

Water Supply Project
Eastern and Midlands Region
**Project Need
Report**

February 2015



Abstract

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.

The Water Supply Project, Eastern and Midlands Region, has been in development for almost two decades. Irish Water, since assuming responsibility for the Project in January 2014, has carried out a fundamental review of all the factors which determine the need for water, and are now consulting widely on the Project Need Report.

The Project Need Report 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 Report forecasts population in the Water Supply Area serving Dublin, to rise from 1.52m at the 2011 Census, to between 2.02m and 2.15m by 2050. The additional population of a potential Benefiting Corridor around a transfer pipeline from a new source to Dublin, if it were routed across the Midlands, would rise from a current figure of 0.53m at 2011, to approximately 0.68m by 2050.

The Report takes account of new data from the domestic meter installation programme and has included the results in water demand projections. The early information from the domestic metering programme has indicated that domestic water consumption, per person, is lower than that used in previous assumptions.

For the first time in Ireland, the Report looks at industrial water requirements, by sector, linked to growth projections for those sectors and it recognises that intensity of water usage by industry is reducing, as production in water using industry becomes more efficient.

The Report recognises that leakage from water supply systems is a national problem and it sets ambitious targets for reducing leakage over the next decade and onwards, over the planning period (2015 – 2050).

The maximum capacity of existing sources of supply is assessed in this report and for all current sources of supply we are now very close to the limit of what can be abstracted without causing adverse environmental impacts. Existing water treatment plants on the River Liffey, at Leixlip and Ballymore Eustace, have been developed over decades, on infrastructure originally provided in the 1940s and 1960s. In the case of the Vartry Reservoir, water supply depends on infrastructure dating from the 19th century. The Liffey water supply plants now account for 84% of water treatment capacity in the Dublin Water Supply Area. More than 40% of the mean annual flow in the river Liffey is allocated to water supply. Against this background, it is very important that operational risks and potential climate change impacts are addressed when planning for meeting future water supply needs in a secure and resilient manner.

The Report contains a review by independent economists which underlines the strategic importance of secure, resilient, high quality water supplies for the key exporting sectors of the Irish economy. The economists have highlighted the “very significant negative employment impacts if adequate water supply is not available to meet the needs of indigenous and overseas businesses”. The Report has examined the costs to the economy of water supply disruptions similar to those experienced in Dublin over the past 4 years. Costs to the Irish Economy are estimated to be in excess of €78m per day of disruption in the Dublin Water Supply Area.

Based on the demographic, economic and water demand projections and on considerations of resilience of supply, there is a need for a new water supply source. The projections point to a New Source water requirement of 296 - 330 megalitres per day (Mld)¹ by the year 2050.

There is a need to provide early support to the existing sources in order to increase overall supply resilience and diversify risk associated with them. Irish Water’s Project Need Report proposes that a Phase 1 capacity of 267 Mld be developed for a new water supply option serving the Eastern and Midlands Region and that planning should proceed to have this in place by 2021 / 2022.

¹ megalitre per day = 1 million litres per day = 1 Mld

Contents

1 Introduction	5
1.1 Project Need Report	5
1.2 The Water Services (No. 2) Act 2013 and the Water Services Strategic Plan (WSSP)	6
1.3 Irish Waters' Statutory Obligations and Planning Scenarios	7
2 The Metropolitan Water Supply Area and Benefiting Corridor	9
2.1 Introduction	9
2.2 Water Supply Area	9
2.2.1 Combined Water Supply Area	10
3 The Demographics Report	13
3.1 Introduction	13
3.2 Planning Scenarios	13
3.3 Scenarios Used in Water Demand Planning	14
4 The Economist Report	17
4.1 Residential Demand	17
4.2 Non Residential Demand	17
4.3 Unaccounted For Water (UFW)	18
4.4 Economic Value of Water and Competitiveness	18
4.5 The Benefiting Corridor	19
4.6 Regionally Shared Benefit	19
4.7 Climate Risk	20
4.8 Summary	21
5 The Water Demand Review	22
5.1 Introduction	22
5.2 Adopted Planning Scenarios	22
5.3 Domestic Water Demand	22
5.4 Non-Domestic Water Demand	23
5.5 Strategic Industrial Provision	24
5.6 Customer Side Leakage (CSL)	24
5.7 Unaccounted for Water (UFW)	24
5.8 Peaking Factor	25
5.9 Provision for Headroom and Outage	25

5.9.1 Headroom Provision	25
5.9.2 Provision against Outage	25
5.9.3 Conclusion	26
5.10 Overall Water Demand Projection	26
6 The need for Resilience in Water Supply	28
6.1 Resilience	28
6.2 Climate Change	31
6.3 Providing for Resilience in Phasing	32
7 Conclusions and Recommendations on Infrastructural Planning	31
7.1 Conclusions	31
7.2 Recommendations	34
8 Project Roadmap and Next Steps	33
Appendix A – WSP Summary of Demographic Projection	1
Appendix B – (WSP) The Economist Report	3
Appendix C – Water Demand Review	5
Table 3-1 Proportions of National Population by Area (Census 2011)	14
Table 3-2 Projected Population at 2050 for Adopted Scenarios	15
Table 3-3 Scenario 1(a): Planned Growth 'High' M2F2 Traditional	15
Table 3-4 Scenario 1(b): Planned Growth 'Low' M2F2 Recent	15
Table 3-5 Scenario 2: Most Likely Growth M2F2 Modified	16
Table 5-1 Water Demand Projection Summary (Shannon source option)	26
Table 6-1 Production Capacity/ Deployable Output of the water treatment plants serving the Water Supply Area of Dublin	30

1 Introduction

1.1 Project Need 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 public water supply 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 assuming responsibility at January 1st, 2014, for the Water Supply Project (Eastern and Midlands Region) ("WSP") which in essence is a nationally strategic Water Supply Project, Irish Water commissioned a review of the fundamental determinants of 'Need' for the project. This Irish Water Review is supported and informed by three complementary specialist studies / reports:

1. A Demographics Report (AOS Planning – Appendix A)
2. An Independent Economist Report (Indecon – Appendix B)
3. A Water Demand Review Report (Jacobs-Tobin – Appendix C)

A successful planning outcome for the development of a new major water source for the Eastern and Midlands Regions requires the question of need to be comprehensively addressed and Irish Water is now seeking to consult widely around the outcome of the 'Need' review, which is presented in this Project Need Report.

The Project Need Report examines:

- (a) A range of demographic scenarios to a planning year of 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 the projection of water demand drawing on currently available data returns from domestic water metering, 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 Midlands and Eastern areas, for the life and health of people living there, and for the sectors of the economy that sustains their livelihoods.
- (d) The importance of resilient connectivity of water resources for the safety, security and reliability of water services.

A corresponding, appropriate level of 'Need' review will follow onwards to the other regions of the country, following the preparation of a National Water Resources Plan and, as soon as source data permits, on more than 1,000 water supply schemes transferred to Irish Water.

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

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,

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,

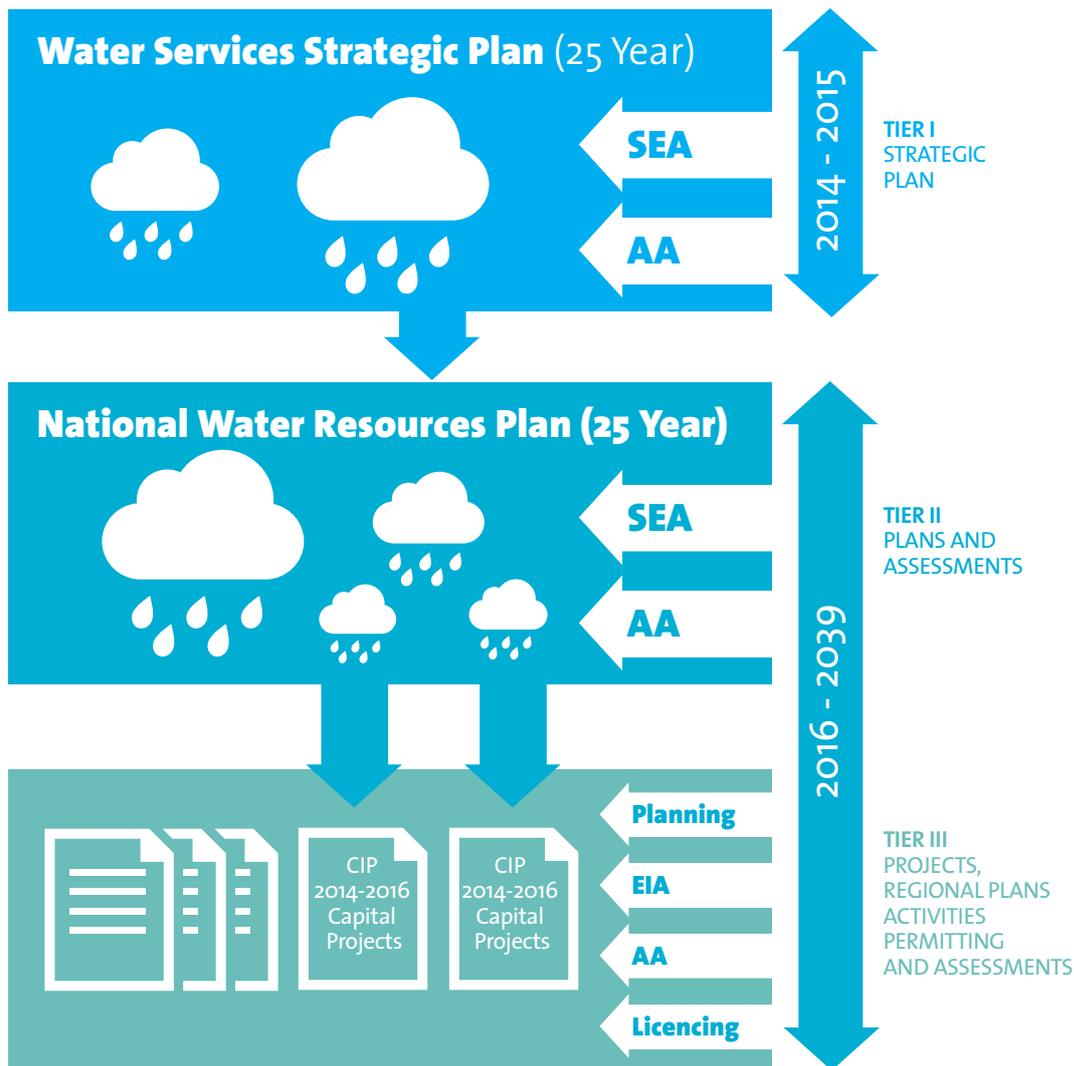
- (d) the conservation of water resources,
- (e) the continuity, safety, security, and sustainability of water services,
- (f) that Irish Water can meet all reasonable demands for water both current and foreseeable

Consultation on scoping of the Strategic Environmental Assessment and Appropriate Assessment of the Water Services Strategic Plan (WSSP) has already taken place.

