innovative solutions to reduce that number.

Sometimes rainwater falling on impermeable surfaces such as roofs and roads can be contaminated by surface contaminants; it can also get into the sewer system and be contaminated by foul sewage. This contaminated water needs to be pumped & treated and if the volume overwhelms the downstream assets, then sometimes diluted sewage has to be released into rivers and the sea via a storm overflow. Storm overflows, previously known as combined sewer overflows (CSOs) are a relief valve for the drainage system to prevent the devastating impact of sewer flooding. These storm overflows are licensed by the Environment Agency and need to meet set criteria before discharges occur.

Managing surface water is a complex, shared problem as it means making sure that water drains effectively from homes and gardens, roads, fields, businesses and public spaces.

Southern Water has set up a Task Force with a number of aims, the key one being to significantly reduce the use of storm overflows by 2030. To investigate how this can be achieved, a number of pathfinder projects have been set up and the Sandown catchment is one of those. These pathfinders have a staged approach as follows:

Stage 0 – study and surveys
Stage 1 – no regret interventions and trials
Stage 2 – More complex interventions and large scale pilots
Stage 3 – Larger scale investments to deliver the outcome

The interventions identified are likely to be a mix of types of innovative and traditional solution such as:

- Upstream source control (removing and slowing the flow of rainwater)
- System optimisation (making better use of the existing infrastructure)
- Infrastructure enhancements (build new or larger infrastructure)

The delivery mechanism for these interventions is also likely to be innovative, with Southern Water working in partnership with the Isle of Wight Council, Island Roads, Parish councils and community groups to provide solutions that provide multiple benefits.

We have initially identified some areas that we would like to investigate for sustainable urban drainage systems but in addition, further survey work and modelling will be required to confirm if these potential interventions will provide the benefit required. We will continue to identify and, where appropriate, enact these interventions whilst we collate the results of the rest of the surveys.

This report is only the start of the journey towards a sustainable drainage system in the Sandown catchment. We will work as partners to investigate and better understand the existing drainage systems, to identify and deliver opportunities for improvement, and plan together for sustainable growth on the Isle of Wight.

What we ask of our partners and the community is to continue to support that journey, with photos and data, ideas and enthusiasm. So that together we can agree how decisions can be made, now and in the future for our mutual benefit.

1.0 Introduction and document purpose

This report is an output of a Stage 0 study for the Sandown Wastewater Treatment works catchment. The Sandown catchment was specifically chosen as a pathfinder catchment as it is the catchment with the largest number of storm overflow releases in 2020.

This report summarises the initial investigations, analysis and characterisation of the main drivers for the releases, the characterisation of the catchments around the storm overflows, the identification of potential interventions and the next steps required.

2.0 The Problem

2.1 The Groundwater infiltration and surface water Management

Managing surface water is about making sure that water drains safely from homes and gardens, roads, fields, businesses and public spaces. Good surface water management is about making sure that rain can drain effectively to the environment, using a combination of natural and manmade drainage networks.

Sometimes rainwater falling on impermeable surfaces such as roofs and roads can be polluted; it can also get into the sewer system and be contaminated by foul sewage. This water then needs to be pumped & treated and if the volume overwhelms the downstream assets, then sometimes the heavily diluted sewage has to be released into rivers and the sea via permitted storm overflows, see Section 4 for more details. Storm overflows, previously known as combined sewer overflows (CSOs) are a relief valve for the drainage system to prevent the devastating impact of sewer flooding. These storm overflows are licensed by the Environment Agency and need to meet set criteria before discharges occur. However, we recognise and support the need to reduce the use of storm overflows and are keen to work with other stakeholders and organisations to achieve the required improvements.

Another source of excess flow into the sewer system is from ground water. If there is a high ground water level within an area then flow can infiltrate into the sewer pipes, again getting contaminated with foul sewage and impacting downstream assets.

Water companies have a critical part to play in improving surface water management and ground water infiltration.

2.2 Sandown Drainage System

The wastewater recycling facility at Sandown Wastewater Treatment works was built in the late 1990’s as a result of the Seaclean Wight strategy to centralise wastewater treatment for the major conurbations on the Island. The driver for this was the revised bathing water directive and the Urban Wastewater Treatment Directive which required enhanced wastewater treatment and a reduction in releases to the environment. The number of overflow points were reduced in the Seaclean wight scheme and 7 sites were closed. Therefore flow from the major conurbations is transferred to Sandown WwTW via 9 transfer pumping stations (Norton; Shalfleet; Woodvale; Springhill Cowes; Fairlee; Appley Park Ryde; Lane End Road, Bembridge; Quay Lane Brading & Lions Point Ventnor.).

Because of this centralisation work, the Sandown catchment covers the largest geographical area in the Southern Water region. There are a large number of Storm overflows are attributed to the Sandown WwTW catchment and as a whole this catchment has the highest number of Storm overflow releases in our baseline year of 2020. Therefore, it has been targeted as a pathfinder catchment to trial a number of innovative solutions to reduce the number of storm overflow releases.

This report covers the details of the general Sandown Catchment, and the pathfinder aims. Within the appendices there are more details about the individual sub-catchments:

- Bembridge – Appendix F
- Cowes – Appendix G
- Fishbourne – Appendix H
- Newport – Appendix I
- Ryde – Appendix J
- Sandown – Appendix K
- Ventnor – Appendix L
- Yarmouth – Appendix M

3.0 Particulars about Sandown Drainage

3.1 Governance

The Sandown catchment is in the Isle of Wight, located in the English Channel in South England. It is about 2 miles away from the Hampshire coast. There are daily ferries from Portsmouth, Southsea, Southampton and Lymington to some of the Island towns – Ryde, Cowes, East Cowes, Fishbourne and Yarmouth. The Isle of Wight Council (IoW) is responsible for more strategic services such as education, libraries, main roads, social services, trading standards and transport. Island Roads hold the Private finance initiative (PFI) contract with the Isle of Wight Council to maintain highway assets for 25 years. The Town and Parish councils are responsible for improving facilities and services for local people.

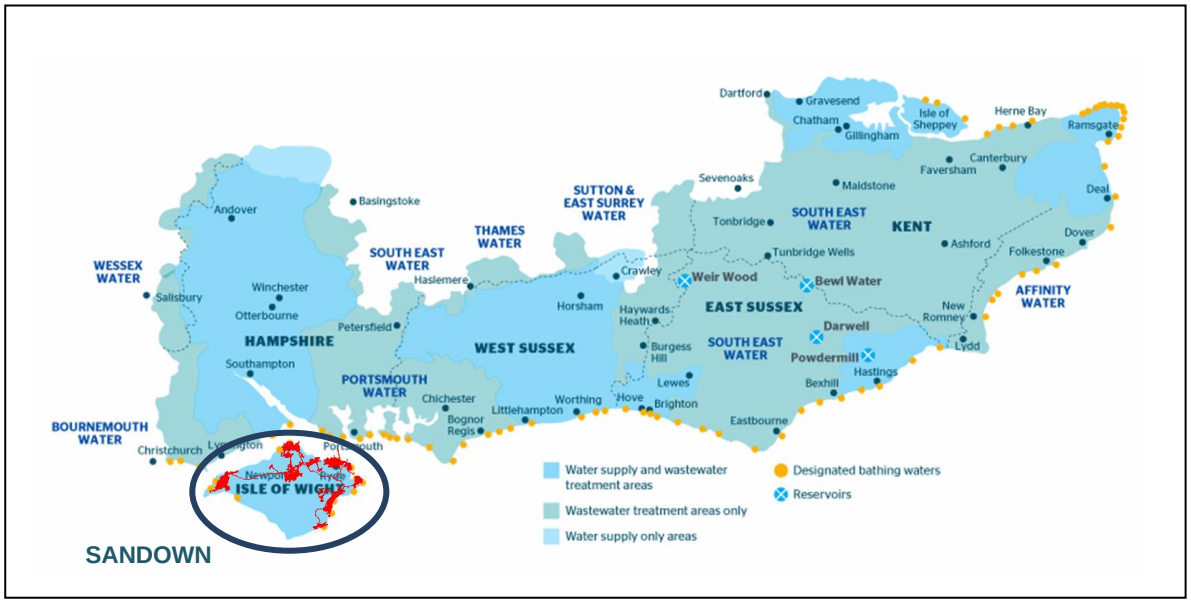

Figure 1 – Location of Sandown Drainage catchment within Southern Water region[1]

3.2 Topography

The topography of the catchment is mildly undulating with the highest point of the catchment in the south area with a height of approximately 242m AOD, falling towards the coast around Ventnor (Figure 2).

[1] Sandown AMP6 Drainage Area Plan (DAP), 2019

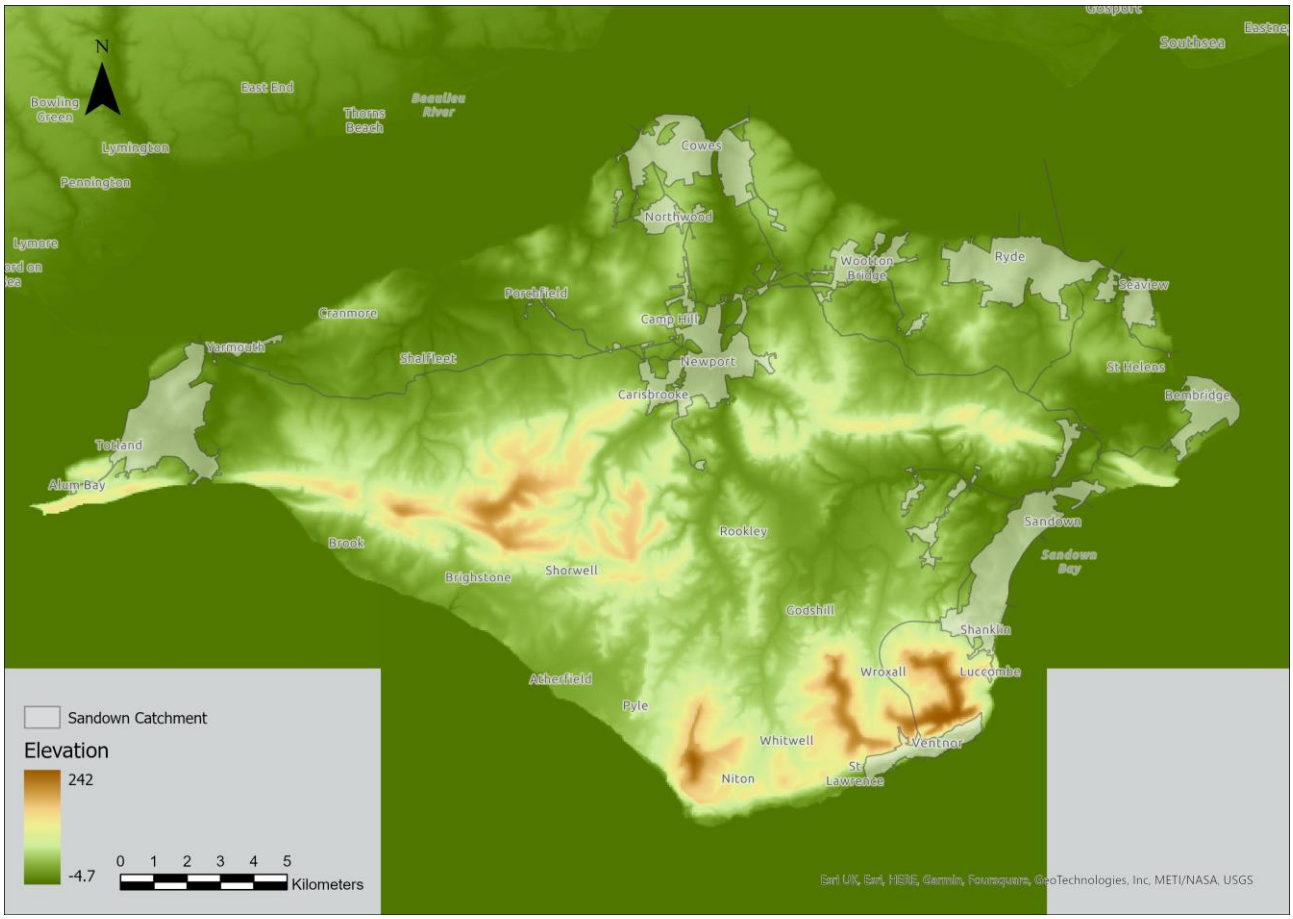

Figure 2 – Sandown Topography[2]

3.3 Geology

The Isle of Wight can be divided into a northern half and a southern half, separated by a narrow band of high ground (mainly chalk) aligned east west along the central axis of the island as seen below image (Figure 3).

