

## PRIORITISED INTERVENTIONS ON SEWER NETWORKS

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### Introduction

As an appointed Sewer Management Plan (SMP) consultant for Severn Trent Water, Pick Everard is responsible for the management of a number of SMP catchments ensuring they meet and retain a 'live' status. This has been achieved through the build and maintenance of hydraulic models, capturing and prioritising risks within these catchments, development of intervention zones to group risks together in accordance with root cause and the establishment of a range of concept solutions for prioritised intervention zones.

The Snarrows SMP catchment is located in North West Leicestershire covering an area of 6,400 hectares and serving a population of approximately 44,000 people.

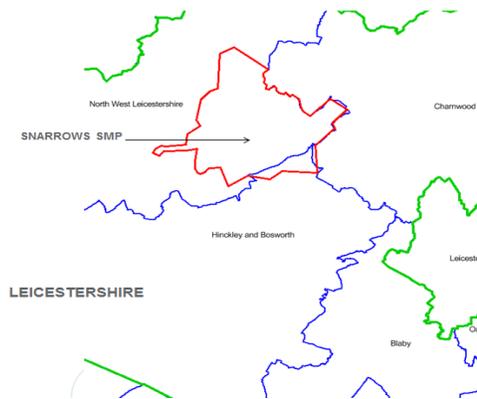


Figure 1: Location map of Snarrows



Figure 2: Location of Snarrows within the STW Region

The catchment contains a range of interlinked current and future risks that Pick Everard has developed into clearly defined intervention zones. The prioritisation and phasing of these interventions are paramount to the mitigation of existing and future network risks. The plan for Snarrows SMP is very much driven by and for Severn Trent's Customers, and has been achieved through collaborative working with a number of key stakeholders both internal and external.

This paper details the approach taken to achieve the catchment needs meeting Severn Trent Waters objectives to deliver the best value for its customers, whilst facing the challenge of increasing network performance pressure caused by growth, tightened environmental regulations and an increased and aging asset base, especially following adoption of private sewers and pumping stations.

The approach taken in the development and prioritisation of intervention zones in Snarrows has provided a number of key advantages including;

- A greater understanding of risks and common root cause
- A clear direction of investment need enabling stakeholder buy-in
- The development of time based interventions to ensure a long term strategy for the catchment.
- TOTEX savings through the development of a holistic plan rather than multiple short term temporary solutions

## Principles behind Catchment Planning

The catchment planning principles within Severn Trent Water have evolved throughout AMP5 as the business constantly challenges how to deliver and increase efficiency. This journey is expected to continue throughout AMP6 and beyond. The planning principles are currently supported by SRM5 and the Drainage Strategy Framework as shown in the figure below:



Figure 3: Drainage Strategy framework principles mapped to the drainage planning process (Halcrow, 2013)

Within Snarrows SMP these Drainage Strategy Framework principles have been applied as follows:

- Partnership - An approach to internal and external stakeholder engagement and a collaborative approach to delivery of the prioritised catchment strategies.
- Uncertainty – Identification of both model and data confidence to underpin the assessment of risk and development of intervention zones within the catchment. Also maximising our use of existing datasets and identifying data gaps at an early stage in the process.
- Risk based – Maintaining a live proactive approach to identifying the root cause of risk to enable optimised management of risk within the catchment.
- Whole Life Costs and Benefits – Throughout the process assessing and evaluating both the current and future costs as well as benefits of proposed solutions.
- Live process – Making the SMP live and maintaining the catchment as Live and Ready to respond to the business needs both now and in the future.
- Innovative and Sustainable – Utilisation of current industry best practice whilst developing innovative tools to assess current and future operational issues and costs within the catchment.

## CASE STUDY: SNARROWS SMP CATCHMENT PLAN

### Identifying Risk

Data relating to catchment risk was obtained by a number of methods including information provided directly by Severn Trent such as reported pollutions, flooding and operational issues. In addition risks were identified and captured through stakeholder engagement, site visits, external data sources (local authority planning portal), and predicated hydraulic model performance.

Risks were then mapped geographically on a GIS database and linked to a summary workbook.

Coloured polygons were then used to represent different types of risk with a zone. This assists the catchment planning process by identifying clusters and provisionally grouping risks at a catchment wide level. The following types of risk groups were used;

- Asset Condition
- Health and Safety
- Pollution
- Service Condition and Operation
- Sewer Flooding
- Structural Condition
- Review Consents

Risks were kept live through regular review with stakeholders and includes information on the date captured, review date, associated capital schemes and a risk status, 'Live' or 'Closed'.

