TORBAY COUNCIL

Torbay 2040

An Assessment of Future Sewer Capacity in Torbay

May 2023

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1 Executive Summary

1.1 Background

Every local planning authority needs to have a local plan that sets out what can be built and where building should take place over a period of at least 15 years. Local Plans hold important policies to support environmental protection, jobs, and the economy. They also help to decide where investment is needed for infrastructure like roads, schools, recreation, and health services.

Torbay Council are currently updating the Torbay Local Plan 2012-2030. The updated plan "Torbay Local Plan update 2022-40: A Landscape to Thrive" will be an evolution of the plan adopted in 2015, with the main changes anticipated to be as a result of changes to government policy on housing.

As such, the AECOM report *"Torbay 2032 An Assessment of Future Sewer Capacity in Torbay"* (last updated in 2014) requires updating to reflect a potential extension to the plan period, changes in local population projections and, in light of new information and guidance, potential updates to the hydraulic modelling.

This report updates the hydraulic modelling predictions using current guidance and therefore allows consideration to be given as to whether the findings can still be relied upon to support the update of the Local Plan housing and growth policies to 2040.

1.2 Modelling

The scope of this project was to update the predictions for the effect of foul water flow from new development on the combined sewer network serving Brokenbury Quarry Waste Water Treatment Works (WwTW) using latest guidance.

Using data provided by South West Water (SWW) and Torbay Council, Waterco carried out a series of computer hydraulic model runs to examine the effect of population growth, urban creep, climate change and water efficiency improvements across the Torbay sewer network.

Assessment of treatment capacity or process changes due to changes in sewage concentration at Brokenbury Quarry WwTW is outside the scope of this hydraulic modelling project, which is focused on flows within the sewerage network.

1.3 Findings

Water consumption per capita is predicted to fall from 138 litres per head per day (l/h/d) to 122 l/h/d by the 2040 design horizon of this study based on SWW predictions (from SWW data). This is approximately an 11.5% drop in water consumption.

Using the updated local plan housing allocations, the population of Torbay is projected to increase by 8.6% to 2040. Allowing for some flexibility in the projections (the updated local plan "aims to exceed" the 300 houses per year allocated by redeveloping brownfield land) the projected decrease in water consumption is approximately balanced by the projected increase in population. Therefore, based on **foul only** connections the hydraulic capacity of Torbay's strategic combined sewer network will not limit development before 2040.

If the number of houses built is increased to match the government's Standard Methodology figure (a development target of an additional 600 dwellings per annum), then there will be an increase of approximately 17.2% in the population of Torbay by 2040. At this level of growth, SWW will need to be consulted regarding the adequacy of pumping station and treatment capacity.

Notwithstanding the above, the cumulative effect of climate change and urban creep (the addition of new impermeable area caused by local changes, such as patios and conservatories, draining into the sewer network) outside the proposed development areas will cause significant detriment to the performance of the combined sewer system. This detriment is in the form of increased flooding risk and increased spills from the combined sewer overflows (CSOs) in the catchment. Under the National Planning Policy Framework (various dates last revised 2021) adding more than $5m^2$ of impermeable area to front gardens and driveways requires planning permission however elsewhere on a property it is generally permitted development.

These findings are in line with those from the AECOM report *"Torbay 2032 An Assessment of Future Sewer Capacity in Torbay"* however climate change guidance has been updated since the AECOM report was produced. Using the latest (2021) climate guidance reduces the ability of the combined sewer system to accommodate additional flows.

1.4 Conclusions

For foul only flows the effect of predicted increase in population is approximately balanced by predicted decrease in water consumption in the period to the design horizon provided development is limited to the proposed local plan figure of 300 new dwellings per annum. Significantly more development (for example meeting the government's Standard Methodology target of 600 dwellings per annum) will lead to detriment in the strategic sewer network. Strategic sewers are the core sewer network, through which the majority of flow will pass. The outlying sewer network will have been designed for a specific local area and as such will not necessarily have sufficient spare capacity to take additional development.

Notwithstanding the above, there are substantial challenges in ensuring the Torbay sewer network can accommodate proposed development, urban creep, and climate change up to the 2040 design horizon whilst maintaining the current level of service. Robust policies need to be in place to:

- Ensure water efficiency measures reduce water consumption in line with predictions.
- Minimise urban creep and, where creep is identified, ensure mitigation is included as part of any planning or building control submissions.
- Ensure planning and development / regeneration policy mandates climate change mitigation, with the aim of removing or attenuating surface water before it enters the combined sewer system. Planning policy for new development may cover this, a similar policy should be adopted for all works within the existing urban areas. In particular:
    - Ensuring runoff from new development does not enter the combined sewer network is essential. This can be achieved using sustainable drainage of surface water using features such as rainwater harvesting and reuse, infiltration areas, soakaways, porous pavements, attenuation wetlands and tree pits.
    - Separating surface water from existing assets and reducing water consumption is also extremely beneficial. This can be achieved by retrofitting water sensitive urban design, particularly when urban areas are being regenerated should be a high priority, Community SuDS and improving water efficiency.

2 Background

Every local planning authority needs to have a local plan that sets out what can be built and where building should take place over a period of at least 15 years. Local Plans hold important policies to support environmental protection, jobs, and the economy. They also help to decide where investment is needed for infrastructure like roads, schools, recreation, and health services.

The whole of Torbay is designated by the Environment Agency (EA) as a Critical Drainage Area (CDA). For this reason, all development will require a basic Flood Risk Assessment. The catchments within Torbay are typically small, steep, and in the most part highly developed in nature. There is also a legacy of culverting (piping) of the watercourse channels which adds to the risk of flooding and as such all new development must deliver a reduction in current rainfall run-off rates. This requirement also applies to brownfield sites that will have to match the same standards.

Torbay Council are currently updating the Torbay Local Plan 2012-2030. The updated plan “Torbay Local Plan update 2022-40: A Landscape to Thrive” will be an evolution of the plan adopted in 2015, with the main changes anticipated to be as a result of changes to government policy on housing. The current Local Plan seeks to deliver 8,900 new homes between 2012 and 2030, or approximately 500 dwellings pa. The Local Plan update will need to assess how far current needs can be sustainably accommodated within Torbay, considering environmental and infrastructure constraints. The government’s Standard Methodology identifies a minimum level of housing need of 600 dwelling per annum A study of sewer capacity is needed to inform the Local Plan Update. The updated plan “Torbay Local Plan update 2022-40: A Landscape to Thrive” recommends that Torbay builds at least 300 new homes a year and this figure has been used for growth predictions in this model.

As such, the AECOM report *“Torbay 2032 An Assessment of Future Sewer Capacity in Torbay”* (last updated in 2014) requires updating to reflect a potential extension to the plan period, changes in local population projections and, in light of new information and guidance, potential updates to the hydraulic modelling.

The stated aims of the AECOM report *“Torbay 2032 An Assessment of Future Sewer Capacity in Torbay”* were to inform Torbay Council on the possible impacts of growth and development on the local sewerage network and present a range of practicable measures that could be taken to ensure Torbay’s sewerage network maintains sustainable levels of capacity long into the future.

This report updates the hydraulic modelling predictions using current guidance and therefore allows consideration to be given as to whether the findings can still be relied upon to support the update of the Local Plan housing and growth policies to 2040.

To ensure no changes to water quality (which can have an adverse effect on the integrity of the Lyme Bay and Torbay Marine Special Area of Conservation (SAC)) due to additional growth proposed in the Plan, it will be necessary to consider the effectiveness of any adopted mitigation measures and whether any additional measures may be required. As such, the Torbay Council Water Cycle Study may also need to be revised to achieve these aims.