The geology of each of the three parts, (Northern, Southern, Central) is very different, therefore also potential for surface water soakage to ground via SUDS schemes varies. The three parts are considered separately, as follows

Northern Part.
Sandown WwTW Sub catchments: Fishbourne, Yarmouth, Cowes, Ryde, Newport, Bembridge.
This area of the Isle of Wight, i.e. north of the chalk ridge, up to the Solent and north coast of the island, is underlain by a solid geology collectively called the Solent Group. This comprises mainly of clays and silts, fine grained deposits and therefore of low permeability. Drift and weathering deposits derived from these are also fine grained. There are some sands, but these are a minority and occur only sporadically.

[2] Southern Water Asset Miner OS copyright

Southern Part

Sandown WwTW Urban Areas: Sandown, Ventnor.

This area, the southern half of the island, is underlain by a geology of the Greensand Beds underlain by the Wealden Beds. They comprise fine and medium grained poorly cemented sandstones, with occasional coarser bands. At outcrops they would be expected to be weathered to loose and medium density sands. Permeability would be expected to be at least intermediate and, in some places, quite high, and soakage rates are therefore expected to be reasonable, so anticipated useable for soakaway drainage/SUDS.

Central

Sandown WwTW Urban Areas: N/A

This is a much smaller area than the other two, it is the high ground aligned centrally east - west along the island and comprises mainly Chalk. Chalk has a high permeability so would be suitable in principle for SUDS drainage, although it is a principal aquifer so consultation with the Environment Agency will be required. There is more detail about the geology of each sub-catchment in the appendices.

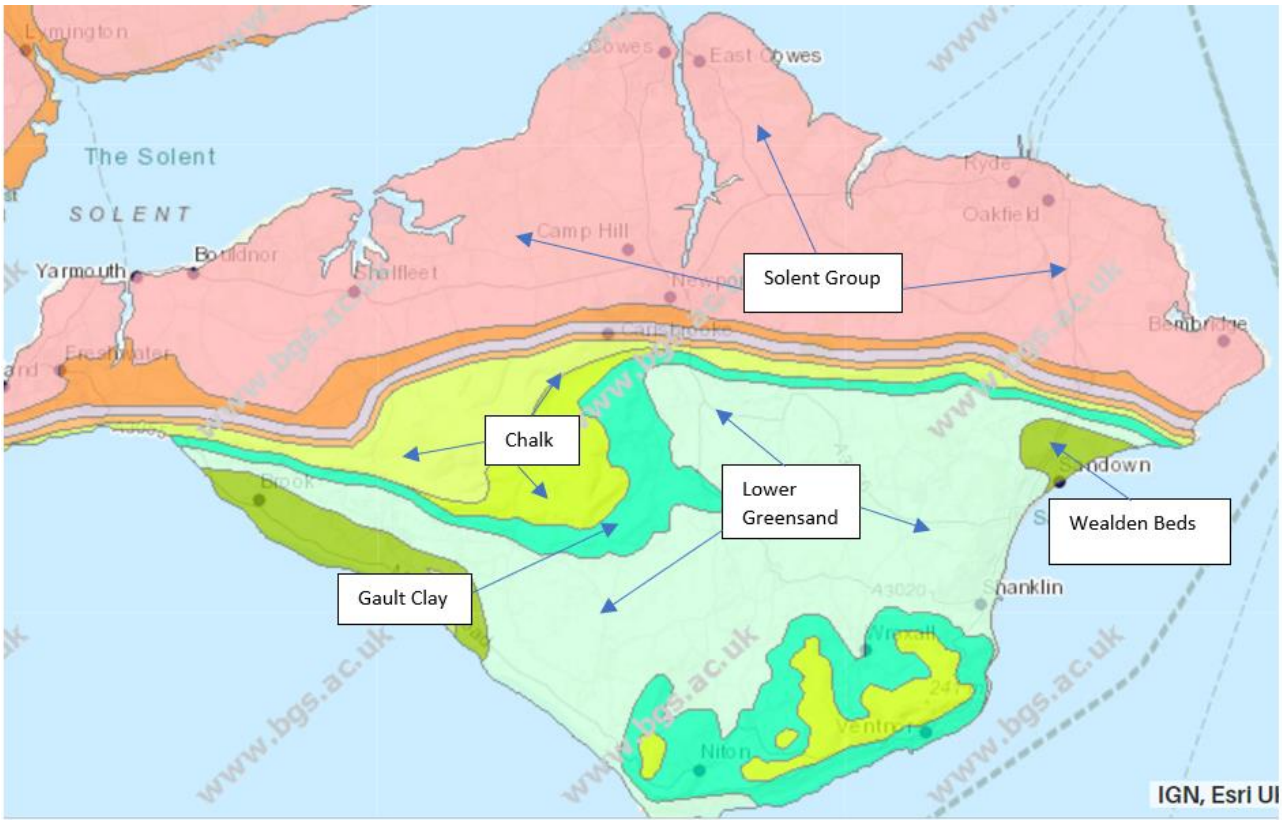

Figure 3 – Summary of geology in IoW

3.4 Wastewater Treatment and drainage on the Isle of Wight

There are 20 WwTWs on the Isle of Wight. The largest of them is at Sandown WwTW (Table 1).

Table 1: WwTW on the Isle of Wight[3].

WwTW	Population equivalent
Sandown New	124,937
Wroxall	2,549
Roud	1,631
Godshill	1,604
Brighstone	1,256
St Helens	1,114
Chale	527
Shalfleet	523
Chillerton	311
Willow Wood St Lawrence	116
Hazeley Coombe Arreton	100
North View Thorley	95
Highwood Lane Rookley	59
Newlands Merstone	40
Blackwater	23
Arreton Street Arreton Top	16
Newtown Iow	16
Knighton	9

3.4.1 Sandown WwTW & catchment

Sandown New Wastewater Treatment Works (WwtW) is the largest of 20 treatment facilities on the Isle of Wight and it serves 92% of the population, with 8% being treated at the rural works. The catchment of the works is split into eight physically separate urban areas which all pump to the WwtW: Fishbourne; Yarmouth & Freshwater; Bembridge; Newport, Cowes; Sandown & Shanklin; Ryde and Ventnor (Figure 4). Within the appendices there are more details about the individual urban areas.

At the WwtW, a 600 mm and a 1950 mm diameter sewer pipe bring the wastewater to the inlet works. Then the wastewater is pumped through 5 inlet pumps to the treatment process at a rate of 900 litres per second.

[3] Southern Water Drainage and Wastewater Management Plans, Isle of Wight River Basin Catchment, 2020

There are 6 storm tanks with a combined capacity of 4,500 m^3. If incoming flows exceed the capacity of the storm tanks, then excess flow is released to the English Channel via long and short sea outfalls.

Figure 4 – Location of Sandown drainage catchment and surrounding towns[4]

3.4.2 The urban areas of the Sandown WwTW Drainage system

Drainage systems can be made up of single pipe systems (combined) and two pipe systems (foul and surface water).
Appendix B – How does Urban Drainage Work? provides some background information on how drainage systems have developed and in particular the contribution that legacy housing (houses where the roof drainage and sewage combine) makes to surface water management.

Table 2 shows how the different urban areas in Sandown are split into combined and separate sewer systems.

Table 2: Sewer System Type[5]

Urban areas	Area drained by Combined (ha)	Area drained by Foul/Storm (ha)	Combined (%)	Foul/Storm (%)
Bembridge	55.41	231.77	19	81
Cowes	265.38	450.04	37	63
Fishbourne	51.68	122.18	30	70
Newport	209.03	511.19	29	71
Ryde	303.67	1268.22	19	81
Sandown	436.12	214.18	67	33

[4] Sandown AMP6 Drainage Area Plan (DAP), 2019
[5] Southern Water Asset Miner System

Ventnor	91.11	33.48	73	27
Yarmouth	109.92	341.08	24	76
Total	1522.32	3172.14	32	68

3.4.3 The Network Model

We have a network model of the existing foul & combined sewer system of Sandown, which we use to run different rainfall scenarios to understand the impacts on the system. As more information about the catchment is gathered and the catchment changes then this model must be updated, calibrated and verified. Figure 5 below shows the current extent of the model. More detailed figures are provided for foul/combined sewer system for each urban area in the appendices.

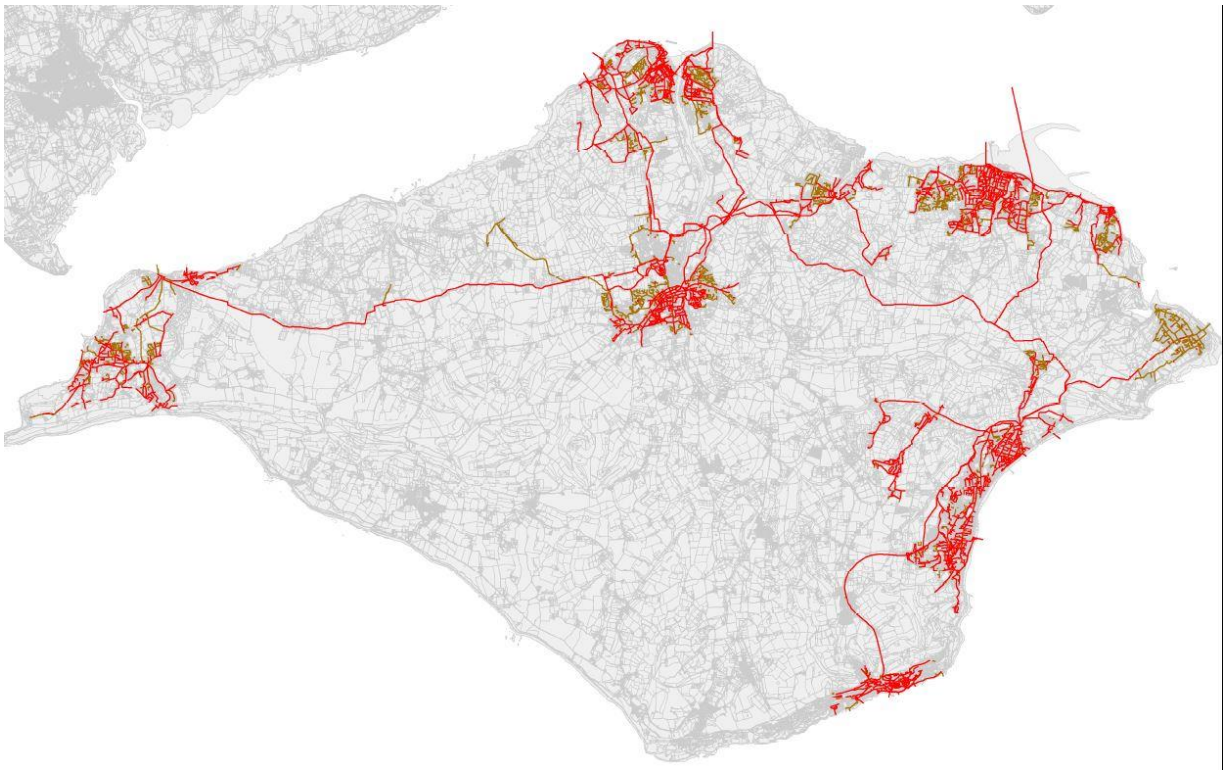

Figure 5 – Foul/combined sewer system in the Sandown Catchment[6]

In addition, there is a rollout plan to install over 650 sewer level monitors (SLMs) in the Sandown Catchment. This will also give us more 'real-time' data of water levels in the sewers to support our analysis and modelling work, see section 6 & 7.

