

Water Supply Project
Eastern and Midlands Region

Preliminary Options Appraisal Report

Volume 3

Appendix E
Abstraction
Location MCA

November 2015



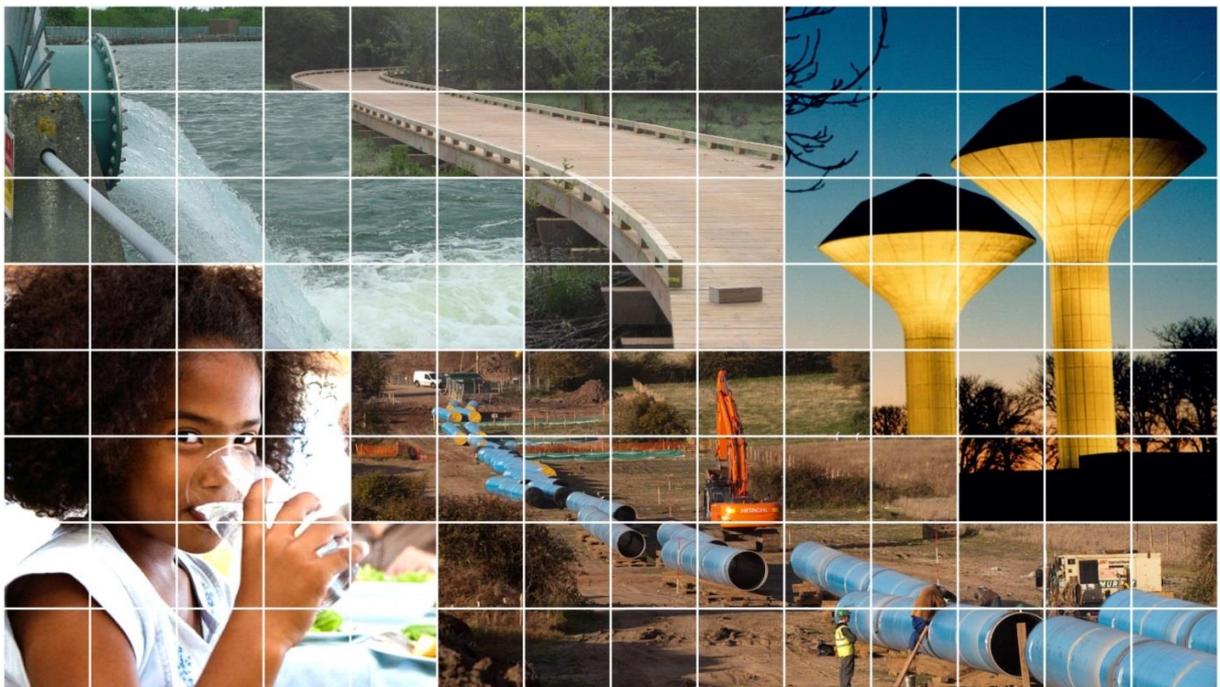
Water Supply Project Eastern and Midlands Region (WSP)

Appendix E: Abstraction Location MCA



October 2015

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1.1 Introduction

Four reasonable alternative options have been identified from previous studies – refer to the *Water Supply Options Working Paper* (Project Road Map Stage 2). These are reconfirmed below.

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)
- Option H (Desalination)

The selection of 4 reasonable alternative options was founded on two key considerations (refer to Section 5 of the *Water Supply Options Working Paper*) namely that of:

- Source yield technical assessment; and
- Habitats Directive Assessment.

While presented as two separate assessments, the considerations of source yield sustainability and compliance with the habitats directive are closely interlinked, as there is a potential for the hydraulic effects of water abstraction to directly impact the ecology of the source waterbody.

The Preliminary Options Appraisal Report (Project Road Map Stage 3) is tasked with identifying an Emerging Preferred Option from the 4 reasonable alternative options.

The process of options appraisal (refer to the Preliminary Options Appraisal Report, Section 5) considers principally the impact associated with abstraction works, its interaction with the source water body, and the sustainability of that source to provide a reliable supply to the Midlands and Eastern Region.

This Appendix E describes the decision making process used to appraise the abstraction locations associated with each of the reasonable alternative options. It is summarised as section 7 of the Preliminary Options Appraisal Report.

1.2 Approach to Appraisal of Reasonable Alternative Options

1.2.1 Identification of Abstraction Locations

The SEA identified potential abstraction locations along the eastern shoreline of Lough Derg, the eastern shoreline of Parteen Basin and the eastern seaboard as suitable for the siting of infrastructure associated with the abstraction of raw water.

Given the period of time that had elapsed since completion of the earlier SEA the method of identification and continued suitability of these locations was initially reviewed. This review sought to account for any relevant issues that may have transpired over the intervening duration.

Those potential locations not considered compromised by developments since the SEA were taken forward for further consideration, refer to Appendix E2.

1.2.2 Specialist Appraisal

To undertake the appraisal of abstraction locations, a range of specialists were engaged, in their applicable fields, to conduct a comparative assessment of abstraction locations (refer to Preliminary Options Appraisal Report, Section 5). The following disciplines were engaged:

- i. **Ecology** – the consideration of impact on animals, plants and their environment.
- ii. **Water** – the consideration of impacts on the surface water environment.
- iii. **Air and Noise** - the consideration of air and noise pollution
- iv. **Cultural Heritage** - the consideration of existing archaeological and built heritage
- v. **Soils, Geology and Hydrogeology** – the consideration of impact on soils, geology and hydrogeology.
- vi. **Landscape and visual** – the consideration of landscape and visual impact.
- vii. **Agronomy** – the consideration of impact on land based enterprise.
- viii. **People** – the consideration of impacts on people
- ix. **Planning** – the consideration of planning and land use policy in relation to proposed works
- x. **Engineering** - the consideration of technical challenges associated with proposed works.
- xi. **Traffic** - the consideration of impact on traffic and road network

The specialists independently assessed each location relative to appraisal criteria applicable to their field of expertise. This process, or methodology, is referred to as Multi-Criteria Analysis and explicitly considers multiple criteria (see

Table E - 1) within a decision-making environment.



Table E - 1 Appraisal Criteria

Environmental Criteria	Technical Criteria	Risk Criteria
Biodiversity, Flora and Fauna	Safety	Technical Risk relating to the Source
Fisheries	Planning Policy	Technical Risk relating to Infrastructure and Operations
Water	Engineering and Design	Environmental and Planning Risk
Air/Climatic Factors	Capital and Operational Costs	Financial Risk
Material Assets (Energy)	Sustainability	Socio-economic risk
Cultural Heritage (including Architecture & Archaeology)		
Landscape & Visual		
Material Assets (Land use)		
Tourism		
Population		
Human Health		
Soils, Geology and Hydrogeology		

The assessments are presented as individual statements within this Appendix E.

1.2.3 Appraisal Process

With the specialists engaged, the following process was employed in the assessment of abstraction locations:

1. Individual Specialists were engaged to independently assess each location relative to the criteria applicable to their field of expertise, and establish an initial position on the least impact under each criterion listed in

Table E - 1.

2. The initial position of each Specialist was collated and presented in matrix format. The specialists then convened at a workshop.
3. In this workshop setting, the matrix of initial individual assessments was presented to the Specialist Collective. The position of each of the Specialists was then discussed to reach a consensus of agreement on a least constrained location.

1.2.4 Information sources

This appraisal was informed by the interpretation of datasets and information sources made available.

Key amongst these information sources were, and are, the investigative studies recommended in the SEA, which are either ongoing or have been completed within this project planning stage, namely:

- Water quality modelling of Lough Derg and Parteen Basin Reservoir; and
- A full geophysical survey of the soil and bedrock conditions at Garryhinch.

With regular information forthcoming from these studies, appraisal was defined by a two part parallel process; refer to Figure E-1.

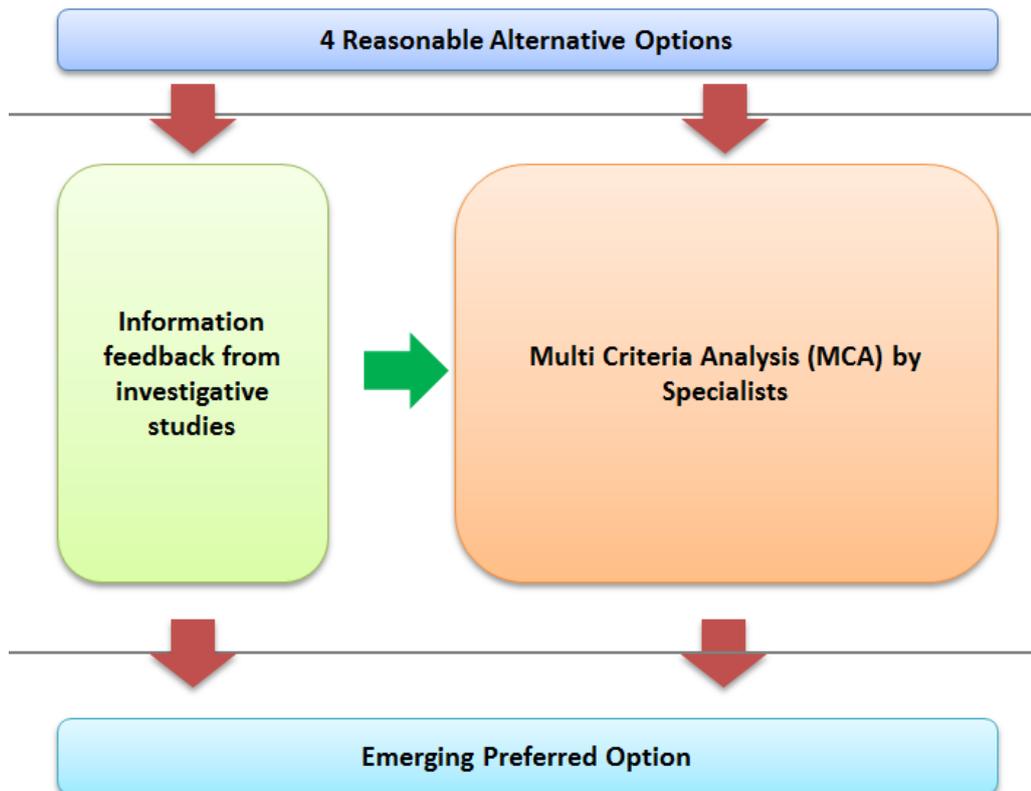


Figure E-1 Options Assessment

Note: Multi Criteria Analysis (MCA) is a mechanism that explicitly considers multiple criteria, as stated in Table E-1, within a decision-making environment. The MCA approach to the WSP is outlined in Section 5.2.2, and discussed in further detail in Section 7 of the Preliminary Options Appraisal Report.

1.2.5 Water Supply Options Working Paper – Consultation Feedback

Submissions from the public consultation on the Water Supply Options Working Paper were received by the project team; refer to Section 4 of the Preliminary Options Appraisal Report.

Feedback from the consultation process was considered by the Specialists, primarily to establish if there was any impact as part of the individual assessments process, but also within the collective arrangements facilitated by the workshop setting.

2.1 Potential Abstraction Locations

9 abstraction locations were identified from the initial review of the SEA abstraction locations (refer to appendix E2), with:

- 4 along the eastern shore of Lough Derg
- the Parteen Basin Reservoir
- 4 along the eastern seaboard

2.2 Specialist Appraisal

Assessment of the abstraction locations by the Specialists relative to the appraisal criteria is presented as 14 separate assessments, namely.

Appendix E3 – Ecology (Terrestrial)

Appendix E4 – Ecology (Aquatic) & Fisheries

Appendix E5 – Surface Water Environment

Appendix E6 – Air

Appendix E7 – Noise

Appendix E8 – Cultural Heritage

Appendix E9 – Landscape and Visual

Appendix E10 – Agronomy

Appendix E11 – Tourism

Appendix E12 – Soils, Geology and Hydrogeology

Appendix E13 – Planning

Appendix E14 – Engineering and Design

Appendix E15 – Traffic

Appendix E16 – Risk

Each assessment outlines the decision making process applied by each specialist in this comparative analysis.

2.3 Matrix of Multi-Criteria Analysis

The individual work of each specialist was amalgamated and presented to the Specialist Collective in a workshop environment.

The amalgamated assessments of the source waterbodies are presented overleaf.

3 Lough Derg / Parteen Basin

3.1 Potential Abstraction Locations

Five abstraction locations were assessed along the Shannon system, with:

- 4 along the eastern shore of Lough Derg
- 1 at the Parteen Basin Reservoir

See Figure E-2 below:

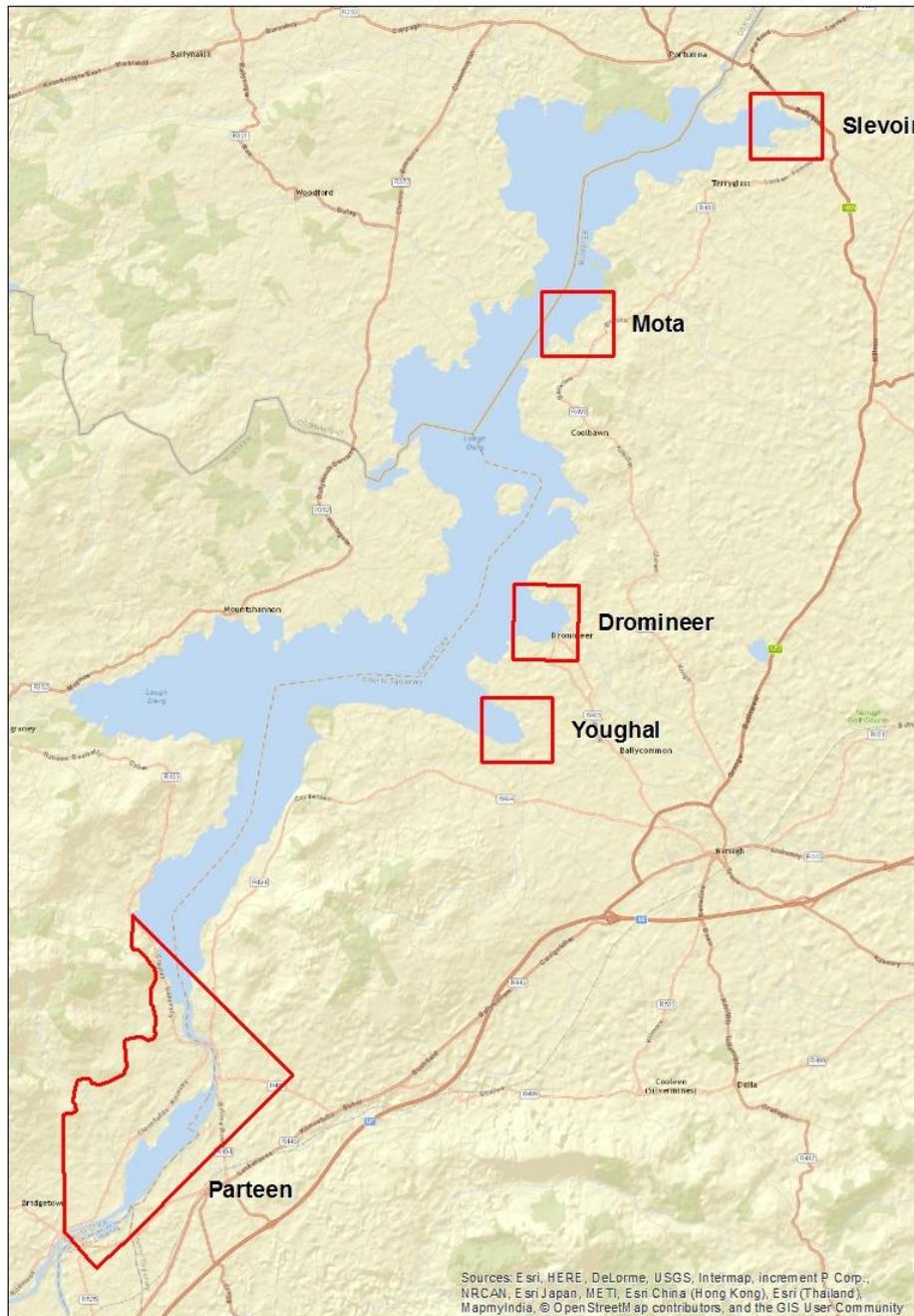


Figure E-2 Potential Abstraction Locations from Lough Derg and Parteen Basin Reservoir

3.1.1 Categories of impact

The relative analysis of potential locations to define a “least constrained” location is based upon a subjective assessment by each Specialist in their discipline of expertise. This judgement is presented as weighted impact; colour coded for ready identification.

Very high	Dark blue
High	Blue
Mid-range	Green
Low	Light Green
Very low	Cream

3.2 Matrix of Multi-Criteria Analysis



Ref	Criteria	Location 1 - Slevoir	Location 2 - Mota	Location 3 - Dromineer	Location 4 - Youghal Bay	Location 5 - Parteen Basin
1.0	Environmental *					
1.1	Biodiversity, Flora & Fauna (Terrestrial)					
1.1.1	Potential to impact on Natura 2000 Sites	Very High: Lake area and sections of terrestrial/lake fringe habitat contained with SAC & SPA.	Very High: Lake area and sections of terrestrial/lake fringe habitat contained with SAC & SPA.	High: Lake area and sections of terrestrial/lake fringe habitat contained with SAC & SPA.	High: Lake area and sections of terrestrial/lake fringe habitat contained with SAC & SPA.	Mid-range: Lake area and sections of terrestrial/lake fringe habitat contained with Lower Shannon SAC. Habitats include alluvial woodland 91E0.
1.1.2	Potential to impact on Natural Heritage Areas and proposed Natural Heritage Areas	Very high: large section of area contained within pNHA 000011.	Very high: large section of area contained within pNHA 000011.	High: large section of area contained within pNHA 000011.	High: large section of area contained within pNHA 000011.	Mid-range: Section between Killaloe and Ballina contained within Lough Derg pNHA 000011. Parteen Basin not in pNHA/NHA therefore impact for this area of study area lower.
1.1.3	Potential impact Annex I listed habitats (designated)	Very High: for Qualifying Interest Habitat to be impacted 91E0 (alluvial woodland) 7230 & 7210 (fen). Other annex 1 habitat potential.	High: for Qualifying Interest Habitat to be impacted 91E0 (alluvial woodland) 7230 & 7210 (fen). Other annex 1 habitat potential.	High: for Qualifying Interest Habitat to be impacted 91E0 (alluvial woodland) 7230 & 7210 (fen). Other annex 1 habitat potential.	High: for Qualifying Interest Habitat to be impacted 91E0 (alluvial woodland) 7230 & 7210 (fen). Other annex 1 habitat potential.	Mid-range: Lake area and sections of terrestrial/lake fringe habitat contained with Lower Shannon SAC. Habitats include alluvial woodland 91E0.
1.1.4	Potential impact Annex I listed habitats (non-designated)	High: potential to impact on non-qualifying interest Annex I habitat including (but not limited to) semi-natural grasslands, marsh, raised bog & mesotrophic lake (L. Derg).	High: for Qualifying Interest Habitat to be impacted 91E0 (alluvial woodland) 7230 & 7210 (fen). Other annex 1 habitat potential exists.	Mid-range: grassland, woodland habitats including those associated with mesotrophic lake.	Mid-range: grassland, woodland habitats including those associated with mesotrophic lake.	Mid-range: grassland habitats including unimproved GS4 with potential to host 6410, woodland habitats and habitats associated with mesotrophic lake.
1.1.5	Potential to impact high ecological value habitats (semi-natural habitats)	High: reedbeds, semi-natural grasslands, marsh, peatlands, woodlands including hedgerows/treelines.	High: reedbeds, semi-natural grasslands, marsh, peatlands, woodlands including hedgerows/treelines.	High: reedbeds, semi-natural grasslands, marsh, peatlands, woodlands including hedgerows/treelines.	Mid-range: reedbeds, woodland, hedgerows, Newtown river (floodplain).	Mid-range: extensive area of unimproved GS4 (potential 6410) to east Kilmastulla river, Kilmastulla River, woodland (91E0) north east shore and hedgerows.
1.1.6	Potential to impact on protected Flora - Flora Protection Order	Very High: Irish Fleabane (only known location in Ireland) occurs shoreline habitat in Terryglass area, potential for other protected flora.	Mid-range: Irish Fleabane (habitat shoreline), other protected flora (potential).	Low: Irish Fleabane (habitat shoreline), other protected flora (potential).	Mid-range: potential impact on protected flora in unimproved grassland and also Irish Fleabane (habitat shoreline).	Low: potential impact on protected flora in unimproved grassland.
1.1.7	Potential to impact on Annex II species	Mid-range: potential impact on species including but not limited to otter and bats.	Mid-range: potential impact on species including but not limited to otter and bats.	Mid-range: potential impact on species including but not limited to otter and bats.	Mid-range: potential impact on species including but not limited to otter and bats.	Mid-range: potential impact on species including but not limited to otter and bats.
1.1.8	Potential to Impact on Annex IV species (wherever they occur)	Mid-range: potential impact on species including but not limited to otter and bats.	Mid-range: potential impact on species including but not limited to otter and bats.	Mid-range: potential impact on species including but not limited to otter and bats.	Mid-range: potential impact on species including but not limited to otter and bats.	Mid-range: potential impact on species including but not limited to otter (qualifying interest of Lower Shannon SAC) and bats.

Ref	Criteria	Location 1 - Slevoir	Location 2 - Mota	Location 3 - Dromineer	Location 4 - Youghal Bay	Location 5 - Parteen Basin
1.1.9	Potential to impact on the breeding / wintering habitat for Annex I listed and other qualifying interest bird species	High: for special conservation interests of SPA including wetlands and waterbird habitat of SPA. Potential for impact on a wide mix of species including breeding waders and disturbance to wintering birds.	Mid-range: for special conservation interests of SPA including wetlands and waterbird habitat of SPA. Potential for impact on a wide mix of species including breeding waders and disturbance to wintering birds.	Mid-range: for special conservation interests of SPA including wetlands and waterbird habitat of SPA. Potential for impact on a wide mix of species including breeding waders and disturbance to wintering birds.	High: for special conservation interests of SPA including wetlands and waterbird habitat of SPA. Potential for impact on a wide mix of species including breeding waders and disturbance to wintering birds.	Mid-range: for special conservation interests of Lough Derg (Shannon) SPA including Tufted Duck which have links to the SPA populations. Western side lake more sensitive.
1.1.10	Potential to impact flora and fauna protected under Wildlife Act e.g. Birds, badger	Mid-range: potential impacts on a mix of species including amphibian, reptiles and on bird nest sites and badger setts.	Mid-range: potential impacts on a mix of species including amphibian, reptiles and on bird nest sites and badger setts.	Mid-range: potential impacts on a mix of species including amphibian, reptiles and on bird nest sites and badger setts.	Mid-range: potential impacts on a mix of species including amphibian, reptiles and on bird nest sites and badger setts.	Mid-range: potential impacts on a mix of species including amphibian, reptiles and on bird nest sites and badger setts.
1.1.11	Potential to impact on salmonid habitat - protected under SI Reg	<i>See Aquatic Ecological Assessment</i>	<i>See Aquatic Ecological Assessment</i>			
1.1.12	Potential to impact on a freshwater pearl mussel - protected under SI Reg	<i>See Aquatic Ecological Assessment</i>	<i>See Aquatic Ecological Assessment</i>			
1.1.13	Potential to impact upon high quality aquatic habitat for protected aquatic species.	<i>See Aquatic Ecological Assessment</i>	<i>See Aquatic Ecological Assessment</i>			
1.1.14	Potential to impact on coastal zone habitats (intertidal)	<i>See Aquatic Ecological Assessment</i>	<i>See Aquatic Ecological Assessment</i>			
1.1.15	Potential to impact on marine habitats (e.g. Subtidal)	<i>See Aquatic Ecological Assessment</i>	<i>See Aquatic Ecological Assessment</i>			
1.1.16	Potential to impact marine/coastal birds	Low: Potential to impact on breeding populations including gulls and Common Tern populations through change in water levels, water quality and other alterations to lake aquatic system and prey including residence time.	Low: Potential to impact on breeding populations including gulls and Common Tern populations through change in water levels, water quality and other alterations to lake aquatic system and prey including residence time.	Low: Potential to impact on breeding populations including gulls and Common Tern populations through change in water levels, water quality and other alterations to lake aquatic system and prey including residence time.	Low: Potential to impact on breeding populations including gulls and Common Tern populations through change in water levels, water quality and other alterations to lake aquatic system and prey including residence time.	Very low: no known breeding populations.
1.1.17	Potential to impact marine mammals	<i>See Aquatic Ecological Assessment.</i>	<i>See Aquatic Ecological Assessment.</i>			
1.2	Biodiversity, Flora & Fauna (Aquatic)					

Ref	Criteria	Location 1 - Slevoir	Location 2 - Mota	Location 3 - Dromineer	Location 4 - Youghal Bay	Location 5 - Parteen Basin
1.2.1	Potential to impact on Natura 2000 Sites	Low Impact: Due to predicted decrease in flushing time in L. Derg, aquatic ecology of the SAC may be impacted.	Very low impact: Not designated as an SAC.	Very low impact: Not designated as an SAC.	Very low impact: Not designated as an SAC.	Very low impact: As predicted changes in flushing rates are low, the ecological status of the SAC will not be significantly affected.
1.2.2	Potential to impact on Natural Heritage Areas and proposed Natural Heritage Areas	Low Impact: Due to predicted decrease in flushing time in L. Derg, aquatic ecology of NHAs may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, aquatic ecology of NHAs may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, aquatic ecology of NHAs may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, aquatic ecology of NHAs may be impacted.	Very low impact: Not designated as pNHA.
1.2.3	Potential impact Annex I listed habitats (designated)	Low Impact: Due to predicted decrease in flushing time in L. Derg, designated Annex I listed habitats may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, designated Annex I listed habitats may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, designated Annex I listed habitats may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, designated Annex I listed habitats may be impacted.	Very low impact: As predicted changes in flushing rates are low, the ecological status of designated Annex I listed habitats will not be significantly affected.
1.2.4	Potential impact Annex I listed habitats (non-designated)	Low Impact: Due to predicted decrease in flushing time in L. Derg, non-designated Annex I listed habitats may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, non-designated Annex I listed habitats may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, non-designated Annex I listed habitats may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, non-designated Annex I listed habitats may be impacted.	Very low impact: As predicted changes in flushing rates are low, the ecological status of non-designated Annex I listed habitats will not be significantly affected.
1.2.5	Potential to impact high ecological value habitats (semi-natural habitats)	Low Impact: Due to predicted decrease in flushing time in L. Derg, high ecological value habitats (semi-natural habitats) may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, high ecological value habitats (semi-natural habitats) may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, high ecological value habitats (semi-natural habitats) may be impacted.	Low Impact: Due to predicted increasing of flushing time in L. Derg, high ecological value habitats (semi-natural habitats) may be impacted.	Very low impact: As predicted changes in flushing rates are low, the ecological status of high ecological value of will not be significantly affected.
1.2.6	Potential to impact on protected Flora - Flora Protection Order	Low Impact: Due to predicted decrease in flushing time in L. Derg, protected Flora - Flora may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, protected Flora - Flora may be impacted.	Due to predicted decrease in flushing time in L. Derg, protected Flora - Flora may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, protected Flora - Flora may be impacted.	Very low impact: As predicted changes in flushing rates are low, the ecological status of protected Flora and Fauna will not be significantly affected.
1.2.7	Potential to impact on Annex II species	Low Impact: Due to predicted decrease in flushing time in L. Derg, Annex II species may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, Annex II species may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, Annex II species may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, Annex II species may be impacted.	Very low impact: As predicted changes in flushing rates are low, the ecological status of Annex II species will not be significantly affected.
1.2.8	Potential to Impact on Annex IV species (wherever they occur)	Low Impact: Due to predicted decrease in flushing time in L. Derg, Annex IV species may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, Annex IV species may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, Annex IV species may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, Annex IV species may be impacted.	Very low impact: As predicted changes in flushing rates are low, the ecological status of Annex IV species will not be significantly affected.
1.2.9	Potential to impact on the breeding / wintering habitat for Annex I listed and other qualifying interest bird species	<i>See also chapter on terrestrial ecology.</i>	<i>See also chapter on terrestrial ecology.</i>			
1.2.10	Potential to impact flora and fauna protected under Wildlife Act e.g. Birds, badger	<i>See also chapter on terrestrial ecology.</i>	<i>See also chapter on terrestrial ecology.</i>			

Ref	Criteria	Location 1 - Slevoir	Location 2 - Mota	Location 3 - Dromineer	Location 4 - Youghal Bay	Location 5 - Parteen Basin
1.2.11	Potential to impact on salmonid habitat - protected under SI Reg	Low Impact: Due to predicted decrease in flushing time in L. Derg, salmonid habitat may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, salmonid habitat may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, salmonid habitat may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, salmonid habitat may be impacted.	Very low impact: As predicted changes in flushing rates are low, impact on salmonid habitats will not be significantly affected.
1.2.12	Potential to impact on a freshwater pearl mussel - protected under SI Reg	Not applicable as Freshwater Pearl Mussels are not present.	Not applicable as Freshwater Pearl Mussels are not present.	Not applicable as Freshwater Pearl Mussels are not present.	Not applicable as Freshwater Pearl Mussels are not present.	Not applicable as Freshwater Pearl Mussels are not present.
1.2.13	Potential to impact upon high quality aquatic habitat for protected aquatic species.	Low Impact: Due to predicted decrease in flushing time in L. Derg, high quality aquatic habitat for protected aquatic species may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg high quality aquatic habitat for protected aquatic species may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, high quality aquatic habitat for protected aquatic species may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, high quality aquatic habitat for protected aquatic species may be impacted.	Very low impact: As predicted changes in flushing rates are low, impact on high quality habitat for protected aquatic species will not be significantly affected.
1.2.14	Potential to impact on coastal zone habitats (intertidal)	Not applicable as site is not within coastal zone environment.	Not applicable as site is not within coastal zone environment.	Not applicable as site is not within coastal zone environment.	Not applicable as site is not within coastal zone environment.	Not applicable as site is not within coastal zone environment.
1.2.15	Potential to impact on marine habitats (e.g. Subtidal)	Not applicable as site is not within coastal zone environment.	Not applicable as site is not within coastal zone environment.	Not applicable as site is not within coastal zone environment.	Not applicable as site is not within coastal zone environment.	Not applicable as site is not within coastal zone environment.
1.2.16	Potential to impact marine/coastal birds	Not applicable as site is not within coastal zone environment.	Not applicable as site is not within coastal zone environment.	Not applicable as site is not within coastal zone environment.	Not applicable as site is not within coastal zone environment.	Not applicable as site is not within coastal zone environment.
1.2.17	Potential to impact marine mammals	Not applicable as site is not within coastal zone environment.	Not applicable as site is not within coastal zone environment.	Not applicable as site is not within coastal zone environment.	Not applicable as site is not within coastal zone environment.	Not applicable as site is not within coastal zone environment.
1.3	Fisheries					
1.3.1	Potential to impact on water quality and inshore fishing grounds based on regional fisheries datasets.	Not applicable as site is not within coastal zone environment.	Not applicable as site is not within coastal zone environment.	Not applicable as site is not within coastal zone environment.	Not applicable as site is not within coastal zone environment.	Not applicable as site is not within coastal zone environment.
1.3.2	Potential to impact on transient protected marine species (cetaceans and salmonids), which may pass through the affected area within the survey area footprint.	Low Impact: Due to predicted decrease in flushing time in L. Derg, species including Sea Lamprey and salmonids may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, species including Sea Lamprey and salmonids may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, species including Sea Lamprey and salmonids may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, species including Sea Lamprey and salmonids may be impacted.	Very low impact: As predicted changes in flushing rates are low, impact on transient marine species (lamprey, salmonids) will not be significantly affected.
1.4	Water					

Ref	Criteria	Location 1 - Slevoir	Location 2 - Mota	Location 3 - Dromineer	Location 4 - Youghal Bay	Location 5 - Parteen Basin
1.4.1	<p>Potential to support the objectives of the WFD water bodies .</p> <ul style="list-style-type: none"> - Potential to impact on the water quality, hydromorphology of a WFD water bodies of "good" or higher status. - Potential to impact on a WFD Annex IV - Protected Areas: <ul style="list-style-type: none"> A) Waters used for the abstraction of drinking water B) Areas designated to protect economically significant aquatic species C) Recreational Waters D) Nutrient Sensitive Areas E) Areas designated for the protection of habitats or species (Ecology Scope) 	Potential for impacts on the objectives of the WFD are considered to be very high .	Potential for impacts on the objectives of the WFD are considered to be very high .	Potential for impacts on the objectives of the WFD are considered to be very high .	Potential for impacts on the objectives of the WFD are considered to be very high .	Potential for impacts on the objectives of the WFD are considered to be high .
1.5	Air/Climatic Factors					
	Air					
1.5.1	Potential for Construction phase Air Quality impact at Sensitive receptors	Rural Area with Sparse Settlement. Potential for dust emissions during construction phase.	Rural Area with Sparse Settlement. Potential for dust emissions during construction phase.	More settlement in this area with Dromineer Village. Potential for dust emissions during construction phase.	Rural Area with Sparse Settlement. Potential for dust emissions during construction phase.	More settlement in this area with Ballina and Killaloe. Potential for dust emissions during construction phase.
1.5.2	Potential for Operational phase Air Quality impact at Sensitive receptors	Very low impacts during operational phase, only operational impacts would be due to traffic generated from staff.	Very low impacts during operational phase, only operational impacts would be due to traffic generated from staff.	Very low impacts during operational phase, only operational impacts would be due to traffic generated from staff.	Very low impacts during operational phase, only operational impacts would be due to traffic generated from staff.	Very low impacts during operational phase, only operational impacts would be due to traffic generated from staff.
1.5.3	Proximity to EPA Waste Licensed facility	No facilities present in study area.				
1.5.4	Proximity to EPA IPPC Licensed Intensive Agriculture facility	No facilities present in study area.				
1.5.5	EPA Air Quality Zone Classification	Zone D.				
1.5.6	Wind Rose Assessment	West-south-west prevailing wind.				

Ref	Criteria	Location 1 - Slevoir	Location 2 - Mota	Location 3 - Dromineer	Location 4 - Youghal Bay	Location 5 - Parteen Basin
1.5.7	Construction Phase Impact rating	Low impact from construction dust emissions.	Low impact from construction dust emissions.	Low impact from construction dust emissions.	Low impact from construction dust emissions.	Low impact from construction dust emissions.
1.5.8	Operational Phase Impact rating	Very low impact due to additional traffic (likely to be minimal) generated by abstraction.	Very low impact due to additional traffic (likely to be minimal) generated by abstraction.	Very low impact due to additional traffic (likely to be minimal) generated by abstraction.	Very low impact due to additional traffic (likely to be minimal) generated by abstraction.	Very low impact due to additional traffic (likely to be minimal) generated by abstraction.
	Noise					
1.5.9	Potential for Construction phase noise impact at Sensitive receptors	The area is considered rural with a small number of low density residential dwellings.	The area is considered rural with a small number of low density residential dwellings and a hotel.	The area is considered rural with a small number of low density residential dwellings and a larger residential settlement at Dromineer.	The area is considered rural with a small number of low density residential dwellings.	The area is considered rural/suburban with a number of low density residential dwellings and also a number of larger residential settlements.
1.5.10	Potential for Operational phase noise impact at Sensitive receptors	Operational traffic is likely to have small noise impact, mechanical plant/pumps noise mitigation measures will be provided to minimise impacts.	Operational traffic is likely to have small noise impact, mechanical plant/pumps noise mitigation measures will be provided to minimise impacts.	Operational traffic is likely to have small noise impact, mechanical plant/pumps noise mitigation measures will be provided to minimise impacts.	Operational traffic is likely to have small noise impact, mechanical plant/pumps noise mitigation measures will be provided to minimise impacts.	Operational traffic is likely to have small noise impact, mechanical plant/pumps noise mitigation measures will be provided to minimise impacts.
1.5.11	Existing Ambient Noise Climate in the Area (significant noise sources)	Existing ambient noise climate likely to be low. Nearby noise sources are likely to consist of traffic from local roads and the N65 and other anthropogenic sources	Existing ambient noise climate likely to be low. Nearby noise sources are likely to consist of traffic from local roads and the N65 and other anthropogenic sources	Existing ambient noise climate likely to be low. Nearby noise sources are likely to consist of traffic from local/regional roads and other anthropogenic sources.	Existing ambient noise climate likely to be low. Nearby noise sources are likely to consist of traffic from local/regional roads and other anthropogenic sources.	Existing ambient noise climate likely to be low. Nearby noise sources are likely to consist of traffic from local/regional roads and other anthropogenic sources.
1.5.12	Construction Phase Impact rating	Low noise impact expected during construction phase.	Low noise impact expected during construction phase.	Low noise impact expected during construction phase.	Low noise impact expected during construction phase.	Low noise impact expected during construction phase.
1.5.13	Operational Phase Impact rating	Very low noise impact expected during operational phase.	Very low noise impact expected during operational phase.	Very low noise impact expected during operational phase.	Very low noise impact expected during operational phase.	Very low noise impact expected during operational phase.
1.6	Material Assets (Energy)					
1.6.1	Potential for energy recovery	Transmission main will include gravity sections	Transmission main will include gravity sections	Transmission main will include gravity sections	Transmission main will include gravity sections	Transmission main will include gravity sections
1.7	Cultural Heritage (including Architecture & Archaeology)					
1.7.1	Potential to impact (direct/indirect) on National Monuments (designated sites)	Very low as none are present.	Very low as none are present.	Very low as none are present.	Very low as none are present.	Low as only two are recorded in a large area.
1.7.2	Potential to impact (direct/indirect) on RMPs (designated sites)	Very low as none are present.	Very low as none are present.	Low as only three are recorded in a relatively large area.	Low as only four are recorded in a relatively large area.	Mid-range as a large amount of sites are recorded within the area, although the areas itself is relatively large.

