Greater Dublin Drainage Strategy

Overview & Future Strategic Needs
Asset Planning

May 2018

Contents

1. Executive Summary

1.1 Background

The Ringsend WWTP Upgrade and the Greater Dublin Drainage ("GDD") project have their origins in the Greater Dublin Strategic Drainage Study ("GDSDS")[1], which was a major region wide strategic plan, completed in 2005, for medium and long-term urban drainage needs. The GDSDS made detailed recommendations on wastewater infrastructure requirements, which included the optimisation of the capacity of existing plants and networks for near-term requirements, coupled with the development of new infrastructure to meet growth in the medium and long- term. The key findings of the GDSDS were the subject of a Strategic Environmental Assessment ("SEA") which was completed in May 2008. The SEA was drafted following a rigorous process and its key recommendations were as follows:

Table 1.0: SEA Recommendations
• The upgrade of all wastewater treatment plants ("WwTPs") in the region, including Ringsend, to their ultimate capacity;
▪ Construction of a new regional WwTP and associated marine outfall in the northern part of the Greater Dublin Area ("GDA");
▪ Completion of a rigorous 4-stage 'Alternative Sites Assessment Study' to determine the preferred location for the Regional WwTP;
▪ Associated coastal outfall and pipeline route to be defined; and
▪ A suite of mitigation measures and a Monitoring Programme to be undertaken during the construction and operation of the project.

In line with the SEA recommendations, Irish Water has prioritised the expansion of the Ringsend WwTP to its ultimate capacity, together with the associated network upgrades required to mobilise that capacity for immediate growth needs. These include city centre intensification (e.g. Docklands) together with new peripheral development. At the same time, the GDD project is planned to relieve both the Ringsend treatment plant and network loading within the medium-term, following which the capacity of the Ringsend system will cater for the core catchment and the South Western growth area (South Dublin County). The GDD project effectively implements the balance of the SEA recommendations as it involves the development of:

• an orbital sewer;
• a WwTP on a 29.8-hectare site at Clonshaugh; and
• an outfall pipe from the WwTP discharging 1km north-east of Ireland's Eye.

[1] The GDSDS was proposed by the Dublin Region Local Authorities in the Greater Dublin Area and was supported by the Department of the Environment, Heritage and Local Government. Dublin City Council was appointed as the contracting authority for the study which was conducted by the Dublin Drainage Consultancy.

1.2 Water Services Strategic Plan ("WWSP")

The Ringsend and GDD projects have been in development for over a decade and pre-date Irish Water's WSSP obligations. The WSSP is Irish Water's strategic national plan for the delivery of water and wastewater services over the next twenty five years. The GDSDS was reviewed in framing the WSSP. It was determined that the conclusions of the GDSDS and the associated SEA were entirely valid, and that the additional capacity was required but not within the original timeframes envisaged by the GDSDS due to the economic recession in Ireland.

While the WSSP does not alter the fundamental strategy of the GDSDS, the latter has been further reviewed to take account of specific aims and objectives in the WSSP. A key element within the WSSP relates to the provision of headroom, which is recognition of peaking factors and growth uncertainty in forward planning. This headroom factor is intended to ensure long-term resilience of strategic infrastructure, reducing the risk of failure which has characterised the Dublin region infrastructure for decades. The Water Services Strategic Plan sets a long-term objective of providing 20% headroom in larger urban settlements, including Dublin.

The load and growth projections included in the GDSDS have been revised to follow a standard methodology set out in the WSSP which removes speculative industrial load but builds realistic growth projections (high, medium and low) and provides for the critical headroom factor. This headroom factor is particularly necessary in wastewater planning in Dublin where peak loads at the Ringsend WwTP have at times reached multiples of average day load due to flat gradient and large proportion of combined sewers. This severely stresses both collection and treatment systems.

1.3 Ringsend WWTP Upgrade Project

The Ringsend WwTP Upgrade project is underway and will deliver the expansion works required to maximise the capacity of the plant. The completed upgrade will provide an ultimate installed capacity of 2.4m population equivalent ("PE").The present plant capacity is 1.65m PE. The plant is experiencing average daily loads of 1.8-1.9m PE which is resulting in breaches of both the EPA plant licence and the Urban Wastewater Treatment Directive. The enhanced capacities upon upgrade are the maximum capacities of this plant given both site constraints and the limitations of the city drainage system.

Constraints on any further upgrades of network capacity to convey flows to Ringsend include the intensity of urban development and associated utilities, together with:

- Critical pipe constraints; e.g. the inlet syphon capacity from the Main Lift Pumping Station ("MLPS") to the Ringsend WWTP is inadequate and duplication is infeasible;
- Inadequate flexibility to protect the Ringsend area from flood risk for any increase in flows to the MLPS; and
- The social impact of conveyance construction works in the city.

1.4 Load Projections

The average capacity required for the current Ringsend Agglomeration is projected to reach 2.9m PE by 2050 based on:

- The 'Most Likely' growth scenario in respect of population and associated commercial load;
- No specific allowance for growth in industrial demand, other than in respect of a specific Significant Industrial Customer ("SIC"), identified in confidential briefings to Irish Water, and
- In accordance with the WSSP, a provision for headroom has been allowed, calculated as 20% of the projected combined residential and associated commercial load.

This is illustrated in following Figure 1.1.

This is in accordance with the capacity requirement projected in the "Assessment of Domestic & Non Domestic Load on Proposed Regional WwTP, 19 December 2017"

The Ringsend Programmed Capacity shown in figure 1.1 refers, in the longer term to capacity with full compliance with the Waste Water Discharge Authorisation and UWWT Regulation. However the initial scope of the expansion of the plant to 2022 will be based on compliance with Article 4 of the UWWT Directive. Works will continue past this date to achieve full compliance. The sequencing of works should be optimized to bring about full compliance at the earliest practicable date.

The figure also shows, for comparison purposes, the original load projected in the GDSDS Report in 2005.

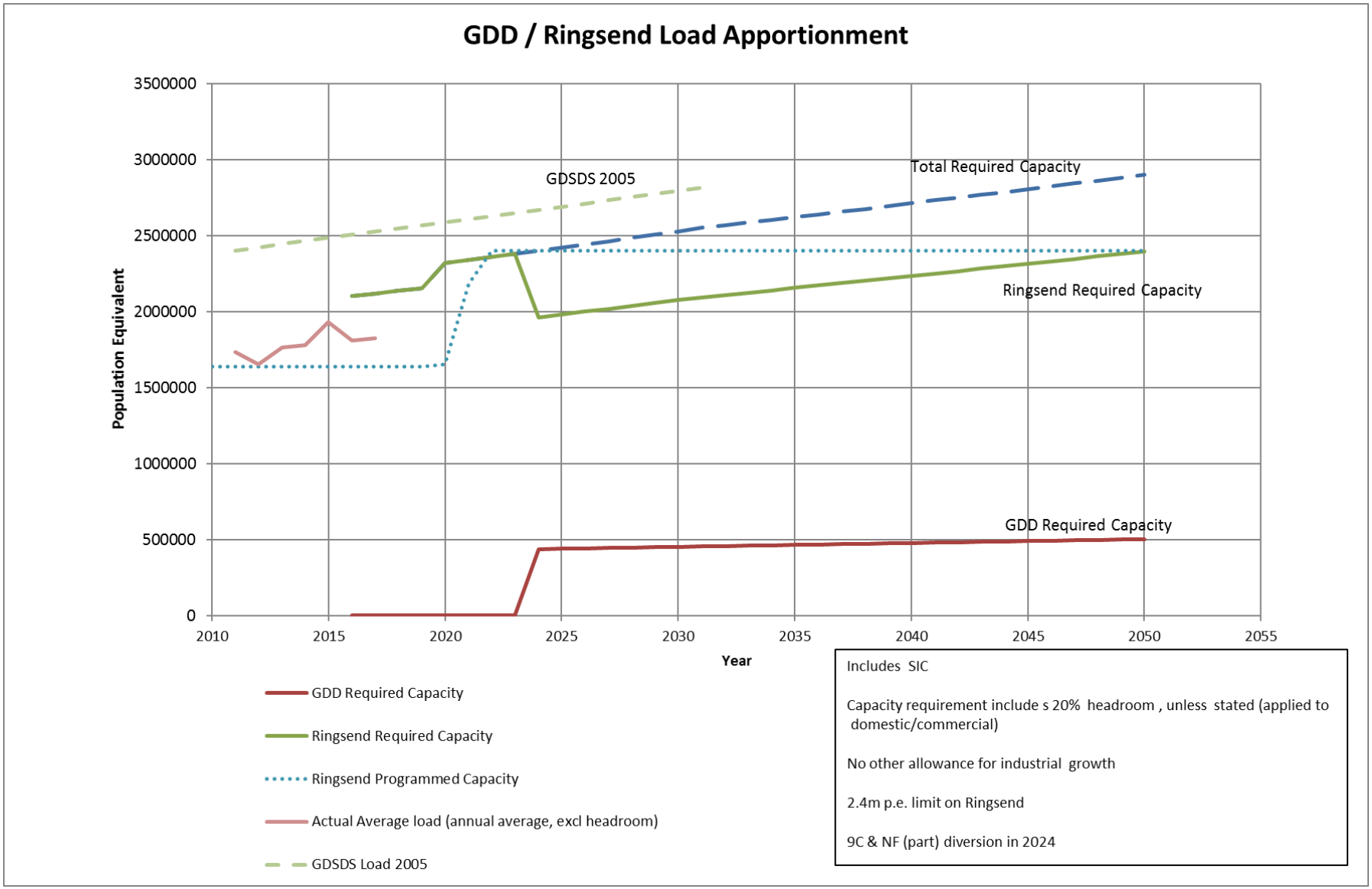

GDD / Ringsend Load Apportionment
Population Equivalent
3500000
3000000
2500000
2000000
1500000
1000000
500000
0
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
Year
GDSDS 2005
Total Required Capacity
Ringsend Required Capacity
GDD Required Capacity
GDD Required Capacity
Ringsend Required Capacity
Ringsend Programmed Capacity
Actual Average load (annual average, excl headroom)
GDSDS Load 2005
Includes SIC
Capacity requirement include s 20% headroom , unless stated (applied to domestic/commercial)
No other allowance for industrial growth
2.4m p.e. limit on Ringsend
9C & NF (part) diversion in 2024

Figure1.1

The above graph shows the revised load profiles used in planning the medium and long-term drainage infrastructure for the Greater Dublin Area ("GDA") including the GDD. The graph displays a reduction from the profile adopted in the original GDSDS report, reflecting the severe economic recession from 2008 – 2013 during which the projected industrial growth included in the GDSDS load profiles failed to materialise. However, growth in recent years shows a dramatic upward profile indicative of the strong economic recovery. The load profile includes an allowance for headroom of 20% but does not include any allowance for industrial growth other than the SIC.

There are a number of risk factors inherent in the load profiles as follows:

- The load arising in any catchment can be very variable, and this is particularly so in Ringsend due to the flat catchment and the load stored within the sewers during dry spells;
- At present, on average, industries are discharging considerably less than they are permitted under their existing licences. With the economic recovery it is possible that peaks will increase and that the unused licence capacity will diminish;
- Short-term growth can exceed longer-term average growth projections, and, given the timeframe to deliver any phased upgrades in plant capacity, Irish Water needs to be in a position to be responsive to new industrial and commercial demands;
- It is possible that economic growth and resulting increased domestic and industrial loads could exceed this proposed growth rate, resulting in a requirement for earlier delivery.

1.5 Need for Ringsend WWTP Project

The present plant capacity is 1.65m PE. The plant is experiencing average daily loads of 1.8-1.9m PE which is resulting in breaches of both the EPA plant licence and the Urban Wastewater Treatment Directive. The enhanced capacities upon upgrade are the maximum capacities of this plant given both site constraints and the limitations of the city drainage system. The additional Ringsend capacity will be added in stages over the period 2020-2024 with overloading stress experienced in the interim. The 2020 increment is critical to meet growth expected from developments such as (Docklands, Poolbeg, Children's Hospital etc.).