3.5 Transfer Pumping Stations

When a number of WwTW were closed as part of the Seaclean Wight project they were replaced with large transfer pumping stations which transfer the wastewater across the island to Sandown WwTW. A schematic of these transfer pumping stations across the island is shown in the figure 6 below.).

[6] Southern Water Asset Miner System

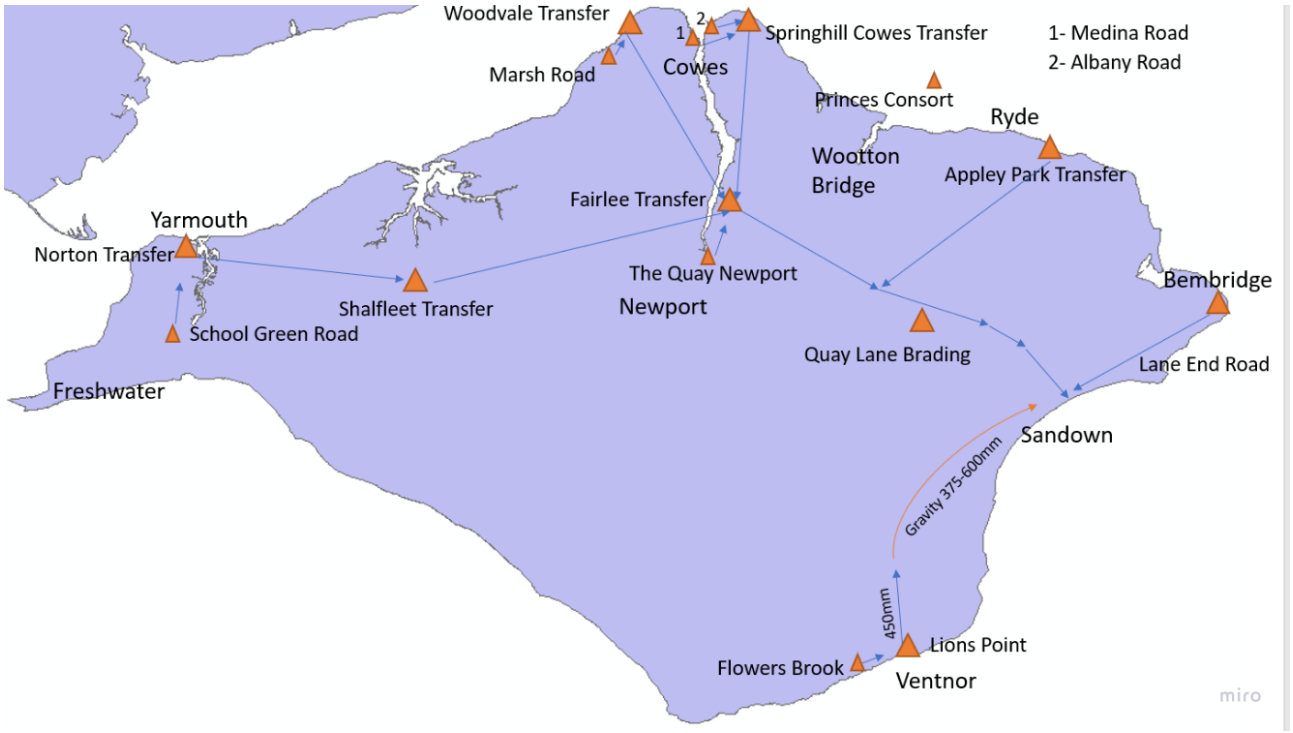

Figure 6 – Transfer Pumping station schematic to Sandown WwTW [7]

3.6 Catchment Pumping Stations

Within the Sandown catchment there are 152 pumping stations. A split of WPS across the catchments is given in Table 3 and shown in Figure 7.

Table 3: Wastewater Pumping Stations in the Catchments[8]

Urban Area	Number of WPS
Fishbourne	13
Yarmouth	18
Bembridge	6
Cowes	32
Newport	21
Sandown	28
Ryde	26
Ventnor	8
Total	**152**

[7] Sandown AMP6 Drainage Area Plan (DAP), 2019
[8] Sandown AMP6 Drainage Area Plan (DAP), 2019

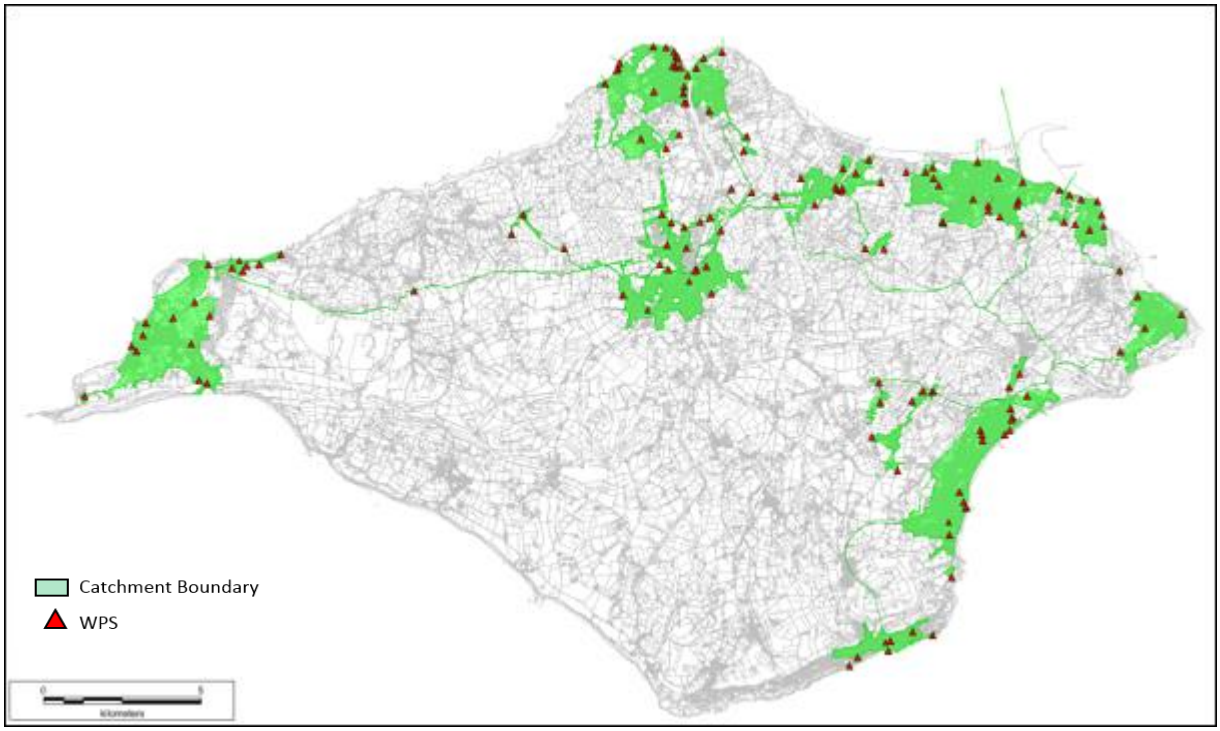

Figure 7 – Location of Pumping Stations within the Sandown Catchment[9]

In Appendix E – Pumping Station Schematics, there are schematics for 3 of the urban areas showing the relationship between main WPS and CSO's. We are developing schematics for all of the urban areas.

3.7 Sandown Storm Overflows

Storm overflows are a pressure relief valve for the system to prevent the devastating impact of sewer flooding, see Section 4.0 for more information. There are 108 storm & emergency overflows within the Sandown catchment (Table 4). An emergency release is typically on a pumping station or WwTW and is only used if the site has suffered a power or mechanical failure (see Section 6.1).

Table 4: List of Storm and Emergency Overflows within the Sandown WwTW Catchment

Urban Areas	Number of CSOs
Fishbourne	8
Yarmouth	19
Bembridge	3
Cowes	23
Newport	15
Sandown	16
Ryde	20
Ventnor	4
Total	**108**

[9] Sandown AMP6 Drainage Area Plan (DAP), 2019

3.8 The Surface Water System

Figure 8 below, shows the current public surface water sewers in the Southern Water Geographical Information System (GIS). More detailed figures are provided in the appendices for the surface water system for each urban area. As you can see from figure below and the appendices there is not a significant amount of public surface water sewers on the Island.

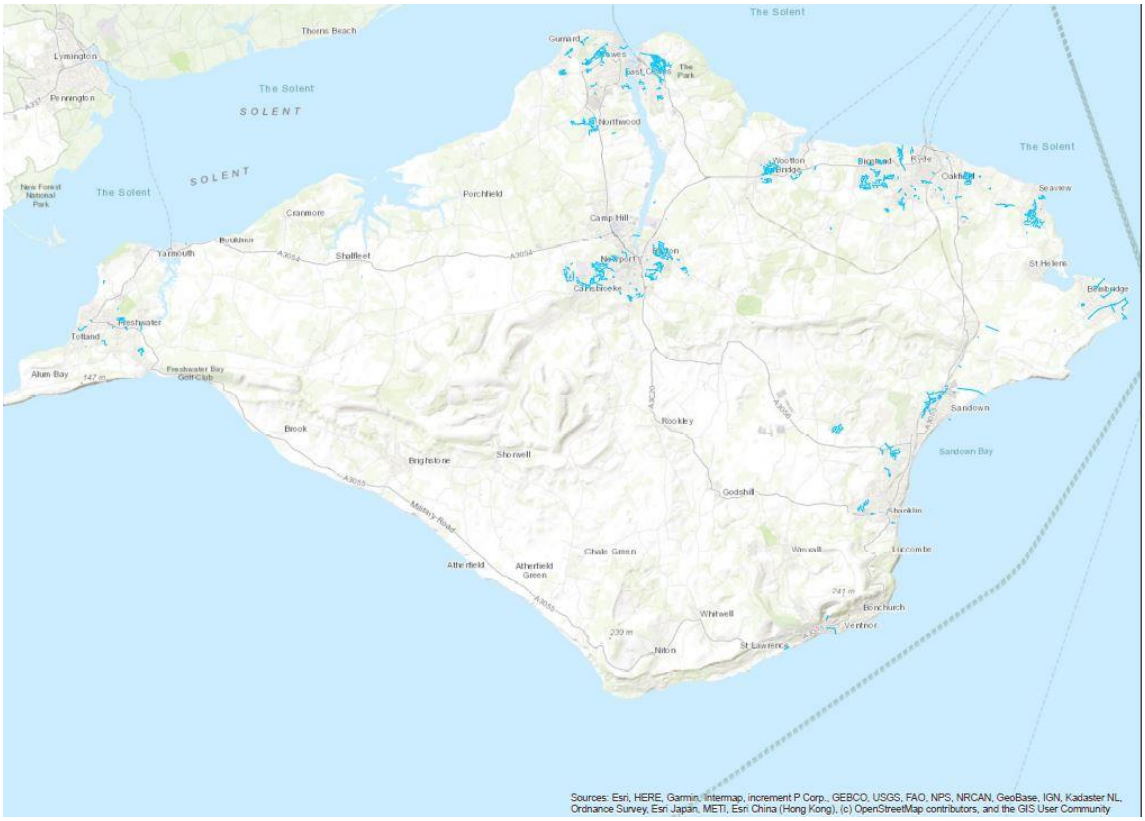

Figure 8 – Current Mapping of Surface Water System in Sandown Catchment[10]

3.9 The Highway Drainage System

Highway drainage generally consists of road gullies connected to the surface water and combined sewer system. For Sandown, the highway drainage is owned by the Isle of Wight council but maintained by Island Roads. Island Roads have provided us with the mapping information for the road gullies across the Sandown catchment. We will be working with the IoW Council and Island Roads to understand if/how these gullies connect to the combined or surface water sewers.

We will use this information to work with IoW Council to identify future opportunities to disconnect highway drainage from the combined system. See section 8.0 for further details.

More detailed figures are provided for highway gullies for each urban area in the Sandown catchment (See the Appendices).