This report is intended as an update to the AECOM report “Torbay 2032 An Assessment of Future Sewer Capacity in Torbay” version 2 dated 8th September 2014 (henceforth referred to as the AECOM report). As such, this report follows the general structure of the AECOM report and should be read in conjunction with the AECOM report, which contains more details on the background to the project and suggestions regarding ways to remove surface water from the combined sewer system.

From the AECOM report, an overview of the types of water and sewer network infrastructure in Torbay is as follows:

Potable (mains) water supply

Potable water is water that is fit for consumption. Torbay's potable water supply is largely sourced from Dartmoor's rivers and reservoirs. It undergoes a rigorous treatment process to ensure it meets the required standards. Following treatment, potable water is distributed to customers through a pressurised water supply network.

Foul Sewer

The foul sewer transports wastewater (sewage) from houses and businesses to the wastewater treatment works (WWTW). Torbay's sewers largely rely on gravity; however, some of the larger trunk sewers or sewers in the lower reaches of the catchment require pumping. These are termed rising mains. Nearly all of Torbay's wastewater is treated at Brokenbury Quarry WWTW in Churston.

Surface Water Sewer

The primary function of the surface water sewer is to prevent flooding. It does this by draining rainwater from roads, roofs and other hard surfaces. The surface water sewer discharges directly into local streams or the sea. Under normal operation, the surface water network does not contain wastewater.

Combined sewer

Town centres and older developments typically feature combined sewers. The combined sewer network receives wastewater (foul) and surface water runoff (stormwater) from properties. Road runoff may also drain to the combined sewer in these areas. Combined sewers can overflow to the surface water sewer if they become blocked or if they receive too much rainwater. Torbay has extensive areas of combined sewers throughout Torquay, Paignton and Brixham.

Also from the AECOM report:

Vulnerability of Combined sewers

When compared to foul drainage networks, the flow rates and volumes in the combined sewer can vary greatly during rainfall events. If they receive too much rainwater, combined sewers can discharge into the environment. This normally occurs via a combined sewer overflow (CSO).

In these occurrences, the CSO acts like a 'safety valve' to ensure the system doesn't back up and cause flooding and pollution at property level. Flooding and pollution at property level can present a health risk to the occupants and on this basis, discharging via CSOs is the least harmful option. The foul and stormwater mixture that spill from the CSO enter the environment during times of peak flow and are largely diluted as they travel downstream.

Climate change and urban intensification will only increase the amount of rainfall that enters the existing combined sewer network. This increase is likely to result in CSO spills occurring more often than at present. The implications of increased CSO discharges could be detrimental to Torbay's bathing water quality and the *broader tourist industry.*

Current investment by SWW however, will mitigate the impact of this on a number of key CSO locations discharging to bathing waters. The project horizons of these investment schemes will deal with flows beyond 2032.

To reduce the risk of increased CSO spills, it is important that steps are taken to reduce the amount of rainfall that enters the combined sewer system. A range of possible approaches to improve Torbay's sewer capacity are presented in this report.

3 Understanding Torbay's Current Sewerage Capacity

3.1 Connectivity and Flows: Torbay Sewer Network Overview

The AECOM report description of the Torbay sewer system is still appropriate:

Brokenbury Quarry WwTW receives nearly all of Torbay's wastewater for treatment. The only area of Torbay that is not served by Brokenbury is Edginswell in Torquay. Wastewater from Edginswell drains into the Aller Valley trunk sewer to the northwest of Torquay from where it feeds the Buckland WwTW in Newton Abbot.

Most of the sewer networks in Torquay, Paignton and Brixham are combined. These combined sewers convey a mixture of stormwater and foul sewage under gravity to the large trunk sewers around Torbay's coastline. A series of sewage pumping stations (SPS) pump the wastewater to Brokenbury Quarry for treatment through rising mains. The final treated effluent from Brokenbury Quarry is discharged into the English Channel through a long sea outfall at Sharkham Point in Brixham.

Figure 1 provides an overview of Torbay's sewer system, illustrating the complexity and extent of the Torbay sewer network. It also details the location of the main sewer pumping stations serving each town. The network marked green on the map highlight the extent of the combined sewer network.

It's worth noting that some of the areas served by separate sewers (surface and combined) comprise dual manholes. This means that during high flows, the system can effectively operate as a combined sewer.

In addition, some areas of Torbay have historic watercourses which have been culverted under the urban areas and are now used as combined sewers. The most notable of these is the River Fleet, which is culverted through the centre of Torquay and has been diverted northeast from its original outfall into Torquay Harbour, passing behind Meadfoot Beach to Ilsham Valley pumping station from where flows are pumped to Brokenbury Quarry WwTW. Excess flows arriving at Ilsham Valley spill at Hopes Nose whilst excess flows unable to pass through the tunnel from Fleet Street spill from the Fleet Street CSOs into Torquay Harbour.