The Water Supply Project has been in development for almost two decades and therefore runs parallel to, and pre-dates Irish Water's WSSP obligations. The discipline of strategic planning holding a national perspective embodied in the WSSP, has nonetheless been embraced in this review on the Water Supply Project, and will continue to inform the Project.

The draft WSSP, which has been published for consultation in February 2015 and is due to be finalised in mid 2015, 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.

Figure 1-A Irish Water Strategic Plans and Programmes



1.3 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 water demand 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, High Water Demand scenario were to unfold.

The Economist's Report (refer to Appendix B) supports this position, when it says:

"In Indecon's view this suggests that in strategic planning, Irish Water should seek abstraction planning for a higher demand than would be assumed in any central forecast in order to accommodate foreseeable potential demand. In evaluating demand for water,

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 sectors in an open economy, Irish Water is seeking to ensure that Irelands’ sustainable water resources serve the lives and economic prosperity of all. Water supply 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 planning and water abstraction permissions, and the design of infrastructure, have enough inbuilt modular, incremental augmentation features, to respond to development requirements in optimistic growth scenarios and in a timely manner.

2 The Metropolitan Water Supply Area and Benefiting Corridor

2.1 Introduction

The need for a new water supply source for the metropolitan area of Dublin and surrounding environs (**the Water Supply Area**) was first identified in the Greater Dublin Water Supply Strategic Study (GDWSSS) of 1996 and endorsed in a review of the GDWSSS in 2000.

The transfer of water services assets and functions to Irish Water in January 2014 has also permitted a more in depth strategic review of the water requirements for potentially benefiting corridors between a new water source and a terminal reservoir near the Dublin Metropolitan Area, permitting the combination of the requirements of the Water Supply Area with those of a Benefiting Corridor (**the Combined Water Supply Area**).

The Benefiting Corridor between a new water source and a Terminal Reservoir near Dublin, will depend on, and will be defined by, that source. It will be a larger Benefiting Corridor for a water supply from the River Shannon, than it would be for a coastal Desalination option, for example. The Demographics Report explains the adopted position in this Project Need Report, when it says:-

“For the purpose of establishing the maximum possible supply requirement, these Demographic Projections are based upon a spatial configuration that envisages a project to supply a Defined Water Supply Zone – consisting of Dublin City and surrounding counties and an adjoining area of the midlands that stretches as far west as Tipperary and Westmeath (Demand and Corridor Area).

All other alternative spatial configurations and technical options are likely to serve smaller areas and smaller populations – accordingly this ‘maximum area’ is the basis for examination –in accordance with best practice for impact assessment purposes.”

Accordingly, discussion of a Benefiting Corridor in this Report is without prejudice to any eventual preferred water supply option.

The principal consideration for this Project Need Report is to determine the water supply requirements for the Combined Water Supply Area from a base year of 2011, to the 2050 design year horizon, using new and updated data not available in the previous studies.

2.2 Water Supply Area

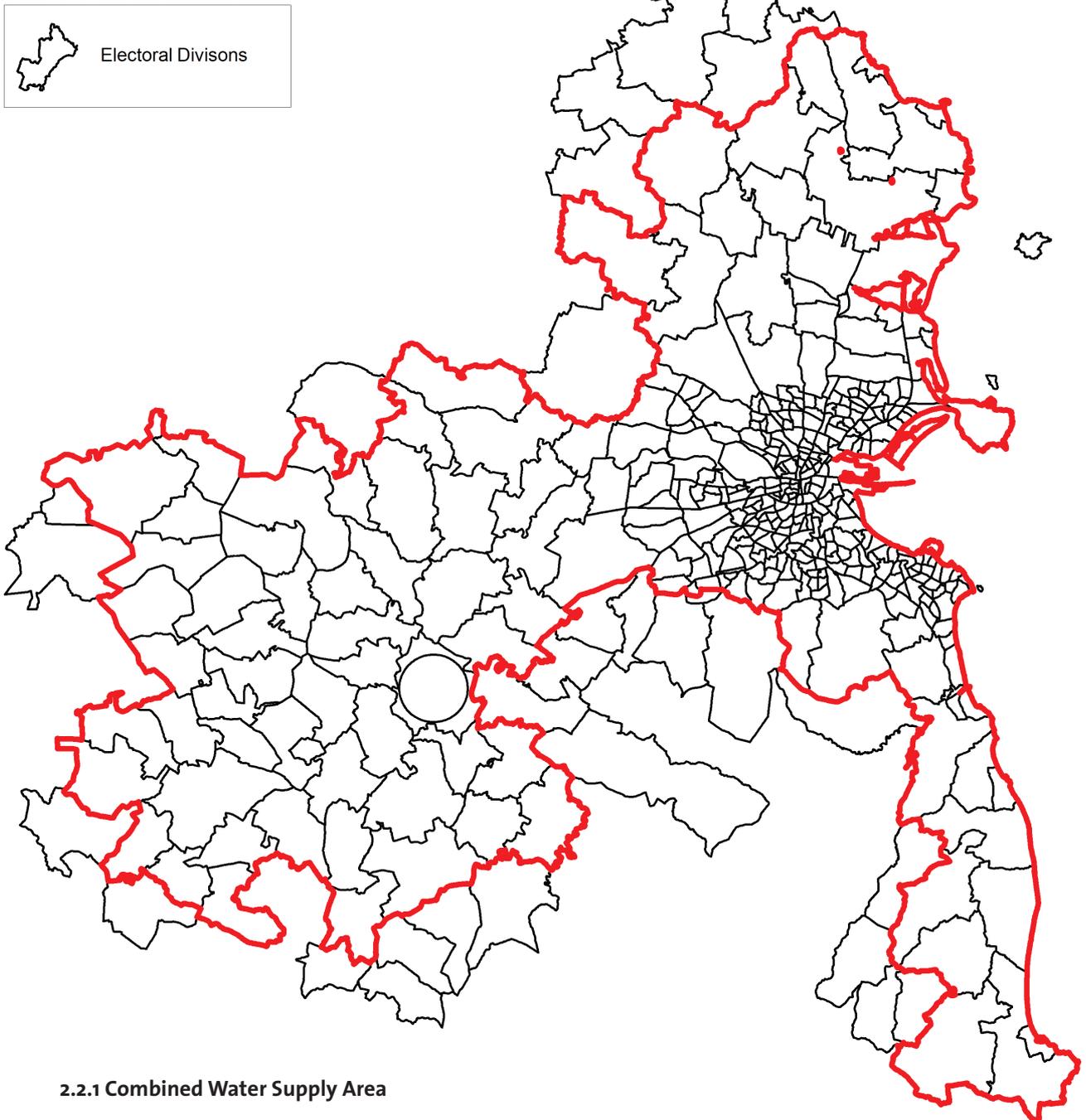
The Water Supply Area is defined by the existing water supply network of the Dublin metropolitan area serving an estimated 1,516,133 people (2011 Census). Split by county, it serves:

- Dublin – 98.33% of total County by population
- Meath – 12.27% of total County by population
- Kildare – 82.19% of total County by population
- Wicklow – 50.40% of total County by population

The extent of the Water Supply Area is illustrated in Figure 2-A.

²Including Fingal County Council, Dublin City Council, Dun Laoghaire-Rathdown County Council and South Dublin County Council

Figure 2-A Water Supply Area



2.2.1 Combined Water Supply Area

In determination of projected water supply requirements for the Water Supply Area, Irish Water is seeking to secure the greatest possible national benefit from the development of a new water source.

A transfer pipeline from a new source to a Terminal Reservoir near, or in, the Water Supply Area, would effectively function as a ‘water spine’ and in the case of Shannon-based options a ‘national water spine’.

The water supply position for communities adjacent to the route of such a transfer pipeline (based on abstraction from the Shannon or a desalination plant in north Fingal, for example) are a factor to be considered in scaling the overall project requirements, where the aspiration of Irish Water is to achieve nationally uniform standards of service from consolidated, efficient, water treatment plants, and resilient distribution systems.

Irish Water, in considering a position where it has inherited more than 1,000 separate water treatment plants, is examining opportunities to consolidate this number in a drive towards equality of service standards for all citizens. The World Health Organisation's (WHO) recommendation for Water Safety Plans covering drinking water sources, strongly endorses this approach to consolidation of Ireland's water supply schemes.

Preliminary investigations have identified a number of areas which could benefit from a resilient and consolidated supply, provided through the creation of a 'national water spine'. These are illustrated in Figure 2-B and Figure 2-C, with further information included in the Water Demand Review (Appendix C).