Ref	Criteria	Location 1 - Slevoir	Location 2 - Mota	Location 3 - Dromineer	Location 4 - Youghal Bay	Location 5 - Parteen Basin
1.7.3	Potential to impact (direct/indirect) on RPS (designated sites)	Low as only three are recorded in a relatively large area.	Low as only three are recorded in a relatively large area.	Low as whilst there are a number listed for the area, these are mostly clustered together in a relatively large area.	Very low as only one structure is recorded within the area.	Low although there are a number of structures recorded within the area most are focused on existing built up areas.
1.7.4	Potential to impact (direct/indirect) on NIAH	Very low as none are present.	Very low as only one structure is recorded within the area.	Low as whilst there are a number listed for the area, these are mostly clustered together in a relatively large area.	Very low as only one structure is recorded within the area.	Low although there are a number of structures recorded within the area most are focused on existing built up areas.
1.7.5	Potential to impact (direct/indirect) on historic designed landscapes	Low as only two are recorded in a relatively large area.	Mid-range as three demesnes are recorded in the area all of which are associated with protected structures.	Low as only two are recorded within a relatively large area.	Low as only two are recorded within a relatively large area.	Mid-range as a number of demesnes are recorded within the area, although many are no longer extant.
1.7.6	Potential to impact on ACA	Very low as none are present.	Very low as only two are present in the area, which include the centres of Killaloe and O'Brienbridge.			
1.7.7	Recorded shipwreck sites/underwater archaeology	Mid-range due to the fact that infrastructure associated with the abstraction of water may impact on underwater archaeology within the lough.	Mid-range due to the fact that infrastructure associated with the abstraction of water may impact on underwater archaeology within the lough.	Mid-range due to the fact that infrastructure associated with the abstraction of water may impact on underwater archaeology within the lough.	Mid-range due to the fact that infrastructure associated with the abstraction of water may impact on underwater archaeology within the lough.	Low as the watercourse to the south of Killaloe and Ballina is artificially built.
1.8	Landscape & Visual					
1.8.1	Potential to impact on designated areas of 'Highly Sensitive Landscape'	High: (precautionary) Not currently specified in CDP or County Landscape Character Assessment - awaiting update (6 weeks).	High: (precautionary) Not currently specified in CDP or County Landscape Character Assessment - awaiting update (6 weeks).	High: (precautionary) Not currently specified in CDP or County Landscape Character Assessment - awaiting update (6 weeks).	High: (precautionary) Not currently specified in CDP or County Landscape Character Assessment - awaiting update (6 weeks).	High: (precautionary) Not currently specified in CDP or County Landscape Character Assessment - awaiting update (6 weeks) 'Heritage Landscape' designation on County Clare side.
1.8.2	Potential to impact on rare or distinctive landscape elements (rock outcrops, water bodies etc)	Mid-range: Shores of Lough Derg.				
1.8.3	Potential to disrupt landscape structure (treelines / hedgerows / field pattern etc.)	Low: Potential disruption of riparian vegetation and field boundaries.	Mid-range: Potential disruption of riparian woodlands around Cooldoney.	Mid-range: Potential disruption of riparian woodlands and mature tree line field boundaries.	Low: Potential disruption of riparian vegetation and field boundaries.	Low: Potential disruption of riparian vegetation and field boundaries.
1.8.4	Potential to impact on woodlands and significant tree groups	Low: Some dense bands of riparian vegetation.	Mid-range: Potential disruption of riparian woodlands around Cooldoney.	Mid-range: Potential disruption of riparian woodlands and mature tree line field boundaries.	Low: Some dense bands of riparian vegetation.	Mid-range: Some areas of mature riparian woodland and 3no. Clare coco TPOs at northern end of basin.
1.8.5	Potential to impact on historic designed landscapes	Low: National monument <1km west see cultural heritage appraisal.	Low: National monument <1km west see cultural heritage appraisal.	Mid-range: Appear to be several stately houses and demesnes with designed views towards the Lough.	Low: National monument <1km N & S see CH appraisal.	Mid-range: Numerous national monuments particularly around northern end of basin.

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1.8.6	Potential to alter the prevailing landscape character	Mid-range: Tranquil amenity location with some naturalistic elements and low levels of built development.	Mid-range: Tranquil amenity location with some naturalistic elements and arcadian character.	Mid-range: Tranquil amenity location with some naturalistic elements and arcadian character.	Low: Some degree of lakeside tranquillity but also a productive rural character.	Low: Some degree of lakeside tranquillity but also a productive rural character, considerable built development and Parteen Weir.
1.8.7	Potential to impact on designated scenic routes / views	Mid-range: Elevated pastoral views towards lough from R493 <1km SE.	Low: Elevated but filtered pastoral views towards lough from R493 <1km S.	High: Lakeside scenic views from NE and elevated Lough views from S.	Low: Slightly elevated and open views towards lough from scenic route <1km SW.	Mid-range: Nth Tipp scenic route emanates from northern end of focus area (R494) and Clare coco have designated R463 on western side of basin as a designated scenic route.
1.8.8	Potential to impact on views from heritage/tourist/amenity features of national or regional importance	Very Low: Does not appear to be any major heritage or amenity features in the immediate vicinity.	Mid-range: Coolbawn Quay tourist and amenity area.	Mid-range: Lough Derg Yacht club, marinas, accommodation, restaurants.	Very Low: Does not appear to be any major heritage or amenity features in the immediate vicinity.	Mid-range: Killaloe/Ballina popular tourist villages.
1.8.9	Potential to impact on views from settlements	Low: Terryglass <2km SW.	Very Low: No significant settlements within 2km.	Mid-range: Dromineer at centre of abstraction area.	Low: Pallas Derg circa 1 km S.	Mid-range: Principally Killaloe/Ballina but also O'Briens Bridge to the south.
1.8.10	Potential to impact on views from dwellings / local roads	Low: Small number of rural dwellings within 1km.	Low: Small number of rural dwellings within 1km.	Low: Scattering of local residences outside the settlement of Dromineer.	Low: Sparse scattering of dwellings close to the Lough but relatively dense and dispersed rural community within 1-2km S & SW.	Low: Outside of settlements sparse scattering of dwellings close to the Lough but relatively dense and dispersed rural community within 1-2km S & SW.
1.8.11	Potential to impact on views from motorways	Very Low.	Very Low.	Very Low.	Very Low.	Very Low.
1.8.12	Potential to impact on views from other major roads (national or regional roads)	Mid-range: Elevated views from R493 <1km SE (designated scenic view).	Low: Elevated but filtered pastoral views towards lough from R493 (scenic route) <1km S.	Low: R495 approaches Dromineer from the east.	Low: R494 affords slightly elevated views from within 1.5km to the South.	Low: Old barge loop immediately S (O'Briens Bridge) and Crag Wood Walk c. 2km NE on higher ground.
1.8.13	Potential to impact on views from rail lines	Very Low.	Very Low.	Very Low.	Very Low.	Low: National railway line passes through Birdhill <1km SE.
1.8.14	Potential to impact on arrival views from Airports including aerial approach and vehicular egress	Very Low.	Very Low.	Very Low.	Very Low.	Very Low.
1.8.15	Potential to impact on views from national 'way marked' walking routes	Very Low - (Hymany Highway c. 3km NW).	Very Low.	Mid-range: Southern approach to Dromineer (scenic route) is part of Lough Derg Way.	Mid-range: Lough Derg Way passes around Youghal Bay adjacent to the Lough.	Mid-range: Lough Derg Way and the East Clare Way passes through focus area converging on Killaloe.
1.8.16	Potential to impact on local walks	Very Low.	Low - Nenagh Cycle Loop runs along R493 (scenic route) <1km S.	Mid-range: Nenagh Cycle Loop passes through Dromineer.	Low - Nenagh Cycle Loop runs along R494 within 1.5km to the South.	Low - Old barge loop immediately S (O'Briens Bridge) and Crag Wood Walk c. 2km NE on higher ground.
1.8.17	Potential to impact on views from angling or swimming locations (rivers, lakes, sea)	Low - Marina and foreshore amenity area at Terryglass <2km SW.	Mid-range: Coolbawn Quay tourist and amenity area.	Mid-range: Jetties and promenade at Dromineer.	Mid-range: Dedicated swimming location at Youghal Village .	Mid-range: Lough Derg and Parteen basin renowned for water based recreation generally.

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1.8.18	Potential that landscape screening measures will be ineffective or incongruous	Low: Screen planting can be assimilated into riparian vegetation patterns but elevated views afforded	Low: Screen planting can be assimilated into riparian vegetation patterns but elevated views afforded	Very Low: Screen planting can be assimilated into prevailing vegetation patterns and built development	Very Low: Screen planting can be assimilated into prevailing vegetation patterns	Very Low: Screen planting can be assimilated into prevailing vegetation patterns and built development
1.9	Material Assets (Agronomy)					
1.9.1	Approximate % Reduction in overall farm holding	Exact site location unknown; reduction on holding unknown.	Exact site location unknown; reduction on holding unknown.	Exact site location unknown; reduction on holding unknown.	Exact site location unknown; reduction on holding unknown.	Exact site location unknown; reduction on holding unknown.
1.9.2	Farming Enterprise	Predominantly beef, tillage and small amount of forestry.	Predominantly beef, some tillage.	Predominantly beef, some tillage and sheep.	Predominantly beef, some tillage and dairy.	Predominantly beef, some tillage and dairy.
1.9.3	Number of landowners impacted within site boundary	Study area contains between 4 and 8 landowners. The exact number impacted will be known when the exact location decided.	Study area contains between 5 and 10 landowners. The exact number impacted will be known when the exact location decided.	Study Area contains between 4 and 9 landowners. The exact number impacted will be known when exact location decided.	Study Area contains between 5 and 10 landowners. The exact number impacted will be known when exact location decided.	Study Area contains between 6 and 12 landowners. The exact number impacted will be known when exact location decided.
1.9.4	Land Quality	Good.	Generally good, some patches of scrub.	Very good.	Very good.	Good.
1.9.5	Severance based on site location within overall land holdings	Individual farm Impact to be evaluated when exact location decided.	Individual farm Impact to be evaluated when exact location decided.	Individual farm Impact to be evaluated when exact location decided.	Individual farm Impact to be evaluated when exact location decided.	Individual farm Impact to be evaluated when exact location decided.
1.9.6	Potential Impacts on landholdings	Loss of land, possible severance and injurious affection.	Loss of land, possible severance and injurious affection.	Loss of land, possible severance and injurious affection.	Loss of land, possible severance and injurious affection.	Loss of land, possible severance and injurious affection.
1.9.7	Crop rotation practiced	Predominantly permanent pasture, some tillage (20%) and forestry (10%).	Predominantly permanent pasture, some tillage (20%).	Predominantly permanent pasture, some tillage (20%).	Predominantly permanent pasture, some tillage (25%).	Predominantly permanent pasture, some tillage (20%).
1.9.8	Overall Impact	Low impact - slight at national level.	Low impact - slight at national level.	Low impact - slight at national level.	Low impact - slight at national level.	Low impact - slight at national level.
1.10	Tourism					
1.10.1	Potential to impact on known community amenities and facilities within 1km from site boundary.	n/a	Approx. 1.3km of national walking trail extends through the south-east corner of the study area. More sections of the national trail are within 1km of the study area.	Approx. 1.7km of the national walking trail within the study area, bending back on itself. More sections of the national trail are within 1km of the study area.	Approx. 1.6 and 3.8km of the national walking trail are within the study area to the north and south, respectively. More of the trail lies within 1km of the study area.	Approx. 15.4km of the national trail lies within the study area, with more lying within 1km of it.
1.10.2	Likely Impact from a Fisheries Perspective	Likely to have a very high/high negative impact as a result of impact on euphotic zones within the Lough Derg waterbody.	Likely to have a very high/high negative impact as a result of impact on euphotic zones within the Lough Derg waterbody.	Likely to have a very high/high negative impact as a result of impact on euphotic zones within the Lough Derg waterbody.	Likely to have a very high/high negative impact as a result of impact on euphotic zones within the Lough Derg waterbody.	Likely to have little or no positive or negative impact on fisheries perspective as a result of lack of existing euphotic zones and other fishery support systems in Parteen Basin.

Ref	Criteria	Location 1 - Slevoir	Location 2 - Mota	Location 3 - Dromineer	Location 4 - Youghal Bay	Location 5 - Parteen Basin
1.11	Population					
1.11.1	Peoples and Communities	Final plant siting is not sufficiently defined to support a differentiating assessment at this stage. However, plant siting, as part of the next stage of the options assessment, will include an assessment of people and communities to ensure full consideration within the MCA process.	Final plant siting is not sufficiently defined to support a differentiating assessment at this stage. However, plant siting, as part of the next stage of the options assessment, will include an assessment of people and communities to ensure full consideration within the MCA process.	Final plant siting is not sufficiently defined to support a differentiating assessment at this stage. However, plant siting, as part of the next stage of the options assessment, will include an assessment of people and communities to ensure full consideration within the MCA process.	Final plant siting is not sufficiently defined to support a differentiating assessment at this stage. However, plant siting, as part of the next stage of the options assessment, will include an assessment of people and communities to ensure full consideration within the MCA process.	Final plant siting is not sufficiently defined to support a differentiating assessment at this stage. However, plant siting, as part of the next stage of the options assessment, will include an assessment of people and communities to ensure full consideration within the MCA process.
1.12	Human Health					
1.12.1	Human Health	Final plant siting is not sufficiently defined to support a differentiating assessment at this stage. Regardless of plant siting, all plant would be operated within appropriate safeguards i.e. permissions and licences with respect to human health to ensure that there are no significant health risks to the population.	Final plant siting is not sufficiently defined to support a differentiating assessment at this stage. Regardless of plant siting, all plant would be operated within appropriate safeguards i.e. permissions and licences with respect to human health to ensure that there are no significant health risks to the population.	Final plant siting is not sufficiently defined to support a differentiating assessment at this stage. Regardless of plant siting, all plant would be operated within appropriate safeguards i.e. permissions and licences with respect to human health to ensure that there are no significant health risks to the population.	Final plant siting is not sufficiently defined to support a differentiating assessment at this stage. Regardless of plant siting, all plant would be operated within appropriate safeguards i.e. permissions and licences with respect to human health to ensure that there are no significant health risks to the population.	Final plant siting is not sufficiently defined to support a differentiating assessment at this stage. Regardless of plant siting, all plant would be operated within appropriate safeguards i.e. permissions and licences with respect to human health to ensure that there are no significant health risks to the population.
1.13	Soils, Geology and Hydrogeology					
1.13.1	Aquifer Classification - importance of the groundwater resource to a given area	Low potential impact.				
1.13.2	Vulnerability Classification - potential for groundwater contamination	Mid-range vulnerability.	High Vulnerability.	Mid-range vulnerability.	Mid-range vulnerability.	Mid-range vulnerability.
1.13.3	GSI Groundwater Protection Response matrix	No data available for this area	No data available for this area.			
1.13.4	Groundwater Supplies - identification of water supply springs and bored wells based on GSI, EPA and FCC records	No features identified in this area.	2 Features identified: Conlan Borehole, Ballinderry Spring	No features identified in this area.	No features identified in this area.	No features identified in this area.
1.13.5	Groundwater Source Protection Area's and Zones of Contribution as per available GSI & EPA data	None within the vicinity of Slevoir (Lorrha 1km NE of Slevoir).	None within the vicinity of Mota.	None within the vicinity of Dromineer.	None within the vicinity of Youghal Bay.	None within the vicinity of Parteen Basin.
1.13.6	Potential to impact on Geological Heritage Sites / County Geological Sites	North Tipperary Crags and Tails CGS (possible NHA) near Slevoir	No potential impact identified.	No potential impact identified.	No potential impact identified (the nearest CGS is located 3.6km SW of Youghal Bay - Slate Quarries).	No potential impact identified (the nearest CGS is located 6km NE of Parteen Basin-Slate Quarries).
1.13.7	Potential to interact with contaminated land	Low potential.				

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1.13.8	Potential to sterilise mineral resource	Low potential.	Low potential.	Low potential.	Low potential.	Low potential.
1.13.9	Potential to encounter shallow bedrock during construction (interactions with other disciplines during construction - noise, dust etc)	Low potential.	High possibility (but mitigation measures can be implemented to reduce the impact).	Mid-range potential.	Mid-range potential.	Mid-range to the north/NE of Parteen, low to the south/west.
1.13.10	Potential impact on karst features	Low potential.	Low potential.	Low potential.	Low potential (springs identified at Youghal).	Low potential.
1.13.11	Potential to encounter soft ground	High possibility.	Mid-range possibility.	High possibility.	Mid-range possibility.	High possibility.
1.13.12	Soils Types	Peaty soils mainly –potential for increased suspended solids in runoff if disturbed during construction.	Well drained soils with some minor alluvial (rock close to surface to east).	Lacustrine type soils mainly with some well drained soils.	Alluvial Soils.	Alluvial, rock close to surface to the north.
1.13.13	Sub Soil Types	Cutover peat and some possible intact peat.	Mainly Till with some Alluvial.	Lacustrine type soils mainly with some till.	Alluvial soils with Till to north and south of bay.	Mainly Alluvial.
1.13.14	Depth to rock	<3 to >5m Deepest to the centre of the Bay.	<3m along most of the shore.	>10 reducing to 3m to the north and south of bay.	5 to 10m.	>5.
2.0	Technical					
2.1	Planning Policy					
2.1.1	Existing Land Use on Site	Agriculture/forestry.	Agriculture/forestry/Coolbawn Quay/Low density residential.	Dromineer village - quays/residential/tourism.	Agriculture/forestry/ribbon development.	Ballina/Killaloe villages and associated village zonings.
2.1.2	Site Zoning	No zoning.	No zoning but note existence of Coolbawn Quay and associated Residential development.	Amenity/Residential/ Commercial.	No zoning.	Residential existing and new/Commercial/Retail/Tourism/Active Open Space/Mixed use.
2.1.3	Local Objectives on Site	N/A.	N/A.	Tourism/low density housing.	N/A.	Tourism/New Residential/Commercial.
2.1.4	Other Local Objectives on Site	None.	None.	Dromineer Settlement Plan.	N/A.	Lough Derg Study.
2.1.5	Land Uses present within 1km of Land Parcel Boundary	Village of Carrigahorig in the vicinity (~400m).	Ballinderry ~1.9km distance; Newchapel/Kilbarron Village ~2.6km distance.	Puckane ~1.6km distance.	Villages of Ballycommon (~2.3km); Garrykennedy (~2.4km); Portroe (1.9km) ; Newtown/Youghalarra (~1.3km); and (Nenagh (4.5km) distance.	Village of Birdhill ~790m distance.
2.1.6	Zoning present within 1km of Land Parcel Boundary	Carrigahorig village zoning: Existing & New Residential/Amenity/ Commercial. Portumna, Lorrha and Terryglass villages in the vicinity.	No zoning but note existence of Coolbawn Quay and associated residential development.	Dromineer and Puckane Settlement Plans.	Newtown Settlement Plan.	Birdhill Settlement Plan.
2.1.7	Local Objectives within 1km of Land Parcel Boundary	Carrigahorig VDS.	Ballinderry and Kilbarron subject to Variation no.1; Protected View 05.	Protected View 03 and 04.	Newtown Settlement Plan.	Protection of vistas from Birdhill to Lough Derg.

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2.1.8	Other Local Objectives present within 1km of Land Parcel Boundary	HERT31 and other general policies (see Section 2.1.1 above).	HERT31 and other general policies (see Section 2.1.1 above).	HERT31 and other general policies (see Section 2.1.1 above).	Protect trees along the eastern shore of Lough Derg from Ballina to Youghalarra (from T23a to T23b).	HERT31 and other general policies (see Section 2.1.1 above).
2.2	Engineering and Design					
2.2.1	Area prone to flooding (PRFA/SCFRAMs) and predicted flood extents within and adjacent to the site. - Proximity to water bodies in terms of flooding and as an indicator of sensitive surface water receptors.	Low: Some flooding does occur within the location but Lands are available outside of the flood zones	Low: Some flooding does occur within the location but Lands are available outside of the flood zones	Low: Some flooding does occur within the location but Lands are available outside of the flood zones	Low: Some flooding does occur within the location but Lands are available outside of the flood zones	Low: More extensive flooding does occur within the location but lands are available outside of the flood zones
2.2.2	Proximity to effluent discharges	Portumna WWTP (3,100pe) and Terryglass WwTP (400pe) discharges to Lough Derg.	N/A	Outfall from Nenagh Agglomeration (13,000pe) is to the Nenagh River which is nutrient sensitive and discharges to Dromineer Bay.	N/A	4,000pe WWTP at Killaloe/Ballina discharges to Lough Derg.
2.2.3	Constructability	No major construction issues envisaged for treatment plant.	No major construction issues envisaged for treatment plant.	No major construction issues envisaged for treatment plant.	No major construction issues envisaged for treatment plant.	No major construction issues envisaged for treatment plant.
2.2.4	Process waste arising's	On site treatment of process wastes will likely be required.	On site treatment of process wastes will likely be required.	On site treatment of process wastes will likely be required.	On site treatment of process wastes will likely be required.	On site treatment of process wastes will likely be required.
2.2.5	Power availability	220KV Line approx 3.2km from potential site.	220KV Line approx 7.1km from potential site.	220KV Line approx 4.1km from potential site.	220KV Line approx 2.6km from potential site.	400KV Line approx 1.2km from potential site.
2.2.7	Alignment with WSSP	Similar for all sites.	Similar for all sites.	Similar for all sites.	Similar for all sites.	Similar for all sites.
2.3	Traffic					
2.3.1	Length of access road required	Very Low: Land very accessible from the N65.	Access via narrow Regional road network. 12km from National road at Carrigahorig and 20km from National road at Nenagh.	Regional Road R493 is approx 2.5km from abstraction location. Very narrow local roads for 2.5km - width for one vehicle.	Regional Road R495 is approx 2.7km from abstraction location. Regional Road R494 is approx 4.4km from abstraction location. Very narrow local roads - width for one vehicle.	Regional Road R494 is approx 0.9km from abstraction location - no issues with road width. Good proximity to the M7 and old N7.

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2.3.2	Number of crossings required for access road	Land very accessible from the N65 so no crossings required.	An independent access route from the R493 required in order to provide a safe entrance which would result in one crossing of a local access road.	Access road can be routed through agricultural land without the need to cross existing roads.	An independent access route from the R495 required in order to provide a safe entrance which would result in one crossing of a local access road.	Access likely direct from R494 with no road crossings.
2.3.3	Potential Impact on landowners	Short distance from N65 to lake shore so minimal number of landowners impacted. Treatment plant can be located a short distance from the N65 and the abstraction location so minimal number of landowners impacted.	Land take for abstraction and pumping station would not have a significant impact on landowners. However, an access road from the R493 would likely be required and this would potentially result in land splitting. Potential to site the treatment plant in a single land holding near the R493 where there is a wooded area.	Land take for abstraction, pumping station and treatment plant would not have a significant impact on landowners. However, an access road for 1.5km would likely be required and this would potentially result in land splitting and impact on a significant number of landowners.	Land take for abstraction and pumping station would not have a significant impact on landowners. However, an access road for 4.4km would likely be required from the R495 and this would potentially result in land splitting and impact on a significant number of landowners. Alternative would be to widen the local roads.	Short distance from R494 to lake shore so minimal number of landowners impacted. An access road would potentially be required to the Treatment Plant site from the regional road that is likely to impact on a number of landowners depending on the selected route.
2.3.4	Works required to provide safe access entrance	New access off N65 near bends in road and works will be required to provide relevant sight distances.	Access from R493 to abstraction would be via a narrow one vehicle wide road; consideration would have to be given for the construction of an independent access route from the R493.	An access road for 1.5km would likely be required as the existing local road is only wide enough for a single vehicle.	An access road for 4.4km would likely be required from the R495. Alternative would be to widen the local roads.	New access from R494 would be required for abstraction. New access from R494, or R445 or R496 would be required for treatment plant.
2.3.5	Potential impact on surrounding local road network	New access off N65 near bends in road and works will be required to provide relevant sight distances.	Access from R493 to abstraction would be via a narrow one vehicle wide road; consideration would be given for the construction of an independent access route from the R493.	Regional Road R493 is approx 2.5km from abstraction location. So with 1.5km of new access road there would remain an impact on 1km of local road network.	An access road for 4.4km would likely be required from the R495. Alternative would be to widen the local roads.	For abstraction only impact will be on the R494. For treatment plant site only impact will be on either the R494, or R445 or R496.
2.3.6	Frequency of accidents near entrance	Not an area of frequent accidents.	Not an area of frequent accidents.	Not an area of frequent accidents.	Not an area of frequent accidents.	R494 and R445 are roads identified where a high number of accidents have been caused by speeding.
2.3.7	Frequency of accidents on surrounding network (indication of general road safety issues)	Not an area of frequent accidents.	Not an area of frequent accidents.	Not an area of frequent accidents.	Not an area of frequent accidents.	R494 and R445 are roads identified where a high number of accidents have been caused by speeding.
2.3.8	Road link impacted upon by all construction traffic (excluding major routes i.e. R132/N32)	Location adjacent to and very accessible from the N65.	Access for construction traffic via narrow Regional road network. Long distance from National road network. 12km from National Road at Carrigahorig and 20km from National road at Nenagh. Also local access road is also access to three residential properties.	Regional Road R493 is approx 2.5km from abstraction location. Very narrow local roads for 2.5km - width for one vehicle.	Regional Road R495 is approx 2.7km from abstraction location. Regional Road R494 is approx 4.4km from abstraction location. Very narrow local roads - width for one vehicle.	Available abstraction possibly located in private estate so as to avoid the embankments. Regional Road R494 is approx 0.9km from abstraction location - no issues with road width. Good proximity to the M7 and old N7.

Ref	Criteria	Location 1 - Slevoir	Location 2 - Mota	Location 3 - Dromineer	Location 4 - Youghal Bay	Location 5 - Parteen Basin
2.3.9	Construction Risk	Very Low.	Access from R493 to abstraction location is a narrow one vehicle road that is also access to three residential properties, agricultural land and Mota Quay.	Access from the R493 to the abstraction would require travel on 1km of local road to the west of Puckaun.	Significant works and associated risks with construction of 4.4km of access road or alternative local road widening.	Very Low.
2.4	Capital and Operational Costs					
2.4.1	CAPEX	€ 700 - 900m (ex VAT)				
2.4.2	OPEX	€ 200 - 300m (ex VAT)				
2.5	Sustainability					
2.5.1	Carbon Footprint	Emerging Preferred Option is not sufficiently defined to support a calculation of embodied or operation carbon at this stage. However, option definition, as part of the next stage of the options assessment, will include an assessment of carbon to ensure full consideration within the MCA process.	Emerging Preferred Option is not sufficiently defined to support a calculation of embodied or operation carbon at this stage. However, option definition, as part of the next stage of the options assessment, will include an assessment of carbon to ensure full consideration within the MCA process.	Emerging Preferred Option is not sufficiently defined to support a calculation of embodied or operation carbon at this stage. However, option definition, as part of the next stage of the options assessment, will include an assessment of carbon to ensure full consideration within the MCA process.	Emerging Preferred Option is not sufficiently defined to support a calculation of embodied or operation carbon at this stage. However, option definition, as part of the next stage of the options assessment, will include an assessment of carbon to ensure full consideration within the MCA process.	Emerging Preferred Option is not sufficiently defined to support a calculation of embodied or operation carbon at this stage. However, option definition, as part of the next stage of the options assessment, will include an assessment of carbon to ensure full consideration within the MCA process.
3.0	Risk					
3.1	Technical Risk relating to Source	High	High	High	High	Low
3.2	Technical Risk relating to Infrastructure & Operations	High	High	High	High	Low
3.3	Environmental Risk	High	High	High	High	Mid Range
3.5	Financial Risk	Mid Range				
3.6	Socio-economic Risk	High	High	High	High	Low

3.3 Least constrained Abstraction Location

The Specialist Collective was convened in a workshop environment and the amalgamated assessment was challenged and discussed.

Through this discussion the position of each specialist was confirmed, see table E – 3 below.

Table E-3 MCA Comparison between Abstraction Locations

Constraint	Slevoir	Mota	Dromineer	Youghal	Parteen
Ecology	Dark Blue	Dark Blue	Blue	Blue	Green
Aquatic Ecology	Light Green	Light Green	Light Green	Light Green	Yellow
Surface Water	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Blue
Air Quality	Yellow	Yellow	Yellow	Yellow	Yellow
Noise	Yellow	Yellow	Yellow	Yellow	Yellow
Cultural Heritage	Light Green	Green	Light Green	Green	Light Green
Landscape and Visual	Light Green	Green	Green	Light Green	Green
Agronomy	Light Green				
People	Light Green	Light Green	Light Green	Yellow	Yellow
Soils, Geology & Hydrogeology	Light Green	Light Green	Light Green	Yellow	Light Green
Planning Policy	Light Green	Green	Blue	Light Green	Green
Traffic, Engineering & Design	Yellow	Green	Light Green	Light Green	Yellow
Risk	Blue	Blue	Blue	Blue	Green
Overall	2	4	5	3	1

Although a number of potentially significant constraints were identified in relation to the Parteen Basin Reservoir option, , it is important to note that the study area for this water body is much larger than the relatively confined sites considered in Lough Derg; it is not a like-for-like comparison.

The Parteen Basin Reservoir location is considered to be the least constrained of the Shannon abstraction options overall for the following reasons:

- Modelling studies of the Lough Derg abstraction locations have shown a measurable impact on flushing time in the lake and this would be likely to have a negative impact on the conservation objectives of Lough Derg SAC and of the entire lake aquatic ecosystem. The level of impact predicted at Parteen Basin Reservoir is considered too low to affect its ecological status.
- Parteen Basin Reservoir is a reservoir formed by the creation of Ardnacrusha dam, hence it is not as sensitive a lake habitat as Lough Derg, with low fisheries value, less developed wetlands habitat and with areas of more modified (non-qualifying habitat) occurring on the eastern shore.
- The limited relative impact on flushing times in Parteen Basin Reservoir supports the consideration of a lower potential impact on the objectives of the Water Framework Directive relative to abstraction from Lough Derg
- It is likely that due to the scale of the location of the Parteen Basin Reservoir there is a possibility of finding a suitable site for the location of the necessary

infrastructure with will significantly mitigate impact on known Planning, cultural heritage, Landscape and Visual constraints.

- From an Agronomy impact perspective the location of an abstraction point will be low at all locations and therefore no location is more or less constrained than another.

4 Desalination

4.1 Potential Abstraction Locations

8 abstraction locations were assessed along the Eastern Seaboard, with 4 considered to remain relevant to the appraisal process (refer to Appendix E2), namely:

- South Dublin
- Balbriggan
- Loughshinny North
- Loughshinny South

See Figure E-3 below:

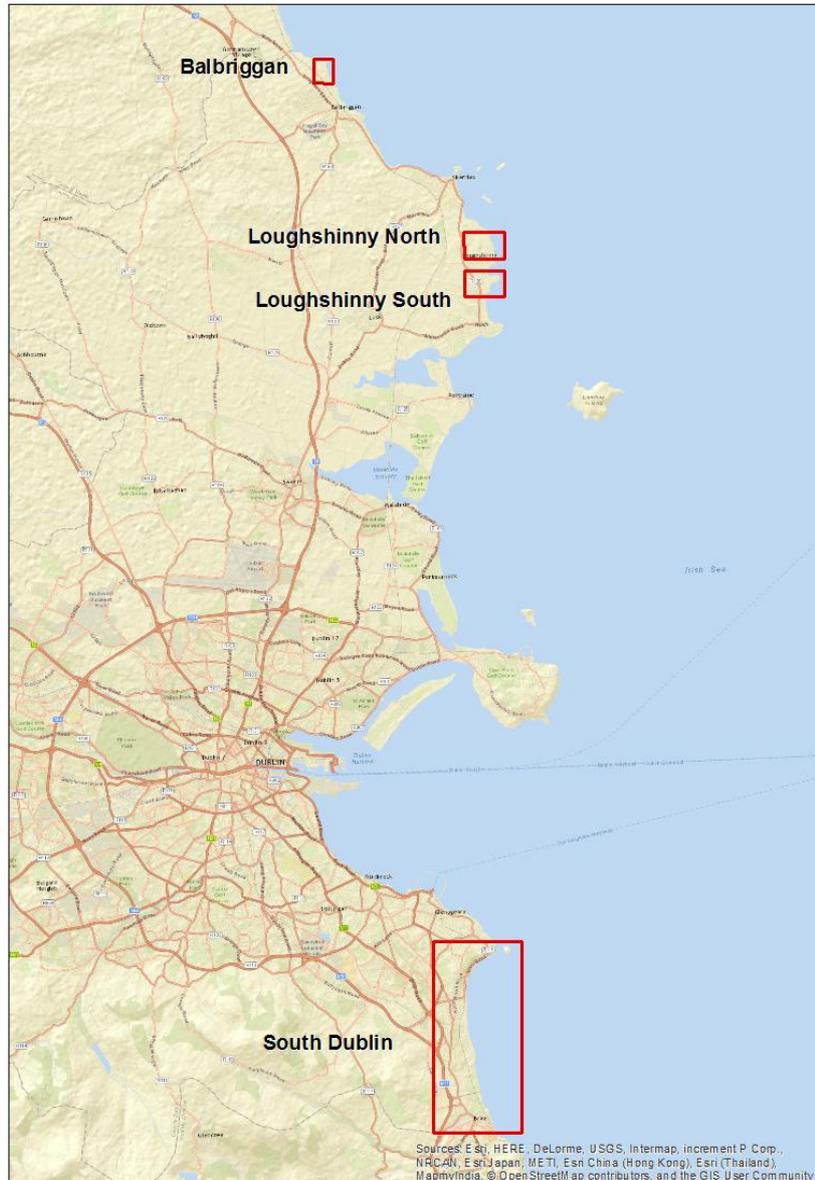


Figure E-3 Potential Abstraction Locations from Lough Derg and Parteen Basin Reservoir

4.1.1 Categories of impact

The relative analysis of potential locations to define a “least constrained” location is based upon a subjective assessment by each Specialist in their discipline of expertise. This judgement is presented as weighted impact; colour coded for ready identification.

Very high	Dark blue
High	Blue
Mid-range	Green
Low	Light Green
Very low	Cream

4.2 Matrix of Multi-Criteria Analysis

Ref	Criteria	Location 1 - South Dublin	Location 2 - Loughshinny North	Location 3 - Loughshinny South	Location 4 - Balbriggan
1.0	Environmental *				
1.1	Biodiversity, Flora & Fauna (Terrestrial)				
1.1.1	Potential to impact on Natura 2000 Sites	Low: potential to impact upon breeding bird populations for SPA's.	Low: potential to impact upon breeding bird populations for SPA's.	Low: potential to impact upon breeding bird populations for SPA's.	Low: potential to impact upon breeding bird populations for SPA's.
1.1.2	Potential to impact on Natural Heritage Areas and proposed Natural Heritage Areas	Mid-range: coastal pNHA (Dalkey Coastal Zone and Killiney Hill) located to the north and centre of the site.	High: Loughshinny Coast pNHA within study area.	Low: potential no pNHA in immediate vicinity of study area.	Low: potential no pNHA in immediate vicinity of study area.
1.1.3	Potential impact Annex I listed habitats (designated)	Very low: potential for terrestrial habitats including semi-natural grasslands.	Very low: potential for terrestrial habitats including semi-natural grasslands.	Very low: potential for terrestrial habitats including semi-natural grasslands.	Very low: potential for terrestrial habitats including semi-natural grasslands.
1.1.4	Potential impact Annex I listed habitats (non designated)	Low: potential with the exception of coastal habitats (see Aquatic Ecology).	Mid-range: potential on semi-natural grasslands, cliff habitats and habitats associated with Loughshinny Coast pNHA.	Low: potential with the exception of coastal habitats (see Aquatic Ecology).	Low: potential with the exception of coastal habitats (see Aquatic Ecology).
1.1.5	Potential to impact high ecological value habitats (semi natural habitats)	Mid-range: Woodland and other semi-natural habitats likely to be at least of high ecological value in a local context.	Mid-range: Woodland and other semi-natural habitats likely to be at least of high ecological value in a local context.	Mid-range: Woodland and other semi-natural habitats likely to be at least of high ecological value in a local context.	Mid-range: Woodland and other semi-natural habitats likely to be at least of high ecological value in a local context.
1.1.6	Potential to impact on protected Flora - Flora Protection Order	Low: potential for flora in undeveloped habitat.	Mid-range: Protected coastal flora: Green winged orchid.	Low: potential for protected flora in unimproved grassland.	Low: potential for protected flora in unimproved grassland.
1.1.7	Potential to impact on Annex II species	Mid-range: potential to impact on species including bats.	Low: potential to impact on species including bats.	Low: potential to impact on species including bats.	Low: potential to impact on species including bats.
1.1.8	Potential to Impact on Annex IV species (wherever they occur)	Mid-range: potential to impact on species including bats.	Low: potential to impact on species including bats.	Low: potential to impact on species including bats.	Low: potential to impact on species including bats.
1.1.9	Potential to impact on the breeding / wintering habitat for Annex I listed and other qualifying interest bird species	Low: Potential to impact on breeding Tern populations.	Mid-range: potential impact on marine seabird colonies and wader roosts.	Mid-range: potential impact on marine seabird colonies and wader roosts.	Mid-range: potential impact on marine seabird colonies and wader roosts.
1.1.10	Potential to impact flora and fauna protected under Wildlife Act e.g. Birds, badger	Mid-range: potential impacts on a mix of species including amphibian, reptiles and on bird nest sites and badger setts.	Mid-range: potential impacts on a mix of species including amphibian, reptiles and on bird nest sites and badger setts.	Mid-range: potential impacts on a mix of species including amphibian, reptiles and on bird nest sites and badger setts.	Mid-range: potential impacts on a mix of species including amphibian, reptiles and on bird nest sites and badger setts.
1.1.11	Potential to impact on salmonid habitat - protected under SI Reg	<i>See Aquatic Ecological Assessment.</i>			
1.1.12	Potential to impact on a freshwater pearl mussel - protected under SI Reg	<i>See Aquatic Ecological Assessment.</i>			
1.1.13	Potential to impact upon high quality aquatic habitat for protected aquatic species.	<i>See Aquatic Ecological Assessment.</i>			

Ref	Criteria	Location 1 - South Dublin	Location 2 - Loughshinny North	Location 3 - Loughshinny South	Location 4 - Balbriggan
1.1.14	Potential to impact on coastal zone habitats (intertidal)	<i>See Aquatic Ecological Assessment.</i>			
1.1.15	Potential to impact on marine habitats (e.g. Subtidal)	<i>See Aquatic Ecological Assessment.</i>			
1.1.16	Potential to impact marine/coastal birds	Low: Potential to impact on breeding populations via, loss of habitat and disturbance.	Mid-range: Potential to impact on breeding populations via, loss of habitat and disturbance.	Mid-range: Potential to impact on breeding populations via, loss of habitat and disturbance.	Low: Potential to impact on breeding populations via, loss of habitat and disturbance.
1.1.17	Potential to impact marine mammals	<i>See Aquatic Ecological Assessment.</i>			
1.2	Biodiversity, Flora & Fauna (Aquatic)				
1.2.1	Potential to impact on Natura 2000 Sites	Very low impact: Not within a SAC.	Very low impact: Adjacent to Natura sites.	Very low impact: Adjacent to Natura sites.	Very low impact: Adjacent to Natura sites.
1.2.2	Potential to impact on Natural Heritage Areas and proposed Natural Heritage Areas	Very low impact: Not within an NHA.	Very low impact: Adjacent to Natura sites.	Very low impact: Adjacent to Natura sites.	Very low impact: Adjacent to Natura sites.
1.2.3	Potential impact Annex I listed habitats (designated)	Very low impact: Annex I designated listed habitats present.	Very low impact: Adjacent to Natura sites.	Very low impact: Adjacent to Natura sites.	Very low impact: Adjacent to Natura sites.
1.2.4	Potential impact Annex I listed habitats (non designated)	Very low impact: Annex I non-designated listed habitats present.	Very low impact: Adjacent to Natura sites.	Very low impact: Adjacent to Natura sites.	Very low impact: Adjacent to Natura sites.
1.2.5	Potential to impact high ecological value habitats (semi natural habitats)	Very low impact: High ecological value habitats present.	Very low impact: High ecological value habitats present.	Very low impact: High ecological value habitats present.	Very low impact: High ecological value habitats present.
1.2.6	Potential to impact on protected Flora - Flora Protection Order	Very low impact: Potential to impact on protected Flora.	Very low impact: Potential to impact on protected Flora.	Very low impact: Potential to impact on protected Flora.	Very low impact: Potential to impact on protected Flora.
1.2.7	Potential to impact on Annex II species	Very low impact: Marine mammals may pass through the area.	Very low impact: Marine mammals may pass through the area.	Very low impact: Marine mammals may pass through the area.	Very low impact: Marine mammals may pass through the area.
1.2.8	Potential to Impact on Annex IV species (wherever they occur)	Very low impact: Marine mammals may pass through the area.	Very low impact: Marine mammals may pass through the area.	Very low impact: Marine mammals may pass through the area.	Very low impact: Marine mammals may pass through the area.
1.2.9	Potential to impact on the breeding / wintering habitat for Annex I listed and other qualifying interest bird species	<i>See Terrestrial Ecological Assessment.</i>			
1.2.10	Potential to impact flora and fauna protected under Wildlife Act e.g. Birds, badger	Very low impact: Potential to impact flora and fauna protected under Wildlife Act e.g. Birds.	Very low impact: Potential to impact flora and fauna protected under Wildlife Act e.g. Birds.	Very low impact: Potential to impact flora and fauna protected under Wildlife Act e.g. Birds.	Very low impact: Potential to impact flora and fauna protected under Wildlife Act e.g. Birds.
1.2.11	Potential to impact on salmonid habitat - protected under SI Reg	Very low impact: Brine discharge will locally impact the benthic communities.	Very low impact: Brine discharge will locally impact the benthic communities.	Very low impact: Brine discharge will locally impact the benthic communities.	Very low impact: Brine discharge will locally impact the benthic communities.
1.2.12	Potential to impact on a freshwater pearl mussel - protected under SI Reg	Freshwater Pearl Mussel not present.			

