# Sutton PS Drainage Area Plan

## DAP Stage 1 Report

28th February 2018

rpsgroup.com/ireland

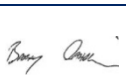
# Sutton PS Drainage Area Plan (DAP)

# Stage 1 Report

# Document Control Sheet

| | |
|---|---|
| Client: | Irish Water |
| Project Title: | Sutton PS Drainage Area Plan |
| Document Title: | Stage 1 Report |
| Document No: | MDW0793RP0001F01 |

| | | | |
|---|---|---|---|
| Text Pages: | 69 | Appendices: | 10 |

| Rev. | Status | Date | Author(s) | | Reviewed By | | Approved By | |
|---|---|---|---|---|---|---|---|---|
| A01 | For Approval | 30th January 2018 | MF |  | SPH |  | BC |  |
| F01 | Final | 20th February 2018 | MF |  | SPH |  | BC |  |

# TABLE OF CONTENTS

# LIST OF FIGURES

# LIST OF TABLES



# APPENDICES

# 1 INTRODUCTION

## 1.1 PROJECT APPOINTMENT

RPS Consulting Engineers Ltd was appointed by Ervia for the Provision of Engineering/Technical Consultancy Services for the Sutton PS Drainage Area Plan (tender reference 12/085-278) in October 2017. RPS formally commenced work on the project following receipt of the initial data manual from Irish Water on the 28th November 2017.

The key objectives of this project are to:

(1) Review and supplement the present wastewater asset and survey database of the Sutton PS DAP area with asset and validated survey data, rendering it suitable for organisation-wide use on the Irish Water GIS;

(2) Build a current (2017) development status wastewater network hydraulic model for the study boundary;

- The extents of all areas newly built and verified using up-to-date survey data shall be undertaken in accordance with Irish Water's Wastewater Network Model Build and Verification Standard with reporting that clearly indicates model build data and verification confidence levels;
- The wastewater network hydraulic model shall be built to sufficient detail and verified to sufficient confidence levels, in particular in areas of known regular deficiencies, to enable its use as an appropriate analysis and design tool at DAP Stage 3 and Stage 4;

(3) Assess known and predicted risk (including the risk categories of hydraulic, environmental, structural, service/operational and other significant risks), followed by the identification of needs in accordance with Irish Water's Wastewater Network Risk Assessment and Needs Identification Standard. This will facilitate the evaluation of solutions and the development of options to sufficiently cater for present and future needs with regard to hydraulic, structural, environmental, planning, legal policy, climate change and operational issues and constraints;

(4) Analyse the network capacity availability in the Sutton PS DAP area and the quantification of the extent of additional development that could connect to the existing network, without adverse risk (including hydraulic, environmental, structural and operational). This analysis will be carried out for the 'Current Design', 'Short Term Future Design' and 'Strategic Future Design' development scenarios (refer DAP Stage 3 Standard). The development and assessment of feasible options (including modifications to the existing network if required) will follow, producing conceptual design solutions, to provide adequate wastewater infrastructure for each development scenario epoch;

(5) Fulfilment of all the requirements contained within the Terms of Reference.

- Stage 1: Data Collection followed by Study and Survey Scoping
- Stage 2: Surveys and Hydraulic Model Build and Verification
- Stage 3: Risk Assessment and Needs Identification

- Stage 4: Strategy, Optioneering and Future Solutions Design

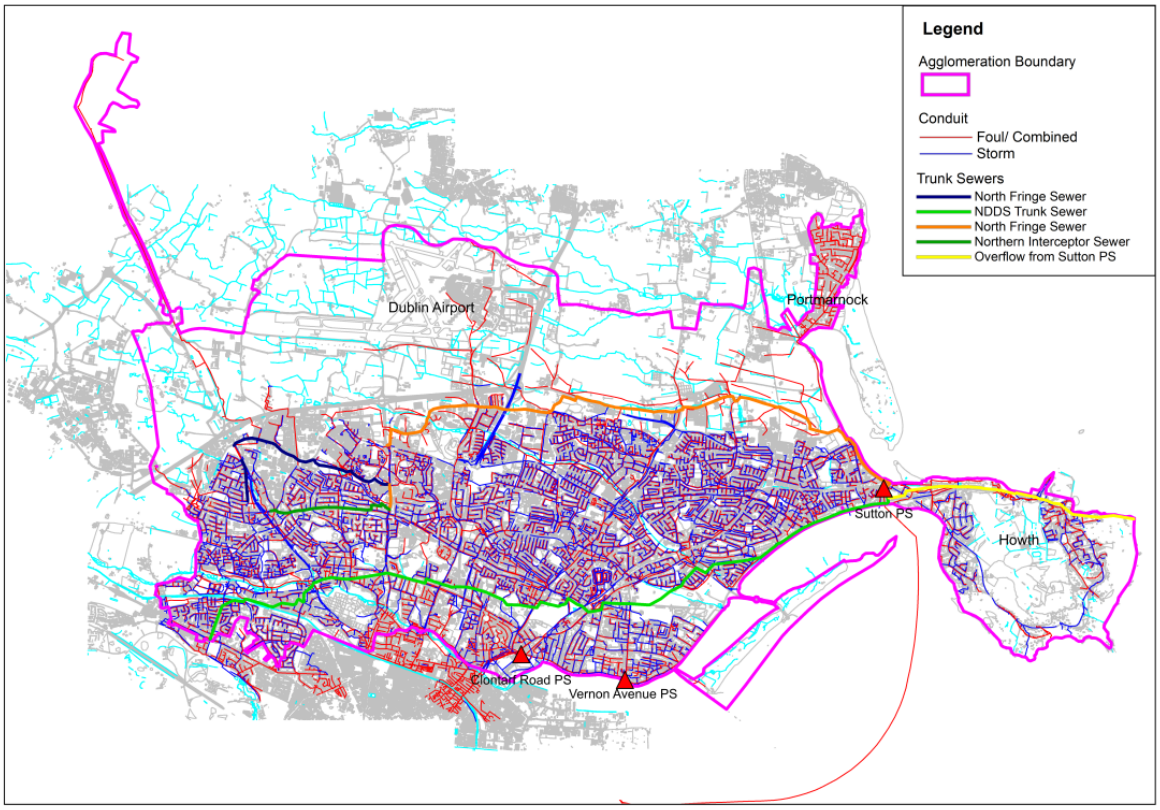
This **Stage 1 Report** outlines the work carried out as part of the DAP Stage 1 for the Sutton PS DAP Study Boundary, i.e. Data Collection and Scoping, in accordance with Irish Water's *Wastewater Network Data Collection and Scoping Standard* (Document Number IW-TEC-100-008, Rev 1.1). The main objective of this Stage is to collate and review all available historical information within the Sutton PS DAP Study Boundary. This will ensure that all known catchment risks can be identified, and data collection prioritised to ensure sufficient confidence in the hydraulic model to be created in Stage 2.

# 2 DEFINITION OF STUDY ENVELOPE

## 2.1 STUDY AREA DESCRIPTION

Pumped flows from Sutton PS represent one of four wastewater streams entering Ringsend WWTP – the others being Main Lift Pumping Station, Dodder Valley Sewer and West Pier Dun Laoghaire. The catchment for this study the area of North Dublin City that is drained by two large trunk sewers, known as the NDDS (North Dublin Drainage Scheme) and the NFS (North Fringe Sewer). Both sewers run in an easterly direction and serve lands from Finglas to the west, the River Tolka to the south and Dublin Airport and Portmarnock to the north.

**Figure 2-1 Sutton PS DAP Study Area**




The NDDS trunk sewer was constructed in the 1950s and originally discharged directly to the Irish Sea off the coast at Howth. Since the construction of the Dublin Bay Submarine Pipeline, linking Sutton Pump station to Ringsend WWTP, the NDDS trunk sewer terminates at the Sutton Pumping Station. The remaining section of the original NDDS trunk sewer now acts as an overflow for Sutton Pumping Station.

Arising from the recommendations of an MCOS Study in 1994, the NFS was constructed in the early 2000's and runs largely parallel but further north to the NDDS. It was designed to serve both developed lands and a significant quantity of future development. It also serves a number of areas that were originally drained to the NDDS via the Northern Interceptor Sewer. The NFS also terminates at Sutton Pumping Station. The collection network to the east of Sutton Pumping Station (predominately the suburbs of Howth and Sutton) originally drained to the NDDS trunk sewer. This

area was re-directed via new pipework and pumping stations – constructed as part of 'Contract 5' - to now drain to Sutton Pumping Station.

The catchment contains approximately 610km of surface water sewers including over 13,000 manholes. Approximately 75% of the surface water network within the InfoNet database has been surveyed in the last 25 years. The ToR specifies that the network model build shall fully incorporate the surface water system, however the focus should be primarily on Irish Water's wastewater system and therefore the focus of this report, the surveys and the modelling has been on the foul/combined system.

The catchment in general slopes from west to east with elevations from over 70 mOD in the west of the catchment to sea level in the east. The NDDS sewer drains by gravity to the Sutton Pumping Station however there are a number of sub-catchments served by this sewer that are pumped to the NDDS sewer (including Clontarf Road PS and Vernon Avenue PS). The North Fringe Sewer drains by gravity to Sutton PS after receiving pumped flows from Ballymun PS. Flows from Portmarnock and Baldoyle are pumped into the NFS. The areas contributing to both trunk sewers are for the most part served by both wastewater and surface water systems, however there are considerable areas that would be classified as 'part-separate', particularly in the older areas contributing to the NDDS. Even the newer NFS areas are believed to generate significant rainfall response in flows.

The DAP Study Boundary covers areas to the north of Dublin city, that are within the Fingal Local Authority and Dublin City Council boundaries. The catchment currently serves a population of over 270,000 as well as large industrial/non-domestic development. The population of the Sutton PS Study Boundary (as defined by the Central Statistics Office settlement boundaries and not the Study boundary) has increased during the most recent inter-census interval, with a population of 278,537 recorded in 2016, up by 5% from the 2011 result of 264,614.

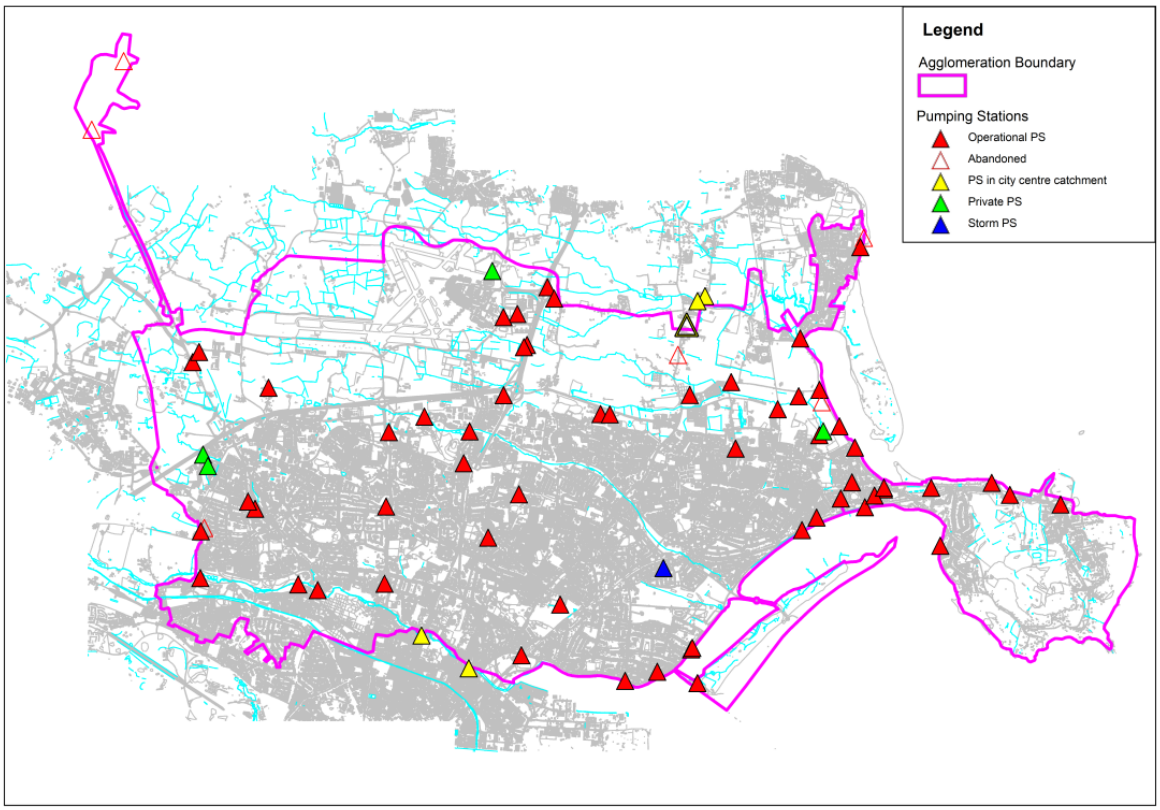
### 2.1.1 Critical Infrastructure

#### 2.1.1.1 Pumping Stations

The ToR identified a total of 40 pumping stations within the Sutton PS DAP Study Boundary. The largest pump stations include Sutton PS, Clontarf PS and Ballymun PS.

In total, there is a record of 74 pumping stations within the Sutton PS DAP Study Boundary, of which 67 are operational and seven have been decommissioned. The pumping stations within the Study boundary are shown on Figure 2-2: Five of the pumping stations lie outside of the study boundary and will not be included in the analysis, giving a total of **69** pumping stations, of which **63** are operational in the Sutton PS Study Boundary.

**Figure 2-2 Sutton PS DAP Pumping Stations**




Details of all pumping stations, and any differences to the ToR, are in provided in Table 2.1 of Appendix D.

Discussions with Dublin City Council identified a number of pumping stations that require particular attention during the project. Please refer to the table in Appendix D.

Sources of information on the Pumping Stations in addition to the ToR quantity are as follows:

- Discussions with Dublin City and Fingal County Council identified 11 additional pumping stations to those outlined in the ToR, bringing the total number of pumping stations in the Study Boundary to 51.
- Following this an InfoNet database was supplied by Irish Water and a search for node type 'P' (Pumping Station) identified a further 17 additional pumping stations that have an impact upon the Study Boundary.
- Further consultations with Fingal County Council suggested an additional six pumping stations that were not identified within the above processes, with these being a mixture of abandoned, IW owned and private pumping stations. The majority of the additional pumping stations were located near Dublin Airport, Kinsealy and Baldoyle, where network data coverage is poor. Two pumping stations considered to be operational have now been confirmed as abandoned by the Fingal Operations team, as identified in Appendix D.
- The Stage 1 meeting identified that the pumping stations at Thornton Hall, R130 and Coolquay, next to the Newsagents on the corner had not been constructed.

Meetings with operations staff from Fingal County Council and Dublin City Council allowed for clarification of the pumping stations in terms of their locations and surrounding network issues. Since the development of the NFS and NDDS there have been some changes to the network and the way in which the pumping stations operate. The meetings with the operations staff ensured that any alterations to existing GIS data were highlighted at the onset of the project in order to understand the connectivity of the network and plan surveys accordingly.

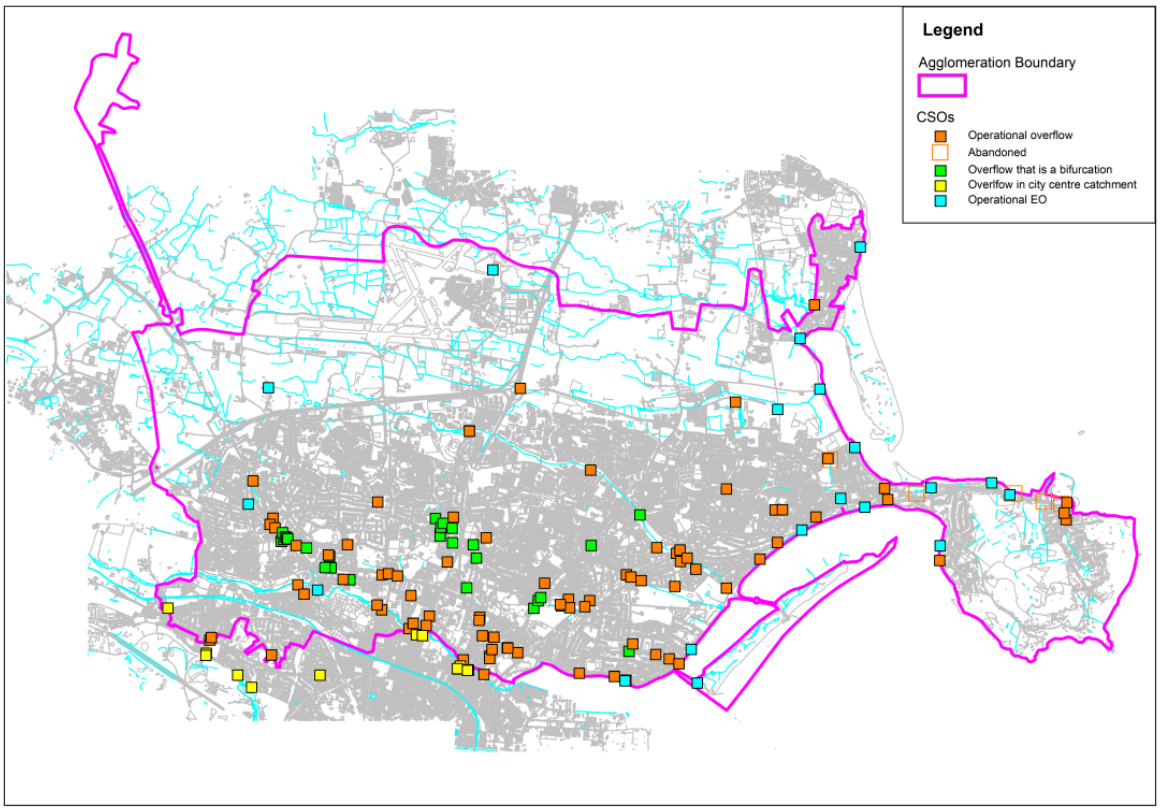
#### 2.1.1.2 Outfalls and Combined Sewer Overflows

The current Irish Water database contains over 80 outfalls connected to the wastewater network within the Study Area. This includes emergency overflows from pumping stations as well as CSOs. It is possible that there may be unrecorded CSOs particularly in older sections of the network.

A review of the InfoNet database identified an additional 75 manholes that had been coded up with 'V' (Overflow), although some of these are considered to be bifurcations that spill foul to foul, within the network.

In total the current database indicates **155 overflows** within the catchment of which 30 are considered to be foul to foul bifurcations, 118 are overflows on the network and a further seven overflows are considered to be abandoned. A further review of the network identified that 15 of the overflows were contained in the City Centre DAP. Please refer to table in Appendix D.

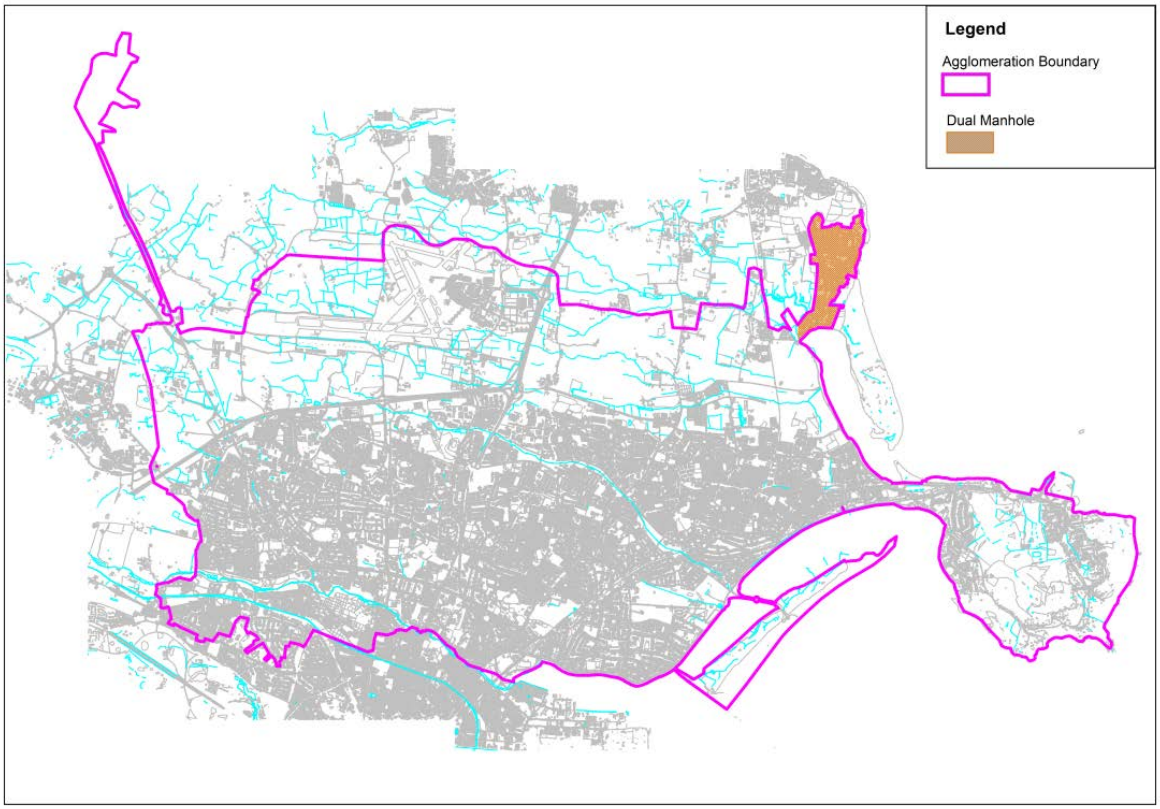
**Figure 2-3 Sutton PS DAP Overflows**



#### 2.1.1.3 Dual Manholes

It is reported that there are a number of dual manholes in the Portmarnock area shown in Figure 2-4 below; these manholes may permit surface waters to enter the foul system. The exact number and location of these dual manholes is currently unknown.

**Figure 2-4 Sutton PS DAP Dual Manholes**




#### 2.1.1.4 Siphons

There are two siphons on the NDDS trunk sewer, one in Finglas (twin 300mm & 600mm diameter siphons under the River Tolka) and a second in Killester (under Dublin-Belfast railway line). There is another siphon (525mm) recorded at Brookwood under the Dublin-Belfast railway line near Harmonstown Station. According to the ToR, it is also possible that there are other siphons in the smaller diameter network.