Figure 2-B Irish Water Regions and Study Area

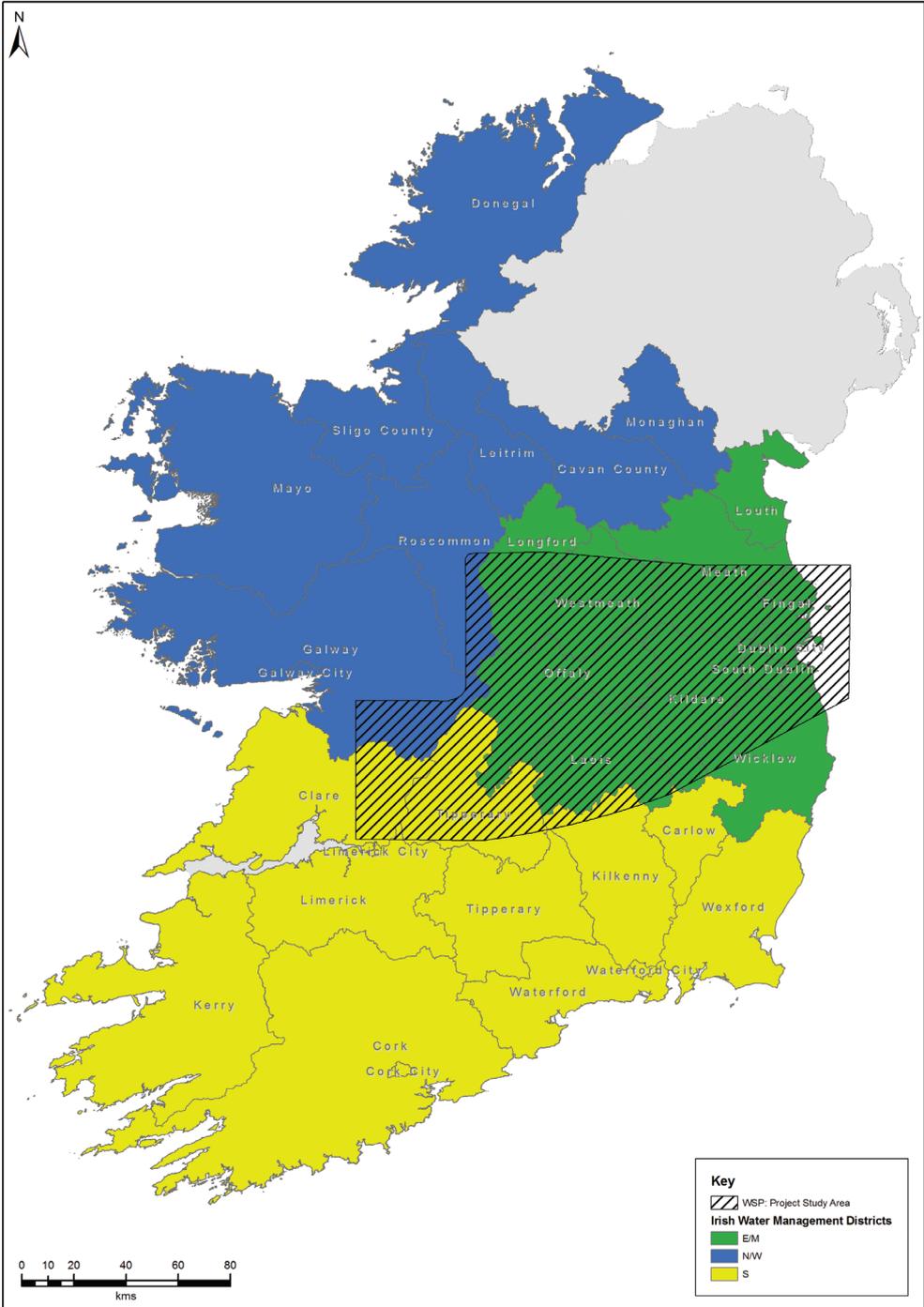
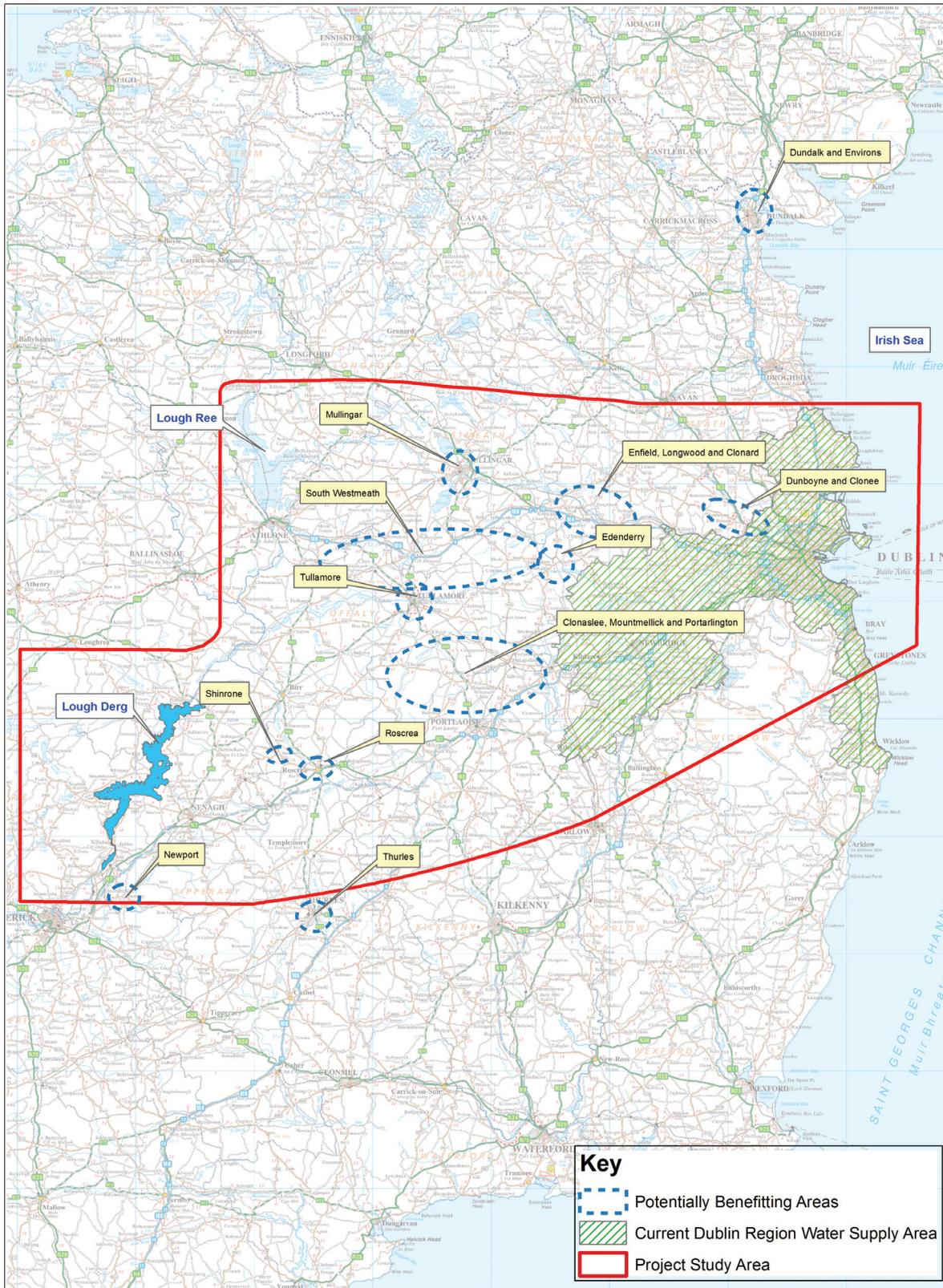


Figure 2-C Potentially Benefiting Areas



3 The Demographics Report (Appendix A)

3.1 Introduction

AOS Planning, a specialist planning and environmental consultant, has undertaken a detailed study on demographic assessment with the objective of examining a range of growth scenarios for State and regional population projections, to a planning horizon of 2050, as a basis for the estimation of water demand. This work, entitled “Water Supply Project Eastern and Midlands Region: Summary of Demographic Projection”, Rev.2, February 2015, is attached as Appendix A to this Report.

The demographers have based these scenarios on the nearest equivalent standard scenarios used by CSO, where years 2031 and 2046 represent the furthest dates used for the CSO Regional and State Population Projections, respectively. The projections are primarily based on the most relevant CSO Projections for the Planning Regions out to 2031 and then by way of providing Regional ‘best fits’ in respect of the CSO’s State projections to 2046, and finally to projecting them forward to 2050. The meanings of the various acronyms for Fertility and Migration assumptions attaching to the CSO Scenarios are defined in the Demographics Report (Appendix A).

3.2 Planning Scenarios

The national planning scenarios considered in the demographic study were as follows:

- Planned Growth ‘High’, referred to as Scenario 1(a) – is based on the balanced regional development approach to developing all areas of the country with a moderate increase in the metropolitan Water Supply Area share of the State population. For this scenario, the CSO M2F2 Traditional Projection was considered as providing the ‘best fit’.
- Planned Growth ‘Low’, referred to as Scenario 1(b) – is based on the modest, balanced growth for Dublin with higher Rest of State (RoS) area regional growth. The CSO M2F2 Recent Projection was considered as ‘best fit’ in this case.
- Most Likely Growth, termed Scenario 2, is based on the robust metropolitan Water Supply Area growth pattern, driven by consolidated Foreign Direct Investment (FDI) clusters and a recovering building industry, enhancing Dublin’s ‘Agglomeration effect’. The CSO M2F2 Modified Projection was considered as ‘best fit’ in this case.
- Minimum Expected Economic Growth, referred to as Scenario 3 – reflecting the minimum expected economic growth, including some regional loss of population projected for the West Region, persistent high unemployment, negative migration and limited FDI growth. The CSO M3F2 Recent Projection considered as ‘best fit’ in this case.
- Maximum Expected Economic Growth ‘Low’, referred to as Scenario 4(a) – based on growth led by the metropolitan area and Ireland’s strong economic performance reflected in its steady net inward migration and robust natural growth. The CSO M2F1 Projection was taken as ‘best fit’ for this scenario.
- Maximum Expected Economic Growth ‘High’, referred to Scenario 4(b) – based on the Scenario 4(a) predictions with the highest available 2031 Regional population figures reflecting subsequent growth as an urban agglomeration effect that applies primarily to Ireland’s cities, generated by higher employment and sustained levels of external in-migration into city regions. CSO M2F1 Modified Projection moving to M1F2 Projection after 2031 considered as ‘best fit’.