1.6 Need for GDD Project

The scope of GDD construction works (see map at the end of this report) is as follows:

- The diversion of the Blanchardstown (Route 9C) sewer, pumping station and mains/trunk sewers to deliver to the new GDD wastewater treatment plant ("WwTP");
- Diversion of flow from the North Fringe sewer, close to the access road to the proposed new WwTP.
- New WwTP with design capacity of 500,000 PE;.
- A marine outfall to the Irish Sea;

A key objective of the GDD is to serve the north-west quadrant of the existing Ringsend catchment, and the area to the west of the proposed WwTW currently served by the North Fringe sewer. The diversion of the load from the 9C sewer (Blanchardstown/Clonee/

Dunboyne/ Ratoath/Ashbourne and Leixlip) and the North Fringe sewer to the GDD will reduce the load to the Ringsend WwTP and release critical network capacity to Ringsend to cater for planned growth in Lucan/Clondalkin/Peamount.

The graph indicates that by 2024 the expanded Ringsend capacity will no longer meet the projected capacity requirements of the current catchment.

This diversion of load will enable future growth in the 9C and the Lower Liffey Valley (Leixlip) catchment to continue beyond 2024. These catchments are strategic growth areas, both in terms of housing and industry (existing and future Foreign Direct Investment). Irrespective of the treatment constraint at Ringsend WwTP, the full capacity of the 9C (including planned upgrade) will not be available to cater for growth beyond 2024, without the diversion of flows from the 9C Sewer to the GDD Orbital Sewer due to network constraints downstream near the Phoenix Park.

The diversion of load from the Ringsend catchment to the GDD enables growth to continue beyond 2024 in the other sub-catchments which remain served by Ringsend. This applies in particular to the Lucan/Clondalkin catchment where there is substantial scope for development both for housing and industrial, and the City Centre catchment where growth through urban regeneration, development of brownfield sites and densification is occurring, in areas such as the Docklands Strategic Development Zone ("SDZ"), Grangegorman Development and the proposed Poolbeg SDZ. These developments are critical in order to respond to housing needs and to facilitate growth. A key objective outside the core GDA is to relieve the situation at Leixlip, where the current plant has exhausted the assimilative capacity of the Liffey at that point.

In summary, the GDD is strategically important to the Dublin Region, and nationally, in that it will provide capacity for residential and commercial growth. However the planning and programming of the project must have regard for the uncertainties associated with the projections used. When programme uncertainty is considered, it is clear that there is a high risk is in the planning phase of the project, when uncertainty is highest.

1.7 Ringsend WWTP Upgrade Programme and Summary

The implementation of the planning and design stage for a project of the scale and complexity of the Ringsend will require an extended time period. The scale of such a project will also present programme risks at each stage. A realistic programme for implementation of the various phases of the Ringsend WWTP Upgrade Project from Planning to Implementation is presented below.

The 400,000 PE expansion of capacity will not bring the treatment plant into full compliance with UWWT Directive. The timeframe for the full delivery of the other works is based on bringing the plant into full compliance with the UWWT Regulations and Waste Water Discharge Authorisation, but compliance with Article 4 of the Directive will be achieved at an earlier date.

Stage	Duration	Scope	Programme Risk	Date Finish	Relative Cost
Design and Planning	2 years	Design and contract documentation	-	2016	Modest
Procurement and Construction	3 years	Prequalification, Tender advertising, tender assessment and award, construction.	Moderate (Procurement)	2020	High
Commissioning	0.5 years	Commissioning	Moderate	2020	Modest

Table 1.1: 400,000 PE Expansion

Stage	Duration	Scope	Programme Risk	Date Finish	Relative Cost
Design and Planning	3 years	Planning approvals, statutory consents, investigative contracts, design and contract documentation	High	2019	Modest
Procurement and Construction	5 years	Prequalification, Tender advertising, tender assessment and award, construction.	Moderate	2023	High
Commissioning	0.5 years	Commissioning	High	2024	Modest

Table 1.2: SBR Retrofit Lot 1

Stage	Duration	Scope	Programme Risk	Date Finish	Relative Cost
Design and Planning	1 years	Planning approvals, statutory consents, investigative contracts, design and contract documentation	Low	2020	Modest
Procurement and Construction	4 years	Prequalification, Tender advertising, tender assessment and award, construction.	Low	2024	High
Commissioning	0.5 years	Commissioning	Low	2025	Modest

Table 1.3: SBR Retrofit Lot 2

1.8 GDD Programme and Summary

The implementation of the planning and design stage for a project of the scale and complexity of the GDD will require an extended time period. The scale of such a project will also present programme risks at each stage. A realistic programme for implementation of the GDD Project from Planning to Implementation is presented below.

Stage	Duration	Scope	Programme Risk	Date Finish	Relative Cost
Design and Planning	3 years	Planning approvals, statutory consents, land acquisition, wayleaves, investigative contracts, design and contract documentation	High	2020	Modest
Procurement and Construction	4 years	Prequalification, Tender advertising, tender assessment and award, construction.	Moderate (Procurement)	2024	High
Commissioning	1 year	Commissioning	Low	2025	Low

Table 1.4: GDD Project Phase 1

Based on the current projections of required treatment capacity, design and planning of the project must proceed without delay. This will ensure that

- potential planning delays are, insofar as possible, addressed; and
- project delivery can be as responsive as possible to any change in required delivery time, particularly in response to increased economic growth and housing need in the GDA. On that basis, it is imperative that the next phase of the GDD project be approved as planned. During the design and planning phase the projected treatment capacity requirements will be monitored and re-profiled as required**. In the event that the load projections are deferred, the construction of the project can be delayed as required within the 10 year planning permission timetable.**

2. Introduction

2.1 Purpose of the Report

In January 2014, Irish Water assumed responsibility for the provision of public Water Services previously provided by thirty four Local Authorities. Prior to January 2014, Local Authorities provided water and wastewater services within the resources available to them, largely autonomously within their functional areas, and with limited cross boundary strengthening linkages between adjacent schemes. The operational heritage of Local Authorities on the transferred assets is invaluable and in managing continuity of service, Irish Water has entered into Service Level Agreements with Local Authorities for the operation of Irish Water's assets for the next twelve years.

The transfer of water services functions to Irish Water has opened a unique opportunity to take, for the first time in Ireland, a strategic view of providing water services, at a national level, and also on projects which are strategic for Ireland.

On January 1st, 2014, Irish Water assumed responsibility for the Ringsend WWTP Upgrade, Greater Dublin Drainage ("GDD") Project and associated wastewater network drainage projects which are in essence nationally strategic wastewater projects.

A review of the fundamental determinants of 'Need' for the project is set out in this Report.

This Irish Water Review is supported and informed by the following complementary specialist studies / reports:

1. The Greater Dublin Drainage Strategic Drainage Strategy Study ("GDSDS"; Final Strategy Report; 2005;

2. Strategic Environmental Assessment of the GDSDS Final Strategy; 2008;

3. "Assessment of Domestic & Non-Domestic Load on Proposed Regional WwTP, 19 December 2017";

4. Blanchardstown Regional Drainage Scheme; Preliminary Report and subsequent Design Reports.

5. Leixlip Transfer Pipeline; Route Selection and Concept Design Report, 2015;

A successful planning outcome for the development of a new major waste water treatment facility for the Greater Dublin Area ("GDA") requires the question of need to be comprehensively addressed.

2.1.1 Water Supply Project

While the supply area of the Water Supply Project, Eastern and Midlands Region, does not coincide with the drainage catchments for Ringsend and GDD, the same underlying principles of predicting growth and provision of headroom apply.
The Project Need Report of the Water Supply Project examines:

a) A range of population scenarios, from 2015 to 2050, for Ireland as a whole, for the water supply area served by the existing water sources in the Dublin area, and for those areas likely to benefit from proximity to transfer pipelines from a new source.
b) The fundamentals of every element of water demand, learning from most recent data on domestic water usage, projecting industrial water requirements, and assuming ambitious targets on water conservation.
c) An independent assessment by professional economists, of the strategic economic importance of secure, resilient water supplies in the Eastern and Midlands Region, for the life and health of people living there, and for the sectors of the economy that sustains their livelihoods.
d) The maximum sustainable capacity of existing sources of supply (i.e. how much water we can take from existing supplies without adversely impacting them for future generations or adversely impacting the environment) and the importance of developing resilient connectivity of water resources for the overall safety, security and reliability of water services.

The GDD "Assessment of Domestic & Non Domestic Load" report draws on the WSP "Demographic Study" and the CSO projections, for the purpose of projecting load.

Three future population growth scenarios with respect to the Greater Dublin Drainage project are proposed based on the assumptions scenarios in the WSP study and CSO projections. The three growth scenarios are:

- Growth Scenario 1 – Planned "Low" – (CSO "M2F2 Recent" Scenario)
- Growth Scenario 1 – Planned "High" – (CSO "M2F2 Traditional" Scenario)
- Growth Scenario 2 – "Most Likely" – (CSO "M2F2 Modified" Scenario)

For the Ringsend catchments the relative annual growth rates for these scenarios are:

Scenario	2011-2021	2021-2031	2031-2041	2041-2050
Growth Scenario 1 - Low	0.75	0.79	0.70	0.66
Growth Scenario 1 - High	0.85	1.02	0.84	0.56
Growth Scenario 2	0.96	1.09	0.84	0.81

Table 2.0: Growth Scenarios

This present report utilises the projections of population growth scenario 2 – "Most Likely", against the baseline of the 2016 census. This growth rate was also applied to "commercial load", but not to "industrial" load.

2.2 The Water Services (No. 2) Act 2013 and the Water Services Strategic Plan

The Water Services (No. 2) Act 2013 and subsequent Regulations, transfers most functions of Local Authorities in relation to water services to Irish Water. The preparation of a Water Services Strategic Plan (WSSP) is a statutory obligation on Irish Water under Section 33 of that Act. Irish Water must state its objectives and the means to achieve those objectives, for the coming 25 year period, including in relation to (inter alia):

(a) drinking water quality,

(b) the prevention or abatement of risks to human health or the environment relating to the provision of water services,

(c) the existing and projected demand for water services,

(d) existing and planned arrangements for the provision of water services by Irish Water,

(e) existing and reasonably foreseeable deficiencies in the provision of water services by Irish Water,

(f) existing and planned water conservation measures,

(g) the management of the property of Irish Water

Section 39 of the Water Services (No. 2) Act 2013 goes on to require the Commission for Energy Regulation, in the performance of its functions as Economic Regulator, to have regard to the need to ensure, inter alia,

(b) that water services are provided by Irish Water in an economical and efficient manner,

(e) the continuity, safety, security, and sustainability of water services,

(f) that Irish Water can meet all reasonable demands for water both current and forseeable,

(g) the recovery of costs of water services in accordance with Article 9 of the EU Water Framework Directive,

(h) that Irish Water performs its functions in a manner that will enable the achievement by the State of the environmental objectives of that Directive,

The Ringsend WWTP Upgrade Project, the Greater Dublin Drainage Project and the associated strategic wastewater networks projects have been in development for over a decade and therefore run parallel to, and pre-date Irish Water's WSSP obligations. The discipline of strategic planning holding a national perspective, embodied in the WSSP, has nonetheless been taken cognisance of in this review of the Preferred Strategic Option within the SEA which formed an Addendum to the

Final Strategy Report of the GDSDS. This included the Ringsend WWTP Upgrade Project and the Greater Dublin Drainage Project, and the WSSP will continue to inform these Projects.

The WSSP was developed following two phases of public consultation and underwent a Strategic Environmental Assessment (SEA) and an Appropriate Assessment (AA). The initial consultation was non-statutory and took place from July to September 2014. As part of the second statutory phase of public consultation, Irish Water invited submissions on the Draft WSSP together with the SEA Environmental Report and Natura Impact Statement (AA process) from the 19th February to the 17th April, 2015.

Delivering on the WSSP over the next 25 years will require an unprecedented transformation in how the industry operates and increased levels of investment. The WSSP sets out the challenges we face as a country in relation to the provision of water services and identifies strategic national priorities. It includes Irish Water's short, medium and long term objectives and identifies strategies to achieve these objectives.
The final Water Services Strategic Plan was approved by the Minister for Environment, Community and Local Government in October 2015.

The WSSP is the Tier 1 Strategic Plan for Irish Water. It will be reviewed at five year intervals to take account (inter alia) of economic (and water demand) growth, consumption patterns, demographics and climate change. An interim review is also planned to ensure alignment between the WSSP and the new National Spatial Strategy and Regional Economic Strategy which will be developed over the next few years.