#### 2.1.1.5 Other Ancillaries

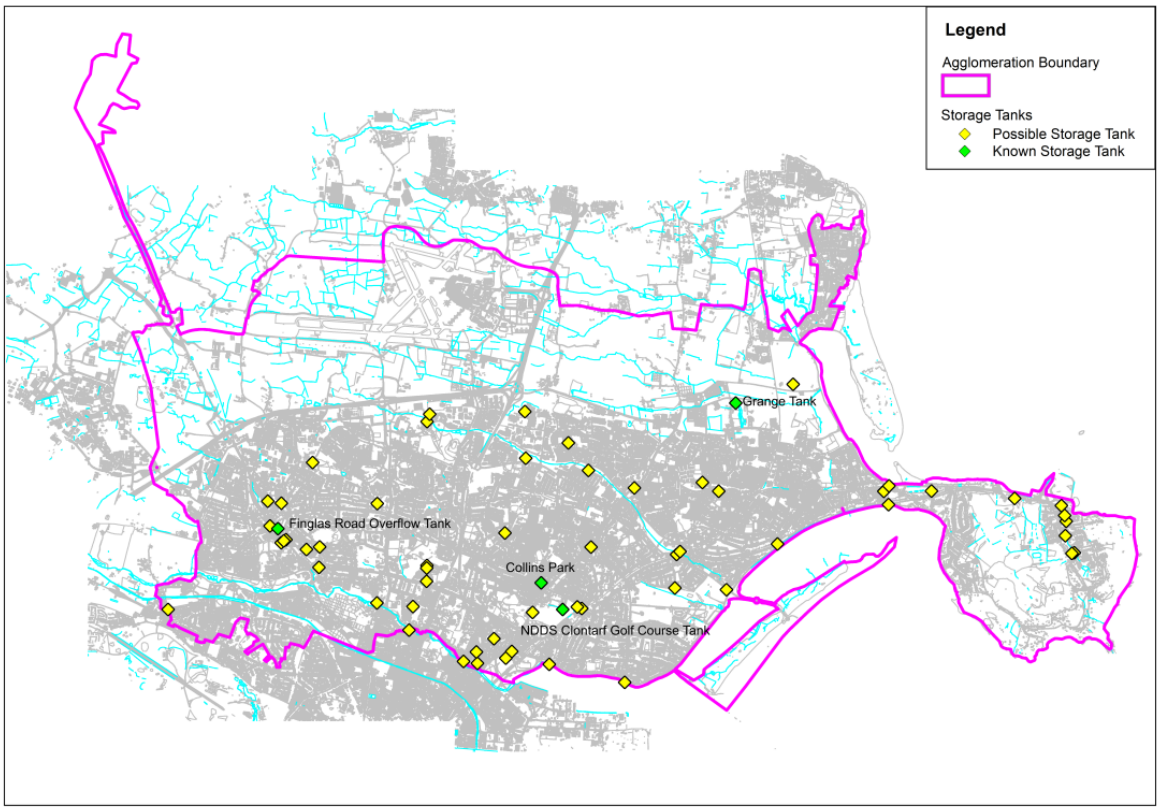
There are a number of flume chambers in the catchment (Clontarf GC, St Anne's Park, Santry) as well as a penstock valve house on the NDDS at Raheny. In addition, particularly in the older parts of the network, there are numerous bifurcations or flow split manholes.

### 2.1.1.6 Storage Tanks

There are a number of elements in the network designed for storage of wastewater with the ToR stating 87 nodes in the current hydraulic model noting chamber areas of greater than 5m$^2$. While most of these nodes are associated with pump stations there are also assets designed specifically for storage such as Collins Park, Finglas Road Overflow Chamber, the NFS Grange Tank which has a storage capacity of over 5,000m$^3$ and the NDDS Clontarf Golf Course tank (built early 2000's).

Although the ToR suggests the above figures, after using the ICM Infoworks Validation Tool, 62 potential storage locations were identified and are shown in figure 2-5. These were identified by reviewing areas where there was a significant size difference in the network, indicating the possibility of online storage.

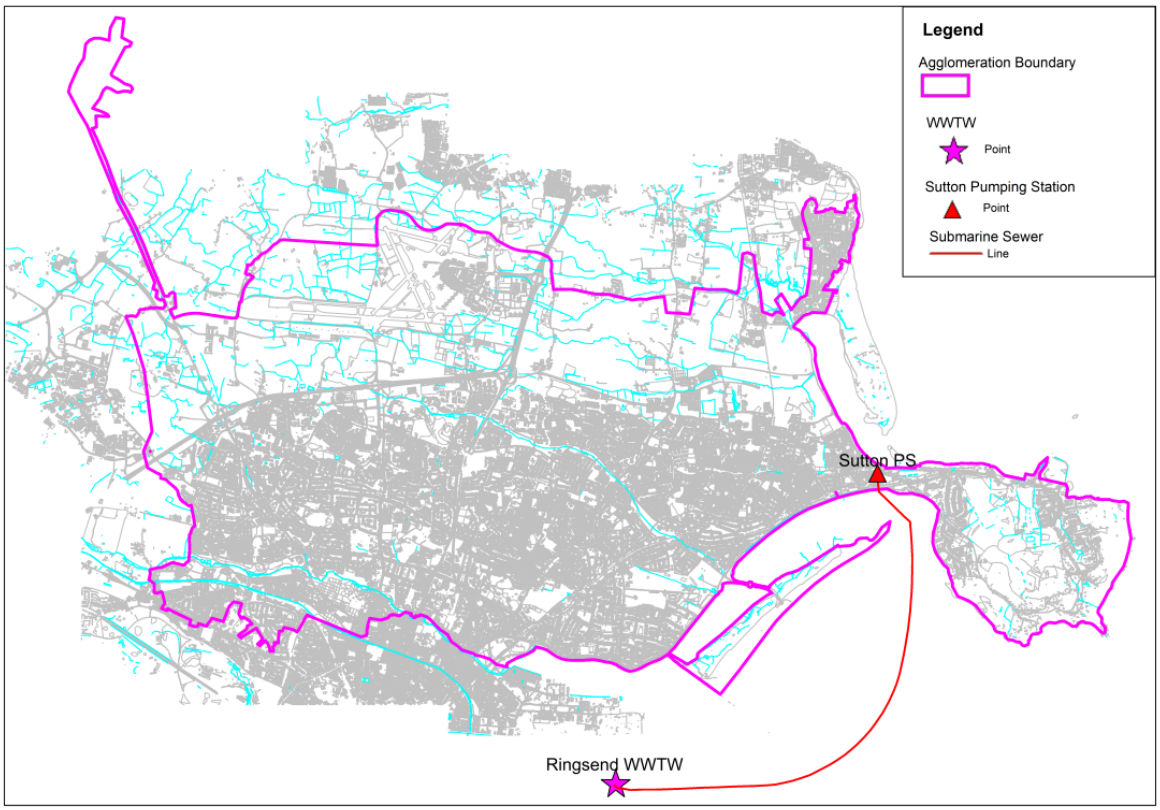
**Figure 2-5 Sutton PS DAP Possible Storage Tanks**




### 2.1.1.7 Wastewater Treatment Plant

The Sutton PS directs all flows out of the Study Boundary to the Ringsend Wastewater Treatment Works shown on Figure 2-6.

**Figure 2-6 Sutton PS DAP WwTW**




## 2.2 FUTURE DEVELOPMENT

A review of both The Dublin City Development Plan (2016-2022) and The Fingal Development Plan (2017-2023) has been undertaken in order to obtain information regarding proposed future developments within the Study Boundary.

A number of future development sites were identified:

- Cloghran (Fingal County Council)
- Dardistown (Fingal County Council)
- Baldoyle 3 (Fingal County Council)
- Balgriffin/Belcamp 6 (Fingal County Council)
- Portmarnock 7 (Fingal County Council)
- Turnapin (Fingal County Council)
- SDRA 1 North Fringe (including Clongriffin/Belmayne) (Dublin City Council)
- SDRA 17 Oscar Traynor Road (Dublin City Council)
- SDRA 2 Ballymun (Dublin City Council)
- SDRA 3 Ashtown/Pelletstown (Dublin City Council)

Figure 2-7 below shows that the planned development across the Sutton PS DAP Study Boundary is varied in land use, with five large residential development areas planned, and 11 smaller residential areas. Across the Dublin City, the capacity for residential development varies and it is estimated that there is the capacity for an estimated 52,000 additional residential units with approximately 11,700

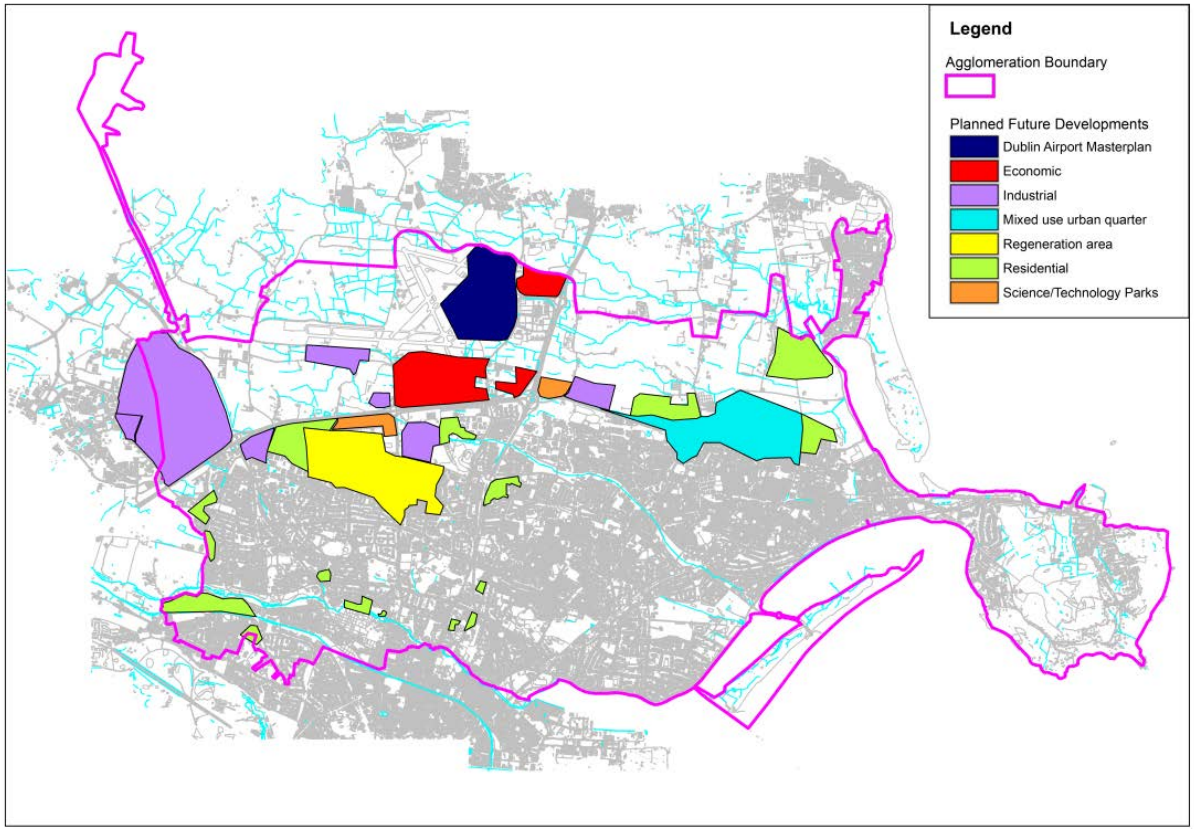
outlined in the SDRAs within the DAP Study Boundary. The details of the developments are given in Table 2.1.

### Table 2-1 Sutton PS Study Boundary Future Developments

| Development | Area (Ha) | Potential Yield (Number of Units) | Anticipated Timeframe | Brief Description |
|---|---|---|---|---|
| Objective Portmarnock 7 | 81.151 | Unknown | Unknown | Mixed Residential Area |
| Objective Balgriffin/Belcamp 6 | 48.605 | Unknown | Unknown | Mixed Residential, Community and Recreational Facilities Area Planned |
| Objective Baldoyle 3 | 29.977 | Unknown | Unknown | Mixed Residential Area |
| Cloghran | 38.674 | Unknown | Unknown | Economic Development |
| Dublin Airport Masterplan | 188.968 | Unknown | New hotel expected by 2019<br>New runway expected by 2020. | 420 bedroom hotel complex, New runway, Commercial development adjacent to the airport |
| Turnapin | 20.142 | Unknown | Unknown | Economic Development |
| Dardistown | 159.507 | Unknown | Unknown | Economic Development |
| SDRA 3 Ashtown/ Pelletstown | 47.918 | 2,000 Constructed<br>1,500 Planned | Unknown | Mixed Residential Area |
| SDRA 17 Oscar Traynor Road | 17.798 | Estimated 650-700 Residential Units | Unknown | Mixed Residential Area |
| SDRA 2 Ballymun | 269.347 | Estimated 3,000 Residential Units | Unknown | Regeneration Area |
| SDRA 1 North Fringe (including Clongriffin/ Belmayne) | 243.514 | 3,400 Residential Units<br>41,000 $m^2$ Commercial floor space | Unknown | Mixed Use Urban Quarter |
| 2011 Zoned Science/Technology Parks/Land 1 | 19.110 | Unknown | Unknown | Science and Technology Park Development |
| 2011 Zoned Science/Technology Parks/Land 2 | 28.779 | Unknown | Unknown | Science and Technology Park Development |
| 2011 Zoned Industrial Land 1 | 36.604 | Unknown | Unknown | Industrial Development |
| 2011 Zoned Industrial Land 2 | 41.810 | Unknown | Unknown | Industrial Development |
| 2011 Zoned Industrial Land 3 | 9.779 | Unknown | Unknown | Industrial Development |
| 2011 Zoned Industrial Land 4 | 24.032 | Unknown | Unknown | Industrial Development |
| 2011 Zoned Industrial Land 5 | 81.241 | Unknown | Unknown | Industrial Development |
| 2011 Zoned Industrial Land 6 | 15.642 | Unknown | Unknown | Industrial Development |
| 2011 Zoned Industrial Land 7 | 44.196 | Unknown | Unknown | Industrial Development |
| 2011 Zoned Residential Land 1 | 55.332 | Unknown | Unknown | Residential Development |
| 2011 Zoned Residential Land 2 | 8.812 | Unknown | Unknown | Residential Development |
| 2011 Zoned Residential Land 3 | 7.829 | Unknown | Unknown | Residential Development |
| 2011 Zoned Residential Land 4 | 13.274 | Unknown | Unknown | Residential Development |
| 2011 Zoned Residential Land 5 | 19.452 | Unknown | Unknown | Residential Development |

| Development | Area (Ha) | Potential Yield (Number of Units) | Anticipated Timeframe | Brief Description |
|---|---|---|---|---|
| 2011 Zoned Residential Land 6 | 2.726 | Unknown | Unknown | Residential Development |
| 2011 Zoned Residential Land 7 | 4.711 | Unknown | Unknown | Residential Development |
| 2011 Zoned Residential Land 8 | 9.912 | Unknown | Unknown | Residential Development |
| 2011 Zoned Residential Land 9 | 1.013 | Unknown | Unknown | Residential Development |
| 2011 Zoned Residential Land 10 | 2.916 | Unknown | Unknown | Residential Development |

**Figure 2-7 Sutton PS DAP Plan of Developments**




## 2.3 INTERACTION WITH OTHER PROJECTS / STUDIES

There have been a number of previous projects / studies that have been undertaken in the Dublin region over recent years. Of significant importance to the Sutton PS DAP are the network hydraulic models regarding the NDDS and NFS. Details of these projects are outlined below.

### Previous Network Hydraulic Models

GDSDS NDDS and North Fringe Interceptor Drainage Area - 2006

As part of the Greater Dublin Strategic Drainage Strategy (GDSDS) - NDDS and North Fringe Drainage Area project a hydraulic model referred to as the NDDS and North Fringe Interceptor model was

constructed and verified using InfoWorks CS, version 4.56. This model was largely based on SUS25 data supplemented with an asset survey of details of some CSOs, pumping stations, flumes, siphons, valve houses, outfalls and specific manholes where network connectivity was uncertain. While there were large amounts of survey data available, the report associated with the hydraulic model build noted that some data (ground levels, inverts, diameters etc.) was missing. Observed flow survey data, from a total of 83 flow monitors, was used to verify the hydraulic performance of the model. A moderate level of verification was achieved and it was considered adequate for use in a strategic level study and to carry out the hydraulic assessment using design storms.

Previous to this a Wallrus model was completed as part of the NDDS Catchment Area Study Preliminary Report (1993) by MCOS, however it was concluded that the model was considered unsuitable for use in the GDSDS due to its age and incompatibility with newer software packages. The GDSDS did however use much of the detailed information collected during the early 1990s.

2004 North Dublin Connections Study (NDCS) - 2004

The 2004 NDCS model was constructed to reflect the collection network as it was at the time including the diversion of a number of catchments from the NDDS to the NDCS.

North Fringe Sewer Model update - 2013

RPS were commissioned to undertake an update on the 2004 NDCS model but the scope of the project was restricted by the project Client to the use of existing available data only. The following were the proposed aims of the study;

- Update the model to include flows from developments which were constructed after the 2004 NDCS.
- Update the model to include flows from the proposed Terminal 2 building at Dublin Airport
- Calibrate the model based on flow and rainfall data from existing local authority permanent flow monitoring arrangements only and run the model for the 2 and 30 year events.

The model used in the 2008 study was based on the GDSDS model and adjusted to include the NFS and newly constructed branch connections to it, though no further calibration or verification was carried out. The 2013 NFS model also included design details for the diversion of flows from Howth and Sutton to Sutton Pumping station. A model review was carried out and the results, as are summarised below, indicate that the model adds little in terms of understanding current network performance:

Significant difficulties were encountered in the calibration process owing to the quality of data available from the permanent flow monitors;

- The number of rain gauges used (2 No.) was insufficient based on the catchment size;
- The total number of functioning flow monitors was 4 and is considered insufficient;
- Flow monitoring data from Dublin Airport was not available at 5 minute time intervals;
- There was no monitoring of CSO spills and emergency overflows from the catchment;
- One flow monitor showed evidence of pumping within the network which was not represented in the model;

- Data from Portmarnock and Baldoyle pumping stations was of limited use;
- The modelled pumping station operation regime at Ballymum (taken from NDCS model) was significantly different to the observed response;
- New catchments added to the model were identified by a data collection exercise in 2009.

It was concluded that as the 2013 NFS Model Update was restricted to the analysis of existing available data, it did not deliver a model in compliance with the WaPUG Code of Practice for a Type 1 Skeletal Planning Model. As a result the model should be used to identify areas for further assessment only, and should not be used as a planning or detailed design tool. The absence of detailed flow and rainfall data limited the potential identification of network hydraulic deficiencies in the NFS catchment and the lack of asset information also contributed to the problems encountered in the calibration process. It was also noted that the pre-2004 sub-catchments have not been recalibrated since their diversion from the NDDS to the NFS and as a result there may be some discrepancies between modelled and actual flows due to routing errors.

### Significant changes to the wastewater network

Since the completion of the last major study on the sewerage system (GDSDS) there have been a number of modifications to the network including:

- The commissioning of the NFS project including the Grange Storm Tank, Ballymun PS, Northern Interceptor pipeline and other diversionary pipelines connecting areas to the NFS;
- The largest alteration to the network has been the works carried out to pump wastewater from Sutton PS to Ringsend WWTW. This involved the construction of a pump station at Sutton which intercepts flows from the NDDS and NFS and pumps via a cross-bay submarine pipeline to Ringsend WWTW;
- Following completion of the above project, works commenced in 2006 (Contract 5.1) to divert flows from Howth and Sutton to Sutton PS. A series of pumping stations (or alterations to existing ones), storage tanks and interceptor sewers were constructed to convey wastewater from Howth to Sutton PS and retaining the use of the NDDS sewer, between Sutton PS and its discharge point off the Nose of Howth, as an overflow sewer only;
- The addition of many new developments, particularly in the North Fringe area, including some large scale developments. A new large sewer servicing Dublin Airport, replacing a smaller 300mm sewer, has been constructed connecting the Airport with the NFS near the Swords Road;
- There was a ‘developer provided’ rising main and gravity network laid through Northwood Demesne in Santry connecting to the North Fringe Sewer. This was to cater for the future upgrading of Santry Pump Station. It was intended to re-direct flows from the Santry Network and increase the capacity of this pump station; this project was never completed but the intention remains to divert these flows to the reduce the impact on downstream sewer flooding experienced in Santry. The Santry pump station upgrade preliminary report is available form Irish Water.

### 2.3.1 Other Ongoing Works

There are a number of projects that are ongoing in the Study Boundary, generally around key assets. The details of these are outlined below.

Multidisciplinary Pump Station Surveys

This project was undertaken by Jacobs on behalf of Irish Water in 2015/2016/2017. The objectives of this project were to:

- Determine the condition of the listed pump stations and identify remedial or upgrade works
- Develop a standardised survey template to allow comparable work to be carried out on similar IW assets
- Collate data for a large number of IW pump stations, in a standard format to enable the prioritisation of capital investment decisions.
- Undertake asset register capture in accordance with the Above Ground Asset Capture (AGAC) standard
- Develop a standardised set of Contract Documents to allow comparable work to be carried out on similar IW assets.

A number of pump stations (35no. in total) were selected for this project and those within the study area of this project (20no.) are listed in Table 2.2 below:

**Table 2-2 Multidisciplinary Pumping Station Surveys**

| Site No. | EPA I.D. | Site Name | Easting (ING) | Northing (ING) |
|---|---|---|---|---|
| 2 | D0034-0 I | Ballymun | 315447.9 | 239203.3 |
| 3 | D0034-0 I | Ballyboggan | 313723.7 | 237675.9 |
| 4 | D0034-0 I | Beaumont | 317452.1 | 238591.2 |
| 7 | D0034-0 I | Bull Island | 321559.6 | 235740.4 |
| 8 | D0034-0 I | Cara Park | 319657.4 | 241018.4 |
| 12 | D0034-0 I | Clontarf | 318101.5 | 236285.4 |
| 13 | D0034-0 I | Dollymount | 321434.6 | 236400.9 |
| 14 | D0034-0 I | Domville Court | 316971 | 240052 |
| 15 | D0034-0 I | Drumcondra | 316123 | 236664 |
| 16 | D0034-0 I | Dunsink Lane | 311880.9 | 238780.7 |
| 18 | D0034-0 I | Finglas Bridge | 314105.8 | 237565 |
| 19 | D0034-0 I | Grange | 323062 | 241189 |
| 21 | D0034-0 I | Kilbarrack | 323609.9 | 238741.3 |
| 22 | D0034-0 I | Kincora | 320767.9 | 235960.8 |
| 25 | D0034-0 I | Mellows Park | 312878.8 | 239160.7 |
| 27 | D0034-0 I | Mobhi Road | 315417.6 | 237688.7 |
| 28 | D0034-0 I | Pelletstown | 311803.8 | 237801.5 |

| Site No. | EPA I.D. | Site Name | Easting (ING) | Northing (ING) |
|---|---|---|---|---|
| 30 | D0034-0 I | Ratoath | 311793 | 238688 |
| 33 | D0034-0 I | Tara Lawns | 319840 | 241003 |
| 35 | D0034-0 I | Vernon Avenue | 320137.9 | 235783.9 |

The pump station reports are available from Irish Water however this data may not be adequate for the purpose of the DAP study. As such, it is important that these assets are still considered for survey as part of the Sutton PS DAP. However, if the data is deemed acceptable from the multidisciplinary surveys then there may be scope to reduce the pumping station surveys schedules for the DAP study. Energy audit work is still ongoing. In some cases the alignment of rising mains was unknown and therefore parts of the work were unable to be completed as part of the initial survey.

Data required under the Multidisciplinary Pump Station Surveys

Condition assessments for the existing assets were requested as follows:

1. Mechanical inspection (pumps, motors, valves, lifting equipment, screens, etc.)
2. Electrical inspection to include transformer details, installed power, drive lists, spare capacity, panel type, RTU/SCADA/PLC (make & model) etc.
3. Instrumentation inspection (flow, level, pressure, gas detection etc.)
4. Civil/Structural inspection to include:
    a. Pipework
        i. Levels of all pipework, invert, coping, etc. to Ordinance Datum
        ii. Pipework diameter
        iii. Condition
    b. dry well, wet well,
    c. storm storage,
    d. storm screening
    e. other tankage,
    f. chamber covers,
    g. other access,
    h. Station lighting etc.
5. Operational details:
    a. No. of pumps & pump configuration – Duty/Assist/Stand-by
    b. Pump Details
    c. Operating setpoints (start/stop/assist level or band)
    d. Overflow routes & Screened – yes/no
6. Pump testing (energy audit);
    a. Static conditions
    b. Dynamic Conditions (test at a no. of points if VSD or Series/Parallel application)

Local Network Reinforcement Project

The aim of this project commissioned by Irish Water is to progress the design on a number of proposed schemes for the purpose of providing necessary capacity in the local wastewater network to facilitate residential development in the short term in the Greater Dublin Area.