Ref	Criteria	Location 1 - South Dublin	Location 2 - Loughshinny North	Location 3 - Loughshinny South	Location 4 - Balbriggan
1.2.13	Potential to impact upon high quality aquatic habitat for protected aquatic species.	Low impact: Brine discharge will locally impact the benthic communities.	Low impact: Brine discharge will locally impact the benthic communities.	Low impact: Brine discharge will locally impact the benthic communities.	Low impact: Brine discharge will locally impact the benthic communities.
1.2.14	Potential to impact on coastal zone habitats (intertidal)	Very low impact: Very low risk of the intertidal habitat being impacted.	Very low impact: Very low risk of the intertidal habitat being impacted.	Very low impact: Very low risk of the intertidal habitat being impacted.	Very low impact: Very low risk of the intertidal habitat being impacted.
1.2.15	Potential to impact on marine habitats (e.g. Subtidal)	Low impact: Brine discharge will locally impact the benthic communities.	Low impact: Brine discharge will locally impact the benthic communities.	Low impact: Brine discharge will locally impact the benthic communities.	Low impact: Brine discharge will locally impact the benthic communities.
1.2.16	Potential to impact marine/coastal birds	See Terrestrial Ecological Assessment.			
1.2.17	Potential to impact marine mammals	Low impact: Marine mammals may pass through the area.	Low impact: Marine mammals may pass through the area.	Low impact: Marine mammals may pass through the area.	Low impact: Marine mammals may pass through the area.
1.3	Fisheries				
1.3.1	Potential to impact on water quality and inshore fishing grounds based on regional fisheries datasets.	Very low impact: Low risk impact on inshore fisheries.	Very low impact: Low risk impact on inshore fisheries.	Very low impact: Low risk impact on inshore fisheries.	Very low impact: Low risk impact on inshore fisheries.
1.3.2	Potential to impact on transient protected marine species (cetaceans and salmonids), which may pass through the affected area within the survey area footprint.	Very low impact: Marine mammals and salmonids may pass through the area.	Very low impact: Marine mammals and salmonids may pass through the area.	Very low impact: Marine mammals and salmonids may pass through the area.	Very low impact: Marine mammals and salmonids may pass through the area.
1.4	Water				
1.4.1	<p>Potential to support the objectives of the WFD water bodies .</p> <ul style="list-style-type: none"> - Potential to impact on the water quality, hydromorphology of a WFD water bodies of "good" or higher status. - Potential to impact on a WFD Annex IV - Protected Areas: A) Waters used for the abstraction of drinking water - Potential to impact on a WFD Annex IV - Protected Areas: B) Areas designated to protect economically significant aquatic species - Potential to impact on a WFD Annex IV - Protected Areas: C) Recreational Waters - Potential to impact on a WFD Annex IV - Protected Areas: D) Nutrient Sensitive Areas - Potential to impact on a WFD Annex IV - Protected Areas: E) Areas designated for the protection of habitats or species (Ecology Scope) 	Potential for impacts on the objectives of the WFD are considered to be high .	Potential for impacts on the objectives of the WFD are considered to be high .	Potential for impacts on the objectives of the WFD are considered to be high .	Potential for impacts on the objectives of the WFD are considered to be high .
1.5	Air/Climatic Factors				

Ref	Criteria	Location 1 - South Dublin	Location 2 - Loughshinny North	Location 3 - Loughshinny South	Location 4 - Balbriggan
	Air				
1.5.1	Potential for Construction phase Air Quality impact at Sensitive receptors	High density residential area, as a result potential for dust emissions during construction phase will likely have a Mid-range Impact.	Predominantly rural area with little residential settlement, some quarries/pits located in area. Low Impact at sensitive receptors.	Predominantly rural area with residential settlement to the south i.e. north Rush Village. Low impact at sensitive receptors.	Low Density Residential Area with high density residential to south of study area. Low impact from construction phase.
1.5.2	Potential for Operational phase Air Quality impact at Sensitive receptors	Very low impacts during operational phase, only operational impacts would be due to traffic generated from staff.	Very low impacts during operational phase, only operational impacts would be due to traffic generated from staff.	Very low impacts during operational phase, only operational impacts would be due to traffic generated from staff.	Very low impacts during operational phase, only operational impacts would be due to traffic generated from staff.
1.5.3	Proximity to EPA Waste Licensed facility	No facilities present in study area.	No facilities present in study area.	No facilities present in study area.	No facilities present in study area.
1.5.4	Proximity to EPA IPPC Licensed Intensive Agriculture facility	No facilities present in study area.	No facilities present in study area.	No facilities present in study area.	No facilities present in study area.
1.5.5	EPA Air Quality Zone Classification	Zone A.	Zone D.	Zone D.	Zone C.
1.5.6	Wind Rose Assessment	South west prevailing wind.	South west prevailing wind.	south west prevailing wind.	south west prevailing wind.
1.5.7	Construction Phase Impact rating	Mid-range impact from construction dust emissions	Low impact from construction dust emissions	Low impact from construction dust emissions	Low impact from construction dust emissions
1.5.8	Operational Phase Impact rating	Very low impact due to additional traffic (likely to be minimal) generated by abstraction.	Very low impact due to additional traffic (likely to be minimal) generated by abstraction.	Very low impact due to additional traffic (likely to be minimal) generated by abstraction.	Very low impact due to additional traffic (likely to be minimal) generated by abstraction.
	Noise				
1.5.9	Potential for Construction phase noise impact at Sensitive receptors	The area is predominantly suburban with mixed density residential development.	The area is considered rural with a small number of low density residential dwellings.	The area is considered rural/suburban with a small number of low density residential dwellings and a larger estate at St Catherine's.	The site is absent of residential development, there are nearby residential dwellings that are outside of the zone marked.
1.5.10	Potential for Operational phase noise impact at Sensitive receptors	Operational traffic is likely to have small noise impact, mechanical plant/pumps noise mitigation measures will be provided to minimise impacts.	Operational traffic is likely to have small noise impact, mechanical plant/pumps noise mitigation measures will be provided to minimise impacts.	Operational traffic is likely to have small noise impact, mechanical plant/pumps noise mitigation measures will be provided to minimise impacts.	Operational traffic is likely to have small noise impact, mechanical plant/pumps noise mitigation measures will be provided to minimise impacts.
1.5.11	Existing Ambient Noise Climate in the Area (significant noise sources)	Existing ambient noise climate likely to be reasonably low. Nearby noise sources are likely to consist of traffic from local/regional roads/N11 along with rail traffic noise and other anthropogenic sources.	Existing ambient noise climate likely to be low. Nearby noise sources are likely to consist of traffic from local/regional roads and other anthropogenic sources.	Existing ambient noise climate likely to be low. Nearby noise sources are likely to consist of traffic from local/regional roads and other anthropogenic sources.	Existing ambient noise climate likely to be low. Nearby noise sources are likely to consist of traffic from local/regional roads and other anthropogenic sources.
1.5.12	Construction Phase Impact rating	Low noise impact expected during construction phase.	Low noise impact expected during construction phase.	Low noise impact expected during construction phase.	Very low noise impact expected during construction phase.

Ref	Criteria	Location 1 - South Dublin	Location 2 - Loughshinny North	Location 3 - Loughshinny South	Location 4 - Balbriggan
1.5.13	Operational Phase Impact rating	Low noise impact expected during operational phase.	Very low noise impact expected during operational phase.	Very low noise impact expected during operational phase.	Very low noise impact expected during operational phase.
1.6	Material Assets (Energy)				
1.6.1	Potential for energy recovery	Transmission main will include gravity sections	Transmission main will include gravity sections	Transmission main will include gravity sections	Transmission main will include gravity sections
1.7	Cultural Heritage (including Architecture & Archaeology)				
1.7.1	Potential to impact (direct/indirect) on National Monuments (designated sites)	Low due to only two recorded in the area.	Very high due to the presence of a passage tomb complex that are protected by a preservation order.	Very high due to the presence of a promontory fort and associated features, that are protected with a preservation order.	Mid-range due to the presence of the promontory fort to the south.
1.7.2	Potential to impact (direct/indirect) on RMPs (designated sites)	Mid-range as 30 sites or groups of sites are recorded within the area and some of those occupy areas that to date have not been developed to any great extent.	Mid-range due to the presence of the passage tomb cemetery that has associated features recorded within the RMP.	Very high due to the presence of a promontory fort and associated features, along with additional sites.	High due to the presence of a large cluster of prehistoric sites recently discovered as part of the Discovery Programme research.
1.7.3	Potential to impact (direct/indirect) on RPS (designated sites)	High due to the multiple recorded structures and associated curtilages.	Mid-range due to the fact that the passage tomb cemetery is also listed as a protected structure.	Very high due to the presence of a number of landmark structures in the area and the fact that the promontory fort is also a protected structure.	Mid-range due to the presence of the promontory fort to the south.
1.7.4	Potential to impact (direct/indirect) on NIAH	Low in most of the area due to the fact that the NIAH survey for Dun Laoghaire Rathdown has yet to be carried out.	Very low as none are present.	High as there are a number of NIAH structures throughout the study area. Many of these are also RMPs and RPSs.	Very low as none are present.
1.7.5	Potential to impact (direct/indirect) on historic designed landscapes	High due to multiple landscapes, some of which survive as open spaces or in association with protected structures.	Very low as none are present.	Low as only one is recorded in the area and this has already been impacted upon by development.	Very low as none are present.
1.7.6	Potential to impact on ACA	Mid-range due to the presence of several ACAs and the fact that they can cover a wider area than RPS or NIAH designations.	Very low as none are present.	Very low as none are present.	Very low as none are present.
1.7.7	Recorded shipwreck sites/underwater archaeology	High due to the coastal resource. Any outfall or marine infrastructure has a high potential to impact on previously unrecorded wrecks.	High due to the coastal resource. Any outfall or marine infrastructure has a high potential to impact on previously unrecorded wrecks.	High due to the coastal resource. Any outfall or marine infrastructure has a high potential to impact on previously unrecorded wrecks.	High due to the coastal resource. Any outfall or marine infrastructure has a high potential to impact on previously unrecorded wrecks.
1.8	Landscape & Visual				
1.8.1	Potential to impact on designated areas of 'Highly Sensitive Landscape'	Mid-range: No specific landscape value or sensitivity designation but northern end of focus area contained in NHA and ACAs.	Very High: Coastal area identified as a 'highly Sensitive Landscape' in the Fingal CDP.	Very High: Coastal area identified as a 'highly Sensitive Landscape' in the Fingal CDP.	Very High: Coastal area identified as a 'highly Sensitive Landscape' in the Fingal CDP.

Ref	Criteria	Location 1 - South Dublin	Location 2 - Loughshinny North	Location 3 - Loughshinny South	Location 4 - Balbriggan
1.8.2	Potential to impact on rare or distinctive landscape elements (rock outcrops, water bodies etc)	Mid-range: Rocky shoreline particularly around Killiney.	Very High: Rocky shoreline and coves along this section of coast.	Very High: Distinctive low sea cliffs along this section of coast.	Very High: Distinctive low sea cliffs along this section of coast.
1.8.3	Potential to disrupt landscape structure (treelines / hedgerows / field pattern etc.)	Very Low: Varied urban setting.	Low: Large coastal fields with little boundary definition.	Low: Field boundaries.	Low: Field boundaries.
1.8.4	Potential to impact on woodlands and significant tree groups	Low: Several TPOs and woodland areas associated with Killiney Hill, Shanganagh Park and Woodbrook Golf Course.	Very Low: none identified.	Very Low: none identified.	Very Low: none identified.
1.8.5	Potential to impact on historic designed landscapes	Mid-range: Killiney ACA, Sorrento Terrace ACA and Rosedale House.	Low: Several RMP features near point but not designed landscapes.	Low: Several RMP features but not designed landscapes.	Low: Several RMP features but not designed landscapes.
1.8.6	Potential to alter the prevailing landscape character	Low: Varied urban landscape with Dart line and Shanganagh Sewage works. Greater potential to impact on landscape character around Killiney.	Mid-range: Rugged open coastal character with relatively low levels of built development.	Mid-range: Rugged coastal character with relatively low levels of built development.	Mid-range: Rugged coastal character with relatively low levels of built development.
1.8.7	Potential to impact on designated scenic routes / views	Mid-range: Coastal scenic views at northern end of focus area but not south of Killiney.	Mid-range: Short section of R132 coastal road designated as a scenic route along this section of coast.	Very High: R128 coastal road designated as a scenic route along this section of coast plus small section of elevated local road adjacent to Popeshall.	Very High: R128 coastal road designated as a scenic route along this section of coast plus small section of elevated local road adjacent to Popeshall.
1.8.8	Potential to impact on views from heritage/tourist/amenity features of national or regional importance	Mid-range: Elevated views from Killiney Hill, Sorrento Terrace, Dalkey Island all at northern end of focus area.	Low: Coastal settlement of Balbriggan a popular tourist and amenity location.	Low: Coastal settlements of Rush and Skerries popular tourist and amenity locations.	Low: Coastal settlements of Rush and Skerries popular tourist and amenity locations.
1.8.9	Potential to impact on views from settlements	Very High: Densely populated coastal suburbs of Dublin City.	Mid-range: Balbriggan immediately adjacent to the south.	Mid-range: Loughshinny immediately adjacent and Rush and Skerries c. 2km S and N.	Mid-range: Loughshinny immediately adjacent and Rush and Skerries c. 2km S and N.
1.8.10	Potential to impact on views from dwellings / local roads	Very High: As above.	Low: Sparse rural population north of Balbriggan.	Low: Relatively sparse rural / seasonal population outside of main settlements.	Low: Relatively sparse rural / seasonal population outside of main settlements.
1.8.11	Potential to impact on views from motorways	Very Low.	Very Low: M1 motorway c.3km W but heavily screened along this section.	Very Low.	Very Low.
1.8.12	Potential to impact on views from other major roads (national or regional roads)	Mid-range: R119 (Vico Road) affords elevated views of rocky coastline along south eastern Flank of Killiney Hill.	Mid-range: R132 coastal road (short section designated as a scenic route) runs along this section of coast	Very High: R128 coastal road designated as a scenic route along this section of coast.	Very High: R128 coastal road designated as a scenic route along this section of coast.
1.8.13	Potential to impact on views from rail lines	Very High: Heavily utilised coastal DART section passes through focus area.	Very High: Main Belfast Dublin rail line passes through this focus area.	Mid-range: Main Belfast Dublin rail line passes c. 1km to the west.	Mid-range: Main Belfast Dublin rail line passes c. 1km to the west.

Ref	Criteria	Location 1 - South Dublin	Location 2 - Loughshinny North	Location 3 - Loughshinny South	Location 4 - Balbriggan
1.8.14	Potential to impact on arrival views from Airports including aerial approach and vehicular egress	Very Low.	Very Low: Possibly visible from Dublin Airport flight path but without material consequence.	Very Low: Possibly visible from Dublin Airport flight path but without material consequence.	Very Low: Possibly visible from Dublin Airport flight path but without material consequence.
1.8.15	Potential to impact on views from national 'way marked' walking routes	Very Low.	Very Low.	Very Low.	Very Low.
1.8.16	Potential to impact on local walks	Mid-range: Local walks associated with Killiney Hill, Shangannagh park and the coastline.	Mid-range: Coastal walks along this section of coastline identified under specific objectives of Fingal CDP.	Mid-range: Coastal walks along this section of coastline identified under specific objectives of Fingal CDP.	Mid-range: Coastal walks along this section of coastline identified under specific objectives of Fingal CDP.
1.8.17	Potential to impact on views from angling or swimming locations (rivers, lakes, sea)	Mid-range: Swimming, fishing, sailing and sea kayaking all popular water based pursuits along this section of coastline.	Mid-range: Beaches accessible from Balbriggan.	Mid-range: Beaches and Harbour at Loughshinny.	Low: Beaches and Harbour at Loughshinny.
1.8.18	Potential that landscape screening measures will be ineffective or incongruous	Low: Relatively open coastal strip could be interrupted by mitigation planting.	Mid-range: Prevailing vegetation in this area is low and windswept - proposals for taller vegetation may be incongruous and difficult to establish.	Mid-range: Prevailing vegetation in this area is low and windswept - proposals for taller vegetation may be incongruous and difficult to establish.	Mid-range: Prevailing vegetation in this area is low and windswept - proposals for taller vegetation may be incongruous and difficult to establish.
1.9	Material Assets (Landuse)				
1.9.1	Approximate % Reduction in overall farm holding	Exact site location unknown; reduction on holding unknown.	Exact site location unknown; reduction on holding unknown.	Exact site location unknown; reduction on holding unknown.	Exact site location unknown; reduction on holding unknown.
1.9.2	Farming Enterprise	Beef, Tillage.	Tillage.	Tillage.	Tillage and beef.
1.9.3	Number of landowners impacted within site boundary	Study area contains between 4 and 8 landowners. The exact number impacted will be known when the exact location decided.	Study area contains between 1 and 5 landowners. The exact number impacted will be known when the exact location decided.	Study area contains between 1 and 5 landowners. The exact number impacted will be known when the exact location decided.	Study area contains between 3 and 7 landowners. The exact number impacted will be known when the exact location decided.
1.9.4	Land Quality	Very good.	Very good.	Very good.	Very good.
1.9.5	Severance based on site location within overall land holdings	Individual farm Impact to be evaluated when exact location decided.	Individual farm Impact to be evaluated when exact location decided.	Individual farm Impact to be evaluated when exact location decided.	Individual farm Impact to be evaluated when exact location decided.
1.9.6	Potential Impacts on landholdings	Loss of land, possible severance and injurious affection.	Loss of land, possible severance and injurious affection.	Loss of land, possible severance and injurious affection.	Loss of land, possible severance and injurious affection.
1.9.7	Crop rotation practiced	Permanent pasture, tillage.	Tillage.	Tillage.	Permanent pasture, tillage.

Ref	Criteria	Location 1 - South Dublin	Location 2 - Loughshinny North	Location 3 - Loughshinny South	Location 4 - Balbriggan
1.9.8	Overall Impact	Low impact - slight at national level. Woodbrook golf course is located between Bray and Shankill 53.218805, -6.109332.	Low impact - slight at national level.	Low impact - slight at national level.	Low impact - slight at national level.
1.10	Tourism				
1.10.1	Potential to impact on known community amenities and facilities within 1km from site boundary.	Approx. 1 km of the national trail is within the study area. A number of beaches are located close by, with Killiney Beach awarded a blue flag for the past two years.	Loughshinny Beach is closely and has not been awarded a blue flag since 1996. The fishing spot at Loughshinny is close by.	Rush South Beach has not been awarded a Green Coast award since 2011. Loughshinny Beach and the fishing spot of Loughshinny are located close by.	The fishing spots at Delvin River Mouth and Balbriggan are close by. The fishing port at Balbriggan brings in demersal fish and shellfish.
1.11	Population				
1.11.1	Peoples and Communities	Final plant siting is not sufficiently defined to support a differentiating assessment at this stage. However, plant siting, as part of the next stage of the options assessment, will include an assessment of people and communities to ensure full consideration within the MCA process.	Final plant siting is not sufficiently defined to support a differentiating assessment at this stage. However, plant siting, as part of the next stage of the options assessment, will include an assessment of people and communities to ensure full consideration within the MCA process.	Final plant siting is not sufficiently defined to support a differentiating assessment at this stage. However, plant siting, as part of the next stage of the options assessment, will include an assessment of people and communities to ensure full consideration within the MCA process.	Final plant siting is not sufficiently defined to support a differentiating assessment at this stage. However, plant siting, as part of the next stage of the options assessment, will include an assessment of people and communities to ensure full consideration within the MCA process.
1.12	Human Health				
1.12.1	Human Health	Final plant siting is not sufficiently defined to support a differentiating assessment at this stage. Regardless of plant siting, all plant would be operated within appropriate safeguards i.e. permissions and licences with respect to human health to ensure that there are no significant health risks to the population.	Final plant siting is not sufficiently defined to support a differentiating assessment at this stage. Regardless of plant siting, all plant would be operated within appropriate safeguards i.e. permissions and licences with respect to human health to ensure that there are no significant health risks to the population.	Final plant siting is not sufficiently defined to support a differentiating assessment at this stage. Regardless of plant siting, all plant would be operated within appropriate safeguards i.e. permissions and licences with respect to human health to ensure that there are no significant health risks to the population.	Final plant siting is not sufficiently defined to support a differentiating assessment at this stage. Regardless of plant siting, all plant would be operated within appropriate safeguards i.e. permissions and licences with respect to human health to ensure that there are no significant health risks to the population.
1.13	Soils, Geology and Hydrogeology				
1.13.1	Aquifer Classification - importance of the groundwater resource to a given area	Mid-range permeability. Mid-range importance (poor aquifer, north and south corners).	Mid-range permeability. Mid-range importance.	Mid-range permeability. Mid-range importance.	Mid-range permeability. Mid-range importance.
1.13.2	Vulnerability Classification - potential for groundwater contamination	High Vulnerability.	High Vulnerability.	High Vulnerability.	High Vulnerability.
1.13.3	GSI Groundwater Protection Response matrix	No data available for this area.			

Ref	Criteria	Location 1 - South Dublin	Location 2 - Loughshinny North	Location 3 - Loughshinny South	Location 4 - Balbriggan
1.13.4	Groundwater Supplies - identification of water supply springs and bored wells based on GSI, EPA and FCC records	No features identified in this area.	No features identified in this area.	No features identified in this area.	No features identified in this area.
1.13.5	Groundwater Source Protection Area's and Zones of Contribution as per available GSI & EPA data	None within the vicinity of South Dublin.	None within the vicinity of Loughshinny North.	None within the vicinity of Loughshinny South.	None within the vicinity of Balbriggan.
1.13.6	Potential to impact on Geological Heritage Sites / County Geological Sites	High Potential: liaise with GSI to reduce impact.	Low: Laytown to Gormanstown located to the north of study area.	High Potential: liaise with GSI to reduce impact.	High Potential: liaise with GSI to reduce impact.
1.13.7	Potential to interact with contaminated land	Low to Moderate potential impact.	Low potential impact.	Low potential impact.	Low potential impact.
1.13.8	Potential to sterilise mineral resource	Low potential impact.	Low potential impact.	Low potential impact.	Low potential impact.
1.13.9	Potential to encounter shallow bedrock during construction (interactions with other disciplines during construction - noise, dust etc)	High to Moderate (northern area) - mitigation measures can be implemented to reduce the impact.	High to Moderate (Coastal area and centre of study area) - mitigation measures can be implemented to reduce the impact	High to Moderate (Coastal area and centre of study area) - mitigation measures can be implemented to reduce the impact	High to Moderate (Coastal area and area in centre) - mitigation measures can be implemented to reduce the impact
1.13.10	Potential impact on karst features	Low potential impact.	Low potential impact.	Low potential impact.	Low potential impact.
1.13.11	Potential to encounter soft ground	Low potential impact.	Low potential impact.	Low potential impact.	Low potential impact.
1.13.12	Soils Types	Well drained soils and Made Ground.	Deep poorly drained.	Deep poorly drained.	Deep poorly drained.
1.13.13	Sub Soil Types	Gravel and Made Ground.	Mainly Till.	Mainly Till.	Mainly Till.
1.13.14	Depth to rock	Typically <3m.	At surface to >5m.	Typically >5m.	Typically >5m.
2.0	Technical **				
2.1	Planning Policy				
2.1.1	Existing Land Use on Site	Urban development/Metropolitan Area.	Agriculture/Low density residential.	Agriculture/Residential.	Agriculture.
2.1.2	Site Zoning	High Amenity/Open Space/Residential/Mixed Use/Economic Development/Greenbelt.	High Amenity/Greenbelt/ Agriculture.	Agriculture/High Amenity/Open Space/Residential/ Commercial / Infrastructure.	High Amenity/Open Space.

Ref	Criteria	Location 1 - South Dublin	Location 2 - Loughshinny North	Location 3 - Loughshinny South	Location 4 - Balbriggan
2.1.3	Local Objectives on Site	Woodbrook LAP; Old Conna LAP; Rathmichael.	High Amenity (HA):Protect these highly sensitive and scenic locations from inappropriate development; Greenbelt (GB):Create a rural/urban Greenbelt zone that permanently demarcates the boundary; Rural (RU) - Protect and promote in a balanced way, the development of agriculture.	HA:Protect these highly sensitive and scenic locations from inappropriate development; Rural (RU) - Protect and promote in a balanced way, the development of agriculture; Open Space (OS): Preserve and provide for open space and amenities; RS: Protected existing Residential amenities; Community Infrastructure (CI): Protect and Provide for community, religious, education, health and social infrastructure.	HA: Protect these highly sensitive and scenic locations from inappropriate development; OS: Preserve and provide for open space and amenities.
2.1.4	Other Local Objectives on Site	Site not defined.	Local Objective (LO)113 : Promote a millennium walkway.	LO126: Encourage the restoration of the Martello tower; LO127: Promote and facilitate a public walkway around the Drumanagh Promontory Fort, providing an attractive pedestrian link from Rush to Loughshinny. Preserve views.	Coastal walk/preserve Views.
2.1.5	Land Uses present within 1km of Land Parcel Boundary	Urban development/Metropolitan Area.	Loughshinny Village to the south of boundary 150m.	Residential/Agriculture/ Tourism related.	Agriculture/Residential.
2.1.6	Zoning present within 1km of Land Parcel Boundary	Site not defined.	Residential/Local centre/Community Infrastructure/General Employment.	Residential/High amenity/Open Space.	Greenbelt/ Rural/Residential/ Community Infrastructure.
2.1.7	Local Objectives within 1km of Land Parcel Boundary	LAP's, SDZ (Cherrywood),	Greenbelt GI07/GI08/GI09	Rural related business/Residential/ coastal walkways	Greenbelt GI07/GI08/GI09
2.1.8	Other Local Objectives present within 1km of Land Parcel Boundary	Site not defined.	LO116 - 3 houses; LO118 - redevelopment of harbour; LO119 - cultural/mixed use development; LO120 - parking; LO122 - pedestrian route; LO123 - nursing home; LO124 - existing use.	LO129 - Study for future use of land; LO132 - Retail for farm produce; LO135 - Improve access to beach; LO142 - Horticultural use; LO143 - Prepare a Masterplan for the protection and enhancement of the 'HA' lands at the North Beach, in the interests of environmental sustainability.	LO3 - Prepare a Gateway Strategy for the northern/southern/western and eastern approaches to the town ; LO4 - Upgrade the access laneway to the Council's recreational lands and the seashore at Bremore; LO5 - detailed archaeological study; LO6 - Promote and facilitate the development of a Heritage Centre including Civic/Community/Recreational Uses at Bremore Castle; LO7- Promote and facilitate the development of a Civic Theatre at Bremore Castle.
2.2	Engineering and Design				
2.2.1	Area prone to flooding (PRFA/SCFRAMs) and predicted flood extents within and adjacent to the site. - Proximity to water bodies in terms of flooding and as an indicator of sensitive surface water receptors.	Low: Some flooding does occur within the location but Lands are available outside of the flood zones	Low: Some flooding does occur within the location but Lands are available outside of the flood zones	Low: Some flooding does occur within the location but Lands are available outside of the flood zones	Low: Some flooding does occur within the location but Lands are available outside of the flood zones

Ref	Criteria	Location 1 - South Dublin	Location 2 - Loughshinny North	Location 3 - Loughshinny South	Location 4 - Balbriggan
2.2.2	Proximity to effluent discharges	Shanganagh WwTP (200,000pe) discharges treated effluent via a long sea outfall to Killiney Bay.	Portrane (65,000pe) discharges treated effluent to the Irish Sea.	Portrane (65,000pe) discharges treated effluent to the Irish Sea.	Ballbriggan/Skerries WwTP (28,000pe) discharges treated effluent via a long sea outfall from Kelly's Bay to the Irish Sea.
2.2.3	Constructability	No major construction issues envisaged for treatment plant.	No major construction issues envisaged for treatment plant.	No major construction issues envisaged for treatment plant.	No major construction issues envisaged for treatment plant.
2.2.4	Process waste arising's	On site treatment of process wastes will likely be required.	On site treatment of process wastes will likely be required.	On site treatment of process wastes will likely be required.	On site treatment of process wastes will likely be required.
2.2.5	Power availability	110 kV power line located approximately 1-2km from the centre of the South Dublin location	38 kV power line located approximately 1.5km from the centre of the Loughshinny North location	38 kV power line located approximately 1.5km from the centre of Loughshinny South location	38 kV power line located approximately 1km from the centre of the Balbriggan location
2.2.7	Alignment with WSSP	Abstraction and Treatment at source can provide up to 40MI/d treated water to the Benefiting Corridor. The ability to link to known areas of demand is constrained by geography of source and terminal point.	Abstraction and Treatment at source can provide up to 40MI/d treated water to the Benefiting Corridor.	Abstraction and Treatment at source can provide up to 40MI/d treated water to the Benefiting Corridor.	Abstraction and Treatment at source can provide up to 40MI/d treated water to the Benefiting Corridor.
2.3	Traffic				
2.3.1	Length of access road required	Considered that length of access road required will be less than 0.2km due to density of road network.	Potentially require a new access road from the R128 - Typical length 1.0km.	Potentially require a new access road from the R128 - Typical length 1.0km.	A new access road or an upgraded access road from the R132 - Typical length 0.7km.
2.3.2	Number of crossings required for access road	Due to the density of the existing road network there is likely to be no crossings required.	None - direct route off the R128.	None - direct route off the R128.	Potential crossing of the Railway Line.
2.3.3	Potential Impact on landowners	Undeveloped lands in urban area.	Some landowners in agricultural lands likely to be impacted.	Some landowners in agricultural lands likely to be impacted.	Some landowners in agricultural lands likely to be impacted.
2.3.4	Works required to provide safe access entrance	Due to the density of the existing road network there is likely to be no significant works required to provide a safe entrance.	New access road off the the R128.	New access road off the the R128.	A new access road or an upgraded access road from the R132 - Typical length 0.7km. Railway line crossing also required.
2.3.5	Potential impact on surrounding local road network	Due to the density of road network and the highly urbanised area there is likely to be some impact on the road network.	Only impact would be on the R128.	Only impact would be on the R128.	Only impact would be on the R132.
2.3.6	Frequency of accidents near entrance	Not a significant accident location.	Not a significant accident location.	R128 has record of accidents through Rush.	Not a significant accident location.

Ref	Criteria	Location 1 - South Dublin	Location 2 - Loughshinny North	Location 3 - Loughshinny South	Location 4 - Balbriggan
2.3.7	Frequency of accidents on surrounding network (indication of general road safety issues)	Not a significant accident location.	R128 has record of accidents through Rush.	R128 has record of accidents through Rush.	R132 north and south of site entrance has high frequency of accidents.
2.3.8	Road link impacted upon by all construction traffic (excluding major routes i.e. R132/N32)	High density of regional roads so road link impact could be minimal.	No road link impacts other than major routes.	No road link impacts other than major routes.	No road link impacts other than major routes.
2.3.9	Construction Risk	Risk associated with construction works in a highly urbanised area.	No significant construction risks associated with traffic identified at this stage.	No significant construction risks associated with traffic identified at this stage.	Risk associated with crossing of railway line.
2.4	Capital and Operational Costs				
2.4.1	CAPEX	€ 500 - 700m (ex VAT)			
2.4.2	OPEX	€ 800 - 900m (ex VAT)			
2.5	Sustainability				
2.5.1	Carbon Footprint	Emerging Preferred Option is not sufficiently defined to support a calculation of embodied or operation carbon at this stage. However, option definition, as part of the next stage of the options assessment, will include an assessment of carbon to ensure full consideration within the MCA process.	Emerging Preferred Option is not sufficiently defined to support a calculation of embodied or operation carbon at this stage. However, option definition, as part of the next stage of the options assessment, will include an assessment of carbon to ensure full consideration within the MCA process.	Emerging Preferred Option is not sufficiently defined to support a calculation of embodied or operation carbon at this stage. However, option definition, as part of the next stage of the options assessment, will include an assessment of carbon to ensure full consideration within the MCA process.	Emerging Preferred Option is not sufficiently defined to support a calculation of embodied or operation carbon at this stage. However, option definition, as part of the next stage of the options assessment, will include an assessment of carbon to ensure full consideration within the MCA process.
3.0		Risk			
3.1	Technical Risk relating to Source	Mid range	High	High	Mid range
3.2	Technical Risk relating to Infrastructure & Operations	High	High	High	High
3.3	Environmental Risk	Mid range	High	High	Mid range
3.4	Financial Risk	Mid range	Mid range	Mid range	Mid range
3.5	Socio-economic Risk	High	Mid range	Mid range	Mid range

4.3 Least constrained Abstraction Location

The Specialist Collective was convened in a workshop environment and the amalgamated assessment was challenged and discussed.

Through this discussion the position of each specialist was confirmed, see table E – 4 below.

Table E-4 MCA Comparison between Abstraction Locations

Constraint	South Dublin	Loughshinny North	Loughshinny South	Balbriggan
<i>Ecology</i>	Light Green	Green	Light Green	Light Green
<i>Aquatic Ecology</i>	Yellow	Yellow	Yellow	Yellow
<i>Surface Water</i>	Blue	Blue	Blue	Blue
<i>Air Quality</i>	Yellow	Yellow	Yellow	Yellow
<i>Noise</i>	Yellow	Yellow	Yellow	Yellow
<i>Cultural Heritage</i>	Blue	Green	Dark Blue	Green
<i>Landscape and Visual</i>	Light Green	Green	Green	Green
<i>Agronomy</i>	Light Green	Light Green	Light Green	Light Green
<i>People</i>	Light Green	Yellow	Yellow	Yellow
<i>Soils, Geology & Hydrogeology</i>	Green	Light Green	Light Green	Light Green
<i>Planning Policy</i>	Light Green	Blue	Blue	Blue
<i>Traffic, Engineering & Design</i>	Yellow	Yellow	Light Green	Green
<i>Risk</i>	Blue	Blue	Blue	Green
Overall	2	3	4	1

It was the consensus position of the specialists in consideration of the MCA process, available information and feedback from public consultation that the Balbriggan location be the least constrained of the Irish Sea abstraction locations. This position drew upon the following reasons;

- Regarding surface water, all the areas were found to be highly constrained and therefore of high sensitivity. Despite the multiple constraints within all the study areas it is more likely that further studies could result in the identification of a site that would not impede the objectives of the WFD within the Balbriggan Study Area;
- The Balbriggan areas as extensive areas of low ecological value farmland suitable for locating the proposed development.
- The Balbriggan site would be least constrained from an air quality and noise perspective due to the absence of dense residential development;
- The absence of equine enterprises and lesser number of intensive horticultural enterprises support its least constrained status in terms of agronomy and agriculture; whilst
- It is the least constrained location from the point of view of Soils, Geology and Hydrogeology.