2.3 Irish Waters' Statutory Obligations and Planning Scenarios

The statutory requirement that Irish Water be in a position to meet 'all reasonable demands for water, both current and foreseeable', and that it should address in its strategic planning, 'existing and reasonably foreseeable deficiencies in the provision of water services' requires a particular focus and very important perspective on the use of Planning Scenarios in infrastructural planning for assets of long working life.

A Most Likely Scenario will set out the wastewater capacity requirement profile of greatest probability, given what is known at the present time. However, investment decisions made upon a Most Likely Scenario must not be so inflexible that Irish Water would find itself constrained in its ability to discharge its obligations in the event that a reasonably foreseeable, if less probable, higher growth rate were to materialise. This is particularly so when planning strategic new infrastructure with long delivery times.

In evaluating wastewater capacity, all regions in Ireland must have adequate strategic reserves to accommodate potential demand for the needs of indigenous and multinational firms as well as to accommodate the expansion of the tourism and agri sectors.

As a national water utility, intending to align the provision of 'best in class' water services with the development of water using and wastewater reliant sectors in an

open economy, Irish Water is seeking to ensure that Irelands' sustainable water resources and wastewater treatment systems serve the lives, economic prosperity of all in a environmentally sustainable manner. Water supply and wastewater treatment should not be an opportunity-limiting constraint anywhere in the country.

This approach to infrastructure planning is not to advocate overdesign, or premature investment in capacity provision. Section 39 of the Water Services Act requires the CER to ensure, that "water services are provided by Irish Water in an economical and efficient manner". It does however require that the securing of the planning of strategic wastewater infrastructure, and the design of infrastructure, have enough inbuilt modular, incremental upgrade features, to respond to development requirements in optimistic growth scenarios and in a timely manner.

3. The Greater Dublin Area

3.1 Background

An in-depth study was commissioned by the Dublin Region Local Authorities in 2001 (GDSDS) to evaluate all wastewater treatment infrastructure in the Greater Dublin Area (GDA) with a view to implementing a strategy that would meet future wastewater treatment requirements for the region, allowing for growth in both population and industry.

3.2 Greater Dublin Area (GDA)

The GDA comprises of the following foul/combined agglomerations:

Table 3.0: Foul/Combined Agglomerations with the Greater Dublin Area
• Lower Liffey Valley (Leixlip WWTP)
• Upper Liffey Valley (Osberstown WWTP)
• Bray & Shanganagh (Shanganagh WWTP)
• Ringsend (Ringsend WWTP)
• Malahide (Malahide WWTP)
• Swords (Swords WWTP)
• Donabate and Portrane incl. Lusk and Rush (Portrane WWTP)
• Balbriggan and Skerries (Barnageeragh WWTP)

A layout of these catchments is shown in Figure 3.1 below.

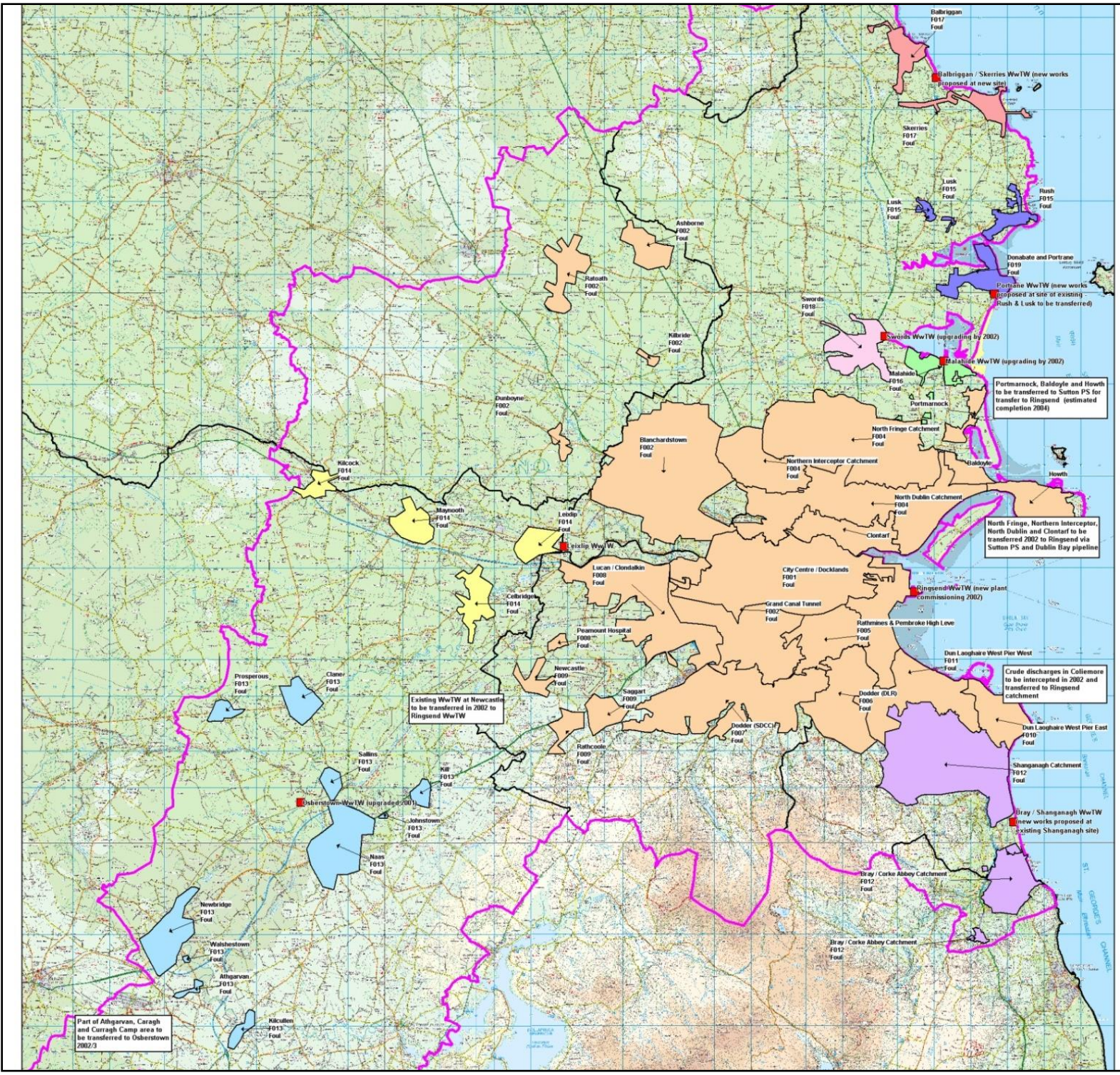


Figure 3.1 Layout of Foul/Combined Catchments

3.3 Previous Reports

3.3.1 Greater Dublin Drainage Strategy Study

The Greater Dublin Drainage Strategy Study, Final Strategy Report was published in 2005. The Strategy reports was the first of its kind in the State and marked a major milestone in terms of informing the future strategic needs of Greater Dublin Area in terms of provision of wastewater treatment and drainage networks. The key aims of the Greater Dublin Strategic Drainage Study are summarised below;

Table 3.1: Key Aims GDSDS

- To put in place an environmentally sustainable Regional Drainage Strategy consistent with the European Union Water Framework Directive (WFD);
- To provide a blueprint for foul and storm water drainage capable of meeting the demands of the Region in the context of current development plans, the strategic planning guidelines of the Greater Dublin Area and the longer term development potential of the region;
- To provide a consistent policy framework and standards which will apply throughout the Region, covering development requirements, storm water management, infiltration and ex-filtration, drainage with respect to basements in older properties, consideration of the effects of climate change and a coherent environmental policy, consistent with water quality objectives of the river systems and of Dublin Bay;
- To develop tools for the effective management of the drainage systems including Geographic Information Systems (GIS), network models and digital mapping; and
- To develop the optimum drainage solution from a range of alternative scenarios having regard to whole-life cost and environmental performance, the solution to be broken down into a set of implementation projects which can be prioritised and put in place.

The Greater Dublin Strategic Drainage Study (GDSDS), commissioned by the seven local authorities in the Greater Dublin Region, was completed in April 2005 with the completion of the Final Strategy Report. The preparation of the GDSDS strategy was necessary due to the increased levels of development since the 1990s resulted in significant demands on the existing drainage infrastructure. Deficiencies in the existing system has led to marked deterioration in water quality, increased risk of flooding and concerns that the drainage system and wastewater treatment infrastructure have insufficient capacity to meet future demands. The provision of adequate wastewater collection and treatment is required by numerous national and European legislative instruments and is a key deliverable in meeting the requirements of the Water Framework Directive (2000/60/EC).

The overall objective of the Study was to develop an environmentally sustainable drainage strategy for the Region consistent with the Water Framework Directive and relevant legislative requirements. The GDSDS Final Strategy provides a consistent policy framework and standards which have been adopted and are being implemented throughout the Region. In addition the GDSDS has made detailed recommendations on infrastructure requirements.

3.3.2 Strategic Environmental Assessment

A Strategic Environmental Assessment (SEA) on the GDSDS was commissioned in November 2006 and completed in May 2008. The SEA was drafted following a rigorous process including:

Table 3.2: SEA Assessment Process

- Preparing a Scoping Report following an extensive statutory and public consultation process
- Preparation of an Environmental Report identifying and evaluating the likely significant environmental effects of the GDSDS
- Consultation with the public, environmental authorities on the Environmental Report
- Modifying the GDSDS Final Strategy following consideration of the findings in the Environmental Report and the outcome of the consultations.

In November 2006 Fingal County Council, on behalf of the local authorities in the Dublin and Mid-East region (excluding Wicklow), appointed Mott MacDonald Pettit Limited and Environmental Resources Management Limited to undertake a Strategic Environmental Assessment of the GDSDS Final Strategy. The key recommendations of the SEA (which broadly endorsed the GDSDS Strategy) are set out in the Addendum to the GDSDS and are provided in the Table below.

Table 3.3: SEA Recommendations

- Upgrading all WWTPs to their ultimate capacity (See Table 3.0);
- Construction of a regional WwTP and associated marine outfall in the northern part of the greater Dublin Area
- Completion of a rigorous 4-stage Alternative Sites Assessment Study to determine the preferred locations for the Regional WwTP,
- Associated coastal outfall and pipeline route
- A suite of mitigation measures and a Monitoring Programme to be undertaken during the construction and operation of the project

The Final Environmental Report and the Addendum to the GDSDS were presented to a Regional Strategic Policy Committee (SPC) meeting, which recommended their adoption, on the 7th May 2008. The SEA Final Environmental Report and the Addendum to the GDSDS were subsequently accepted and adopted by the six local authorities in 2008.

4. Preferred Strategic Drainage Option

4.1 Recommended Strategy

The SEA assessed the original GDSDS Strategy options. The GDSDS Final Strategy Report contained 8 No. alternative strategic drainage options, from which the preferred drainage option was selected. The SEA process resulted in an additional 8 No. options for consideration. The infrastructural provision required to implement the Preferred Strategic Option as set out in the Strategic Environmental Assessment (2008) is provided below, which was broken down into 15 No. elements. It is recognised under the SEA that the elements are likely to be advanced at various stages over the coming years under various projects and that some will be interlinked and highly dependent on other projects. The 2 No. primary key elements of the Recommended Strategy were:

- To expand all wastewater treatment plants in the GDA to their maximum capacities to ensure wastewater infrastructure in the Dublin region could support future development.
- To build a new regional wastewater treatment facility in North Dublin that would treat wastewater from the GDA to a high standard, meeting National and EU Directives and Regulations for water quality.

Dublin Region Local Authorities reviewed these recommendations and established projects to implement these 2 No. key recommendations and to deliver them.

Ringsend Wastewater Treatment Plant Upgrade Project was set up to deliver the expansion works required at the largest plant in the GDA at Ringsend to maximise its capacity.

The Greater Dublin Drainage (GDD) Project was set up to deliver the regional wastewater facility in North Dublin.