Within this Study Area, the two following designs have been developed:-

- A design has been developed to divert part of the existing network in Kinsealy (which presently connects to the Malahide agglomeration) to the North Fringe sub-catchment at Balgriffin; this design which includes a new pumping station, rising main and gravity main is sized for some potential future development in the Kinsealy area.
- A design has been developed to upgrade the existing Portmarnock Bridge Pump Station to cater for future development with a new rising main discharging directly to the North Fringe Sewer. This is a change from the existing arrangement whereby the current Portmarnock Bridge Pump Station discharges to a gravity sewer on the Coast Road which in turn discharges to the Mayne Bridge Pump Station located on the junction of the R106 and R123.

Greater Dublin Drainage

*Refer: http://www.greaterdublindrainage.ie/*

One of the recommendations of the GDSDS was that a new regional WWTP and an orbital drainage network in the northern section of the Greater Dublin Area was required to facilitate growth and divert some flows from the Ringsend WWTP. Arising from this, the Greater Dublin Drainage project was commissioned and this project is currently considering planning implications, an Environmental Impact Statement, Appropriate Assessments and Compulsory Purchase Orders.

Doldrum Bay

This is a small catchment in Howth and is the subject of an ongoing project that is developing a design to connect the catchment to the wastewater network connecting to Sutton PS.

Dublin City Centre Sewerage Scheme

Atkins were commissioned by Dublin City Council in 2014 to progress this project by building a hydraulic model of the City Centre, a sub-catchment of the Main Lift Pumping Station immediately to the south of this Study Area, using available asset data and survey information from a flow and rainfall survey undertaken in 2010. The hydraulic model for the City Centre catchment is now available and has been independently audited. The model was further developed through the use of additional smaller scale flow monitoring undertaken in 2016. It is noted that there are a small number of bifurcation/overflow linkages in the southern section of the catchment that split the flows between two separate study boundarys (Sutton PS and City Centre), an initial review of the network identified approximately five locations where the link between the catchment draining to Sutton PS and the City Centre catchment exists.

Due to timing, the City Centre model was not built in accordance with Irish Water's Model Build and Verification Standard and therefore it does not contain the Standard's model build features and classifications such as data flagging, sub-catchment land-uses and surface types.

CFRAMS and Dublin City Council Flood Defence Studies/Schemes

A number of studies/plans/works have been developed over the last decade addressing fluvial flood risk. These include the following:-

- The Study Area for this project is included in the OPW's CRFAM programmes as part of the Eastern CFRAM area. Details at http://eastcfram.irish-surge-forecast.ie/.
- Details of a number of flood mitigation/prevention studies and schemes managed by Dublin City Council can be found at http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans.
- Details of a proposed coastal flood defence scheme at Clontarf can be found at http://www.dublincity.ie/clontarfflooddefence.
- River Tolka Flood Alleviation Works including flood defence walls/embankments and infrastructure (pumping stations, pipelines) constructed to facilitate drainage of local runoff from developments behind flood defences (including a pump station at Drumcondra which receives discharge from a CSO at Botanic Avenue/Drumcondra Road Lower).
- GDSDS Reports on various watercourses in the study area including Finglas, Santry, Kilbarrack, Blackbanks, Naniken, Clontarf area and Mayne.
- Wad River Flood Relief Scheme, Dublin City Council reports including flood alleviation proposals for the River Wad; information at https://www.dublincity.ie/main-menu-services-water-waste-and-environment-water-projects/pluvial-floodingwad-river.

## 2.4 NETWORK SCHEMATIC

The network schematic is provided in **Appendix A** (A3 format), and has been created using the latest model database and outlines general flow direction against ancillary locations identified during the Stage 1 review.

## 2.5 CATCHMENT STAKEHOLDERS

An important element of the scoping stage was to identify any external and internal stakeholders. This was aimed at understanding all issues within the catchment and supporting the decision with regard to integrated catchment modelling over a wastewater network only or the choice of a 1D only or an integrated 1D/2D modelling approach.

The potential stakeholders and sub-groups are listed below:

- Irish Water
  - Asset Strategy
  - Asset Management
  - Operations
- Dublin City/Fingal County Council
  - Operations Team
  - Planning
  - Roads and Transport
  - Environmental
- Environmental Protection Agency (EPA)
- Office of Public Works (OPW)
- National Parks and Wildlife Services (NPWS)
- Customer Groups

  - Residents Associations
  - Business and Trade Associations
- Waterways Ireland
- Inland Fisheries Ireland
- Dublin Airport Authority

This list is not exhaustive, but has been considered a good starting point for engagement with stakeholders within the catchment. Engagement with IW and the LA's included monthly progress meetings, an operations meeting and a site walkover. The operations meetings at the outset of the project mainly focused on key ancillaries in the catchment, obtaining information with regards to their operation and any known issues related to the asset. Further information was obtained from the additional stakeholders through internet searches.

The information has since been used to identify key locations and ensures the surveys have been targeted at places deemed of significant importance to all stakeholders. Initially the model will be constructed in 1D within InfoWorks ICM, it will be considered as part of future discussions with the above stakeholders whether the model will require 2D modelling in key areas such as flooding locations or areas where the system interacts with watercourses.

# 3 DATA COLLECTION

## 3.1 DATA MANUAL

At the outset of the study a Data Manual was supplied by Irish Water containing numerous core datasets, these have been reviewed for data suitability and a model data log has been completed. Additional data has been acquired from Dublin City and Fingal County Councils as well as further information from Irish Water following consultation with the drainage network operations team and has been added to the Data Manual. All incoming data and DAP outputs are added to the Data Manual continually during the DAP stages.

The current Data Manual Log is attached in **Appendix B**.

## 3.2 CRITICAL DATASETS

A series of project critical datasets were received from Irish Water at the start of the project as part of the Initial Data Manual. These included:

- GIS Network Data
- InfoNet Database
- Background Mapping
- Address Point Data
- LiDAR

### 3.2.1 Survey Data

Irish Water estimates that there is almost 702 km of foul and combined sewers within the Study Area. Conduit and manhole information from Irish Water's GIS database are summarised in Tables 3.1 and 3.2.

**Table 3-1 Wastewater Network Conduit Breakdown***

| Diameter Range | Length (km) | Total (km) |
|---|---|---|
| <300mm | 460 | 702 |
| >=300mm and <600mm | 180 | |
| >=600mm | 62 | |

**Table 3-2 Wastewater Manhole 'Survey Status' Breakdown***

| Survey Status | Number |
|---|---|
| Surveyed (Yes) | 20,287 |
| Unable to Find (UTF) | 659 |
| Unable to Raise (UTR) | 0 |
| Unable to Survey (UTS) | 367 |
| Unable to Lift/Locate (UTL) | 291 |
| Plotted from Records (PFR) | 3,015 |
| Buried (B) | 79 |
| To Be Constructed (TBC) | 0 |
| To be Surveyed (TBS) | 442 |
| Unspecified (U) | 3 |
| Total | 25,143 |

** Irish Water InfoNet database for the Sutton PS DAP study Boundary as of 21st March 2017. The InfoNet database contains data migrated from SUS25 databases.*

It should be noted that a review by Irish Water indicated that although, as Table 3.2 indicates, the coverage of manhole surveys undertaken in the Study Area appears reasonably comprehensive, there are a number of areas where connectivity within the network has not been successfully resolved. In addition some record sheet surveys of critical assets from the early 2000's that have been 'attached' to the InfoNet database contain conflicting information when compared to the asset data in the InfoNet database (e.g. pipework at Vernon Ave. PS, Dollymount PS, overflows in Finglas, flume on Clontarf GC).

The InfoNet database supplied by Irish Water contains 28,071 records of manhole survey, dating from 1979 -2014. It is important to note that the majority of manholes with a survey status of 'Yes' were surveyed in the period 1992-1994. It is suggested in the ToR that approximately 75% of the represented surface water network appears to have been 'manhole-surveyed' over the last 25 years.

CCTV Survey Data

Irish Water has a copy of the Dublin City Council (DCC) Examiner software CCTV survey database. This contains defect coding information for surveys undertaken in the DCC area back as far as 1990. The information is in Word format though Irish Water is presently planning works to 'link' this survey information to the assets in the InfoNet database. It has not yet been determined exactly how much survey information is available for the catchment upstream of Sutton PS, however it is known that the data contains a number of surveys in the study area undertaken in the mid 1990's.

A CCTV Survey of the Portmarnock area comprising approximately 17km of pipe length was undertaken by USA Ltd. in 2016 on behalf of Irish Water. Irish Water is currently in the process of uploading the CCTV survey defect coding files to the InfoNet database. At present it is unknown whether this was solely focused on the waste water system or also included surveys on the surface water system.

The InfoNet database supplied at the outset has 57 entries for CCTV survey undertaken in 2007, these focussed on the foul system within parts of Blanchardstown, small sections of this network are shown to drain into the Sutton PS Study Boundary.

Flow Data

Flow survey data is available from the flow and rainfall survey undertaken for the GDSDS.

There are a number of permanent flow monitors in the Study Area including approximately six on the NFS or sewers connecting to the NFS. However it is important to note that these monitors, though presently in-situ, have not been calibrated for a period of time (up to two years). Irish Water is currently in the process of organising a tender process for re-establishing an operation and maintenance contract for permanent monitors on the NFS.

Rainfall Data

In addition to nearby Met Eireann synoptic stations at Dublin Airport, Phoenix Park and Casement Aerodrome, a number of rain gauges have been installed by the local authorities in recent years throughout the Study Area - including at Ballymun PS, The Grange Tank, and also nearby at Malahide WWTW, Ballycoolen Reservoir and Chapelizod. Data from the aforementioned Local Authority raingauges is available from Irish Water's telemetry system and is generally available at 15min resolution. Irish Water has not undertaken an assessment of the suitability of these sites or the quality of the data produced.

### 3.2.2 Population Data and Growth Forecast

The population within the Sutton PS Study boundary is 278,537 according to the 2016 census data. The DAP study boundary covers 81 electoral divisions, of which nine have been partially included, within both the Fingal Local Authority and Dublin City Council boundaries. With an approximate area of 123.5 sq. km, the study boundary has a 2016 population density of 2,255 persons per sq. km. The majority of residents live in houses, with over 75% (78,757) of accommodation in the Sutton PS DAP study boundary being of this type (Table 3-4). Details on the type of accommodation within the rest of the study boundary are unknown due to the data not being available from the Central Statistics Office for the smaller townland areas. Table 3.5 details the sewerage facilities within the Sutton PS DAP Area, based upon Census data supplied by the householders. Although the data has been used, it should be treated with a degree of caution as it is open to interpretation errors from the homeowner.

**Table 3-3 Population of the Sutton PS DAP study boundary according to the 2016 census**

| Male | Female | Total |
|---|---|---|
| 134,110 | 144,427 | 278,537 |

**Table 3-4 Private households by type of accommodation according to the 2016 census**

| | Type of accommodation | Households | Persons |
|---|---|---|---|
| **Sutton DAP Area** | House/Bungalow | 78,757 | 224,372 |
| | Flat/Apartment | 19,873 | 43,685 |
| | Bed-sit | 204 | 266 |
| | Caravan/Mobile Home | 148 | 517 |
| | Not stated | 1529 | 4621 |
| | Total | 100,511 | 273,461 |

**Table 3-5 Permanent private households by sewerage facility according to 2016 census**

| | Household | Amount |
|---|---|---|
| **Sutton DAP Area** | Public scheme | 93,665 |
| | Individual septic tank | 686 |
| | Other individual treatment | 138 |
| | Other | 306 |
| | No sewerage facility | 94 |
| | Not stated | 5,474 |
| | Total (minus caravan/mobile homes) | 100,363 |

The overall projections for regional authority areas show that all areas increase in population with an average annual increase of between 0.2% in the West and Border regions to 1.2% in the Mid-East (Table 3-6). The projections show that apart from GDA (Greater Dublin Area), Dublin and the Mid-East all other regions generally rely on natural increase as the predominant factor for population increase. For the Dublin region in which the study boundary is situated, the population is expected to increase by 257,000 from 2011 to 2031 (at an annual rate of 0.9%). The future developments outlined in Section 2.2 account for part of the regions expected growth with the remainder accounted for by development in the Dublin region outside of the Sutton PS DAP study boundary.

**Table 3-6 Actual and projected populations of Regional Authority areas, 2011 and 2031 (M2F2 Traditional)**

| Regional Authority Area | Population 2011 | Natural Increase | Internal Migration | External Migration | Total Increase | Population 2031 | Average Annual Increase |
|---|---|---|---|---|---|---|---|
| | Thousands | | | | | | % |
| Border | 516 | 49 | -22 | -9 | 18 | 533 | 0.2 |
| GDA | 1,795 | 298 | 92 | 11 | 401 | 2,197 | 1.0 |
| **Dublin** | **1,262** | **188** | **47** | **23** | **257** | **1,519** | **0.9** |
| Mid-East | 534 | 110 | 45 | -11 | 144 | 678 | 1.2 |
| Midland | 284 | 39 | -21 | 7 | 25 | 309 | 0.4 |
| Mid-West | 378 | 43 | -10 | -1 | 32 | 410 | 0.4 |
| South-East | 499 | 58 | -16 | 9 | 51 | 550 | 0.5 |
| South-West | 662 | 80 | -18 | 8 | 71 | 733 | 0.5 |
| West | 441 | 31 | -6 | -10 | 15 | 456 | 0.2 |
| State | 4,575 | 598 | 0 | 15 | 613 | 5,188 | 0.6 |

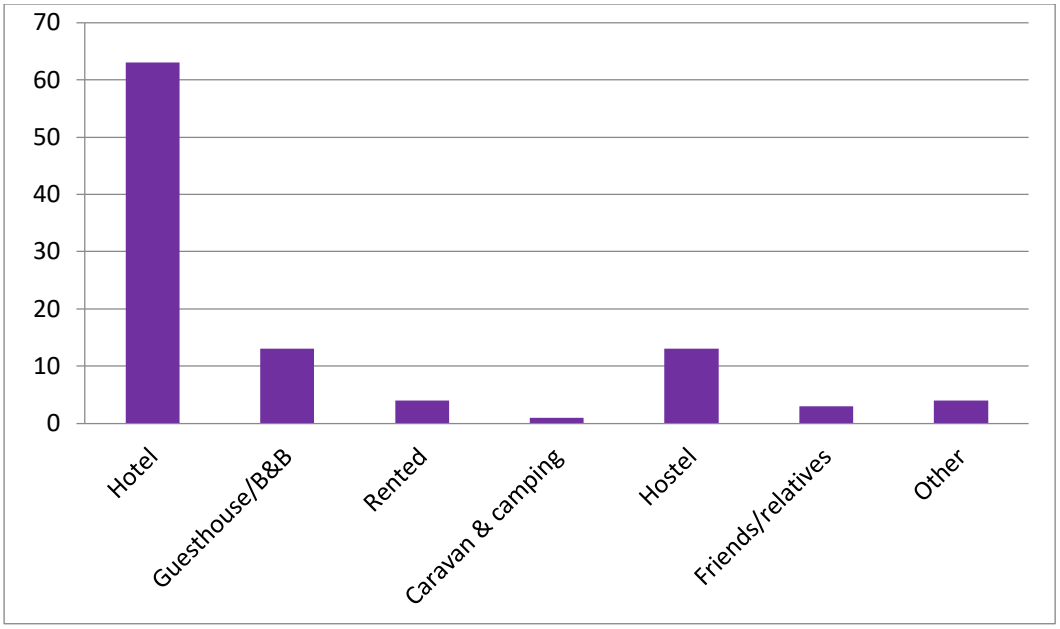
#### 3.2.2.1 Tourism

The Sutton PS DAP study boundary sits within the Dublin Tourism Region, according to the Irish Tourism Industry Confederation. It should be noted that all statistics found are for this tourism region as a whole, so figures for the study area are likely to be lower.

A record number of over 10.3 million people visited the island of Ireland in 2016, almost a million (+834k) more than in 2015 (+9% increase), providing €5.3 billion in overseas revenue - an additional +€446million compared to 2015. In 2016, 55% of Ireland's overseas day visitors and 68% of the holidays were spent in Dublin, a huge proportion of the country's total tourism totals.

A high volume of visitors to the area requires a high volume of accommodation to be available. This should be taken into consideration when including hotels within the model, as this may affect flows within the sewer network. Figure 3.1 shows the percentage of accommodation types that holidaymakers chose within the Dublin tourism region in 2015.

**Figure 3-1 Profile of accommodation types of overseas holidaymakers selected in 2015 in the Dublin region, from Fáilte Ireland**




Tourism is expected to continue to grow across Ireland, as it has done between 2013 and 2016 (see Table 3-7). Specific projects have been setup in order to achieve the Government's Tourism Policy Statement "People, Place and Policy; Growing Tourism to 2025", with Dublin's successful tourism growth playing a vital part to achieving this goal.

**Table 3-7 Tourism Numbers 2013 – 2016, Fáilte Ireland**

| | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|
| **Total Overseas Numbers (000s)** | 6,686 | 7,105 | 8,036 | 8,742 |

Dublin Airport is located 12km from Dublin city centre and is the gateway for most visitors into the country, handling nearly 28 million passengers in 2016. Flows from the airport are included in the study boundary and must be suitably accounted for. These trade flows are expected to vary seasonally, with visitor numbers increasing significantly in July, August and over the Christmas period.

Dublin Airport currently has two adjacent hotels the Maldron and Radisson Blu with 251 and 229 rooms respectively. The Dublin Airport Masterplan includes the development of a 420 room hotel by 2019, as detailed in Section 2.2. A number of hotels and tourist services exist between Dublin Airport and the city centre and therefore tourist flows are expected within the Sutton PS DAP study boundary.

The most significant influx of visitors to the Sutton PS DAP study boundary occurs at Croke Park Stadium which hosts both sporting and entertainment events and has a capacity of 82,300 people. Throughout the year there is significant variation in visitor numbers, with increases seen in June-July for open air music concerts and September due to GAA finals.

Some consideration should be given during the study to the fluidity of tourists in and out of the study boundary, especially when allowing for the high volumes of tourists found within the capital city.

### 3.2.3 OPW Flood Study Data

The ongoing CFRAM Programme, Ireland's Catchment Flood Risk Assessment and Management (CFRAM) Programme, is central to the medium and long-term strategy for the reduction and management of flood risk throughout Ireland.

The initial CFRAM stage, Preliminary Flood Risk Assessment, saw an extensive national programme of data collection and analysis to identify the areas where flood risk would be further assessed. A national, formal consultation was undertaken in 2011.

The Sutton PS DAP sits within the Eastern River Basin District which covers agricultural land, holiday coastline, the city of Dublin and the towns which form the Greater Dublin Area and its commuter belt. With a land area of around 6,300 $km^2$, the Eastern River Basin District covers about one tenth of the entire country and has 350 $km^2$ of marine waters.

The OPWs National Flood Hazard Mapping tool has been used to research historic flooding within the study boundary. Climate and high rainfall events influence flooding incidents; however these can become exacerbated by existing network issues that become more of a problem when operating at higher capacities. For example, Howth often encounters high tides and fast surface runoff from Howth Hill, this coupled with insufficient culvert capacity and surcharge created particularly problematic flooding events on 14/11/2002 and 21/10/2002. Sutton is often affected by tidal flooding events and blocked surface water outlets caused by tidal deposits are a repetitive issue. Baldoyle has a history of coastal road flooding and a resulting Flood Relief Scheme was completed in 2001 to alleviate recurrent issues here. At Portmarnock the road was raised in 2004 to rectify Portmarnock Bridge flooding.

The main aims of the Eastern CFRAM Study are discussed further in Section 3.8.1 of this report

These draft Flood maps from the Eastern Catchment Flood Risk Assessment and Management Study (ECFRAMS) have been reviewed and have been added to the Data Manual. Flood Risk Management Plans are being developed in 2016 and will be reviewed to assess their impact on this Drainage Area Plan.

## 3.3 SUPPLEMENTARY DATA

Supplementary Data such as Utility Records and Traffic Data will be obtained and utilised during the survey stages of the project in order to ensure efficiencies on the manhole and ancillary surveys. The catchment lies within the major conurbation of Dublin and it is anticipated that surveys will affect a number of traffic sensitive roads. It should be considered a requirement to obtain the

information from the LAs with regards to the traffic sensitive roads so that contractors are aware of these in the tender exercise.

No data was provided with regards to the locations of properties with basements, however a review of the Greater Dublin Strategic Drainage Study showed locations of known and assumed basements within the study boundary.

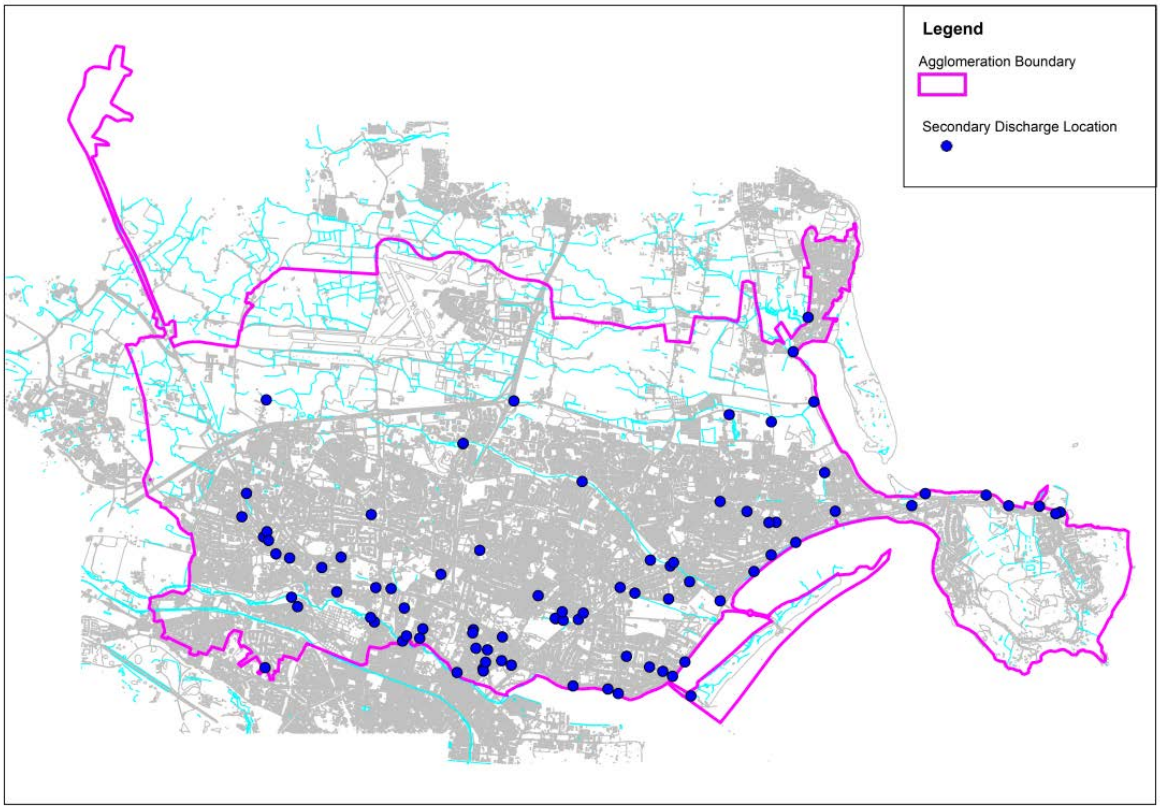
## 3.4 CORPORATE DATA

### 3.4.1 Fixed and Intermittent Discharge Licences

As part of Stage 1, all known license information for both continuous fixed discharges (WwTW) and intermittent discharges (licensed CSOs) was collected.