Water Supply Project Eastern and Midlands Region (WSP)

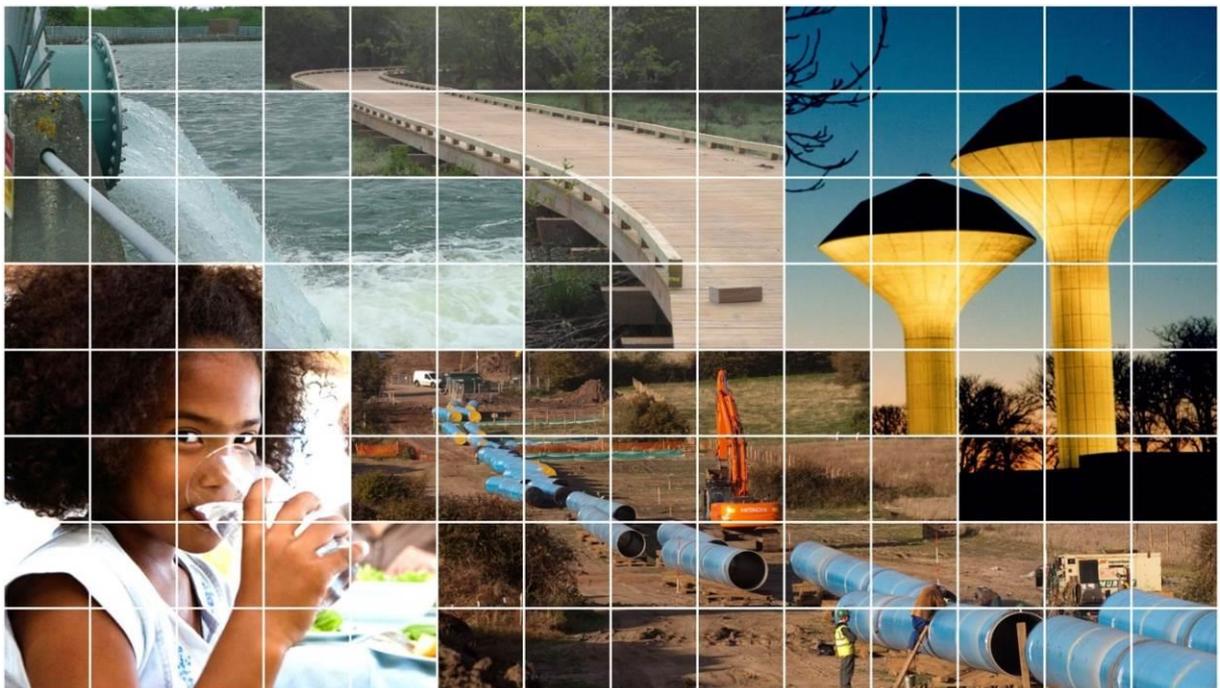
Abstraction Location MCA

Appendix E2: Review of SEA Abstraction Locations



October 2015

F01



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1

Introduction

1.1 Introduction

Four reasonable alternative options have been identified from previous studies – refer to the *Water Supply Options Working Paper* (Project Road Map Stage 2). These are reconfirmed below.

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)
- Option H (Desalination)

Potential abstraction locations associated with the 4 reasonable alternative options were identified as part of previous studies undertaken as part of the past Strategic Environmental Assessment (SEA).

The EIA Directive 2014/52/EU notes the following continuity with the SEA Directive:

“.... With a view to avoiding duplication of assessments, the results of other assessments under Union legislation, such as Directive 2001/42/EC of the European Parliament and the Council should, where relevant and available, be taken into account.”

This report describes the review process used to confirm the continued relevance of these abstraction locations to the options appraisal process of the Preliminary Options Appraisal Report.

2 Preliminary Screening of Locations

2.1 Preliminary Screening of the Lough Derg Locations

2.1.1 2011 Lough Derg Alternative Abstraction Site Selection Report

As part of the SEA, the eastern shore of Lough Derg was examined and a number of technical criteria were initially adopted to narrow the number of abstraction location options. The criteria used in the SEA are as follows:

- *Topography: the surrounding topography should be low lying so as not to restrict the pipeline route and minimise tunnelling.*
- *Elevation: the pumping station has to be at a reasonably low lying level e.g. <35m high.*
- *Access: the abstraction location should preferably be in close proximity to an access road (national roads are preferable for truck and heavy machinery accessibility) and preferably with a road running parallel to the lake shore to optimise pumping station location.*
- *Development: the abstraction location should be at a suitable distance away from commercial or residential development and preferably should be located in a low density residential area.*
- *Distance from the Termination Reservoir: pipeline route.*

The entire shoreline south of Youghal Bay was deemed to be unsuitable for the abstraction location as the Arra mountain range runs adjacent to the lake which gives rise to numerous technical difficulties. The Arra mountain range is shown in the following Figure E2-1 with the elevation above 100mOD shaded in yellow.

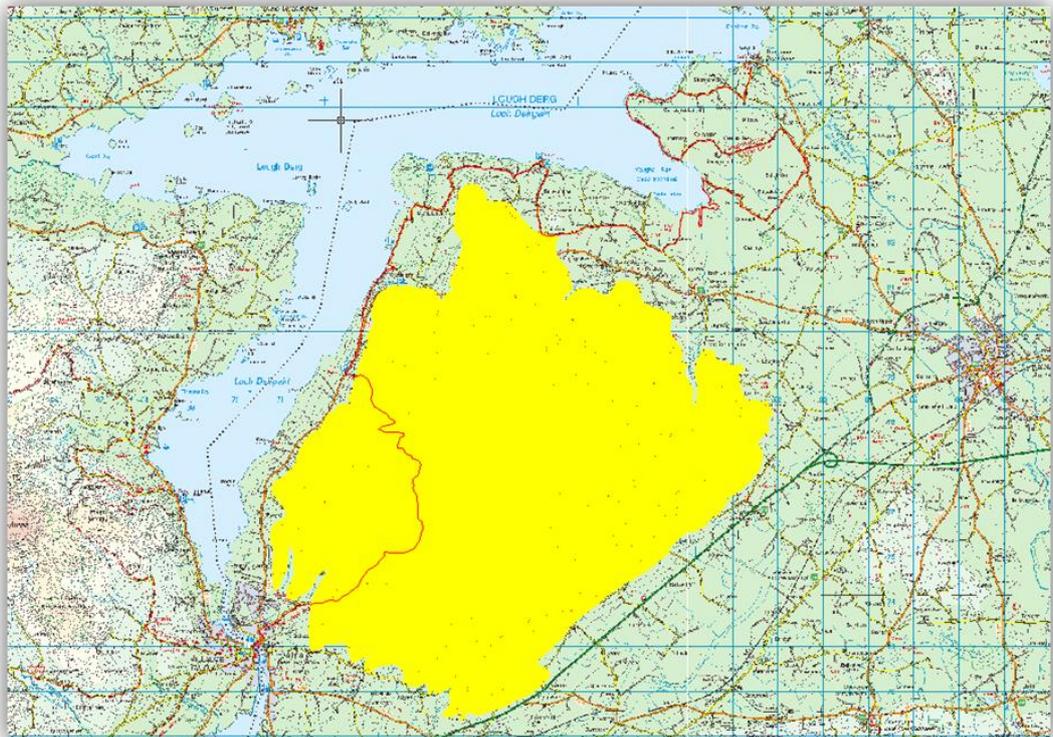


Figure E2-1 Arra Mountain Range with elevation above 100mOD shaded in Yellow (Lake Level 30mOD approx.)

Proximity to a road for both access reasons and pumping station location logistics were used in site selection and a distance of 1km was chosen as the maximum distance from a road. Proximity to housing and developments was also used in the location selection process.

Through this initial assessment, four locations were selected as potential abstraction location:

- Location 1 – Slevoir Bay
- Location 2 – Mota
- Location 3 – Dromineer
- Location 4 – Youghal Bay

The four locations are shown in the following Figure E2-2.

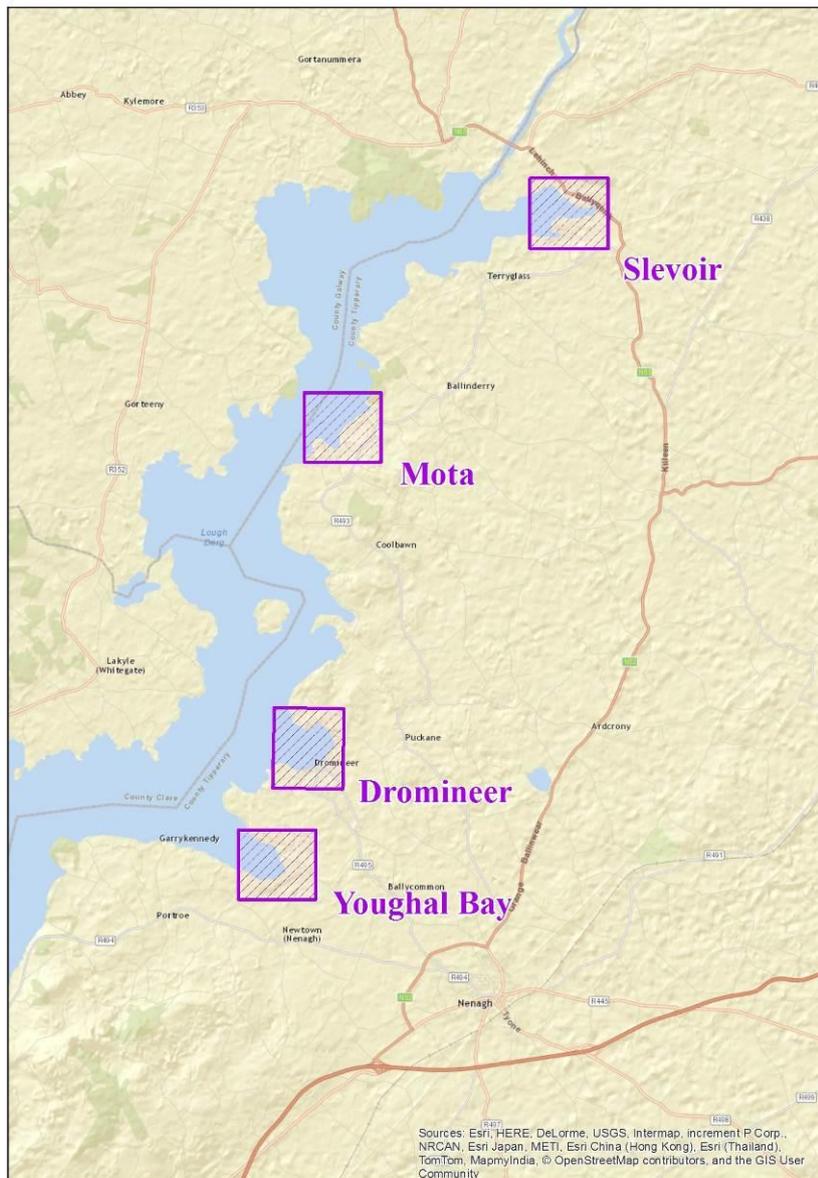


Figure E2-2 Locations of Potential Water Abstraction on Lough Derg

2.1.2 EIA Review

Review of the abstraction locations relied principally on desktop assessment, supported by walkover survey.

Walkover Survey

Following a walkover survey by the engineering specialist, the following high level screening observations are made in respect of the technical criteria applied in 2011:

1 Topography and Elevation:

Table E - 1 Screening Observations

	Slevoir	Mota	Dromineer	Youghal Bay
Shore elevation	Shore at 30mOD Contour	Shore at 30mOD Contour	Shore at 30mOD Contour	Shore at 30mOD Contour
Local topography	Circa 9km ² of adjoining land between 30mOD and 40mOD contour	Land rises from 30mOD to 80mOD over 600m distance from shore	Circa 2.7km ² of adjoining land between 30mOD and 40mOD contour	Circa 5.3km ² of adjoining land between 30mOD and 40mOD contour
	Relatively flat topography for several km's	Relatively flat topography along course of Ballinfinboy River towards Borrisokane	Valley of low topography exists to the north east in the direction of Borrisokane	Relatively flat topography exists in an easterly direction in the direction of the north of Nenagh

Based on a high level preliminary screening of the four identified locations there are no significant topographical or elevation features that would remove any of the identified locations from further consideration at this stage.

2 Access:

Based on a high level preliminary screening of the four identified locations there are no significant access issues that would remove any of the identified locations from further consideration at this stage.

3 Development:

Both the Slevoir Bay and Mota potential locations are remote from urban areas. Dromineer and Youghal Bay have built up areas in close proximity but there are remote areas of the Lough Derg shore available for abstraction in these two locations.

Desktop assessment

Desktop constraint mapping considered the impact of identified environmental constraints on the siting of infrastructure in each of the locations.

This was undertaken in recognition that, regardless of location, any abstraction from Lough Derg will be required to take due regard of the integrity of European sites in the area and their qualifying interests and conservation objectives.

Slevoir Bay

The placement of an abstraction structure at this location would be significantly influenced by the desire to avoid environmental constraints; mapped and detailed below.

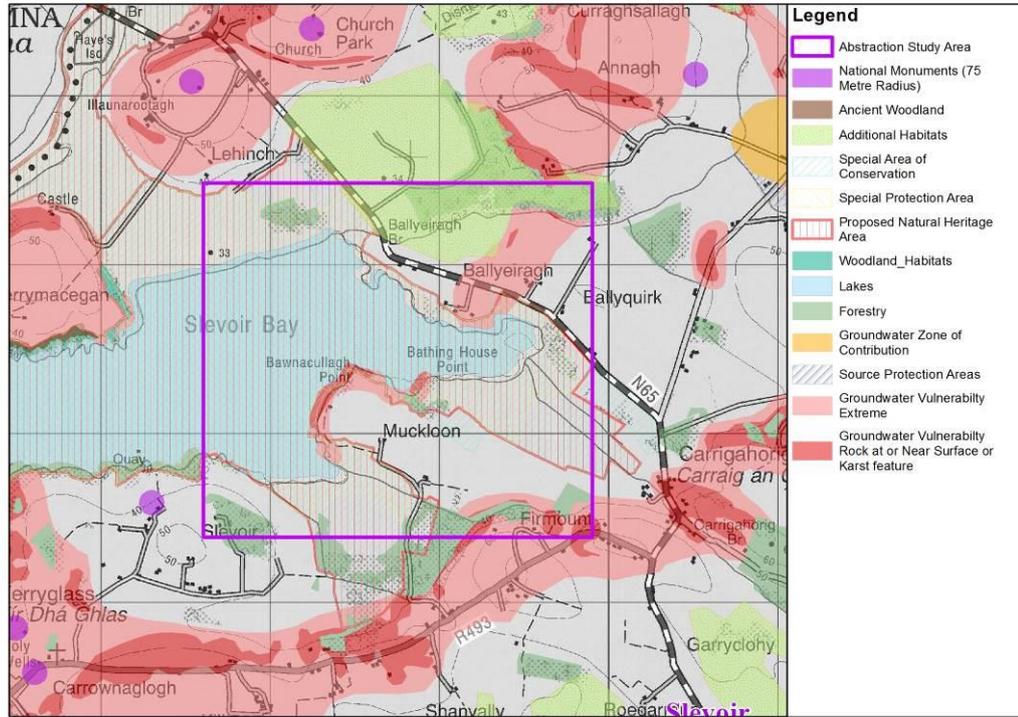


Figure E2-3 Slevoir Bay location

Mota

The placement of an abstraction structure at this location would be significantly influenced by the desire to avoid environmental constraints; mapped and detailed below.

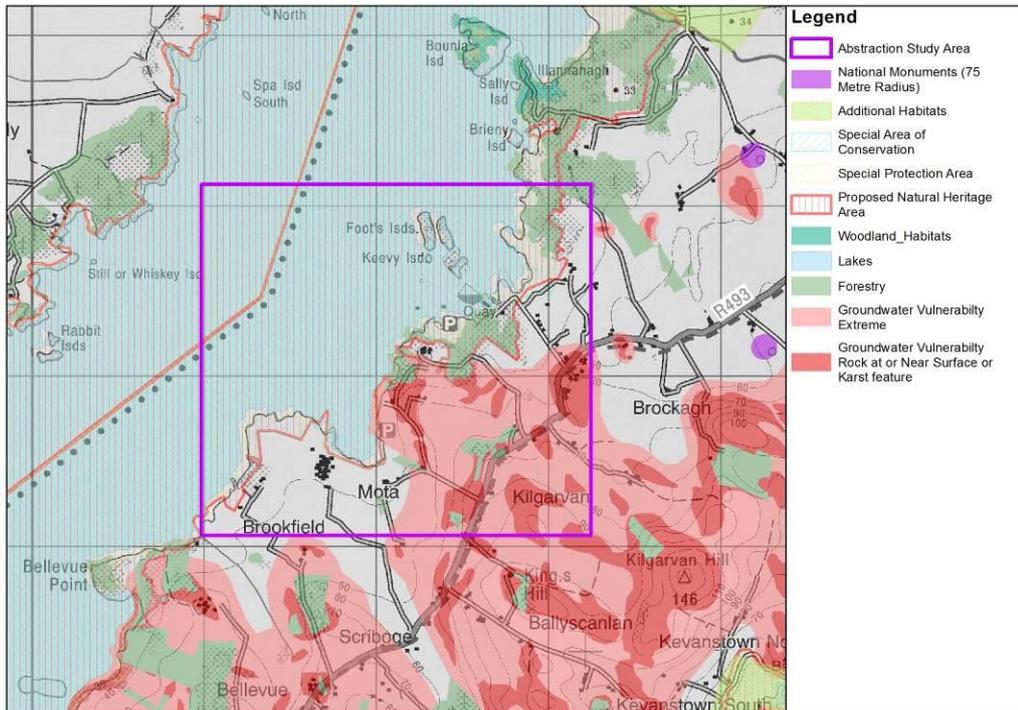


Figure E2-4 Mota Bay Location

Dromineer

The placement of an abstraction structure at this location would be significantly influenced by the desire to avoid environmental constraints; mapped and detailed below.

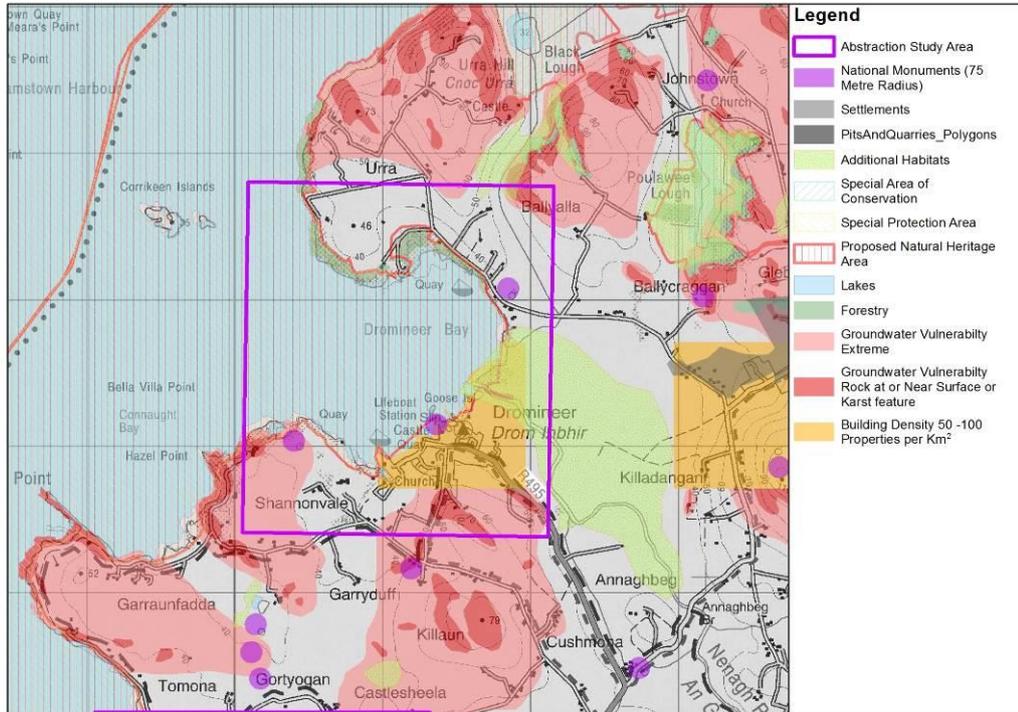


Figure E2-5 Dromineer Location

Youghal Bay

The placement of an abstraction structure at this location would be significantly influenced by the desire to avoid environmental constraints; mapped and detailed below.

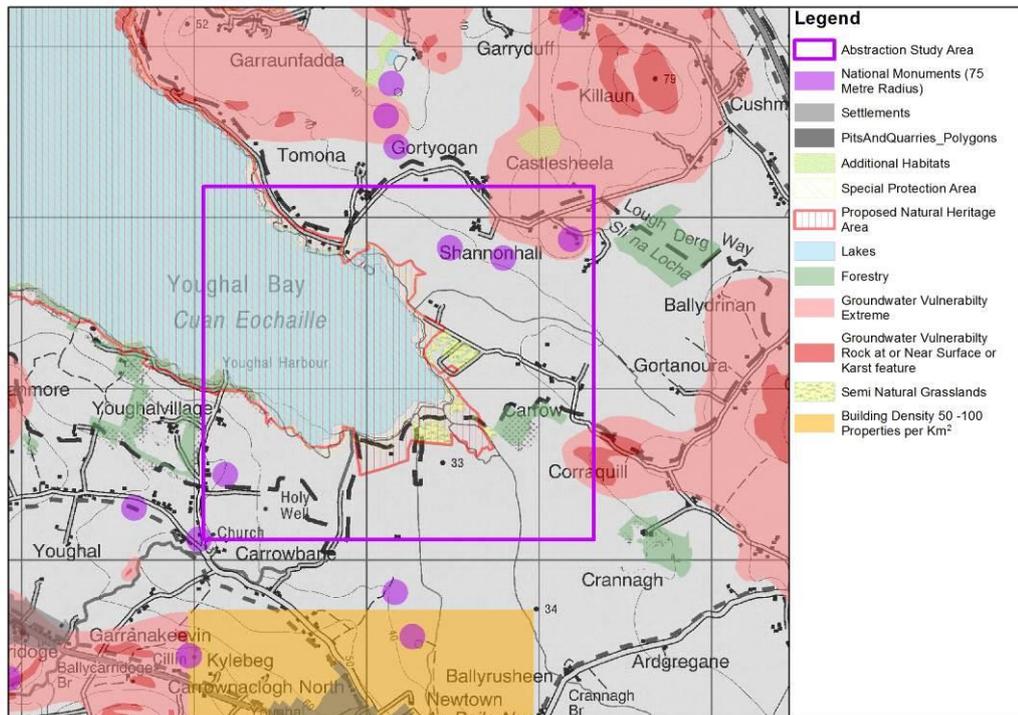


Figure E2-6 Youghal Bay Location

Conclusion

A walkover survey confirmed that the four locations have land parcels of suitable size to accommodate abstraction infrastructure. Subsequent desktop consideration of known environmental constraints within the four locations identified all to be constrained.

Overall, based on a high level preliminary screening of the four identified locations, there are no clear screening criteria that would support removing any location from further consideration as an abstraction location at this stage. Regardless of location, abstraction from Lough Derg will be required to take due regard of the integrity of European sites in the area and their qualifying interests and conservation objectives.

Consequently, the four remaining locations are to be taken forward for MCA to identify a least constrained location.

2.2 Preliminary Screening of the Parteen Basin Location

2.2.1 2008 SEA Phase 2 Environmental Report

An abstraction location was identified as part of the SEA, located to the south eastern part of the Basin. The location is shown in the following Figure E2-7.

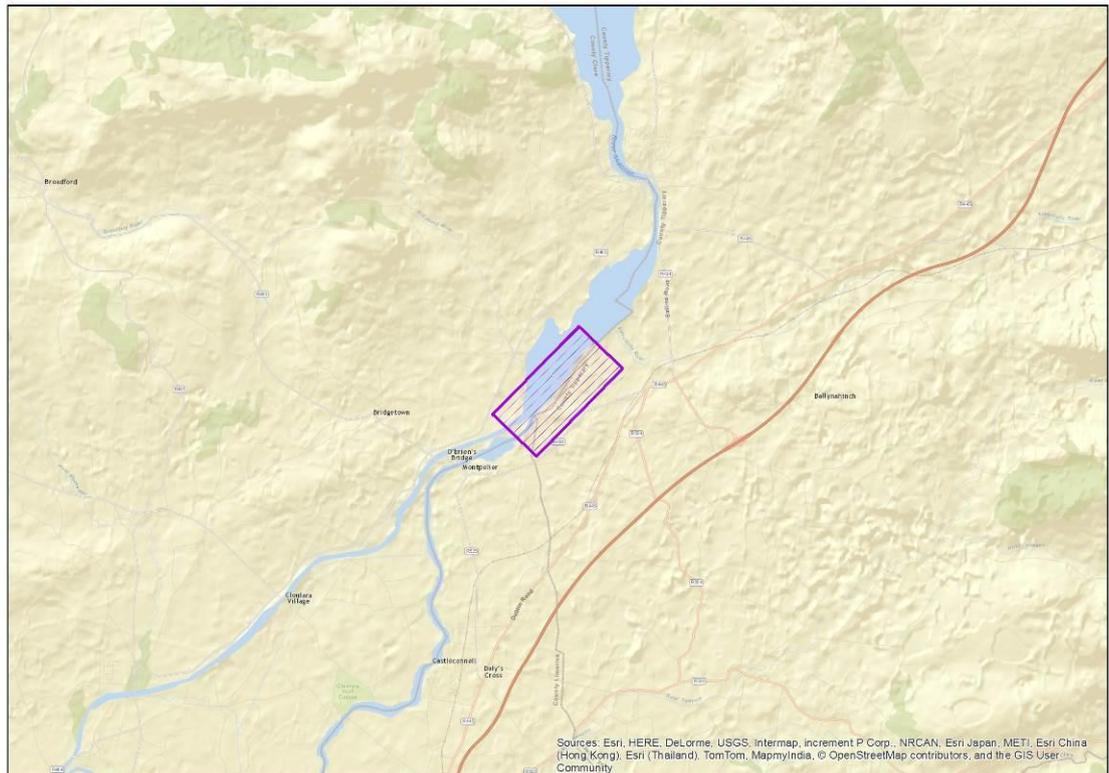


Figure E2-7 Locations of Potential Water Abstraction in Parteen Basin Reservoir

2.2.2 EIA Review

The abstraction area identified in the SEA included the engineering embankments constructed to impound waters upstream of Ardnacrusha power station. The embankments extend approximately 2km along the banks of the Reservoir and are maintained by ESB.

Through recent and ongoing engagement, ESB indicated a preference not to locate the abstraction in any area of Parteen Basin Reservoir that would impact on the stability of these embankments.

To allow the requirements of ESB to be fully considered within a multi-criteria analysis, the area under consideration for the siting of an abstraction structure was revised to encompass all of Parteen Basin Reservoir and its shoreline.

A desktop constraint mapping exercise considered the impact of identified environmental constraints on the siting of infrastructure in the Parteen Basin Reservoir.

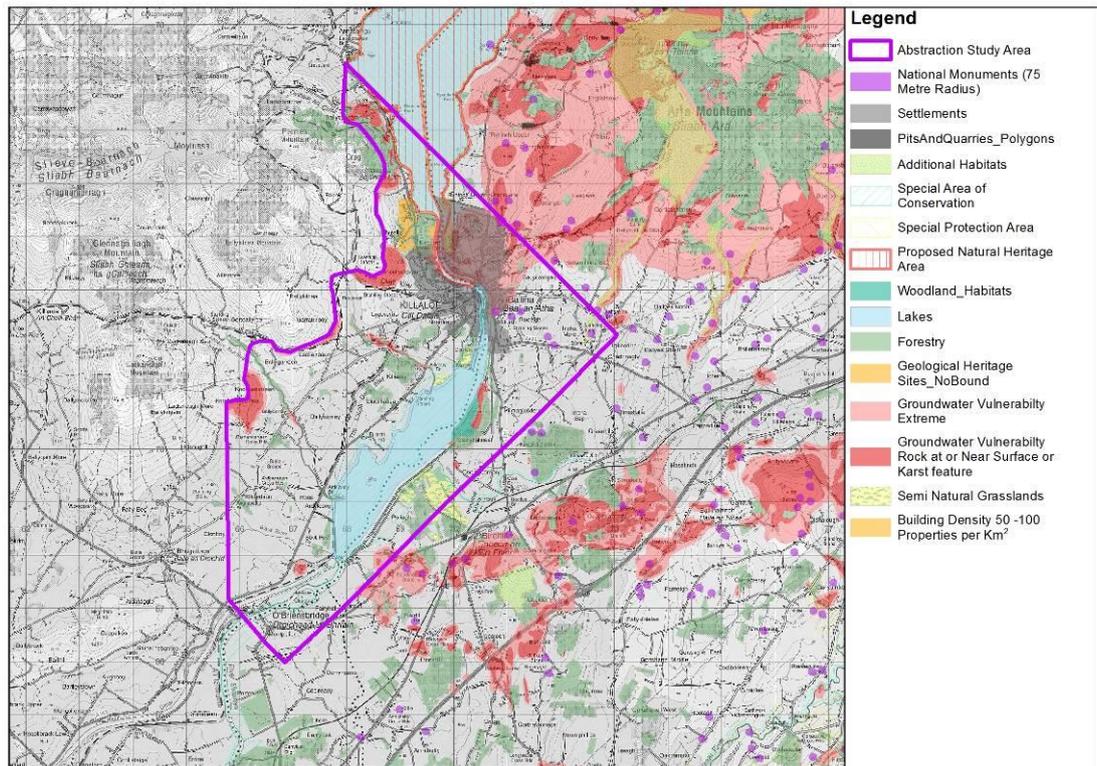


Figure E2-8 Revised Potential Water Abstraction location in Parteen Basin Reservoir

2.2.3 Conclusion

Overall, based on a high level preliminary screening of the Parteen Basin Reservoir and consideration of feedback from affected local stakeholders, the abstraction location to be studied in Parteen basin was expanded to facilitate assessment as an abstraction location for a new source. Abstraction from Parteen basin will be required to take due regard of the integrity of the Lower Shannon SAC and its qualifying interest and conservation objectives.

Consequently the Parteen basin reservoir location will be taken forward for MCA to identify a least constrained location.

2.3 Preliminary Screening the Desalination Sites

2.3.1 Preliminary Report Desalination study (2011)

As part of the SEA, the eastern seaboard near Dublin was examined and a number of potential feasible abstraction locations identified.

8 sites were considered for the location of a Desalination Plant:

1. South Dublin
2. Ringsend
3. Howth Headland
4. Ariella
5. Balbriggan
6. Gormanstown
7. Loughshinny South
8. Loughshinny North

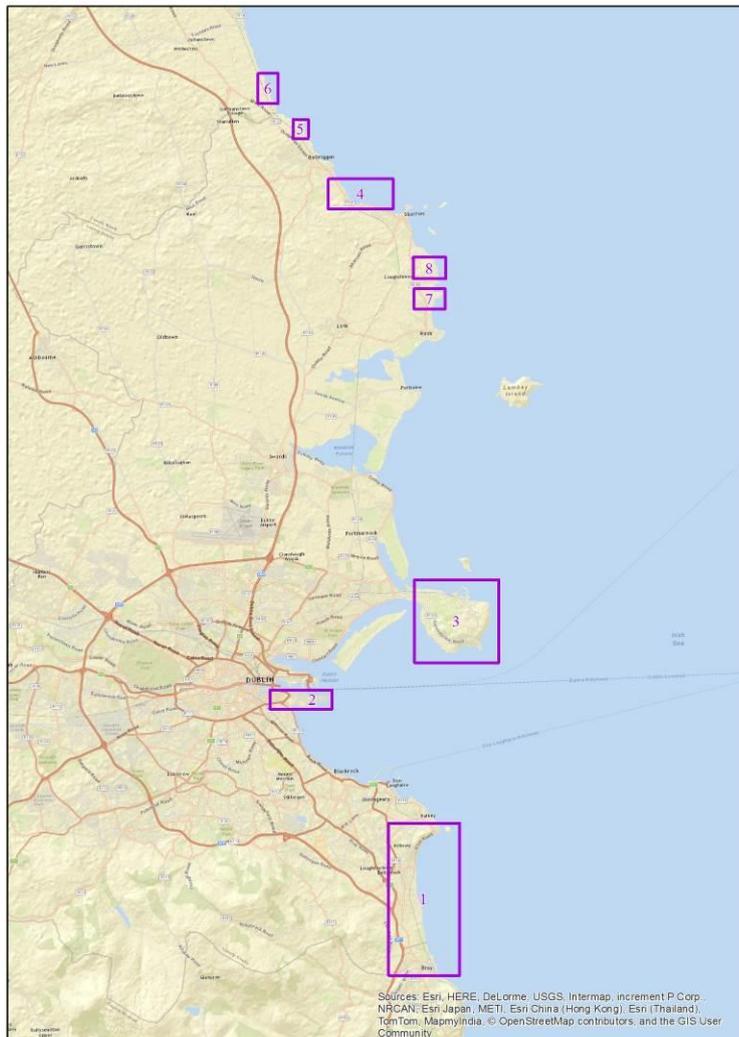


Figure E2-9 Potential Desalination Plant locations

In order to find a suitable location, the 8 sites were evaluated during the SEA in relation to a number of selection criteria. The SEA selection criteria were as follows:

- *Land availability – Suitable location for Desalination Treatment Works including an area of 10-15 hectares required at a coastal location with adequate access.*
- *Water Quality requirements – a consistent water supply with little or no fluctuations in sediment and/or salinity capable of supplying 300MI/d treated water.*
- *Suitable location for abstraction and raw water pumping station. The intake would necessitate the construction of a submerged sea intake..... A land intake structure is required at a level lower than spring low tide level. Bathymetry to be assessed as the intake point to be at a depth of 20m.*
- *Suitable location for outfall pipework to take into consideration the requirement to disperse the effluent discharges associated with the desalination process, including coagulants, antiscalants and brine. The outfall discharge point to be located in a water depth of 15m.*
- *Energy availability...*
- *Feasibility of connection to the electrical supply grid....*
- *Feasibility of connection to the water supply network*
- *Compliance with topography / elevation considerations consistent with the overall design philosophy of minimising pumping energy and optimisation of operational criteria.*
- *Agriculture – number of landowners affected*
- *Residential properties and the approximate distance to nearest populated area*
- *Environmental considerations*
- *Avoidance of Major Natural Constraints – Mountains / Lakes / Forests / Bogs / Mineral Extraction Areas / Rock*
- *Avoidance or minimisation of impacts on:*
 - *Natural Heritage Areas (NHA)*
 - *Special Protection Areas (SPA)*
 - *Special Areas of Conservation (SAC)*
 - *Known Archaeological Sites*
 - *Cultural Heritage Sites*

2.3.2 EIA Review

In review of the SEA selection criteria, land availability was considered to be a principal screening criterion.

The application of this criterion relied on definition of a required footprint for infrastructure.

Through review of technological developments in Desalination since 2011, an upper boundary of 15 Hectare (Ha) was considered to remain a prudent land provision for a Desalination plant of this scale.

Desktop Survey

To inform the assessment of available land (within which to place a 15 Ha Desalination Plant) a desktop constraint mapping exercise was undertaken. This considered the impact of identified environmental constraints on the siting of a Desalination Plant.

Due to the largely developed/semi-developed nature of the eastern seaboard near Dublin, the Geo-directory dataset was also mapped as a current indicator of development in the eastern region.

Location No. 1: South Dublin

The South Dublin Location includes a number of densely urbanised areas, linked by development along the interconnecting road network, with discrete areas of currently undeveloped land interspersed between. While the placement of a desalination plant at this location would be significantly influenced by the desire to avoid environmental constraints; mapped and detailed below, the potential to site a 15Ha plant in this location was confirmed.

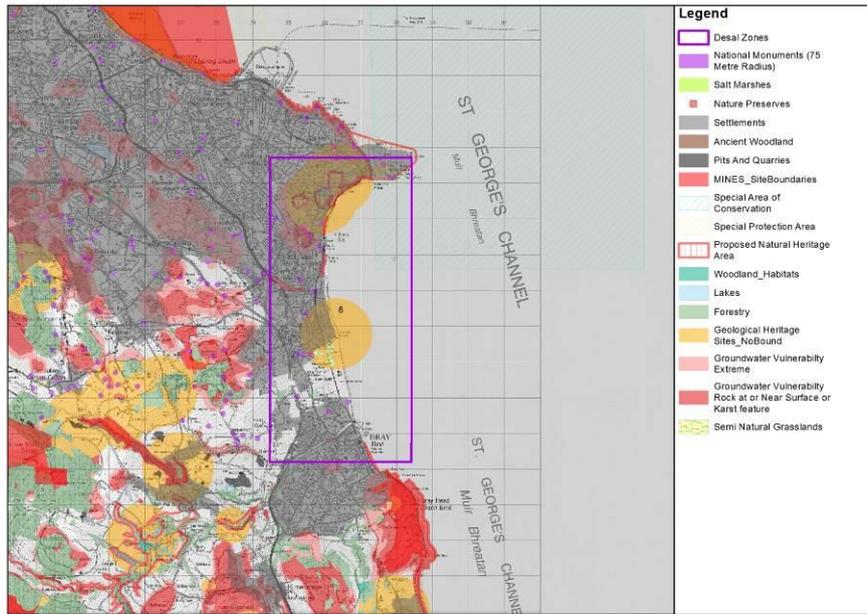


Figure E2-10 South Dublin Location

Location No. 2: Ringsend

The Ringsend Location is currently well developed with a mixture of industrial and residential dwellings. In combination, the density of existing development was found to exclude the potential to construct a 15Ha site at this location.

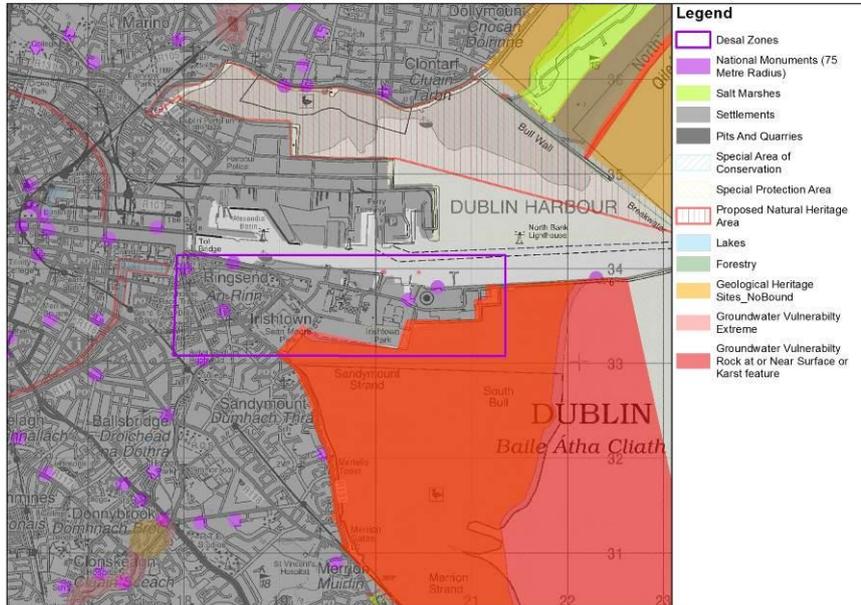


Figure E2-11 Ringsend Location

Location No. 3: Howth Headland

The Howth Headland Location is influenced by residential development banding the upper heights of the headland. The desire to avoid environmental constraints at this location; mapped and detailed below, in combination with the existing footprint of development was found to exclude the potential to construct a 15Ha site at this location.