[10] Southern Water Asset Miner System

3.10 River and Coastal Flooding

There are many main rivers (as characterised by the EA) in the Sandown catchment. The River Medina, Eastern Yar, Newton River, Wootton Creek and Western Yar are the longest river streams in the catchment. Figure 9 shows the Main Rivers within the catchment

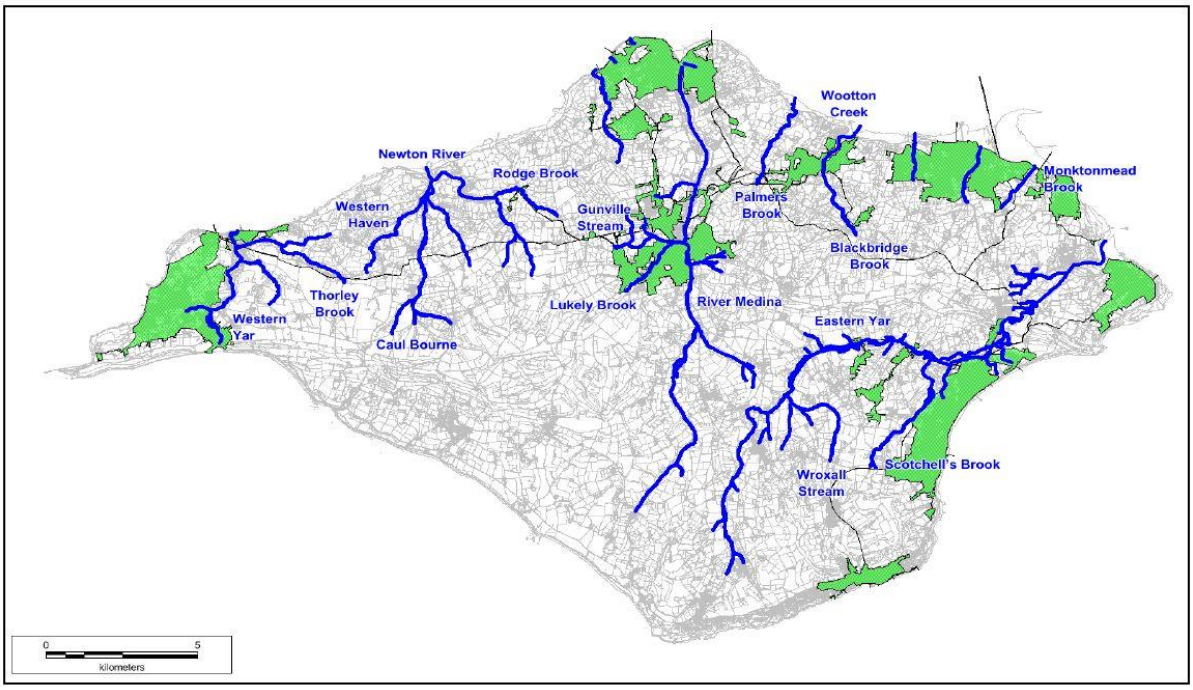

Figure 9 – Main rivers within Sandown Catchment[11]

In the various urban areas there are localised high risks of river and coastal flooding according to Environment Agency's maps. Detailed maps are shown in the appendices.

3.11 Surface Water Flooding

Flooding from surface water is typically associated with natural overland flow paths and local depressions in topography. Here surface water runoff can accumulate during or following heavy rainfall events. The Environment Agency's map of the surface water flooding in the urban areas is shown in the Appendices. There are localised high risks of surface water flooding in almost all the urban areas of Sandown WwTW.

[11] Sandown AMP6 Drainage Area Plan (DAP), 2019

3.12 Simplified Sandown Drainage System

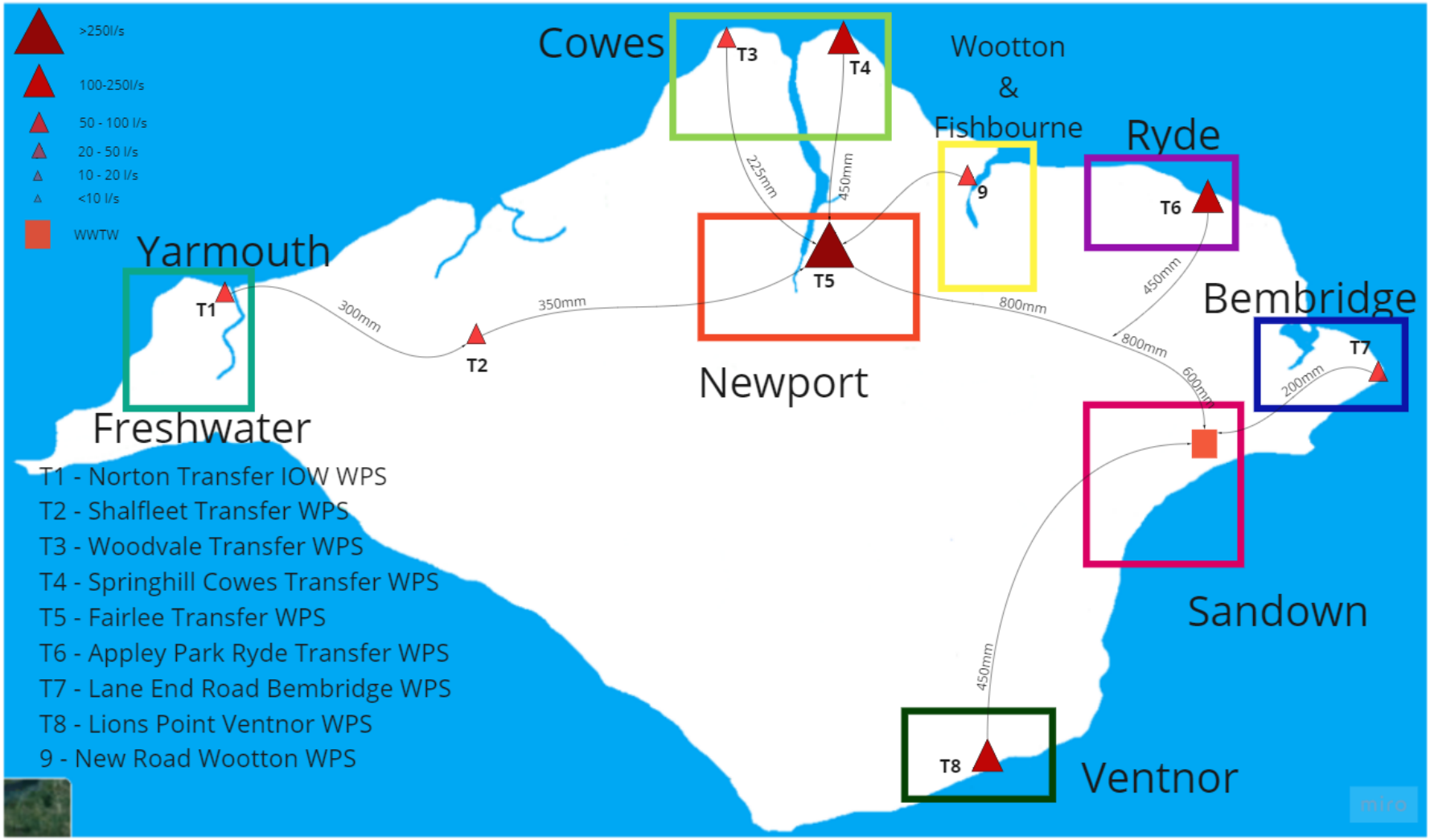

Figure 10 – Simplified diagram of the Sandown Drainage System

4.0 Why Change is Required and What are We Doing

4.1 Why Change is Required

The next few paragraphs describe some of the reasons why we need to make a change now. It is to everyone's benefit if rainwater can be channelled safely back into the environment at a local catchment level rather than being pumped, treated and discharged to rivers or the sea.

Flooding

Unmanaged surface water especially after extreme events can cause uncontrolled flooding which is unacceptable. Section 3.0 begins to describe the various drainage pathways for surface water and how they are interconnected. To solve this problem, we need a different approach to surface water management.

Urban creep

"The country's-built environment is constantly changing and "urban creep" – home extensions, conservatories and paving over front gardens for parking – can all add to the amount of water going into our sewers and drains. Green spaces that would absorb rainwater is covered over by concrete and tarmac that will not. In fact, studies show that "urban creep" results in a larger increase in predicted flooding than new housing, because it adds more rainwater to these systems"[12].

Climate change

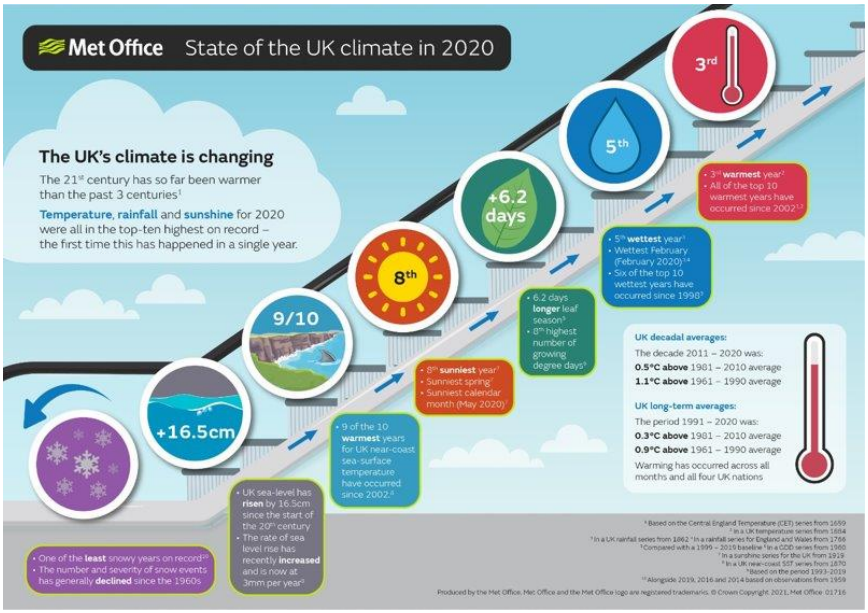

Figure 11 – Climate Change Drivers[13]

[12] 21st Century Drainage Programme – the Context, Water UK
[13] Met office, 2020

"More people, bigger towns and cities and the effects of climate change will mean a greater demand for water when it is hot and dry, and fewer green spaces to absorb rainwater when it is wet and more unpredictable weather"[14]. As global temperatures rise, the number of extreme rainfall days is expected to increase. With increased numbers of intense short duration storms which may exceed the capacity of the surface water and combined systems and risk a higher frequency of flooding.

Figure 12 shows the Met Office classification of rainfall intensity in mm/hr, which has been matched, for these purposes, to an appropriate type of storm to aid understanding.

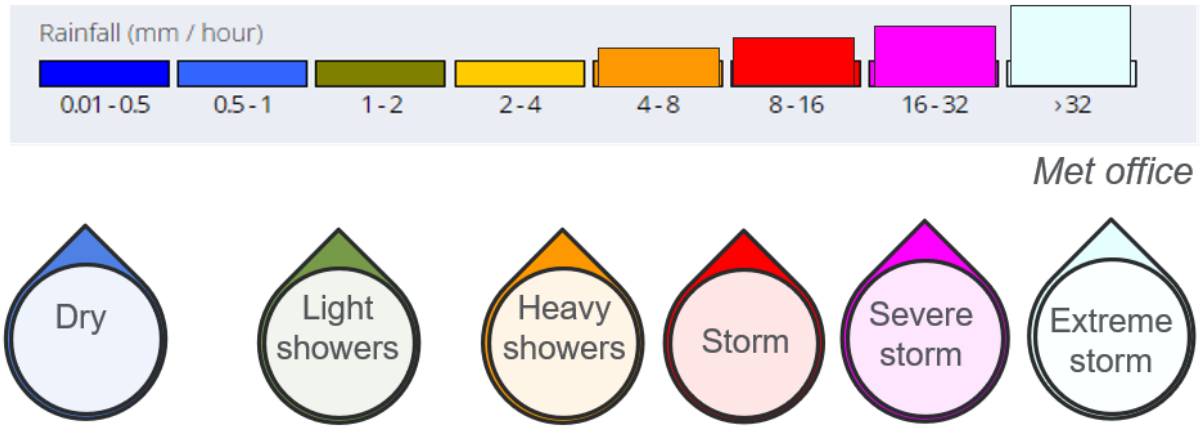

Figure 12 – Rainfall Intensity/Storm Size Diagram

As the South East is already water-stressed it may be particularly susceptible to the impacts of climate change. Water resources are already scarce, and rising temperatures will reduce them further, leading to more frequent droughts[15].