Significant information on the existing network is contained in the EPA Waste Water Discharge Licence applications and associated Annual Environmental Reports (AER) for Ringsend WWTW (Ref. No. D0034-01) on the EPA's website (www.epa.ie/licensing/). The Waste Water Discharge Licence Application Form for the Sutton PS DAP study boundary provided information on secondary discharge locations. The Secondary discharge locations are tabulated in Appendix I and are shown Figure 3-2.

**Figure 3-2 Secondary Discharge Locations**



### 3.4.2 Water Consumption

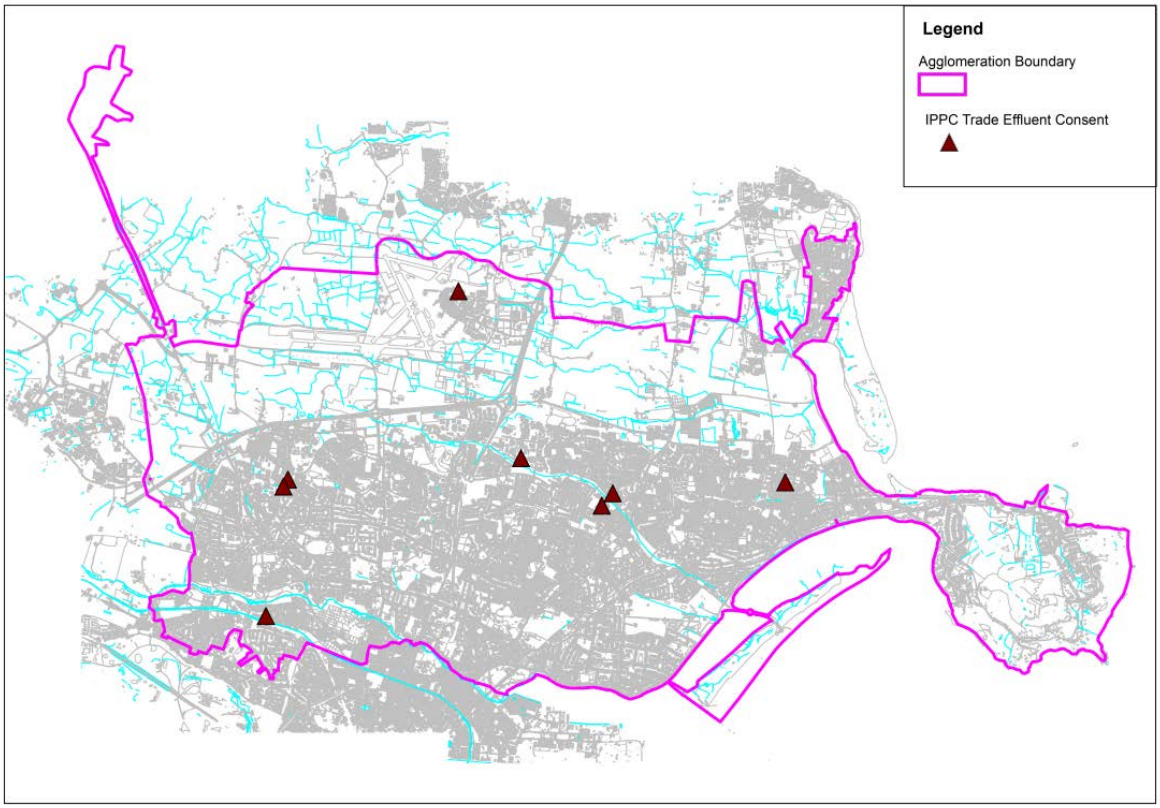
Water consumption data was requested at the outset of the study and has not been supplied at the time of the submitting the DRAFT Stage 1 report. Further efforts will be made to obtain the data during the study and the report updated accordingly.

### 3.4.3 Licensed Trade Effluent

All licensed trade effluent data collected at the start of the project was reviewed and will support the hydraulic model build process. Integrated Pollution Prevention and Control (IPPC) licenses for the Sutton PS DAP study boundary were downloaded from the EPA's website (www.epa.ie/licensing/).

A request was made at the outset of the study for Section 16 licence details within the study boundary. However at the time of submitting the Stage 1 report, this information was still outstanding. Further efforts will be made throughout the study to obtain this data and update the report accordingly. Locations of the IPPCs in the Sutton PS DAP study boundary are shown in Figure 3-3 below.

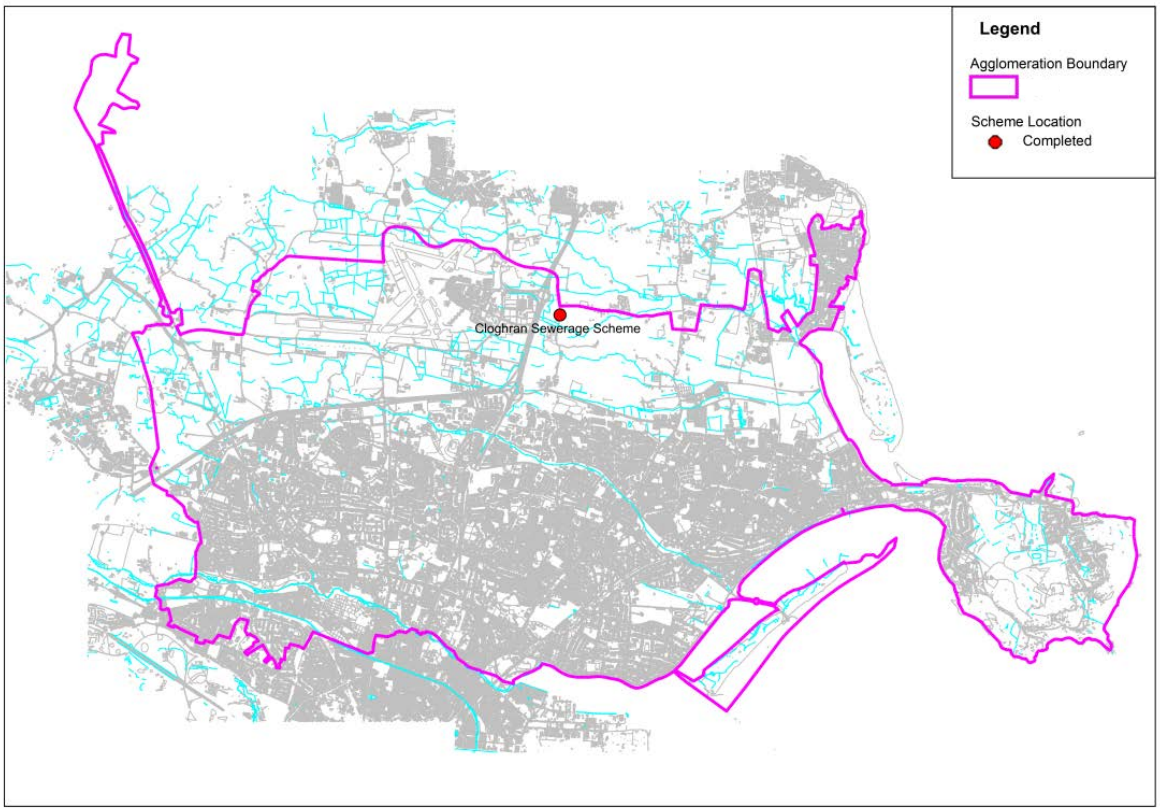
**Figure 3-3 Locations of IPPCs within the Sutton PS DAP study boundary**




### 3.4.4 Irish Water Programmes

There is one completed project included within the Irish Water Capital Investment Programme (CIP) for this study boundary, the Cloghran Sewerage Scheme. Refer to Figure 3-4.

**Figure 3-4 Locations of other ongoing projects**




## 3.5 WATER BODIES

### 3.5.1 Main River Data

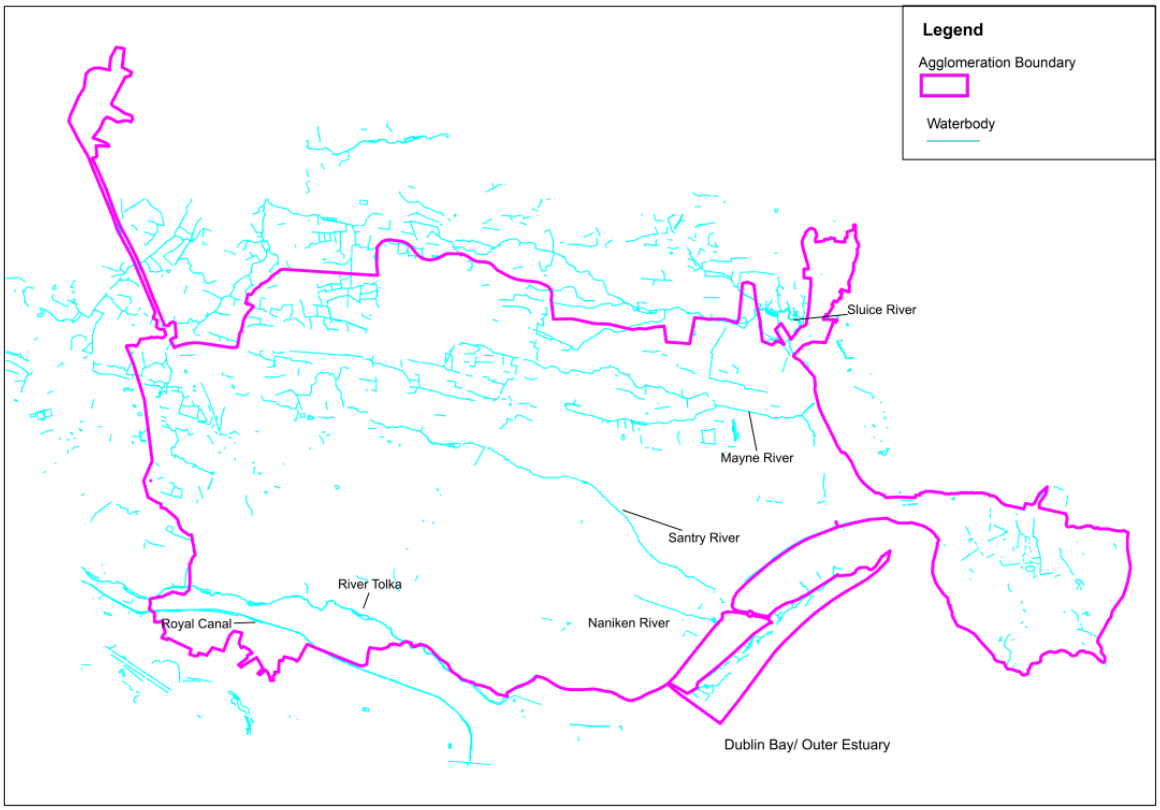
The study area is drained by a number of water courses. The River Tolka is the largest water course, however there are a number of other smaller water courses including the Finglas River, Kilbarrack Stream, Mayne River, Santry River and Wad Rivers among others. While varying in catchment sizes from under 10km$^2$ to over 150km$^2$ in the case of the Tolka, all water courses discharge to Dublin Bay/Irish Sea. These receiving waters are considered to be environmentally sensitive and have been designated both Special Protection Areas and Special Areas of Conservation. There are also a number of designated bathing areas adjacent to the study area.

The EPA's HydroNet page gives details about two long-term monitoring stations within the study boundary. A Botanic Gardens station on the River Tolka gives data on water level and water flow from 1999 onwards and a Cadbury's station on the River Santry provides water level data since 2001.

There are three types of receiving waters associated with the study boundary, as shown in Figure 3-5 below:

- Transitional: Designated Sensitive (River Liffey and River Tolka)
- Rivers (River Tolka, Sluice River, Santry River, Royal Canal, Naniken River, Mayne River)
- Costal (Dublin Bay/ outer estuary)

### Figure 3-5 Sutton PS DAP Receiving Waters




The WwTW is located towards the south of the catchment, at Ringsend. Treated effluent from the plant discharges into the Liffey Estuary and Dublin Bay.

River Basin Management Plans (RBMPs) have been published for all River Basin Districts in Ireland in accordance with the requirements of the Water Framework Directive. A report from the Watermaps viewer (July 2010) provides summary plan information about each waterbody relating to its status, risks, objectives, and measures proposed to retain status where this is adequate, or improve it where necessary. Table 3.8 summarises the ecological status of the main recorded watercourses in the catchment. All risk assessments were completed in 2008.

### Table 3-8 Watercourse Ecological Status.

| Watercouse Name | Waterbody code | Ecological Status | Comments |
|---|---|---|---|
| River Tolka Lower | IE_EA_09_1868 | Bad | '1a At Risk' status from CSOs and diffuse pollution |
| River Santry | IE_EA_09_1507 | Bad | '1a At Risk' status from CSOs, Section 4s (2008) licences and diffuse pollution |
| River Mayne | IE_EA_09_1428 | Poor | '1a At Risk' status from WWTPs (2008), CSOs and diffuse pollution |
| The Sluice | IE_EA_09_1532 | Good | '1a At Risk' status from diffuse pollution |

### 3.5.2 Hydrological Data

The OPW website shows that there are no hydrometric gauges within the study boundary.

### 3.5.3 Groundwater Data

The data contained on the Groundwater Data Viewer on the Geological Survey website suggests that no ground water sources are present within the Sutton PS DAP study boundary.

### 3.5.4 Bathing Waters / Shellfish Waters

The Water Framework Directive suggests that there are no designated Shellfish Water areas in the Sutton PS DAP area.

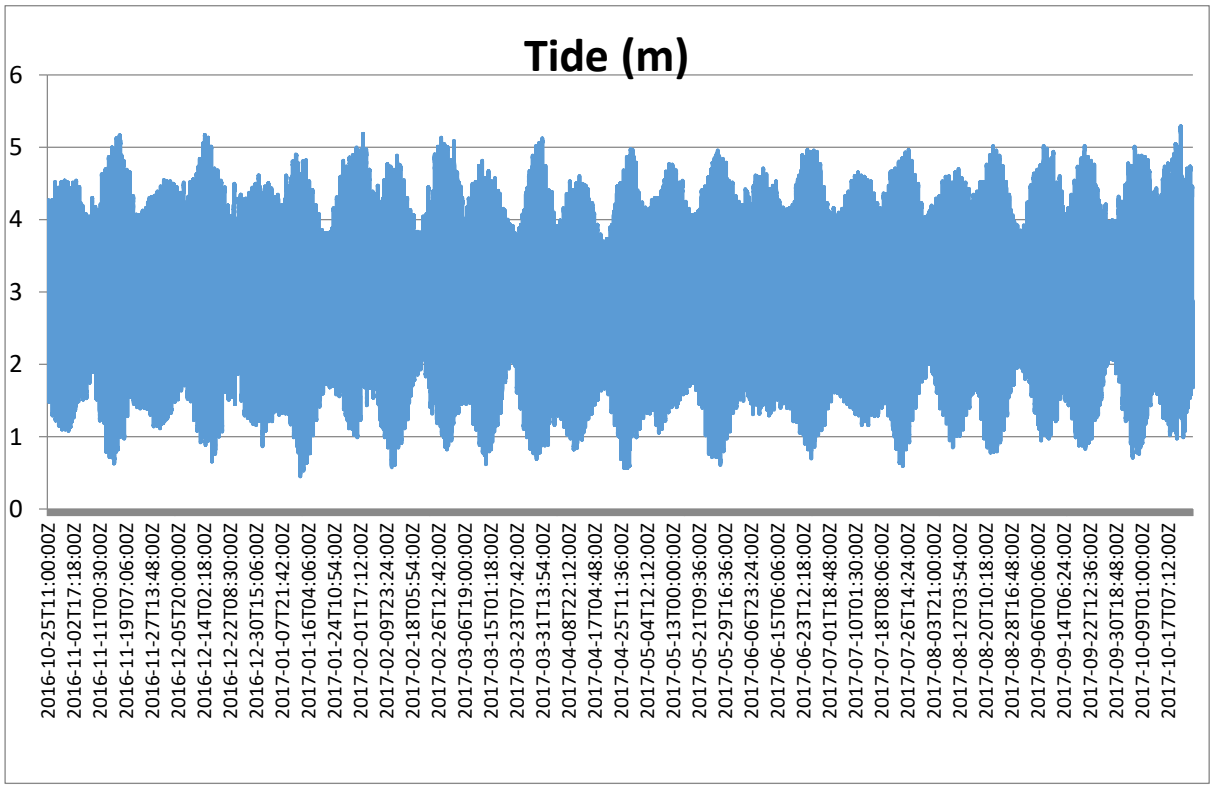
The EPA website shows two designated Bathing Water sites in the study boundary, one at Claremont Beach and the other at Dollymount Strand. The first has a bathing water quality status of 'excellent' and the second has a status of 'good'. A no swim notice was in place at Dollymount Strand in August 2017 following heavy overnight rains in Dublin that resulted in sewer and wastewater overflows being activated. A no swim notice was also issued in August 2017 for Claremont beach after high levels of Enterococci or E coli were found during routine tests.

### 3.5.5 Tide Gauge Data

Tidal infiltration to a system can pose a significant threat to the operation of the network, particularly around key ancillaries. There is tidal influence to some of the network within the Sutton PS DAP study boundary, particularly along the coastline at Kilbarrack, where it has been reported that there is tidal interaction with the CSOs in the area. Consequently, this has been considered when planning the surveys in the area.

Tidal data from Howth Harbour Tidal Station was obtained from Ireland's Digital Ocean and the year 25/10/2016 to 25/10/2017 is shown in figure 3-6. The highest tide in the period was 5.292mOD (2.33m above Malin datum) and the lowest tide level was -2.57mOD (-5.532m above Malin datum). These values have been used to determine locations at which tidal ingress is considered to have the greatest impact upon the sewerage system of the Sutton PS study boundary. Initial assessment of the current model identified that no sewers lie below the lowest tide level. A total of 117km of sewer lie below the highest tide.

**Figure 3-6 Howth Harbour Tide Levels for October 2016 – October 2017, extracted from Ireland's Digital Ocean.**




Some of these high risk areas are within the vicinity of some key assets; Coast Road PS, Sutton PS, Kilbarrack PS, Baldoyle Road PS, Vernon Avenue PS, Dollymount PS, Sutton Strand PS, Burrow Road/Sutton Golf Course PS Deer Park PS, Grange PS, Baldoyle Village PS, Clontarf Road PS and Harbour Road (Howth) PS. This information has been used in the scheduling of the CCTV surveys, detailed in section 6.4.1 of this report.

### 3.5.6 Coastal Bathymetry Data

Coastal Bathymetry Data if required can be obtained from the Marine Institute and the INFOMAR project. This has not been obtained at present.

## 3.6 INCIDENT RECORDS

Incident records for blockages, collapses, flooding and odours were obtained from the following sources and are described further in Section 4 of this report:

- Local Authority digital records
- Meeting with Irish Water and Dublin City/Fingal County Council Operations
- Maximo data supplied by Irish Water

## 3.7 PLANNING DATA

Adopted Local Area Plans from Fingal County Council and Dublin City Council have been reviewed to inform the future planning and growth projections.

## 3.8 EXTERNAL STAKEHOLDER PROJECTS

### 3.8.1 The Eastern Catchment Flood Risk Assessment and Management (CFRAM) study

To progress the implementation of flood risk management measures for the Eastern district, the OPW commissioned consultants to undertake the Eastern CFRAM Study in June 2011.

The main aims of the Eastern CFRAM Study are to:

1. assess flood risk, through the identification of flood hazard areas and the associated impacts of flooding
2. Identify viable structural and non-structural measures and options for managing the flood risks for localised high-risk areas and within the catchment as a whole
3. Prepare a strategic Flood Risk Management Plan (FRMP) and associated Strategic Environmental Assessment (SEA) that sets out the measures and policies that should be pursued to achieve the most cost effective and sustainable management of flood risk
4. Ensure that full and thorough public and stakeholder consultation and engagement is achieved

This study was split into four Hydrometric Areas, with the study boundary falling within HA 09 (Liffey-Dublin Bay), a relatively urbanised catchment, containing Greater Dublin and its surrounding commuter belt. Within HA09 there are 13 Areas for Further Assessment (AFA), with five falling within the study boundary: Raheny, Santry, Clontarf, Sutton- Baldoyle and Sutton- Howth. All of these five are at risk from coastal flooding and Raheny, Santry and Sutton- Baldoyle are additionally at risk from fluvial flooding.

Further information available at: http://eastcfram.irish-surge-forecast.ie/

### 3.8.2 Dublin City Council Flood Prevention Plans

Projects currently underway include:

*Dublin Flooding Protection Project*

- Designed to reduce the risks to life and property caused by coastal flooding. The project will propose solutions and an enhanced early warning system for the region.

*SAFER Project*

- The project will use emergency response management to provide the best level of flood protection. The SAFER Project is part of a €10m EU funded INTERREG project involving Dublin City, Germany, Scotland and Switzerland.

*River Tolka Flooding Study*

- To carry out a detailed analysis on the River Tolka. The principal output will be an analysis of the flood risk based on extreme flood events. This will include options for flood prevention and protection for properties at risk.

*Flood ResilienCity Project*

- To integrate the increasing demand for more houses and other buildings with the increasing need for more and better flood risk management measures in North West European cities along rivers.

*Clontarf Flood Defence Scheme*

- Clontarf is one of the most vulnerable areas of the City and is at risk of severe flooding. This risk is present all of the time. The proposed coastal flood defence scheme involves landscaped gentle grass mounding and some sea walls where mounding is not possible. This project strikes the best balance between providing essential protection for the people of Clontarf, while at the same time retaining much of the existing nature of the promenade as an open grassed area.

Further information available at: http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drains-sewers-and-waste-water/flood-prevention-plans

### 3.8.3 River Tolka Flood Alleviation Works

The River Tolka Flooding Study was commissioned by Dublin City Council, in association with Fingal County Council, Meath County Council and the OPW in 2002. The study arose from concerns regarding increased flooding risk to properties along the River Tolka arising from a significant flood in November 2000, when many properties were inundated particularly in parts of Meath and in the Dublin City Council area. The River Tolka Flooding Study identifies that substantial areas of urban development in the study area are at risk of repeat flooding from the River Tolka. The separate Dublin City Coastal Flood Risk Assessment (DCCFRA) study is examining the issue of tidal flooding of the coastal area. In addition, the OPW will address a number of issues of general policy as part of the National Flood Management review being undertaken.

The upgrades carried out as part of the flood alleviation works that are relevant to the study boundary include:

Dublin City Council Area

- New walls and embankments
- Replacement footbridge
- Widening of banks
- Lowering of Distillery Weir
- Scour damage repair
- General channel maintenance
- Construction of Drumcondra pumping station on the River Tolka (which receives discharge from a CSO at Botanic Avenue/Drumcondra Road Lower).

Fingal County Council Area

- Embankments
- Channel maintenance
- Major bridge replacement

### 3.8.4 Wad River Flood Relief Scheme/ Clanmoyle Flood Alleviation Scheme

The Wad River drains a catchment area of approximately 483 hectares, including parts of Ballymun, Santry, Donnycarney, and Killester to the seafront at Clontarf in north County Dublin. The Wad River, originally an open channel, has been completely replaced with culverts and pipelines of varying dimensions over the 6 kilometre route from Albert College Park on Ballymun Road to the seafront at Clontarf Road. Flooding events occurred in August 2008, July 2009 and October 2011 as a result of extreme rainfall in the catchment. These events posed a significant risk to public safety, caused significant damage to property and disruption to road and rail traffic.