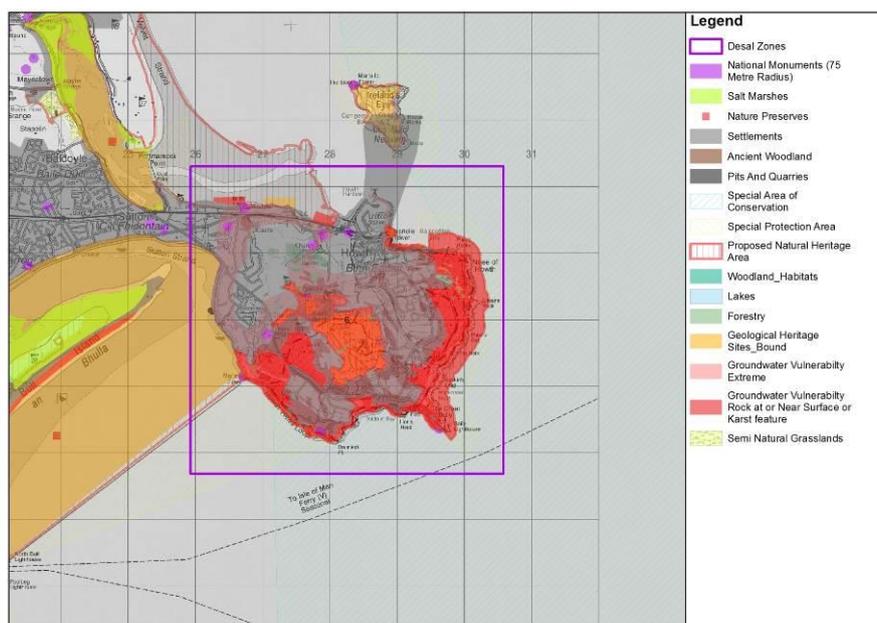


Figure E2-12 Howth Headland Location

Location No. 4: Ardgillan

The Ardgillan Location (No. 4) is relatively undeveloped with remote sites available. However, the desire to avoid environmental constraints at this location; mapped and detailed below, in combination with the impact of the railway line was found to exclude the potential to construct a 15Ha site at this location.

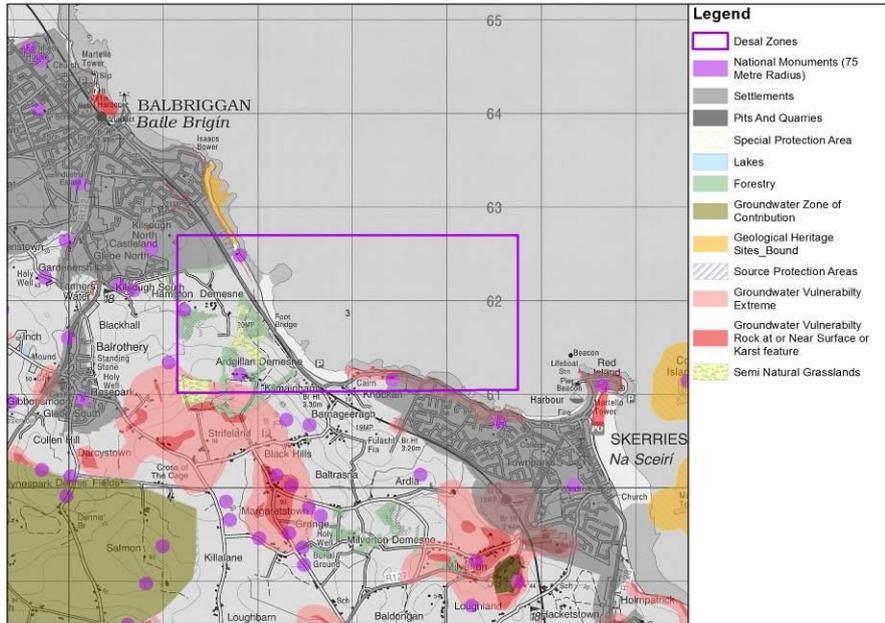


Figure E2-13 Ardgillan Location

Location No. 5: Balbriggan

The Balbriggan Location (No. 5) is primarily a Greenfield site, partitioned to a degree by the Dublin-Drogheda railway line. While the placement of a desalination plant at this location would be significantly influenced by the desire to avoid environmental constraints; mapped and detailed below, the potential to site a 15Ha plant in this location was confirmed.

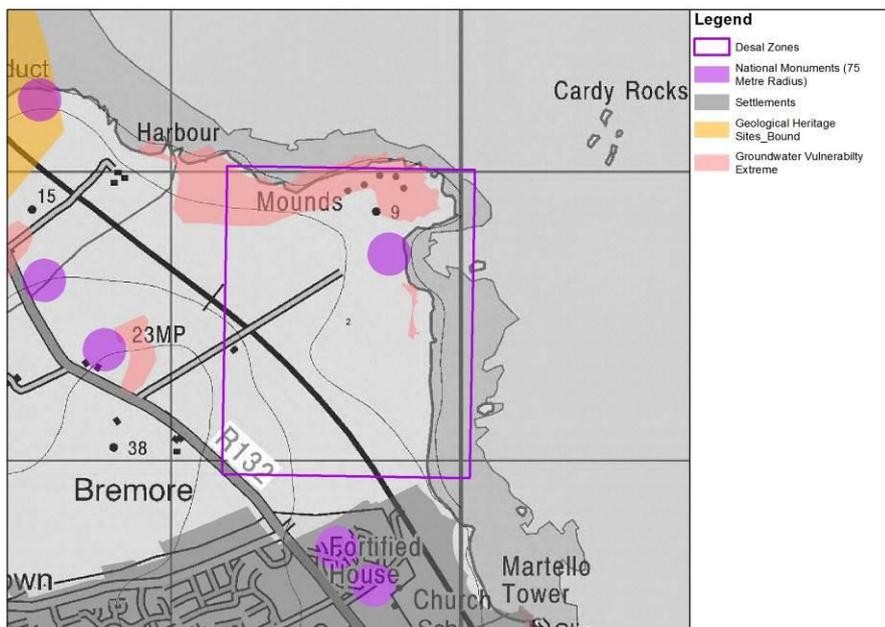


Figure E2-14 Balbriggan Location

Location No. 6: Gormanstown

The Gormanstown Location (No. 6) is primarily a Greenfield site, partitioned to a significant degree by the Dublin-Drogheda railway line. The desire to avoid environmental constraints at this location; mapped and detailed below, was found to exclude the potential to construct a 15Ha site at this location.

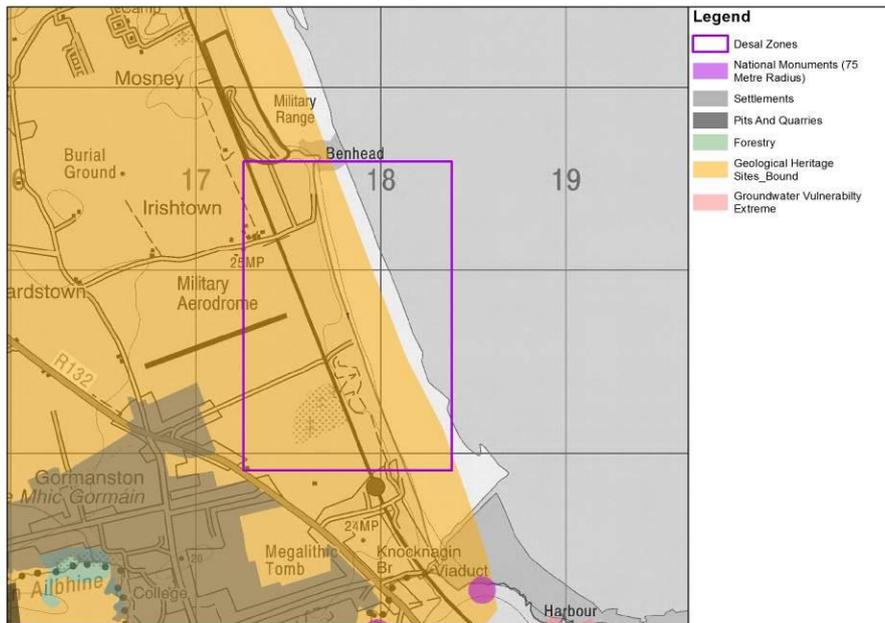


Figure E2-15 Gormanstown Location

Location No. 7: Loughshinny South

The Loughshinny South Location (No. 7) is bounded in its western extent by residential development. While the placement of a desalination plant at this location would be significantly influenced by the desire to avoid environmental constraints; mapped and detailed below, the potential to site a 15Ha plant in this location was confirmed.

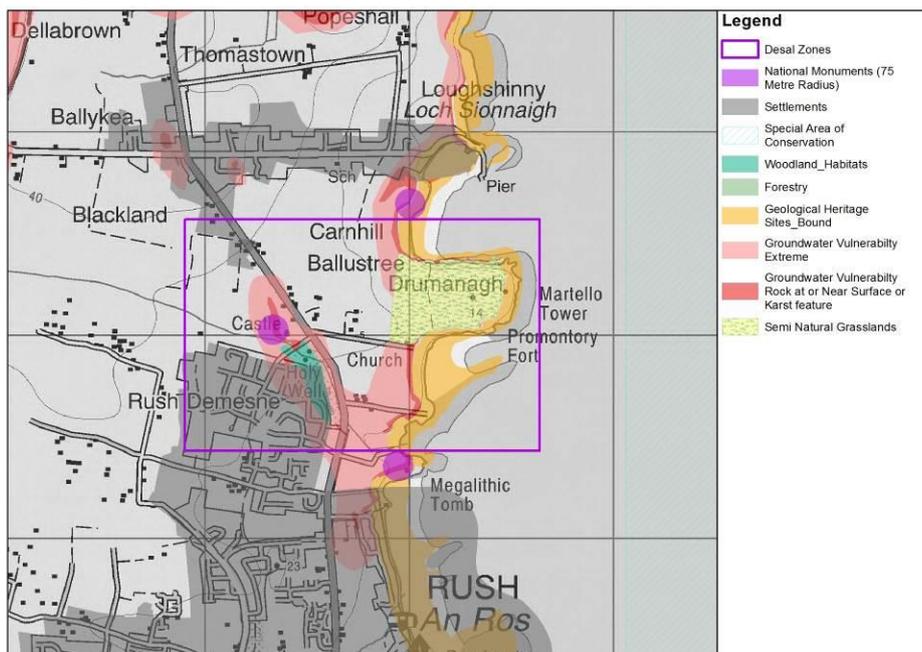


Figure E2-16 Loughshinny South Location

Location No. 8: Loughshinny North

The Loughshinny North Location (No. 8) is largely free from development. While the placement of a desalination plant at this location would be significantly influenced by the desire to avoid environmental constraints; mapped and detailed below, the potential to site a 15Ha plant in this location was confirmed.

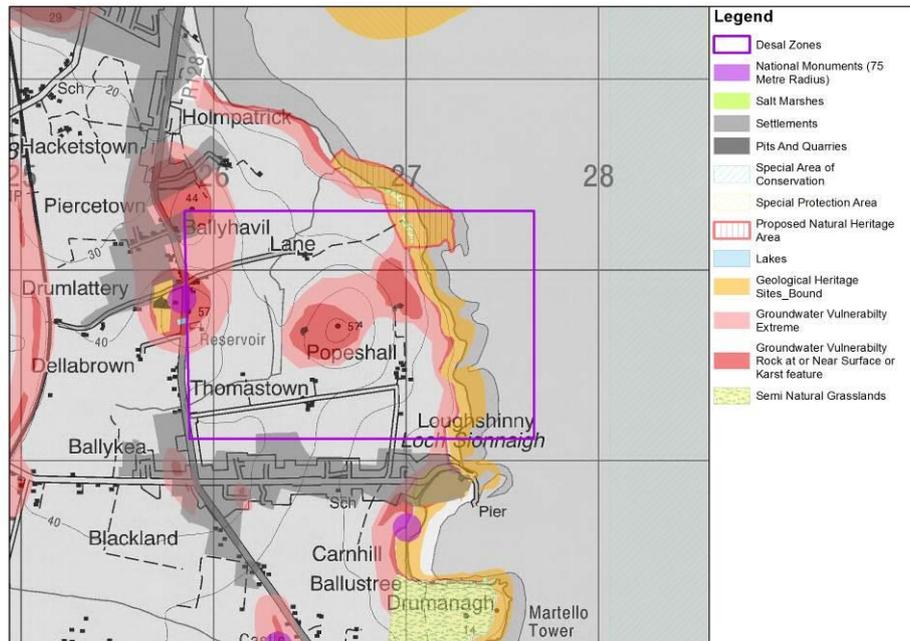


Figure E2-17 Loughshinny North Location

2.3.3 Conclusion

Desktop consideration of known environmental constraints within the eight locations identified all sites to be influenced by environmental constraints.

The desire to minimise the impact on environmental constraints by setting aside more heavily constrained locations, where other options exist, excluded the potential to construct a 15ha site at four locations.

Overall, based on a high level preliminary screening of the eight identified locations, four locations were removed from further consideration as abstraction locations at this stage.

These were:

- Location No. 2: Ringsend
- Location No. 3: Howth Headland
- Location No. 4: Ardgillan
- Location No. 6: Gormanstown

Consequently, the four remaining locations are to be taken forward for MCA to identify a least constrained location.

Water Supply Project Eastern and Midlands Region (WSP)

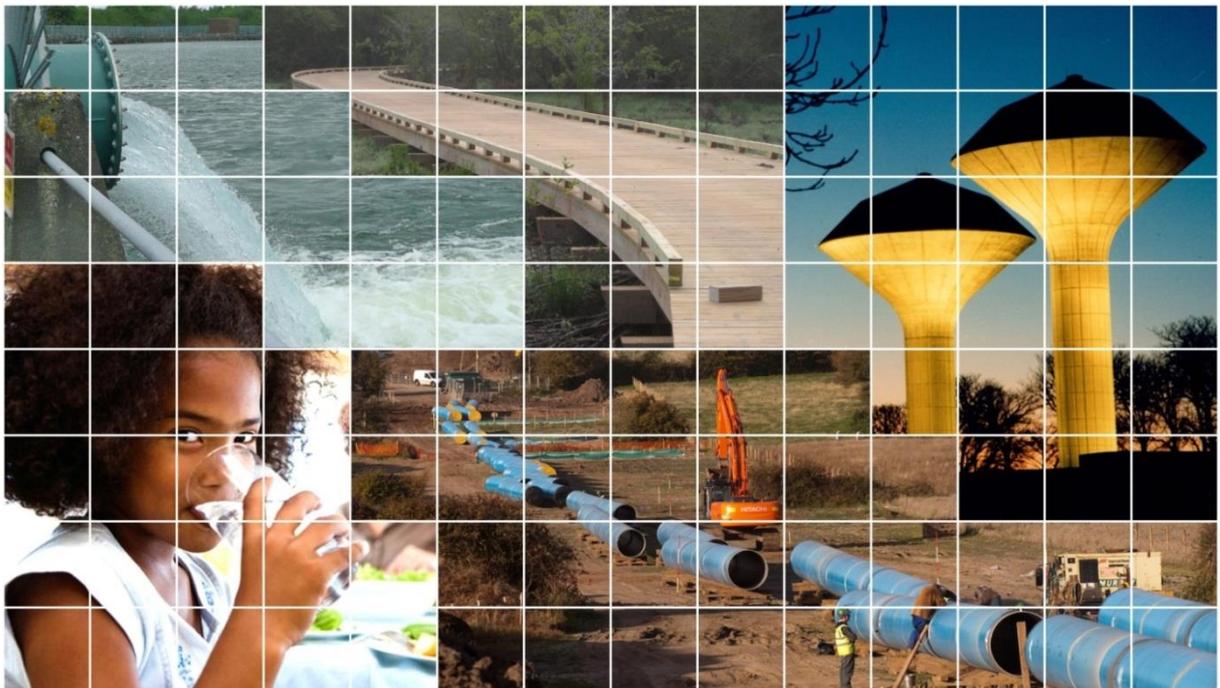
Abstraction Location MCA

Appendix E3: Ecology (Terrestrial)



October 2015

F02



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1.1 Introduction

Four reasonable alternative options have been identified from previous studies – refer to the *Water Supply Options Working Paper* (Project Road Map Stage 2). These are reconfirmed below.

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)
- Option H (Desalination)

This report describes the decision making process used to appraise the abstraction locations associated with each of the reasonable alternative options.

To undertake the appraisal of abstraction locations a range of specialists were engaged, in their applicable fields, to conduct a comparative assessment of abstraction locations. The following disciplines were engaged:

- i. **Ecology** – the consideration of impact on animals, plants and their environment.
- ii. **Water** – the consideration of impacts on the surface water environment.
- iii. **Air and Noise** - the consideration of air and noise pollution
- iv. **Cultural Heritage** - the consideration of existing archaeological and built heritage
- v. **Soils, Geology and Hydrogeology** – the consideration of impact on soils, geology and hydrogeology.
- vi. **Landscape and visual** – the consideration of landscape and visual impact.
- vii. **Agronomy** – the consideration of impact on land based enterprise.
- viii. **People** – the consideration of impacts on people
- ix. **Planning** – the consideration of planning and land use policy in relation to proposed works
- x. **Engineering** - the consideration of technical challenges associated with proposed works.
- xi. **Traffic** - the consideration of impact on traffic and road network

The specialists independently assessed each location relative to appraisal criteria applicable to their field of expertise. This process, or methodology, is referred to as Multi-Criteria Analysis and explicitly considers multiple criteria (see Table E3 - 1), within a decision-making environment.

Environmental Criteria	Technical Criteria	Risk Criteria
Biodiversity, Flora and Fauna	Safety	Technical Risk relating to the Source
Fisheries	Planning Policy	Technical Risk relating to Infrastructure and Operations
Water	Engineering and Design	Environmental and Planning Risk
Air/Climatic Factors	Capital and Operational Costs	Financial Risk
Material Assets (Energy)	Sustainability	Socio-economic risk
Cultural Heritage (including Architecture & Archaeology)	-	-
Landscape & Visual	-	-
Material Assets (Land use)	-	-
Tourism	-	-
Population	-	-
Human Health	-	-
Soils, Geology and Hydrogeology	-	-

Table E3 - 1 Appraisal Criteria

The assessments are presented as individual statements within this Appendix E.

This Appendix E3 is a statement on the specialism Ecology (Terrestrial) and describes the decision making process used in identifying the least constrained raw water abstraction locations associated with the options listed above.

The Site Selection Methodology in Appendix B outlines the process employed in identifying least constrained locations. This report should be read in conjunction with the *Site Selection Methodology*.

1.2 Methodology

This is ‘Non-linear Site Methodology – Step 1’ as described in the *Site Selection Methodology*.

To determine effectively the least constrained abstraction location from the identified options, each location was assessed under nineteen Ecology sub-criteria, eleven of which are assessed in this report Ecology - Terrestrial. The remaining aquatic sub-criteria are assessed (along with overlapping sub-criteria between both terrestrial and aquatic ecology) within the Aquatic Ecology report in Appendix E4. The eleven sub-criteria used for assessment within this report are as follows:

- Potential to impact on European Sites (candidate Special Areas of Conservation – cSAC and Special Protection Areas - SPA)
- Potential to impact on Natural Heritage Areas (NHA) and proposed Natural Heritage Areas (pNHA)
- Potential impact to Annex I listed habitats¹ (designated)

¹ The term “Annex I habitats” refers to those listed in Annex I of the Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora, often referred to as “The Habitats Directive”.

- Potential impact to Annex I listed habitats (non-designated)
- Potential to impact high ecological value habitats (semi-natural habitats)
- Potential to impact on protected Flora - Flora Protection Order
- Potential to impact on Annex II species²
- Potential to Impact on Annex IV species³ (wherever they occur)
- Potential to impact on the breeding / wintering habitat for Annex I birds species⁴ and other qualifying interest bird species
- Potential to impact flora and fauna protected under Wildlife Acts e.g. Birds, Badger
- Potential to impact marine/coastal birds

1.2.1 Supporting studies

A desk study exercise of the potential abstraction locations was carried out using the software package *ArcReader*. The supplied datasets and information are as described in the *Site Selection Methodology*.

The desk study also included review of existing databases including in particular National Parks and Wildlife Service database⁵. This enabled a review of records of rare and protected flora and fauna and a review of European Sites and an assessment of those with links to the proposed development.

The desk study was supported by preliminary field surveys⁶ conducted throughout winter 2014 into summer 2015 to identify concentrations of birds and note / validate the presence of potentially noteworthy habitats identified during the desk study, in particular wetlands including groundwater-dependent habitats in the vicinity of all of the five proposed abstraction locations.

1.2.2 Categories of impact

The relative analysis of potential locations to define a “least constrained” location is based upon a subjective assessment by each Specialist in their discipline of expertise. This judgement is presented as a weighted impact; colour coded for ready identification.

2 The term “Annex II species” refers to those listed in Annex II of the Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora, often referred to as “The Habitats Directive”.

3 The term “Annex IV species” refers to those listed in Annex IV of the Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora, often referred to as “The Habitats Directive”.

4 The term “Annex I bird species” refers to those listed in Annex I of the Council Directive 2009/147/EC on the Conservation of Wild Birds, often referred to as “The Birds Directive”.

5 National Parks and Wildlife Service www.npws.ie

6 Further detailed field surveys will be undertaken at subsequent stages of the design process.

Very high	Dark blue
High	Blue
Mid-range	Green
Low	Light Green
Very low	Cream

Considered in the assessment are potential impacts to ecological receptors including;

- designated sites (cSAC, SPA, NHA and pNHA);
- protected flora species;
- birds and other fauna; and
- lake fringing wetlands, terrestrial/wetland habitats and species.

2.1 Locations

An assessment of the potential abstraction locations was carried out for the following options:

- Lough Derg: Slevoir Bay, Mota, Dromineer and Youghal (Option B - North East Lough Derg Direct and F2 - North East Lough Derg with Storage)
- Parteen Basin (Option C - Parteen Basin Reservoir Direct)

2.1.1 Designated Sites

Lough Derg is designated as Lough Derg pNHA (site code 000011) and Lough Derg (Shannon) SPA (IE004058), with the north eastern corner designated as Lough Derg, North-east Shore cSAC (Site Code: IE002241).

Parteen Basin is designated as Lough Derg (Shannon) SPA (IE004058).

Lough Derg and Parteen Basin are both recorded as an Annex I habitat *Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.* [3140]. This habitat is not a Qualifying Interest of either Lough Derg, North-east Shore SAC or the Lower River Shannon SAC. However the entirety of the wetland is a Special Conservation Interest of the Lough Derg (Shannon) SPA, under “wetlands”.

Lough Derg pNHA [000011]⁷

Lough Derg pNHA encompasses the whole of Lough Derg lake from Portumna to Killaloe/Ballina. The site is noted to be of significant ecological interest, and includes examples of six habitats that are listed on Annex I of the E.U. Habitats Directive. Four of these are priority habitats, i.e. *Cladium* fen, alluvial woodland, Yew woodland and limestone pavement; other annexed habitats present include alkaline fen and Juniper scrub formations on heath and calcareous grasslands. The priority habitats are found mainly at the north and north-east of the lake. *Cladium* fen occurs occasionally along the lake margins, mainly in association with alkaline fens, Common Reed (*Phragmites australis*) and other swamp vegetation. Some of the finest examples of Juniper (*Juniperus communis*) formations in Ireland occur along the lake edge. In places along the lake shore Juniper forms a mosaic with Black Bog-rush (*Schoenus nigricans*) and Great fen-sedge *Cladium mariscus* fen with many of the islands supporting significant Juniper cover. Other habitats present within the site include wooded islands, semi-natural deciduous woodland, callow grasslands and improved grassland, the latter being of particular importance for feeding by waterfowl.

This is the only known site for Red Data Book species Irish Fleabane (*Inula salicina*), protected under the Flora (Protection) Order, 1999. The site also hosts Marsh Pea (*Lathyrus palustris*) and a charophyte (*Chara tomentosa*), both Red Data Book species.

⁷ National Parks and Wildlife Service (2004). Lough Derg Site Synopsis (Site Code: 000011)

Lough Derg is an important site for both breeding and wintering birds. The site supports a nationally important breeding colony of Common Tern and breeding pairs of White-tailed Sea Eagle, with large numbers of Black-headed gull and Cormorant also present. In winter, the lake is important for a range of waterfowl species, especially diving ducks, with nationally important populations of Tufted Duck, Goldeneye and Mute Swan. An area of the lake close to Portumna Forest Park is a Wildfowl Sanctuary. The site is also used by Greenland White-fronted Goose and Whooper Swan.

Three species of lamprey are known to occur including a landlocked population of Sea Lamprey (*Petromyzon marinus*). Brook Lamprey (*Lampetra planeri*) is known to be common in the lower River Shannon catchment where all three Irish Lamprey species breed. The endangered fish, Pollan (*Coregonus autumnalis pollan*) is recorded from Lough Derg, one of only four sites in which it occurs. Atlantic Salmon (*Salmo salar*) use the lake and its tributaries as a spawning ground. White-clawed Crayfish (*Austropotamobius pallipes*), is found in many of the rivers which feed into the eastern edge of the lake. The site hosts a range of invasive species including Zebra Mussel (*Dreissena polymorpha*) which has been linked to an improvement in water quality.

Lough Derg, North-east Shore SAC [IE002241]⁸

Lough Derg, North-east Shore SAC encompasses the northern and north eastern corner of Lough Derg and the eastern section of the lake from Portumna southwards to Meelick, north of Dromineer

The Qualifying Interests of the European Site are listed below:

- 5130 *Juniperus communis* formations on heaths or calcareous grasslands
- 7210 Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* (priority habitat⁹)
- 7230 Alkaline fens
- 8240 Limestone pavements (priority habitat)
- 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) (priority habitat)
- 91J0 *Taxus baccata* woods of the British Isles (priority habitat)

Lough Derg (Shannon) SPA [IE004058]¹⁰

Lough Derg (Shannon) SPA encompasses Lough Derg and Parteen Basin in their entirety, stretching from Portumna to the outlet of Lough Derg, north of Killaloe/Ballina.

The Special Conservation Interests of Lough Derg (Shannon) SPA are listed below.

- Cormorant (*Phalacrocorax carbo*) [A017] (Breeding & Wintering)
- Tufted Duck (*Aythya fuligula*) [A061] (Wintering)

⁸ National Parks and Wildlife Service (2015). Conservation Objectives for Lough Derg North-east Shore SAC 002241.

⁹ Priority Habitats are a sub-set of the Annex I habitat types which Article 1(d) of the Habitats Directive defines as 'natural habitat types in danger of disappearance' for whose conservation the European Union has 'particular responsibility' (ECJ CASE C-258/11): <http://curia.europa.eu/juris/celex.jsf?celex=62011CJ0258&lang1=en&type=TXT&ancre=>

¹⁰ National Parks and Wildlife Service (2015). Conservation Objectives for Lough Derg (Shannon SPA) 004058.

- Goldeneye (*Bucephala clangula*) [A067] (Wintering)
- Common Tern (*Sterna hirundo*) [A193] (Breeding)
- Wetland and Waterbirds [A999]

SPAs are primarily chosen if they are a) regularly used by 1% or more of the all-Ireland population of a listed (i.e. Annex 1) species or b) regularly used by 1% or more of the biogeographical population of a migratory species or c) regularly used by more than 20,000 waterfowl.

Lower River Shannon cSAC [IE002165]¹¹

The Lower River Shannon cSAC extends from the mouth of the Shannon at Kerry and Loop Head to Killaloe/Ballina in Co. Clare and Co. Tipperary. The Qualifying Interests of the Lower River Shannon SAC are listed below:

- Sandbanks which are slightly covered by sea water all the time [1110]
- Estuaries [1130]
- Mudflats and sandflats not covered by seawater at low tide [1140]
- Coastal lagoons [1150] (priority habitat)
- Large shallow inlets and bays [1160]
- Reefs [1170]
- Perennial vegetation of stony banks [1220]
- Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]
- *Salicornia* and other annuals colonising mud and sand [1310]
- Atlantic salt meadows (*Glauco-Puccinellietalia maritima*) [1330]
- Mediterranean salt meadows (*Juncetalia maritimi*) [1410]
- *Tursiops truncatus* (Common Bottlenose Dolphin) [1349]
- *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029]
- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation [3260]
- Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) [91E0] (priority habitat)
- *Lutra lutra* (Otter) [1355]
- *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410]
- *Petromyzon marinus* (Sea Lamprey) [1095]
- *Lampetra planeri* (Brook Lamprey) [1096]
- *Lampetra fluviatilis* (River Lamprey) [1099]
- *Salmo salar* (Salmon) [1106]

¹¹ National Parks and Wildlife Service (2012). Conservation Objectives Series: Lower River Shannon SAC 002165, Version 1.

2.1.2 Slevoir



Figure E3 – 1 Lough Derg - Slevoir

This extensive bay is characterised by relatively undisturbed and extensive fringing wetlands and semi-natural woodlands with the area immediately surrounding the lake largely undeveloped, with limited access to the lake edge. The terrestrial area is dominated by managed agricultural grasslands interspersed with treelines and wetland habitats. Extensive reedbeds are located around the lake edge. Low densities of widely distributed qualifying bird species nest and winter all around the shoreline. Slevoir Bay is included within Lough Derg North-east Shore cSAC, Lough Derg (Shannon) SPA, and Lough Derg pNHA, with these designations overlapping

onto terrestrial habitats. The lake in this bed is noted to be relatively shallow at the northern end being mostly 6 m in depth⁷.

Any works in this area will result in direct and indirect impacts, including the removal of habitats, and probable permanent adverse effects on sensitive SAC feature of interest, and other high value habitats. In particular, *Cladium* and alkaline fens (SAC - features of interest), likely occur here. These habitats are very sensitive to possible effects of this development.

In general it will be difficult to show no adverse effects at Slevoir Bay without long term and extensive baseline ecological studies. In particular, studies will be required of lake, littoral zone and transitional wetland ecology (e.g. fens) and the bird species using these wetland habitats. Mitigation by avoidance or reduction through fully informed ecology surveys can reduce impacts by informing project design and appropriate locations for the development. However, it is still highly likely that residual adverse effects will occur as Annex 1 (SAC – feature of interest) and other high value habitats fringe the entire bay, and likely cannot be avoided.

This is the least favourable Lough Derg option. Permanent adverse effects (habitat reduction within a SAC), are likely to fringing wetland and woodland habitats located, extensive areas of which are likely to be Annex 1 (SAC – feature of interest) habitats. Potential localised but long term disturbance effects would likely also arise to birds within the SPA, associated with the development. In addition to these quantifiable effects, there will be probable changes to water levels (shallow bay) and water quality, which would result in uncertain risks to birds and fringing wetlands.

Mitigation by reduction, fully informed by site surveys can reduce but not avoid these development effects. Residual uncertainty regarding water level and water quality changes and associated effects to ecological receptors will arise.

2.1.3 Mota



Figure E3 – 2 Lough Derg - Mota

This area is dominated by managed agricultural grassland with large areas of woodland. The area immediately surrounding the lake is largely undeveloped but there is a marina located to the southern section of the study area. The lake area is included within designated sites (including Lough Derg SPA and Lough Derg North-east Shore cSAC and Lough Derg pNHA). Lake edge habitats are dominated by a mix of extensive reedbeds and woodlands. Such woodland habitats have potential to host pockets of priority Annex I alluvial woodland habitat for which Lough Derg (Shannon) cSAC is designated. An area of Juniper habitat (also an Annex I qualifying interest habitat of the cSAC) is located northeast of the study area¹², and potential exists for this habitat to occur in small pockets elsewhere in the area.

¹² Habitat identified during desktop study using data provided from NPWS (2015).

Low densities of widely distributed qualifying bird species nest and winter all around the shoreline. Any works in this area will result in direct and/or indirect permanent impacts to shoreline habitats with potential risk to qualifying interest habitats including fens and alluvial woodlands. Some sensitive semi-natural wooded areas could be avoided through good design but it may be difficult to show no effects long term without extensive and long term baseline ecological studies in particular of wetland ecology.

Permanent adverse effects (habitat reduction within SAC), may arise to fringing woodland and lakeshore wetland habitats located within Lough Derg SAC, some of which is likely to be Annex I qualifying interest habitat. Potential localised but long term disturbance effects may also arise to birds within the SPA, associated with the development. In addition to these quantifiable effects, there will be probable changes to water levels (shallow bay) and water quality, which would result in uncertain risks to birds and fringing wetlands.

Mitigation by avoidance or reduction, fully informed by site surveys can reduce these development effects. Residual uncertainty regarding water level and water quality changes and associated effects to ecological receptors will arise.

2.1.4 Dromineer



Figure E3 – 3 Lough Derg - Dromineer

This area is dominated by managed agricultural grassland with a fringe of wetland and woodland habitat along the shoreline. Dromineer quay is well developed with artificial and imported surfaces along the lake forming a yacht club, marinas, promenades, mix of residential and commercial buildings and cobbles for a lake edge habitat.

Low densities of widely distributed qualifying bird species nest and winter all around the shoreline. The lake and a proportion of the terrestrial habitat is included within

Lough Derg (Shannon) SPA and Lough Derg pNHA. The Nenagh River discharges into Lough Derg at this location. Strips of fringing woodland and wetland habitats are associated with the lake edge in undeveloped areas.

Any works in this area will cause unavoidable direct impacts to lake edge and terrestrial habitats including loss/disturbance to such habitats, with potential for adverse effects on sensitive qualifying interests at least in the short to mid-term. It will be difficult to show no adverse effects long term without extensive and long term baseline ecological studies, in particular regarding the lake ecology and relevant species which characterise this qualifying habitat.

Permanent adverse effects (habitat reduction within SAC), may arise to fringing woodland and lakeshore wetland habitats located within Lough Derg SAC, some of which is likely to be Annex I qualifying interest habitat. Potential localised but long term disturbance effects may also arise to birds within the SPA, associated with the development. In addition to these quantifiable effects, there will be probable changes to water levels (shallow bay) and water quality, which would result in uncertain risks to birds and fringing wetlands.

Mitigation by avoidance or reduction, fully informed by site surveys can reduce these development effects. Residual uncertainty regarding water level and water quality changes and associated effects to ecological receptors will arise.

2.1.5 Youghal



Figure E3 – 4 Lough Derg - Youghal

The surrounding terrestrial habitats at the Youghal abstraction location are dominated by managed agricultural grassland dissected with treelines and patches of woodland. A narrow fringe of wetland and woodland habitat is located along the shoreline. The Newtown River, Youghal Stream and Ardgregane Stream discharge into Youghal Bay. The lake and a proportion of the terrestrial habitat (mainly fringe

and wetland habitats) are included within Lough Derg (Shannon) SPA and Lough Derg pNHA.

Low densities of widely distributed qualifying bird species nest and winter all around the shoreline. Known areas of Annex I semi-natural grassland (*Molinia meadows* 6410) are located around the Bay with high potential for unknown additional areas. Any works in this area may cause unavoidable direct impacts to lake edge and terrestrial habitats including loss/disturbance to such habitats, with potential for adverse effects on sensitive qualifying interests. It will be difficult to show no adverse long-term effects without extensive and long term baseline ecological studies, in particular regarding lake ecology and relevant species which characterise this qualifying habitat.

Permanent adverse effects (habitat reduction within SAC), may arise to fringing woodland and lakeshore wetland habitats located within Lough Derg SAC, some of which is likely to be Annex I qualifying interest habitat. Potential localised but long term disturbance effects may also arise to birds within the SPA, associated with the development. In addition to these quantifiable effects, there will be probable changes to water levels (shallow bay) and water quality, which would result in uncertain risks to birds and fringing wetlands.

Mitigation by avoidance or reduction, fully informed by site surveys can reduce these development effects. Residual uncertainty regarding water level and water quality changes and associated effects to ecological receptors will arise.

2.1.6 Parteen Basin Reservoir

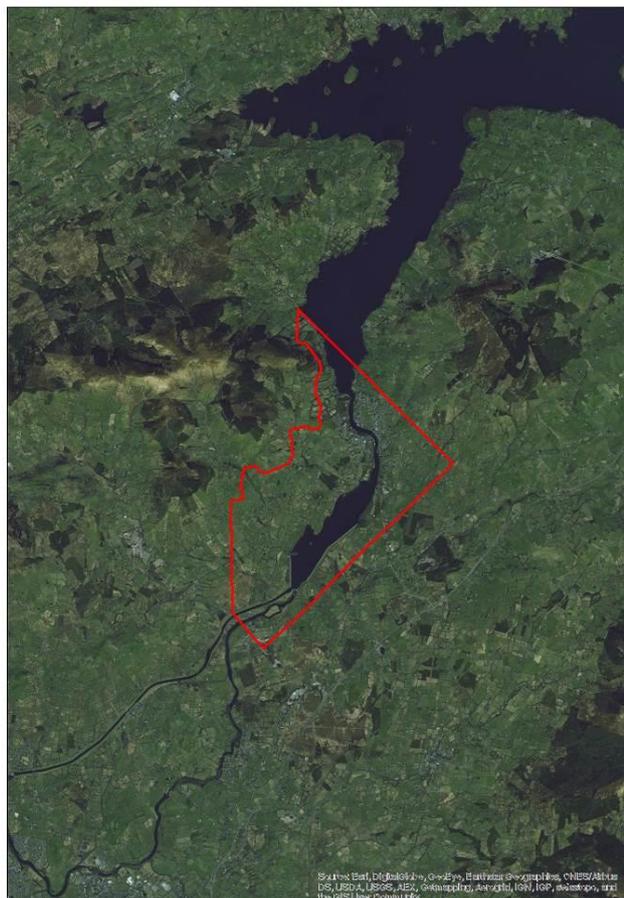


Figure E3 – 5 Parteen Basin Reservoir

Parteen Basin is a 'provisional' Heavily Modified Water Bodies (pHMWB)¹³ and as noted, the lake itself is recorded as Annex I habitat - Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. [3140]. This habitat does not form one of the Qualifying Interest habitats for the Lower River Shannon cSAC, within which Parteen Basin and a proportion of surrounding terrestrial lands is contained.

Parteen Basin water levels are controlled by the weirs at its outflow, diverting water down the "Old" Shannon River or the headrace to Ardnacrusha Power Station. Retaining embankments associated with the weir line both the eastern and western edge of the lake, with the eastern lake embankment encompassing a larger area of the lake edge habitat. To facilitate the construction of the eastern embankment, the Kilmastulla River was diverted to run behind and parallel to the embankment, bypassing the Parteen Weir and flowing into the 'Old' Shannon River downstream of the weirs.

A larger area of fringe habitats (mainly reedbeds) occur along the western edge of the basin, compared with the eastern area, due to a combination of maintenance works and a steep drop along the embankments. Strips of woodland are present in the northeast (above the retaining embankment) as far as Ballina and on the western lake edge close to Killaloe.

As Parteen Basin is heavily modified it is considered a less sensitive habitat than Lough Derg. This is for various reasons including its lack of more sensitive habitat along a large proportion of its shoreline and a high degree of manipulation of water levels by ESB for supply to Ardnacrusha Power Station.