Greenhouse gases and energy use

Water industry operations require large amounts of energy for treating drinking water, processing wastewater, and pumping large volumes around an extensive network. Wastewater treatment processes use about half of the total operational energy across the water sector. Greenhouse gas emissions from the operational side of the water industry are around 0.7% of UK emissions (Ofwat, 2010). In 2011-12 companies reported that they emitted the equivalent of about 4 million tonnes of carbon dioxide. It is therefore very important that the impact on carbon emissions is carefully considered, and holistic catchment solutions are likely to drive the most sustainable solutions.

[14] 21st Century Drainage Programme – the Context, Water UK
[15] Southern Water Climate Change Adaptation 2021

Storm overflows to rivers and the sea

Storm overflows, previously known as CSOs are a pressure relief valve for the system to prevent the devastating impact of sewer flooding. However, we cannot just block them up as this could cause flooding (Figure 13).

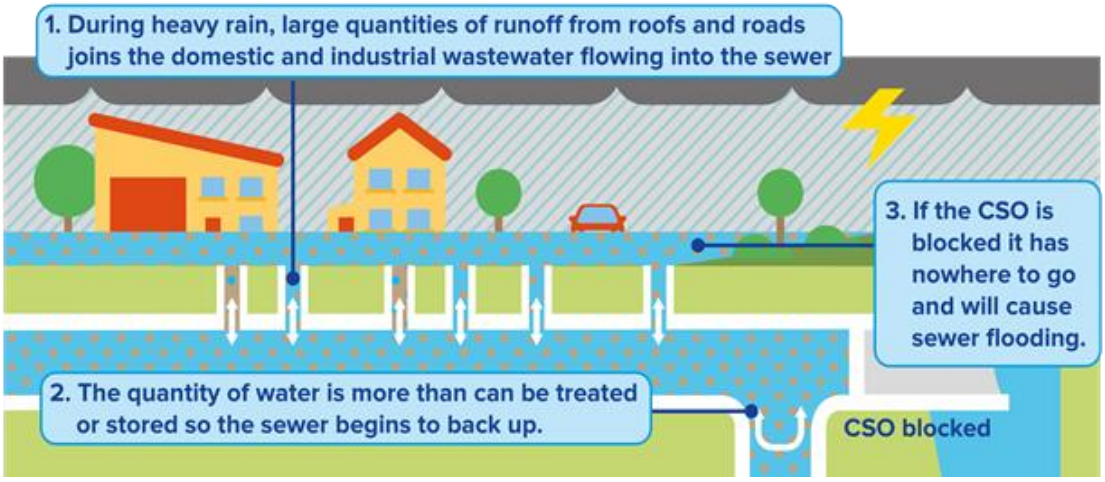

Figure 13 – Why do We Need Storm Overflows?

4.2 The Southern Water Storm Overflow Task Force

Southern Water have set up a Storm Overflow Task Force with four streams:

1) The pathfinder projects.
2) Developing a regional plan to significantly reduce the use of storm releases by 2030.
3) Complaints & Engagement – create and communicate a common narrative which informs the public on the current debates surrounding storm overflows.
4) Beachbouy and transparency.

4.3 The Pathfinder Projects

The first workstream of the task force are the pathfinder catchment projects. The pathfinder projects have been set up to develop and trial a better more collaborative approach to surface water management.

The initial 5 pathfinder catchments are:

- Deal, Kent
- Margate, Kent
- Swalecliffe, Kent
- Sandown, Isle of Wight
- Seven Parishes (Pan Parish) near Andover, Hampshire

4.4 Sandown Pathfinder Objective

We aim to demonstrate a significant reduction in storm overflows by trialling, at scale, innovative methods in the urban areas. We will optimise existing infrastructure and deploy a range of nature-based solutions which will slow the flow of rainwater entering and passing through our network. This is better than simply building bigger assets end-

of-pipe solutions which is carbon intensive and does not tackle the root causes of storm overflows in the long-term. In the industry, this has been the traditional default model to reduce storm overflows. We will engage closely with the public and local stakeholders, to collaborate on the best options and solutions for the Island. Partnership working will be key to building a sustainable network fit-for-the-future.

4.5 A Staged Approach

We are undertaking a staged approach to the pathfinder project which allows us to identify and deliver some low-risk interventions and pilot schemes quickly; whilst we undertake further modelling to provide confidence and ensure we understand and manage risk for larger interventions.

Learning from the pathfinders will also feed into the Southern Water 5 yearly funding request process.

The staged approach is described below (Table 5):

Table 5: Staged approach description

Stage	Description
Stage 0	Initial surveys and study with identification of early 'no regrets' low risk interventions and any additional surveys and modelling requirements
Stage 1	No regret interventions and small trials (SWS and partner organisations)
Stage 2	More complex interventions and scaled pilots (SWS and partner organisations)
Stage 3	Larger scale investments to achieve pathfinder outcomes (SWS and partner organisations) -

Appendix C shows how the additional data that we want to capture around the catchment will be combined to provide a holistic view for storm water management. This is an ongoing process. Early small interventions with low risk of unintended consequences can be enacted quickly. As we gain a more detailed understanding of the catchment then our understanding of the risks associated with a larger scale more complex intervention improves, which provides confidence of a successful outcome.

5.0 Potential Solutions and the Wider Benefits

As mentioned in section 4 floods and storm overflow releases are caused by rainwater in the sewer overwhelming it. The key to reducing these risks are either by reducing the volume of rainwater getting into the sewer or increasing the sewer's ability to cope with it. To that end we have split this into 3 main types of intervention to reduce the risk of flooding and storm overflow use:

- Upstream source control (removing and slowing the flow of rainwater)
- System optimisation (making better use of the existing infrastructure)
- Infrastructure enhancements (build larger infrastructure)

5.1 Upstream Source Control

5.1.1 Removing and Slowing the Flow of Rainwater

Types of solution

- Rainwater harvesting

Water butts can be retrofitted easily to existing downpipes, they hold back the peak run off from roofs and adjust the amount of water drained to the drainage system. They also provide rainwater for domestic garden use.

- Permeable paving

Impermeable footpaths and driveways, car parks and parking bays can be converted to a surface which allows water to soak into porous ground or where the ground is less porous into a gravel filled base which slows the flow into the drainage system or into the ground.

- Green roofs

Green roofs are generally made up of a shallow layer of material planted with low-growing, stress-tolerant grasses, mosses and sedum. These lightweight systems require little maintenance. They not only attenuate run off i.e., ‘slow the flow’ but have other benefits such as providing insulation in winter, and cooling in summer by absorbing heat from the sun.

- Bioretention – tree pits

Bioretention areas/tree pits are designed to collect, attenuate and or infiltrate runoff by providing both storage volume and infiltration area within the underlying structure. The soils around the trees can also be used to filter out pollutants from runoff directly. These are particularly useful in urban roads and pavements to help manage surface water from highways.

- Bioretention – planters

Planters are typically raised above ground features or repurposing of existing raised areas to attenuate run off, ‘slow the flow’. Above ground planters can be easily retrofitted to accept diverted flows from downpipes where there is space.

- Rain garden (swales)

These are vegetated channels which are used to convey, treat and infiltrate surface water; and disconnect conventional roofs and paved areas from the combined and surface water drainage. Swales can be retrofitted into existing systems by re-purposing existing landscaped or grassed areas to contain swale features.

Natural and social capital impact

Southern Water defines natural capital as the element of nature that provides value to society. Social capital is defined as Southern Water's relationships and others' trust in the business. In addition to the drainage benefits that the above solutions provide, they also give many other benefits, some of which are listed below.

Water resource and water quality benefits

- Water butts can reduce the volume of mains water used for gardening.
- Infiltration supports aquifer recharge and can improve raw water quality by filtering water through the soil.
- 'Slowing the flow' measures intercept flows containing sediment, and other pollutants washed from fields, roads etc and can improve water quality by trapping these in situ.

Urban environment benefits

- Planted vegetation can contribute to a reduction in the urban heat island effect by providing shade and reducing local temperatures. Green roofs can reduce the need to heat & cool buildings.
- Vegetation helps to absorb carbon and helps to remove pollutants from the air resulting in improved public health and reduced costs associated with treating health issues (e.g., asthma).
- Removing rainwater from the system avoids the carbon costs of pumping effluent across catchments and to wastewater treatment works. Chemical carbon costs associated with treating this diluted sewage are also reduced.

Natural environment and wellbeing benefits

- Vegetation can provide habitats for pollinators and other wildlife.
- Vegetation can sequester carbon.
- Green spaces improve the aesthetics of local communities and enable people to connect more with nature.

5.1.2 Ground Water Infiltration

For areas that have high ground water (mainly in winter) there are traditional and modern solutions to stop that ground water infiltrating into the sewers, both private drains and public sewers, see Figure 14.

Figure 14 – Sewerage Ownership

Leak tight lining

The traditional methodology for sealing sewers is to install leak tight liners made either of epoxy or silicate-based resins. These are tested against 5m head of water and have a design life of at least 50 years. There are also numerous contractors comfortable in the technology and approach, therefore large numbers of crews could be deployed to deliver the scope quickly. The manholes are sealed separately. This can be done by either spray lining the manhole from the inside, or stitch drilling and injecting a resin into the ground surrounding the manhole to make it watertight. The same methodology is also an option for private drains.

Flood Grouting

This technique is one of the modern methods to solve ground water infiltration problems. In this method, two silicate-based chemicals are pumped into network with each in turn, allowing the liquids to find and fill all the pipe defects, and once the second is pumped out, the pipe is sealed. Again this can be used for public and private drains.

5.2 System Optimisation – Making Better Use of Existing Infrastructure

If we cannot remove or slow the flow of water before it gets into the system then we would look at our existing infrastructure, pumps, storage tanks and instrumentation to enable us to control the system better, i.e., smart network control with increased digitalisation.

Types of solution:

<u>Improvements in storage tank use and control</u>
By being able to adjust how a storage tank fills and releases then there is more flexibility to manage the variable types of storms that could hit a catchment. e.g., intense short summer storms after a period of dry weather or prolonged winter rainstorms.

<u>Improvements in pumping station use and control</u>
Optimising the use of pumping stations across the catchment can also mean we utilise the catchment storage better, reduce wear, and improve resilience of the assets. This can also result in reduced energy use and hence carbon dioxide production.

Better data availability
Level monitoring in the catchment and at storage tanks and flow meters on pumping stations means that more data is available to identify issues proactively, plan maintenance, optimise the system and design solutions.

Natural and social capital impact
Whilst system optimisation may require some additional instrumentation it enables us to make full use of existing assets, as well as potentially providing energy and carbon benefits.

Optimisation of existing assets also avoids the disruption of large construction projects. More data can also aid real time reporting to the public, enabling trust with local communities and impacted groups such as recreational bathers.

5.3 Infrastructure Enhancements – Build Larger Infrastructure

In some instances, we may not be able to remove enough surface water or optimise a system sufficiently to avoid constructing new assets. These may be:

Types of solution
- Larger sewers & pumping stations – to transfer the rainwater and/or diluted sewage more quickly away from an affected area.
- Larger storm tanks – to store more of the volume of rain during storms.
- Large treatment works – to treat the rainwater and/or diluted sewage before it is discharged back to the environment.

Natural and social capital impact
- There will be high carbon costs (embedded and emissions) associated with the construction and operation of these new assets.
- There is the potential for the direct loss of vegetation and habitat during construction which could lead to the loss of a range of ecosystem services (e.g., biodiversity, air quality, health and wellbeing etc).
- There will be disruption to the local community whilst these assets are being constructed (traffic, noise, air quality impacts etc).

6.0 Types of Overflows, Overflow Characterisation & Catchment Characterisation

This section explains how we are characterising the different overflows and catchments. Section 7.0 shows what we have identified so far and the planned next steps for Sandown Catchment.