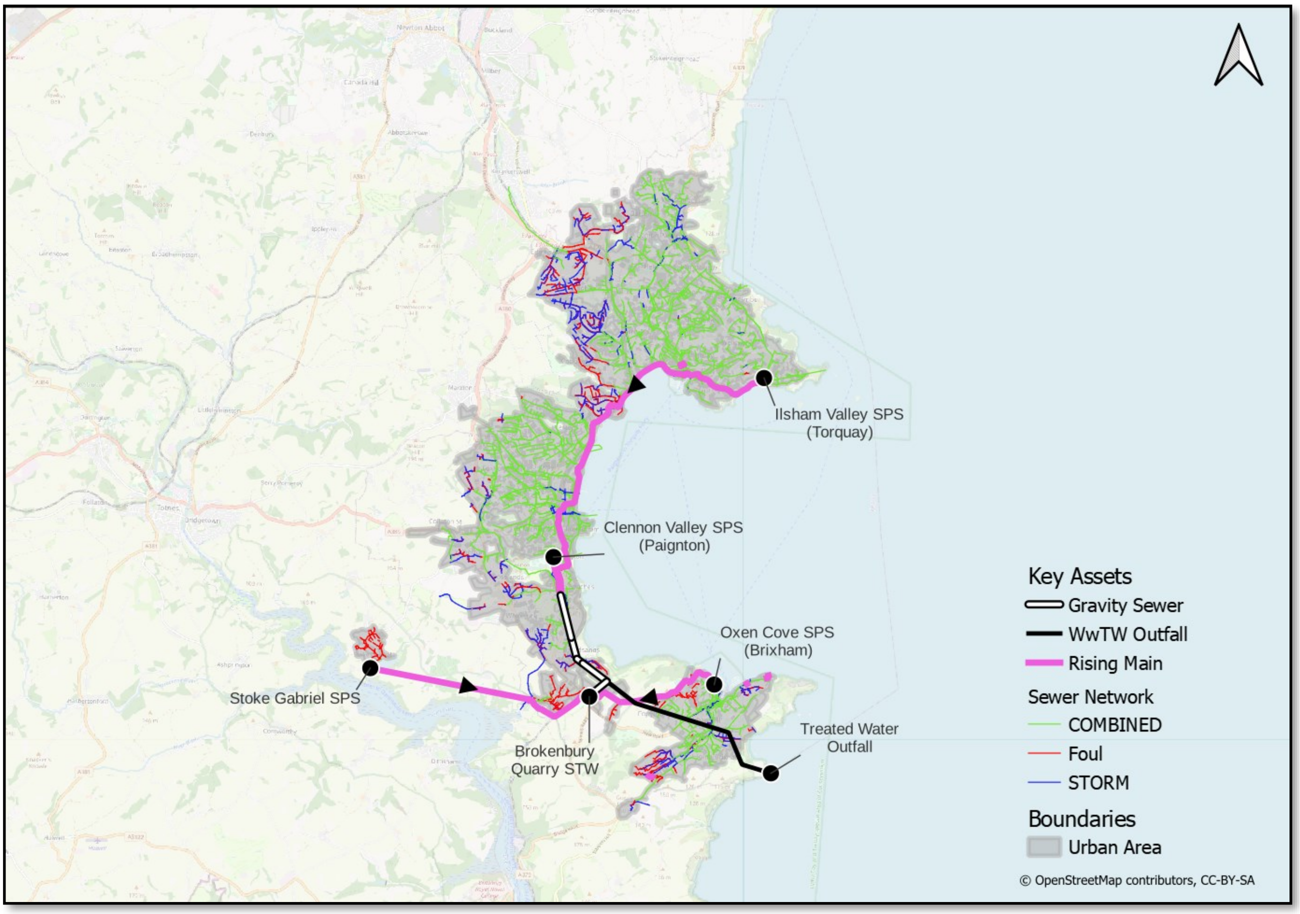

Figure 1- Overview of the Torbay sewer system

3.2 Hydraulic Modelling

The scope of this project was to update the predictions for the effect of foul water flow from new development on the combined sewer network serving Brokenbury Quarry Waste Water Treatment Works (WwTW) using latest guidance.

Using data provided by South West Water (SWW) and Torbay Council, Waterco carried out a series of model runs to examine the effect of population growth, urban creep, climate change and water efficiency improvements across the Torbay sewer network. Assessment of treatment capacity or process changes due to changes in sewage concentration at Brokenbury Quarry WwTW is outside the scope of this hydraulic modelling project, which is focused on flows within the sewerage network.

Waterco modelled a range of urban creep and climate change scenarios for multiple return periods to understand the effect of these parameters on the sewer network. Climate change guidance by the EA has been updated since the publication of the previous local plan, the effect of applying the updated guidance is to increase predicted spills at the combined sewer overflows (CSOs) within the catchment and to exacerbate existing flooding from the combined sewer system. Urban creep without suitable mitigation measures increases predicted detriment.

SWW have provided a copy of their current computer hydraulic model of the Brokenbury Quarry catchment, which covers the majority of the Torbay area and is built using Infoworks ICM™ hydraulic modelling software. Infoworks ICM™ version 2023.0.0 has been used for the hydraulic modelling carried out as for this study.

The Brokenbury Quarry hydraulic model comprises all areas draining to the Brokenbury Quarry Waste Water Treatment Works (WwTW). Some areas (for example Stoke Gabriel) drain to the WwTW however are outside the Torbay Council Local Authority boundary, whereas Edginswell drains to the Buckland WwTW as described above. See Figure 2.

Note that the AECOM report stated that the models used were separate for each of the main catchments (Torquay, Paignton and Brixham) however the current model includes all the areas in one model.

The SWW hydraulic model was re-verified in 2016 for dry weather and storm flows using flow survey data obtained from monitors placed in the sewer system. The as-received model had been updated to the 2020 design horizon, it is considered that this is appropriate to use as the baseline for this study. Checking of model calibration is outside the scope of this study.

Waterco carried out a series of hydraulic model runs to understand Torbay's current sewer capacity, testing network performance across a range of storm durations, return periods, and climate change scenarios all with summer and winter rainfall profiles.

As for the previous (AECOM) report the critical duration storm (i.e., the storm duration which produces the worst case – either highest flows or most depth in the sewer system) varies across the catchment. Generally, shorter duration storms apply to smaller areas of the catchment and longer duration storms apply to larger areas, with a 120-minute duration being close to the worst case across the entire catchment. Therefore, the results of 1 in 30-year, summer rainfall events of 120 minutes duration (M30-120S) are presented as they illustrate the points raised in the report with the most consistency and allows comparison with previous work. Flood volumes for these events are not necessarily the worst case at all locations.

Existing water consumption has been modelled as 138 l/h/d per person, from the as-received modelling information.

In addition to scenarios corresponding with the AECOM report (as described above) the hydraulic model has been run for two years of continuous simulation selected from the full 18 year rainfall supplied by SWW. The years chosen are 2008 and 2014 as these have a reasonable distribution of rainfall. Predicted spills are not necessarily "typical" however running two years allows the effect of climate change and population increase to be assessed.

All the above model simulations have been carried out using "free discharge" conditions at the CSO outfalls. This ensures that the model results show the effect of climate change and development on the sewer network without changes to sea level skewing the results. Additional model simulations have been carried out on a subset of the design simulations in conjunction with elevated tide levels to confirm whether the effect of projected sea level rise needs to be considered in respect of future sewer capacity.