The full portfolio of projects associated with the Preferred Strategic Drainage Option are listed in the Table below:

Ref. No.	Recommended Strategic Drainage Option
1	A Regional WWTP (to be developed on a phased-basis as considered necessary) located at a suitable site in the northern Greater Dublin Area.
2	Coastal outfall point, at a suitable location on the North Dublin coastline
3	Untreated effluent sewer (Orbital Sewer), conveying sewerage from newly developed areas in north, west and north-west of the Greater Dublin Area. (including e.g. Lucan, Clondalkin, Blanchardstown, Mulhuddart, East Meath and Kildare) to the new Regional WwTP.
4	Treated effluent pipeline, conveying treated effluent to the coastal outfall point.
5	Local upgrading of the 9B trunk sewers and pumping station in Lucan and Clondalkin. A new combined sewer overflow (CSO) at Ballymount with overflows to the storm section of the Grand Canal Trunk Sewer (GCTS).
6	Sewers serving the 9C catchment of Blanchardstown and Mulhuddart to be duplicated. A new CSO and storage at Castleknock (with 11,000m3 storage) to be developed.
7	The trunk sewer along Dolphin Road connecting the 9B and 9C sewers to the GCTS would need to be augmented between Davitt Road and Herberton Road.
8	Diversion of the 9C to the new Orbital Sewer
9	(a) Divert North and South Quay interceptor sewers near Heuston Station to connect with the new pumping station to connect to GCTS on Davitt Road. Trunk sewers, CSO's and interceptors in Dublin City Centre. (b) New pumping station and storage (15,600m3) at Ballyowen with rising main to transfer 9B flows to the new Orbital Sewer.
10	Four sewer diversions from the Rathmines and Pembroke to foul and storm cells of the GCTS.
11	New pumping station for the Dublin Docklands area (0.6m3/s, with 5,000m3 storage)
12	New rising main and sewer 6.5 kilometres in length transferring flows from the upgraded Kilbride pumping station to the new Orbital Sewer.
13	New pumping station to transfer approximately 75,000 p.e. from Kildare to the Orbital Sewer.
14	Upgrade Ringsend to 2.16m population equivalent (p.e.) and other planned upgrade works to the existing WWTP's in the Study Area: and
15	Upgrade CSO's along the River Liffey.

Table 4.0: Preferred Strategic Drainage Option (GDSDS & SEA)

4.1.1 Sludge Management

The increased load in the catchment will result in increases in sludge generated by wastewater treatment. This increase will manifest initially at the upgraded Ringsend WWTP, with an increase in sludge production during the upgrade when the CEPT process is in use[2]. When the GDD WWTP is commissioned there will be a reduction in Ringsend as a result of the load diversion. In any event there will be increased sludge production at Ringsend and a new source of treated sludge at the GDD WWTP. Planning for the GDD WWTP also envisages it as being a hub for the treatment of imported sludges, with capacity to deal for other WWTP sludges generated in Fingal.

The Irish Water "National Wastewater Sludge Management Plan" was published in September 2016. This sets out Irish Water's national strategy, and the Ringsend and GDD projects are required to comply with this strategy. The Plan envisages maximising beneficial use of treated sludge on land, but will also recognise the prohibition that exists on sludge use within certain agricultural QA policies. This will require increasing focus on use for crops that are not for direct human consumption, and will also require further evaluation of other re-use and disposal options.

In any event energy recovery, through advanced anaerobic digestion, and use on land of high quality treated sludge are fundamental elements of the on-going policy. Landspreading of sludge requires storage of the treated sludges during periods when spreading is prohibited or not available.

In this regard the development of the Ringsend and GDD projects will require an increase in available storage.

The NWSMP states:

> *In line with the approach taken to other facilities in this Plan, the development of Sludge Storage Facilities will no longer be considered solely on a per-plant or per-county basis. Where appropriate, Sludge Storage Facilities will be developed to serve a number of local plants and/or a wider regional need. In particular, the upgrade to the Ringsend sludge hub and the proposed new North Dublin WWTP will result in a significant increase from current sludge volumes with a consequent increase in storage requirements. Therefore, a dedicated sludge storage facility should be developed in conjunction with the expansion of Ringsend to meet its requirements and take account of other future needs in the region.*

Options for the provision of strategic storage for treated sludge (biosolids) have been evaluated and a preferred solution identified. This involves the construction of a dedicated storage facility, the Regional Biosolids Storage Facility (RBSF) on an 11.4 ha site at Newtown / Kilshane.

The development of this facility is considered a necessary component of the expansion of wastewater treatment in the Dublin Region, particularly in relation to the necessary development of the Ringsend and GDD WwTPs. Accordingly the planning for this facility will be advanced in conjunction with, and as a component of, the WwTP projects.

Apart from facilitating the seasonal spreading of biosolids in agriculture, this will address the need to have contingency storage capacity to deal with any possible interruption to planned sludge re-use.

[2] CEPT is Chemically Enhanced Primary Treatment. The addition of chemicals increases sludge production.

4.2 Ringsend WWTP Upgrade Project

Dublin City Council applied to An Bord Pleanála and in 2012 received permission to carry out the recommended upgrade and expansion works at the plant to maximise its capacity and to also construct a 9km undersea tunnel designed to relocate treated wastewater from the plant out into Dublin Bay.

In January 2014, Irish Water assumed responsibility for the Ringsend Wastewater Treatment Plant from Dublin City Council. Irish Water undertook reviews and evaluations of the elements of the project and are now proposing an alternative solution within a revised project.

The alternative solution involves the use of the Aerobic Granular Sludge (AGS) technology treatment process and the exclusion of the originally planned 9km undersea tunnel.

AGS technology is an advanced nutrient removal technology that is a further development of the activated sludge process. This treatment process will consistently produce high-quality treated wastewater which can be safely discharged into Dublin Bay.

Irish Water have conducted detailed testing and trials of the technology since April 2015 to treat the wastewater being received at the Ringsend plant. These trials have proved successful; confirming that wastewater treated by AGS technology can be safely discharged to the Lower Liffey Estuary and Dublin Bay. The revised project can be summarised as follows and includes:

Ringsend WWTP Upgrade Project
• Proposed exclusion of the 9km long undersea tunnel.
• Proposed increase in the flow through the plant by approx. 20% thereby increasing the amount of wastewater that can be treated and reducing the level of storm overflows which occur during heavy rainfall events.
• Proposed extension to treatment capacity and the use of AGS technology in the existing treatment tanks, increasing the capacity to 2.4 million Population Equivalent (PE) as approved by An Bord Pleanála in 2012.
• Proposed expansion of the plant's sludge treatment facilities to match the overall increase in wastewater treatment capacity.
• Proposed provision of a new phosphorous recovery process.
• Proposed provision of additional odour control facilities.

Table 4.2: Ringsend WWTP Upgrade

In particular, it should be noted that:

- No increase in capacity over what was approved in 2012 is being proposed.
- The revised project will meet the same stringent odour control standards as set out by An Bord Pleanála in 2012.

- From an operational and visual perspective, the revised project is not expected to result in any significant change on the site of the plant from the project approved in 2012. The main change will occur outside the site due to the proposed exclusion of the 9km long undersea tunnel.

4.2.1 Proposed capacity of the upgraded Ringsend Works

The proposed upgrade of the Ringsend works is to an average capacity of 2.4 m p.e. The original GDSDS report stated that "*Ringsend WwTW therefore needs to be extended now to the maximum treatment capacity of the site, thought to be approximately 2.16m PE*". The technology now proposed for the Ringsend site (Aerobic Granular Sludge) was not available when the maximum treatment capacity of the Ringsend site was estimated at the time of the original report.
It is now considered that the technology will allow development to 2.4m p.e., on an annual average basis. While there may even be the potential to marginally increase this capacity at Ringsend; there are other hydraulic constraints within the network that would prevent a very significant increase in the envisaged load. As in the case in changing growth levels and projections, this does not alter the fundamental strategy, but may impact of the timing of delivery.

The proposed upgrade will not increase the peak capacity to be delivered to the plant (22.4 m3/s), but will upgrade the capacity of the secondary treatment process from 11.1 m3/s to 13.6 m3/s FFT (Flow Forward to Treatment). A large component of the existing flow is infiltration within the existing catchment. With effective control on further developments this base infiltration flow should not increase significantly. Accordingly the effective increase is greater than appears.

4.3 GDA Strategic Projects

The recommended strategy confirmed within the SEA Report is being implemented under a number of separate projects, which have been progressed to differing stages of the project delivery cycle since the approval of the strategy in 2008. In relation to the above the Addendum noted:

> *"All of the above projects are likely to be advanced at various stages over the coming years. Some will be interlinked and highly dependent on other projects (e.g. the orbital sewer, regional WwTP, treated effluent pipeline and the outfall location) while others will be separate and discrete pieces of infrastructure…The individual infrastructural requirements will be the subject of detailed engineering design. For many of the requirements, the sites are broadly identified (e.g. pumping station at Heuston Station) but for some of the key pieces of infrastructure, sites have yet to be identified."*

Ref. No.	Currently falling under Project	Project Status	Update Since SEA & GDSDS	Project Dependency	Gate Status
1, 2, 3, 4 & 8	GDD Project	Proposed elements to be implemented under the GDD Project. In concept design stage.	This is part of the "Greater Dublin Drainage" project. Site selection process has been completed. The project has recently completed a fourth round of public consultation and is currently preparing an Environmental Impact Statement which will form part of the application for planning approval for the project. The planning application will be submitted to An Bord Pleanála who will subsequently carry out statutory consultation. This will provide an additional opportunity for interested stakeholders and members of the public to participate in and provide input to the proposed project. This project will connect to the 9C (6) west of James Connolly Hospital.	6, 9 (b), 13	Gate 1
5	MLPS and Rathmines & Pembroke Drainage Study	Study is at pre-concept design stage.	A high level assessment of the MLPS and Rathmines & Pembroke catchments has been completed. An output of this assessment is the scoping of asset surveys and flow/rainfall surveys to enable a verified model for these catchments to be built. From this model solutions will be developed and options considered will include those options proposed under the Rathmines and Pembroke DAP (2003) and the GDSDS.	None	Gate 1
6	Blanchardstown Regional Drainage Scheme – 9C Duplication and Storage	Currently in Detailed Design Stage. Planning to be submitted.	Under the solution development of the BRDS Preliminary Report the location of the storage tanks has altered to Blanchardstown, west of James Connolly Hospital within the Liffey Valley Park. An output of the BRDS was the requirement for the 9C Liffey Siphons to be rehabilitated to enable increased flows to be conveyed from the 9C to the GCTS up until the Orbital Sewer and Regional WwTP intercept and treat flows from the 9C. The potential (6) cannot be realised without the Liffey Siphon Rehabilitation Contract. The extent of (6) has been reduced to interface with the GDD Project with works removed downstream of James Connolly Hospital that would have become obsolete once the GDD came into operation.	9C Liffey Siphons Rehabilitation Contract	Gate 2
9 (a)	City Centre Sewerage Scheme (CCSS)	Substantially advanced and at Concept Design Stage. Verified hydraulic model complete.	The requirement for and if required the scale of the pumping station at Heuston Station is to be determined based on outcome of solution development and optioneering stage under the CCSS Project.	15	Gate 1
9 (b)	MLPS and Rathmines & Pembroke Drainage Study	Study is at pre-concept design stage.	A high level assessment of the MLPS and Rathmines & Pembroke catchments has been completed. An output of this assessment is the scoping of asset surveys and flow/rainfall surveys to enable a verified model for these catchments to be built. From this model solutions will be developed and options considered will include those options proposed under the Rathmines and Pembroke DAP (2003) and the GDSDS.	(9a)	Gate 1
Ref. No.	Currently falling under Project	Project Status	Update Since SEA & GDSDS	Project Dependency	Gate Status