6.1 Release types

There can be different causes of releases from the public drainage system. These can be split into:

1. Emergency releases – caused by technical faults

2. Storm overflows – permitted and regulated releases caused by excess flow within the system that is released into the environment to avoid homes, businesses, and roads flooding in the catchment. The excess flow within the system can come from rainwater or from groundwater.

6.2 Overflow characterisation

We are undertaking detailed analysis of the historic releases to understand what the main driver is, in order to offer the most appropriate type of solution, see Section 5.0. The main drivers could be:

- Is it potentially an **operational** issue?
- Is it a **Surface water management** issue?
- Is it a **Groundwater** issue?
- Is it an **Optimisation** opportunity?

So far, we have preliminary findings for some of the storm overflows in the Sandown catchment. Below is a table of those storm overflows that we believe are significantly driven by surface water, however further analysis being undertaken (Table 6).

Table 6: Preliminary catchment characterisation – Significant driver – Surface Water

Asset	Urban Areas
KITE HILL WOOTTON WPS	Fishbourne
DODNOR LANE NEWPORT CSO	Newport
SCHOOL GREEN ROAD FRESHWATER WP	Yarmouth
MARKET HILL COWES WPS	Cowes
HILLWAY BEMBRIDGE NEW WPS	Bembridge
MARSH ROAD GURNARD CEO	Cowes

COASTGUARD LANE FRESHWATER BAY	Yarmouth
ALBANY ROAD EAST COWES WPS	Cowes
THORLEY ROAD BOULDNOR WPS	Yarmouth
HOPE BEACH SHANKLIN NEW WPS	Sandown
NEWBARN FARM APSE HEATH WPS	Sandown
OFF FOREST ROAD NEWPORT WPS	Newport
THE QUAY NEWPORT CEO	Newport
KINGS MANOR CEO	Yarmouth
LION POINT VENTNOR WPS	Ventnor
THE INSTITUTE YARMOUTH CEO	Yarmouth
LUCCOMBE WPS	Sandown
LAKE GREEN ROAD SANDOWN CSO	Sandown
THE POINT BEMBRIDGE CSO	Bembridge
ESPLANADE SEAVIEW CEO	Ryde
EASTERN GARDENS SANDOWN WPS	Sandown
MILL ROAD YARMOUTH CSO	Yarmouth
NICHOLSON ROAD RYDE WPS	Ryde
COLWELL BAY WPS	Yarmouth
SALTERNS ROAD SEAVIEW CEO	Ryde
ASHEY ROAD RYDE CSO	Ryde
WINFORD WPS	Sandown
SPRING VALE OTF	Ryde
FLOWERS BROOK VENTNOR WPS	Ventnor
SCHOOL GREEN ROAD FRESHWATER OUTSIDE NO. 33	Yarmouth

We are working to complete this list and also identify the locations where ground water may be the major driver or where asset optimisation would provide the most benefit.

6.3 Urban Area characterisation

For those storm overflow releases where we are confident that surface water is the main driver then we are using the network model to target these SuDs interventions in locations that will give us the most benefit.

So far, we have trialed this approach on three of the eight Sandown urban areas. These were selected based on the number of releases in our baseline of 2020 per person and the historic rainfall data available to support the analysis. The initial three urban areas that we have analysed are Fishbourne & Wootton, Cowes, and Newport. The figures below (Figure 15, Figure 16 and Figure 17) show the overflow catchment characterization for these 3 areas.

These figures highlight areas where a larger proportion of impermeable area is connected to the combined sewers (darker red). By targeting the darker areas and removing flow here there will be greater benefit to the downstream storm releases. The locations of the storm overflows and the number of releases in 2020 are shown as dots.

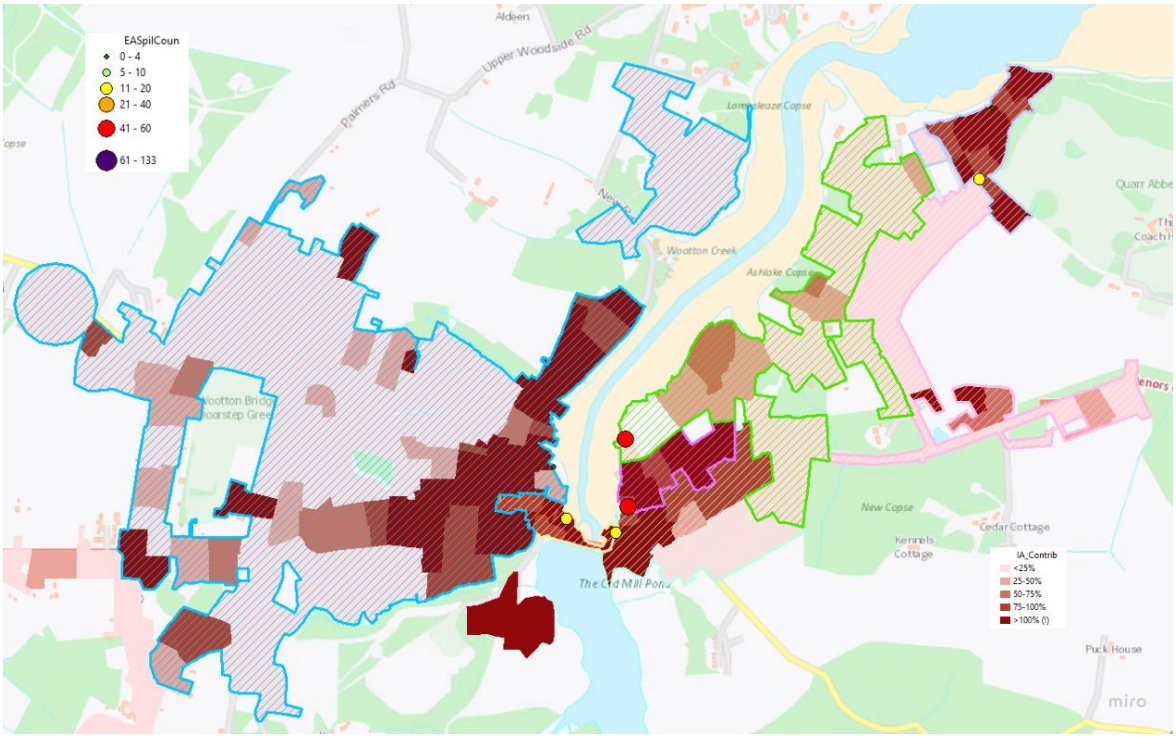

Figure 15 – Fishbourne/ Wootton storm overflow catchment characterisation diagram

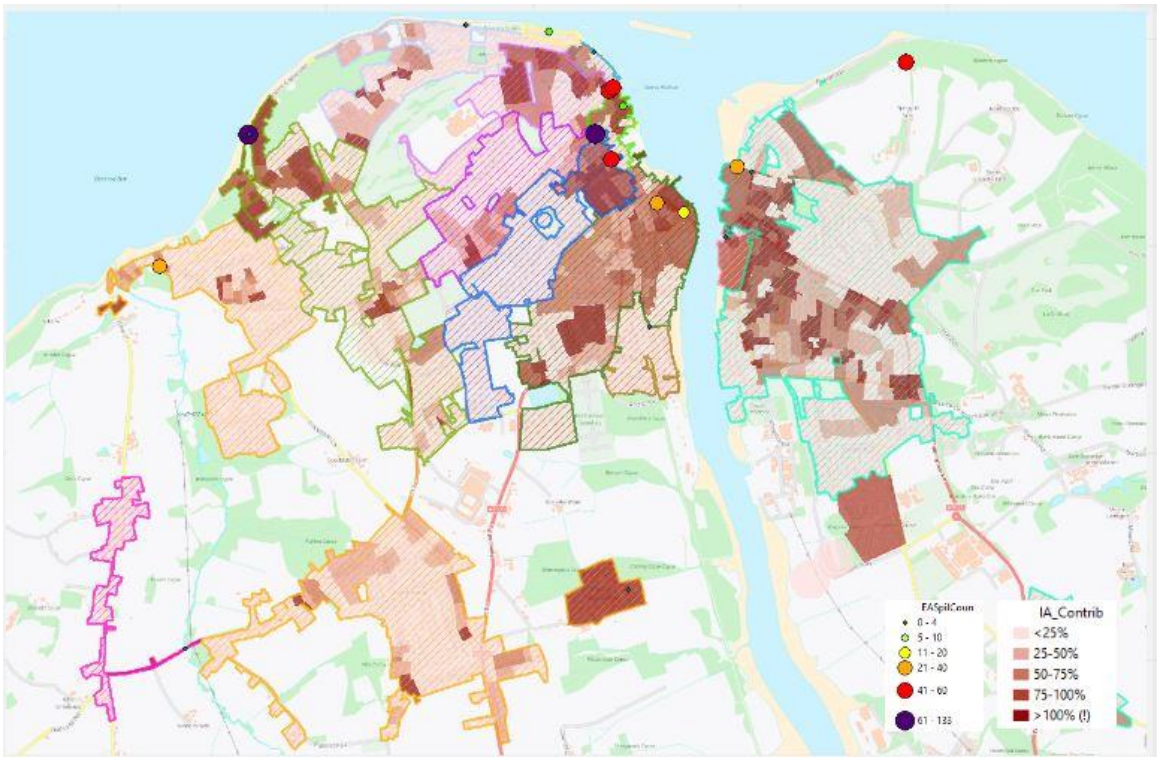

Figure 16 – Cowes storm overflow catchment characterisation diagram

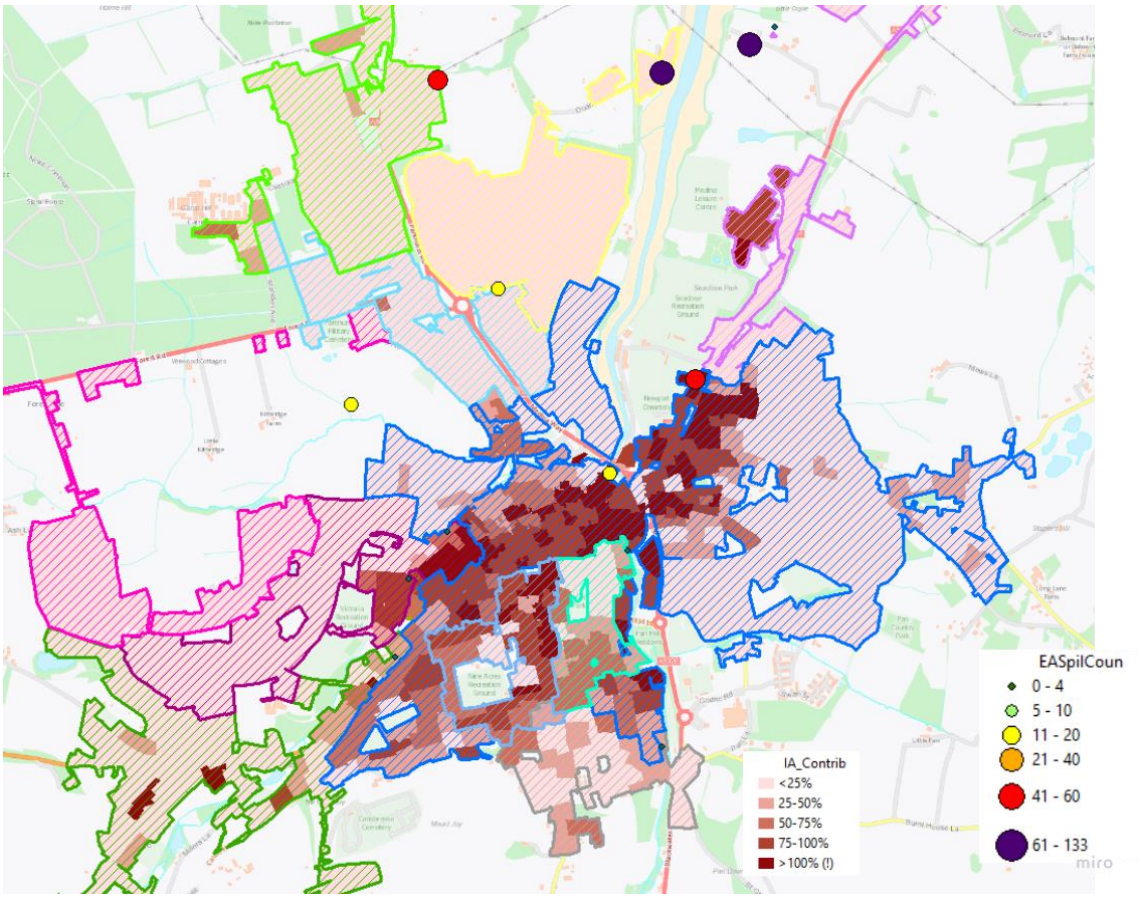

Figure 17 – Newport storm overflow catchment characterisation diagram

We are in the process of completing these catchment diagrams for the other urban areas.