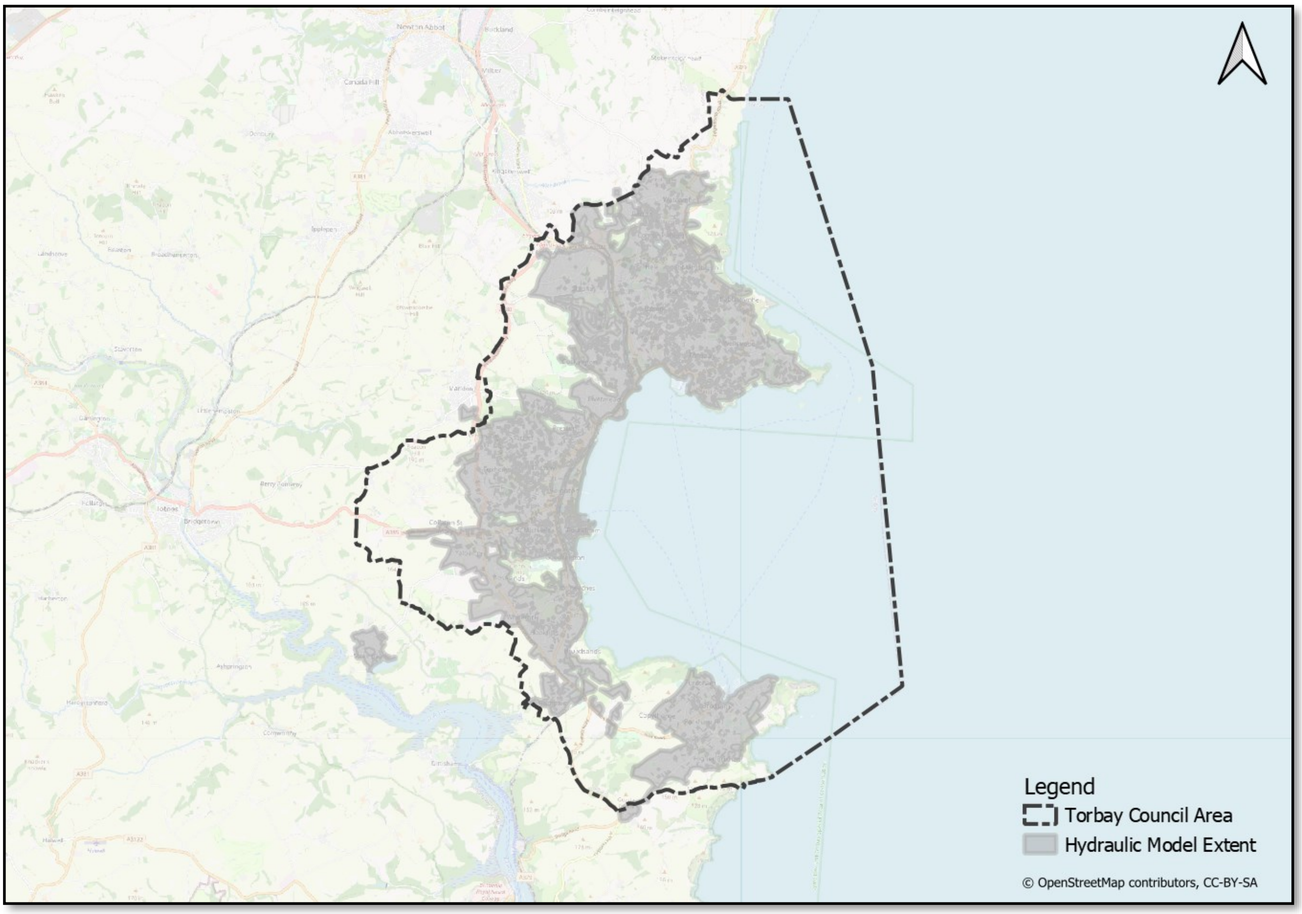

Figure 2- Area of Torbay covered by the Brokenbury Quarry hydraulic model

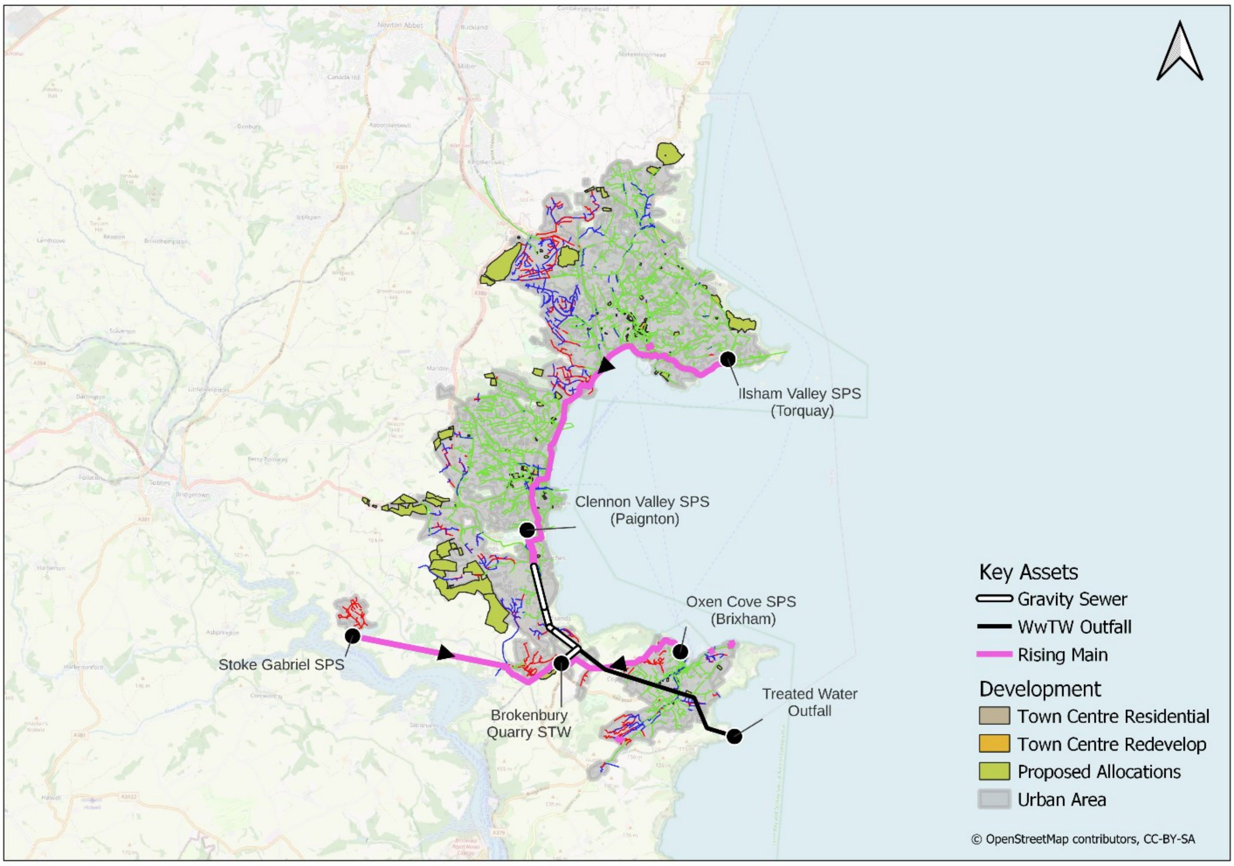

Figure 3- Housing site options in the Torbay area

3.3 Hydrology

The existing model uses the inbuilt ReFH2 rainfall generator (software which allows estimation of design and observed flood hydrographs for rural and urbanised ungauged catchments across the UK) within Infoworks ICM to generate design events using FEH point data obtained from the FEH Web Service (the FEH Web Service delivers catchment descriptors and rainfall data to support the methods outlined in the Flood Estimation Handbook (FEH), and implemented in the FEH software, for estimating floods and site runoff rates across the UK).

The existing model used one FEH point however as parameters vary significantly across the Torbay area three FEH points were used, one for each catchment area (Torquay, Paignton and Brixham) The FEH points are located at National Grid Reference (NGR) 292317, 055666 (Brixham); NGR 288500, 061500 (Paignton) and NGR 291767, 064905 (Torquay). The average subcatchment size within the model is 1 hectare, therefore this has been used within the rainfall generator to calculate rainfall. Rainfall smoothing has been used in the hydraulic model run to account for spatial variation across the catchment.

The parameter with the greatest variation across the catchment is the estimate of base flow index based on hydrology of soil types classification (BFIHOST). In the Torbay area, there are significant differences between the legacy (1995) BFIHOST values and the latest BFIHOST19 data (2019). For this study, BFIHOST19 data has been used although this does not affect the total rainfall generated for this subcatchment-based runoff model it is important if a 2D “rainfall to mesh” model is used for any future SUDS design.

Climate change allowed for in the existing model has been based on the UKWIR research project *‘Rainfall Intensity for Sewer Design’* published in 2017. Climate change uplifts of 8% for the 2035 epoch and 13% for the 2050 epoch had been selected. The 2017 guidance has subsequently been superseded by the *‘FUTURE-DRAINAGE: Ensemble Climate Change Rainfall Estimates for Sustainable Drainage’* study by the UK Climate Resilience Programme, published in 2021. Climate change uplift values for the 2021 study agree with the peak rainfall intensity allowances published as part of the latest EA guidance on climate change. The EA climate change allowances for the South Devon Management Catchment have been adopted and are shown in Table 1 below.

Table 1 Climate Change Allowances

Return Period	Epoch	Central Allowance	Upper End Allowance
3.3% AEP Event	2050	20%	35%
	2070	25%	40%
1% AEP Event	2050	25%	45%
	2070	30%	50%

3.4 Tide Calculations

The model studies the effects of the tidal flood risk in Torbay. Tide curves, applied at the CSO outfalls, have been updated in line with the latest UK Climate Projections 2018 (UKCP18) dataset and in accordance with current EA guidance on sea level rise.

Tide calculations have been undertaken at Torbay by extracting base tide curve data from the port at Exmouth (the nearest port to Torbay). As per latest guidance, the base tide data selected is between the High

Astronomical tide and the Mean High Water Spring tide.

The donor storm surge shape adopted (i.e. the shape which affects the length of time total sea level is elevated by surge above a particular level) is from Weymouth.

The extreme sea levels for a range of return periods have been extracted from Chainage 4860 of the UKCP18 dataset, the closest chainage perpendicular to Torbay. The extreme sea levels from the UKCP18 dataset are dated 2017 and therefore, sea level rise (for both the Higher Central and Upper End allowances) has been applied to bring levels up to the present day. Sea level rise associated with Climate Change have been calculated up to the 2040 epoch.