In 2009, flood alleviation investigations provided potential scenarios for the Wad Catchment but none of them provided the required flood risk reduction on their own. A scheme using the beneficial elements of each scenario/flood alleviation measure was created and called the Clanmoyle Flood Alleviation Scheme. Proposals for this scheme include:

- Pipe flood waters in Clanmoyle Road in the quarry area of the Golf Club and release it slowly back into the existing Wad culvert when the storm abates
- Tunnelled upgrade of the culvert capacity at Howth Road and an additional outfall to the bay alongside Clontarf Road
- Localised works to the west of the M1 to alleviate the risk of flooding
- New culvert from Collins Park to link up with the proposed culvert on Clanmoyle Road
- To construct a second culvert with a second outfall to the sea at Clontarf Promenade. The proposed new outfall is a new box culvert to be constructed under the grassed area of the Clontarf Promenade, from the bus lane of Clontarf Road to the foreshore. The new culvert is to be located alongside the existing underground Wad River Culvert. Its aim is to increase the carrying capacity of this section of the Wad network and thus reduce flooding upstream.

Further information available at: http://www.dublincity.ie/main-menu-services-water-waste-and-environment-water-projects/pluvial-floodingwad-river

### 3.8.5 Dublin City Council Pluvial Flooding Work Projects

1. *Glendhu Park and Park Road*
    - An extreme flooding event at Glendhu Park in 2008 caused an entire estate to experience high levels of road flooding and interior flooding to eight houses. Two Swales were constructed to provide a volume of surface water storage to ensure that no flooding will recur in a similar 100 year pluvial event. These are to be located at Glendhu Park (1200m$^3$ of open flood storage) and Park Road (500m$^3$ of open flood storage). Following a severe storm event the swales are designed to self-drain back into the existing surface water sewer system, thus ensuring that there will be no

significant water present in the swales other than during and following a major flood event.

2. *Finglas area*
    - In 2009, 20 houses were flooded in Ballygall Crescent and Griffith Road. Some local improvements on the drainage system were carried out. They were:
        i. Ballygall Crescent, a 20m length of Surface water pipe was diverted which has improved drainage deficiencies
        ii. Extra gullies were also installed in Ballygall Crescent
        iii. New and upgraded pipework was constructed between Griffith Avenue Extension and the Finglas Road to connect to the Finglas River
        iv. There is also a proposal to construct a swale for the storage of c. 2,300 $m^3$ of flood waters in a public park along Glasanaon Road. Construction and maintenance of these swales should result in no property flooding in the 100 year - 60-minute event.
3. *Cabra West – Dingle Road, Carnlough Road & Drumcliffe Drive*
    - Following an extreme flooding event in 2008 Dublin City Council has proposed to install two swales to reduce the possibility of flooding. The proposed locations are: Killala Road (flood water storage of 2200$m^3$) and Drumcliffe Road (flood storage of 950$m^3$).
4. *Cabra East – Leix / Cuala Road*
    - In 2008, 12 houses were flooded leading to a full analysis of the sewer network in the area. There are c. 2570 houses and c. 13,472m of sewers on the network. A 225mm overflow was constructed in Imaal Road from the combined sewer into the Bradogue stream culvert, which will reduce flood levels there.

Further information available at: http://www.dublincity.ie/main-menu-services-water-waste-and-environment-water-projects/pluvial-flooding-works

## 3.9 COST DATA

RPS will contact Irish Water for available cost data such as repair cost factors.

## 3.10 SITE VISIT INFORMATION

In order to discuss and review existing datasets and operational issues two separate meetings were held with Local Authority staff, and Irish Water O&M staff.

As well as the above meetings a separate site visit was carried out by RPS on 8th November 2017 and this was to primarily focus on locating key assets and helping the modeller familiarise themselves with the catchment. A general understanding of the buildings within the catchment was gained during the site visit, with notes being taken on vacant sites, demographics and development areas to help identify key areas of the catchment that may require surveys.

The findings of the meetings can be found in **Appendix H**.

## 3.11 OTHER DATA

All data received so far can be categorised within sections 3.2 to 3.10 above.

# 4 INITIAL PERFORMANCE REVIEW

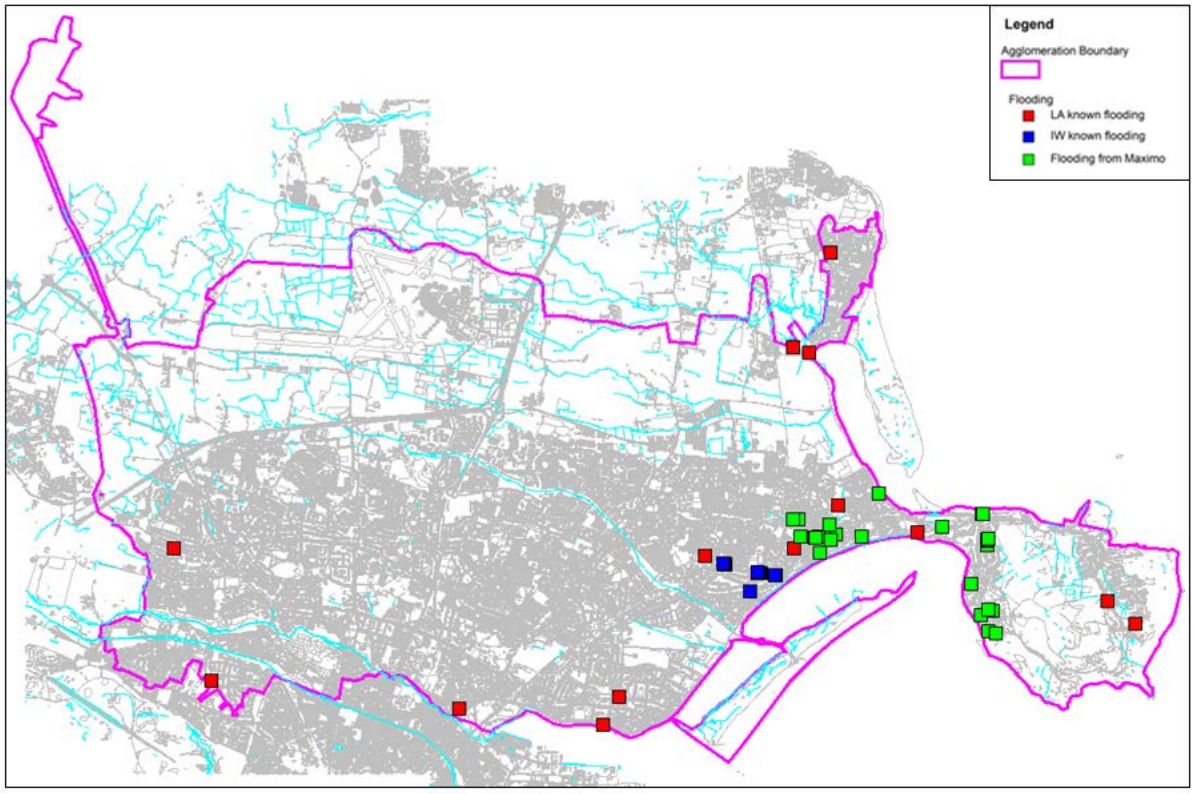
The following section provides an overview of the known performance issues within the Sutton PS DAP study boundary prior to any modelling work, using data extracted from Irish Water systems. A review of the reported flooding, pollution, structural assessment and operational issues has been undertaken, with data supplemented by meetings undertaken with Irish Water and Dublin City Council and Fingal County Council Operational staff.

## 4.1 REPORTED HYDRAULIC DEFICIENCIES

A review of the Maximo data supplied by Irish Water on the 11th December 2017 identified a total of 27 flooding locations which have been investigated within the catchment since April 2014. These are listed in Table 4.1 within Appendix H. It should be noted that issues with the accuracy of the data recorded on Maximo mean that the data should be treated with caution and as such the reported flooding locations have only been used as an initial source. The data will be updated periodically throughout the study. Data supplied by the local authority identified six flooding incidents to have occurred historically within the study boundary. Additional data supplied by IW identified a further 14 flooding locations that local operations teams considered an issue. This data was discussed with the local operations team to determine the accuracy of the reduced incidents.

Figure 4-1 below shows the location of the reported flooding within the Sutton PS DAP study boundary, contained within Maximo and from LA and IW knowledge:

**Figure 4-1 Reported Flooding Locations from Maximo, LA and IW**



## 4.2 REPORTED ENVIRONMENTAL DEFICIENCIES

A review of the investigations into the LAs and IW internal systems identified there to be no reports of pollution within the Sutton PS DAP study boundary.

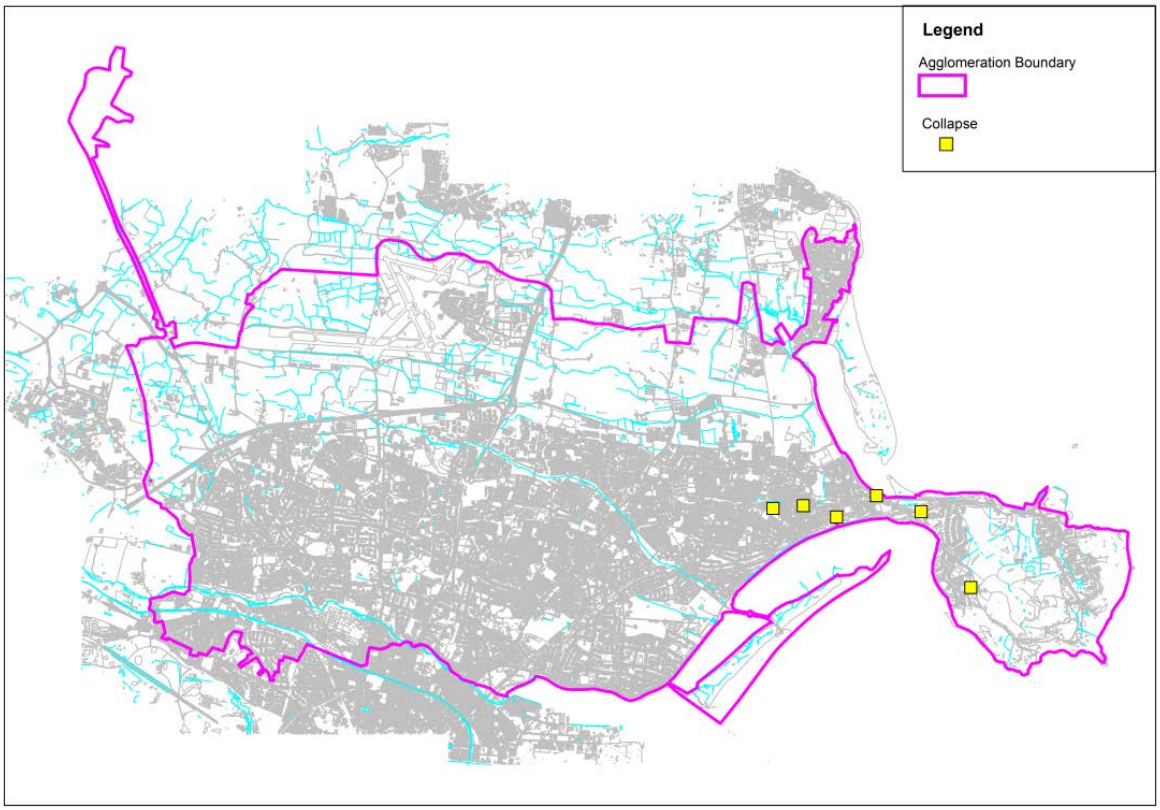
The 2016 Annual Environmental Report (AER) for Ringsend WwTW was reviewed and highlighted the following key findings:

- The sensitivity of the River Tolka Estuary to the discharge from the wastewater treatment plant;
- A negative impact from the wastewater treatment plant on the WFD status was also observed;
- The Tolka Estuary was identified to have a 'moderate' WFD status whilst Dublin Bay was identified to have a 'good' WFD status;
- Ringsend WwTW is not designed for nutrient removal and has experienced plant overloading and works on the Nereda Process Providing (PPS2). As a consequence, it is not compliant with the Emission Limit Values (ELV) limits in the licence for Total N and Total P, cBOD, COD and Total SS;
- Other parameters, pH and Toxicity were compliant with the licence;
- A detailed Storm Water Overflow Identification & Inspection report was updated with information from the City Centre Sewerage Scheme. This identified 86 CSOs relating to the City Centre Catchment, 21 identified as 'not a CSO' and 122 CSOs which fall outside the city centre catchment.

## 4.3 REPORTED STRUCTURAL DEFICIENCIES

A review of the investigations into the LAs and IW internal systems for the Sutton PS DAP study boundary identified six incidents of sewer repairs/collapses since May 2014, these are listed in the Table 4.4 within Appendix H and are shown on Figure 4-2:

**Figure 4-2 Reported Collapse Locations from Maximo**




The local authorities did not have any data on historical collapses within the catchment and therefore the best available data was that provided by the Irish Water Maximo system.

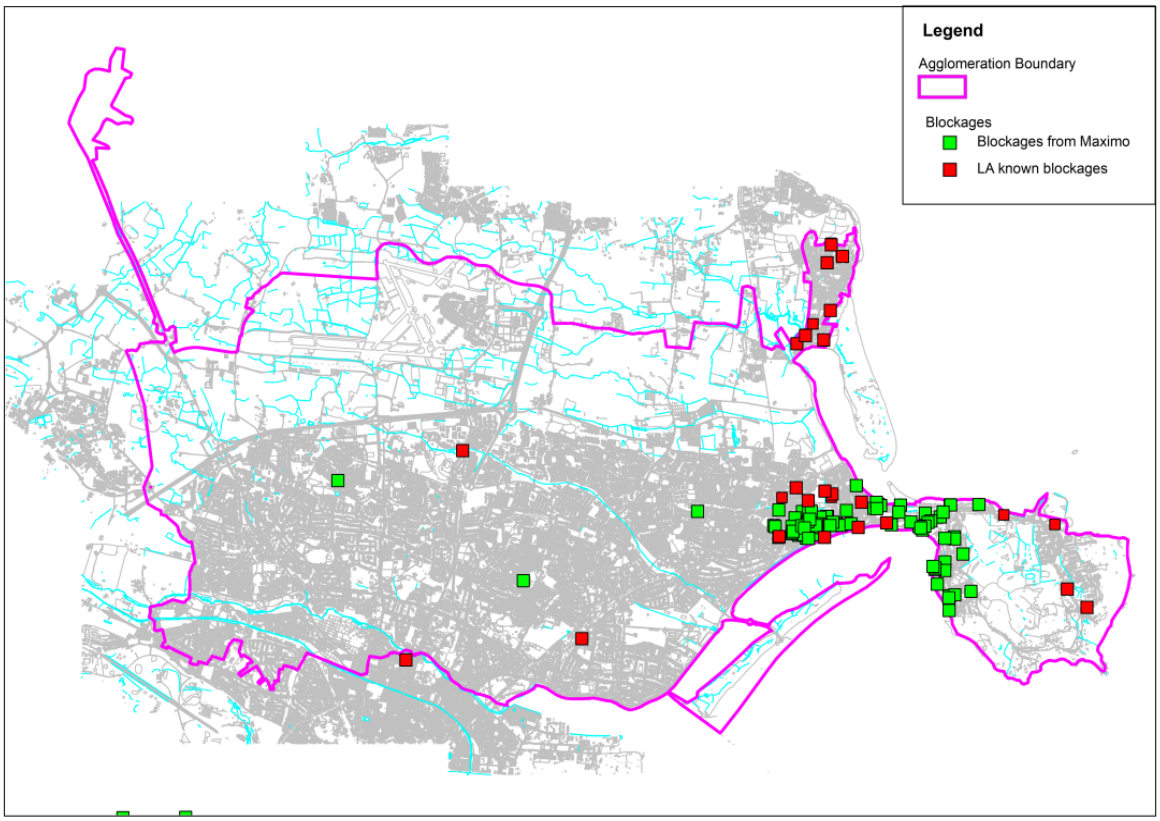
The InfoNet database for the Sutton PS study boundary contained limited CCTV data for a survey undertaken in 2007. The data contained no incidents of sewer collapses and therefore the best available data was that provided by the Irish Water Maximo system.

## 4.4 REPORTED OPERATIONAL DEFICIENCIES

A review of the investigations into the LAs and IW internal systems identified a total of 88 locations where blockages had occurred in the Sutton PS DAP study boundary. Refer to Table 4.6 within Appendix H. The data supplied by the Local Authority identified 36 blockage incidents. A large proportion of the reported blockages are located within the Sutton and Kilbarrack area.

Blockages reported within the Maximo database are displayed in Figure 4-3 below. In general there is a cluster of blockages that have been reported within the Sutton and Kilbarrack part of the study boundary. There is also a cluster of blockages stretching from the Sutton Train Station southwards, in the Howth region of the study boundary. Again this data is to be used with caution as the apparent cluster of issues may only reflect the Maximo system being used more often by Fingal County Council.

**Figure 4-3 Reported Blockage Locations from Maximo/ LA Data**




## 4.5 RISKS IDENTIFIED FROM PREVIOUS STUDIES

RPS is not aware of any further studies that have identified risks within the catchment, and which are relevant to the Sutton PS DAP project.

## 4.6 RISKS IDENTIFIED THROUGH STAKEHOLDER CONSULTATION AND DATA COLLECTION

RPS met with Dublin City and Fingal County Council representatives to discuss performance risks and asset conditions within the catchment. The risks highlighted in this section should be considered when planning and undertaking the surveys within the study boundary.

During the meeting with Dublin City Council representatives, risks were identified with regards to access difficulties with certain areas of the study boundary. Access to a number of the pumping stations in the study boundary may be restricted due to previous conflicts with Dublin City Council and residents. This should be considered when planning and undertaking surveys within these areas.

Conversations with Irish Water identified a number of known operational issues across the Sutton PS study boundary.

- Previous CCTV surveys in the Portmarnock area of the study boundary found large amounts of sediment in the network around Strand Road. This was jetted at the time but it is thought that some gully connection issues are a possible cause of the issue.
- The Baldoyle area in the east of the catchment was highlighted by Fingal County Council as being an area that is low lying and prone to sediment build-up which results in cleansing on a regular basis.
- Furthermore, in a similar area, there are reports of grease build up from the Baldoyle Industrial Estate which may impact upon the operation of the network.

Network performance risks were also discussed and have been highlighted in the previous relevant sections of the report.

## 4.7 RISKS ASSOCIATED WITH PROGRAMME TARGETS AND FINANCE

There is a risk associated with the quality of data supplied by survey contractors at Stage 2 of this project. This is especially relevant if multiple survey contractors are engaged, with the potential to initially produce outputs of varying quality. In order to control this risk and ensure all outputs meet Irish Water standards, RPS will monitor contractor performance, promote knowledge share and hold dissemination workshops on-site throughout the programme, to drive consistency. It is important these risks are reduced if the programme is to remain on target, with a high quality output.

As a result of the increase in flow monitors compared to that stated in the ToR (See Section 6.3.5 for details), there is a significant risk associated with verification being delivered in the programmed timeframe. Delays may occur due to unforeseen complex hydraulics, thus resulting in further verification surveys being required. Additionally, although the flow survey is initially planned for twelve weeks, this may be delayed due to the WaPUG event criteria not being met within this timeframe. Not only may this cause delays to the programme, there may be increased costs associated with the additional work (extended surveys, reviewing and assessing the data on a weekly basis). In order to reduce this risk, it has been recommended that the flow survey is phased throughout the programme. Further details of the proposed flow survey phasing are outlined in section 6.8 of this report.

A risk register is continually updated in the progress meetings held between RPS and stakeholders. This outlines any associated risks to the project and how RPS aims to reduce the impacts of these. A copy of the current risk register is attached in Appendix G.

# 5 HISTORICAL DATA INVESTIGATION

## 5.1 INFORMATION RECEIVED

At the outset of the study an initial Data Manual was supplied for the catchment, this was updated throughout the Stage 1 process as and when new data was received. A Data Manual Log has been created detailing all data that has been received during the process and this is contained in **Appendix B.**

## 5.2 IDENTIFICATION OF CURRENT MODEL

The purpose of the study is to create a hydraulic model of the Sutton PS catchment, which pumps to Ringsend WwTW. The most recent model was built and verified against a 2011 short term flow survey, as part of the NFS (North Fringe Sewer) study undertaken by RPS. A number of other historical models exist such as the FWS (Foul Water System), GDSDS (Greater Dublin Strategic Drainage Strategy), NDCS (North Dublin Connections Study) and SWS (Surface Water System) models. However the 2011 NFS model is considered to be the latest model available on the Irish Water system.

### 5.2.1 Initial Model Review

The previous model built and verified in 2011 is considered the most up to date model available from Irish Water and an initial model review has been undertaken on this model, the findings of which are given below:

- The model was verified against a 2011 flow survey and can be considered out of date for reviewing overflow performance and predicted flooding locations. The model upgrade will enable the user to have greater confidence in model predictions;
- An additional asset survey is required to address the requirements to have greater confidence in the key driver locations;
- An additional flow survey is required to address the requirements to have greater confidence in the key driver locations;
- Any future schemes would be progressed on unverified areas and risk over/underdesign and no real understanding of the hydraulic impact of changes, particularly to unverified CSOs where weir level changes are proposed;
- All assets and key driver locations such as reported flooding locations are required to be flow monitored;
- All asset surveys to be focussed around key driver locations.

The outcome from the above review identified the need to undertake a new model build with further asset and flow surveys to be undertaken. The new model will have a model resolution of Type II in all areas (all node model) in order to provide a tool capable of investigating all risks currently identified in the catchment, as well as proactively providing a model to address new risks in the future. Confidence in model predictions near flooding and growth driver areas will be high, which will allow for accurate headroom / flooding analysis. The Model review can be found in Appendix J of the stage 1 report.

## 5.3 HISTORICAL DATA COLLECTION

The timeline of studies and reports undertaken in relation to Sutton PS modelling is as follows: -

GDSDS, NDDS and North Fringe Interceptor Drainage Area

As part of the Greater Dublin Strategic Drainage Strategy (GDSDS) - NDDS and North Fringe Drainage Area project a hydraulic model referred to as the NDDS and North Fringe Interceptor model was constructed and verified using InfoWorks CS, version 4.56. This model was largely based on SUS25 data supplemented with an asset survey of details of some CSOs, pumping stations, flumes, siphons, valve houses, outfalls and specific manholes where network connectivity was uncertain. While there were large amounts of survey data available, the report associated with the hydraulic model build noted that some data (ground levels, inverts, diameters etc.) was missing. Observed flow survey data, from a total of 83 flow monitors, was used to verify the hydraulic performance of the model. A moderate level of verification was achieved and it was considered adequate for use in a strategic level study and to carry out the hydraulic assessment using design storms.

Previous to this a Wallrus model was completed as part of the NDDS Catchment Area Study Preliminary Report (1993) by MCOS, however it was concluded that the model was considered unsuitable for use in the GDSDS due to its age and incompatibility with newer software packages. The GDSDS did however use much of the detailed information collected during the early 1990s.

2004 North Dublin Connections Study (NDCS) - 2004

The 2004 NDCS model was constructed to reflect the collection network as it was at the time including the diversion of a number of catchments from the NDDS to the NDCS.

North Fringe Sewer Model update (2013)

In May 2008 RPS were commissioned to undertake an update on the 2004 NDCS model but the scope of the project was restricted by the project Client to the use of existing available data only. The following were the proposed aims of the study;

- Update the model to include flows from developments which were constructed after the 2004 NDCS.
- Update the model to include flows from the proposed Terminal 2 building at Dublin Airport
- Calibrate the model based on flow and rainfall data from existing local authority permanent flow monitoring arrangements only and run the model for the 2 and 30 year events.