Many of the Qualifying Interest habitats of the Lower River Shannon cSAC are marine / coastal in origin and do not occur within Parteen Basin. Potential exists for qualifying interest habitat to occur along sections of the lake edge which have not been highly modified, including those closer to Ballina/Killaloe with possible Alluvial Woodland and other high value semi natural woodland. Otter is known to use this area and is a Qualifying Interest of the cSAC. Annex I semi-natural grassland (Molinia meadow 6410) is located on the eastern side along the Kilmastulla River (known locally as Bird Callows) with potential for this habitat to occur elsewhere. Much of the eastern side of Parteen is a modified embankment which is not Annex I or high value habitat and extensive plantation woodland and improved grassland mean there is scope for avoiding high value ecological areas.

Parteen Basin is not within a pNHA but the northern area of the channel from Lough Derg leading into Parteen Basin is a pNHA. Additionally Parteen Basin is not within an SPA but wintering wildfowl, particularly Tufted Duck (Special Conservation Interest of Lough Derg (Shannon) SPA) were recorded in 2014/2015 using the Parteen Basin (i.e. potential links to the SPA in the form of providing supporting habitat). This is a constrained site ecologically and hosts significant wintering bird populations which are concentrated on the western shore.

This is the least constrained of the Lough Derg (freshwater) options from an ecology standpoint. The lake habitat and fringing wetlands have been modified by past shoreline profiling works and flooding associated with Parteen Dam. The lake bed is also relatively deep on the western side with high water volumes resulting in likely minimal effects on lake heights with drawdown (water abstraction) and water quality. However careful site location/ project design and appropriate mitigation are required.

¹³ RPS 2005. Shannon River Basin District: Characterisation & Analysis Summary Report

2.2 Matrix of Multi Criteria Analysis

Criteria	Slevoir	Mota	Dromineer	Youghal Bay	Parteen Basin
Potential to impact on Natura 2000 Sites	Very High: Lake area and sections of terrestrial/lake fringe habitat with cSAC & SPA.	Very High: Lake area and sections of terrestrial/lake fringe habitat with cSAC & SPA.	High: Lake area and sections of terrestrial/lake fringe habitat contained with cSAC & SPA.	High: Lake area and sections of terrestrial/lake fringe habitat contained with cSAC & SPA.	Mid-range: Lake area and sections of terrestrial/lake fringe habitat with Lower Shannon SAC. Habitats include alluvial woodland 91E0.
Potential to impact on Natural Heritage Areas (NHA) and proposed Natural Heritage Areas (pNHA)	Very high: large section of area within pNHA 000011.	Very high: large section of area within pNHA 000011.	High: large section of area within pNHA 000011.	High: large section of area within pNHA 000011.	Mid-range: Section between Killaloe and Ballina within Lough Derg pNHA 000011. Parteen Basin not in pNHA/NHA therefore impact lower.
Potential to impact Annex I listed habitats (designated)	Very High potential for Qualifying Interest 91E0 (alluvial woodland) 7230 & 7210 (fen). Other annex 1 habitat potential.	High potential for Qualifying Interest habitat to be impacted 91E0 (alluvial woodland) 7230 & 7210 (fen). Other annex 1 habitat potential.	High potential for Qualifying Interest Habitat to be impacted 91E0 (alluvial woodland) 7230 & 7210 (fen). Other annex 1 habitat potential.	High: for Qualifying Interest Habitat to be impacted 91E0 (alluvial woodland) 7230 & 7210 (fen). Other annex 1 habitat potential.	Mid-range: Lake area and sections of terrestrial/lake fringe habitat with Lower Shannon c SAC. Habitats include alluvial woodland 91E0.
Potential to impact Annex I listed habitats (non-designated)	High: potential to impact on non-qualifying interest Annex I habitat including (but not limited to) semi-natural grasslands, marsh, raised bog & mesotrophic lake (L. Derg).	High: for Qualifying Interest Habitat to be impacted 91E0 (alluvial woodland) 7230 & 7210 (fen). Other annex 1 habitat potential exists.	Mid-range: grassland, woodland habitats including those associated with mesotrophic lake.	Mid-range: grassland, woodland habitats including those associated with mesotrophic lake.	Mid-range: grassland habitats including unimproved GS4 with potential to host 6410, woodland habitats and habitats associated with mesotrophic lake.

Potential to impact high ecological value habitats (semi-natural habitats)	High: reedbeds, semi-natural grasslands, marsh, peatlands, woodlands including hedgerows/treelines.	High: reedbeds, semi-natural grasslands, marsh, peatlands, woodlands including hedgerows/treelines.	High: reedbeds, semi-natural grasslands, marsh, peatlands, woodlands including hedgerows/treelines.	Mid-range: reedbeds, woodland, hedgerows, Newtown river (floodplain).	Mid-range: extensive area of unimproved GS4 (potential 6410) to east Kilmastulla river, Kilmastulla River, woodland (91E0) north east shore and hedgerows.
Potential to impact on protected Flora - Flora Protection Order	Very High: Irish Fleabane (only known location in Ireland) occurs shoreline habitat in Terryglass area, potential for other protected flora.	Mid-range: Irish Fleabane (habitat shoreline), other protected flora (potential).	Low: Irish Fleabane (habitat shoreline), other protected flora (potential).	Mid-range: potential impact on protected flora in unimproved grassland and also Irish Fleabane (habitat shoreline).	Low: potential impact on protected flora in unimproved grassland.
Potential to impact on Annex II species	Mid-range: potential impact on species including but not limited to otter and bats.	Mid-range: potential impact on species including but not limited to otter and bats.	Mid-range: potential impact on species including but not limited to otter and bats.	Mid-range: potential impact on species including but not limited to otter and bats.	Mid-range: potential impact on species including but not limited to otter and bats.
Potential to Impact on Annex IV species (wherever they occur)	Mid-range: potential impact on species including but not limited to otter and bats.	Mid-range: potential impact on species including but not limited to otter and bats.	Mid-range: potential impact on species including but not limited to otter and bats.	Mid-range: potential impact on species including but not limited to otter and bats.	Mid-range: potential impact on species including but not limited to otter (qualifying interest of Lower Shannon cSAC) and bats.
Potential to impact on the breeding / wintering habitat for Annex I listed and other qualifying interest bird species	High: for special conservation interests of SPA including wetlands and waterbird habitat of SPA. Potential for impact on a wide mix of species including breeding waders and disturbance to	Mid-range: for special conservation interests of SPA including wetlands and waterbird habitat of SPA. Potential for impact on a wide mix of species including breeding waders and disturbance to	Mid-range: for special conservation interests of SPA including wetlands and waterbird habitat of SPA. Potential for impact on a wide mix of species including breeding waders and disturbance to	High: for special conservation interests of SPA including wetlands and waterbird habitat of SPA. Potential for impact on a wide mix of species including breeding waders and disturbance to	Mid-range: for special conservation interests of Lough Derg (Shannon) SPA including Tufted Duck which have links to the SPA populations. Western side lake more sensitive.

	wintering birds.	wintering birds.	wintering birds.	wintering birds.	
Potential to impact flora and fauna protected under Wildlife Act e.g. Birds, badger	Mid-range: potential impacts on a mix of species including amphibian, reptiles and on bird nest sites and badger setts.	Mid-range: potential impacts on a mix of species including amphibian, reptiles and on bird nest sites and badger setts.	Mid-range: potential impacts on a mix of species including amphibian, reptiles and on bird nest sites and badger setts.	Mid-range: potential impacts on a mix of species including amphibian, reptiles and on bird nest sites and badger setts.	Mid-range: potential impacts on a mix of species including amphibian, reptiles and on bird nest sites and badger setts.
Potential to impact on salmonid habitat - protected under SI Reg	See Aquatic Ecological Assessment.				
Potential to impact on a freshwater pearl mussel - protected under SI Reg	See Aquatic Ecological Assessment.				
Potential to impact upon high quality aquatic habitat for protected aquatic species.	See Aquatic Ecological Assessment.				
Potential to impact on coastal zone habitats (intertidal)	See Aquatic Ecological Assessment.				

Potential to impact on marine habitats (e.g. Subtidal)	<i>See Aquatic Ecological Assessment.</i>	<i>See Aquatic Ecological Assessment.</i>			
Potential to impact marine/coastal birds	Low: Potential to impact on breeding populations including gulls and Common Tern populations through change in water levels, water quality and other alterations to lake aquatic system and prey including residence time.	Low: Potential to impact on breeding populations including gulls and Common Tern populations through change in water levels, water quality and other alterations to lake aquatic system and prey including residence time.	Low: Potential to impact on breeding populations including gulls and Common Tern populations through change in water levels, water quality and other alterations to lake aquatic system and prey including residence time.	Low: Potential to impact on breeding populations including gulls and Common Tern populations through change in water levels, water quality and other alterations to lake aquatic system and prey including residence time.	Very low: no known breeding populations.
Potential to impact marine mammals	<i>See Aquatic Ecological Assessment.</i>	<i>See Aquatic Ecological Assessment.</i>			

2.3 Comparative Discussion

Water levels within Lough Derg and Parteen Basin are artificially controlled by the weirs at Parteen Basin for power generation to Ardnacrusha Power Station.

The effects of this water level control on lakeside habitat may be more evident closer to the dam with Parteen Dam effectively a reservoir subject to frequent alterations in water levels which reduce wetland fringe habitat quality. Lough Derg is likely to be less affected by this control compared to Parteen Basin. Consequently Lough Derg is characterised with more natural lake fringe habitats including sensitive hydro-logically linked wetlands and fens adjacent to the lake. The lakeside shoreline is relatively shallow with typical mesotrophic littoral and sublittoral plant communities resulting in concentrations of breeding and wintering wildfowl at the shoreline. This is a key observation when assessing options in that additional abstractions associated with the development at Lough Derg may concentrate effects littoral and sublittoral habitats where birds and sensitive plant communities are concentrated.

Each of the five study areas has the potential to host freshwater wetland and woodland qualifying feature habitats for the Lough Derg North-east corner cSAC and Lower River Shannon cSAC, or at least provide supporting habitat to these European Sites. Otter, a mobile faunal species is a Qualifying Interest of the Lower River Shannon cSAC. Lough Derg provides suitable Otter resources and it is considered that Otter populations in Lough Derg are linked to the populations in the Lower River Shannon cSAC.

Lough Derg is designated as Lough Derg (Shannon) SPA, whereas Parteen Basin is not designated as an SPA; however potential links between the two sites exist. Wintering feature species (in particular Tufted Duck and Mute Swan) potentially move between these areas and Parteen may likely be considered a sub-site of the SPA, as detailed above in Section 2.1.1.

Lough Derg is designated as a pNHA in its entirety whereas Parteen Basin is not included within a pNHA or NHA.

Given the requirements of Article 6(3) of the Habitats Directive, the proposed development (either alone or in combination with other projects or plans) must '*not adversely affect the integrity of the site in order for it to proceed*'. In this regard consideration has been given to the potential for adverse effects to the Qualifying Interests of European Sites. The "bad" national conservation status¹⁴ of fen and woodland Qualifying Interest habitats (Cladium Fen, Alkaline Fen, Alluvial Woodland and Yew Woodland), for Lough Derg North-east shore cSAC indicates the extreme sensitivity to any alterations in supporting environmental conditions for these habitats. In accordance with case law, the data informing assessments of impacts to European sites must constitute "best scientific knowledge in the field"¹⁵, to inform complete, precise, and definitive findings, without gaps, over which there are no reasonable doubts. In this context, it should be noted that this assessment was predominantly undertaken as a desk study without detailed field investigations.

15 European Court of Justice: Case (2004) C-127/02. <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:62002CJ0127&from=EN>

Slevoir Bay, Mota and Youghal Bays are considered the three most sensitive locations. This is mainly due to the extensive fringe of semi-natural woodland and wetlands surrounding the vast majority of the lake edge, and in some cases up to 500m inland in particular at Slevoir Bay. At Dromineer, sections of lake edge and the surrounding immediate area have been developed and therefore potential exists for minimal loss/disturbance of habitat if the proposed development is appropriately located within these areas. However the potential exists at all Lough Derg sites to permanently impact high ecological value wetland and woodland habitats including feature of interest - Annex 1 habitat. In addition there is a high risk of permanent adverse localised effects to birds including feature of interest species in the SPA.

Out of the five options, Parteen Basin is considered to be the least constrained option. This is mainly based on the high degree to which Parteen Basin has been modified with ongoing manipulation of water levels. Feature of interest habitat in the Lower River Shannon cSAC does occur within Parteen Basin study area (alluvial woodland and grassland and with field surveys, appropriate design and mitigation (including avoidance of semi-natural habitats) impacts to such habitats will likely be avoided or at least reduced. Detailed ecological studies are required to inform the final design, Appropriate Assessment and Environmental Impact Assessment if this option is selected

3.1 Desalination Locations

An assessment of the potential abstraction and desalination locations was carried out for the Irish Sea – South Dublin, Loughshinny South, Loughshinny North and Balbriggan (Option H - Desalination)

3.1.1 Designated Sites

Designated sites noted to be located in close proximity to the desalination locations considered include:

- South Dublin
 - Dalkey Coastal Zone and Killiney Hill pNHA (Site Code: 001206)
 - Rockabill to Dalkey Island cSAC (Site Code: IE003000)
 - Dalkey Islands SPA (Site Code: 4172)
- Loughshinny South
 - Rockabill to Dalkey Island cSAC (Site Code: IE003000)
 - Rockabill SPA (Site Code: IE004014)
- Loughshinny North
 - Loughshinny Coast pNHA (Site Code: 002000)
 - Rockabill to Dalkey Island SAC (Site Code: IE003000)
 - Rockabill SPA (Site Code: IE004014)
- Balbriggan
 - Rockabill to Dalkey Island cSAC (Site Code: IE003000)
 - Rockabill SPA (Site Code: IE004014)

Dalkey Coastal Zone and Killiney Hill pNHA (Site Code: 001206)

This site includes the coastal stretch from Scotman's Bay to south of White Rock, the Dalkey Island group, Dalkey Sound and Killiney Hill. This site represents a fine example of a coastal system with habitats ranging from the sub-littoral to coastal heath. The flora is well developed and includes some scarce species. The islands are important bird sites. The site also has geological importance.

Rockabill to Dalkey Island SAC (Site Code: IE003000)¹⁶

Rockabill to Dalkey Island cSAC is a marine cSAC located off the eastern coast of Ireland from Skerries, north of Dublin to Dalkey, south of Dublin city. The Qualifying Interests of the Lower River Shannon cSAC are listed below:

- Reefs
- Harbour Porpoise (*Phocoena phocoena*)

Dalkey Islands SPA (Site Code: 4172)

Dalkey Islands SPA encompasses Dalkey Island, Lamb Island and Maiden Rock and surrounding sea area located off Sorrento Point on the South Dublin coastline.

¹⁶ National Parks and Wildlife Service (2013). Conservation Objectives Series: Rockabill to Dalkey Island SASC 003000 Version 1.

Dalkey Island, the largest of the three is low lying with low growing vegetation. The Special Conservation Interests are listed below:

- Roseate Tern (*Sterna dougallii*)
- Common Tern (*Sterna hirundo*)
- Arctic Tern (*Sterna paradisaea*)

Rockabill SPA (Site Code: IE004014)

Rockabill SPA encompasses two islands off the north Dublin coastline – Lighthouse Island and Bill Island. They are low-lying islands with a mix of coastal vegetation. The Special Conservation Interests are listed below:

- Purple Sandpiper (*Calidris maritima*) [A148]
- Roseate Tern (*Sterna dougallii*) [A192]
- Common Tern (*Sterna hirundo*) [A193]
- Arctic Tern (*Sterna paradisaea*) [A194]

Loughshinny Coast pNHA (Site Code: 002000)¹⁷

This site is situated north of Dublin Bay, midway between Loughshinny and Skerries. The south boundary of the site extends to the clay cliffs while the north end is bounded by a stream. This coastal area is noted for its geological interests, the rocks being conglomerates, limestones and shales. The main habitat of the site is coastal grass, which merges into a shingle/rocky shore with some patches of saltmarsh. Green-winged Orchid (*Orchis morio*) protected under the Flora Protection Order occurs onsite. A flush (potential Annex I habitat) was recorded at the northern end of the site. Coastal birds use the grasslands for roosting, including Curlew and Oystercatcher.

¹⁷ National Parks and Wildlife Service pNHA site synopsis (Date Unknown). Loughshinny Coast (Site Code: 002000)

3.1.2 South Dublin



Figure E3 – 6 South Dublin

The South Dublin option is the largest of the potential desalination locations, stretching from Dalkey Island in the north to Bray Harbour at its southern extents. It takes in a combination of steep rocky shoreline at the northern end and a flatter pebble beach towards the southern end. This is also a highly urbanised area with the considerable residential development of South County Dublin’s suburbs running right up to the coastline. The subject section of coastline is also navigated by the main railway line that serves south Dublin commuters (DART) and the south-east of the country. The Shanganagh wastewater treatment facility also occurs close to the coastline near the central portion of this location at Shankill. Small pockets of agricultural land exist towards the southern section of the site, mainly between Shankill and Bray. Woodland habitat exists as treelines, hedgerows, as pockets within large private estates and on amenity lands including golf courses.

Rockabill to Dalkey cSAC is located offshore, at the northern end of the study area only. Dalkey Coastal Zone and Killiney Hill pNHA covers two separate areas of the coast; it overlaps with Dalkey Island SPA and extends both north and south along the Dublin coast from this point yet it also includes a distinct patch of the coastal area south of Killiney train station at Ballybrack.

Moderate adverse impacts are predicted in the worst case scenario post-mitigation if green field (farmland areas) are used in any proposed development. In particular direct woodland loss and associated disturbance effects may arise to bats, other protected mammal species and birds. The southern section of the South Dublin study area is considered to be the least constrained section of this study area, south of Rockabill to Dalkey cSAC and Dalkey Coastal Zone and Killiney Hill pNHA. However potential exists for the proposed development to be predominantly contained within existing developed areas which would minimise ecological impacts. Subsequently the main impact would be where the abstraction pipeline/structure comes onshore on the sublittoral and littoral habitats. Appropriate design and mitigation, including avoidance or reduction through fully informed site surveys, may reduce any potential impacts.

3.1.3 Loughshinny North



Figure E3 – 7 Loughshinny North

The potential desalinisation location at Loughshinny North is contained within the coastal plain midway between the Rush, to the south, and Skerries to the north. The rural area is dominated by intensively managed agricultural lands with few settlements. The agricultural lands are dissected by maintained hedgerow and are relatively uninterrupted until they meet the coastline. The coastline consists of low sea cliffs that provide a distinct and abrupt transition between the coastal plain and the shoreline which consists of rocky outcrops and pebbled coves. The main Dublin - Belfast railway line passes in a north-south direction a short distance inland from the coast.

The northern section of the study area, along the coast is contained within Loughshinny Coast pNHA. The coastal habitat provides important habitat for small coastal breeding bird colonies.

Moderate adverse impacts are predicted in a worst case scenario (post mitigation) if green field (farmland areas) are used as a site for a desalination plant. In particular impacts will likely arise through direct hedgerow/linear woodland loss, protected mammal species and disturbance to birds. A coastal location may additionally disturb coastal birds and protected flora.

3.1.4 Loughshinny South



Figure E3 – 8 Loughshinny South

The potential desalination location at Loughshinny South is located a short distance south from the location described above at Loughshinny North. Indeed, the main variation between the two is the closer proximity of the Loughshinny South location to the settlement of Rush. This site however is not contained within a National or EU designated site. Otherwise, the site is similar in description to that of Loughshinny North with the rural area dominated by intensively managed agricultural lands, however as this site is closer to Rush the number of settlements has increased with the study area hosting more developed land. The coastal habitat remains similar and is important for small coastal breeding bird colonies.

Moderate adverse impacts are predicted in a worst case scenario, post mitigation, if a desalination plant and associated works are constructed in green field (farmland) areas. In particular impacts will likely arise through direct hedgerow loss, indirect protected mammal species and birds disturbance. A coastal location may additionally disturb coastal birds.

3.1.5 Balbriggan



Figure E3 – 9 Balbriggan

The potential desalinisation location at Balbriggan occupies an area of land between the northern outskirts of the settlement of Balbriggan and the border between County Meath and County Dublin. The Dublin Belfast railway line passes through the area along with the R132 regional road.

The location is contained in large farmed fields on a relatively open coastal plain where field boundaries are defined by low windswept hedgerows. Coastal habitats at this location include sea cliffs and rocky outcrops, providing important habitat for coastal breeding bird colonies,

Moderate adverse impacts are predicted in a worst case scenario with mitigation if green field (farmland areas) are used for any development. The main impacts will

likely arise through direct hedgerow loss and indirect impacts, including disturbance to protected mammal and bird species.

3.2 Matrix of Multi Criteria Analysis

Criteria	South Dublin	Loughshinny North	Loughshinny South	Balbriggan
Potential to impact on Natura 2000 Sites	Low: potential to impact upon breeding bird populations for SPA's.	Low: potential to impact upon breeding bird populations for SPA's.	Low: potential to impact upon breeding bird populations for SPA's.	Low: potential to impact upon breeding bird populations for SPA's.
Potential to impact on Natural Heritage Areas (NHA) and proposed Natural Heritage Areas (pNHA)	Mid-range: coastal pNHA (Dalkey Coastal Zone and Killiney Hill) located to the north and centre of the site.	High: Loughshinny Coast pNHA within study area.	Low: potential no pNHA in immediate vicinity of study area.	Low: potential no pNHA in immediate vicinity of study area.
Potential impact Annex I listed habitats (designated)	Very low: potential for terrestrial habitats including semi-natural grasslands.	Very low: potential for terrestrial habitats including semi-natural grasslands.	Very low: potential for terrestrial habitats including semi-natural grasslands.	Very low: potential for terrestrial habitats including semi-natural grasslands.
Potential impact Annex I listed habitats (non-designated)	Low: potential with the exception of coastal habitats (see Aquatic Ecology).	Mid-range: potential on semi-natural grasslands, cliff habitats and habitats associated with Loughshinny Coast pNHA.	Low: potential with the exception of coastal habitats (see Aquatic Ecology).	Low: potential with the exception of coastal habitats (see Aquatic Ecology).
Potential to impact high ecological value habitats (semi-natural habitats)	Mid-range: Woodland and other semi-natural habitats likely to be at least of high ecological value in a local context.	Mid-range: Woodland and other semi-natural habitats likely to be at least of high ecological value in a local context.	Mid-range: Woodland and other semi-natural habitats likely to be at least of high ecological value in a local context.	Mid-range: Woodland and other semi-natural habitats likely to be at least of high ecological value in a local context.
Potential to impact on protected Flora - Flora Protection Order	Low: potential for flora in undeveloped habitat.	Mid-range: Protected coastal flora: Green winged orchid.	Low: potential for protected flora in unimproved grassland.	Low: potential for protected flora in unimproved grassland.

Criteria	South Dublin	Loughshinny North	Loughshinny South	Balbriggan
Potential to impact on Annex II species	Mid-range: potential to impact on various species	Low: potential to impact on various species.	Low: potential to impact on various species	Low: potential to impact on various species.
Potential to Impact on Annex IV species (wherever they occur)	Mid-range: potential to impact on species including bats.	Low: potential to impact on species including bats.	Low: potential to impact on species including bats.	Low: potential to impact on species including bats.
Potential to impact on the breeding / wintering habitat for Annex I listed and other qualifying interest bird species	Low: Potential to impact on breeding Tern and various wintering populations.	Mid-range: potential impact on marine seabird colonies and wader roosts.	Mid-range: potential impact on marine seabird colonies and wader roosts.	Mid-range: potential impact on marine seabird colonies and wader roosts.
Potential to impact flora and fauna protected under Wildlife Act e.g. birds, badger	Mid-range: potential impacts on a mix of species including amphibian, reptiles and on bird nest sites and badger setts.	Mid-range: potential impacts on a mix of species including amphibian, reptiles and on bird nest sites and badger setts.	Mid-range: potential impacts on a mix of species including amphibian, reptiles and on bird nest sites and badger setts.	Mid-range: potential impacts on a mix of species including amphibian, reptiles and on bird nest sites and badger setts.
Potential to impact on salmonid habitat - protected under SI Reg	See Aquatic Ecological Assessment.			
Potential to impact on a freshwater pearl mussel - protected under SI Reg	See Aquatic Ecological Assessment.			

Criteria	South Dublin	Loughshinny North	Loughshinny South	Balbriggan
Potential to impact upon high quality aquatic habitat for protected aquatic species.	<i>See Aquatic Ecological Assessment.</i>	<i>See Aquatic Ecological Assessment.</i>	<i>See Aquatic Ecological Assessment.</i>	<i>See Aquatic Ecological Assessment.</i>
Potential to impact on coastal zone habitats (intertidal)	<i>See Aquatic Ecological Assessment.</i>	<i>See Aquatic Ecological Assessment.</i>	<i>See Aquatic Ecological Assessment.</i>	<i>See Aquatic Ecological Assessment.</i>
Potential to impact on marine habitats (e.g. Subtidal)	<i>See Aquatic Ecological Assessment.</i>	<i>See Aquatic Ecological Assessment.</i>	<i>See Aquatic Ecological Assessment.</i>	<i>See Aquatic Ecological Assessment.</i>
Potential to impact marine/coastal birds	Low: Potential to impact on breeding populations via, loss of habitat and disturbance.	Mid-range: Potential to impact on breeding populations via, loss of habitat and disturbance.	Mid-range: Potential to impact on breeding populations via, loss of habitat and disturbance.	Low: Potential to impact on breeding populations via, loss of habitat and disturbance.
Potential to impact marine mammals	<i>See Aquatic Ecological Assessment.</i>	<i>See Aquatic Ecological Assessment.</i>	<i>See Aquatic Ecological Assessment.</i>	<i>See Aquatic Ecological Assessment.</i>

3.3 Comparative Discussion

The options for the desalination location are all along the Dublin coastline, north and south of Dublin City. The northern locations are located within areas dominated by intensively managed agricultural lands with the southern study area covering a larger extent in a more developed landscape associated with a mix of suburban residential, amenity and industrial areas.

South Dublin and Loughshinny North host pNHA's with none of the four potential sites hosting European sites (cSAC's or SPA's). Rockabill to Dalkey Island cSAC is located off the coast of the north Dublin sites and the northern section of the South Dublin study area. Other designated sites are located in close proximity (northern section of South Dublin).

Using a combination of aerial photography and field visits, each of the northern sites are likely to host similar habitat types dominated by agricultural grassland. The south Dublin study area hosts a range of habitats due to its large size, providing a range of resources to a range of species.

Based on available datasets and preliminary field investigations, Loughshinny South, Loughshinny North and the northern section of South Dublin are the least preferred options due to their relatively closer proximity to designated sites and sensitive coastal habitats which, as a result, increases the potential for adverse effects to European site integrity. Consideration was also given to the current landuse and broad habitats present onsite with potential impact to protected species.

Balbriggan, followed by the southern section of the South Dublin study area, are considered to be the least constrained options as they have extensive areas of low ecological value farmland suitable for locating a proposed development. Mitigation such as replanting can be implemented at these sites so as to reduce potential localised impacts to hedgerows.

Water Supply Project Eastern and Midlands Region (WSP)

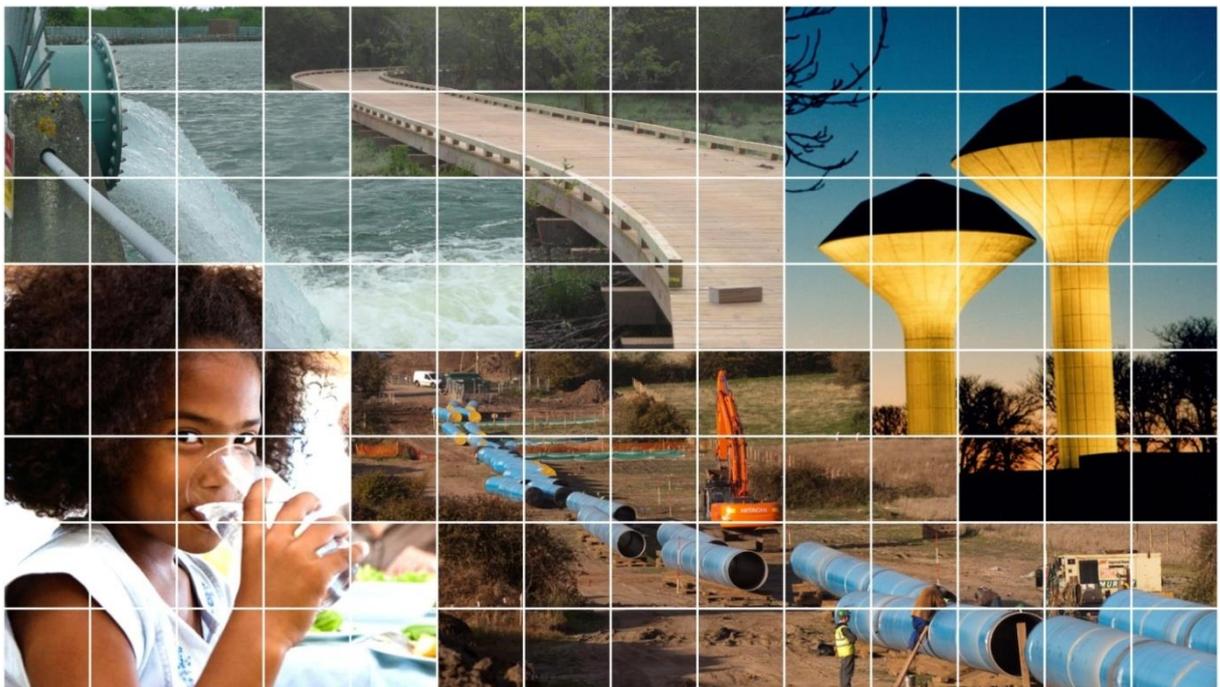
Abstraction Location MCA

Appendix E4: Ecology (Aquatic)



October 2015

F02



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1.1 Introduction

Four reasonable alternative options have been identified from previous studies – refer to the *Water Supply Options Working Paper* (Project Road Map Stage 2). These are reconfirmed below.

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)
- Option H (Desalination)

This report describes the decision making process used to appraise the abstraction locations associated with each of the reasonable alternative options.

To undertake the appraisal of abstraction locations a range of specialists were engaged, in their applicable fields, to conduct a comparative assessment of abstraction locations. The following disciplines were engaged:

- i. **Ecology** – the consideration of impact on animals, plants and their environment.
- ii. **Water** – the consideration of impacts on the surface water environment.
- iii. **Air and Noise** - the consideration of air and noise pollution
- iv. **Cultural Heritage** - the consideration of existing archaeological and built heritage
- v. **Soils, Geology and Hydrogeology** – the consideration of impact on soils, geology and hydrogeology.
- vi. **Landscape and visual** – the consideration of landscape and visual impact.
- vii. **Agronomy** – the consideration of impact on land based enterprise.
- viii. **People** – the consideration of impacts on people
- ix. **Planning** – the consideration of planning and land use policy in relation to proposed works
- x. **Engineering** - the consideration of technical challenges associated with proposed works.
- xi. **Traffic** - the consideration of impact on traffic and road network

The specialists independently assessed each of the location relative to appraisal criteria applicable to their field of expertise. This Multi-Criteria Analysis considers the criteria set out in Table E4 - 1, against each option, within a decision-making environment.

Environmental Criteria	Technical Criteria	Risk Criteria
Biodiversity, Flora and Fauna	Safety	Technical Risk relating to the Source
	Planning Policy	Technical Risk relating to Infrastructure and Operations
Water	Engineering and Design	Environmental and Planning Risk
Air/Climatic Factors	Capital and Operational Costs	Financial Risk
Material Assets (Energy)	Sustainability	Socio-economic risk
Cultural Heritage (including Architecture & Archaeology)		
Landscape & Visual		
Material Assets (Land use)		
Tourism		
Population		
Human Health		
Soils, Geology and Hydrogeology		

Table E4 - 1 Appraisal Criteria

The assessments are presented as individual statements within this Appendix E.

This Appendix E4 is a statement on the specialism Ecology (Aquatic) and describes the decision making process used in identifying the least constrained of the four abstraction location options, from an aquatic ecology perspective.

The Site Selection Methodology in Appendix B outlines the process employed in identifying least constrained locations. This report should be read in conjunction with the *Site Selection Methodology*.

1.2 Methodology

This is ‘Non-linear Site Methodology – Step 1’ as described in the *Site Selection Methodology*.

To determine effectively the least constrained abstraction location from the identified options, each location was assessed under nineteen ecological sub-criteria. The sub-criteria are listed below and often overlap with the sub-criteria used in the terrestrial ecological assessment which can be viewed in Appendix E3.

- Potential to impact on European Sites (Natura 2000) - Special Areas of Conservation (SAC) and Special Protection Areas (SPA)*
- Potential to impact on Natural Heritage Areas (NHA) and proposed Natural Heritage Areas (pNHA)
- Potential impact Annex I listed habitats¹ (designated)
- Potential impact Annex I listed habitats (non-designated)

¹ The term “Annex I habitats” refers to those listed in Annex I of the Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora, often referred to as “The Habitats Directive”.

- Potential to impact high ecological value habitats (semi-natural habitats)
- Potential to impact on protected Flora - Flora Protection Order
- Potential to impact on Annex II species²
- Potential to Impact on Annex IV species³ (wherever they occur)
- Potential to impact on the breeding / wintering habitat for Annex I listed and other qualifying interest bird species
- Potential to impact flora and fauna protected under Wildlife Act e.g. Birds, Badger
- Potential to impact on Salmonid habitat - protected under SI Reg
- Potential to impact on Freshwater Pearl Mussels - protected under SI Reg
- Potential to impact upon high quality aquatic habitat for protected aquatic species.
- Potential to impact on coastal zone habitats (Intertidal)
- Potential to impact on marine habitats (Subtidal)
- Potential to impact marine/coastal birds
- Potential to impact marine mammals
- Potential to impact on water quality and inshore fishing grounds based on regional fisheries datasets.
- Potential to impact on transient protected marine species (cetaceans and salmonids), which may pass through the affected area within the survey area footprint.

1.2.1 Supporting studies

A desk study exercise of the potential abstraction locations was carried out using the software package *ArcReader*. The supplied datasets and information are as described in the *Site Selection Methodology*.

The desk study also included review of existing databases including in particular National Parks and Wildlife Service database⁴. This enabled a review of records of rare and protected flora and fauna and a review of European Sites and an assessment of those with links to the proposed development. Additional datasets reviewed included:

- Inland Fisheries Ireland (IFI) data on its website⁵
- O'Reilly (2009)
- Webb (1967)
- Modelling reports on the abstraction locations carried out by Marcon Ltd.(2015)

2 The term “Annex II species” refers to those listed in Annex II of the Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora, often referred to as “The Habitats Directive”.

3 The term “Annex IV species” refers to those listed in Annex IV of the Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora, often referred to as “The Habitats Directive”.

4 National Parks and Wildlife Service www.npws.ie

5 Inland Fisheries Ireland (IFI) Website: www.ifi.ie

- A bathymetric survey carried out by Geo Mara Ltd (2015)
- Data held in-house in AQUAFAC

Regarding the mathematical modelling, Marcon examined how the abstraction at each of the five locations would affect the flushing time of water at each site. Flushing time is defined as the average amount of time required to replace all the water in a lake (Lough Derg) by the action of the flow rate through the lake. Flushing time begins from the moment that a particle of water enters Lough Derg and ends the moment that the same particle of that substance leaves the Parteen Basin. As water will be abstracted from the lake, the flow through rate will be longer and therefore the flushing time will also be longer. This increase in flushing time will allow for the build-up of nutrients which in turn may generate conditions that will allow algal blooms to occur.

In addition, a review of literature on the impacts of brine discharges to the marine environment was undertaken and is presented below under the desalination section of this report.

1.2.2 Categories of impact

The relative analysis of potential locations to define a “least constrained” location is based upon a subjective assessment by each Specialist in their area of expertise. This judgement is presented as weighted impact; colour coded for ready identification.

Very high	Dark blue
High	Blue
Mid-range	Green
Low	Light Green
Very low	Cream

Potential impacts to aquatic ecological receptors were considered including;

- designated sites (SAC) and their qualifying interests
- recreational fishing status
- water quality

2.1 Lough Derg/Parteen Basin Locations

An assessment of the potential abstraction locations was carried out for the following options:

- Lough Derg: Slevoir Bay, Mota, Dromineer and Youghal (Option B - Lough Derg Direct and F2 - Lough Derg with Storage)
- Parteen Basin (Option C - Parteen Basin Reservoir Direct)

Lough Derg is one of the largest bodies of freshwater in Ireland and parts of it have been designated as a candidate Special Area of Conservation. The entire lake is designated as a Special Protection Area for birds, many of which are aquatic species. Southern (1934/35) and Southern and Gardiner (1931/32, 1938/1940) carried out a number of studies in Lough Derg in relation to phytoplankton, crustacean zooplankton and food and growth of brown trout and, although quite dated, this information is a useful base line for the system at large.

The geology is mostly limestone and this is exposed in some locations at the surface and can be classified as limestone pavement, which is also listed as a priority habitat in the same EU Directive.

In terms of botanical research, the earliest survey of Lough Derg was that of Colgan (1897). Cladium fen occurs occasionally along the lake margins in association with Alkaline Fens, Reed (*Phragmites australis*) and other marshy vegetation. Sedges (*Cladium mariscus*) form dense beds along the lake's edge and other typical species include Common Reed (*Phragmites communis*), Sedge (*Carex rostrata*), Meadowsweet (*Filipendula ulmaria*), Rush (*Schoenus nigricans*) and two species of Horsetail (*Equisetum fluviatile* and *E. palustre*). Other species that occur in the lake in general include Lamprey (2 genera, 3 species) – Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*) and River Lamprey (*L. fluviatilis*), Eel (*Anguilla anguilla*) and Pollan (*Coregonus autumnalis pollan*). Pollan is a landlocked species which tends to occur in deeper parts of lakes and although it is anadromous throughout most of its northern range, the Irish populations are all non-migratory and purely freshwater. Harrod *et al.* (2002) have shown that all Irish populations, except those from Lough Neagh, are in decline. They state that, although at risk, there is evidence for recent spawnings in each population. They point to the following possibilities for the causes of decline – eutrophication, fishing and parasites.

Lough Derg is an important site for both breeding and wintering birds. The site supports a nationally important breeding colony of Common Tern and breeding pairs of white-tailed Sea Eagle, with large numbers of Black-headed gull and Cormorant also present. In winter, the lake is important for a range of waterfowl species, especially diving ducks, with nationally important populations of Tufted Duck, Goldeneye and Mute Swan. An area of the lake close to Portumna Forest Park is a Wildfowl Sanctuary. The site is also used by Greenland White-fronted Goose and Whooper Swan.