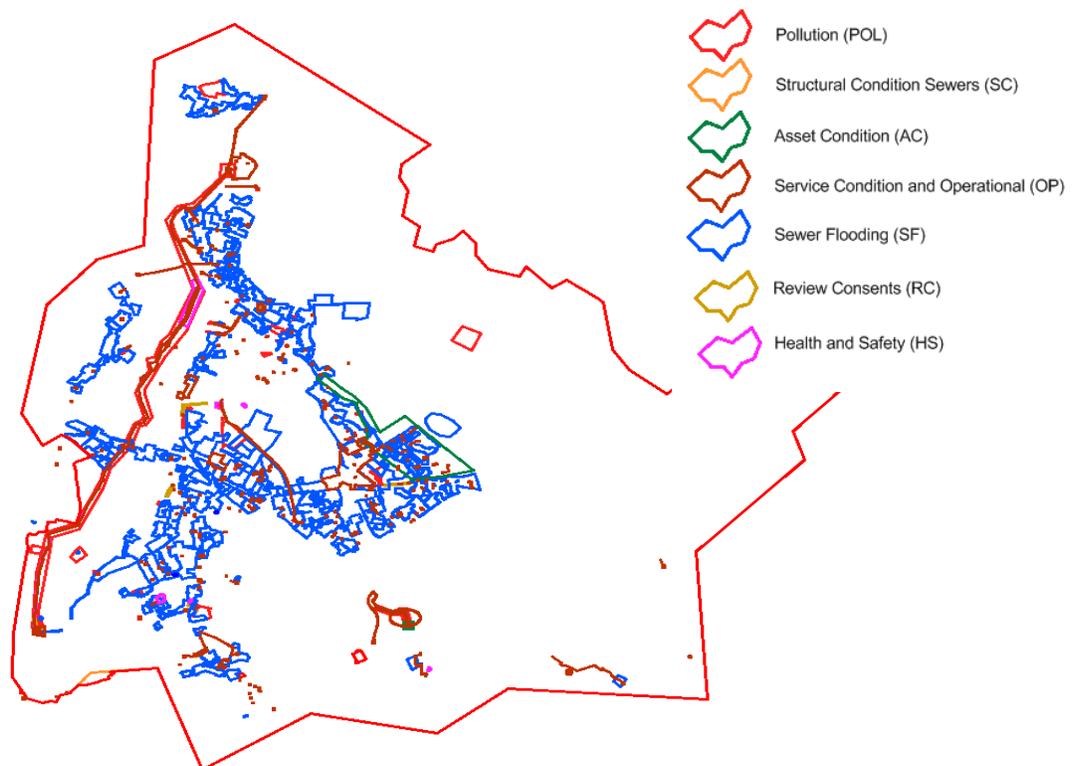


Figure 4: Map of Live Risks within Snarrows SMP

## Root Cause Analysis

The grouping of risks required an understanding of root cause such that risks with a shared or common root cause could be identified and linked where possible; this required a combination of hydraulic model assessment and analysis of captured risk data.

The root causes associated with the catchment risks were recorded within the risk workbook.

Root cause was categorised as follows:

- Change in standards (common causes)
- Change in standards (assignable causes)
- Inadequate design control
- Inadequate planning control
- Inadequate maintenance control
- Unknown real root cause

In general, flood risk within the Snarrows catchment is caused by an exceedance in design flow as a result of inadequate planning control. This has resulted in the predominantly combined system becoming overwhelmed carrying both design flows and additional flows due to catchment creep and recent development sites.

## Intervention Zones

Risks identified with a common root cause were linked together into intervention zones. These intervention zones were either single risk type (e.g. Structural condition, flooding etc.) or multiple risk types.

Intervention zones were then captured both geospatially and within a workbook. The workbook provides links to all associated risks within that zone.

Each intervention zone is classified as having one of four statuses, namely, Watching, Investigating, Non-Promoted and Promoted. These statuses are regularly reviewed and updated and also will have different statuses dependant on time frame (e.g. If we are currently investigating this AMP, then by next AMP it is expected the problem is understood and a concept solution developed, therefore making the status either Non-Promoted or Promoted, dependent on the prioritisation of catchment needs.

## Priority Intervention Zones

Intervention Zones are regularly reviewed and prioritised in line with Severn Trent Water performance targets. As further information and greater confidence in risk is known the intervention will change and the need reassessed.