10	MLPS and Rathmines & Pembroke Drainage Study	Study is at pre-concept design stage.	A high level assessment of the MLPS and Rathmines & Pembroke catchments has been completed. An output of this assessment is the scoping of asset surveys and flow/rainfall surveys to enable a verified model for these catchments to be built. From this model solutions will be developed and options considered will include those options proposed under the Rathmines and Pembroke DAP (2003) and the GDSDS.	9(a)	Gate 1
11	North Docklands Drainage Scheme	Multiple network Projects at various stages of progression. PS operational	Spenser Dock PS, its rising mains and the immediate upstream sewers have been commissioned and operational. The PS is serving the existing drainage network. There are 2 No. Projects which will deliver the necessary drainage infrastructure to service the new developments within the North Docklands SDZ Area and which will convey flows to the PS. The project providing the primary deep sewers is at Gate (3) and the ancillary high level services including drainage is at Gate 2.	None	Gate 3
12	Blanchardstown Regional Drainage Scheme – 9C Duplication and Storage	Currently in Detailed Design Stage. Planning to be submitted.	This option was considered as part of the BRDS and now is being implemented under a modified plan with flow being transferred to the 9C instead of directly to Orbital Sewer. Flows from Kilbride (which serves Ratoath and Ashbourne in Meath) to be transferred to the 9C Sewer and not to the Orbital Sewer as envisaged under the GDSDS. This alternative solution was determined under the BRDS Preliminary Report Study..	6	Gate 2
13	Leixlip Transfer Pipeline Project	Leixlip Transfer Pipeline. Currently in Detailed Design.	The Leixlip Transfer Pipeline will convey flows from Leixlip WWTP (Lower Liffey Valley) to 9C Sewer in Blanchardstown.	6	Gate 2
14	Ringsend WWTP Upgrade Project	The Ringsend WwTP is being upgraded in 3 Phases.	Phase 1 will involve the provision of 400,000 PE of additional secondary treatment capacity to bring the treatment capacity up to 2.0mPE and into compliance with Article 4 of the UWWTD. Phase 2 and 3 will involve the retrofit of a select number of SBR basins with the AGS technology, and full compliance.		Gate 1
15	City Centre Sewerage Scheme (CCSS)	Substantially advanced through Concept Design Stage. Verified hydraulic model complete.	The solutions associated with improving the performance of the CSO's along the River Liffey is to be determined based on outcome of solution development and optioneering stage under the CCSS Project. Assessment of impact of proposed solutions on water quality will be required to ascertain level of benefit and to justify proposed solutions.	9 (a), 11	Gate 1

5. Population & Load Forecast

5.1 Background

The GDSDS (2005) predicted growth in demand, and identified a programme of works to address this forecast demand. The purpose of this present report is to consider the required timing for the elements of the GDSDS, having regard to the revised projections now available.

5.2 Revised Load Projections

The basis for revised projections is the "Assessment of Domestic & Non-Domestic Load on Proposed Regional WwTP, 19 December 2017" prepared as part of the Greater Dublin Drainage Project.
The updated load projections are based on the following principles:

5.2.1 Population Growth

Population growth based on the "Most Likely Growth Scenario" for the respective periods as summarised below:

- 2011 – 2021: Adopt the Adopt the annual average growth rates derived from the 'M2F2 Modified' 2011 - 2021 population figures as set out in the CSO Regional Population Projections 2016-2031
- 2021 – 2031: Adopt the annual average growth rates derived from the 'M2F2 Modified' 2021 - 2031 population figures as set out in the CSO Regional Population Projections 2016-2031
- 2031 – 2041: Adopt the annual average growth rates derived from the 'Growth Scenario 2 – Most Likely' 2031 - 2041 population figures as set out in the WSP 'Demographic Study' 2014.
- 2041 – 2050: Adopt the annual average growth rates derived from the 'Growth Scenario 2 – Most Likely' 2041 - 2050 population figures as set out in the WSP 'Demographic Study' 2014

5.2.2 Commercial and Institutional

This load is assumed to increase at the same rate as for population.

5.2.3 Industrial Growth

- An increase of 150,000 p.e. in industrial load from 2020/2021, attributable to specific identified industrial interest, designated SIC (Significant Industrial Customer). If this load does not arise (which is not currently envisaged to be the case) then the required time frame for the GDD project would be altered. However it should be noted that even if this does not occur the available capacity at Leixlip will be exceeded in the near future requiring (in

accordance with the GDSDS) the diversion of some load from Leixlip (Lower Liffey Valley Sewerage Scheme) to the Ringsend/GDD catchment. In the meantime the infrastructure to complete this connection is at an advanced stage of planning.

- Other than the above, no allowance has been made for any industrial growth, i.e. industrial growth taken as zero. The WSSP states (p.72): *If new industries require large one-off demands, then this would be provided for by utilising available reserves coupled with upsizing of treatment plants and networks to restore system capacity. The actual cost incurred in restoring the headroom would be recovered in full from that industry in accordance with provisions of our New Connections Charging Policy".* In accordance with the WSSP headroom capacity will be provided, and the management of this capacity will allow servicing of some industrial growth. This will be governed by policies which would ultimately require approval of the Economic Regulator.
- The headroom capacity allowance that has been applied for Dublin is 20%, and accordingly the required capacity has been determined by adding 20% headroom to the combined residential/commercial demand.

The current draft National Planning Framework[3] projects 22.5% population growth in Dublin City and suburbs to 2040 (i.e. + 265,000). This is equivalent to an annualised growth rate (straight line) of 0.94% per annum.
The WSP "Most Likely" growth rates used in this report have been applied on a compound basis. These indicate an increase of 26% in the same period. This is would indicate a variance of <3% in the overall projected load by 2040 (i.e. 1.26 v 1.225).

5.3 Headroom

Irish Water's aims with regard to provision of headroom are set out in various sections of the WSSP. The key elements are summarised below:

Water Services Strategic Plan: Headroom Requirements
P. x: The availability of capacity, "Headroom", at water and wastewater treatment plants to meet "core strategies" identified in development plans. The percentage of treatment plants meeting the target capacity headroom to increase from a current baseline of "unknown" to 60% of plants meeting their target by the end of 2021, 75% by 2027 and 100% of plants meeting their target by 2040
P.67: We will aim to provide adequate spare capacity (headroom) in strategic level infrastructure to cater for variability in demand arising from factors such as weather and operational risk and some upward variation around projected development demand.
P. 69: SG2d: "Maintain appropriate headroom in strategic networks and treatment works"
P. 72: A key element of Irish Water's strategy for meeting demand is the maintenance of an acceptable level of headroom (available capacity over current demand) in our systems to allow for growth potential and capacity risks. This is a key parameter in managing risks to service and takes account of the likelihood and consequences of failure from scheme to scheme. Once this headroom falls below the specified level, it acts as a trigger to provide a further increment of capacity

[3] "Ireland 2040 – Our Plan Draft National Planning Framework"

P.72: It is our long-term objective to provide for and maintain capacity headroom based on the size of the settlement served, the economic and social impact of failure and likely growth potential in line with the settlement hierarchy identified in the NSS and its successors as follows:
Large urban settlements (Dublin, Cork, Limerick/Shannon, Galway and Waterford); 20% headroom
Regional Gateways; (Dundalk, Sligo, Letterkenny/Derry and Athlone/Tullamore/Mullingar); 15% headroom
Other towns; 10% headroom
If new industries require large one-off demands, then this would be provided for by utilising available reserves coupled with upsizing of treatment plants and networks to restore system capacity. The actual cost incurred in restoring the headroom would be recovered in full from that industry in accordance with provisions of our New Connections Charging Policy.

P. 89: Definition of Headroom: Spare capacity in water and wastewater infrastructure (treatment plants and networks) to cope with adverse weather conditions or unplanned incidents such as a break in a trunk main or equipment failures at a treatment plant.

Table 5.1: Headroom Policy WSSP

5.4 Treatment Capacity for GDA

In the case of wastewater treatment capacity there are two specific elements to be considered:

1. Maintaining a sufficient margin of capacity above demand to limit the possibility of compliance failure due to fluctuations in load and other uncertainties.
2. Providing, as part of any plant expansion, sufficient capacity to cater for reasonable unforeseen or unplanned loads.

Having regard for both these elements the objective is to reliably treat to compliance standards, and to maintain sufficient capacity to react to unforeseen demands, i.e. to allow planning and timely delivery of interventions. In the case of Dublin the WSSP proposes a headroom of 20%.

The GDSDS did not specifically refer to headroom, however it adopted short term high growth projections from 2002 to 2011 (based on regional Planning Guidelines), and thereafter growth to a long term horizon (2031) at a lower rate. The resulting high initial growth rates, stabilising to lower average growth rates in the long term, are appropriate for strategic planning. Growth can be cyclical and it is sensible to consider that short term growth may exceed longer term rates.

Such short term variation is also observed in the recorded results from the Ringsend WWTW, between 2014 and 2016.

The current projections are based on “Most Likely” growth rates, which may be exceeded. Accordingly the headroom provision in the design is necessary to cover the possibility of higher short term growth.

The original GDSDS report projected the following wastewater loads within the Ringsend catchment:

Sub-Catchment Name	2002	2011	2031	2002	2011	2031	2002	2011	2031
		GDSDS			GDSDS			GDSDS	
		Domestic			Non-Domestic			Total	
City Centre/Docklands	151,959	180,283	203,870	578,733	643,361	643,361	730,692	823,644	847,231
Grand Canal	87,535	141,993	226,554	15,817	173,583	200,083	103,352	315,576	426,637
Grand Canal	35,572	38,450	62,436	12,136	16,377	18,077	47,708	54,827	80,513
Grand Canal	73,644	85,531	80,586	25,125	25,125	25,125	98,769	110,656	105,711
NDDS/NF	237,725	275,448	338,497	155,401	205,271	213,047	393,126	480,719	551,544
R&P	50,800	48,851	48,552	30,350	30,475	30,475	81,150	79,326	79,027
DVSS DLRCC	47,341	48,691	51,949	618	2,154	3,954	47,959	50,845	55,903
DVSS SDCC	119,180	110,824	105,515	37,785	39,359	41,681	156,965	150,183	147,196
Lucan/Clondalkin	75,992	111,650	183,801	54,051	77,841	102,399	130,043	189,491	286,200
Newcastle/Rathcoole	4,201	20,292	93,709	2,988	28,555	50,308	7,189	48,847	144,017
DLRCC WP East	22,301	18,662	16,367	8,375	8,375	8,375	30,676	27,037	24,742
DLRCC WP West	52,611	51,025	44,752	19,759	20,427	20,427	72,370	71,452	65,179
Total	958,861	1,131,700	1,456,588	941,138	1,270,903	1,357,312	1,899,999	2,402,603	2,813,900

Table 5.2: GDSDS Project Loads

Recent reported average loads arriving at Ringsend WwTP from the Annual Environmental Reports issued to the EPA as required under the Waste Water Discharge (Authorisation) Licence (WWDL) are as follows:

Annual Environmental Report (AER) (year)	Average Annual Load (p.e.)	Maximum Load (p.e.)
2011	1,755,449	2,486,830
2012	1,651,386	2,362,329
2013	1,764,745	2,449,864
2014	1,777,994	3,098,410
2015	1,933,203	3,101,783
2016	1,808,046	3,817,071
2017	1,825,543	n/a

Table 5.3: Ringsend AER Summary (2011-2016)

Figure 1.1 of page 7 of this report shows how the current proposed capacity requirements compare to the original load projections of the GDSDS report in 2005.

6. Need for Projects

6.1 Need for Ringsend Upgrade Project

The present plant capacity is 1.65m PE. The plant is experiencing average daily loads of 1.8-1.9m PE which is resulting in breaches of both the EPA plant licence and the Urban Wastewater Treatment Directive. In accordance with the GDSDS the plant capacity will be upgraded to its ultimate capacity. Having regard to the technology now available this is estimated at 2.4 m PE. The enhanced capacity upon upgrade is the maximum capacity of this plant given both site constraints and the limitations of the city drainage system. The additional Ringsend capacity will be added in stages over the period 2020-2024, with overloading stress experienced in the interim. The 2020 increment is critical to meet growth expected from developments such as (Docklands, Children's Hospital etc.).

Earlier reports have referred to a "firm" capacity of 2.1m p.e., which relates to the capacity when the largest unit is out of service for repair or maintenance. At the time it was envisaged that up to four treatment tanks would have to be taken out of service at one time. However the design proposed will allow single tanks to be taken out of service, meaning that the "firm" capacity is closer to the full capacity, especially considering that:

- The technology now available is superior to what could be considered in the original reports, with AGS treatment technologies allowing greater treatment potential in the existing tank volumes,
- The capacity is expressed as an annual average capacity and the plant will be designed to cater for significant daily, weekly and seasonal variations outside of this value, and
- The required provision of headroom in the determination of required capacity encompasses resilience to cater for breakdown.