The updated tide curves for a selected return period, base tide data and tidal surge shape are shown in Figure 3 below.

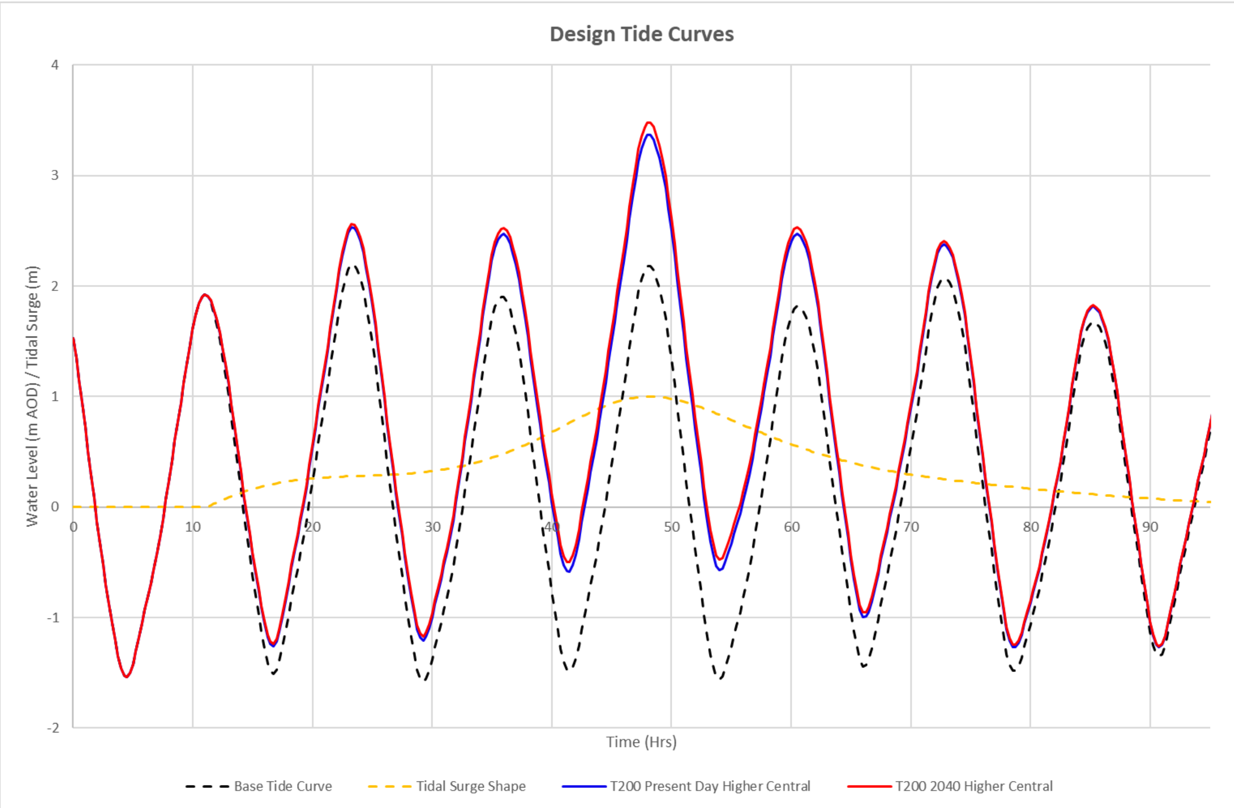

Figure 4 Design Tide Curve for the 0.5% AEP Event

4 Torbay's Sewer Capacity 2040

4.1 New Foul Flows

SWW predicts that per capita water consumption is predicted to fall to 127 litres per head per day (l/h/d) by 2025, 124 l/h/d by 2035 and 118 l/h/d by 2050 (from "SWW Modelling Parameters for BRAVA Assessment"). The SWW figures have been derived from consumption rates for 2025 and interpolated for other epochs (2035 & 2050). Tourist population consumption rate is assumed to be 100 l/h/d throughout all epochs.

Using these figures, an interpolated value of 122 l/h/d has been used for the 2040 design horizon of this study. This is approximately an 11.5% drop in water consumption.

Using the updated local plan housing allocations (see Figure 3), the population of Torbay is projected to increase by 8.6% to 2040. Allowing for some flexibility in the projections (the updated local plan "aims to exceed" the 300 houses per year allocated by redeveloping brownfield land) the projected decrease in water consumption is approximately balanced by the projected increase in population. Therefore, based on **foul only** connections the model predicts that the hydraulic capacity of Torbay's combined sewer network will not be significantly detrimentally affected by the proposed developments before 2040. Note, this does not mean that the model doesn't predict flooding in Torbay, just that predicted flooding is not made worse by the proposed developments.

If the number of houses built is increased to match the government's Standard Methodology figure, then there will be an increase of approximately 17.2% in the population of Torbay by 2040. At this level of growth, detriment to the flooding performance of the sewer network is likely and SWW will need to be consulted regarding the adequacy of pumping station and treatment capacity.

As discussed later in this report, this scenario of "foul flows only" is considered to be unrealistic.

4.2 Urban Creep and Climate Change

Climate change and urban creep in existing areas (outside areas of proposed development) will cause the biggest issues with future capacity of Torbay's sewers. Addressing these issues should be at the heart of planning policy and will require support from all stakeholders.

Urban creep describes the addition of new impermeable areas caused by local changes, such as patios, driveways and conservatories draining to the sewer network. These additional hard surfaces, combined with the predicted changes in rainfall intensity due to climate change can increase the risk of flooding and CSO spills into the environment. Robust policies need to be in place to minimise urban creep and, where creep is identified, ensure mitigation is included as part of any planning or building control submissions

National guidance has been updated since the publication of the AECOM report in 2014. The guidance also states that for developments with a lifetime beyond 2100 (this includes development proposed in applications or local plan allocations):

> *For flood risk assessments and strategic flood risk assessments assess the upper end allowances. You must do this for both the 1% and 3.3% annual exceedance probability events for the 2070s epoch (2061 to 2125).*
> *Design your development so that for the upper end allowance in the 1% annual exceedance probability event:*

- *there is no increase in flood risk elsewhere*
- *your development will be safe from surface water flooding*

Based on this guidance, Waterco have run a suite of simulations with climate change allowances of 20%, 25%, 30%, 35%, 40%, 45% and 50%.

4.3 Sewer Capacity Assessment

The following scenarios were modelled for each of the Torbay catchments, for each of the climate change scenarios above.

1. Impact of new foul flow only on existing sewerage network.
2. Impact of new foul flow plus an allowance for urban creep within new development areas.
3. Impact of new foul flow from development plus catchment wide urban creep and increased rainfall due to climate change.

Scenario 1 is considered to be unrealistic as it ignores both urban creep and the impact of climate change. For this scenario to be valid, extremely robust policies (with similarly robust enforcement) would need to be in place across Torbay to ensure no urban creep takes place and that climate change mitigation is installed across the entire catchment. Retro-fitting sufficient climate change mitigation to the existing infrastructure is likely to be challenging.

Scenario 2 allows for urban creep at the rate of $0.5m^2$ per property in the new developments only. This creep figure has been chosen for consistency with the AECOM report. No allowances have been made for non-residential development. This scenario is again considered to be unrealistically optimistic as it ignores urban creep for existing properties and also ignores the effects of climate change.