3.3 Scenarios Used in Water Demand Planning

The WSP Project Team (Irish Water / Jacobs-Tobin / AOS) considered the outcomes and the key assumptions underpinning the above planning scenarios and formed the view that, for water supply planning purposes, Scenario 3, is unrealistically pessimistic and Scenario's 4a & 4b are unrealistically optimistic.

Therefore, the remaining three planning scenarios have been considered for developing projections of water demand up to the design year horizon of 2050:

- Planned Growth 'High' - Scenario 1(a)
- Planned Growth 'Low' - Scenario 1(b)
- Most Likely Growth - Scenario 2

The Water Supply Area 1 comprises a majority portion of the local authority areas which make up the greater Dublin Area. Area 2 is then defined as the potential Benefiting Corridor (Midlands), and Area 3 is the Rest of the State. The 2011 Census population data for these areas is as follows:

Table 3-1 Proportions of National Population by Area (Census 2011)

Area No	Description	2011 Census	Proportion
1	Water Supply Area	1,516,133	33.04%
2	Benefiting Corridor (Midlands)	533,984	11.64%
3	Rest of the State	2,538,135	55.32%
	Total State Population	4,588,252	100.00%

It is important to note that the Planned Growth Scenarios 1(a) and 1(b) and their detailed assumptions set out in Appendix A, assume that collective National Spatial Planning policies of the State will be successful in regionally balancing the growth of national population and economic activity. That is clearly a desirable outcome and one that Irish Water supports.

However, Scenario 2 considers the implications of a lesser degree of success in regionally balancing national development. It is market and economy driven, rather than an outcome of successful spatial planning policy. Table 3-2 below illustrates how the 'High' and 'Low' Descriptors, referring primarily to population outcomes in the Combined Supply Area, can sit at variance with total projected population in the State as a whole. It also illustrates how a Most Likely Planning outcome can result in a greater population in the Combined Supply Area than a more desirable Spatial Planning led Scenario 1(a).

National Spatial Planning over the past 15 years has struggled to achieve the regional balance envisaged in the Planned Growth Scenarios and Irish Water, in planning for the Water Supply Project, must ensure that water is available in reasonable planning scenarios, including those which might result in additional water demand in the Combined Supply Area.

Table 3-2 Projected Population at 2050 for Adopted Scenarios

Area No	Description	Population at 2050		
		Scenario 1(a) Planned Growth 'High'	Scenario 1(a) Planned Growth 'Low'	Scenario 2 Most Likely Growth
1	Water Supply Area	2,111,142	2,022,316	2,154,252
2	Benefiting Corridor (Midlands)	687,614	681,862	692,296
	Combined Water Supply Area	2,798,756	2,704,178	2,846,548
3	Rest of the State	2,957,044	3,071,822	2,920,852
	Total State Population	5,755,801	5,776,000	5,767,400

The projected populations under each Scenario at the waypoints towards 2050 are presented in Tables 3.3 to 3.5.

Table 3-3 Scenario 1(a): Planned Growth 'High' M2F2 Traditional

Areas	2011	2021	2026	2031	2041	2046	2050
Water Supply Area	1,516,133	1,644,072	1,745,167	1,846,262	2,008,198	2,064,250	2,111,142
Benefiting Corridor	533,984	565,383	590,181	614,978	655,486	672,981	687,614
Rest of State	2,538,135	2,611,345	2,669,052	2,726,760	2,827,316	2,897,969	2,957,044
National Total	4,588,252	4,820,800	5,004,400	5,188,000	5,491,000	5,635,200	5,755,800

Table 3 4 Scenario 1(b): Planned Growth 'Low' M2F2 Recent

Areas	2011	2021	2026	2031	2041	2046	2050
Water Supply Area	1,516,133	1,616,845	1,697,519	1,778,193	1,906,095	1,967,693	2,022,316
Benefiting Corridor	533,984	563,647	586,430	609,291	646,914	664,789	681,862
Rest of State	2,538,135	2,646,808	2,723,752	2,801,516	2,937,991	3,002,718	3,071,822
National Total	4,588,252	4,827,300	5,007,700	5,189,000	5,491,000	5,635,200	5,776,000

Table 3-5 Scenario 2: Most Likely Growth M2F2 Modified

Areas	2011	2021	2026	2031	2041	2046	2050
Water Supply Area	1,516,133	1,642,391	1,742,226	1,842,060	2,003,156	2,081,225	2,154,252
Benefiting Corridor	533,984	564,676	589,693	614,710	655,058	674,430	692,296
Rest of State	2,538,135	2,613,533	2,672,881	2,732,230	2,832,786	2,879,645	2,920,851
National Total	4,588,252	4,820,600	5,004,800	5,189,000	5,491,000	5,635,300	5,767,400

The Demographics Report acknowledges that these contrasting population projections reflect the established natural growth differences which have become evident in the period since 1996. In that time, the natural growth in the Dublin water supply area and its environs, has almost matched that of the Rest of the State, despite their size difference. It also emphasises that the employment trends favouring city regions are becoming more pronounced, and Irish Water, while supporting the national drive towards balanced regional development will need to closely monitor the actual unfolding position, and ensure that infrastructural capacity can respond to that.

4 The Economist Report

Irish Water commissioned Indecon International Economic Consultants to prepare an independent assessment of the economic need for water. While their immediate assessment focuses initially on the Water Supply Area, Indecon emphasise that all regions in the State require reliable and sustainable water supply, to support the needs of the population as well as non-residential requirements. Irish Water supports this position and are planning to conduct similar assessments at a national level as soon as relevant data is available (see Section 1.1). The Economist's Report is attached as Appendix B.

The Water Supply Project has the potential to deliver new water supplies and support economic development in other counties, in what could be described as the Benefiting Corridor/Zone, which would enable access by other areas to water infrastructure servicing both a Benefiting Corridor and the Dublin Region.

This assessment includes new independent estimates of the demand for water over the planning period in line with international best practice and new empirical modelling, informed by careful assessment of relevant economic drivers, to evaluate likely future requirements for the residential and non-residential sectors. Indecon's approach combines evidence on sectoral water usage and economic growth patterns to forecast future non-residential demand.

4.1 Residential Demand

Indecon recognise that a key uncertainty with population forecasts relates to migration, a factor influenced by economic developments. Indecon has used alternative approaches to test the validity of the population projections using an econometric model. This research broadly validates the Most Likely Growth scenario produced by the independent demographers, AOS Planning.

Indecon have considered carefully the evolution of Per Capita Consumption (PCC) in the Dublin Water Supply Area over the forecast horizon and have taken account of:

- average household size
- the metering of households
- the introduction of tariffs for residential water usage
- evidence from other jurisdictions on the path of water consumption
- the likely impact of new housing stock on intensity of water use

Their assumption of a 5% fall in residential water demand in response to the introduction of water charging and metering is the minimum expected, excluding household leakage.

4.2 Non Residential Demand

Indecon have undertaken a detailed sectoral analysis of available customer level data on water usage, based on a NACE 2-digit classification system³. This has enabled for the first time in Ireland, a sectoral estimation of existing patterns of non-residential water usage, in addition to the development of sectorally differentiated projections for future water demand in the

³Statistical classification of economic activities in the European Community.

metropolitan water supply area. In this assessment, Indecon combined the data on sectoral water usage with CSO data on sectoral economic characteristics to carry out an assessment of the water intensity of economic activity at a sectoral level. Modelling of that water usage intensity and international experience, indicates a decline in the intensity of water use in industry over time, and this trend has been acknowledged and included in the projection methodology, which is based on the ESRI Medium-Term Review (2013) growth forecasts for the Irish economy.

The traditional approach to estimation of non-domestic demand linked growth to corresponding population growth is outlined (solely for comparison purposes) in the Water Demand Review (Appendix C).

Indecon endorses the need to have sufficient water capacity to respond to the expansion needs of existing users and potential new users. In forecasting these needs using detailed sectoral economic output forecasts, they also acknowledge that expansion of demand, outside the bounds of these sectoral forecasts, is possible in the case of large existing and potential future water users. They consider that this may need to be considered separately (by Irish Water) in the evaluation of capacity options.

4.3 Unaccounted For Water (UFW)

The (Economist) Report considers the losses of water from the distribution network, on both the customer side and public mains side. Given the relatively high levels of leakage, not only in the Dublin region, but in the Irish water supply system in general, reduction in leakage rates could go some way to extending the ability of the existing water supply sources to meet future growth in water demand.

From the early findings from water meter validation data, Indecon note that an approach whereby households are assisted to address customer side leaks, such as Irish Water's First Fix Scheme, could potentially be cost-effective in reducing leakage, maximising the benefit to customers and saving the maximum amount of water currently lost from the system.

In addition to facilitating effective targeting of Customer Side Leakage, Indecon also believe that the early metering data suggests a wider benefit through removing important sources of bias in water balance calculations to more accurately pinpoint where water is lost. This would assist in more accurately identifying unaccounted for water and underpin more reliable prioritisation and targeting of scarce resources to address future mains rehabilitation in the distribution system.

The Report concludes that:

“short-term reprieve to the water supply network is likely to occur due to increased water conservation, but the evidence suggests this is not likely to eliminate the need for an expansion of supply over the medium to long term.”

4.4 Economic Value of Water and Competitiveness

In commenting on the economic value of water, the Report notes that several of the industries in which Ireland attracts the largest amount of foreign direct investment are heavy water users. Pharmaceuticals, the manufacture of computer chips, and facets of the information and communication technology (ICT) services sector are examples of these water-

dependent industries. For these industries, a reliable, sustainable, and high quality supply of water is a key factor in their location decisions when contemplating foreign investment and is a crucial component of our international competitiveness. Indecon have commented that:-

“There are also very significant negative employment impacts if adequate water supply is not available to meet the needs of indigenous and overseas businesses. Given the continuing high unemployment rate in Ireland, this consequence should not be underestimated.”