6.2 Need for GDD Project

The scope of GDD proposed construction works (see map at the end of this report) is as follows:

- The diversion of the Blanchardstown (Route 9C) sewer, pumping station and mains/trunk sewers to deliver to the new GDD wastewater treatment works ("WwTW");
- Diversion of flow from the North Fringe sewer, close to the access road to the proposed new WwTW.
- New WwTW with design capacity of 500,000 PE;.
- A marine outfall to the Irish Sea.

A key objective of the GDD is to serve the north-west quadrant of the existing Ringsend catchment. The diversion of the loads from the 9C sewer (Blanchardstown/Clonee/ Dunboyne/ Ratoath/Ashbourne and Leixlip), and a portion of the North Fringe sewer, to the

GDD will reduce the load to the Ringsend WwTP and release critical network capacity to Ringsend to cater for planned growth in Lucan/Clondalkin/Peamount.

This diversion of load will enable future growth in the 9C and the Lower Liffey Valley (Leixlip) catchment to continue beyond 2024. These catchments are strategic growth areas, both in terms of housing and industry (existing and future Foreign Direct Investment). Irrespective of the treatment constraint at Ringsend WwTP, the full capacity of the 9C (including planned upgrade) will not be available to cater for growth beyond 2024, without the diversion of flows from the 9C Sewer to the GDD Orbital Sewer due to network constraints downstream near the Phoenix Park.

The diversion of load from the Ringsend catchment to the GDD enables growth to continue beyond 2024 in the other sub-catchments which remain served by Ringsend. This applies in particular to the Lucan/Clondalkin catchment where there is substantial scope for development both for housing and industrial, and the City Centre catchment where growth through urban regeneration, development of brownfield sites and densification is occurring, in areas such as the Docklands Strategic Development Zone ("SDZ"), Grangegorman Development and the proposed Poolbeg SDZ. These developments are critical in order to respond to housing needs and to facilitate growth. A key objective outside the core GDA is to relieve the situation at Leixlip, where the current plant has exhausted the assimilative capacity of the Liffey at that point.

In summary, the GDD is strategically important to the Dublin Region, and nationally, in that it will provide capacity for residential and commercial growth. However the planning and programming of the project must have regard for the uncertainties associated with the projections used. When programme uncertainty is considered, it is clear that the greatest risk is in the next phase of the project, through planning processes, when uncertainty is highest.

Where feasible works may be phased, to have regard for the rate of development of demand, in particular relating to;

- Mechanical and electrical fitout of WwTW and pumping stations
- Storage at the RBSF.

6.3 Need for GDA Network Projects

6.3.1 Kildare Transfer Pipeline

An upgrade of the Leixlip WWTP was completed in 2016, increasing capacity from 80,000 PE to 150,000 PE.
The Leixlip WWTP serves the Lower Liffey Valley Regional Sewerage Scheme which treats waste water flows from the towns/villages of Straffan, Celbridge, Maynooth, Leixlip and Kilcock. A significant industry in the Leixlip catchment has a reserve capacity of approximately 87,000 PE. Based on current population growth and the utilisation of the reserve capacity taken up by the single industry the upgraded treatment plant is currently near full capacity. However, presently the actual load is less than the capacity of the treatment plant due to the under-utilisation of the reserved capacity by industry.

The upgraded Leixlip WWTP cannot be expanded beyond the capacity of 150,000Pe due to assimilation constraints associated with the receiving water (River Liffey) at Leixlip. The Greater Dublin Strategic Drainage Strategy (GDSDS) envisaged that the future growth above the 150,000 PE in the Lower Liffey Valley agglomeration would be served by transferring excess flow from Leixlip to the GDD. The GDDS and previous Studies undertaken as part of the Blanchardstown Regional Drainage Scheme (BRDS) have identified the most appropriate reception point for the Leixlip Transfer as being the 9C Sewer in Blanchardstown.

The Leixlip Transfer pipeline forms part of the strategic network within the GDA, which will permit development within the potential high growth areas of North Kildare. An existing significant industry submitted a new connection enquiry seeking an additional treatment capacity in excess of 100,000 PE, with a requirement for treatment capacity to be in place by 2020/2021. This new connection cannot be facilitated by Irish Water without the Leixlip Transfer pipeline being in place and an upgrade to the wastewater network in Leixlip. The lack of future capacity is highlighted in the Figure 6.3 below which gives growth projections for the Lower Liffey Valley Regional Drainage Scheme which is served by the Leixlip WWTP.

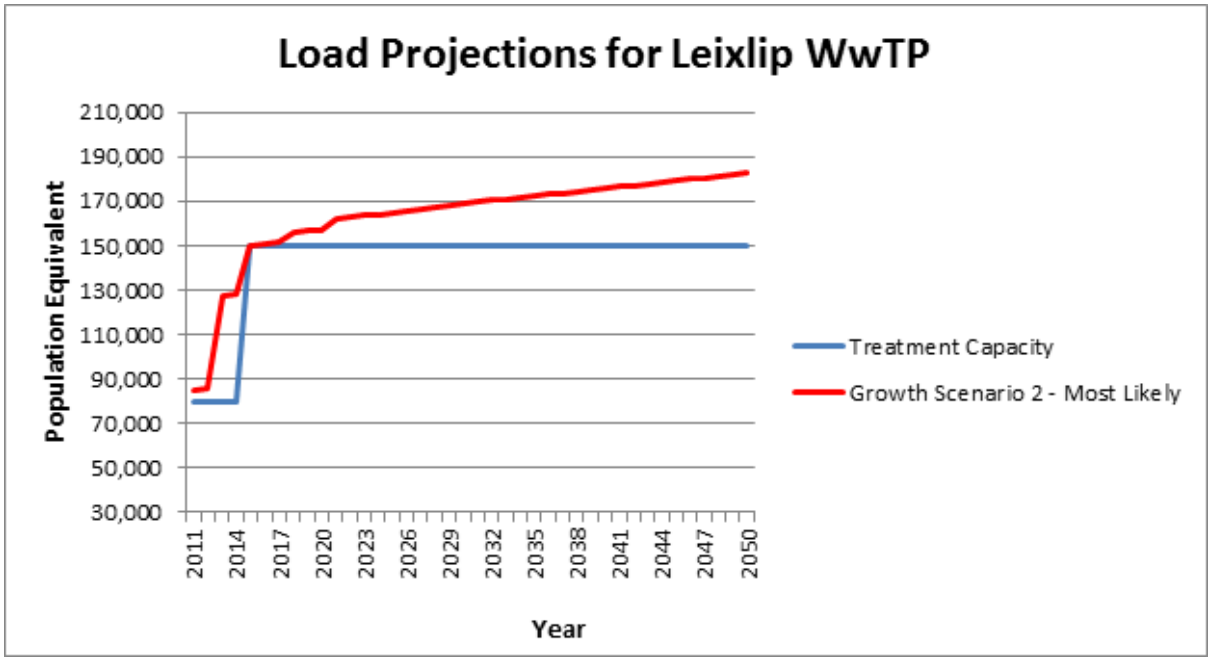


Figure 6.3 Load Projection based on 100% Utilisation of current Reserved Capacity

6.3.2 9C Duplication and Storage

The 9C Trunk Sewer was constructed in the 1970s along the Tolka Valley to provide for the planned towns of Blanchardstown, Mulhuddart and Castleknock. This sewer connects to the Grand Canal Tunnel via twin siphons through the Phoenix Park and under the Liffey and ultimately onto the Ringsend Wastewater Treatment Works.

In the intervening years parts of Meath (Dunboyne, Clonee, Ashbourne and Ratoath) have been connected to the 9C sewer. In addition, the original catchment has had significant growth. Significant level of new connection enquiries for housing developments and industry have been received by Irish Water and are currently being assessed with the future provision of this capacity as a major driver. Provision of this infrastructure will also allow the strategic

connection from the Leixlip Transfer pipeline.

A need for this project was originally identified during the Greater Dublin Strategic Drainage Study (GDSDS). At this stage it was known that the 9C sewer was operating at capacity and that additional capacity would be required to cater for future growth within the catchment The GDSDS identified an interim requirement for the duplication of the 9C sewer to the Liffey Siphons with storage to limit CSO spills and an ultimate requirement that flows be transferred via a new Orbital Sewer to a new Wastewater Treatment Works.

Operational Data shows extensive flooding in the Mulhuddart area in the region of the Shanty Pub and Tesco's has been recorded in the past during storm conditions.

A flooding event in 2002 caused the closure of the N3. There was also substantial flooding in August 2008 which caused the closure of the N3 opposite the Liberty Insurance Building.

When this project was inherited by Irish Water in January 2014, there was a Part 8 planning consent in place for storm holding tanks and storm pumping station in the Blanchardstown Park, near the 'Institute of Horology' building. For information purposes the duplication of the 9C sewer was shown in the Part 8 package. This duplication started at Parslickstown Bridge and ran to Ashtown.

In 2013 when it was known that the Greater Dublin Drainage (GDD) project was being initiated, it was decided that the duplication would terminate at the storm pumping station and storage tanks.

As the duplication will now terminate at Blanchardstown Park, the pumping station will serve the dual purpose of a Dry Weather Pumping Station and Storm Pumping Station for an interim period until the GDD connects to the 9C. Storm tanks will act as balancing tanks for this interim period, and in the longer term. Planning permission has been obtained for the overall development, including this change which includes a larger building and re location of the tanks.

As the detailed design has progressed, the viability of the duplicate being laid using open cut construction has been re-evaluated. Sections of the proposed route were also re-assessed. This has resulted in tunneling option being recommended with slight alterations to the original route.

The 9C Duplication and Storage project is therefore a strategic network project and a necessary prerequisite to facilitate the Leixlip Transfer Pipeline. The 9C Duplication and Storage is also required immediately to service growth in the Blanchardstown and the upstream Meath sub-catchments. It is required to alleviate flooding and to prevent storm water overflow spills from the 9C catchment negatively impacting the receiving water, namely the River Tolka.

The 9C Duplication and Storage Project is not dependent on the GDD Project until 2024 when diversion to the GDD of flows from the 9C will facilitate growth beyond this date. The 9C Duplication and storage is required and can operate independently of the Leixlip Transfer pipeline.

6.3.3 9C Liffey Siphons Rehabilitation

Based on the survey work carried out under the BRDS, rehabilitation works were recommended to permit the twin 900mm 9C Liffey Siphons to operate as per the original design intent. The works include rehabilitation works to shafts, tunnels, chambers and hatch boxes. The rehabilitation works will;

- Facilitate the siphons being cleaned and undertaking of detailed internal asset surveys to identify any further rehabilitation works that may be required.
- Facilitate the controlled pass forward flow required through the siphons to service growth in the 9C catchment.
- Facilitate ongoing operation and maintenance of the asset in a safe manner.

Both penstocks on the 9C Liffey Siphons are broken and inoperable. They are only partially wedged open providing approximately the equivalent pass forward flow capacity of only one siphon, with a pass forward capacity of 1.1-1.3 m^3/s. There is ongoing development pressure in the contributing catchment for residential and industrial development that will put increased pressure on the 9C sewer and the Liffey Siphons. The estimated flows within the 9C Liffey Siphons up until interception of flows upstream by the GDD are expected to reach 1.8 m^3/s, which far exceeds the current restricted capacity.

The 9C Liffey Siphons project is therefore a strategic network project and necessary prerequisite to facilitate the 9C Duplication and Storage and the Leixlip Transfer Pipeline.

6.3.4 Orbital Sewer (part of GDD)

The orbital sewer is needed to create the strategic link between the western catchments (incl. the 9C) and the new wastewater treatment plant in North Dublin. The orbital sewer is to be advanced with the other elements of the GDD project which are all mutually dependent. The other elements being the new wastewater treatment plant, the treated effluent pipeline to the coastal outfall and the coastal outfall. The need for the orbital sewer is therefore provided under the need for the GDD Project. The orbital sewer will represent the largest investment in new strategic drainage infrastructure since the construction of the North Fringe Sewer over a decade ago.

The orbital sewer will initially serve the 9C catchment (incl. the Leixlip Transfer Pipeline), and a portion of the existing North Fringe catchment, but due to its scale and the envisaged design horizon must have sufficient capacity to fulfilling the longer term objectives envisaged under the GDSDS and transfer of flows from other catchment within the GDA which may be routed to the new treatment plant via the orbital sewer.