Scenario 3 allows for urban creep across the whole catchment, using $0.5m^2$ per property in new development and using the SWW urban creep spreadsheet for the existing system. The SWW urban creep spreadsheet allocates creep based on property density, with figures ranging from 0.629 to 0.03 m^2/house/year. Where the subcatchment percentage impermeability is over 80% the spreadsheet assumes no creep takes place – the effect of this in Torbay is that although the raw average creep is approx. 2.5% over 20 years, the applied average creep is 1% to the existing system.

4.4 2040 Model Outputs

The findings are presented using summer rainfall events of 120-minute duration and various return periods. The 30-year 120-minute duration (M30-120S) design event gives a reasonable illustration of the potential detriment in Torbay due to development, creep and climate change. The results do not necessarily show the worst-case flooding at all locations.

Sewers have been identified as being at risk from development flows when the following scenarios are exceeded;

- When a worsening of sewer flooding is predicted by the model when compared with the present day situation.
- When water levels are predicted to reach a critical level. For this assessment, the critical level has been taken as 0.5m below the manhole cover. This is the point where water level may impact upon

low lying property by causing flooding or restricted sewer use. It should be noted that the results have been generated from a relatively extreme rainfall event and must be viewed as an indicator of modelled performance, rather than of the likelihood of actual sewer flooding occurring.

Figures 5 to 9 illustrate the relative impact of development flows (at an assumed growth rate of 300 dwellings per annum) upon the catchment performance within the strategic sewer network for the M30-120S design event. As discussed within the body of this report, the hydraulic model predicts that:

- For the additional development foul flows only, there is very little detriment.
- For the additional development foul flows plus creep in the new development only, detriment is increased however is still minor.
- For the additional development foul flows plus creep across the entire catchment, detriment is significant in Paignton and Brixham.
- For the additional development foul flows plus creep across the entire catchment in conjunction with 50% climate change allowance, detriment is significant in the entire Torbay area.

Individual developments will require further evaluation to understand local constraints, to identify suitable connection points and to understand the effects of local topography on drainage solutions. Where local issues are identified, developer contributions may be sought to overcome these via local sewer improvement schemes. The use of planning conditions should also be considered to ensure the sewerage network is not overloaded before alterations can be made.

Annual time series simulations have been carried out to assess the effect of development, creep and climate change on the CSO spill regime. Taking the Fleet Walk CSOs as an example, climate change is the main factor affecting spills. There is an approximately 10% increase in spill volume at these CSOs between present day and the 2040 design horizon (using the SWW 2050 rainfall). This is increased by an additional 1% when the development and catchment-wide creep is added.

The hydraulic model has been run for various combinations of tide curves to determine whether predicted sea level rise has an effect on predicted flooding detriment within the catchment. Figure 8 shows additional predicted detriment when compared to figure 7, which is the same comparison without tidal climate change. It can be seen that additional detriment is predicted in low lying areas near the CSO outfalls. Note, these model runs only consider detriment caused by tide-locking of the outfalls. Wave overtopping of the sea defences, which may lead to more water in the combined sewer system, has not been considered for this study however could be significant.

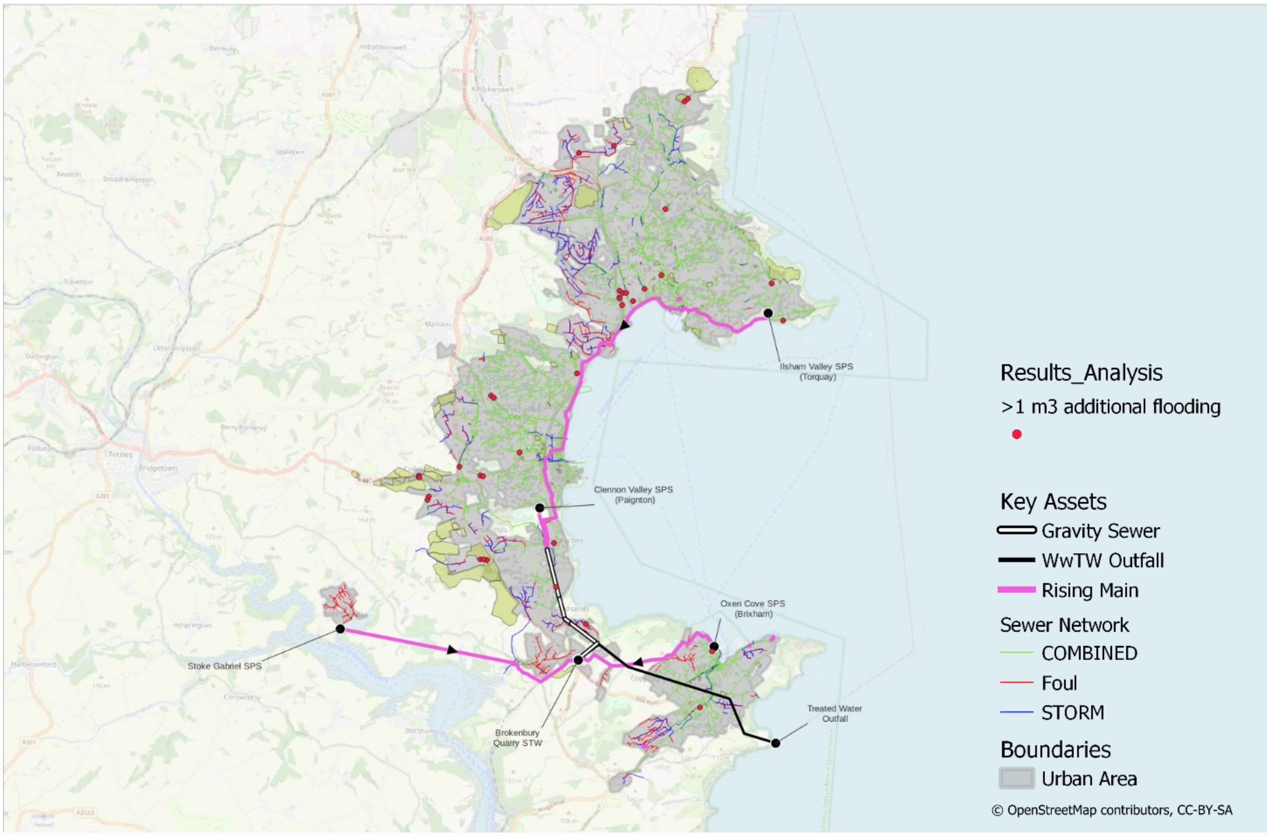

Figure 5 2040 Design Horizon – Flooding detriment due to development foul flows only (Scenario 1)