The Report discusses the economic impacts of disruption of water supply from international studies. It concludes that an unreliable water supply would have significant economic costs and estimates of the cost of even one days' disruption in the Water Supply Area (€78m - €219m), provided in the Economist's Report, are a significant fraction of the likely capital cost of any solution to this problem.

“Interruptions in supply or intermittent falls in water quality have the potential to interrupt business for those firms already operating, while simultaneously discouraging similar firms from setting up in Ireland”.

These considerations lead Indecon to the view that there may be merit from an infrastructural planning perspective of ensuring adequate supply to accommodate a higher demand scenario than the base case. The significant economic cost of water supply disruption indicated by their research, also supports the case for accommodation of a higher demand scenario. While noting there is uncertainty regarding whether the High Demand scenario will be realised, Indecon consider that it is based on a credible possible outcome for the Irish economy.

4.5 The Benefiting Corridor

The Benefiting Corridor between a new water source and a Terminal Reservoir near Dublin, will depend on, and will be defined by, that source. It will be a larger Benefiting Corridor for a water supply from the River Shannon, than it would be for a coastal desalination option, for example.

Indecon point out that the supply estimates (for a larger benefiting corridor defined by a Shannon source) relate to specific supply projects (as advised by Jacobs-Tobin) potentially at risk or inadequately supplied or constrained. They go on to acknowledge that:

“Some or all of these small existing supplies may need to be replaced in order to ensure that the water supply needs of parts of Tipperary, Offaly, Laois, Westmeath and Meath are met. To the extent to which these existing small supply options are not adequate, the deficit may be larger than indicated. In this context we note that any investment which Irish Water would need to incur to upgrade existing supplies in the benefiting corridor which would remain dependent on inadequate hydrological yield could be avoided by connecting to a water spine drawing from a quality assured source. This would represent an important advantage for the benefiting corridor. This supports the merit of utilising our higher demand estimates for abstraction planning purposes.”

This question is considered further in Section 5.

4.6 Regionally Shared Benefit

Indecon have considered the manner in which benefits of a 'national water spine' serving the Midlands and East, if the new source of the River Shannon were to be selected, can be shared. They refer initially to the potential to release additional water supplies to local authorities within the benefiting corridor, which could support economic development in these areas. This is important, but what is less obvious, but perhaps equally important, and which falls within the capacity of Irish Water as a national water utility to deliver, is:-

"Addressing second level capacity constraints in other areas of infrastructure that undermine the ability to capture the full benefits from a new water supply source."

Additional water supplies will result in additional wastewater generation and the ability to analyse, and prioritise, resolution of drainage or effluent treatment 'bottlenecks', in a single 'Irish Water' utility overview, in partnership with Local Authorities, is an important part of positioning any community within a benefiting corridor, to sustainably take up opportunities. As we move toward the lifting of dairy quotas this year and as Irish Water plans to support sectoral strategies such as Harvest 25, this ability to assess and provide for the full implications of "water in, water out" is a significant benefit.

4.7 Climate Risk

Irish Water's assets are vulnerable to the impacts of climate change: temperature rise; the potential reduction in summer rainfall leading to lower available water resources and reduced assimilative capacity in receiving water bodies; intense cold snaps leading to damage to underground pipe networks and increased flooding and rising sea levels which pose a risk for low-lying and coastal assets. Changing patterns of precipitation will impact on water services provision and on levels of pollution and contamination, with significantly wetter winters and storm occurrences of a greater intensity.

4.8 Summary

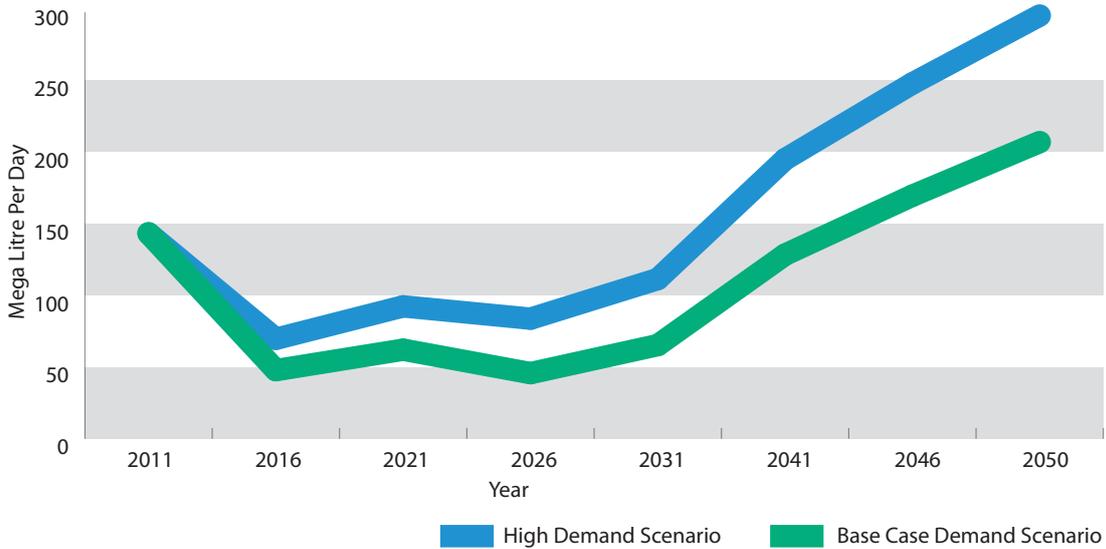
In summary, Indecon have independently analysed the current position whereby "increasing water demandhas been met within a very narrow 'supply-demand balance' operational regime, where there is very limited spare capacity in the existing supply system", and they assess the inherent economic costs in latent disruption risks.

They have undertaken a robust independent assessment of every element of the calculation of future water demand, both residential and non-residential. They validate the demographic projections of AOS Planning, and they take account of the likely effect of domestic metering on behaviour and charging on domestic water usage. They have grounded their non-residential work in sectoral analysis of water usage by industry and in modelling of how those sectors will grow. The importance of water supplies to the key exporting sectors of the Irish economy is underlined and the need to position the Benefiting Corridor to take advantage of economic growth opportunity is acknowledged.

Their analysis of the evidence highlights "the need for significant investment to address the expected gap between supply and demand for water over time".

The projected supply deficits contained in the Economist Report are outlined in figure 4-A. This supply deficit assumes an existing supply of 67.5 Mld in the Benefiting Corridor, which is discussed further in section 5.10.

Figure 4 A: Projected Supply Deficits



In viewing these projections, the initial drop in water deficit is the result of a number of factors:

- (a) the development and integration of the existing sources serving the Water Supply Area to the sustainable maximum extent by 2026,
- (b) the decline in per capita consumption expected on the introduction of domestic metering and water charges on a flat tariff basis, and
- (c) the drive to curtail Customer Side Leakage and Unaccounted for Water.

It must be remembered that this is a graphical illustration of predicted water deficit, which is one dimension of the overall requirement. There is a separate source resilience requirement (discussed in Section 6) which must be met, independently of any progress on water conservation or on tackling Unaccounted for Water. This is because loss of a key water source, treatment plant element or aqueduct, or the very likely impact of reduced capacity of existing sources due to climate change impacts, remain as risks to be managed, even as the drive to minimise water demand continues.

5 The Water Demand Review

5.1 Introduction

Water demand was previously projected for the Water Supply Area, for a 2040 design horizon, in the Preliminary Report of July 2010. That work was based on the 2006 Census and was undertaken at a time of high inward migration and economic growth. The economic landscape has altered markedly since 2008, the Demographic Report shows a shift in migration trends, and in accordance with Irish Waters' requirement for a fundamental review of Need, all of the components of Water Demand have been reviewed in Appendix C.

The 2011 Census, together with the CSO's Population and Labour Force Projections 2016 – 2046 (April 2013) and the Regional Population Projections 2016 – 2031 (December 2013), give a solid basis for this review, and have been used to extend the design horizon to 2050.

A valuable dividend from Irish Waters' domestic metering programme in the form of the early validation data, has also permitted a close examination of Per Capita Consumption (PCC) and significant revision of domestic water demand occurs as a result.

The Water Demand Review (Appendix C / Jacobs-Tobin) follows a systematic methodology in assessment and it tabulates and explains each of the components of water demand.

5.2 Adopted Planning Scenarios

The Planning Scenarios developed by the Demographers and listed in Section 3, were reviewed by the WSP Project Team. Analysis of the key assumptions underpinning those planning scenarios lead the Team to the view that, for water supply planning by Irish Water as the national water utility, Scenario 3, is unrealistically pessimistic. Scenario's 4a & 4b, on the other hand were considered unrealistically optimistic. These scenarios have therefore been noted, but are not further referenced in developing projections of water demand in the Water Supply Area serving Dublin and its environs.

Therefore, the remaining three planning scenarios have been considered for developing projections of water demand up to the design year horizon of 2050:

- Planned Growth 'High' - Scenario 1(a)
- Planned Growth 'Low' - Scenario 1(b)
- Most Likely Growth - Scenario 2

Taking the Metropolitan Water Supply Area initially, these scenarios envisage a population of between 2.02 million and 2.15m by the year 2050, compared to the 2011 Census population of 1.52 million.

5.3 Domestic Water Demand

On Per Capita Consumption, the Water Demand Review (Appendix C) notes that the early validation data from the metering programme places average PCC figures between 111.4 - 125.5 litres per head per day (l/hd/d). It sounds a note of caution on these early results, in that the range of PCC in metered properties reported by the Water Regulator in the UK (Ofwat) is wider, at 111 - 153 litres per head per day (l/hd/d), and it references an average across a range of European cities of 144 l/hd/d.

Forecasting how PCC will trend over the projection period up to 2050 is difficult, because it is difficult to predict the joint impact, of both domestic metering and new water charges, on customer behaviour. Other factors that will also have an influence on PCC are future household composition, occupancy rates, and the impact of new housing stock, with more efficient plumbing and water appliances.