Lough Derg is also a well-known fishing lake with a good Trout (*Salmo trutta*) fishery. Atlantic Salmon (*Salmo salar*) use the lake and its tributaries as a spawning ground. As for other freshwater systems in Ireland, Lough Derg has been invaded by a number of non-native invertebrate species including the Zebra Mussel

(*Dreiseena polymorpha*) (see Minchin and Moriarity 1998 inter alia) and the shrimp (*Hemimysis anomala*) (see Minchin and Boelens, 2010). White-clawed Crayfish (*Austropotamobius pallipes*), is found in many of the rivers which feed into the eastern edge of the lake.

This is the only known site for Red Data Book species Irish Fleabane (*Inula salicina*), protected under the Flora (Protection) Order, 1999. The site also hosts Marsh Pea (*Lathyrus palustris*) and a charophyte (*Chara tomentosa*), both Red Data Book species.

2.1.1 Designated Sites

Lough Derg is designated as Lough Derg pNHA (site code 000011) and Lough Derg (Shannon) SPA (IE004058), with the north eastern corner designated as Lough Derg, North-east Shore SAC (Site Code: IE002241). Parteen Basin is designated as Lough Derg (Shannon) SPA (IE004058). As noted above in Section 1.2, any development that is proposed to take place within or near to a Natura site is likely to be difficult to receive consent; it is recommended that any such locations are not considered further.

Lough Derg and Parteen Basin are both recorded as an Annex I habitat *Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.* [3140]. This habitat is not a Qualifying Interest of either Lough Derg, North-east Shore SAC or the Lower River Shannon SAC.

Lough Derg pNHA [000011]⁶

Lough Derg pNHA encompasses the whole of Lough Derg lake from Portumna to Killaloe/Ballina. The site is noted to be of significant ecological interest, and includes examples of six habitats that are listed on Annex I of the E.U. Habitats Directive. Four of these are priority habitats, i.e. *Cladium* fen, alluvial woodland, Yew woodland and limestone pavement; other annexed habitats present include alkaline fen and Juniper scrub formations on heath and calcareous grasslands. The priority habitats are found mainly at the north and north-east of the lake. *Cladium* fen occurs occasionally along the lake margins, mainly in association with alkaline fens, Common Reed and other swamp vegetation. Some of the finest examples of Juniper formations in Ireland occur along the lake edge. In places along the lake shore Juniper forms a mosaic with Black Bog-rush and Great fen-sedge fen with many of the islands supporting significant Juniper cover. Other habitats present within the site include wooded islands, semi-natural deciduous woodland, callow grasslands and improved grassland, the latter being of particular importance for feeding by waterfowl.

Lough Derg, North-east Shore SAC [IE002241]⁷

Lough Derg, North-east Shore SAC encompasses the northern and north eastern corner of Lough Derg and the eastern section of the lake from Portumna southwards to Meelick, north of Dromineer

The detailed Qualifying Interests of the European Site are listed below:

⁶ National Parks and Wildlife Service (2004). Lough Derg Site Synopsis (Site Code: 000011)

⁷ National Parks and Wildlife Service (2015). Conservation Objectives for Lough Derg North-east Shore SAC 002241.

- 5130 *Juniperus communis* formations on heaths or calcareous grasslands
- 7210 Calcareous fens with *Cladium mariscus* and species of the *Caricion davalliana* (priority habitat⁸)
- 7230 Alkaline fens
- 8240 Limestone pavements (priority habitat)
- 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) (priority habitat)
- 91J0 *Taxus baccata* woods of the British Isles (priority habitat)

Lough Derg (Shannon) SPA [IE004058]⁹

Lough Derg (Shannon) SPA encompasses Lough Derg and Parteen Basin in their entirety, stretching from Portumna to the outlet of Lough Derg, north of Killaloe/Ballina.

The detailed Special Conservation Interests of Lough Derg (Shannon) SPA are listed below.

- Cormorant (*Phalacrocorax carbo*) [A017] (Breeding & Wintering)
- Tufted Duck (*Aythya fuligula*) [A061] (Wintering)
- Goldeneye (*Bucephala clangula*) [A067] (Wintering)
- Common Tern (*Sterna hirundo*) [A193] (Breeding)
- Wetland and Waterbirds [A999]

SPAs are chosen if they are a) regularly used by 1% or more of the all-Ireland population of a listed (i.e. Annex 1) species or b) regularly used by 1% or more of the biogeographical population of a migratory species or c) regularly used by more than 20,000 waterfowl.

Lower River Shannon SAC [IE002165]¹⁰

The Lower River Shannon SAC extends from the mouth of the Shannon at Kerry and Loop Head to Killaloe/Ballina in Co. Clare and Co. Tipperary. The detailed Qualifying Interests of the Lower River Shannon SAC are listed below:

- Sandbanks which are slightly covered by sea water all the time [1110]
- Estuaries [1130]
- Mudflats and sandflats not covered by seawater at low tide [1140]
- Coastal lagoons [1150] (priority habitat)
- Large shallow inlets and bays [1160]
- Reefs [1170]
- Perennial vegetation of stony banks [1220]
- Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]
- *Salicornia* and other annuals colonising mud and sand [1310]
- Atlantic salt meadows (*Glauco-Puccinellietalia maritima*) [1330]
- Mediterranean salt meadows (*Juncetalia maritimi*) [1410]

⁸ Priority Habitats are a sub-set of the Annex I habitat types which Article 1(d) of the Habitats Directive defines as 'natural habitat types in danger of disappearance' for whose conservation the European Union has 'particular responsibility' (ECJ CASE C-258/11): <http://curia.europa.eu/juris/celex.jsf?celex=62011CJ0258&lang1=en&type=TEXT&ancre=>

⁹ National Parks and Wildlife Service (2015). Conservation Objectives for Lough Derg (Shannon SPA) 004058.

¹⁰ National Parks and Wildlife Service (2012). Conservation Objectives Series: Lower River Shannon SAC 002165, Version 1.

- *Tursiops truncatus* (Common Bottlenose Dolphin) [1349]
- *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029]
- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation [3260]
- Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) [91E0] (priority habitat)
- *Lutra lutra* (Otter) [1355]
- *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410]
- *Petromyzon marinus* (Sea Lamprey) [1095]
- *Lampetra planeri* (Brook Lamprey) [1096]
- *Lampetra fluviatilis* (River Lamprey) [1099]
- *Salmo salar* (Salmon) [1106]

2.1.2 Slevoir



Figure E4 – 1 Lough Derg – Slevoir.

This northern, upper part of Lough Derg, south east of Portumna includes the northern shore of the lake from the mouth of the Kilcrow River in the north-west to just below Black Lough at the north-eastern shore. Water depths are in the region of 1 – 2m (Geomara 2015). Slevoir Bay is somewhat sheltered from prevailing west/south westerly winds by the constriction to the west between Terryglass, on the southern shore (Slevoir Head), and the headland immediately east of where the River Shannon flows into Lough Derg (Derrymacegan). There are no islands in this part of Lough Derg. The area lies within a candidate Special Area of Conservation

(Lough Derg, North-east Shore SAC, Lough Derg (Shannon) SPA, and Lough Derg pNHA). The aquatic qualifying interests of this SAC listed on the NPWS site synopsis include *Cladium* fen (Habitat code 7210), which is a priority habitat in the EU Habitats Directive, alkaline fens (Habitat code 7230) and alluvial forests (Habitat Code 91J0).

Lough Derg is the only site in Ireland where Irish Fleabane is found (Webb, 1967) and this species is listed on the SAC site synopsis for this part of the lake. The Red Data Book Stonewort *Chara tomentosa*, has its National stronghold in L. Derg and it too is noted in the NPWS site synopsis. The shallow shoreline vegetation in Slevoir Bay includes Reed, Sedges, Meadowsweet and Rush. The sedges and reeds can form dense beds. Although not listed on the NPWS site synopsis, the following species of high conservation interest are considered likely to be present in the Slevoir Bay area: 3 Lamprey species, Salmon, Eel and Otter.

Modelling studies (Marcon, 2015) on how the abstraction at this site would affect flushing time of water showed that there would be marked decrease in the rate that water flows through the area and this is likely to cause a change in nutrient concentrations which would affect water quality status. This in turn would impact the distribution of shallow water floral and faunal communities. It is therefore, not possible to say with certainty that there would be no negative impact on the conservation status of the SAC.

The facts that

- 1) this abstraction area lies within a Natura site (see comment in Section 1.2 regarding developments in or near Natura sites) and that
- 2) modelling output indicates the flushing time will increase thereby potentially affecting the ecological status of this part of Lough Derg

give rise to a considerable level of uncertainty regarding the likelihood that consent for this location would be successful. Given this uncertainty, it is considered the least favourable abstraction option of all possible sites being considered.

Derg and this is most likely to have a negative impact on aquatic ecology, affecting species of high conservation status. Changes in the distribution and species composition of shallow water floral and faunal communities due to changes in the nutrient status of the lake cannot be discounted.

Mota is considered an unsuitable abstraction site due to the predicted negative impact on flushing time and the consequent impact on aquatic ecology and species of conservation interest. Furthermore, as there are small, unsurveyed islands close by, there is a risk, albeit unquantified, that there may be other species or habitats within the location that require protection.

2.1.4 Dromineer



Figure E4 – 3 Lough Derg – Dromineer.

Dromineer Bay faces due west and is therefore open to the prevailing west/southwesterly winds. The lake and a proportion of the terrestrial habitat is included within Lough Derg (Shannon) SPA and Lough Derg pNHA. Water depths range from 1- 3m (Geo Mara 2015). There is a small island, Goose Island, just to the south of the mouth of the Nenagh River, which flows into Dromineer Bay, and there is a small cluster of islands, the Corrikeen Islands to the northwest of the bay. To the best of our knowledge, it is understood that these islands have not been surveyed for their flora and fauna and it has to be considered that they may support populations of rare plant species.

Along its eastern shore, sands dominate the substrate type, reflecting the more exposed character of the site: the greater the exposure to prevailing winds, the greater the potential for removal of fine sediment particles such as muds and their deposition in more sheltered or deeper parts of Lough Derg.

The common, shallow shoreline vegetation at Dromineer Bay includes Reed, Sedges, Meadowsweet and Rush. The following species of high conservation interest are considered likely to be present in the Dromineer area: 3 Lamprey species, Salmon, Eel and Otter.

Modelling studies on how abstraction at this site would affect flushing time of water showed that there would be marked decrease in the rate that water flows through the area. The same ecological concerns that were outlined above for Slevoir and Mota apply here.

Although Dromineer Bay does not lie within a SAC, the same arguments outlined above in relation to Slevoir and Mota and increased water retention time in the lake and the consequent increased nutrient levels and risk of algal blooms, make it an unsuitable abstraction site. Furthermore, as there are unsurveyed islands close by, it is considered that this features could give added conservation status to the location.

2.1.5 Youghal



Figure E4 – 4 Lough Derg – Youghal.

Youghal Bay is a westerly facing bay on the eastern shore of Lough Derg and is therefore open to the prevailing westerly/southwesterly winds. The lake and a proportion of the terrestrial habitat is included within Lough Derg (Shannon) SPA and Lough Derg pNHA. Water depths are in the range of 1 – 3m. Sands are a common substrate of the eastern parts of the bay .As noted above for Dromineer, this greater level of exposure to prevailing winds and associated wave turbulence, removes fines from the system and leaves behind the heavier, sand particles. No significant river flows into the bay and there are no islands either within or near to it. Although it is not designated as a SAC, it is considered without doubt that species of conservation interest such as lamprey species, eel, salmon and otter occur in the area.

Modelling studies show that, in common with Slevoir, Mota and Dromineer, an abstraction at Youghal would affect the water residence time in the lake with a marked decrease in the rate that water passes through the bay being predicted. As stated earlier, this raises concerns about the possible impact on nutrient levels and water quality and therefore also on species of high conservation status. Youghal bay is therefore considered an unsuitable abstraction site due to the predicted negative impact on aquatic ecology and species of conservation interest.

2.1.6 Parteen Basin Reservoir



Figure E4 – 5 Parteen Basin Reservoir.

Parteen Basin lies within the Lower Shannon candidate Special Area of Conservation. Freshwater qualifying interest habitats and species include: water

courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation, Freshwater Pearl Mussel, 3 species of Lamprey, Salmon and Otter.

Parteen Basin is a 'provisional' Heavily Modified Water Bodies (pHMWB)¹¹ and as noted, the lake itself is recorded as Annex I habitat - Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. [3140].

One river flows into the basin, the Ardcloney River (not listed by O'Reilly, 2009 as an important fishery) on the western Co. Clare side. There is one small, unnamed island north of where the Ardcloney River enters the basin. Shallow lake floor substrates in the area are comprised of sands. Water levels in the basin are highly regulated by the ESB as the basin acts as a reservoir with dams located on the southern end, controlling the release of water downstream into the old Shannon river course and/or to the tailrace for Ardnacrusha hydroelectric dam.

Modelling studies on how abstraction at Parteen Basin would affect residence time of water showed that there would be no change in Lough Derg flushing time characteristics during winter high flow conditions. During summer low flow conditions, abstraction from Parteen Basin would result in a slight improvement (3 day decrease) in flushing times in the southernmost regions of Lough Derg. This result is due to the fact that the flow of water has already passed through Lough Derg prior to encountering the Parteen Basin abstraction point. Therefore there is unlikely to be a significant, measureable negative impact on aquatic ecology including on qualifying interest species such as lamprey, salmon and otter.

Based on the above, the Parteen Basin Abstraction location is considered the best option out of the five abstraction options as it has least impact on the aquatic environment.

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2.2 Matrix of Multi Criteria Analysis

Criteria	Slevoir	Mota	Dromineer	Youghal Bay	Parteen Basin
Potential to impact on Natura 2000 Sites	Low Impact: Due to predicted decrease in flushing time in L. Derg, aquatic ecology of the SAC may be impacted.	Very low impact: Not designated as an SAC.	Very low impact: Not designated as an SAC.	Very low impact: Not designated as an SAC.	Very low impact: As predicted changes in flushing rates are low, the ecological status of the SAC will not be significantly affected.
Potential to impact on Natural Heritage Areas and proposed Natural Heritage Areas	Low Impact: Due to predicted decrease in flushing time in L. Derg, aquatic ecology of NHAs may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, aquatic ecology of NHAs may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, aquatic ecology of NHAs may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, aquatic ecology of NHAs may be impacted.	Very low impact: Not designated as pNHA.
Potential impact Annex I listed habitats (designated)	Low Impact: Due to predicted decrease in flushing time in L. Derg, designated Annex I listed habitats may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, designated Annex I listed habitats may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, designated Annex I listed habitats may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, designated Annex I listed habitats may be impacted.	Very low impact: As predicted changes in flushing rates are low, the ecological status of designated Annex I listed habitats will not be significantly affected.
Potential impact Annex I listed habitats (non-designated)	Low Impact: Due to predicted decrease in flushing time in L. Derg, non-designated Annex I listed habitats may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, non-designated Annex I listed habitats may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, non-designated Annex I listed habitats may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, non-designated Annex I listed habitats may be impacted.	Very low impact: As predicted changes in flushing rates are low, the ecological status of non-designated Annex I listed habitats will not be significantly affected.

					affected.
Potential to impact high ecological value habitats (semi-natural habitats)	Low Impact: Due to predicted decrease in flushing time in L. Derg, high ecological value habitats (semi-natural habitats) may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, high ecological value habitats (semi-natural habitats) may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, high ecological value habitats (semi-natural habitats) may be impacted.	Low Impact: Due to predicted increasing of flushing time in L. Derg, high ecological value habitats (semi-natural habitats) may be impacted.	Very low impact: As predicted changes in flushing rates are low, the ecological status of high ecological value of will not be significantly affected.
Potential to impact on protected Flora Flora Protection Order	Low Impact: Due to predicted decrease in flushing time in L. Derg, protected Flora Flora may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, protected Flora Flora may be impacted.	Due to predicted decrease in flushing time in L. Derg, protected Flora - Flora may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, protected Flora Flora may be impacted.	Very low impact: As predicted changes in flushing rates are low, the ecological status of protected Flora Flora and Fauna will not be significantly affected.
Potential to impact on Annex II species	Low Impact: Due to predicted decrease in flushing time in L. Derg, Annex II species may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, Annex II species may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, Annex II species may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, Annex II species may be impacted.	Very low impact: As predicted changes in flushing rates are low, the ecological status of Annex II species will not be significantly affected.
Potential to Impact on Annex IV species (wherever they occur)	Low Impact: Due to predicted decrease in flushing time in L. Derg, Annex IV species may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, Annex IV species may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, Annex IV species may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, Annex IV species may be impacted.	Very low impact: As predicted changes in flushing rates are low, the ecological status of Annex IV species will not be significantly

					affected.
Potential to impact on the breeding / wintering habitat for Annex I listed and other qualifying interest bird species	<i>See also chapter on terrestrial ecology.</i>	<i>See also chapter on terrestrial ecology.</i>	<i>See also chapter on terrestrial ecology.</i>	<i>See also chapter on terrestrial ecology.</i>	<i>See also chapter on terrestrial ecology.</i>
Potential to impact flora and fauna protected under Wildlife Act e.g. Birds, badger	<i>See also chapter on terrestrial ecology.</i>	<i>See also chapter on terrestrial ecology.</i>	<i>See also chapter on terrestrial ecology.</i>	<i>See also chapter on terrestrial ecology.</i>	<i>See also chapter on terrestrial ecology.</i>
Potential to impact on salmonid habitat - protected under SI Reg	Low Impact: Due to predicted decrease in flushing time in L. Derg, salmonid habitat may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, salmonid habitat may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, salmonid habitat may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, salmonid habitat may be impacted.	Very low impact: As predicted changes in flushing rates are low, impact on salmonid habitats will not be significantly affected.
Potential to impact on Freshwater Pearl Mussels - protected under SI Reg	Not applicable as Freshwater Pearl Mussels are not present.	Not applicable as Freshwater Pearl Mussels are not present.	Not applicable as Freshwater Pearl Mussels are not present.	Not applicable as Freshwater Pearl Mussels are not present.	Not applicable as Freshwater Pearl Mussels are not present.
Potential to impact upon high quality aquatic habitat for protected aquatic species.	Low Impact: Due to predicted decrease in flushing time in L. Derg, high quality aquatic habitat for protected aquatic species may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg high quality aquatic habitat for protected aquatic species may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, high quality aquatic habitat for protected aquatic species may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, high quality aquatic habitat for protected aquatic species may be impacted.	Very low impact: As predicted changes in flushing rates are low, impact on high quality habitat for protected aquatic species will not be significantly affected.

Potential to impact on coastal zone habitats (Intertidal)	<i>Not applicable as site is not within coastal zone environment.</i>	<i>Not applicable as site is not within coastal zone environment.</i>	<i>Not applicable as site is not within coastal zone environment.</i>	<i>Not applicable as site is not within coastal zone environment.</i>	<i>Not applicable as site is not within coastal zone environment.</i>
Potential to impact on marine habitats (Subtidal)	<i>Not applicable as site is not within coastal zone environment.</i>	<i>Not applicable as site is not within coastal zone environment.</i>	<i>Not applicable as site is not within coastal zone environment.</i>	<i>Not applicable as site is not within coastal zone environment.</i>	<i>Not applicable as site is not within coastal zone environment.</i>
Potential to impact marine/coastal birds	<i>Not applicable as site is not within coastal zone environment.</i>	<i>Not applicable as site is not within coastal zone environment.</i>	<i>Not applicable as site is not within coastal zone environment.</i>	<i>Not applicable as site is not within coastal zone environment.</i>	<i>Not applicable as site is not within coastal zone environment.</i>
Potential to impact marine mammals	<i>Not applicable as site is not within coastal zone environment.</i>	<i>Not applicable as site is not within coastal zone environment.</i>	<i>Not applicable as site is not within coastal zone environment.</i>	<i>Not applicable as site is not within coastal zone environment.</i>	<i>Not applicable as site is not within coastal zone environment.</i>
Potential to impact on water quality and inshore fishing grounds based on regional fisheries datasets.	<i>Not applicable as site is not within coastal zone environment.</i>	<i>Not applicable as site is not within coastal zone environment.</i>	<i>Not applicable as site is not within coastal zone environment.</i>	<i>Not applicable as site is not within coastal zone environment.</i>	<i>Not applicable as site is not within coastal zone environment.</i>
Potential to impact on transient protected marine species (cetaceans and salmonids), which may pass through the affected area within the survey area footprint.	Low Impact: Due to predicted decrease in flushing time in L. Derg, species including Sea Lamprey and salmonids may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, species including Sea Lamprey and salmonids may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, species including Sea Lamprey and salmonids may be impacted.	Low Impact: Due to predicted decrease in flushing time in L. Derg, species including Sea Lamprey and salmonids may be impacted.	Very low impact: As predicted changes in flushing rates are low, impact on transient marine species (lamprey, salmonids) will not be significantly affected.

2.3 Comparative Discussion

As noted above, the modelling studies (Marcon, 2015) of the four possible abstraction locations in Lough Derg have all shown that abstraction at these locations will have a measurable impact on flushing time in the lake and that this would be likely to have a negative impact on the conservation objectives of Lough Derg SAC and of the entire lake aquatic ecosystem. For this single reason therefore, none of these locations are seen as being viable options in terms of aquatic ecology in the sense that consenting authorities are considered not to permit abstraction at these sites. Furthermore, non-Governmental groups, angling groups and any third party either inside or outside the State are likely to object to a proposal to abstract water at these sites. Even allowing for reducing impacts by design, construction methods and other mitigation measures, aquatic ecological impacts due to decreased flushing times which give rise to increased levels of nutrients in the water and consequential changes in the trophic status of the lake water and therefore changes in species composition of aquatic communities, are likely to be adverse.

Parteen Basin has therefore been assessed to be the least constrained location in terms of aquatic ecology. A level of impact on flushing time is still predicted at this location; however, the changes are considered too low to affect the ecological status of the basin. None the less, detailed engineering methods, site location/ project design, monitoring and relevant mitigation are all required to establish a “least” level of impact.

3**Desalination****3.1 Background**

An assessment of the potential abstraction and desalination locations was carried out for the following options:

- Irish Sea – South Dublin, Loughshinny South, Loughshinny North and Balbriggan (Option H - Desalination)

3.2 Literature Review on Brine Discharge on the Marine Environment**3.2.1 Introduction**

The effluent from a desalination plant contains approximately three times more salt than sea water; discharge of this effluent into the marine environment is more ecologically sensitive than the abstraction of the sea water for desalination. It is for this reason that a literature review on this topic was undertaken.

As part of the assessment of the possible impacts on the marine environment of brine effluent from a desalination plant, a review of other peer-reviewed papers was undertaken.

In assessing the four locations for desalination the data sources consulted included:

- A review of International literature relating to research on disposal of brine to the sea from desalination plants;
- National and European Designated Sites; and
- Specialists reports on the marine environment in that part of the Irish Sea e.g. MAFF (1981), Mackie et al., (1995), Bolens (1998), Wilson et al., (2001) and CEFAS (2002).

3.2.2 Results

The importance of selecting a site with suitable hydrodynamic conditions, e.g. current velocity and water depth that would ensure maximum dilution and dispersion of the proposed discharge was a recurrent theme in much of the literature. Roberts *et al.* (2010) note a clear consensus amongst many articles regarding discharge site selection as the primary factor that determines the extent of ecological impacts of desalination plants. Turbulent coastal environments with continuous flushing, as found in this part of the Irish Sea, are predicted to be less susceptible to detrimental impacts compared to low energy systems. With reference to modelling, Roberts *et al.* (2010) note that mathematical dispersion models suggest that the worst discharge design from the perspective of brine dilution is an intertidal or surface discharge because plumes tend to extend further and dilute less rapidly. Roberts *et al.* (2010) also note that semi-enclosed areas e.g. the Baltic Sea, the Arabian Gulf and the Red Sea are more susceptible to significant increases in salinity around outfalls due to the limited flushing that these environment experience. Roberts *et al.* (2010) also state that the spatial extent of plumes can be minimised by building discharges further offshore and that detailed design of the angle of the release “jets” enhances mixing and offshore transport of brine plumes (see Roberts *et al.*, 1997). These authors conclude that there is broad agreement amongst modelling studies that sub-tidal offshore discharges in an area of persistent turbulent flow, such as is present in

this part of the Irish Sea (CEFAS, 2000), is the optimal design to minimise the spatial extent and intensity of brine plumes.

Jenkins *et al.* (2012) in a list of recommendations of brine discharges to coastal waters, comment that discharges with rapid initial dilution, into areas of good flushing, result in impacts that extend only a few tens of meters from the discharge pipes. Considering that these are the types of physical oceanographic conditions that characterise the Western Irish Sea at the proposed discharge site (CEFAS, 2000), it can therefore be anticipated that a similar aerial extent of impact would apply to this site.

Danoun (2007) lists the following attributes of a disposal site as being positive to minimise brine discharge impacts:

- wind direction and speed;
- wave height and speed;
- bathymetry (water depth); and
- mean tidal speed.

Danoun (2007) notes that when the values of any of these elements are high, as is the case in this part of the Western Irish Sea for water depth and tidal speed, rapid diffusion will occur, thus reducing the zone of high risk and extending the area of low risk of brine discharge impacts.

Del Pilar Ruso *et al.* (2007) studied a brine plume coming from a desalination plant at Alicante (SE Spain) and noted a change in faunal community type at stations close to the discharge where salinities exceeded 39 practical salinity units psu, from one characterised by polychaetes, crustaceans and molluscs to one dominated by nematodes. Infaunal benthic communities dominated by nematode indicate some level of stress which, in this case, can be attributed to brine. These authors also observed changes in deeper water stations but attributed these changes to impacts from effluent from a sewage treatment plant and proximity to Alicante Harbour, which had undergone recent expansion. Del Pilar Ruso *et al.*, (2008) also examined the sensitivity to brine discharges of a number of polychaete families and found ampharetids to be most sensitive followed by nephtyids, spionids, syllids and capitellids. Paraonids were found to be the least sensitive polychaete family. They also documented no apparent changes in the composition of deeper water faunal assemblages *i.e.* $\pm 15\text{m}$.

Raventos *et al.* (2006), also working in Spanish Mediterranean waters off Blanes, studied macrobenthic communities in the vicinity of a subtidal outfall pipe from a desalination plant surfacing at a water depth of 16.5m. These authors recorded no significant variations attributable to brine discharges on marine species including sessile, tube-dwelling taxa such as *Mesochaetopterus rogeri*. In agreement with other studies, Raventos *et al.*, (2006) also recommended that brine discharge pipe diffusers should be sited in hydrodynamically active areas, *e.g.* areas swept by strong currents affected by wave action, as rapid dilution of brine discharges would likely contribute to the minimising of any negative impact on benthic communities in the surrounding areas.

As regards to studies on lixiviation of rock salt, Quintino *et al.*, (2008) working on a site on the Western coast of Portugal, carried out a series of laboratory experiments on a variety of marine invertebrate taxa including the tube dwelling polychaete *Sabellaria alveolata*, the free living polychaete *Ophelia radiata*, the amphipod *Corophium multisetosum*, the isopod *Eurydice pulchra*, the bivalve *Mytilus galloprovincialis* and the echinoderm *Paracentrotus lividus*. Results for these

laboratory-based experiments showed that all the tested species were negatively affected by even diluted brine. Quintino *et al.* (2008) concluded that such biological responses obtained during the experiments could not be simply attributed to salinity levels but to the result of differences in ionic composition of the rock salt solution compared to sea water. As the source of salt in the brine generated in the case of the desalination option is sea water and not rock salt, there can be no differences in ionic composition.

In the U.K., researchers from the University of Hull (see Perez Dominguez *et al.*, 2013, Smyth *et al.*, 2014 *inter alia*) carried out a programme focusing on assessing the effects of brine discharge on a site located off the East coast at Aldborough. The study reached the following conclusions:

1. Benthic communities in 2009 were not significantly reduced in quality and number compared to those recorded during a baseline study carried out in 2004. In addition, there was no clear spatial distribution of communities or species in relation to the discharge event;
2. It was considered unlikely that there would be any direct mortality to fish species due to the small size of the plume;
3. With regard to commercial crustacean species such as crabs and lobsters, there was no recognisable effect of the brine on shellfish populations in the area of the outfall;
4. Using pots into which lobsters had been placed and deployed at different distances from the out fall pipe, results indicated no significant effects regarding lobster mortalities relating to the brine discharge;
5. There was some reduction in species richness/diversity in epifaunal communities at the point of discharge but that impacts were limited to the areas within the consented mixing zone.

A report by Pérez-Dominguez *et al.*, (2013), examining the toxicity of the same brine plume at Aldborough on brown crabs (*Cancer pagurus*), found a negligible effect on the crustacean fisheries resource of the area. These authors suggested that brown crab mortalities recorded from *in situ* experiments were probably related to the stresses of confinement and handling. In relation to local free-living decapods, it is suggested that healthy unrestrained specimens would be able to detect the plume and avoid any adverse physiological effects.

Smyth *et al.*, (2014), working on the reaction of crab (*Cancer pagurus*) and lobster to brine discharges, were able to detect and discriminate between changes in salinity of magnitudes comparable to those likely to be found in areas subjected to brine discharges. These authors concluded that if salinities of discharged effluent exceed the known thresholds for these two species, it is likely that the adults will relocate to areas of more favourable salinities.

Other research carried out at Hull University at the Aldborough discharge site showed that populations of mobile species such as fish were not impacted by the brine plume. The researchers concluded that fish had an avoidance behaviour to the high salinity water by swimming away from it (*pers. comm*, Prof. Mike Elliott University of Hull, 2014).

3.2.3 Conclusions

The importance of proper brine outfall location was one of the main issues highlighted by both review papers and peer reviewed papers on impacts on either intertidal/subtidal faunal communities or individual species. Given the hydrodynamic characteristics of the marine environment in the Irish Sea e.g. relatively easily

accessible water depths of 20m and more, high current velocities and high levels of turbulence, the brine plume will quickly dilute and disperse. This assessment is further substantiated by field studies on communities and species referenced in this review. These studies suggest that the impacts of brine plume discharges are usually spatially restricted to the immediate area around the diffuser. There will be an area of sea bed near the outfalls that will be negatively impacted by the release of brine. However, this impact will be spatially limited. In assessment of each location, consideration was given to potential siting of abstraction and brine disposal infrastructure.

As noted above, the siting of a brine outfall requires important consideration. The potential locations to allow for effective dilution and dispersal were examined using the criteria referenced above *i.e.* water depth (*ca* + 20m) and velocity (*ca* +50 cm/sec). Oceanographic data held on water depths and current velocities in the central Irish Sea and oceanographic mathematical modelling output were examined to provide input to the assessment of potential desalination sites around Dublin.

The intake location is not considered as sensitive an issue as the discharge location. The intake can be sited outside any European site thereby minimising potential effects on its integrity. Construction techniques, such as horizontal directional drilling, could be considered to help minimise potential impacts on the sea bed.

3.3 Designated Sites

There are number of designated sites located in close proximity to the desalination location options. pNHAs and SPAs in close proximity to each outfall location include:

- Dalkey Coastal Zone and Killiney Hill pNHA (Site Code: 001206);
- Loughshinny Coast pNHA (Site Code: 002000);
- Rockabill SPA (Site Code: IE004014); and
- Dalkey Islands SPA (Site Code: 4172).

Each of the above SPAs are further discussed and assessed in the terrestrial ecology report (Appendix E3).

Dalkey Coastal Zone and Killiney Hill pNHA (Site Code: 001206)

This site includes the coastal stretch from Scotman's Bay to south of White Rock, the Dalkey Island group, Dalkey Sound and Killiney Hill. This site represents a fine example of a coastal system with habitats ranging from the sub-littoral to coastal heath. The flora is well developed and includes some scarce species. The islands are important bird sites. The site also has geological importance.

Loughshinny Coast (Site Code: 002000)¹²

This site is situated north of Dublin Bay, midway between Loughshinny and Skerries. The south boundary of the site extends to the clay cliffs while the north end is bounded by a stream. This coastal area is noted for its geological interests, the rocks being conglomerates, limestones and shales. The main habitat of the site is coastal grass, which merges into a shingle/rocky shore with some patches of

¹² National Parks and Wildlife Service (Date Unknown). Loughshinny Coast (Site Code: 002000)

saltmarsh. Green-winged Orchid (*Orchis morio*) protected under the Flora Protection Order 1987 occurs onsite. A flush (potential Annex I habitat) was recorded at the northern end of the site. Coastal birds use the grasslands for roosting, including Curlew and Oystercatcher.

Figure 1 below shows candidate Special Areas of Conservation (SAC) in the vicinity of the four possible desalination sites (including a marine SAC). (See Section 1.2 regarding the sensitivity of developments within or near Natura sites). These SACs include:

- Rockabill to Dalkey Island (Site Code: 003000);
- South Dublin Bay (Site Code: 000210);
- North Dublin Bay (Site Code: 000206);
- Howth Head (Site Code: 000202);
- Baldoyle Bay (Site Code: 000199);
- Malahide Estuary (Site Code: 000205);
- Ireland's Eye and (Site Code: 002193); and
- Lambay Island (Site Code: 000204).

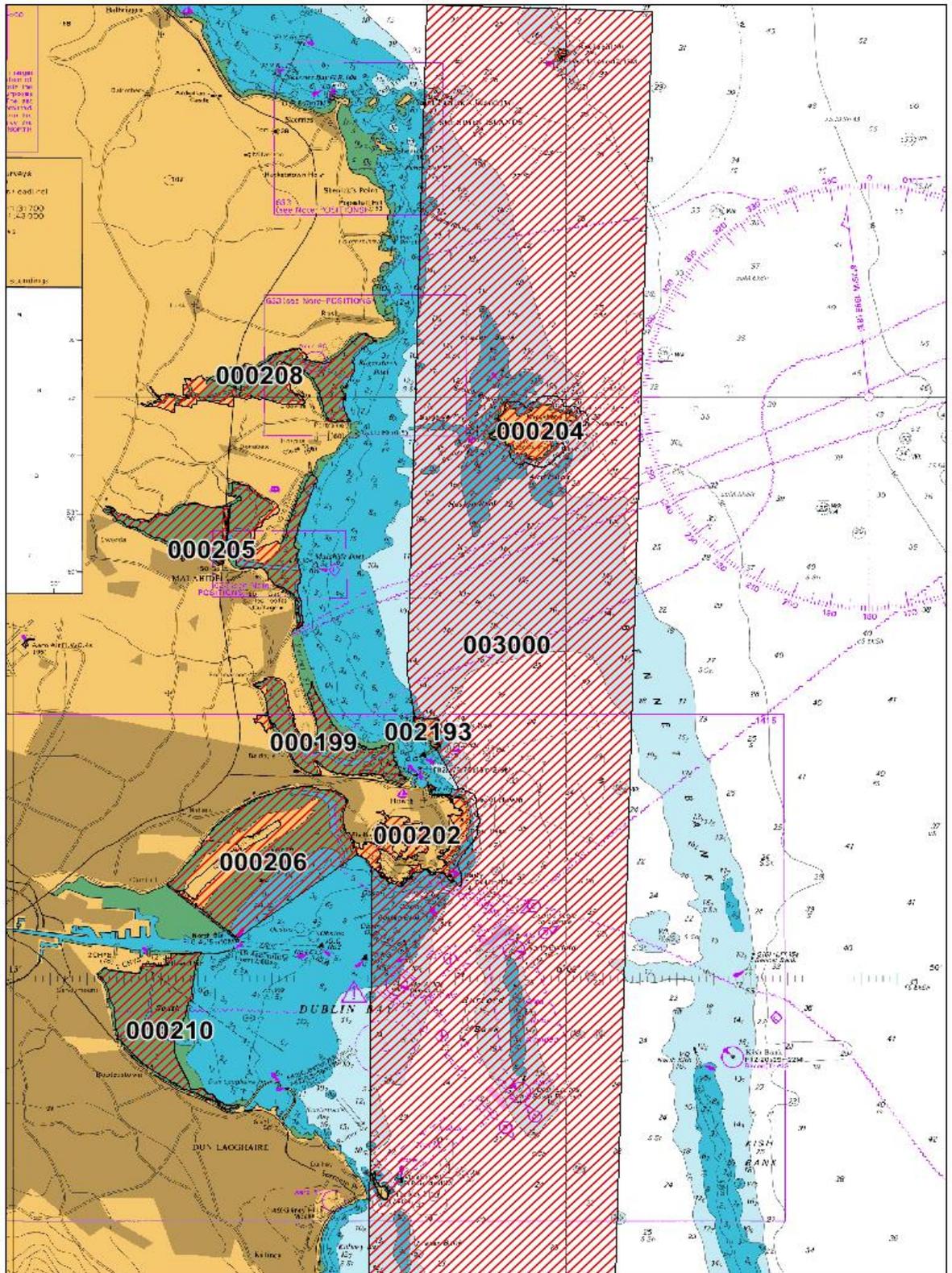


Figure E4– 6. Locations of SACs in the vicinity of potential brine discharge sites.

As these sites are protected under both National and EU law, possible impacts on them from the desalination process needs to be considered. A description of each is presented below.

In assessing each location, consideration was given to potential siting of abstraction and brine disposal infrastructure. The siting of the brine outfall will be an important consideration as shown in the literature review presented above. The potential locations to allow for effective dilution and dispersal were examined using the following criteria: water depth (ca + 20 m, see Figure 2 for water depths at each location) and velocity (ca +50 cms sec).