The model used in this study was based on the GDSDS model and adjusted to include the NFS and newly constructed branch connections to it, though no further calibration or verification was carried out. The 2013 NFS model also included design details for the diversion of flows from Howth and Sutton to Sutton Pumping station. A model review was carried out and the results, as are summarised below, indicate that the model adds little in terms of understanding current network performance:

Significant difficulties were encountered in the calibration process owing to the quality of data available from the permanent flow monitors;

- The number of rain gauges used (2 No.) was insufficient based on the catchment size;
- The total number of functioning flow monitors was 4 is considered insufficient ;
- Flow monitoring data from Dublin Airport was not available at 5 minute time intervals;
- There was no monitoring of CSO spills and emergency overflows from the catchment;
- One flow monitor showed evidence of pumping within the network which was not represented in the model.
- Data from Portmarnock and Baldoyle pumping stations was of limited use;
- The modelled pumping station operation regime at Ballymum (taken from NDCS model) was significantly different to the observed response;
- New catchments added to the model were identified by a data collection exercise in 2009.

It was concluded that as the NFS Model Update was restricted to the analysis of existing available data, it did not deliver a model in compliance with the WaPUG Code of Practice for a Type 1 Skeletal Planning Model. As a result the model should be used to identify areas for further assessment only, and should not be used as a planning or detailed design tool. The absence of detailed flow and rainfall data limited the potential identification of network hydraulic deficiencies in the NFS catchment and the lack of asset information also contributed to the problems encountered in the calibration process. It was also noted that the pre-2004 sub-catchments have not been recalibrated since their diversion from the NDDS to the NFS and as a result there may be some discrepancies between modelled and actual flows due to routing errors.

### Significant changes to the wastewater network

Since the completion of the last major study on the sewerage system (GDSDS) there have been a number of modifications to the network including:

- The commissioning of the NFS project including the Grange Storm Tank, Ballymun PS, Northern Interceptor pipeline and other diversionary pipelines connecting areas to the NFS;
- The largest alteration to the network has been the works carried out to pump wastewater from Sutton PS to Ringsend WwTW. This involved the construction of a pump station at Sutton which intercepts flows from the NDDS and NFS and pumps via a cross-bay submarine pipeline to Ringsend WwTW;
- Following completion of the above project, works commenced in 2006 (Contract 5.1) to divert flows from Howth and Sutton to Sutton PS. A series of pumping stations (or alterations to existing ones), storage tanks and interceptor sewers were constructed to convey wastewater from Howth to Sutton PS and retaining the use of the NDDS sewer, between Sutton PS and its discharge point off the Nose of Howth, as an overflow sewer only.
- The addition of many new developments, particularly in the North Fringe area, including some large scale developments. A new large sewer servicing Dublin Airport, replacing a smaller 300mm sewer, has been constructed connecting the Airport with the NFS near the Swords Road.
- There was a ‘developer provided’ rising main and gravity network laid through Northwood Demesne in Santry connecting to the North Fringe Sewer. This was to cater for the future upgrading of Santry Pump Station. It was intended to re-direct flows from the Santry

Network and increase the capacity of this pump station; this project was never completed but the intention remains to divert these flows to the reduce the impact on downstream sewer flooding experienced in Santry. The Santry pump station upgrade preliminary report is available form Irish Water.

# 6 DEFINITION OF STUDY REQUIREMENTS

The following section discusses the key catchment drivers that have been identified and the modelling requirements and surveys that have been scheduled to improve confidence in model predictions, so that the new model can be used as a strategic planning tool in the future.

## 6.1 CATCHMENT DRIVERS

Throughout the Stage 1 process, a number of key catchment drivers have been identified, and are summarised below:

### Environmental

- European Court of Justice (ECJ) case outlined in Infringement Notice 2013/2056 – Ringsend WwTW.
- Pollution incidents reported by local authority operations team located across the study boundary.

### Hydraulic

- The catchment has 27 locations of reported flooding contained on the Maximo database (April 2014 to December 2017).
- A further six areas of hydraulic capacity issues were identified by the LAs operatives.
- Further information supplied by IW identified 15 locations of flooding not contained on any internal system. This information was supplied at meetings with IW operations teams.

### Ancillaries

- The Sutton PS study boundary contains record of 140 existing overflows (87 CSOs, 18 EOs, 30 foul to foul overflows and 5 Abandoned), 69 pumping Stations (59 Irish Water owned, 4 Private and 6 Abandoned). Surveys of all ancillaries identified are required to obtain the most current data on the asset performance. A drive by survey of the abandoned pumping stations is scheduled to confirm no structure exists.

### Growth

- The study boundary covers the Dublin City Development Plan (2016-2022) and The Fingal Development Plan (2017-2023) regions, and identified 31 sites that are outlined for growth in the future.

### Serviceability

- The data collection exercise database identified 88 reported Blockage Locations (from April 2014 to 2017); the local authority database identified 36 incidents of blockages in the catchment.
- The data collection exercise identified 6 structural deficiencies (from April 2014 to 2017).
- The data collection exercise contained no pollution incidents (from April 2014 to 2017).
- Further serviceability issues were identified across the study boundary by the Local Authorities.

### 6.1.1 Stakeholders

To ensure the highest confidence outcome is achieved, continuous interaction with all catchment Stakeholders (See Section 2.5) will be required.

## 6.2 MODELLING STRATEGY

The previous model was built and verified in 2011 as part of the North Fringe Sewer model update study and updated again in 2013 to take into account developments that have been constructed in the North Fringe catchment post 2004. The model was audited and was considered to not meet the verification requirement for a Type I skeletal planning model due to lack of confidence in the model and its predictions. Due to the limitations identified in the previous model build report and following the guidance within the Irish Water Technical Standards (IW-TEC-200-001), a Type II model will be constructed to provide a tool capable of investigating all risks currently identified in the catchment, as well as proactively providing a model to address new risks in the future.

In order to improve the confidence in model predictions, a number of surveys have been scheduled, focussing on key driver areas, such as hydraulic deficiencies, ancillary (PSs, CSOs) status, growth and serviceability. Survey requirements are detailed in section 6.3 Initial Data Collection below.

## 6.3 INITIAL DATA COLLECTION

The following section discusses the survey requirements proposed for the model upgrade that is recommended to be carried out during Stage 2 of the Sutton PS DAP. The project ToR (p.44) assumed the following surveys, for tendering purposes.

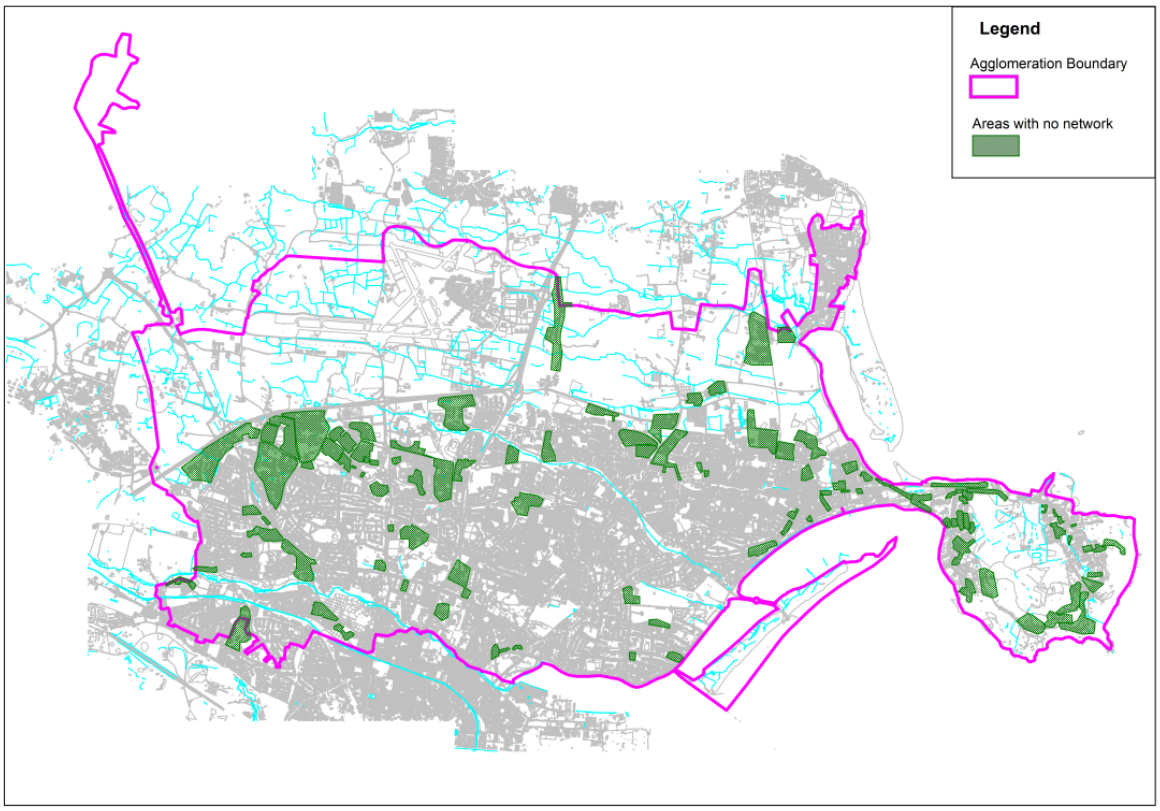
**Table 6-1 Assumed Survey Quantities for tendering purposes (Tor, p.44)**

| Survey Type | Quantity |
|---|---|
| **Flow Monitor locations, nr.** | 560 (480 Flow & 80 Depth) |
| **Conductivity Monitors, nr.** | 2 |
| **Rain Gauges, nr.** | 90 |
| **Duration of surveys above, weeks** | 2 surveys of 12 weeks |
| **Manhole Surveys, nr.** | 2900 |
| **CSO Surveys, nr.** | 85 |
| **Pumping Station Surveys, nr.** | 40 |
| **Other Ancillary Chambers (bifurcations etc.)** | 58 |
| **Impermeable Area Survey, ha** | 400 |
| **CCTV Survey, km** | 70 |

### 6.3.1 Manholes Survey and Digitisation

A number of areas with no records of the existing network have been identified. RPS will engage with the Developers of these areas directly in the coming months, in further efforts to obtain network records and minimise the extent of on-site asset surveys required.

**Figure 6-1 Areas with no digitised network**




In the absence of developer plans or as-built drawings, the areas identified in Figure 6-1 should be surveyed to obtain accurate information about the network layout. If a full manhole survey is not feasible, then surveying every 3rd/4th manhole would give sufficient data to build a network, using the InfoNet inference tool between the surveyed manholes. Surveys should ideally focus on sewer junction manholes where the greatest data value can be obtained from each asset survey. In some areas, the sewers have not yet been taken in charge by Irish Water.

Where surveys are not feasible at all manholes, then sub-catchments for these areas would need to be defined and flows generated based on the applied population and consumption rate, with an assumed connection point assigned. The available LiDAR data will be interrogated to determine whether the connection is via gravity or pumped and will be modelled accordingly. Caution should be taken during this process to ensure there are no instabilities within the model. If instabilities occur then a dummy network would need to be created, to represent the network in these areas, this would be flagged according to the IW specification. This would give sufficient data to complete the model build, although issues may arise within the larger areas where populations could be high, resulting in a large point load being discharged to an IW manhole, as the localised storage has not been taken into account.

It is proposed that a Type II model be created (in accordance with the WaPUG Code of Practice for the Hydraulic Modelling of Sewer Systems (WaPUG CoP)) as part of the study. A Type II model is used to give an overview of a specific drainage area, the purpose of such a model is primarily as a planning tool to:

- Identify hydraulic problems within a drainage area, including identification of flooding areas, surcharge pipes, throttle, reverse flows and the performance of the combined sewer overflows and other ancillaries.
- Identify the need for possible hydraulic upgrading schemes and to carry out initial scheme appraisals.
- Assess the impact of proposed developments.

A Type II model would include all ancillaries and should include all known problem areas, particularly those of known flooding or surcharge. It should also be noted that a Type II model requires a minimum node density (nodes/hd population). The Sutton PS study boundary model will be an 'all node' model, which significantly exceeds this node density value, however the WaPUG CoP was written when computing power was more limited and as such the all node model will provide the best level of model coverage to fulfil all of its objectives.

Following discussions with IW, a review of the study boundary was undertaken and this found that a section of the southern part of the InfoNet database drained into the City Centre catchment and as such a number of the scheduled manhole surveys could be de-scoped.

The initial process for identifying the manhole surveys was undertaken using a priority classification process and this identified **3,224** manholes that would require to be surveyed in order to create a Type II model.

Following the Irish Water approach on previous DAPs the manhole surveys have been scheduled to focus on areas based upon the following set of criteria:

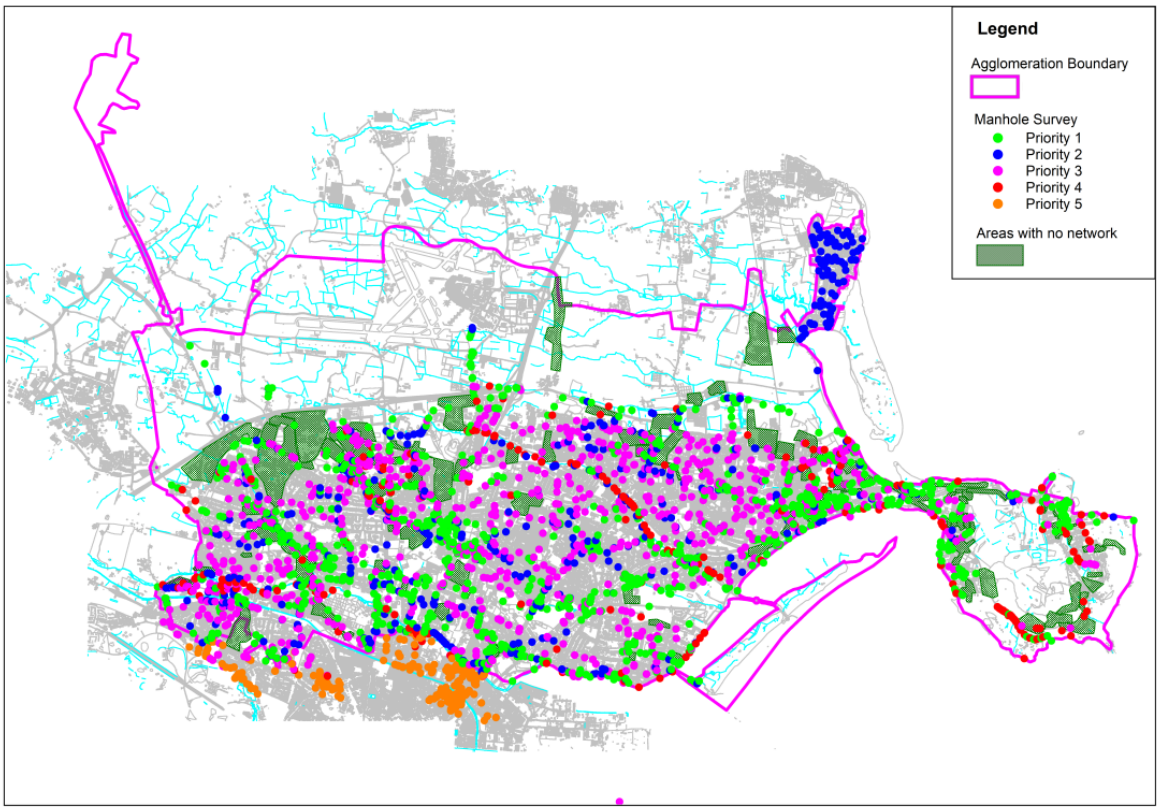
1. Manholes deemed critical to the creation of the Type II model e.g. near ancillaries, flooding locations, key bifurcations and operational areas of interest.
2. In order to allow for data completeness in the model, a number of SQLs have been run on the network to identify the following
    i. Missing pipe shapes and widths, Cover levels
    ii. Missing inverts
    iii. Bifurcations
    iv. Junctions
    v. Outfalls
    vi. Negative Gradients.
3. In order to improve network coverage and facilitate in creating an 'all node' model, an allowance of 25% of nodes within unmapped areas has been used, following previous guidance supplied by Irish Water.

### Table 6-2 Manhole survey priority classifications

| Reason for survey | Number of surveys |
|---|---|
| 1. Key driver locations for creation for Type II Model (Priority 1 Manhole Surveys) | 1,184 |
| 2. Data Completeness for creation for Type II Model (Priority 2 Manhole Surveys) | 586 |
| 3. Unmapped areas – increase network coverage. | 1,454 |
| Total MH surveys | 3,224 |

The manhole survey schedule which details all manholes to survey, priority and reason is contained within Appendix C – Survey Requirements of this report. Priority 3, 4 and 5 manhole surveys have been identified and included as surveying these manhole would increase the completeness of the network but are not critical for a Type II model being used for DAP purposes. Figure 6-2 shows the proposed manhole survey locations pre Stage 1 meeting:

### Figure 6-2 Scheduled Manhole Survey Locations



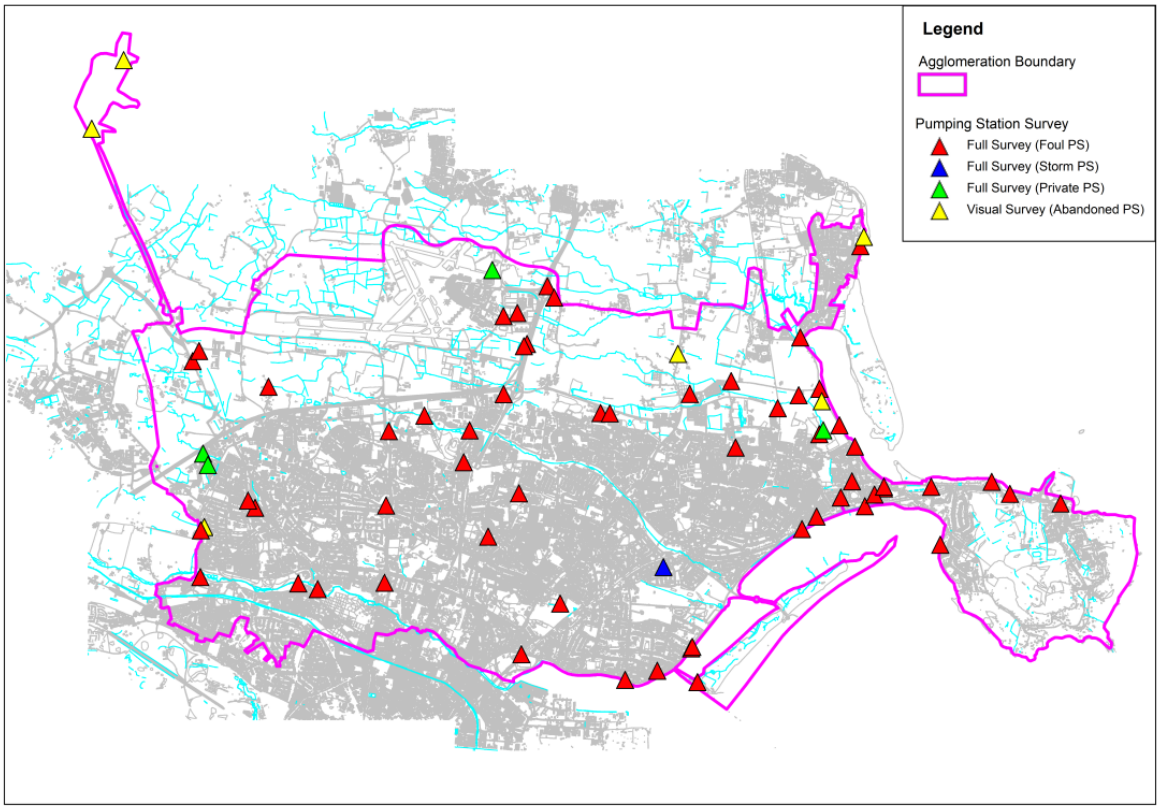
### 6.3.2 Ancillary Surveys

The following section details the ancillary survey requirements for the Sutton PS study boundary.

#### 6.3.2.1 Pumping Stations

Following the process agreed with Irish Water for previous DAPs, it is recommended that all pumping stations whether Irish Water or privately owned would be scheduled for survey. However it should be noted that access issues may exist at the privately owned pumping stations that may prevent the survey being undertaken. In total there are 63 operational pumping stations (62 Foul and 1 storm) scheduled to be surveyed as part of the DAP. It is recommended that all identified pumping stations have a hydraulic survey undertaken to determine their impact upon the sewerage system. As well as the operational pumping stations a total of six abandoned stations are scheduled for a visual survey to confirm no structure exists. This will include drop tests and survey of the wet well. Refer to Table 6.3 in Appendix C and shown in Figure 6-3:

**Figure 6-3 Scheduled Pumping Station Surveys**

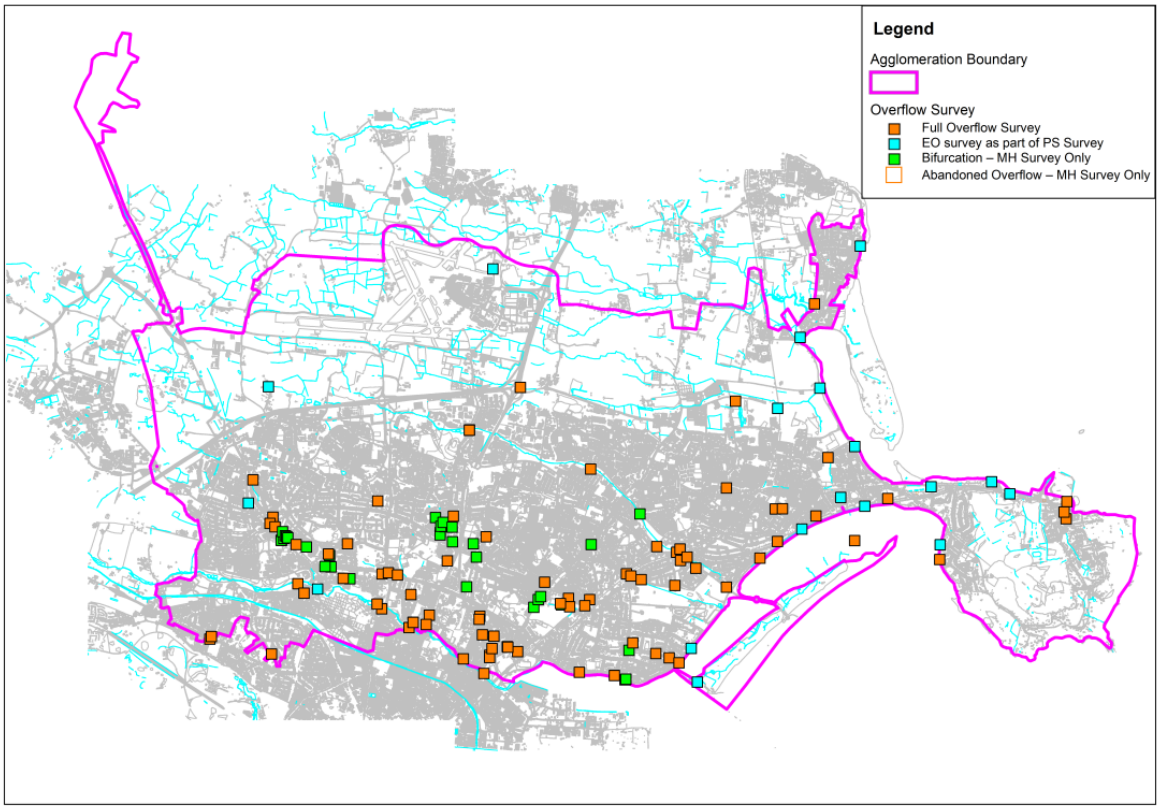



#### 6.3.2.2 Combined Sewer Overflows

In total there are 140 overflows within the Sutton PS study boundary, which has resulted in 87 CSOs being scheduled for a full ancillary survey, a further five CSOs are considered to be abandoned and have been scheduled for a manhole survey to confirm this. It is suggested that the 18 EOs be surveyed as part of the pumping station surveys and their performance will be reviewed as part of the Stage 3 assessment of the catchment. The remaining 30 overflows are considered to be foul to foul overflows and have been scheduled for a separate ancillary survey to confirm spill and

continuation flow paths. The overflows scheduled for survey are included in Table 6.4 within Appendix C and are shown on Figure 6-4:

**Figure 6-4 Scheduled CSO Surveys**




#### 6.3.2.3 Wastewater Treatment Works

All flows are pumped to Ringsend WwTW from Sutton PS and the hydraulic breakpoint of the system is considered to be the pumping station. Therefore it is not considered to be a requirement to survey the WwTW as part of the study.