The Water Demand Review makes challenging assumptions that PCC reductions will be real:

- It is assumed that a reduction of 5% on base year 2011 PCC will be achieved by 2016 for planning scenario 2 – ‘Most Likely Growth’ as a result of the introduction of domestic metering and annual water charges, subject to the current capped charges.
- For planning scenario 1(b) – ‘Planned Growth – Low’ it is assumed that a reduction of 10% on base year 2011 PCC will be achieved by 2016 following the introduction of metering and annual water charges.
- For planning scenario 1(a) – ‘Planned Growth - High’ it is assumed that PCC will not respond to the introduction of metering and charging.
- The combined impact of future household composition, occupancy rate and new build is applied across all three planning scenarios.

Domestic water requirements at 2050 across the three scenarios, are projected to lie in the range from 229 Mld to 263 Mld approximately.

5.4 Non-Domestic Water Demand

Non-domestic water demand (i.e. commercial/industrial/institutional users) has been projected on the traditional approach, on the assumption that this component of demand will grow in-line with population growth. This is developed as a validating link between the traditional approach and the new sectoral analysis and econometric modelling approach adopted by Indecon. Current non-domestic consumption in 2011 has been estimated at 126.5 Mld in the Water Demand Review. The projections of the future non-domestic demand to 2050 have been made from that base year of 2011, in line with the annual average population growth rates for the three planning scenarios, with the exception that large industrial users have been estimated separately from that trend. This approach compares favourably with the Economist’s sectoral based approach.

Tourism-related water usage and the effects of the Commuting Workforce, have been considered in the Water Demand Review. Water consumption in business and commercial parks has been studied and non-domestic water demand per hectare has been determined at 13.5 m³/ha/d, which broadly validates previously used estimates based on a commercial land zoning approach. However, due to the uncertainty in the timing of development of zoned commercial lands, an approach which builds non domestic projections on zoned lands is not favoured in the Water Demand Review.

Non domestic use, including a strategic allowance for large industrial users, is projected to lie in the range 245 Mld – 281 Mld, at the year 2050. This compares well with the projections of 238.2 Mld-272.4 Mld for non residential in the Economist Report

5.5 Strategic Industrial Provision

Foreign Direct Investment (FDI) has played a significant role in advancing Ireland's economic development over the past decades. However, global competition for the attraction of FDI has intensified, the pattern of global FDI is shifting and the role of cities, and how they are connected and networked globally, has become increasingly important to the competitiveness of the country.

The Water Demand Review notes that the investment pattern of multinational corporations means that manufacturing facilities are increasingly becoming scaled up, with up to 50% of world demand being produced in one factory. The impact of this is the large scale demand of such facilities for water (typically 25Mld to 30 Ml/d). The IDA targeted industries, with such water demand characteristics, include integrated circuit manufacture, large scale biotech and nanometer technology industries.

The 2008 Forfas report on the "Assessment of Water and Waste Water Services for Enterprise" noted that the provision of adequate and affordable water and wastewater services is crucial to ensure the sustained growth and development of enterprise in Ireland. Ireland's economic growth is to a large extent dependent on the economic growth of Dublin and its environs. Therefore, the Water Demand Review, supported by Irish Water, recommends that a provision of water supply services in the metropolitan Water Supply Area over the planning period up to 2050 should include a prudent allowance of 50Ml/d - 100Ml/d to facilitate the location and retention of such facilities within the region. Its profile in time has taken account of the views of IDA on existing commitments and live project discussions covering projects for the next five years.

5.6 Customer Side Leakage (CSL)

The Water Demand Review notes that the early validation metered data (provided by Irish Water) from the ongoing domestic metering programme has estimated the current average value of CSL at 66 litres per property per day (l/prop/d).

The early data clearly shows that between 5% and 6% of households exhibit water consumption in excess of twice the average daily household consumption, which suggests potential significant customer side leakage on these properties. Irish Water, working together with customers, will strive to make early inroads on these water losses, supported by its planned 'First Fix' policy (free first leak repair) and those efforts have been factored into water demand projections.

Following a workshop with all relevant parties on the issue, the Water Demand Review assumes that the current rate of 66 l/prop/d will be reduced to 40 l/prop/d by 2021, and steadily driven down to 25 l/prop/d thereafter.

5.7 Unaccounted for Water (UFW)

Unaccounted for Water (UFW) is the volume of water passed in to supply that cannot be accounted for as legitimate water use and is lost from the system. Leaks in water distribution networks are inevitable as all joints are susceptible to seepage and pipes can become damaged over time. The Water Demand Review acknowledges that allowance must be made for it in projection of future demand, even as strenuous efforts are made and ambitious targets are set, to minimise it.

UFW is a significant problem, not just for Dublin, but for the whole country. Leakage from the water networks averages over 41% across the country, twice the level of that in the UK, where

the assets are comparable but have been more intensively managed over the last 20 years. Unaccounted for Water in the (Dublin) Water Supply Area is estimated in the Water Demand Review at 33% and the Review notes that significant investment will be needed over several years to bring Ireland toward international leakage norms.

Irish Water is committed to moving from a relatively passive leakage control status to a proactive approach with the long-term objective of ultimately reducing public and customer side leakage nationally, to a sustainable economic level of leakage (SELL). This is the level of leakage at which it would cost more, in both capital and in social disruption, to make further reductions in leakage than to produce the water from another source. The Review notes the challenges which Irish Water face in marshalling the data from over 1,000 water supply systems nationally, to develop a sustainable economic level of leakage across the country.

The Water Demand Review has applied a working assumption for UFW until such time as the SELL calculation for the metropolitan Water Supply Area can be undertaken with any degree of confidence.

As part of Irish Water's water conservation strategy, it is proposed to reduce distribution leakage to 25% of distribution input in key areas and particularly where there is limited headroom, by 2021. For the metropolitan Water Supply Area this would equate to a saving of between 40 – 50 MI/d within the next 7 years. The Review notes that this level of leakage reduction over such a short timeframe, is extremely ambitious, as it has taken 20 years and thousands of million euros of capital investment in the UK, to reduce leakage by a third to 20% of supply. In Ireland, significant funding in asset replacement would be required, which may not be available within this timeframe. Ranges of differing timelines have therefore been assumed under each planning scenario for achieving this reduction in leakage to 25% of distribution input.

5.8 Peaking Factor

Demand for water varies throughout the year. Seasonal or other peaks occur, due to increased water usage associated with warm dry weather, or in cold weather, or as a result of sporting or cultural events occurring within the water supply area.

The "Average Day Peak Week (ADPW)", as a peak demand, is taken as the normal design basis for water distribution infrastructure. In the Water Demand Review, a Peaking Factor of 20% has been applied to the relevant elements of demand excluding leakage and excluding the Strategic Allowance for Major Water Using Industry.

5.9 Provision for Headroom and Outage

5.9.1 Headroom Provision

Headroom is defined as the difference between the amount of water a utility has available to supply (water available for use) and the volume of water it expects to introduce into its network (distribution input) to meet demand.

Target Headroom is defined as "a buffer between supply and demand designed to cater for specified uncertainties". It is the minimum buffer that a prudent water utility should allow, between supply and demand, to cater for uncertainties in the overall supply-demand balance and in order to meet its agreed level of service. Typical international figures for headroom allowances range from 5% - 10% (and tend toward the higher side) of the accounted for water.

5.9.2 Provision against Outage

A provision against loss of service of a key element of treatment capacity, or key trunk main delivering treated water to the supply network, represents an additional allowance incorporated into the overall 'headroom' allowance to cover instances where the achievable and deliverable output from treatment facilities falls below normal output. This can be for a variety of reasons, such as asset failures, planned maintenance, diminished throughput due to raw water variability etc. Typical international figures for outage allowance range from 5% - 7.5% of AFW.

5.9.3 Conclusion

Pending a detailed quantitative analysis of headroom and outage requirements and considering the current degree of uncertainty in supply side and demand side estimates, an overall allowance of 17.5% of demand (excluding leakage and the strategic allowance for major water users) at base year 2011 has been included in the projections of future demand. This allowance for headroom and outage has been curtailed to 15% of AFW at 2031, reflecting the true expectation that a better understanding of the 'uncertainties' is developed with time and maintained at this level out to 2050.

5.10 Overall Water Demand Projection

The overall Water Demand Projection, including a Midlands Benefiting Corridor, is tabulated in Table 5.1 below.

Table 5-1 Water Demand Projection Summary (Shannon source option)

Component	Scenario 1(a)	Scenario 1(b)	Scenario 2
	2050 (MI/d)	2050 (MI/d)	2050 (MI/d)
Domestic Demand	263.3	228.9	260.7
Non Domestic Demand	177.7	170.0	181.1
Strategic Industrial Allowance	100.0	75.0	100.0
CSL	23.9	22.9	29.6
UFW	130.0	130.0	130.0
Operational Water	4.6	4.2	4.7
Peaking Allowance (20%)	93.9	85.2	95.2
Headroom and Outage (15%)	70.4	63.9	71.4
Production Requirement	863.8	780.1	872.7
less Existing Sources	658.0	658.0	658.0
Demand / Supply Deficit	205.8	122.1	214.7
Benefiting Corridor	99.1	99.1	99.1
Total Potential Supply Requirement	304.9	221.2	313.8
Allowance for WTP usage (5%)	15.3	11.1	15.7
Abstraction Requirement from 'New Source'	320.2	232.3	329.5

There are minor differences in the various elements of the projected overall water requirement, as calculated by Indecon (Appendix B) and Jacobs-Tobin (Appendix C), with the main difference being in the view taken on existing sources in the Benefiting Corridor.