7.0 What are the Next Steps for the Sandown Catchment?

Due to the sheer size of the catchment there are many interventions that could be considered. There is also a variety of underlying geology so sustainable drainage systems directly infiltrating to the ground are an option.

This section sets out the additional investigations that we intend to do with our partners in the Sandown catchment but also some of the trials and early interventions that we would like to construct. These investigations & pilots will further influence our understanding of the issues, risks, impacts, and benefits of various solutions.

Some actions are no regret and can and have been implemented immediately, some will require design and procurement time, and others will need to be trialed and/or modelled to ensure that the impacts are well understood. Southern Water, along with its partners, will log and monitor these interventions, applying them as per the staged approach described in Section 4.

The sections below also list some of the further analysis work. The interventions listed in this section are not exhaustive, and we intend to continuously evolve it and roll out relevant interventions across the urban areas, as the pathfinder project progresses. Table 7 shows a summary of all draft interventions identified to date.

Table 7: Draft Interventions for Stage 0-3 in Sandown Catchment

Stage	Description	Types of intervention
Stage 0	Initial study, characterisation of the releases, characterisation of catchments and identification of potential interventions and any additional surveys and modelling requirements	• N/A
Stage 1	No regret interventions and small trials (SWS and partner organisations)	• Complete characterisation of four catchments and targeted interventions • Operational interventions in Fishbourne • Pilot of Leaky Water butts in Havenstreet • Planters for red roofs in Havenstreet • Identification, design and EA approval of relocation of a surface water connection from combined sewer • Modelling of optimised pumping station intervention • Storage Optimisation interventions at Appley & Fairlee.
Stage 2	More complex interventions and scaled pilots (SWS and partner organisations)	• Design development of a number of targeted SuDS schemes in four urban areas • Programme of design and approval of removing surface water connections from the foul sewer. • Trial of pumping station optimisation • Storage Optimisation interventions at other transfer pumping stations.
Stage 3	Larger scale investments to achieve pathfinder outcomes (SWS and partner organisations)	• Further roll out of SuDS schemes across the rest of the urban areas.

7.1 Characterisation work

We will continue with the Overflow characterisation to help us target the right types of intervention for the different overflows.

7.2 Upstream Source Control – Removing and Slowing the Flow of Rain Water

Where the Storm overflow characterisation indicates that releases are mainly driven by rainfall, we will be looking specifically at collaborating with our partners to install Sustainable Urban Drainage systems.

We are using Geographical Information Systems GIS to identify large roofs and large impermeable areas that may connect into the combined system. We will then work with the owners to identify if these are connected and what are the opportunities to divert the flow or slow the flow, before it connects to the combined system, using some of the measures identified in Section 5.0

Roof Drainage
For example, Figure 18 shows Newport Central in the Newport urban area has a large number of buildings with large roofs. If we confirm that these are indeed connected to the combined sewer system, then we can collaborate with the owners to support them identifying alternatives.

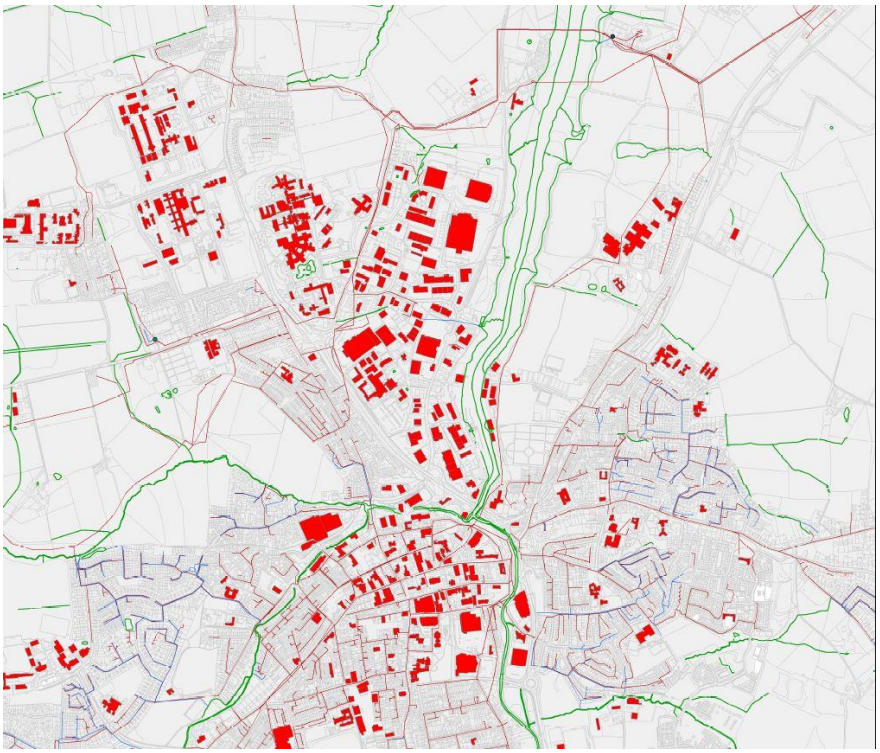

Figure 18 – Potential Pathfinder Focus Area Newport (Large Roofs, Red)

By overlaying this information with that in Figure 17 we can also target our interventions to provide the most value.

Highway drainage reconnection

We will continue to work with the Isle of Wight Council and Island Roads to identify areas of highway drainage that could be disconnected from the combined sewer and connected to a surface water system or an infiltration solution.

Figure 19 – Potential Pathfinder Focus Area in Ventnor Catchment (Wider Roads, Yellow)

Figure 19 gives an example of an area where, if proven to be connected to the combined system; the road widths are sufficient that road drainage could be diverted to local infiltration areas (such as tree pits or roadside basins) or even to larger green spaces.

Domestic solutions to slow the flow and remove impermeable area.

We are looking to identify pilot areas for various domestic solutions within the catchment to assess the benefit, adoption, and maintenance requirements, including:

- Smart water butts
- Leaky water butts
- Raised planters
- Property level rain gardens
- Soakaways
- Porous paving.

7.2.1 Surface Water connections to the combined sewers.

Another source of rainwater into the combined systems is where a surface water sewer for rainwater has been deliberately connected into the combined system. Historically this has been done where, at the time of construction, there were no alternative locations to take the surface water.

We are using GIS to identify these locations and investigate if there are now alternatives for this flow to discharge e.g. infiltrate to ground, a nearby separate surface water pipe or a nearby water course.

From our desktop assessment there are potentially 65 locations within the Sandown catchment (see Figure 20) where there are surface water pipes that may connect to the combined system.

Once these have been identified we will go through a process to:

1) Confirm/test the desktop assumption,
2) Understand the potential flow and hence benefit of disconnecting this location.
3) Look for alternative locations to discharge this flow. These alternatives will be assessed to understand what are the potential impacts on the new location including downstream assets.
4) Agree with local partners and stakeholders the appropriate approach and permitting requirements
5) Design and install the disconnection.

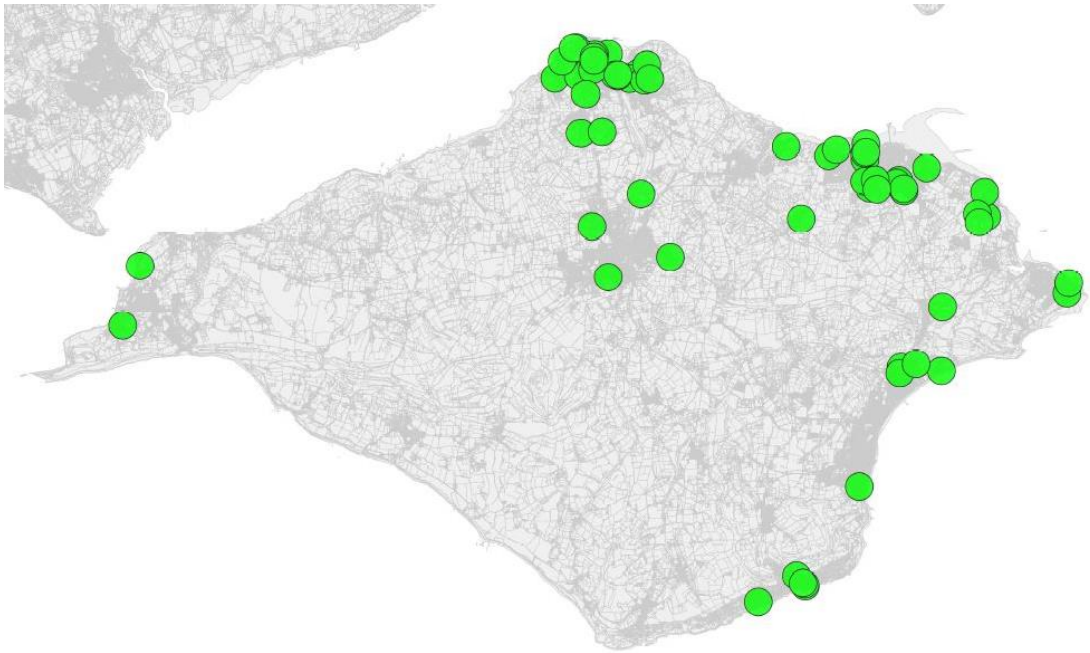

Figure 20 – Sandown surface water connections

One of the connections in Cowes is being taken forward to trial the process. This location is upstream of the Marsh Road Gurnard Wastewater pumping station and overflow, which activated 23 times in 2020. We are working with the Environment Agency to identify an alternate location to discharge this surface water.

7.3 Benefits identification

We are looking to use the network model to run scenarios to understand what benefit removing or slowing the flow will give us to a specific storm overflow.

7.4 System Optimisation – Making Better Use of Existing Infrastructure

7.4.1 Operational Improvements

In parallel, but eventually directed by, the characterisation exercise described in Section 6.0, we are identifying locations where neither surface water nor groundwater appear to be the main driver for a release.

We are then using combination of machine learning and operational staff site visits to identify and resolve the issue. For example, the machine learning can show us where regularity of the releases may tie in with tidal water level changes. One such example is at Rosanna Sailing School overflow where it was found that a non-return valve had been stuck in the open position and therefore the tide was triggering the recording of a release.

Using data analysis and state of the are machine learning we can target maintenance and reduce the number of ‘non-genuine’ releases caused by external sources or instrumentation failings or data inaccuracies.

7.4.2 WPS Storage

As described in Section 3.5, there are a number of large pumping stations that were constructed on the site of old Wastewater treatment works. We are looking at opportunities to utilise existing storage on these sites to provide additional buffering during rainfall, delaying activation of storm releases.

7.4.3 WPS Optimisation - Improvements in pumping station use and control

We are starting a programme where we review the control and output of the key WPSs in the pathfinder catchments. Our investigations aim to understand if optimisation of pumping station controls can be actioned to better utilise catchment storage and smooth the flow being passed forward by those pumping stations. By doing this we may be able to reduce the frequency that the system is overwhelmed and flow is released via the overflows.

Pump schematics have been created for three different urban areas (Cowes, Fishbourne and Newport) in order to better describe the relationship between the WPS and overflows within the catchments (Appendix E – Pumping Station Schematics). We will be continuing this work for the other urban areas.

In the Sandown catchment there are two key areas of opportunity.

- The main transfer Pumping stations that take flow across the island to Sandown WwTW

- Within urban areas there are large individual pumping stations that each have an overflow or affect upstream gravity overflows

We will use optimization software to model the potential benefits and control changes that would be required to optimize the use of the existing assets and therefore minimise the number of storm releases.