6.3.5 City Centre Sewerage Scheme Projects

The addendum to the GDSDS identified the following elements as part of the preferred strategic options: (i) Divert North and South Quay interceptor sewers near Heuston Station to connect with the new pumping station to connect to GCTS on Davitt Road. Trunk sewers (ii) Upgrade CSO's along the River Liffey.

The progression of these infrastructure elements falls under the City Centre Sewerage Scheme (CCSS) which is at Concept Design Stage. The concept design stage involves putting in place a drainage area plan for the catchment with a verified hydraulic model. The

model being the primary design tool to determine potential options and an overall preferred option for the City Centre catchment. The primary drivers for the catchment being; facilitating growth, achieving compliance with EU Directives and the reduction in risk of sewer flooding within the catchment to acceptable service levels. Due to the anticipated high level of capital investment required to implement these measures, it is anticipated that elements will be phased where possible and these will be implemented to fit within capital planning constraints. The justification and benefit associated with each of the elements will be determined as part of the CCSS.

6.3.6 Rathmines and Pembroke

Irish Water appointed consultants on the MLPS and Rathmines and Pembroke (R&P) Drainage Study in 2015. For the GCTS catchment (part of MLPS) the requirement was to update the existing hydraulic model developed under the GDSDS with the more detailed sub-catchment modelling work undertaken in recent years. The initial outputs from the study were in July 2016. A report on Phase 1 of the study is expected early in 2018, with model update and development of options to follow..

There are many elements to this Study and the primary objectives are summarised below which included a review of GCTS Storm System under Item 3 and the scoping of additional surveys for representative and verified DAP Models under Item 2 and 4.

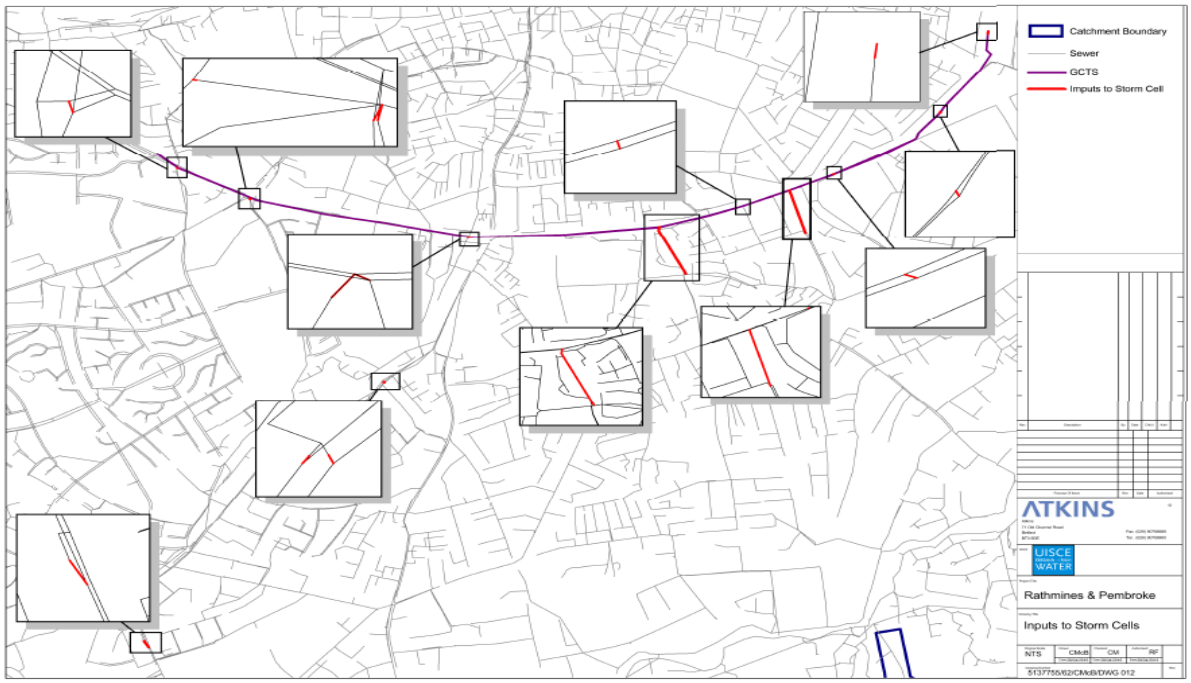
Table 6.3: MLPS and R&P Study – Study Objectives

1.	Development of growth forecasts in the MLPS catchment areas from a base year of 2011 to development horizons of 2021, 2041 and 2050 by assessing appropriate growth rates for residential population, appropriate allowances for existing and future commercial load
2.	Review the R&P HL catchment DAP models, reports and analysis undertaken to date and advise Irish Water of the best approach to take, in accordance with industry best practice and legislative requirements, to improve datasets and undertake necessary surveys and studies in order to build an appropriate modelling tool for the purpose of developing solutions to the complex hydraulic, environmental, operational and structural problems within this established urban catchment.
3.	Review hydraulic and environmental performance of the GCTS Storm Trunk System and its outfall to Grand Canal Dock or River Liffey for present day and future scenarios
4.	Scope additional surveys/studies and modelling work required to develop satisfactory DAP model for MLPS Catchment

The Study has examined the previous modelling undertaken on the Rathmines and Pembroke catchment. Confidence in the model in terms of replicating actual performance of the R&P High Level catchment is low due to a number of factors:

- Missing Network Data
- Connectivity Issues
- Relatively low number of flow monitors used in previous study
- High levels of Impermeable Area (contributing hardstanding area) in model compared to desktop assessment

The study identified inputs from the combined sewer system which connect to the storm cell of the GCTS. The Study examined the spill frequency and total cumulative flows from the combined sewer system and other storm water inputs for a typical year of rainfall.



The findings from the study are that extensive asset surveys, flow & rainfall monitoring have been identified as being needed in order for model accuracy and confidence to be improved. This will allow the model to become a suitable design tool for assessment of future performance requirements and option development to address risks.

The study does not identify what level of impact or proportion of impact that these discharges have on the water quality and how does this impact compare to that imposed on the Grand Canal Basin by the storm water discharges. The Study also examined the constructability of the Storm Water Outfall Extension and reviewed the cost estimate of the previous project.

Based on the above it is important that there is progression of the R&P Drainage Area Plan (DAP) by IW to permit accurate and viable solutions to be derived to address flooding and storm water overflow spills. This will include the progression of extensive asset surveys, flow monitoring and hydraulic model build. Provision for the R&P has been provided for in the Irish Water Investment Plan. In addition the development and progression of an appropriate water quality model in parallel with the City Centre Sewerage Scheme is required to enable capital investment decisions with regard to addressing storm water overflow impacts jointly within the R&P and CCSS catchments to be refined as much as possible to ensure maximised benefit at least whole cost is achieved. The advancement of the R&P and CCSS in to planning and detailed design stage post completion of the DAP to ensure project progression on both of these catchments.

The GDSDS noted some works to extend the Grand Canal Storm Outfall pipe had already been completed and the remaining would be completed. The GDSDS proposed solutions for the 9B and R&P on the basis that overflows from the catchments would discharge via the storm water pipe to the River Liffey and not to the Grand Canal Basin. Section 11.2.1 of the GDSDS notes the following in relation to the R&P and 9B:

"Rathmines and Pembroke high-level catchment flows to the foul cell would be limited to Formula A, with flows in excess of this value overflowed to the storm cell of the GCTS, in turn discharging to the Liffey Estuary. Formula A flows at 2011 total 0.74 m3/s, and at 2031 they total 0.73 m^3/s. Local upgrading of the 9B trunk sewers and pumping stations in Lucan and Clondalkin. A new CSO would be installed at Ballymount to limit pass forward flows to 2 m^3/s with approximately 11,000 m^3 of storage, with flows greater than Formula A spilling into the storm section of the Grand Canal tunnel. A new overflow pipeline would be constructed to transfer spill flows from the CSO to the storm cell of the GCTS."

The Strategic Environmental Assessment (2008) for the GDSDS noted the following:

"In the Rathmines and Pembroke catchment, CSOs are required to limit foul flows to the Grand Canal Tunnel foul cell from the existing combined sewer system. By discharging excess flows to the storm cell which outfalls *to the Liffey transitional waters, a Formula A approach was considered acceptable;"*

Within the GDSDS the extension of the outfall pipe was considered a prerequisite for the solutions in the Preferred Strategic Drainage Option, in particular on solving environmental compliance and flooding issues within the 9B and R&P catchments.

The extension of the outfall to the River Liffey was contained within the Water Services Investment Plan (WSIP) 2007-2009 and was entitled Relocation of Grand Canal Surface Water Outfall. The scheme was programmed to start in 2008. The project was also listed in the 2010-2012 WSIP. A previous project progressed by DCC to extend the storm water outfall under the WSIP was brought to completion of the tender documents by DCC's consultants in late 2009. However the project was not progressed further, primarily due to the economic downturn. The extension of the storm water outfall will not mean the R&P catchment will achieve compliance with the UWWTD but impact on the basin from storm and storm water overflows will be removed.

The basin is currently being used for recreational activity which does involve water contact and immersion (wind surfing, canoeing etc.).

The physical asset is a storm water sewer, which Irish Water is not responsible for under legislation. However IW is responsible for the discharges which spill from the overflows within the R&P catchment which flow through the storm water sewer into the basin and the impact they have on the basin. The progression of the storm water outfall pipe should be considered as a component of the R&P and the 9B catchment. The previous R&P and 9B solutions within the GSDSS were based on a connection to the storm water cells of the GCTS. These solutions are referenced within the Addendum to the GDSDS made under the SEA on the GDSDS.

6.3.7 9B Catchment

A high level assessment of the MLPS (including 9B) and Rathmines & Pembroke catchments has been completed as discussed in Section 6.3.6 above. The findings in relation to the 9B catchment are similar to those of the R&P. There is low confidence in the model, in terms of representing actual performance of the 9B catchment and that further flow and rainfall surveys are required to produce a verified model. Based on the above it is important that there is progression of the 9B Drainage Area Plan by IW to permit accurate and viable solutions to be derived to address flooding, storm water overflow spills and for facilitating growth. This will include the progression of extensive asset surveys, flow monitoring and hydraulic model build. Provision for the 9B DAP has been provided for in the Irish Water Investment Plan.

7. Implementation Programme

7.1 General

The load envisaged in the GDSDS report did not materialise in the time frame predicted in 2005. There can be no doubt that the economic turndown from 2008 on is a significant factor in this. However with the recovery of the economy there will be a recovery in growth. This is in addition to the current demand for housing to cater for population growth, which demand has been suppressed in recent years.
In relation to population growth, and the commercial growth that is associated with this, the "most likely" growth projections in the "Assessment of Domestic & Non-Domestic Load on Proposed Regional WwTP, 19 December 2017" have been applied in this report.

In relation to demand from industry, no specific allowance for growth in industrial demand has been included in the projections, except where an allowance for a specific significant industrial user has been applied. In accordance with the Water Services Strategic Plan a provision of headroom has been allowed, calculated as 20% of the projected combined residential and associated commercial load.

Also the potential for growth to exceed the "most likely" growth scenario must be recognised. It is certainly strategically prudent to consider this eventuality. In this regard it is notable that the current Ringsend WWTP was overloaded at the time of its commissioning due to "Celtic Tiger" growth exceeding the 20 year design projections.

7.2 Ringsend WwTP

In the first case the capacity of Ringsend is being exceeded and the Ringsend upgrade project must proceed to completion in the shortest practical timeframe. This will provide a capacity at Ringsend of 2.4m p.e.. The 3 No. individual elements associated comprise of the:

- The 400,000 PE Expansion
- Sequence Batch Reactor (SBR) Retrofit (Lot 1)
- SBR Retrofit (Lot 2).