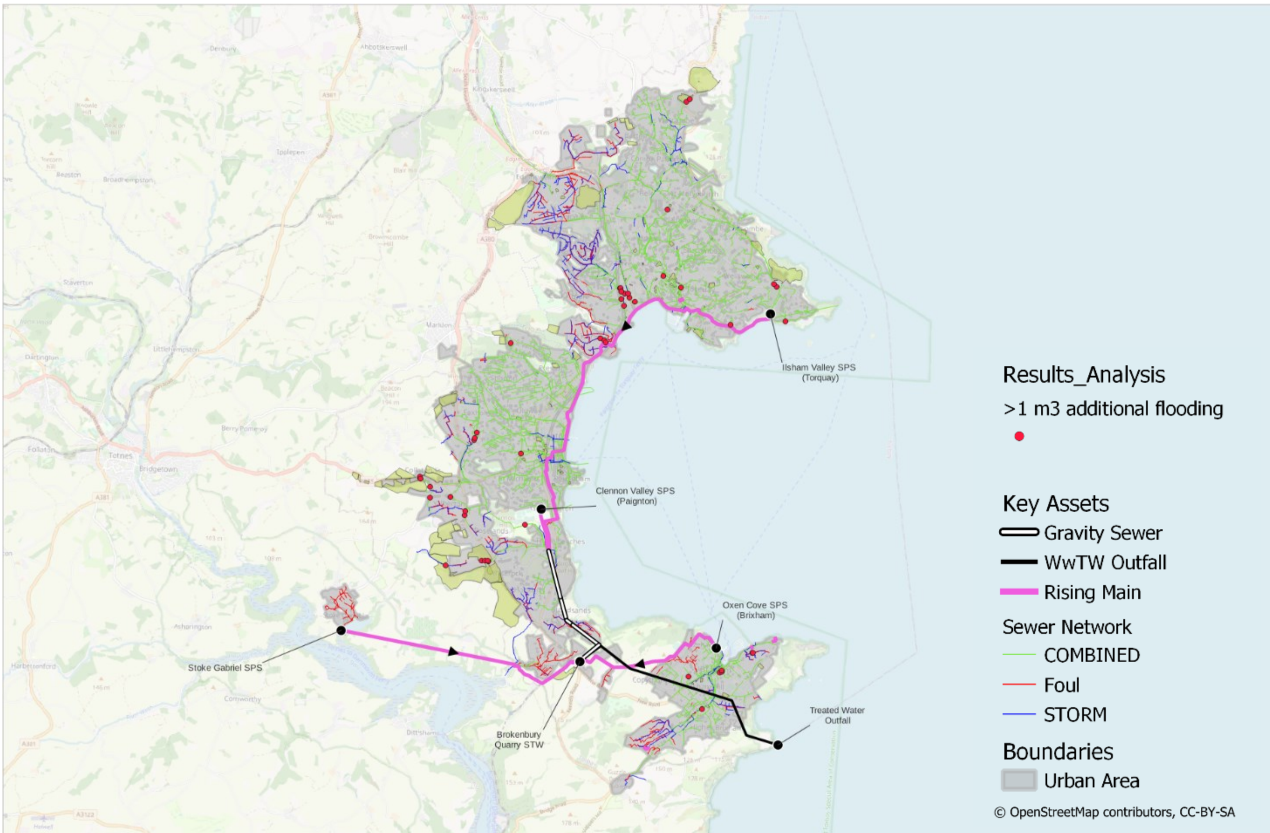

Figure 6 2040 Design Horizon – Flooding detriment due to development foul flows and new development creep only (Scenario 2)

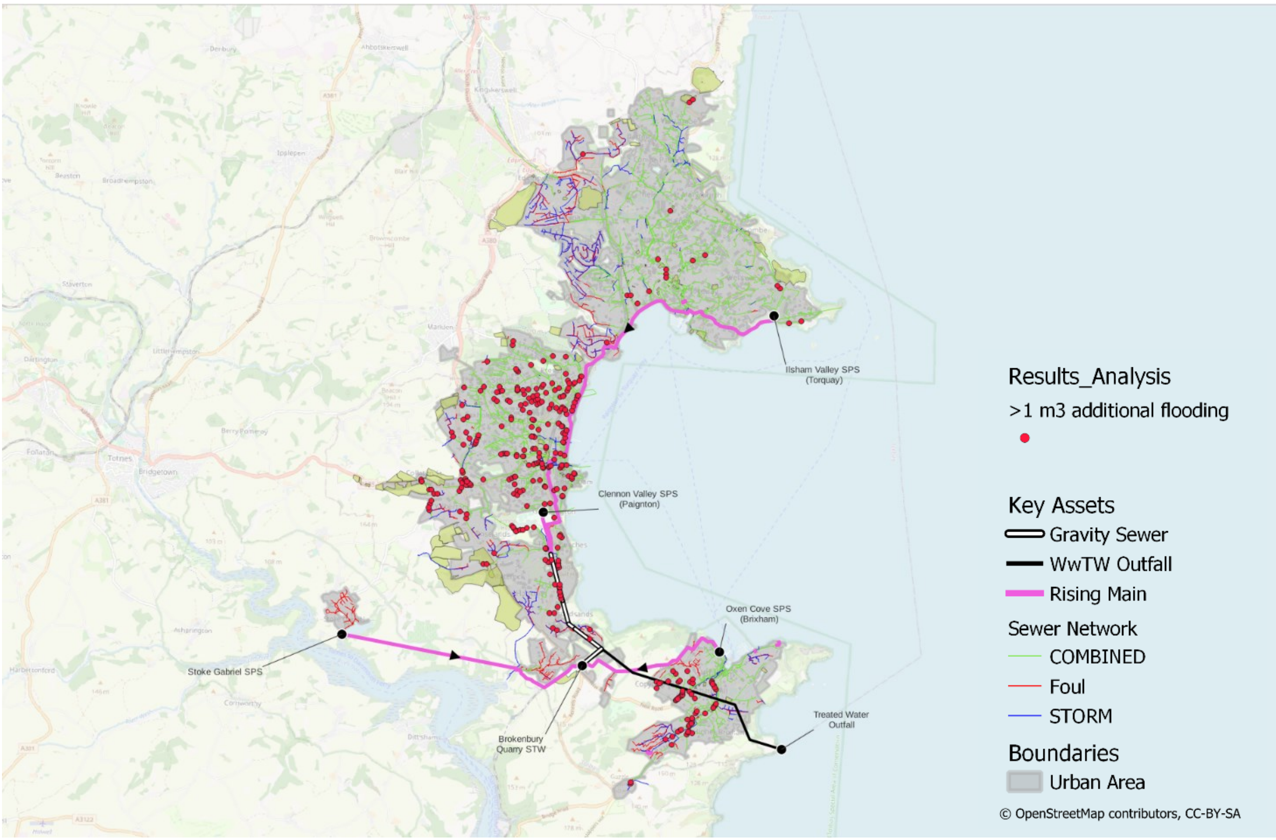

Figure 7 2040 Design Horizon – Flooding detriment due to development foul flows and creep across the whole catchment (Scenario 3)