### 6.3.3 River Profile / Topographical Survey Requirements

It is not anticipated that a river profile or topographical survey is required for the study.

### 6.3.4 Flow Survey Requirements

A short term flow survey has been planned in order to improve model confidence. This has been focused primarily at driver locations such as key ancillaries, reported flooding locations and to obtain flows from upstream areas of the catchment to improve confidence in flows arriving at these locations.

The recommended flow/depth survey has been programmed based upon the following priority ordering and consists of up to 705 flow monitors. Details of the priority classifications are outlined in

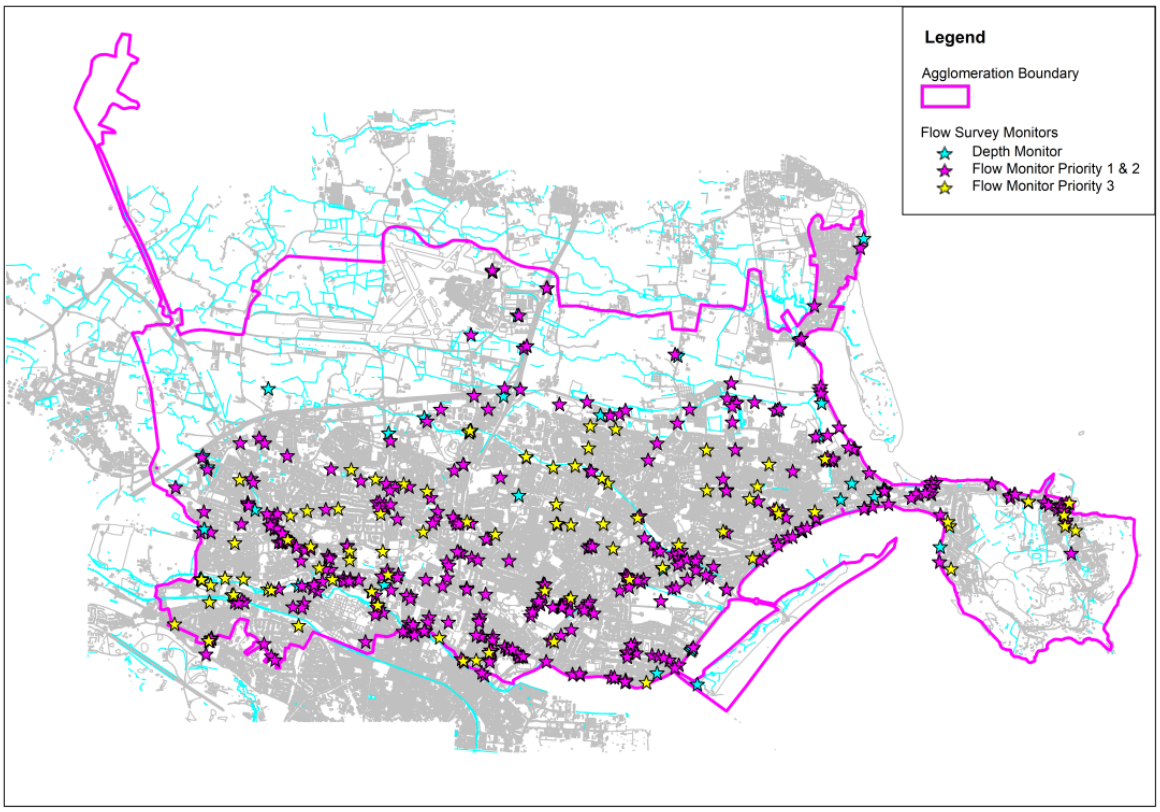
Table 6-3. Initial suggestions identified that **487** monitors were required to successfully create a model to a Type II standard with a further **92** Priority 3 monitors which may be avoided if a reduced verification confidence is acceptable for the uppermost catchments. The scope also includes a further **80** priority 4 monitors that have been de-scoped following a review undertaken with Irish Water. These are at locations in sewers that have a diameter less than 300mm, which have been found historically to give poor flow recordings.

### Table 6-3 Scheduled Flow & Depth Monitors

| Priority | Reason | Quantity | Sub-Total |
|---|---|---|---|
| Priority 1 | Pipe U/S and D/S of CSO | 209 | **418** |
| | Depth Monitor in PS Wet well | 58 | |
| | Tank | 5 | |
| | Incomer to Major PS | 43 | |
| | Major U/S flows | 40 | |
| | Hydraulic Flooding/Operational Issues Location | 7 | |
| | Large Surface water System | 3 | |
| | Major Bifurcations | 10 | |
| | Larger Growth Sites | 11 | |
| | Siphon | 5 | |
| | Trunk Sewer | 27 | |
| Priority 2 | Minor Growth Sites | 6 | **69** |
| | Additional Major Flow Leg | 2 | |
| | Incoming pipes to Minor PS | 1 | |
| | Minor Bifurcations | 60 | |
| **Flow/Depth Surveys required for Type II model (minimum)** | | | **487** |
| Priority 3 | Upstream catchment flows | 74 | **92** |
| | Storm/Abandoned Pumping Stations | 5 | |
| | Small flows at ancillaries | 13 | |
| Priority 4 | Removed following IW Review Meeting | | **80** |
| **Flow/Depth Surveys required for Type III model (desirable)** | | | **659** |

The flow monitor schedule which details all monitors, their locations, reasons for installation and alternative locations is contained within **Appendix C – Survey Requirements** of this report.

### Figure 6-5 Scheduled Flow & Depth Monitor Locations (Priority 1, 2 & 3 only)

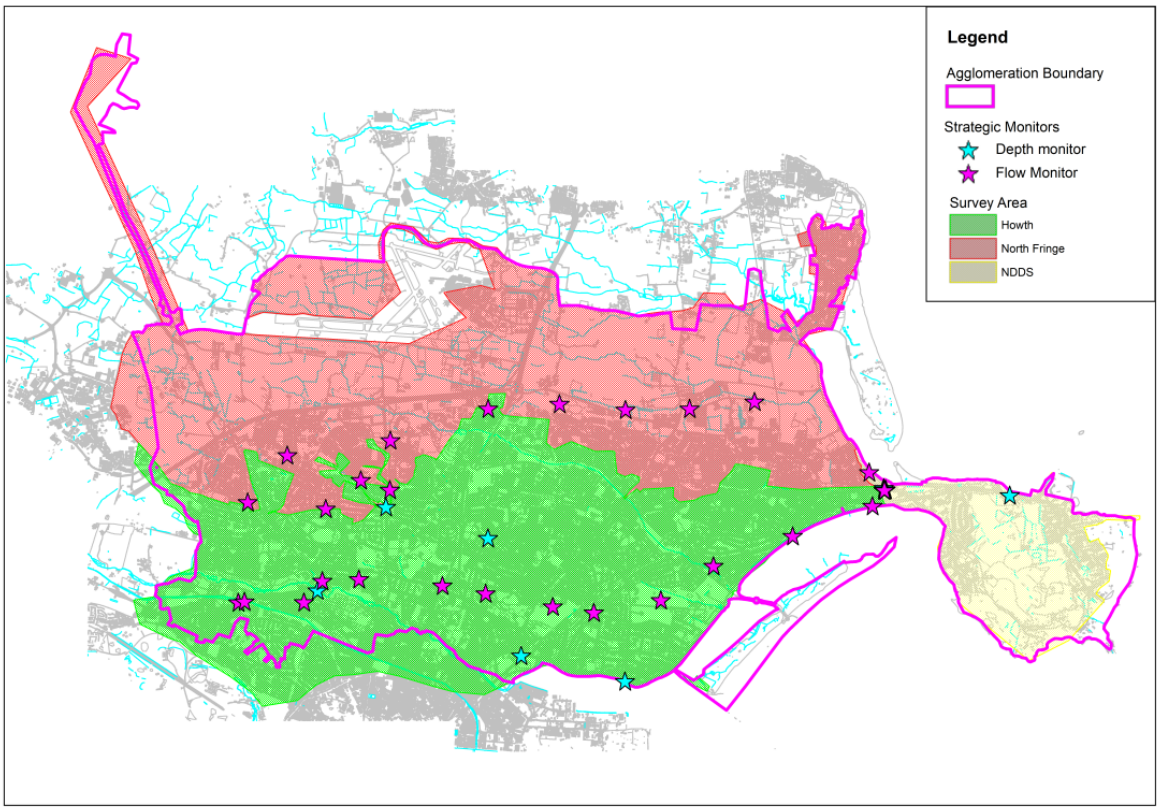



Due to the high number of monitors required for the flow survey and the limited survey resources available in Ireland and the UK, it has been considered that the most efficient way to undertake the flow survey is to divide the survey into two separate areas, primarily a north/south split. The north survey zone consists of the sewers discharging to the north fringe trunk sewer and including all flows from Howth (located towards the east of the catchment), with the south zone being all sewers that discharge to the NDDS sewerage system.

It should be considered that these values are subject to minor alterations at Stage 2, due to any on-going network digitisation process that is running concurrently with the DAP, as well as being supplemented by the asset surveys received from site.

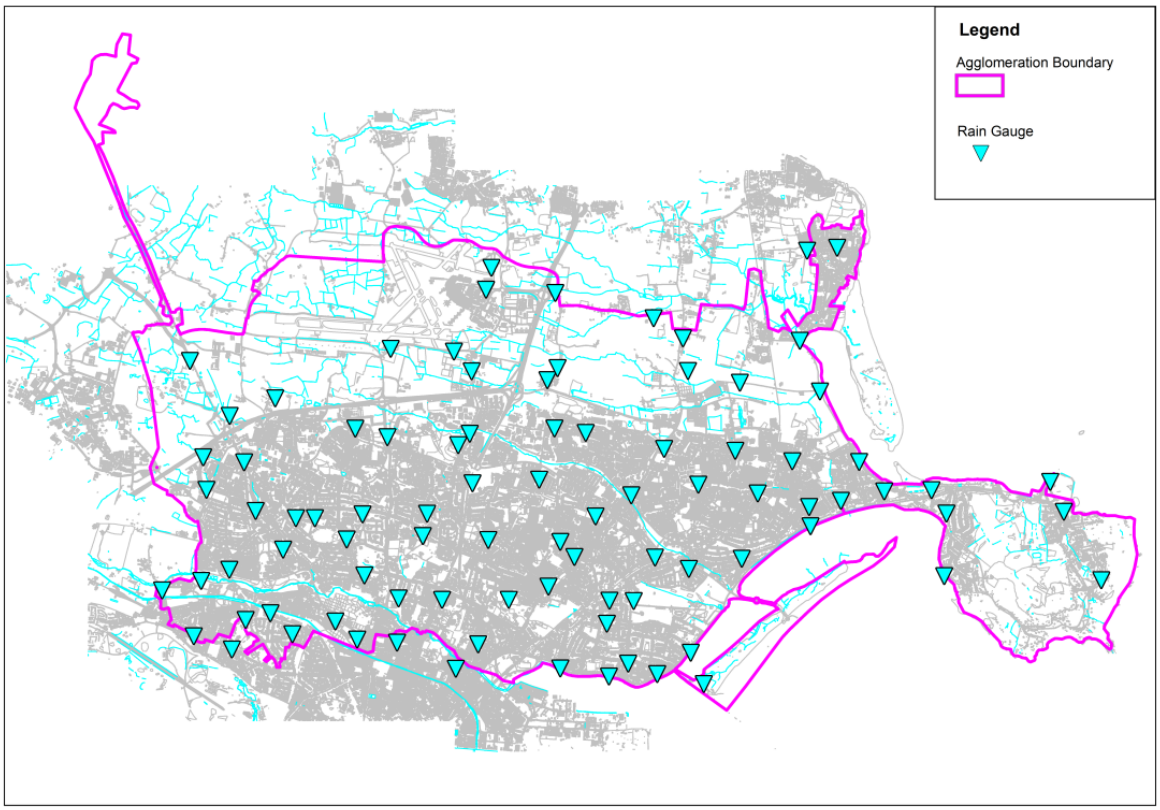
As the survey is to be split into two sub areas, it is required that 38 strategic monitors remain in place for both of the flow surveys, in order to confirm flows at key locations throughout the network and ensure that each sub area verification ties in. Figure 6.6 shows the location of the strategic monitors, which may also be utilised for any permanent monitoring of the Sutton PS network.

## Figure 6-6 Strategic/Long Term Monitors




The ToR identified that 90 rain gauges are required for the project. The WaPUG Code of Practice suggests that the required amount of raingauges for the catchment equals to 52 rain gauges. A review of the catchment, using both network location and Google Street View, identified 89 suitable rain gauge locations (Figure 6-7), it is considered that these are preliminary locations and authorisation would need to be obtained prior to installation. It is envisaged that all of these raingauges will remain in place for the duration of all flow surveys to support the verification of the 38 strategic monitors which are in place for the full duration of the flow survey period.

**Figure 6-7 Scheduled Rain Gauge Locations**

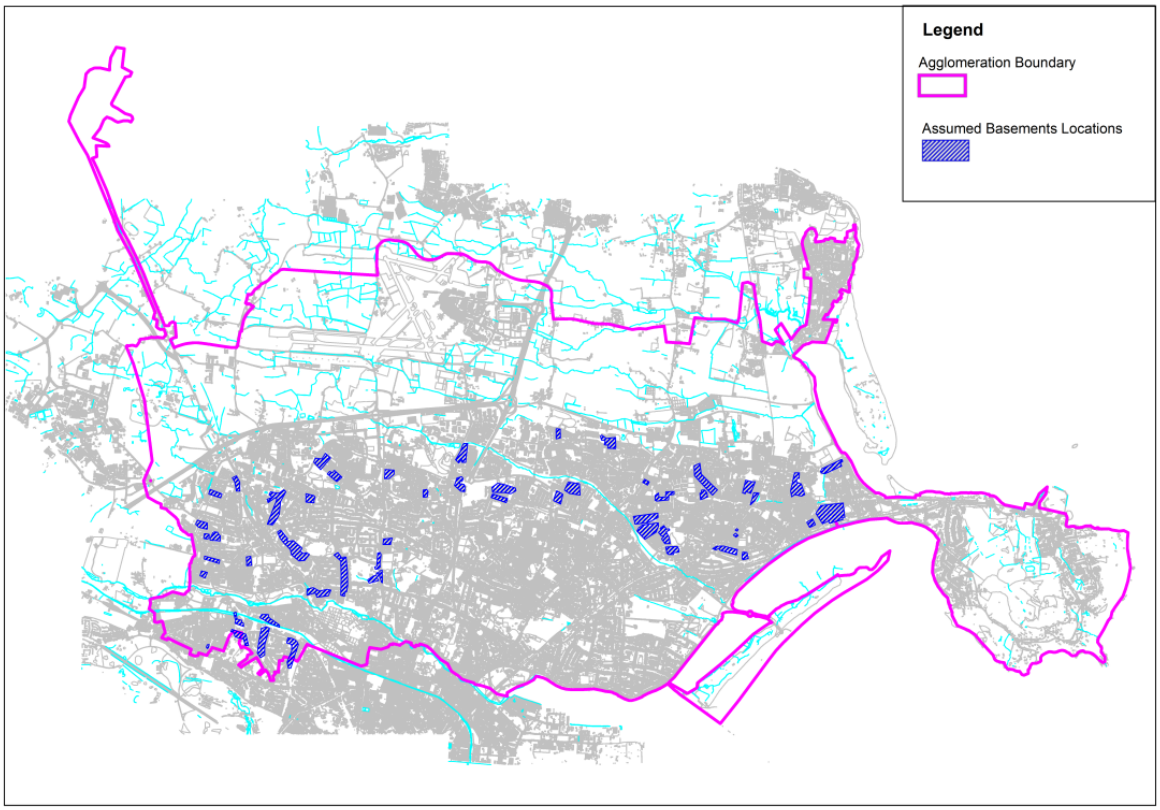



### 6.3.5 Basement Location Survey Requirements

The Greater Dublin Strategic Drainage Study found that, as of 2005, there was no asset database available showing basement location and use throughout the Dublin Region. A Dublin City Council database shows the outline of buildings with basements in the city centre area between the canals and was prepared for property rating purposes. A further database of basements was produced by Bord Gais around 1993. Individual basements were not located but each street was divided into 100m segments and the presence or absence of basements recorded. The survey was limited to those streets that were serviced by old cast iron gas mains.

Figure 6.8 shows the basements identified within the Sutton PS DAP catchment. The GDSDS identified a minimum of 16,200 basements in their study area, only some of which fall within the study boundary.

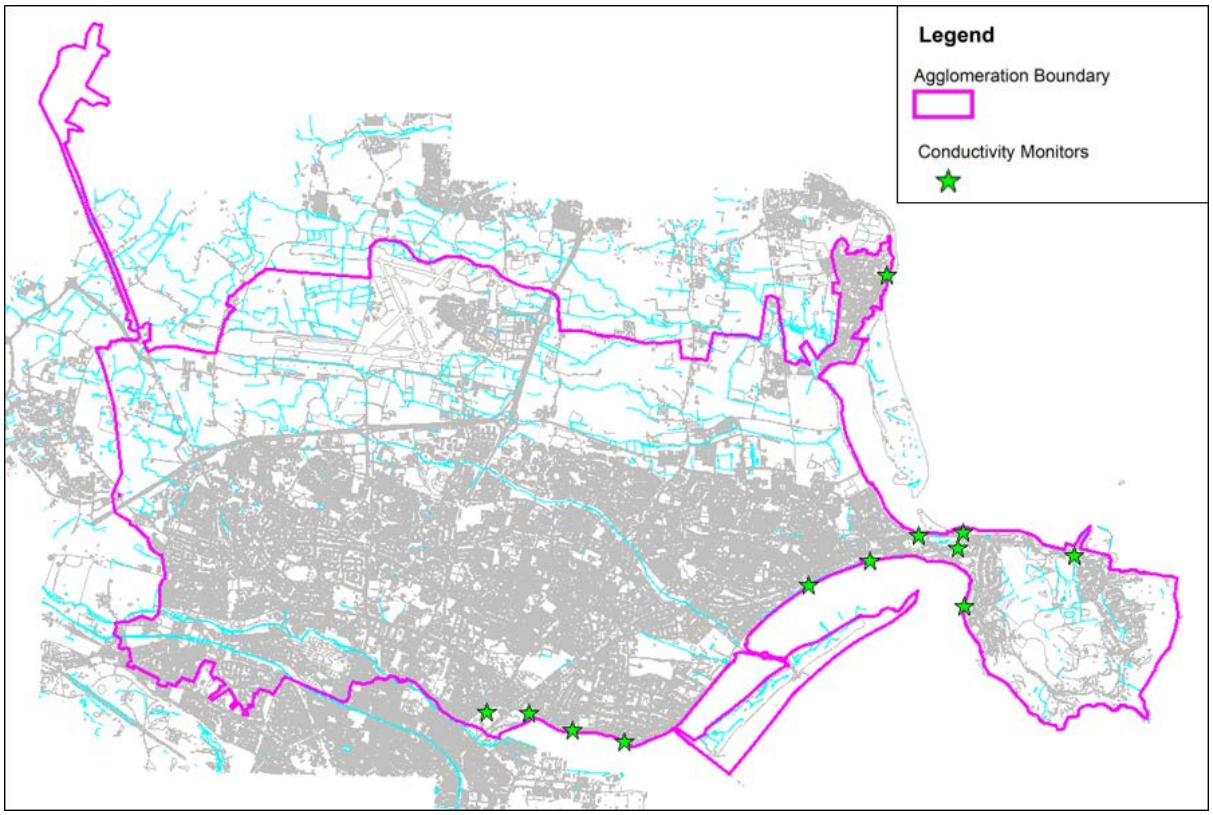
**Figure 6-8 Assumed Basement Locations**




### 6.3.6 Conductivity Surveys

As part of the study it is required that a conductivity survey be programmed to determine the locations were tidal ingress is/may be occurring on the network. The survey has been scheduled to include 11 monitors located strategically throughout the catchment, at locations where the system is considered to be set at a level that falls between the lowest and highest tides recorded throughout a yearly period (Oct 2016 – Oct 2017). Following the Stage 1 workshop it was suggested by Fingal Council that sea ingress may occur in Portmarnock. To confirm this an additional conductivity monitor has been scheduled in Portmarnock at the request of Irish Water.

**Figure 6-9 Scheduled Conductivity Survey**




### 6.3.7 Sonar Surveys

A specialist Sonar Survey of the interceptor sewers is not considered to be required for the Sutton PS DAP. Therefore this has not been scoped as part of the study.

### 6.3.8 Tidal Survey

Although the ToR does not identify the tide to have a significant impact on the Sutton PS DAP sewerage system it is suggested in Section 6.3.6 above that large sections of the network lie below the lowest tide level and therefore it should be considered that the tide could have an impact on the system. To identify the potential input locations of tidal ingress the conductivity survey has been programmed. The tidal levels will be obtained for the flow survey period to represent the tidal influence in the model.

## 6.4 INITIAL CRITICAL SEWER ASSESSMENT

The GIS data supplied by IW did not contain information on the criticality of the sewers and therefore a critical sewer assessment has been undertaken using the Sewer Rehabilitation Manual – 4th version (SRM4) to score the criticality of the sewers. The SRM4 version assigns the higher 'Category A' based upon the following characteristics;

- Above average depth;
- Bad ground and/or high water table;
- Brick or stone construction;

- Man entry size;
- Close proximity to buildings or major underground services.

In order to undertake the critical sewer assessment it is required that the InfoNet database be fully populated with invert levels, cover levels, pipes sizes and materials and as such a large amount of data had to be inferred prior to the process starting. Therefore it is considered that at present this is a starting point for scheduling the CCTV only. The IW standard recommends that the SRM5 Manual be used, this is classified as more of a risk based approach to the critical sewer analysis and this will be used when the critical sewer assessment is revisited once the model has been fully populated following the surveys.

**Table 6-4 Critical Sewer Lengths**

| Description | Unit | Foul/Combined (Critical A) | Foul/Combined (Critical B) | Foul/Combined (Critical C) | Total |
|---|---|---|---|---|---|
| >1000mm | km | 28.21 | 7.72 | 0.36 | **36.29** |
| >750mm- 1000mm | km | 7.53 | 4.42 | 0.12 | **12.07** |
| >525mm- 750mm | km | 18.13 | 12.33 | 0.49 | **30.95** |
| >450mm-525mm | km | 8.22 | 7.82 | 1.09 | **17.13** |
| >375mm- 450mm | km | 12.34 | 10.86 | 4.22 | **27.43** |
| >225mm- 375mm | km | 44.58 | 24.47 | 58.97 | **128.02** |
| 225mm | km | 64.53 | 36.52 | 308.76 | **409.81** |
| <225mm | km | 11.68 | 1.05 | 37.46 | **50.19** |
| **Totals** | **km** | **195.22** | **105.19** | **411.47** | **711.88** |

The network database also contains 622 km of storm sewer, of which 159 km is considered Critical A, 85 km is considered Critical B and 378 km is considered Critical C.

### 6.4.1 CCTV / Man Entry Survey Requirements

Following the Critical Sewer Analysis undertaken as part of the Stage 1 study, the CCTV survey scheduling has followed the same process as agreed by Irish water for previous DAPs. It was agreed by IW that in order to improve the data received and focus on the key areas to the stakeholders it was confirmed that the CCTV would focus primarily on the larger foul/combined sewers in the catchment and this was confirmed as pipes that are greater than 300mm in diameter. It is often considered that any pipes greater than 1200mm in diameter will return poor results with regards to a CCTV survey and as such these will be eliminated from the CCTV schedule. Table 6.5 below shows the critical sewers that are above 300mm in diameter but less than 1200mm in diameter.