Stage	Duration	Scope	Programme Risk	Date Finish	Relative Cost
Design and Planning	2 years	Design and contract documentation	-	2016	Modest
Procurement and Construction	3 years	Prequalification, Tender advertising, tender assessment and award, construction.	Moderate (Procurement)	2020	High
Commissioning	0.5 years	Commissioning	Moderate	2020	Modest

Table 7.1: 400,000 PE Expansion

Stage	Duration	Scope	Programme Risk	Date Finish	Relative Cost
Design and Planning	3 years	Planning approvals, statutory consents, investigative contracts, design and contract documentation	High	2019	Modest
Procurement and Construction	5 years	Prequalification, Tender advertising, tender assessment and award, construction.	Moderate	2023	High
Commissioning	0.5 years	Commissioning	High	2024	Modest

Table 7.2: SBR Retrofit Lot 1

Stage	Duration	Scope	Programme Risk	Date Finish	Relative Cost
Design and Planning	1 years	Planning approvals, statutory consents, investigative contracts, design and contract documentation	Low	2020	Modest
Procurement and Construction	4 years	Prequalification, Tender advertising, tender assessment and award, construction.	Low	2024	High
Commissioning	0.5 years	Commissioning	Low	2025	Modest

Table 7.3: SBR Retrofit Lot 2

7.3 GDD Project

Based on current projections, and assuming capacity take-up by the SIC, the GDD would be required to be in operation in 2024. This would ensure that the projected Ringsend capacity would not be exceeded (though there may be some erosion of available headroom). It is possible that economic growth and resulting increased loads could exceed this growth rate, resulting in a requirement for earlier delivery. A possible indicator of such recovery is the reported increase in load between 2014 and 2015.

It is also possible that the SIC capacity would not be fully utilised, however a partial transfer of Leixlip load would be required in any event to alleviate the loading on that plant.
Based on the current projections, design and planning of the project should proceed without delay. This will ensure that

- potential planning delays are, insofar as possible, addressed, and
- that project delivery can be responsive as possible to any change in required delivery time (particularly in response to increased economic activity).

Stage	Duration	Scope	Programme Risk	Date Finish	Relative Cost
Design and Planning	3 years	Planning approvals, statutory consents, land acquisition, wayleaves, investigative contracts, design and contract documentation	High	2019	Modest
Procurement and Construction	4 years	Prequalification, Tender advertising, tender assessment and award, construction.	Moderate (Procurement)	2023	High
Commissioning	1 years	Commissioning	Low	2024	Low

Table 7.4: GDD Project Phase 1

7.4 Network Projects

The programme for implementation of the strategic wastewater network projects is summarised in the Tables below. The scale of the network projects means that programmes will be undertaken over multiple investment cycles.

Stage	Duration	Scope	Programme Risk	Date Finish	Relative Cost
Design and Planning	2 years	Planning approvals, statutory consents, land acquisition, wayleaves, investigative contracts, design and contract documentation	High	2017	Modest
Procurement and Construction	2 years	Prequalification, Tender advertising, tender assessment and award, construction.	Moderate (Procurement)	2019	High
Commissioning	1 years	Commissioning	Low	2020	Low

Table 7.4.1: Leixlip Transfer Pipeline

Stage	Duration	Scope	Programme Risk	Date Finish	Relative Cost
Design and Planning	3 years	Planning approvals, statutory consents, land acquisition, wayleaves, investigative contracts, design and contract documentation	High	2017	Modest
Procurement and Construction	3years	Prequalification, Tender advertising, tender assessment and award, construction.	High (Procurement)	2020	High
Commissioning	1 years	Commissioning	Low	2021	Low

Table 7.4.2: 9C Duplication and Storage

8. Conclusion and Recommmendations

1. The Ringsend WWTP is already significantly overload and should be upgraded to the full capacity deliverable on the existing site as an immediate priority. Based on available modern technology, which is being pilot tested on the site, this capacity will be in the order of 2.4 m PE (average annual load).

2. The capacity of the upgraded Ringsend WWTP should be sufficient to deal with the daily, weekly and seasonal load variations that occur within the catchment. In this regard the plant will have a technical capacity that exceeds the projected average annual load.

3. The most recent projections of growth, and recent trends of increasing measured loads, coupled with a need (reflected in the WSSP) to maintain a reserve of spare capacity above demand (headroom) indicate that the ultimate treatment capacity of Ringsend, and the capacity of the existing network to convey all flows to Ringsend, will be exceeded in the near future. The best available projections indicate that a diversion will be required in 2024.

4. This diversion requires that new treatment capacity be provided. Extensive studies and assessments have determined the appropriate location for a new WWTP in Clonshagh. The provision of this new WWTP and the diversion of load from the existing Ringsend catchment to this new WWTP is the subject of the Greater Dublin Drainage (GDD) Project.

5. The GDD project is in accordance with the GDSDS, as adopted by the Dublin Regional Authorities.

6. The implementation of the planning and design stage for a project of the scale and complexity of the GDD will require an extended time period. The scale of such a project will also present programme risks at each stage. A realistic programme for implementation of the GDD Project from Planning to Implementation is 8 years, with 3 years allowed for planning.

7. Based on the current load projections, design and planning of the project must proceed without delay. This will ensure the following:

    a. potential planning delays are, insofar as possible, addressed; and
    b. that project delivery can be as responsive as possible to any change in required delivery time, particularly in response to increased economic growth and housing need in the GDA. On that basis, it is imperative that the next phase of the GDD project, i.e. planning, proceed immediately. During the design and planning phase the estimated load projections will be monitored and re-profiled as required**. In the unexpected event that the load projections are deferred, the construction of the project can be delayed as required within the 10 year planning permission timetable.**

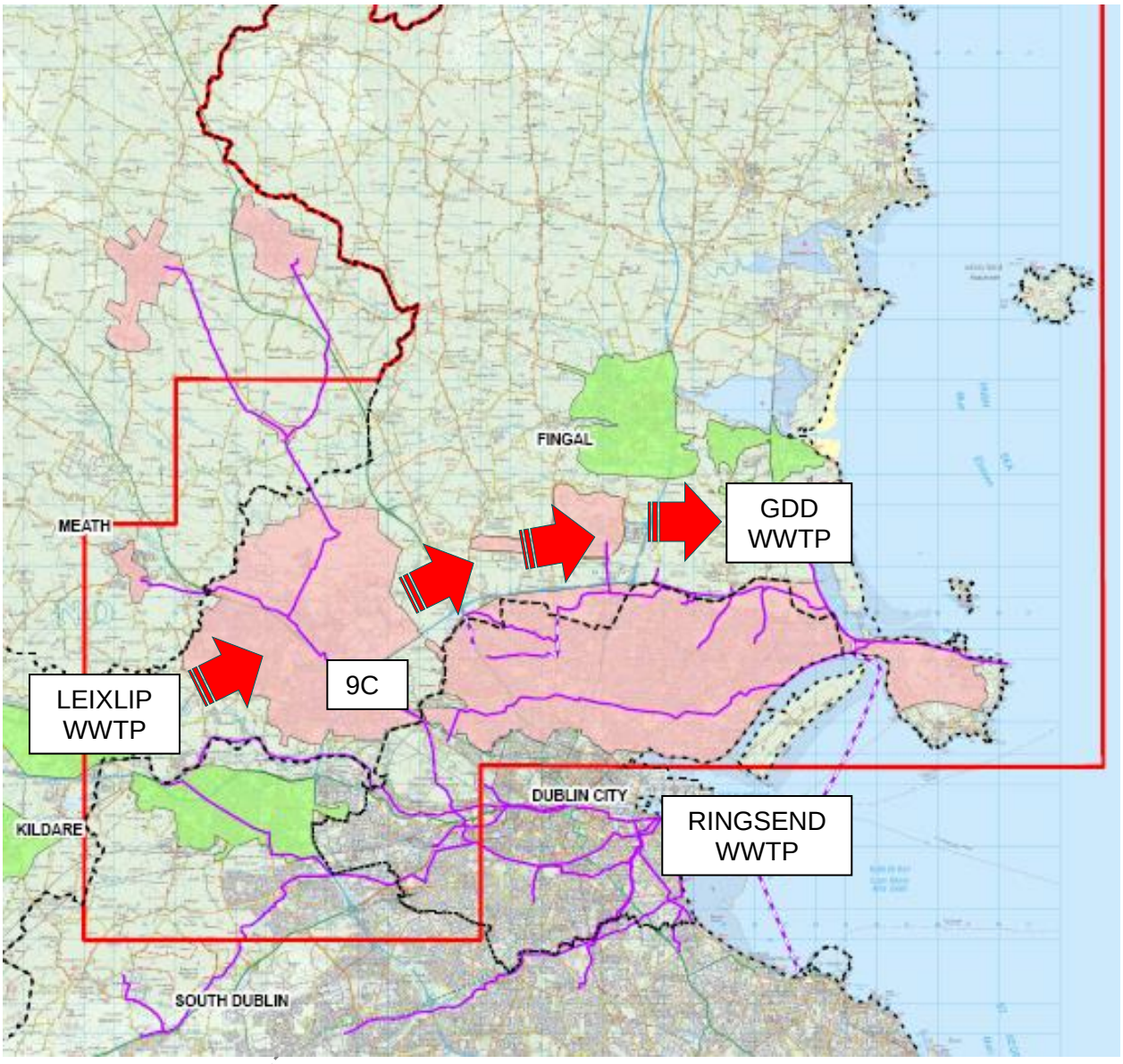
8. There are various factors that can affect the timing of when interventions are required. These include:
    a. Confirmation of load projection for SIC
    b. Regional and areal growth rates
    c. Industrial demand
    d. Final capacity available at Ringsend and efficient utilisation of that capacity
    e. Hydraulic limitations in the network

    Having regard for the above the actual delivery of project elements should be timely and cost effective. The planning approach adopted should not be an unnecessary constraint on the phasing of the works.

9. The planning process requires clear definition of the proposed project. However there are short and long term uncertainties, and a desire to retain, insofar as possible, strategic flexibility. Notwithstanding such uncertainties the project is strategically critical, and the strategic planning must envisage a project that is sufficient to cater for the worst case realistic scenario. Thereafter it is desirable to have flexibility to phase delivery in response to actual needs as they develop. Also the potential for growth to exceed the "most likely" growth scenario must be recognised. It is certainly strategically prudent to consider this eventuality. In this regard it is notable that the current Ringsend WWTP was overloaded at the time of its commissioning due to "Celtic Tiger" growth exceeding the 20 year design projections.

10. Technical evaluation of options, including phasing options, should have regard for energy savings and carbon footprint.

11. Design of trunk sewers and outfalls should provide strategic flexibility to cater for development beyond the scope of the current planning horizon, having regard for the design life of these assets. This should include provision for potential future 9B transfer to the GDD Orbital Sewer.



GREATER DUBLIN AREA – CATCHMENT MAP

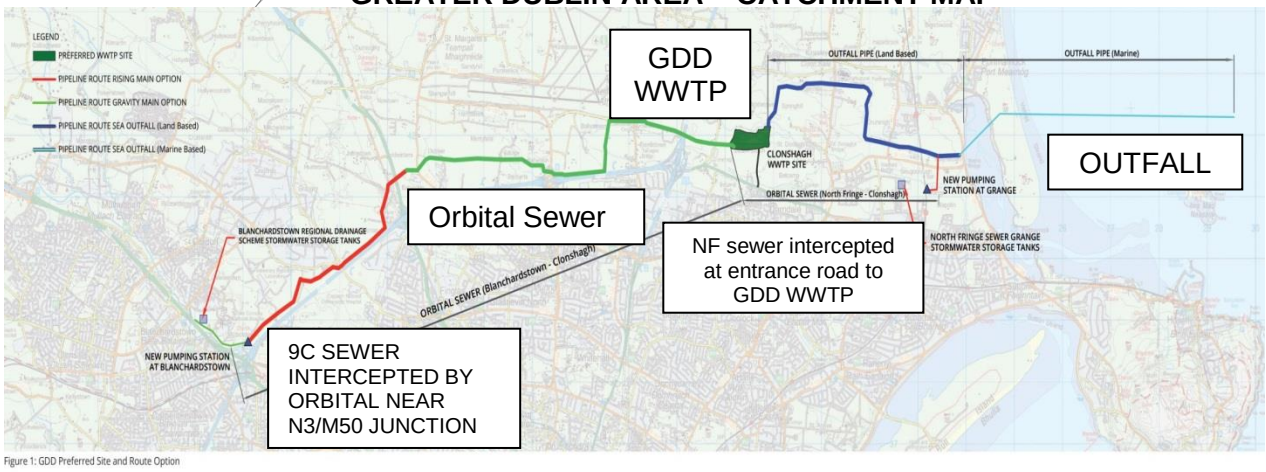


Figure 1: GDD Preferred Site and Route Option

GDD PROJECT (Orbital Sewer, WWTP and Outfall)