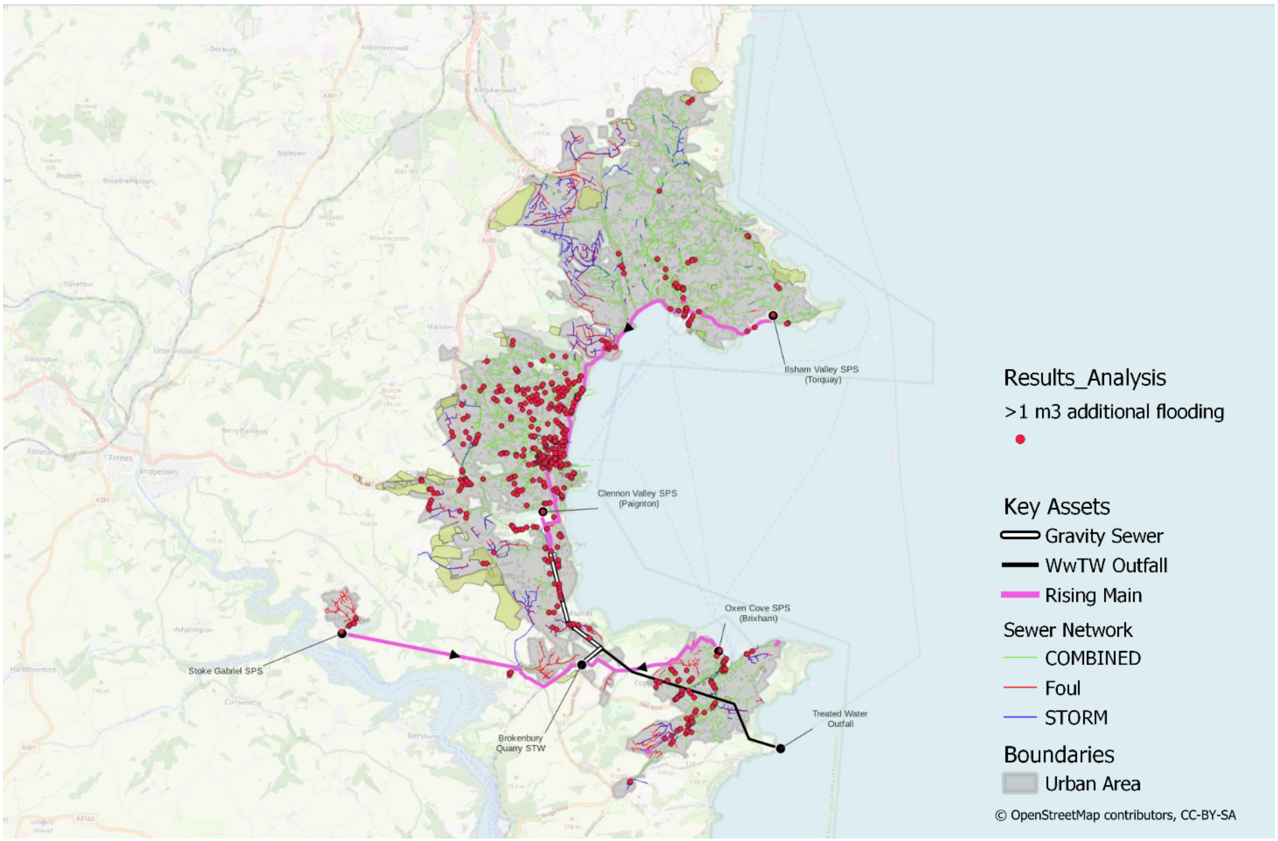

Figure 8 2040 Design Horizon – Flooding detriment due to development foul flows and creep across the whole catchment in conjunction with increase in sea level for the 0.5% AEP (200 year) tide event

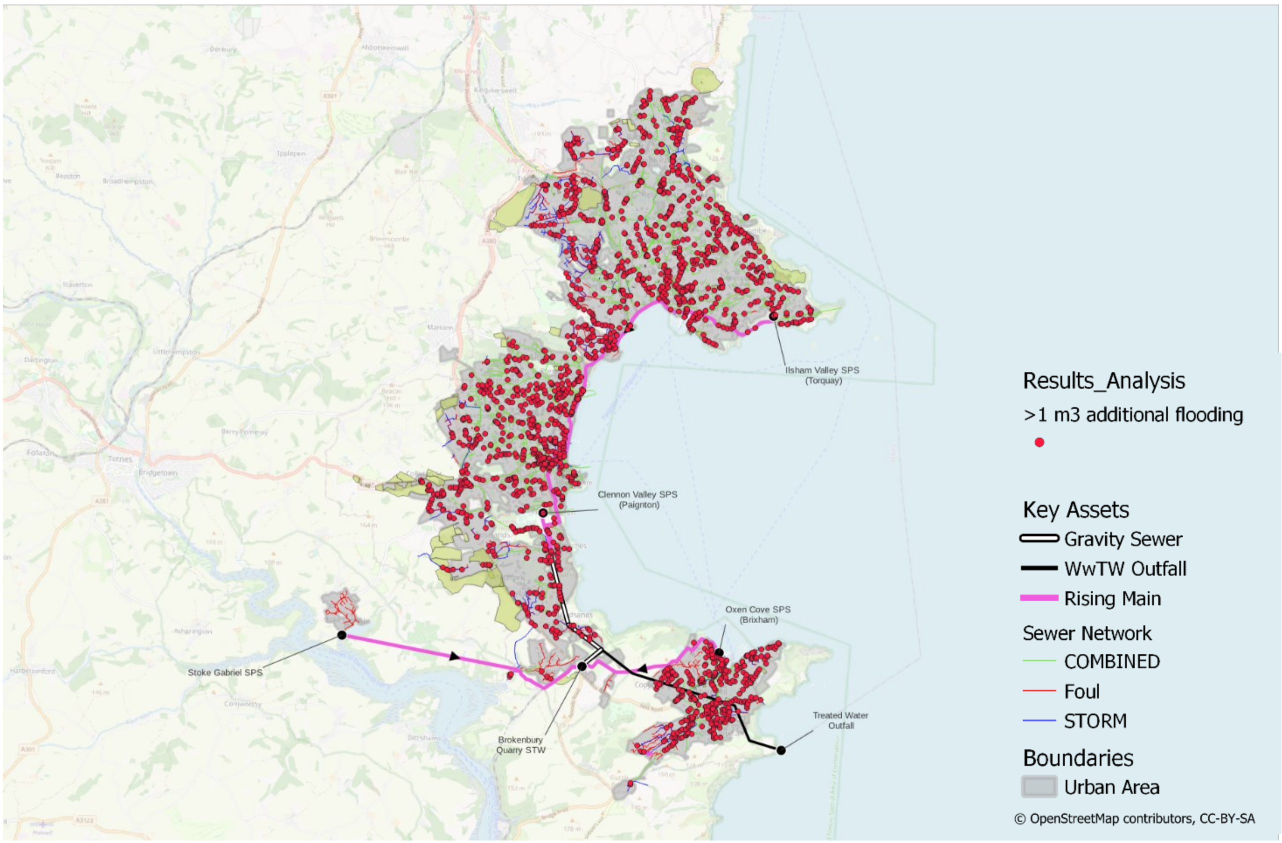

Figure 9 2040 Design Horizon – Flooding detriment due to development foul flows, creep across the whole catchment and 50% climate change allowance

5 Conclusions

For foul only flows the effect of predicted increase in population is approximately balanced by predicted decrease in water consumption in the period to the design horizon provided development is limited to the proposed local plan figure of 300 new dwellings per annum. Significantly more development (for example meeting the government's Standard Methodology target of 600 dwellings per annum) will lead to detriment in the strategic sewer network. Strategic sewers are the core sewer network, through which the majority of flow will pass. The outlying sewer network will have been designed for a specific local area and as such will not necessarily have sufficient spare capacity to take additional development.

Notwithstanding the above, there are substantial challenges in ensuring the Torbay sewer network can accommodate proposed development, urban creep, and climate change up to the 2040 design horizon whilst maintaining the current level of service. Robust policies need to be in place to:

- Ensure water efficiency measures reduce water consumption in line with predictions.
- Minimise urban creep and, where creep is identified, ensure mitigation is included as part of any planning or building control submissions.
- Ensure planning and development / regeneration policy mandates climate change mitigation, with the aim of removing or attenuating surface water before it enters the combined sewer system.

Waterco modelled a range of urban creep and climate change scenarios for multiple return periods to understand the effect of these parameters on the sewer network. Climate change guidance has been updated since the publication of the previous local plan, the effect of applying the updated guidance is to increase predicted spills at the CSOs within the catchment and to exacerbate existing flooding from the combined sewer system. Urban creep without suitable mitigation measures increases predicted detriment.

Possible mitigation measures are outlined in the AECOM report and are still valid therefore have not been updated for this report. These measures include:

- Ensuring runoff from new development does not enter the combined sewer network is essential.
  - Sustainable drainage of surface water using features such as rainwater harvesting and reuse, infiltration areas, soakaways, porous pavements, attenuation wetlands and tree pits.
- Separating surface water from existing assets and reducing water consumption.
  - Retrofitting water sensitive urban design, particularly when urban areas are being regenerated should be a high priority.
  - Community SuDS.
  - Improving water efficiency.

Appendix A – Figures 5 to 9