**Table 6-5 Critical Sewers for CCTV Survey**

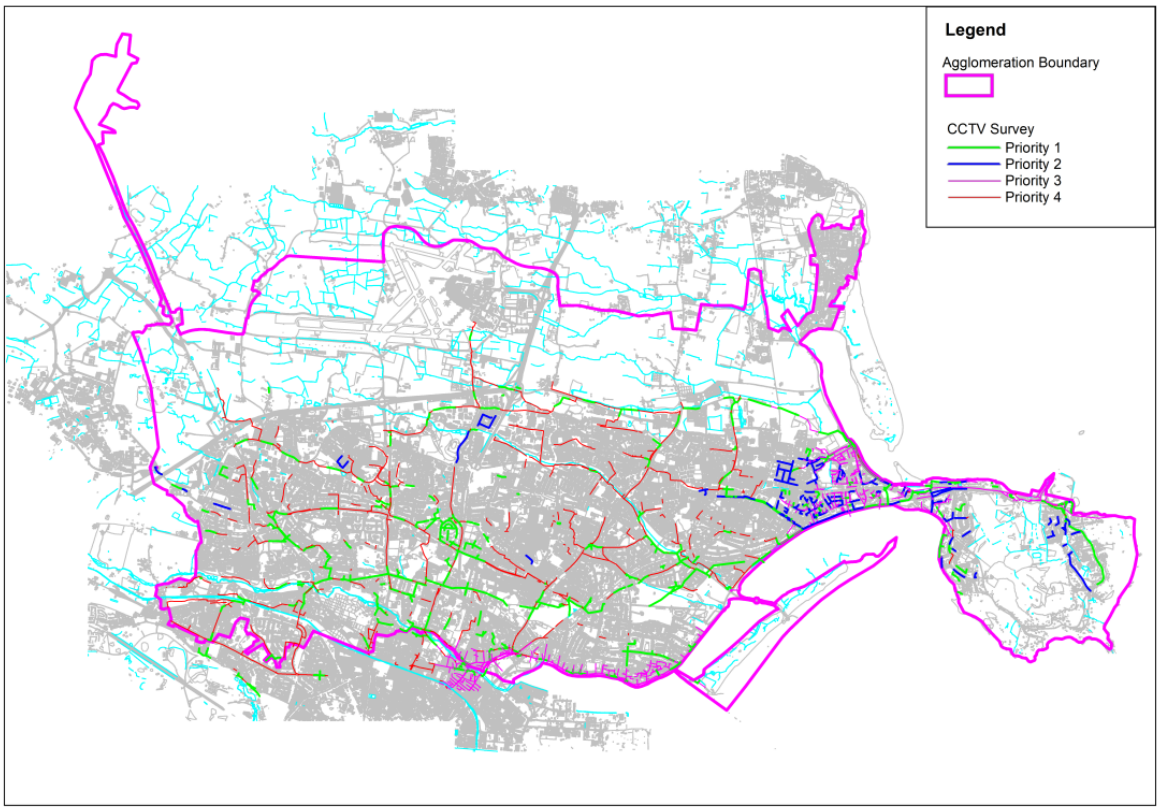
| System Type | Critical A Sewers (km) (300mm to 1200mm) | Critical B Sewer (km) (300mm to 1200mm) | Critical C Sewers (km) (300mm to 1200mm) |
|---|---|---|---|
| Foul/Combined | 97.94 | 62.00 | 63.78 |
| Storm | 84.199 | 72.786 | 138.528 |

An assessment of the network that was deemed critical to the modelling undertaken in Stage 2 identified a further 73.531km of sewers that would require a CCTV survey. As well as these lengths additional CCTV surveys have been scheduled to gain up to date information on sewers with historically poor service performance, this identified an additional 21.627km of sewers.

### Table 6-6 Scheduled CCTV Works Survey

| Reason for CCTV | Length (Km) |
|---|---|
| CSO Locations | 6.150 |
| Reported Flooding Location | 6.085 |
| Flow Monitor Location | 58.846 |
| Requested by Irish Water | 0.924 |
| Pumping Station | 1.524 |
| **Priority 1 - Total** | **73.531** |
| Historical Collapse Locations | 0.875 |
| Historical Operational Issues Locations | 20.750 |
| Historical Pollution Incidents | 0.002 |
| **Priority 2 - Total** | **21.627** |
| **CCTV Surveys required for Type II model (minimum)** | **95.158** |
| Tidal Impact | 79.004 |
| **Priority 3 - Total** | **79.004** |
| Foul/Combined Critical A Sewers (300mm – 1200mm) | 48.282 |
| Foul/Combined Critical B Sewers (300mm – 1200mm) | 43.946 |
| **Priority 4 - Total** | **92.229** |
| **CCTV Surveys required for data completeness (desirable)** | **266.391** |

**Figure 6-10 Scheduled CCTV Survey Lengths**




The CCTV Survey schedule which details all pipes to CCTV, their locations and reasons for the CCTV is contained within **Appendix C – Survey Requirements** of this report.

## 6.5 ADDITIONAL DATA REQUIREMENTS

### 6.5.1 Flow and Load Survey Requirements

It is not a requirement of the study to undertake a flow and load study, therefore this has not been scoped as part of the Sutton PS DAP.

### 6.5.2 Impermeable Area Survey (IAS) Requirements

The impermeable areas will initially be identified by visual inspection of mapping and network data, based on property age and proximity to surface water sewers and watercourses.

The general rules for initially assuming the drainage types for the impermeable areas are outlined as follows:

1. Where no surface water systems exist within the catchment it will be assumed that all roof areas contribute to the combined system.
2. All road areas will initially be set to drain to the storm system, irrespective of sewer network data, as often the existing highway drains are uncharted.

3. Where the properties are pre-1950, and both foul and surface water systems exist, it will be assumed that the area is partially separate.
4. Where the properties are post-1950, and both foul and surface water systems exist, it will be assumed that the area is totally separate, with all impermeable areas connecting to the storm system.

This approach will provide a starting point, however it may be considered necessary to refine the area allocation throughout model verification, based upon other survey data as well as the observed system response exhibited in the flow survey data. As such the 400 Ha of Impermeable Area Survey allocated in the ToR has not been scheduled as part of the Stage 1 report and will be revisited as and when required at the verification stage of the study. The study boundary area totals 10,220 Ha, which would give an allowance of 4% to have an impermeable area survey undertaken. This compares favourably against previous studies where it is generally considered a 5 to 10% allowance for an IAS is acceptable.

# 7 ESTIMATED COSTS AND PROGRAMME

## 7.1 STUDY SCOPE AND FEES

It is acknowledged that, following Stage 1 services, the quantum of surveys required has changed from that assumed for tendering purposes, as summarised in Table 7-1 below. This includes a current target quantity and a ceiling estimate based on the likely movement in asset and monitor numbers/sites.

**Table 7-1 Comparison of Survey Quantities**

| Survey Type | Terms of Reference (ToR) Assumed Quantities | Recommended Survey Quantities |
|---|---|---|
| Flow Monitors, nr. | 560 | 487 |
| Rain Gauges, nr. | 90 | 89 |
| Duration of flow survey, weeks | 2 x 12 | 2 x 12* |
| Manhole surveys, nr | 2900 | 3224 |
| Ancillary Surveys (CSO & WWTW), nr | 85 | 87 |
| Pumping Station Surveys (including any EOs), nr | 40 | 63 |
| Impermeable Area Survey, ha | 400 | 400 |
| CCTV Survey, km (incl. 10% cleaning) | 70 | 95 |
| Other Ancillary Structures | 58 | 30 |
| Conductivity Monitors, nr | 2 | 11 |

* Duration of flow survey is weather dependent and will require close monitoring of returned data

The Consultant scope and fees will be detailed following confirmation on the extent of survey quantities.

## 7.2 ESTIMATED SURVEY COSTS

Cost estimates for the required surveys were prepared using current, tendered rates from recent surveys. It is envisaged that the surveys will be carried out under the Irish Water - Sewer Network Survey and Associated Services framework – Lot 1, where a single Contractor carries out all surveys in a particular sub-catchment.

A summary of the survey requirements and their estimated cost is included in Table 7.2 below. This has currently focussed on the target figures for the catchment. These figures are subject to variance based on the final ceiling survey quantities that are derived through the ongoing investigations in the catchment.

**Table 7-2 Survey Cost Estimates**

| Survey Type | Recommended Quantity | Rate | Estimated Cost |
|---|---|---|---|
| **Manhole Surveys** | 3224 Manhole Surveys, 30 bifurcations, 5 Abandoned Overflows | €75/MH | €244,425 |
| **Ancillary Surveys** | 63 PSs (incl 18 EOs), 87 CSOs | €500 each | €75,000 |
| **CCTV Survey** | 95km | €10,000/km | €950,000 |
| **Flow & Depth Monitors** | 487 Flow Monitors (assume 12-week survey period) | €2,000/monitor | €974,000 |
| **Strategic Monitors** | 38 Flow Monitors (to remain in place for entire 24 week survey ) | Additional €1000/monitor | €38,000 |
| **Rain Gauges** | 89 (to remain in place for entire 24 week survey) | €500/RG | €44,500 |
| **Conductivity Monitors** | 11 Monitors | €500/monitor | €5,500 |
| **Impermeable Area Survey** | 400 Ha | €200/ha | €80,000 |
| **TOTAL (excl. VAT)** | | | €2,411,425 |

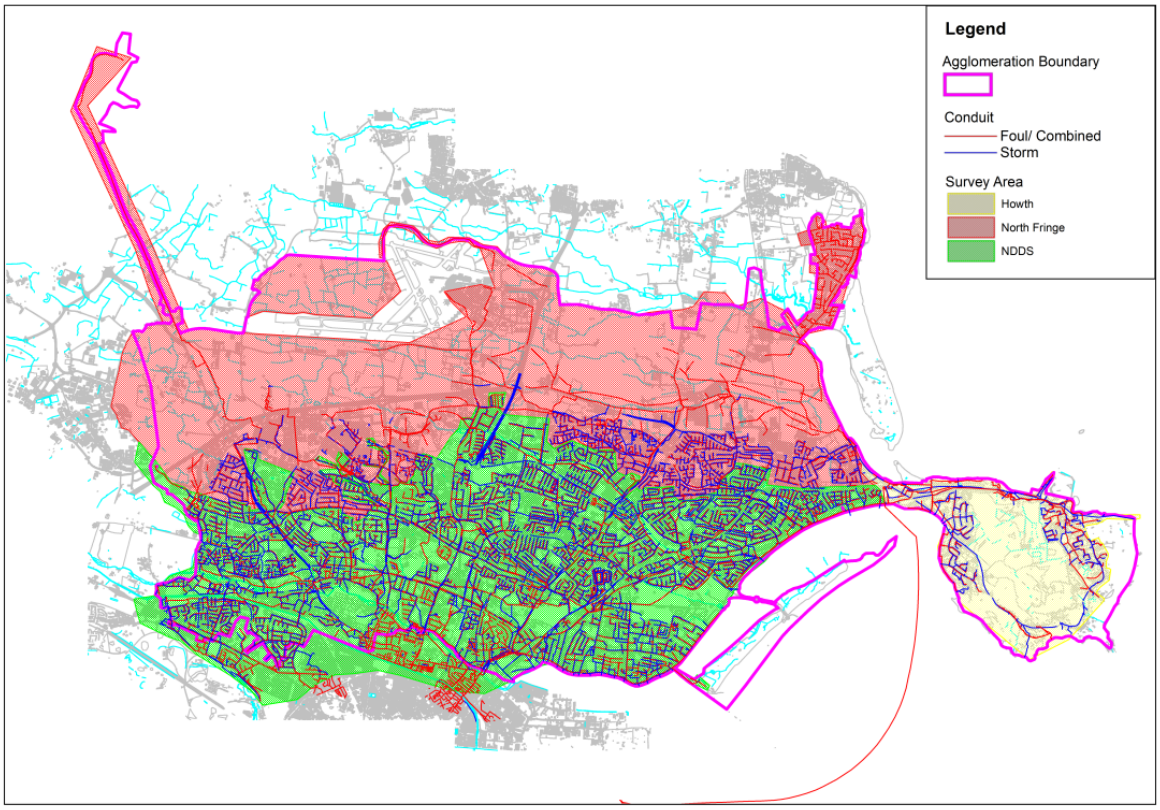
There is a risk that the flow survey works will need to be extended beyond 12-weeks, which could increase the costs.

## 7.3 STUDY PROGRAMME

### 7.3.1 Phasing of Surveys

Due to the size and complexity of the catchment with a large amount of surveys to be undertaken, it is considered that the survey element of the study be split into more manageable survey quantities. A review of the Sutton PS DAP network identified that it was possible to divide the catchment into two individual networks in order to facilitate the surveys. The survey sub areas can be divided into North Fringe (Red) with Howth (Yellow) and NDDS (Green), as shown Figure 7.1.

## Figure 7-1 Survey Areas




The detailed cost estimates for the surveys in each sub area are given in table 7.4 below:

### Table 7-3 Survey Cost Estimates per Survey Area

| | | | | Area 1 | | Area 2 | | |
|---|---|---|---|---|---|---|---|---|
| | | | | North Fringe & Howth | | NDDS | | |
| **Description** | **Unit** | **Rate** | **Total Qty** | **Qty** | **Amount** | **Qty** | **Amount** | **Totals** |
| Manholes | nr | €75 | 3224 (35 Overflows) | 1551 (5) | €116,700 | 1673 (30) | €127,725 | €244,425 |
| PS Survey | nr | €500 | 63 | 40 | €20,000 | 23 | €11,500 | €31,500 |
| Ancillary Survey | nr | €500 | 87 | 9 | €4,500 | 78 | €39,000 | €43,500 |
| CCTV | km | €10,000 | 95 | 33 | €330,000 | 62 | €620,000 | €950,000 |
| FM Priority 1 | nr | €2,000 | 418 | 152 | €304,000 | 266 | €532,000 | €836,000 |
| FM Priority 2 | nr | €2,000 | 69 | 10 | €20,000 | 59 | €118,000 | €138,000 |
| *FM Priority 3* | *nr* | *€2,000* | *92* | *26* | *€52,000* | *66* | *€132,000* | *€184,000* |
| Strategic Monitors | nr | €1,000 | 38 | 19 | €19,000 | 19 | €19,000 | €38,000 |
| Raingauges | nr | €500 | 89 | 41 | €20,500 | 48 | €24,000 | €44,500 |
| Conductivity Monitors | nr | €500 | 11 | 5 | €2,500 | 6 | €3,000 | €5,500 |
| IAS | ha | €200 | 400 | 220 | €44,000 | 180 | €36,000 | €80,000 |
| **Totals for Type II Model** | | | | | €881,200 | | €1,530,225 | €2,411,425 |
| **Overall Totals** | | | | | €933,200 | | €1,662,225 | €2,595,425 |

The surveys will be carried out under the *"Framework for the provision of sewer network surveying and associated services to Irish Water"* Lot 1 – Sewer Network Surveying and Ancillary Services. Under this framework, all surveys works within a particular catchment are to be completed by a single supplier, i.e. Asset surveys and flow monitoring will be completed by one Contractor.

On a previous DAP RPS conducted early engagement with selected Contractors. Key outputs of this discussion were as follows:-

- Allow 20 manholes to be surveyed each day for each team
- Allow 0.5km CCTV survey each day for each team
- Multiple teams per Contractor available (2 or 3 teams)
- Largest flow survey to date by an Irish Contractor had 120 monitors, and most Contractors have not had more than 30 monitors on a single project
- No more than 250 flow/depth monitors (of the full monitor stock in Ireland and the UK) likely to be available to this project. Preferably a maximum of 200 would be needed in a particular sub-catchment
- Major flow surveys generally require 4-weeks of pre-survey site inspections/planning, and further 4-weeks to install the monitors (maximum of 15 monitors installed per day, after inspections and planning). Therefore an 8-week on-site period is required before each flow survey commences
- The flow survey will be a minimum of 5-weeks (as per IW Framework Lot 1), but it can be the case that surveys are extended to 8-weeks or more.
- It typically takes 4-weeks to prepare a final report for 100 flow monitors.

RPS proposes dividing the study area into 2 sub-catchments for survey planning purposes. Sub-catchment 1 will comprise of the North Fringe Sewer and Howth while the second will encompass the North Dublin Drainage Scheme area. These can be tendered separately or together. We assume that 2 asset survey teams will be deployed to each area. Excluding pre-survey inspection/planning and final reporting, the asset survey works will take between 30 and 50 weeks. Key risk duration/quantities are highlighted in Table 7-4 below.

**Table 7-4 Survey sub-catchment critical path quantities and survey durations**

| Contract Area/Sub-catchment | | | North Fringe & Howth | | NDDS | |
|---|---|---|---|---|---|---|
| **Critical Path Surveys** | **Unit** | **Output/ team/day** | **Qty** | **Duration (team wks)** | **Qty** | **Duration (team wks)** |
| Manholes | nr | 20 | 1551 | 8 | 1673 | 8.5 |
| PS Survey | nr | 2 | 40 | 2 | 23 | 1.25 |
| Ancillary Survey (CSO) | nr | 2 | 9 | 0.5 | 78 | 4 |
| CCTV | km | 0.5 | 33 | 7 | 62 | 12.5 |
| **Asset Survey On-Site assuming 2-teams (wks)** | | | **17.5** | | **26.25** | |
| Flow/Depth Monitor Install | nr | 15 | 152 | 2 | 325 | 4.5 |

### 7.3.2 Programme Assumptions

An updated study programme containing scheduled survey dates is included in **Appendix E - Programme**. The following sets out the assumptions made when preparing the programme for the remainder of the project.

Contract documents will be prepared following IW approval of the proposed survey extents

Tender and contract documents will be issued to market in April 2018, with a return date a the start of May assumed. Allowing for tender assessment and the award process, it is estimated that the Contractor will mobilise to site in late May 2018.

Each catchment area includes a 4-week on-site inspection/planning phase, with the flow and asset survey work carried out in parallel. After inspection/planning, each flow survey requires 12-weeks (4-weeks installation and 8-weeks monitoring). Duration of asset survey works is based on a Contractor providing 2 teams per catchment, based on the durations shown in Table 7-4 (again after inspection/planning).

The Contractor's final flow monitoring reports will each take 6-weeks to prepare; following which RPS can commence flow verification of the model. The hydraulic model build for each sub-catchment will be fully built prior to receipt of the final flow monitoring report and RPS will verify 15 flow/depth monitors each week.

Verification of sub-catchments 1 & 2 will require 10 weeks each, (Total of 20-weeks). Preparation of the DAP Stage 2 reports will commence immediately after the verification works for each contract. It will take a total of 54-weeks to verify the model and prepare the corresponding DAP Stage 2 reports (for 487 flow monitors).

A project delivery duration of 32.3 months was stated in the ToR, based on 480 flow monitors. The programme duration has increased to **35.5 months** as a result of the increase quantity of flow and depth monitors, manhole and ancillary surveys and CCTV surveys. This may increase further if any flow survey needs to extend beyond 12-weeks. A comparison of the programme for delivery as identified in the ToR and now programmed based on the recommended surveys is provided below in Table 7-5.

### Table 7-5 Programme Summary

| Key Deliverables | Months ToR | Months Programme | Comment |
|---|---|---|---|
| **DAP Stage 1 Services** | | | |
| Submit final DAP Stage 1 Report | 3 | 4 | |
| **DAP Stage 2 Services** | | | |
| Submit final verified hydraulic model for entire study boundary | 18 | 19 | Risk of mobilisation delay, Increase in Survey Quantities |
| Submit final Model, Build & Verification Report | 21 | 22 | |
| **DAP Stage 3 Services** | | | |
| Submit final DAP Stage 3 Report | 27 | 28 | |
| **DAP Stage 4 Services** | | | |
| Submit Network Monitoring Report | 28 | 29 | |
| Submit FSRs | 32 | 33 | |

# 8 SUMMARY AND RECOMMENDATIONS

The objective of this Stage 1 DAP report was to collect and assess all existing sewer network information for the Sutton PS study boundary. It is recommended that the existing database be used in conjunction with proposed network surveys in order to create a new and current hydraulic model. This will have a model resolution of Type II in all areas in order to provide a tool capable of investigating all risks currently identified in the catchment, as well as proactively providing a model to address new risks in the future.

A number of surveys have been scheduled in order to improve the confidence in predictions of the Type II model. The proposed surveys are focussed on key catchment drivers, such as CSOs, Flooding locations, Pumping Stations, Future Growth Sites and areas experiencing operational performance issues. The Stage 1 process identified the following Stage 2 survey requirements:

- 63 pumping stations (incl. 18 EOs), 87 CSOs, five abandoned overflows and 30 bifurcations to be surveyed.
- A total of 3,224 manholes are required for survey, to improve model confidence.
- 73 -95 km of CCTV Survey
- A short term flow and rainfall survey consisting of 487 - 589 Flow Monitors (Priority 1 FMs – 418; Priority 2 FMs – 69; Priority 3 FMs - 92) and 89 rain gauges, for a minimum of 12-weeks and extended as necessary. Due to monitor availability and resourcing, it is proposed the survey be split into two separate surveys of 12 weeks, resulting in a combined survey period of 24 weeks, weather dependent.

Stage 2 Asset and Flow Surveys are scheduled to commence in May/June 2018. The surveys are programmed to start as follows:

- Asset Surveys for entire catchment (Commence May/June 2018) – 12.5 Weeks
- Flow and Rainfall Area 1 (North Fringe Sewer & Howth) (Commence July 2018) – 16 Weeks
- Flow and Rainfall Area 2 (NDDS) (Commence October 2018) – 16 Weeks

Significant delays to the project could arise due to a Contractor's failure to mobilise promptly, failure to allocate sufficient resources, limited availability of flow monitors, poor data being received, failure to report weekly, delays in permit to work being issued, significant road closures being implemented in the study boundary and delays in raising manholes prior to survey.

The flow survey as previously indicated will benefit from being separated, with 38 strategic flow monitors being put in place permanently. These could be installed as part of separate capital project.

There are a number of factors which are outside the control of this study, and could affect the above survey schedules. The largest risk to the schedules is the requirement to obtain two dry weather flow events and three storm events that meet the WaPUG requirement. After 5-weeks of flows surveys in a particular sub-catchment, discussions will be held between the interested parties to determine whether the flow and rainfall survey needs to continue.

For programming, it is assumed that all events will occur within an 8-week survey period. The overall surveying period is currently scheduled to finish in January 2019.

Cost estimates for all surveys required to produce a model of Type II quality total **€2,411,425** excl. VAT. Key risk to survey costs is extension to flow surveys duration.

It is considered that this DAP Stage 1 report is a 'live' document, i.e. surveying quantities will be further refined in Stage 2, prior to and during the survey contracts. After exhaustive data collection since October 2017, RPS confirms that Stage 1 is as complete as possible and recommends that Stage 2 commences with IW approval.

# APPENDIX A
# NETWORK SCHEMATIC (A3)

# APPENDIX B
# DATA MANUAL LOG

# APPENDIX C
# SURVEY REQUIREMENTS

# APPENDIX D

# CRITAL INFRASTRUCTURE

# APPENDIX E
# PROGRAMME (A1)

# APPENDIX F
# REPORT DRAWINGS

# APPENDIX G

# RISK REGISTER

# APPENDIX H

# INITIAL PERFORMANCE REVIEW

# APPENDIX I

# CORPORATE DATA

# APPENDIX J
# MODEL REVIEW