7.5 Infrastructure Enhancements – Build Larger Infrastructure

Within this Asset Management Period (AMP), 2020 – 2025 there already a number of projects being undertaken on the Isle of Wight (
Appendix N – Planned Isle of Wight Investments in other Schemes). These are not pathfinder projects, but they are part of Southern Water's capital delivery programme. Construction of these schemes is likely to be complete by 2025.

As shown in Section 7.0 our preference is to deliver schemes that will provide multiple benefits (including natural and social benefits) and/or maximise the utilization of our existing infrastructure (to save embodied carbon) however where absolutely necessary there may be schemes that are identified where additional infrastructure must be constructed.

Other catchment schemes on the Island

- Water Industry National Environment Programme (WINEP) Investigations into pesticides, turbidity and algae have been completed and a WINEP Drinking Water Quality scheme has been scoped for AMP8. This will be focused on engaging with farmers, Catchment Partnerships, and community groups to raise awareness of water quality risks, undertake incentives around soil health and infiltration, pesticide resilience and natural capital, nature-based solutions.
- Southern Water have a plan under the Environment Improvement Fund to do additional work on collaborative planning, engagement with a focus on soil health, slowing the flow, natural capital, water quality. Whilst this work fits into the WINEP scheme in part, we are embarking on a more ambitious partnership working strategy in the lead up to AMP8, working more intensively with local partners to build a collaborative plan.
- Southern Water are undertaking water resource investigations into nitrate risks (Carisbrooke and Knighton Chalk Stream) and also into the impact of abstraction on surface water bodies and wetland sites and implementation schemes on Lukely Brook and Plaisch Meadows. This includes water quality and hydro ecology monitoring, as well as engagement with stakeholders (landowners and Newport Rivers Group).

8.0 Partnership and Community Working – What Can You Do to Help?

As shown in Section 3.0 “water companies are not solely responsible for stormwater management; they are one of many organisations involved in ensuring communities stay protected. The change in the weather is testing all sectors of UK society, and we are all moving towards changes in population and in weather conditions that we have never before had to plan for”[16].

To achieve what is needed then utilities, councils and communities need to work together to achieve mutual benefits. Southern Water have committed to doing this by engaging with our partner organisations and the community to solve the problems.

Southern Water are working with the Environment Agency and representatives of the Isle of White Council as part of a technical group to work together to find solutions to the problems in the catchment (Appendix A – Sandown Technical Group).

So, what can the community do?

8.1 Support Further Investigations

We are interested in time and date stamped photos and videos to help us understand how the Sandown catchment reacts to rainfall. With time and date stamped evidence, and a clear location, we can match this information with other information to better understand how the whole system interacts. This includes:

- Photos and videos of overland flow.
- Photos and videos of flooded areas.
- Photos and videos of the level of the surface water ditches.
- Reporting blocked highway gullies to the Isle of Wight Council.

8.2 Protect the Pumping Stations, Foul and Combined Sewers

Fat, oil and grease (FOG)[17]

FOG often ends up being washed down the kitchen sink. Over time, they harden to a concrete-like material and restrict the flow of wastewater in the pipes and can cause blockages. These blockages can cause wastewater to back-up through toilets and sinks into homes and businesses or escape through manholes into streets and rivers.

Unflushables[18]

Items such as wipes, nappies and cotton buds are the scourge of our sewers – they create blockages, cause flooding in homes and damage the environment. Every year in England and Wales water companies deal with over 300,000 blockages – thousands of

[16] 21st Century Drainage Programme – the Context, Water UK
[17] Fat, oil and grease (southernwater.co.uk)
[18] The Unflushables (southernwater.co.uk)

which see people's homes and belongings ruined by sewer flooding. Wastewater companies are still spending around £90 million each year clearing blockages nationwide, while damage to the environment by the plastics used in unflushable items has become a real focus.

Our sewers are only designed to take away the three Ps – pee, poo and paper.
In the kitchen, follow our top tips to avoid fat, oil and grease building up in the sewer.

- Use containers – butter tubs, yoghurt pots or jam jars can all be used to collect cooled fat and oil – then just put them in the bin.
- Clear your plates – scrape any leftover food or grease and fat residue from plates, pans or cooking utensils into the bin before washing up.
- Bag it and bin it – put a bin in your bathroom for anything that is not pee, poo or paper. Perhaps use scented nappy sacks or dog poo bags (degradable if you can) to throw away any nappies, sanitary items or condoms.
- Compost your food waste – collect uncooked fruit and vegetable peelings for use as compost in your garden.
- Strain the pain – a simple sink or drain strainer can stop food and hair getting down the pipes.

8.3 Protect Surface Water and Combined Sewer Capacity – Existing Developments

You can help release capacity in the existing sewer systems by using less water, removing surface water connections and slowing the flow.

Households:

- Install water butts and planters on your property that take the rainwater from your roof and either slow its connection to the sewers or ideally divert it to a soakaway.
- Could you convert your paved, impermeable driveways into permeable surfaces?
- Try to ensure that existing impermeable surfaces drain to a permeable surface rather than the road or the sewers.
- If possible, disconnect existing drainage from the combined and surface water sewerage systems.
- Report blocked highway gullies and drains asap to the Isle of Wight Council.
- Report blocked sewers to Southern Water.

Target 100[19]

Population growth, climate change, increased urbanisation and environmental protection mean we all need to change how we understand and value water. Target 100 is a commitment by Southern Water to its customers to support them to reduce personal consumption to an average of 100 litres each per day by 2040; while we reduce leakage by 15% by 2025 and 40% by 2040. As well as making sure there is enough water to go round, households could cut their bills and less water used mean less water going into the foul and combined sewers creating more capacity.

Community, businesses, developers & partnerships:

Engage with The Isle of Wight council, local Parish and Town councils and other groups to identify areas for surface water removal, management, ownership and maintenance.

[19] Target 100 together let's hit target 100. (southernwater.co.uk)

As described in Section 5 there are multiple benefits that can be achieved for the whole community.

8.4 Protect Surface Water and Combined Sewer Capacity – Future Developments

Households:

- If you extend your house or create additional roof areas (urban creep) if possible, make sure these drain to a soakaway or surface water system or consider green roofs.
- If developing your drive or garden, could you install permeable paving rather than connect to the surface water system or drain to the highway system.
- Avoid misconnections - Misconnections can happen during work to extend or improve a house, when a new house is built or simply when a new appliance is plumbed in. If any of your plumbing drains to a surface water sewer, the wastewater will pollute local watercourses. Similarly, if clean water drains are misconnected, they can overload the foul sewer and lead to flooding. It is the homeowner's responsibility to ensure there are no misconnections at their property. If you are unsure what to do you can go to ConnectRight or contact Southern Water directly. Alternatively, for a list of plumbers in your area, visit the WaterSafe website[20].

Community, businesses, developers & partnerships:

- Ensure new developments are sustainable i.e. they are not connected to the combined sewer and where possible also avoid connection to the surface water system to allow rainwater to infiltrate to the water table. Thus, increasing the water availability for rivers and streams for biodiversity and for extraction for drinking water.

[20] Bad plumbing and pollution (southernwater.co.uk)

9.0 Future Sustainable Growth

Southern Water are looking to work with our drainage and surface water management partners, including the Isle of White Council, Island Roads, Town and Parish councils to agree how surface water management can be better considered and incorporated into the sustainable growth plans for the Sandown catchment and the Isle of Wight. These conversations could include areas such as:

- More detailed consultation on specific proposals, including small scale developments.
- Support to encourage more use of sustainable urban drainage schemes and nature-based solutions, including upstream ‘slow the flow’ type measures.
- Ensuring that post construction, the installations comply with the requirements.
- Collaboration to make policies more aligned with sustainable drainage and climate change requirements.

10.0 Conclusions

For historical reasons there are a large number of storm overflows attributed to the Sandown catchment. The eight urban areas offer a variety of opportunities to identify and target different types of solution to reduce the number of storm overflows.

This report demonstrates the work completed and the planned work to analyse the causes of the storm overflows and pinpoint the best locations for solutions. However, to make a significant difference to the numbers of releases, then Southern Water, its partners and the community all need to work together. By doing so we can reduce the impact of storm overflows on the environment, whilst also providing multiple other benefits to the region, such as: water resource, water quality, green space and biodiversity benefits

11.0 Glossary

Catchment	An area that is drained by a complex sewerage system comprising a network of pipes, wastewater pumping stations, and wastewater treatment works (WwTW).
CCTV	Closed Circuit Television Video sewer inspection refers to the process of using a camera to see inside of pipelines, sewer lines, or drains.
Combined Sewers	The same pipe that serves the purposes of both above.
Storm Overflow	A traditional storm overflow which will have a condition for pass forward flow, an Event Duration Monitor (EDM) a screen and possibly storage volume.
DEFRA	Department for the Environment, Food and Rural
Dry weather flow (DWF)	Dry weather flow is the flow of wastewater in a sewer system during dry weather that presents with minimal infiltration.
Dry weather flow pumps	These are pumps whose size is calculated to pump an agreed volume of flow forward to the WwTW. This flow rate is agreed with the EA.
Emergency Overflow (EO)	Typically, on a pumping station or WwTW and only used if the site has suffered a power or mechanical failure. For example, Margate Emergency Overflow (EMO) goes straight on to the beach so if the station fails it is the last route used.
EDM	Event Duration Monitor
FFT	Flow to Full Treatment
FOG	Fat, oil and grease
Foul Sewer	A Sewer that is expected to carry predominately foul sewage from toilets, sinks, baths and appliances from a domestic property. The foul sewer also carries wastewater industrial and commercial properties.
GIS	Geographic Information Systems (GIS) are most often associated with mapping and provides geographic information through maps or databases. GIS combines hardware, software and data to provide visual geographic information. Also known in Southern Water as the sewer record.
Hydro-Brake®	This is a device that controls the flow coming out of a tank. Under regular conditions, water passes through the Hydro-Brake® unrestricted and continues downstream at normal levels. At times of high flow e.g. during a rainstorm, the structure's internal geometry harnesses the natural energy of the flow. This holds back the water, releasing it at a controlled rate.

IDB	Internal Drainage Board
Intervention	An action or project being undertaken in order to provide a solution/benefit for the catchment issue. E.g. flooding risk or number of storm overflow releases.
LSO	Long Sea Outfall
Main River	Main rivers are usually larger rivers and streams. The Environment Agency designates these and carries out maintenance, improvement or construction work on main rivers to manage flood risk.
Natural capital	Southern Water defines natural capital as the element of nature that provides value to society.
Network model	A software model representing the piped drainage system through which different rainfall scenarios can be run. To understand the impact on storage capacity, water levels & pumping stations capacity.
No regret intervention	Where it has been agreed through Governance that intervention will provide a benefit with negligible risk of a negative outcome.
Ofwat	The Water Services Regulation Authority
Rainfall scenario	Different types of storms that can be used in a network model. These storms may vary in length or intensity.
Social capital	Social capital is defined as Southern Water's relationships and others' trust in the business.
SWS	Southern Water Services
SSO	Short Sea Outfall
Storm Overflow	Where a combined sewer releases a dilute but untreated mix of wastewater and rainwater into a water body during rainfall. The term is synonymous, for the purposes of this document, with the terms, combined sewer overflow, intermittent discharge and storm tank overflow.
SuDs	Sustainable Urban Drainage systems
Unflushables	Items which should be disposed of in the bin, not the toilet.
WPS	Wastewater pumping station
WwTW	Wastewater treatment works

For Appendices see separate document on Pathfinder website pages

Appendix A – Sandown Technical Group

Appendix B – How does Urban Drainage Work?

Appendix C – Building a Holistic View of a Drainage Catchment for Storm Water Management

Appendix D – Urban Area Characterisation Diagrams

Appendix E – Pumping Station Schematics

Appendix F – Bembridge

Appendix G – Cowes

Appendix H – Fishbourne

Appendix I – Newport

Appendix J – Ryde

Appendix K – Sandown

Appendix L – Ventnor

Appendix M – Yarmouth

Appendix N – Planned Isle of Wight Investments in other Schemes