Existing capacity issues across Snarrows SMP resulted in Growth becoming the priority intervention zone. Understanding the extent and time frame of proposed growth in the catchment was imperative to establishing the scope of the intervention zone and identifying additional associated risks that would need to be considered when developing a concept solution. Stakeholder engagement both internally with Severn Trent and externally with Developers and the Environment Agency facilitated this process. The extent of growth is illustrated in figure 5.

The other prioritised intervention zones, whilst are independent schemes (such as infiltration removal and CSO optimisation), also interrelate with the Growth Strategy, as they help provide additional capacity in the system and improve network performance. As such, even when intervention zones are concept solutions are developed, it is key that catchment planners take a holistic view of their catchment ensure the most appropriate phasing of capital schemes.

With known drivers in the area, and additional risks associated with the terminal pumping station downstream, we undertook further investigation to understand the extent and time frame of the growth. As a result of our findings, the area around the SE Coalville development became one of our prioritised intervention zones. This area included a section from the proposed development to Kelham Bridge Terminal Pumping station.

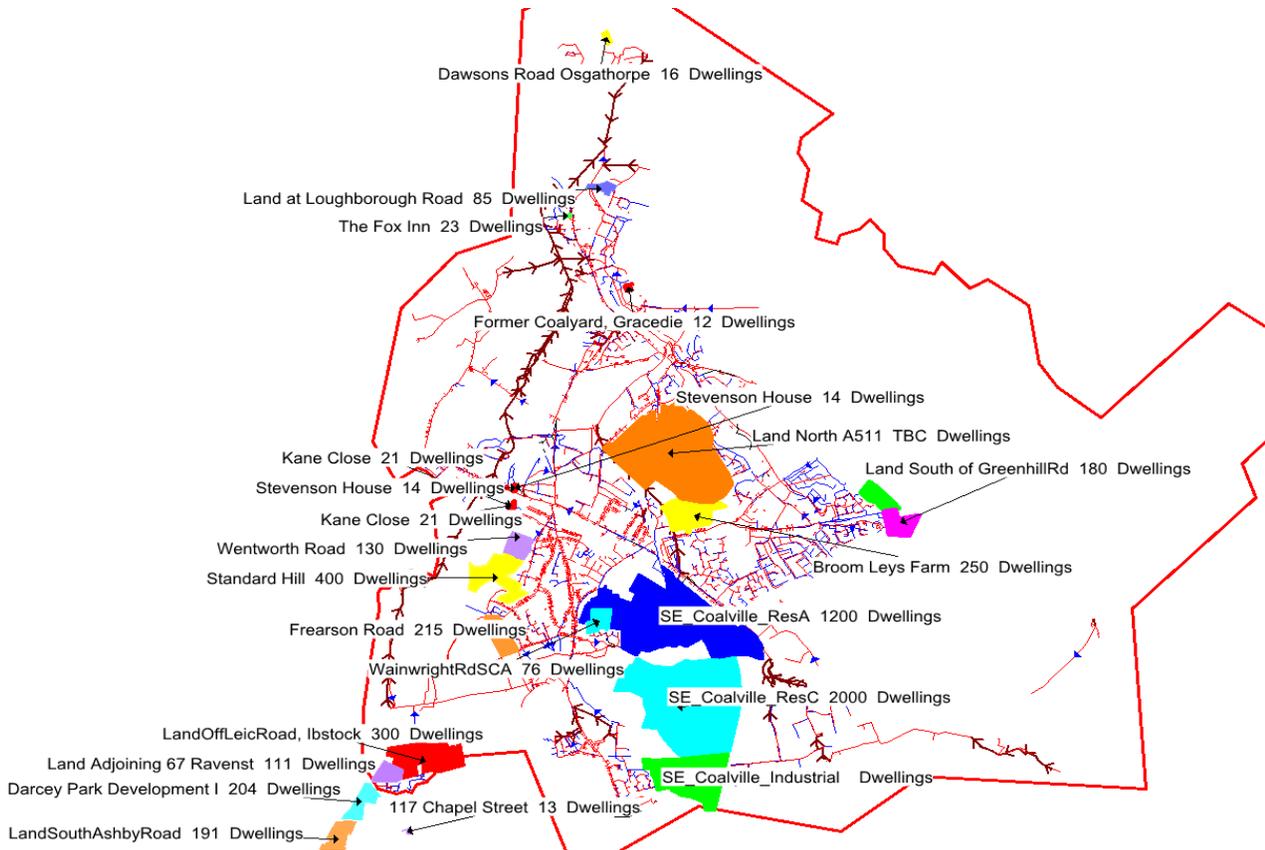


Figure 5: Map of Proposed Growth in Snarrows SMP

Analysis of flow survey data identified the presence of infiltration within the sewer network. With limited headroom within the sewer network further investigation was undertaken to identify areas of catchment sensitive to slow response infiltration. Figure 6 and 7 highlights the outcome of these findings.