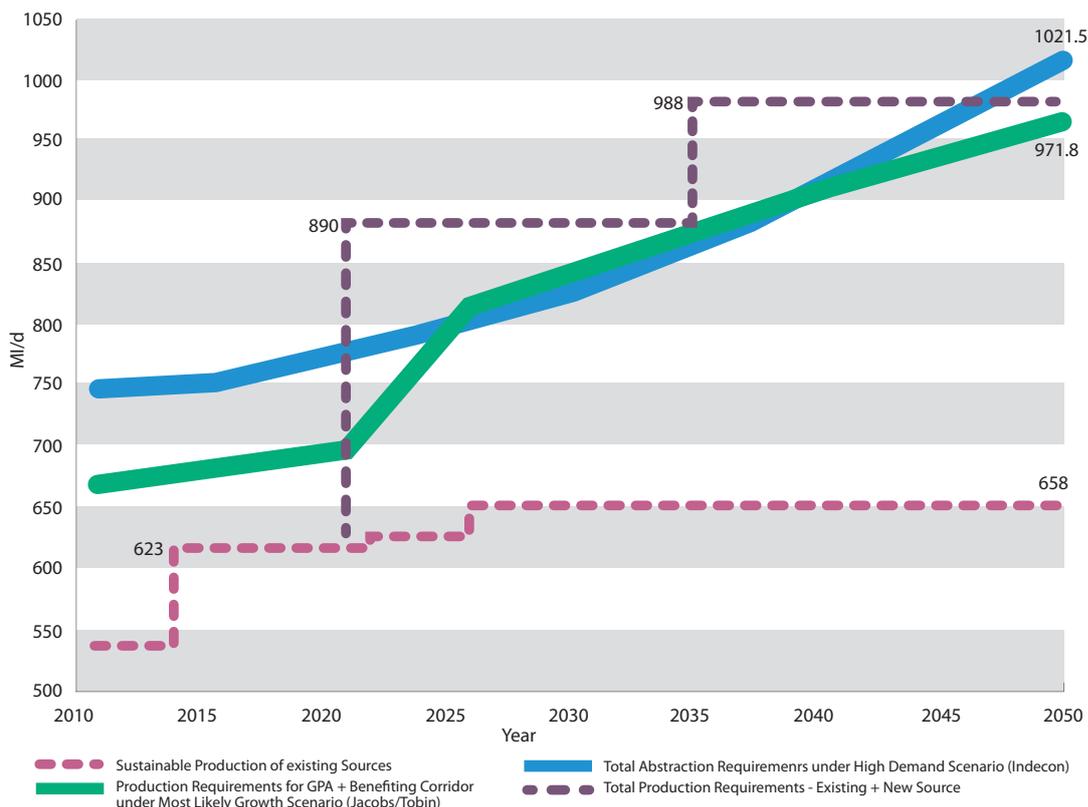
Indecon have approached the Benefiting Corridor water supplies, from the viewpoint of projected water demand, less an assumed availability from existing sources, giving a deficit or water need from a 'national water spine'. They acknowledge however, that:-

"Some or all of these small existing supplies may need to be replaced in order to ensure that the water supply needs of parts of Tipperary, Offaly, Laois, Westmeath and Meath are met. To the extent to which these existing small supply options are not adequate, the deficit may be larger than indicated. In this context we note that any investment which Irish Water would need to incur to upgrade existing supplies in the benefiting corridor which would remain dependent on inadequate hydrological yield, could be avoided by connecting to a water spine drawing from a quality assured source. This would represent an important advantage for the benefiting corridor. This supports the merit of utilising our higher demand estimates for abstraction planning purposes."

The Project Engineering Advisers (Jacobs-Tobin) in conjunction with Irish Water, have taken a different and more conservative view of these existing sources. Even after investment upgrades to these facilities (by Irish Water), they would still be dependent on sources of inadequate hydrological yield and in some instances of proven vulnerability to pollution. In connecting to a national water spine, drawing from a quality-assured and yield-assured source, it is not merely the availability of additional water which constitutes the benefit, it is the step-change in the reliability and quality of water supply made available in the Benefiting Corridor. It should be recalled that discussion of a Benefiting Corridor in this regard is without prejudice to an eventual preferred water source option.

Figure 5-A graphs the demand supply balance for a new 'Shannon' source and outlines the projected overall water requirement, as calculated by Indecon (Appendix B) and Jacobs-Tobin (Appendix C).

Figure 5-A Demand Supply Balance – New 'Shannon' Source



6 The need for Resilience in Water Supply

6.1 Resilience

Resilience of a water supply system is its capacity to maintain levels of service to customers, through a prudent supply/demand balance of sources and treatment capacity, even when availability of a source is disrupted due to a pollution incident, or part of a treatment plant is unavailable, or a key section of arterial main suffers outage due to a burst.

Not only must water be available from those sources still in service during a time of disruption, but it must be effectively deployable around the supply network, even under the interim, exceptional flow conditions. Supply resilience is not a function of greater water abstraction, or building ever larger numbers of treatment plants, it is about diversification of water sources and connectivity. It is a feature of good infrastructural planning for any water, power gas or telecommunications utility, because customers expect continuity of service even through, and around, reasonably foreseeable levels of disruption. It is a requirement which must be met, independently of any progress on water conservation or on success in reducing Unaccounted for Water, because loss of a key water source, treatment plant element, or aqueduct, remains a separate risk to be managed, even as the drive to minimise water demand continues.

This calls for a planned investment, in a prudent distributed capacity increment, determined from a risk appraisal of the probability and consequence of disruption events and available to be called upon, when it is needed.

A national perspective is necessary to build resilient networks and, at present, Irish Water has a national asset base including 856 individual water treatment facilities, ranging from very large to very small (some of which are shown on Figure 6-A), with a large network of approximately 60,000 kilometres of watermains. Many of these water treatment plants and supply schemes throughout the country, operate in effective isolation, with little supporting connectivity which would maintain supplies around disruption of a source, or treatment plant, or key section of trunk main. It is instructive to compare this position with Northern Ireland, where a population of 1.7 million people is served by just 47 individual Water Treatment Plants through a network of 26,000 kilometres of watermains.

The range of scale in the large number of treatment plants serving the country is emphasized by the fact that just eight water treatment plants serve the Water Supply Area, via approximately 9,200km of watermains. These eight plants and associated watermains are among the largest in the country.

Figure 6-A Water Treatment Plants

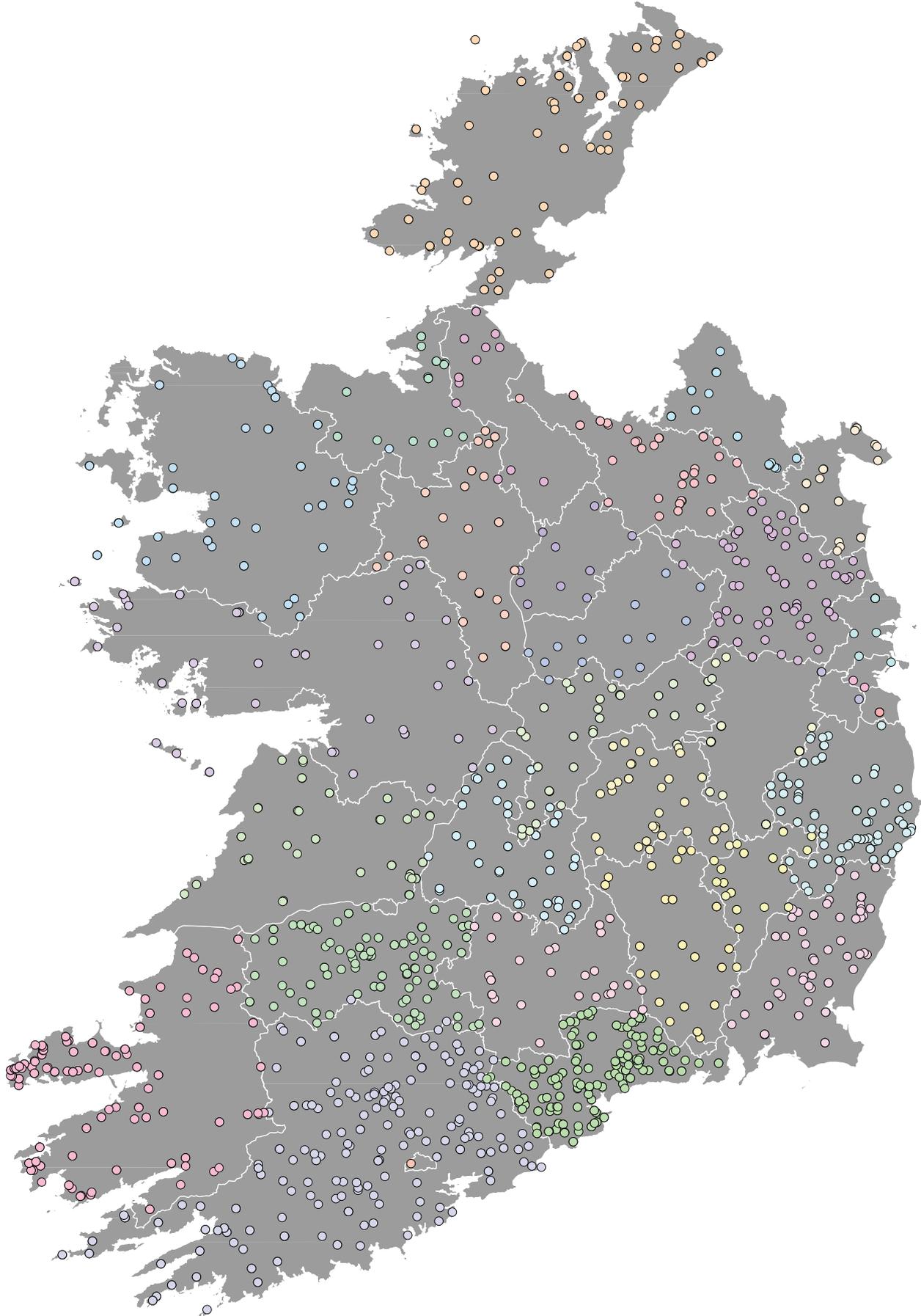


Table 6-1 Production Capacity / Deployable Output of the water treatment plants serving the Water Supply Area of Dublin

Water Treatment Plant	Production Capacity / Deployable Output (MI/d)			
	2011	2015	2022	2026
Ballymore Eustace	310	310	310	310
Leixlip	148	215	215	215
Vartry	65	65	75	75
Ballyboden	12	12	12	12
Srowland	0	13	13	38
Bog of the Ring	3	3	3	3
Rathangan Wellfield	3	3	3	3
Monasterevin Wellfield	2	2	2	2
Total	543	623	633	658

The achievement of the full rated output at 2015 of 623Mld from all sources, assumes that raw water conditions, treatment facilities, pumping plant and transfer pipework, are all functioning at full capacity. It can be validly argued that this current water supply to the Water Supply Area in 2014 relies completely on the prudent resilience provisions made in the 1930s and 1940s in the original Liffey schemes at Ballymore Eustace and Leixlip and their associated aqueducts. The growing water demand of the Water Supply Area since the 1990's has largely been met by encroachment into the 'headroom' margin that ought to have been held in reserve. Erosion of necessary 'headroom' results in disproportionate disruption, arising from quite ordinary events which would be considered 'foreseeable operational risks' in a water supply system of a European capital aspiring to modern standards of service. It also results in increasing exposure, where the probability of failure of particular key links, such as the Vartry Tunnel, is elevated, pending remedial work, or where the output of a Treatment Plant, such as Leixlip or Ballymore Eustace, is delivered by a small number of rising mains or key aqueducts.