Areas observed with a high degree of slow response were then compared to risks captured in the catchment, reported flooding, CSO performance and proposed growth. This resulted in the promotion of a sewer rehabilitation scheme upstream of the Meadow Lane area (Land North A511) prioritised and promoted during AMP5.

Multiple flooding drivers in the Thringstone and Whitwick Area situated downstream of Meadow Lane catchment were combined to form another intervention zone as the benefits of infiltration removal is linked to the promoted AMP6 flood alleviation scheme in this area.

An additional intervention zone was identified covering the Snibstone and Donington Le Heath catchments. Here surface water removal opportunities were identified. Together with targeted sewer rehabilitation the proposed intervention will contribute to network capacity and enable growth whilst improving current performance at Kelham Bridge TPS.

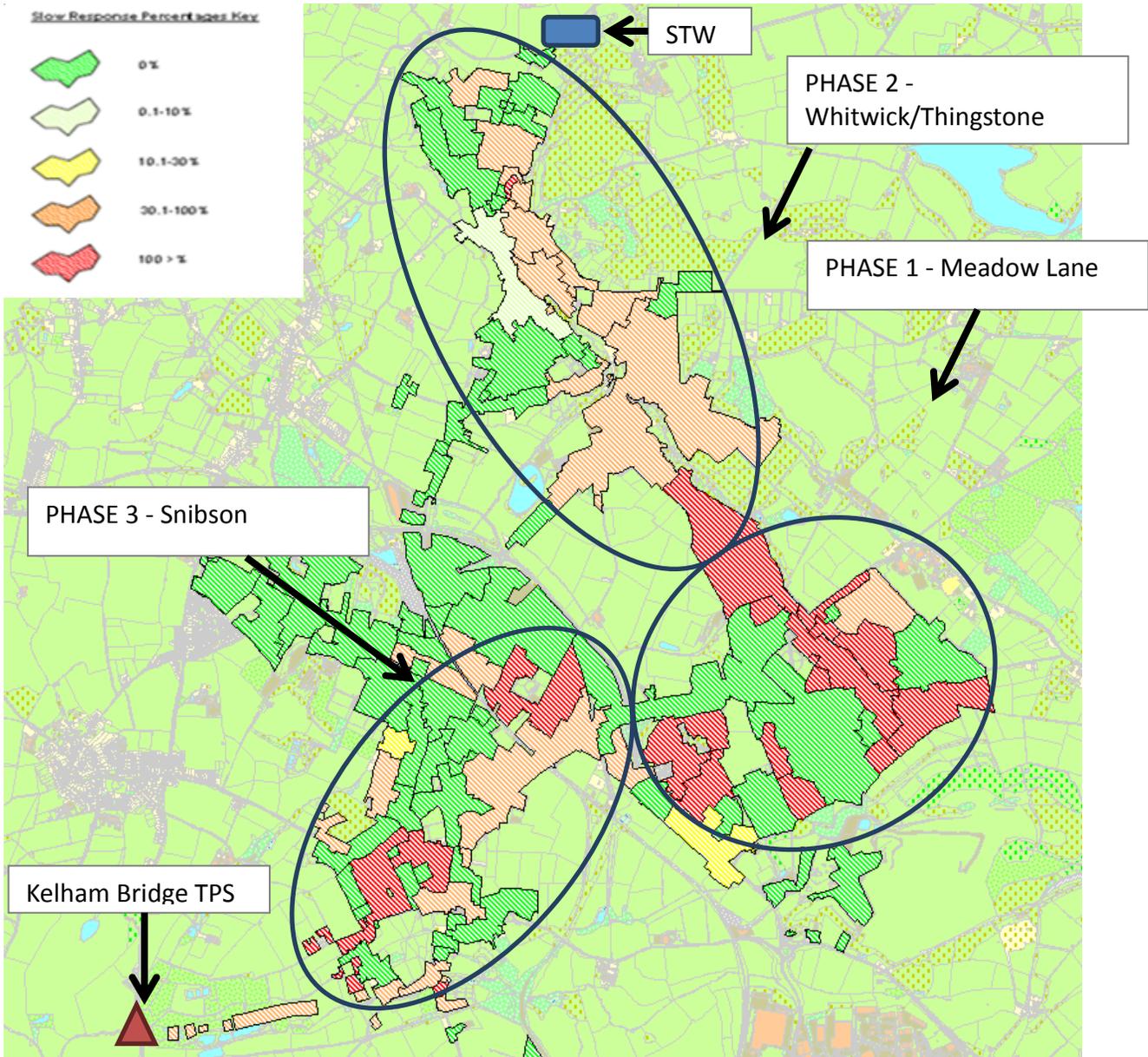


Figure 6: Slow Response Results for Snarrows

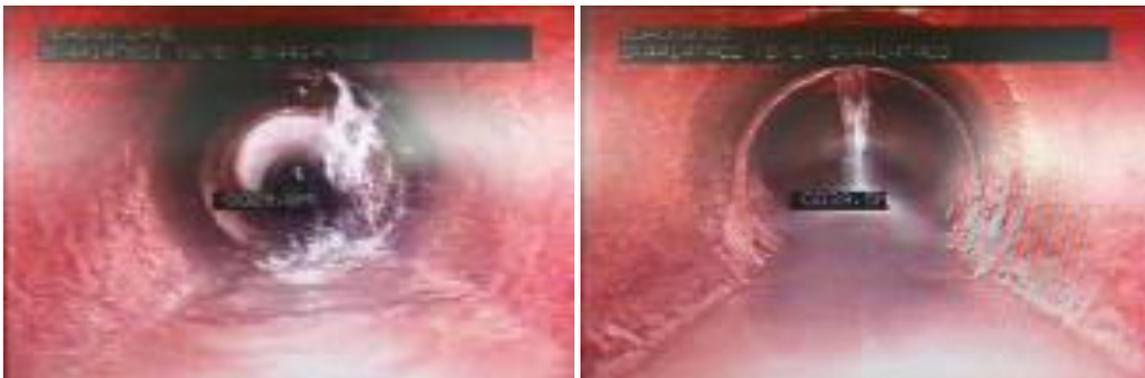


Figure 7: CCTV Photos providing an example of observed infiltration

## Concept Strategies

Six intervention zones were identified and prioritised for the Snarrows SMP, concept strategies were developed for these as follows.

- South East Coalville Growth
- Phase 1 Infiltration Removal at Meadow Lane
- CSO optimisation
- Drome Close/Greenhill Road Flooding
- Phase 2 Infiltration Removal in Whitwick/Thringstone
- Phase 3 Infiltration Removal in Snibson

The promotion of capital investment for these intervention zones is dependent on business drivers and whilst strategies are developed, the interventions zones will be at different statuses (Watching, Investigating, Non Promoted, and Promoted) during different time frames.

### Phases 1 - 3 Infiltration removal

These prioritised intervention zones were identified as described previously and a concept strategy for each zone developed. The phased implementation and its trigger for each zone is described in the table below:

Phase	Triggers	Benefits Delivered	Status
1 – Meadow Lane	Growth, flooding drivers	Increased capacity and reduced risk of flooding	Promoted and completed in AMP5
2 – Whitwick / Thringstone	Flooding drivers	Reduced risk of flooding	Non promoted ready for promotion in AMP6
3 - Snibson	Growth	Increased capacity and reduced operational costs	Investigating ready for assessment in AMP7

### South East Coalville Growth

A concept strategy has been developed and optimised during AMP5 to enable the delivery of over 3,200 dwellings which is scheduled for construction during AMP6. Three main strategies were developed, cost and a phase build plan across future AMPs developed with key trigger points identified. The concept strategy agreed with the various internal and external stakeholders is shown in the figure below:

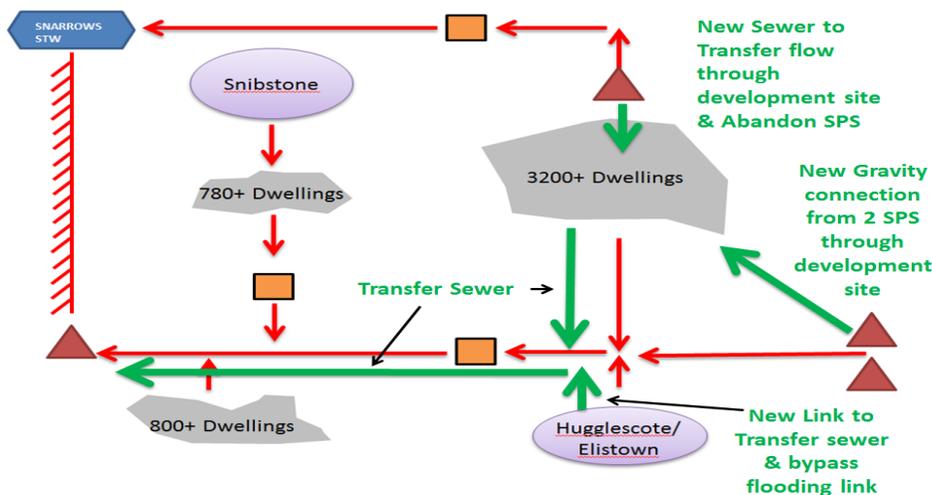


Figure 8: Schematic of Snarrows Growth Concept Strategy

In a similar approach to the Infiltration Removal concept strategy it has been necessary to phase improvements to ensure best value to the customer, as the economy changes and development may or may not progress, money will not be wasted. The current phasing is shown in the table below:

Phase	Triggers	Benefits Delivered	Status
1 – Initial transfer sewer	Growth, flooding drivers, overflow performance	Increased capacity and reduced risk of flooding and pollution	Promoted in AMP5 and due for completion in AMP6
2 – Transfer sewer to Kelham Bridge SPS	Phase 2 of development	Reduced risk of flooding	Investigating ready for promotion in AMP6
3 – Connection through development site and abandonment of existing SPS's	Phase 3 of development	Increased capacity and reduced operational costs	Investigating ready for assessment in AMP7

Each phase has been developed to incorporate both changes in growth and also to draw in additional benefits into the scheme which will result in an overall improvement to sewerage system performance

Once all three phases of the strategy have been implemented the overall number of assets within the catchment will be reduced, reducing total expenditure (TOTEX) within Snarrows SMP. The anticipated sewerage system arrangement is shown in the figure 9 below:

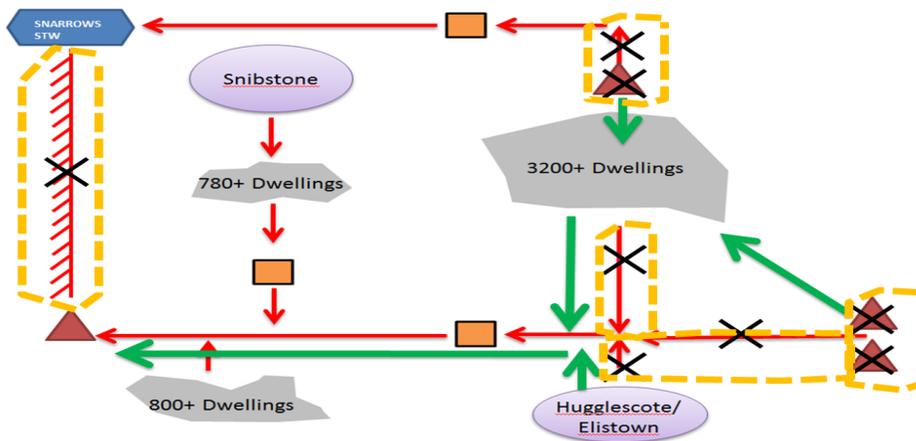


Figure 9: Schematic of Snarrows Growth Concept Strategy

### CSO Optimisation strategy

In this concept strategy it was identified that there are five CSO's discharging to a single watercourse where performance could be optimised. The telemetry data collected at each CSO will be regularly reviewed and interventions prioritised should triggers occur such as changes in environmental standards and increases in OPEX.

### Conclusion

The benefit of using a prioritised intervention zones approach and a holistic view to catchment planning of the Snarrows SMP catchment is summarised as follows;

- Greater clarity over risks and root causes in the catchment
- A clear vision as to the future of the catchment
- Development of an achievable, phased, time based strategy for the catchment that meets current and future need
- TOTEX savings – through identifying the removal of three pumping stations

### References

Halcrow (2013), Drainage Strategy Framework 7 – For water and sewerage companies to prepare Drainage Strategies, Good practice guidance commissioned by the Environment Agency and Ofwat