There have been three events in the past four years which have highlighted the lack of operating headroom in the Water Supply Area, namely the exceptional water demand at the time of severe cold weather in the winter of 2010, the algal bloom experienced on the Vartry Reservoir in May of 2013, and the problems experienced with raw water chemistry at the Ballymore Eustace plant in late October 2013, at the time the Web Summit was hosted in the city.

The improved treatment capacity position following recent expansion at Ballymore Eustace and Leixlip is not entirely deployable throughout the supply network and there are sections of the supply system where usable capacity exceeds current demand by less than 5%. A circumstance where significant sections of the supply network operates continuously, so close to its maximum capability that key elements of it cannot be temporarily taken out of service

for essential routine maintenance, is unsustainable and Irish Water are already taking steps to address these key network constraints as a priority.

More than 84% of water supplied in the Dublin metropolitan region can be seen to be drawn from just one source, the River Liffey and the 2015 capacity of the Liffey WTPs represent 41.5% of the long term runoff of the catchment being used in public water supply.

The catchment of the Liffey is crossed by the M4 and M7 motorways, it is crossed by rail links from the south and west, and it hosts substantial communities, with associated wastewater treatment plants and industries. These are risk factors for potential supply disruption, particularly for the downstream Leixlip WTP, which supplies 215 Mld, or 34% of the total projected available supply at 2015.

Strategic links between water supply schemes are necessary to improve standards of service, matching available resources to water demand, in sustainable abstraction regimes and making the most of existing assets through conjunctive use of water resources. In managing water resources in the Midlands and Eastern Region, it is essential to recognise deficiencies in this regard and to build fundamental connectivity. In our consultations with the Industrial Development Authority, the importance of resilient water supply networks was strongly emphasized and the Economists' Report deals extensively with the serious consequences of supply disruption for communities and industry.

6.2 Climate Change

All areas of service delivery by Irish Water are vulnerable to the impact of climate change and managing its effects will be an ever present investment priority.

Projections of climate change for Ireland suggest that average temperatures will rise by between 1oC and 3oC by 2100, compared to the 1961-2000 average. Winters are expected to become wetter with climate change, while summers are expected to become drier. Under more pessimistic greenhouse gas emission scenarios rainfall may decrease by as much as 20 percent in Summer by the 2050s. With such a reduction in rainfall, reductions in streamflow can be expected to be greater than 20%, with sensitivity being catchment specific. Rain storms are also expected to become more intense than heretofore. Sea level rise of 60 cm has been projected by the year 2100, but there is uncertainty around the rate of loss of land ice which could increase rates of sea level rise.

While projections of climate change, particularly of rainfall changes, are uncertain, reductions in rainfall would aggravate the challenges of water supply for populated centres of high water demand. At present 84 percent of the water supplied to Dublin and its environs, comes from the River Liffey and the existing treatment plants at Ballymore Eustace and Leixlip are rated to use 41 percent of the historic mean annual runoff on the Liffey catchment for water supply. The performance of existing reservoir impoundments on the Liffey, is based on knowledge and recorded data gathered mostly in the period from 1950 to 2010.

While climate change is not currently a direct pressure on water supply, the limited headroom available in Dublin means that water supply in this populated area is vulnerable to reductions in available water. It is prudent that consideration be given to how strategic infrastructural adaptations together with water conservation measures may increase the resilience of water systems in meeting the risks posed by climate change.

At present the headroom allowance in developing water demand projections includes an allowance for reducing yield of existing sources serving Dublin, its environs, and the Benefiting Corridor, but this will need to be kept under review, and the uncertainty has informed our recommendations on new source capacity in Section 5.

6.3 Providing for Resilience in Phasing

Phasing of the eventual preferred option (to be identified) to meet the projected water demand identified in Section 5 would ordinarily be determined by the expected profile of growing demand identified there. However, meeting a water deficit is only one element of the requirement, there is a separate need to bring resilience to the overall supply system, by diversification of sources. The important role of the new source, in contributing to the overall resilience of the combination of the New Source, the Liffey, and the other existing sources, must be recognised and is taken into account in our recommendations on Phasing of the eventual preferred option.

7 Conclusions and Recommendations on Infrastructural Planning

7.1 Conclusions

The following are the Report's conclusions:

- i. The population of the Water Supply Area, on realistic planning scenarios, will rise from 1.52m at the 2011 Census, to between 2.02m and 2.15m by 2050.

Depending on the source option which emerges as preferred, a Benefiting Corridor will be defined by the Water Treatment Plant and the transfer pipeline to a Terminal Reservoir. The population of a potential Benefiting Corridor around a transfer pipeline, if it were routed across the Midlands, would rise from 0.53m at 2011, to approximately 0.68m by 2050

- ii. The principal water abstraction and treatment centres on the River Liffey, at Leixlip and Ballymore Eustace, have been developed over decades on infrastructure originally provided in the 1940s and 1960s and in the case of the Vartry Reservoir, on infrastructure dating from the 19th century.
- iii. The existing water supply sources serving the Water Supply Area can currently supply 623 Mld at full production capacity under stressed conditions, against current average day demand of 540 Mld. When international norms of provision for Peaks, Headroom and Supply Outage are applied, the true position is one of latent deficit. Action is therefore required, where the aspiration is to maintain Supply ahead of Demand by a margin which permits normal international water utility standards of service.
- iv. The provision of water to the Water Supply Area and Benefiting Corridor will involve all elements of water conservation, tackling water losses (both on the customer side and on the mains network), and provision of a new source of supply. The requirement is to both minimise water demand and to diversify risk from over dependence on existing sources.
- v. The independent review by Indecon Economists has underlined the strategic importance of secure, high quality water supplies for the key exporting sectors of the Irish economy and it has underlined the importance of the metropolitan area of Dublin in Ireland's international competitiveness in attracting FDI. It has examined the costs to the economy of water supply disruption and the negative impacts of supply systems which fall short of international norms of resilience and reliability. Indecon have highlighted the "very significant negative employment impacts if adequate water supply is not available to meet the needs of indigenous and overseas businesses". IDA have also emphasised the importance of resilient water supplies, not only for new industry considering locating in Ireland, but also those already established here and considering expansion.

There is, therefore, on the demographic, economic and water demand projections, and on considerations of resilience of supply, an established need for a new water supply source for the Water Supply Area.

- vi. Irish Water, in looking at the water requirements from a new source, takes a national perspective on its scale, on the time profile of the requirement, and on the potential beneficial contribution of a new source to the resilience of the collective sources serving the Eastern and Midlands areas of Ireland. This is an opportunity to address the quality

and reliability of water supplies and to equalise the access of communities in the Midlands and Eastern areas to any opportunity dependent upon availability of adequate water supplies. It is therefore a nationally strategic project.

- vii. Water demand projections have been independently developed, by Indecon and by the Project Engineering Advisers, Jacobs-TOBIN in conjunction with Irish Water. Most recent available data on per capita consumption has been used, econometric modelling of industrial water requirements has been used for the first time and declining intensities of industrial water usage have been identified and incorporated in projections. Ambitious targets have been adopted for curtailing Customer Side Leakage and Unaccounted for Water. The projections point to a New Source water requirement of 296Mld -330 Mld by the year 2050.

The corresponding projection for the year 2041 is 196Mld-276Mld, which is a reduced water requirement compared to the projected 350 Mld at 2040 projected in the Adopted Plan / Preliminary Report of 2010.

This curtailment in projected water demand recognises the demographic adjustments over the past decade, the reduced water consumption accompanying metering and charging, and the ambitious targets on Customer Side Leakage and Unaccounted for Water.

7.2 Recommendations

Irish Water in conjunction with Project Engineering Advisers, Jacobs-TOBIN are planning to pursue the appraisal process on the New Water Supply Options considered in the original SEA and Plan (2010), on the basis of a design water demand from a new source, of 330 Mld at 2050 for an option serving the Eastern and Midlands Region.

Having regard to the need to provide resilience support to the existing sources serving Dublin and Midlands water supplies and for the need to plan against uncertainties in projection, particularly related to agribusiness development opportunities in the Midlands Benefiting Corridor on the lifting of milk quota this year, Irish Water are also recommending that a minimum Phase 1 capacity of 267 Mld be adopted for an option serving the Midlands and East and that planning should proceed to have this be in place by 2021.

8 Project Roadmap and Next Steps

The need for a water supply of 330 Mld from a new source has been established and planning consents to abstract, treat and transfer this water must be obtained, so that a Phase 1 scheme is in place by 2021.

This requires adherence to the project programme to make a Planning Application to An Bord Pleanála by Q2, 2017.

A Working Paper on Options Appraisal, looking at the options examined in the SEA and in the Plan (2007-2011) is being published for consultation in May 2015 (following this Project Need Report). The Working Paper on Options Appraisal will revisit those options against developments in the interim period and will consult on the proposed criteria for reducing them further to an emerging preferred option by end of 2015 and a confirmed preferred option by May 2016.