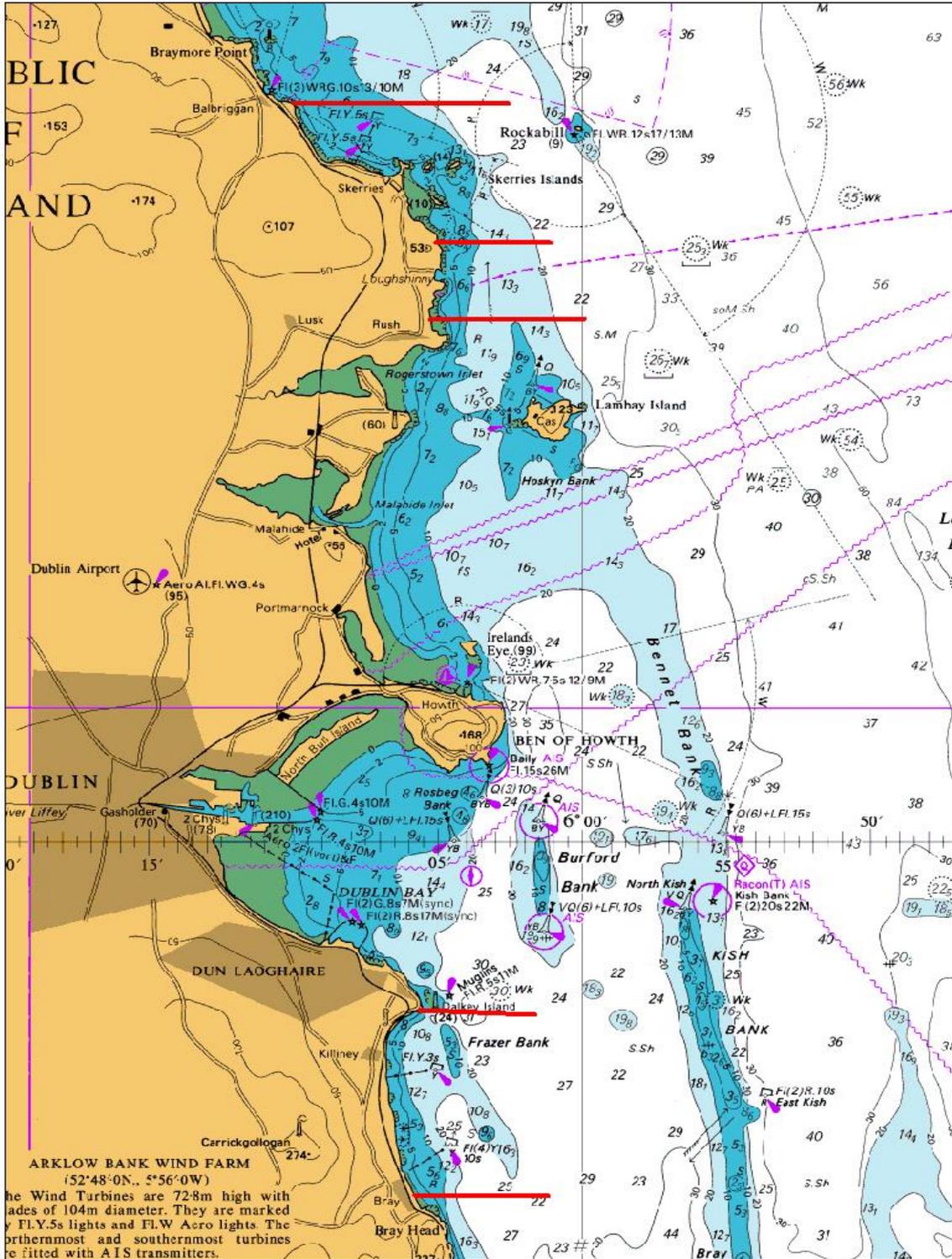


Figure E4– 7 . Bathymetry of the western part of the Irish Sea in the proximity of the proposed outfall sites.

Oceanographic data held in-house in AQUAFAC^T e.g. current velocity and direction data and in reports such as Ministry of Agriculture, Fisheries and Food U.K. (MAFF) (1981), Bolens (1998) and CEFAS (2002) on water depths and current velocities on the central Irish Sea and oceanographic mathematical modelling output were examined to provide input to the assessment. It should be noted that as brine is saltier than sea water (sea water is normally 34 practical salinity units (psu) whereas brine may be twice or three times saltier *i.e.* between 60 and 90 psu), it is heavier than sea water and will therefore remain on/near the seabed.

3.3.1 Rockabill to Dalkey Island SAC

This SAC includes a range of dynamic inshore and coastal waters in the western Irish Sea which include sandy and muddy seabed, reefs, sandbanks and islands. This site extends southwards, in a strip approximately 7 km wide and 40 km in length from Rockabill Island running adjacent to Howth Head and crosses Dublin Bay to Frazer Bank in south Co. Dublin. The site encompasses Dalkey, Muglins and Rockabill Islands.

The site is selected for the following habitats and species:

- Reefs
- Harbour Porpoise (*Phocoena phocoena*)

Reef habitat is uncommon along the eastern seaboard of Ireland due to prevailing geological conditions. However, surveys of the Irish coast have indicated that the greatest habitat resource within the Irish Sea is found fringing offshore islands, which are concentrated along the Dublin coast. A detailed survey of selected suitable islands has shown areas with typical biodiversity for this habitat both intertidally and subtidally. Species recorded in the intertidal zone included *Fucus spiralis*, *Fucus serratus*, *Pelvetia canaliculata*, *Ascophyllum nodosum*, *Semibalanus balanoides* and *Necora puber*. Subtidally, a wide range of species found include *Laminaria hyperborea*, *Flustra foliacea*, *Alaria esculenta*, *Halidrys siliquosa*, *Pomatoceros triqueter*, *Alcyonium digitatum*, *Metridium senile*, *Caryophyllia smithii*, *Tubularia indivisa*, *Mytilus edulis*, *Gibbula umbilicalis*, *Asterias rubens*, and *Echinus esculentus*. These reefs are subject to strong tidal currents with an abundant supply of suspended matter resulting in good representation of filter feeding fauna such as sponges, anemones and echinoderms.

The area selected for designation represents a key habitat for the Annex II species Harbour Porpoise within the Irish Sea. Population survey data show that porpoise occurrence within the site boundary meets suitable reference values for other designated sites in Ireland. The species occurs year-round within the site and comparatively high group sizes have been recorded. Porpoises with young (*i.e.* calves) are observed at favourable, typical reference values for the species.

3.3.2 South Dublin Bay SAC

South Dublin Bay SAC lies south of the River Liffey in Co. Dublin, and extends from the South Wall to the west pier at Dun Laoghaire. It is an intertidal site with extensive areas of sand and mudflats. The sediments are predominantly sands but grade to sandy muds near the shore at Merrion Gates. The main channel which drains the area is Cockle Lake.

The site is selected for the following habitat:

- Tidal Mudflats and Sandflats

The bed of *Zostera noltii* found below Merrion Gates is the largest stand on the east coast. Green algae (*Enteromorpha* spp. and *Ulva lactuca*) are distributed throughout the area at a low density. Furoid algae occur on the rocky shore in the Maretimo to Dún Laoghaire area. Species include *Fucus spiralis*, *F. vesiculosus*, *F. serratus*, *Ascophyllum nodosum* and *Pelvetia canaliculata*. Several small, sandy beaches with incipient dune formation occur in the northern and western sectors of the site, notably at Poolbeg, Irishtown and Merrion/ Booterstown. The formation at Booterstown is very recent. Drift line vegetation occurs in association with the embryonic and incipient fore dunes. Typically drift lines occur in a band approximately 5 m wide, though at Booterstown this zone is wider in places. The habitat occurs just above the High Water Mark and below the area of embryonic dune. A small area of pioneer saltmarsh now occurs in the lee of an embryonic sand dune just north of Booterstown Station. This early stage of saltmarsh development is here characterised by the presence of pioneer stands of glassworts (*Salicornia* spp.) occurring below an area of drift line vegetation. As this is of very recent origin, it covers a small area but ample areas of substrate and shelter are available for the further development of this habitat.

Lugworm (*Arenicola marina*), Cockles (*Cerastoderma edule*) and annelids and other bivalves are frequent throughout the site. The small gastropod *Hydrobia ulvae* occurs on the muddy sands off Merrion Gates.

3.3.3 North Dublin Bay SAC

North Dublin Bay SAC covers the inner part of north Dublin Bay, the seaward boundary extending from the Bull Wall lighthouse across to the Martello Tower at Howth Head.

The site is selected for the following habitats and/or species:

- Tidal Mudflats and Sandflats
- Annual Vegetation of Drift Lines
- *Salicornia* Mud
- Atlantic Salt Meadows
- Mediterranean Salt Meadows
- Embryonic Shifting Dunes
- Marram Dunes (White Dunes)
- Fixed Dunes (Grey Dunes)
- Humid Dune Slacks
- Petalwort (*Petalophyllum ralfsii*)

North Bull Island is a sandy spit which formed after the building of the South Wall and Bull Wall in the 18th and 19th centuries. It now extends for about 5 km in length and is up to 1 km wide in places. A well-developed and dynamic dune system stretches along the seaward side of the island. Various types of dunes occur, from fixed dune grassland to pioneer communities on foredunes.

3.3.4 Howth Head SAC

Howth Head SAC is a rocky headland situated on the northern side of Dublin Bay. The peninsula is composed of Cambrian slates and quartzites joined to the mainland by a post-glacial raised beach. Limestone occurs on the north-west side while glacial drift is deposited against the cliffs in places.

The site is selected for the following habitats:

- Vegetated sea cliffs of the Atlantic and Baltic coasts
- European dry heaths

3.3.5 Baldoyle Bay SAC

Baldoyle Bay SAC extends from just below Portmarnock to the west pier at Howth in Co. Dublin. It is a tidal estuarine bay protected from the open sea by a large sand-dune system and two small rivers, the Mayne and the Sluice, flow into it.

The site is selected for the following habitats:

- Mudflats and sandflats not covered by seawater at low tide
- *Salicornia* and other annuals colonising mud and sand
- Atlantic salt meadows (*Glauco-Puccinellietalia maritima*)
- Mediterranean salt meadows (*Juncetalia maritimi*)

Large areas of intertidal flats are exposed at low tide at this site. These are mostly sands but grade to muds in the inner sheltered parts of the estuary. Extensive areas of Common Cord-grass (*Spartina anglica*) occur in the inner estuary. Both species of eel grass, *Zostera angustifolia* and *Z. noltii*, are present. During summer, the sandflats of the sheltered areas are covered by mats of *Enteromorpha* spp. and *Ulva lactuca*. Sediments have a typical macrofauna, with Lugworm (*Arenicola marina*) dominating the sand flats. The tubeworm, *Lanice conchilega*, is present in high densities at the low tide mark and the small gastropod *Hydrobia ulvae* occurs in the muddy areas, along with the amphipodous crustacean *Corophium volutator*.

3.3.6 Malahide Estuary SAC

Malahide Estuary SAC is situated immediately north of Malahide and east of Swords in Co. Dublin. It is the estuary of the River Broadmeadow. The site is divided by a railway viaduct which was built in the 1800s.

The site is selected for the following habitats:

- Tidal Mudflats and Sandflats
- *Salicornia* Mud
- *Spartina* Swards
- Atlantic Salt Meadows
- Mediterranean Salt Meadows
- Marram Dunes (White Dunes)

- Fixed Dunes (Grey Dunes)

The outer part of the estuary is mostly cut off from the sea by a large sand spit, known as 'the island'. The outer estuary drains almost completely at low tide, exposing sand and mud flats. There is a large bed of both species of eelgrass *Zostera noltii* and, *Z. angustifolia* in the north section of the outer estuary, along with *Ruppia maritima* and extensive mats of *Enteromorpha spp.* and *Ulva lactuca*). Common Cord-grass (*Spartina anglica*) is also widespread in this sheltered part of the estuary.

3.3.7 Rogerstown Estuary SAC

Rogerstown Estuary SAC is situated about 2 km north of Donabate in Co. Dublin. It is a relatively small, narrow estuary separated from the sea by a sand and shingle bar. The estuary is divided by a causeway and narrow bridge, built in the 1840s to carry the Dublin-Belfast railway line.

The site is selected for the following habitats:

- Estuaries
- Tidal Mudflats and Sandflats
- *Salicornia* Mud
- Atlantic Salt Meadows
- Mediterranean Salt Meadows
- Marram Dunes (White Dunes)
- Fixed Dunes (Grey Dunes)

The estuary drains almost completely at low tide. The intertidal flats of the outer estuary are mainly of sands, with soft muds in the north-west sector and along the southern shore. Associated with these muds are stands of Common Cordgrass (*Spartina anglica*). Green algae (mainly *Enteromorpha spp.* and *Ulva lactuca*) are widespread and form dense mats in the more sheltered areas. The intertidal angiosperm Beaked Tasselweed (*Ruppia maritima*) grows profusely in places beneath the algal mats. The Lugworm (*Arenicola marina*) is common in the outer estuary and large Mussel beds (*Mytilus edulis*) occur at the outlet to the sea. The area of intertidal flats in the inner estuary is reduced as a result of the local authority refuse tip on the north shore. The sediments are mostly muds, which are very soft in places. Common Cordgrass is widespread in parts, and in summer, dense green algal mats grow on the muds. In the extreme inner part, the estuary narrows to a tidal river. The habitat '*Salicornia* mud' occurs in both the outer and inner estuaries, and *S. dolichostachya* is the main glasswort species found.

3.3.8 Ireland's Eye SAC

Ireland's Eye SAC is located ca 1.5 km north of Howth in Co. Dublin. It is a Cambrian island with quartzite which forms spectacular cliffs on the north-east side. Elsewhere much of the area is covered by drift.

The site is selected for the following habitats:

- Perennial Vegetation of Stony Banks
- Vegetated Sea Cliffs

3.3.9 Lambay Island SAC

Lambay Island SAC is a large (250 ha) privately owned island lying 4 km off Portrane on the North Co. Dublin coast. The island rises to 127 m and is surrounded by steep cliffs on the north, east and south slopes. These cliffs contain good diversity in height, slope and aspect. The west shore is low-lying and the land slopes gently eastwards to the summit in the centre of the island. The underlying geology is varied, but is dominated by igneous rocks (of andesitic type) and ash. Also present are shales and limestones of Silurian origin, limestone conglomerates, and shales from the Old Red Sandstone era. The bedrock is exposed on the fringing cliffs and in rocky outcrops; elsewhere it is overlain by varying depths of glacial drift.

The site is selected for the following habitats and/or species:

- Reefs
- Vegetated Sea Cliffs
- Grey Seal (*Halichoerus grypus*)
- Common (Harbour) Seal (*Phoca vitulina*)

Lambay Island is flanked by extensive areas of reef habitat. Typical species in the intertidal include *Ascophyllum nodosum*, *Fucus spp.*, *Laminaria spp.*, *Dynamena pumila*, *Actinia equina*, *Littorina littorea*, *L. saxatilis*, *Patella vulgata* and *Semibalanus balanoides*. In these subtidal reef, the following algal species are frequently encountered - *Palmaria palmata*, *Cystoclonium purpureum*, *Delesseria sanguinea*, *Membranoptera alata*, *Hypoglossum hypoglossoides*, *Chorda filum*, *Laminaria saccharina* and *Halidrys siliquosa*.

As some of these SACs are either too remote from any of the four possible desalination plants or are designated for terrestrial habitats or species, they are not considered further here. These are South Dublin Bay, North Dublin Bay, Howth Head, Baldoyle Estuary and Ireland's Eye.

3.4 Desalination Option Locations

3.4.1 South Dublin

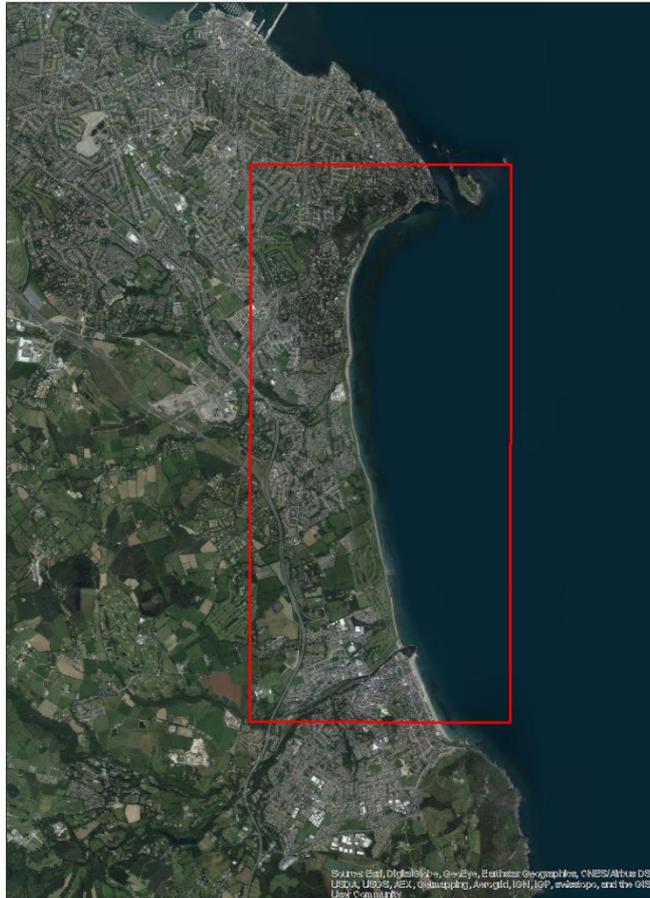


Figure E4 – 8 South Dublin

Marine water quality in the South Dublin area is considered acceptable for abstraction, the only constraint being regulation of intake velocity: this needs to be stipulated so that minimum intake of marine taxa such as fish can be minimised. A further mitigation measure in this regard is the use of screen with mesh sizes of ca 3 cms² to physically prevent organisms getting into the intake pipe. Biological fouling of the intakes will occur rapidly e.g. within weeks and will require regular cleaning.

In terms of physical oceanography, the area off Killiney Beach has suitable water depths (see Figure 2) and velocities to the northeast of Bray Head to allow for effective dilution and dispersion of the brine plume (MAFF, 1981; Bolens, 1998 and CEFAS 2002). Mackie *et al.* (1995) describe the benthic community in this area as being a Deep *Venus* community which they say is typical of large areas of the Irish Sea. Wilson *et al.* (2001) record the substrate type as being sand. Both the biological and sedimentary data indicate a high energy environment *i.e.* fast current speeds which would allow for the fast dispersion of the brine.

Rockabill to Dalkey SAC is located within the northern part of the study area. In order to avoid potential consenting problems as outlined in Section 1.2 above, this should be avoided by siting the intake and outfall pipes as far south of the SAC as possible and as indicated by mathematical modelling studies of the plume dispersion.

3.4.2 Loughshinny North



Figure E4 – 9 Loughshinny North

The outfall site for the Loughshinny North location lies within the Rockabill to Dalkey Island SAC (site code IE003000 and description above). Even though modelling studies indicate that the brine plume will disperse quickly in the water column, because of the fact that the disposal site lies within an SAC and is close to two other Natura sites, the Lough Shinnny North option is not considered a preferential option.

3.4.3 Loughshinny South



Figure E4 – 10 Loughshinny South

The outfall site for this location lies within the Rockabill to Dalkey Island SAC (site code 3000 and description above) and close to two other SACs and these are Rodgerstown Estuary SAC (site code IE000208 and description above), and Lambay Island SAC (site code IE000204 and description above). Even though modelling studies indicate that the brine plume will disperse quickly, because of the fact that the disposal site lies within a SAC and is close to two other Natura sites, the Loughshinny South option is not considered a preferential option. As noted above for the Loughshinny North option, the rationale for this is that any potential impact on a Natura site could compromise the successful consenting of the site by the relevant Authority as it is very likely that the NPWS will object to the development.

3.4.4 Balbriggan



Figure E4 – 11 Balbriggan

Marine water quality in the Balbriggan area is considered acceptable for abstraction, the only constraint being regulation of intake velocity. Biological fouling of the intakes will occur rapidly e.g. within weeks and will require regular cleaning.

In terms of physical oceanography, the area off Balbriggan has suitable water depths to the west of Rockabill (see Figure 2). However, velocities are lower than off Bray Head. Rockabill lies within a SAC (Rockabill to Dalkey Island site code 003000, see above) and potential impact from the brine plume would have to be assessed based on output from brine modelling studies. However mitigation through appropriate diffuser design options will maximise the dispersion possibilities of the brine plume.

3.5 Matrix of Multi Criteria Analysis

Criteria	South Dublin	Loughshinny North	Loughshinny South	Balbriggan
Potential to impact on Natura 2000 Sites	Very low impact: Not within a SAC.	Very low impact: Adjacent to Natura sites.	Very low impact: Adjacent to Natura sites.	Very low impact: Adjacent to Natura sites.
Potential to impact on Natural Heritage Areas and proposed Natural Heritage Areas	Very low impact: Not within an NHA.	Very low impact: Adjacent to Natura sites.	Very low impact: Adjacent to Natura sites.	Very low impact: Adjacent to Natura sites.
Potential impact Annex I listed habitats (designated)	Very low impact: Annex I designated listed habitats present.	Very low impact: Adjacent to Natura sites.	Very low impact: Adjacent to Natura sites.	Very low impact: Adjacent to Natura sites.
Potential impact Annex I listed habitats (non-designated)	Very low impact: Annex I non-designated listed habitats present.	Very low impact: Adjacent to Natura sites.	Very low impact: Adjacent to Natura sites.	Very low impact: Adjacent to Natura sites.
Potential to impact high ecological value habitats (semi-natural habitats)	Very low impact: High ecological value habitats present.	Very low impact: High ecological value habitats present.	Very low impact: High ecological value habitats present.	Very low impact: High ecological value habitats present.
Potential to impact on protected Flora - Flora Protection Order	Very low impact: Potential to impact on protected Flora.	Very low impact: Potential to impact on protected Flora.	Very low impact: Potential to impact on protected Flora.	Very low impact: Potential to impact on protected Flora.
Potential to impact on Annex II species	Very low impact: Marine mammals may pass through the area.	Very low impact: Marine mammals may pass through the area.	Very low impact: Marine mammals may pass through the area.	Very low impact: Marine mammals may pass through the area.
Potential to Impact on Annex IV species (wherever they occur)	Very low impact: Marine mammals may pass through the area.	Very low impact: Marine mammals may pass through the area.	Very low impact: Marine mammals may pass through the area.	Very low impact: Marine mammals may pass through the area.
Potential to impact on the breeding / wintering habitat for Annex I listed and other qualifying interest bird species	<i>See Terrestrial Ecological Assessment.</i>	<i>See Terrestrial Ecological Assessment.</i>	<i>See Terrestrial Ecological Assessment.</i>	<i>See Terrestrial Ecological Assessment.</i>

Criteria	South Dublin	Loughshinny North	Loughshinny South	Balbriggan
Potential to impact flora and fauna protected under Wildlife Act e.g. Birds, badger	Very low impact: Potential to impact flora and fauna protected under Wildlife Act e.g. Birds.	Very low impact: Potential to impact flora and fauna protected under Wildlife Act e.g. Birds.	Very low impact: Potential to impact flora and fauna protected under Wildlife Act e.g. Birds.	Very low impact: Potential to impact flora and fauna protected under Wildlife Act e.g. Birds.
Potential to impact on salmonid habitat - protected under SI Reg	Very low impact: Brine discharge will locally impact the benthic communities.	Very low impact: Brine discharge will locally impact the benthic communities.	Very low impact: Brine discharge will locally impact the benthic communities.	Very low impact: Brine discharge will locally impact the benthic communities.
Potential to impact on a Freshwater Pearl Mussel - protected under SI Reg	<i>Freshwater Pearl Mussel not present.</i>			
Potential to impact upon high quality aquatic habitat for protected aquatic species.	Low impact: Brine discharge will locally impact the benthic communities.	Low impact: Brine discharge will locally impact the benthic communities.	Low impact: Brine discharge will locally impact the benthic communities.	Low impact: Brine discharge will locally impact the benthic communities.
Potential to impact on coastal zone habitats (Intertidal)	Very low impact: Very low risk of the intertidal habitat being impacted.	Very low impact: Very low risk of the intertidal habitat being impacted.	Very low impact: Very low risk of the intertidal habitat being impacted.	Very low impact: Very low risk of the intertidal habitat being impacted.
Potential to impact on marine habitats (Subtidal)	Low impact: Brine discharge will locally impact the benthic communities.	Low impact: Brine discharge will locally impact the benthic communities.	Low impact: Brine discharge will locally impact the benthic communities.	Low impact: Brine discharge will locally impact the benthic communities.
Potential to impact marine/coastal birds	<i>See Terrestrial Ecological Assessment.</i>			
Potential to impact marine mammals	Low impact: Marine mammals may pass through the area.	Low impact: Marine mammals may pass through the area.	Low impact: Marine mammals may pass through the area.	Low impact: Marine mammals may pass through the area.

Criteria	South Dublin	Loughshinny North	Loughshinny South	Balbriggan
Potential to impact on water quality and inshore fishing grounds based on regional fisheries data sets.	Very low impact: Low risk impact on inshore fisheries.	Very low impact: Low risk impact on inshore fisheries.	Very low impact: Low risk impact on inshore fisheries.	Very low impact: Low risk impact on inshore fisheries.
Potential to impact on transient protected marine species (cetaceans and salmonids), which may pass through the affected area within the survey area footprint.	Very low impact: Marine mammals and salmonids may pass through the area.	Very low impact: Marine mammals and salmonids may pass through the area.	Very low impact: Marine mammals and salmonids may pass through the area.	Very low impact: Marine mammals and salmonids may pass through the area.

3.6 Comparative Discussion

In general physical oceanographic conditions such as water depth, current velocity and direction and turbulence, it is predicted that this area of the Irish Sea has the appropriate characteristics to effectively dilute and disperse the brine plume within a spatially small area. Given the strong North/South direction of current flow, the plume will be elliptically shaped along this axis. However, as has been noted above, there are a number of Natura sites in the same area and this criterion is considered the most important feature on which to base selection for the disposal site. Based on this high level assessment, as Loughshinny North and South locations are closer to Natura sites than the South Dublin and Balbriggan sites, they are considered to be more ecologically sensitive. Because of these ecological constraints, the Loughshinny locations are not considered any further in this assessment.

Both the South Dublin and Balbriggan sites are outside Natura sites and cannot be differentiated on this criterion. In oceanographic characteristics, the South Dublin site has higher velocities and a shorter distance from shore to water depths of 20m than the Balbriggan site and, for these reasons, it is considered the preferred option.

4

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Water Supply Project Eastern and Midlands Region (WSP)

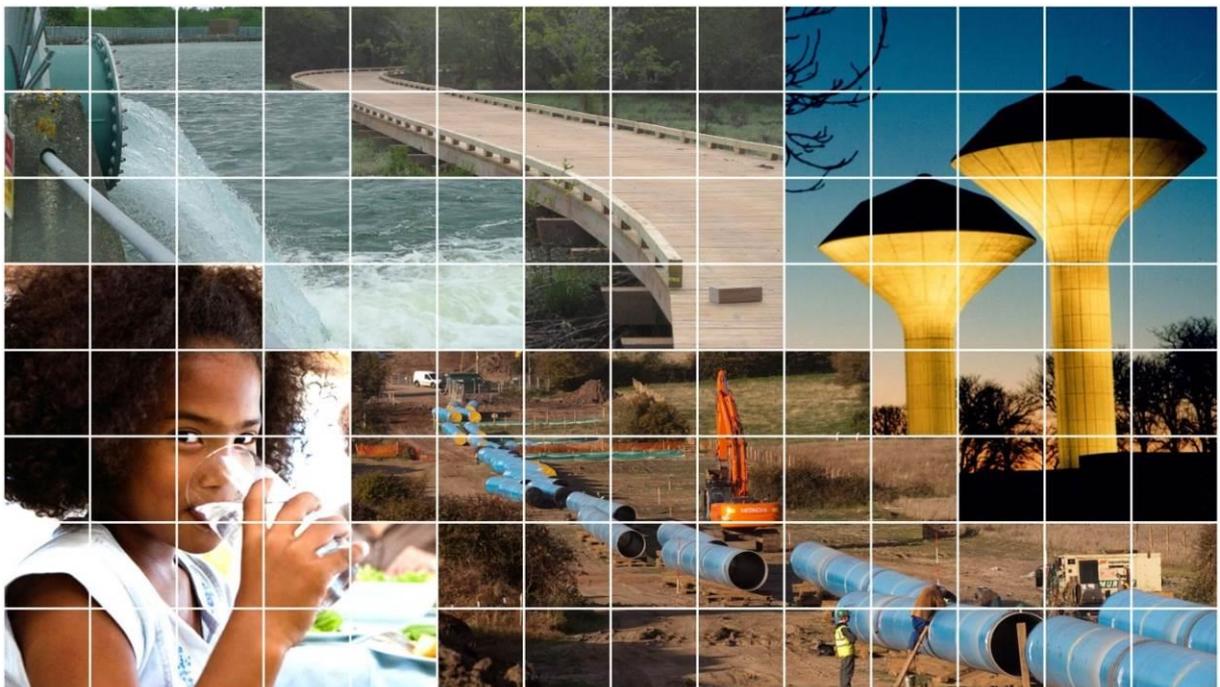
Abstraction Location MCA

Appendix E5: Surface Water Environment



October 2015

F02



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1.1 Introduction

Four reasonable alternative options have been identified from previous studies – refer to the *Water Supply Options Working Paper* (Project Road Map Stage 2). These are reconfirmed below.

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)
- Option H (Desalination)

This report describes the decision making process used to appraise the abstraction locations associated with each of the reasonable alternative options.

To undertake the appraisal of abstraction locations a range of specialists were engaged, in their applicable fields, to conduct a comparative assessment of abstraction locations. The following disciplines were engaged:

- i. **Ecology** – the consideration of impact on animals, plants and their environment.
- ii. **Water** – the consideration of impacts on the surface water environment.
- iii. **Air and Noise** - the consideration of air and noise pollution
- iv. **Cultural Heritage** - the consideration of existing archaeological and built heritage
- v. **Soils, Geology and Hydrogeology** – the consideration of impact on soils, geology and hydrogeology.
- vi. **Landscape and visual** – the consideration of landscape and visual impact.
- vii. **Agronomy** – the consideration of impact on land based enterprise.
- viii. **People** – the consideration of impacts on people
- ix. **Planning** – the consideration of planning and land use policy in relation to proposed works
- x. **Engineering** - the consideration of technical challenges associated with proposed works.
- xi. **Traffic** - the consideration of impact on traffic and road network

The specialists independently assessed each location relative to appraisal criteria applicable to their field of expertise. This process, or methodology, is referred to as Multi-Criteria Analysis and explicitly considers multiple criteria (see Table E5 - 1), within a decision-making environment.

Environmental Criteria	Technical Criteria	Risk Criteria
Biodiversity, Flora and Fauna	Safety	Technical Risk relating to the Source
Fisheries	Planning Policy	Technical Risk relating to Infrastructure and Operations
Water	Engineering and Design	Environmental and Planning Risk
Air/Climatic Factors	Capital and Operational Costs	Financial Risk
Material Assets (Energy)	Sustainability	Socio-economic risk
Cultural Heritage (including Architecture & Archaeology)		
Landscape & Visual		
Material Assets (Land use)		
Tourism		
Population		
Human Health		
Soils, Geology and Hydrogeology		

Table E5 - 1 Appraisal Criteria

The assessments are presented as individual statements within this Appendix E.

1.2 Scope

Appendix E5 is a statement on the specialism Surface Water Environment and describes the decision making process used in identifying the least constrained abstraction locations associated with the reasonable alternative options.

The Site Selection Methodology in Appendix B outlines the process employed in identifying least constrained locations. This report should be read in conjunction with the *Site Selection Methodology*.

1.3 Methodology

1.3.1 Desk study

A desk study exercise of the potential abstraction locations was carried out using the supplied datasets and information are as described in the *Site Selection Methodology*. Reference was made to the following key documents and data sources:

- WFD GIS Data and River Basin Management Plans (RBMP) (Environmental Protection Agency (EPA));
- The Office of Public Works (OPW) Preliminary Flood Risk Assessment (PRFA) Flood Mapping (2011);
- The OPW Catchment Flood Risk and Management Study (CFRAMS) DRAFT Flood Extent Mapping (2015);
- WSP Hydrodynamic and Water Quality Modelling DA2.2: First Pass Modelling Report (Draft July 2015); and

- WSP - Dublin Region (DRAFT PLAN) (Previously titled: Greater Dublin Water Supply - Major Source Development (Draft Plan)) - Desalination Study Report (2008).

1.3.2 Assessment Methodology

This is 'Non-linear Site Methodology – Step 1' as described in the *Site Selection Methodology*.

To effectively determine the least constrained abstraction locations for the reasonable alternative options, the potential abstraction locations were assessed under 2 no. Surface Water Environment sub-criteria.

- Potential to impede the objectives of the WFD (Potential to impact on the water quality, ecology and hydromorphology of WFD waterbodies)
- Potential to impact on WFD Annex IV - Protected Areas, see Annex A:
 - A) Waters used for the abstraction of drinking water;
 - B) Areas designated to protect economically significant aquatic species;
 - C) Recreational Waters;
 - D) Nutrient Sensitive Areas; and
 - E) Areas designated for the protection of habitats or species.

This assessment considers at a high level (as there is not specific detail on the project elements at this time) the potential for the abstraction elements of the Project, both during construction and operation, to impede the objectives of the Water Framework Directive (WFD) (2000/60/EC) for waterbodies within the locations under assessment. The objectives of the WFD are to protect all high status waters, prevent further deterioration of all waters and to restore degraded surface and ground waters to good status. The assessment involved looking at the main constraints associated with the WFD within each location and then assigning an overall sensitivity to the location based on the criteria outlined in Table E5 - 2.

Location Sensitivity	Example of Constraints
High	<ul style="list-style-type: none"> • Good or High WFD Status. • Location contains a number of WFD Protected Areas: <ul style="list-style-type: none"> • Waters used for the abstraction of drinking water; • Areas designated to protect economically significant aquatic species; • Recreational Waters; • Nutrient Sensitive Areas; and • Areas designated for the protection of habitats or species.
Medium	<ul style="list-style-type: none"> • Moderate WFD Status. • None or only limited WFD Protected Areas.
Low	<ul style="list-style-type: none"> • Bad or Poor WFD Status. • No WFD Protected Areas.

Table E5 - 2 Criteria for assigning Sensitivity to the locations – Surface Water & WFD

The sensitivity criteria is informed by the NRA Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (2009) and adjusted by professional judgement. Reference has also been made to the Strategic Environmental Assessment (SEA) carried out for the Water Supply Project Plan in 2008.

1.3.3 Categories of impact

The magnitude of an impact is influenced by the location, timing, scale, size and duration of change over the baseline conditions. Effects on water bodies can be direct or indirect, short or long-term, permanent or temporary, positive or negative, and localised, widespread or cumulative. The relative analysis of potential locations to define a “least constrained” location is based upon a subjective assessment. This judgement is presented as weighted impact; colour coded for ready identification.

Very high	Dark blue
High	Blue
Mid-range	Green
Low	Light Green
Very low	Cream

2 Lough Derg/Parteen Basin

2.1 Lough Derg/Parteen Basin Locations

An assessment of the potential abstraction locations was carried out for the following options:

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)

2.1.1 Slevoir



Figure E5 – 1 Lough Derg - Slevoir

Table E5 - 3 details the WFD waterbodies within the Slevoir Abstraction location.

Waterbody Name	Waterbody Type	EU WFD Code	WFD Status
Lough Derg	Lake	IE_SH_25_191a	Moderate
Firmount Waterbodies	River/Stream	IE_SH_25_3904_	Moderate
Slevoir Waterbody	River/Stream	IE_SH_25_3904_1	Unassigned
Carrigahorig Waterbody	River/Stream	IE_SH_25_945	Moderate
Lorrha Waterbody	River/Stream	IE_SH_25_2507	Moderate

Table E5 - 3 WFD Waterbodies

There are a number of WFD related protected areas within and adjacent to the location as follows:

- The entirety of Lough Derg is classified under the WFD as a Drinking Water and a Nutrient Sensitive Area;
- There are no recreational waters within the location but the bathing area at Portumna is approximately 1.5 km to the west;
- Lough Derg, North-East Shore cSAC [002241] and the Lough Derg (Shannon) SPA [004058] are within the location; and
- The River Shannon Callows cSAC (00216) and the Middle Shannon Callows SPA are less than 500 m to the North West.

The Lough Derg Water Management Unit Action Plan¹ lists the pressures/risks to Lough Derg as including:

- Nutrient sources;
- Wastewater Treatment Plants (WWTP); and
- Industrial Discharges, morphology and abstraction.

The sensitivity of the Slevoir location is rated as **High** due to the number of WFD related protected areas.

¹ This accompanies the Shannon River Basin Management Plan

2.1.2 Mota



Figure E5 – 2 Lough Derg - Mota

Table E5 - 4 details the WFD waterbodies within the Mota abstraction location

Waterbody	Waterbody Type	EU WFD Code	Status
Lough Derg	Lake	IE_SH_25_191a	Moderate

Table E5 - 4 WFD Waterbodies

There are a number of WFD related protected areas within and adjacent to the location as follows:

- The entirety of Lough Derg is classified under the WFD as a Drinking Water and a Nutrient Sensitive Area; and
- Lough Derg, North-East Shore cSAC [002241] and Lough Derg (Shannon) SPA [004058] are within the location.

The Lough Derg Water Management Unit Action Plan lists the pressures/risks to Lough Derg as including:

- Nutrient sources;
- Wastewater Treatment Plants (WWTP); and
- Industrial Discharges morphology and abstraction.

The sensitivity of the Mota location is rated as **High** due to the number of WFD related protected areas.

2.1.3 Dromineer



Figure E5 – 3 Lough Derg - Dromineer

Table E5 - 5 details the WFD waterbodies within the Dromineer abstraction location.

Waterbody Name	Waterbody Type	EU WFD Code	WFD Status
Lough Derg	Lake	IE_SH_25_191a	Moderate
Clonmakilladuff Waterbody	River/Stream	IE_SH_25_3904_1	Unassigned
Nenagh Waterbody	River/Stream	IE_SH_25_2140	Moderate

Table E5 - 5 WFD Waterbodies

There are a number of WFD related protected areas within and adjacent to the location as follows:

- The entirety of Lough Derg is classified under the WFD as a Drinking Water and a Nutrient Sensitive Area;
- In addition the Nenagh Waterbody is Nutrient Sensitive;
- Lough Derg (Shannon) SPA [004058] and is within the location;
- The North-East Shore cSAC [002241] is approximately 700m to the north; and

- The Clonmakilladuff Waterbody is a WFD cSAC waterbody and the Nenagh River is a WFD SPA waterbody.

The Lough Derg Management Unit Action Plan lists the pressures/risks to Lough Derg as including:

- Nutrient sources;
- Wastewater Treatment Plants (WWTP); and
- Industrial Discharges, morphology and abstraction.

The sensitivity of the Dromineer location is rated as **High** due to the number of WFD related protected areas.

2.1.4 Youghal



Figure E5 – 4 Lough Derg - Youghal

Table E5 – 6 details the WFD waterbodies within the Youghal abstraction location.

Waterbody Name	Waterbody Type	EU WFD Code	WFD Status
Lough Derg	Lake	IE_SH_25_191a	Moderate
Youghal Waterbody	River/Stream	IE_SH_25_2530	Moderate
Newtown Waterbody	River/Stream	IE_SH_25_2785	Good
Tomona Waterbody	River/Stream	IE_SH_25_3904_1	Unassigned
Ardregane Waterbody	River/Stream	IE_SH_25_3686	Moderate

Table E5 - 6 WFD Waterbodies

There are a number of WFD related protected areas within and adjacent to the location as follows:

- The entirety of Lough Derg is classified under the WFD as a Drinking Water and a Nutrient Sensitive Area; and
- Lough Derg (Shannon) SPA [004058] is within the location.

The Lough Derg Management Unit Action Plan lists the pressures/risks to Lough Derg as including:

- Nutrient sources;
- Wastewater Treatment Plants (WWTP); and
- Industrial Discharges, morphology and abstraction.

The sensitivity of the Youghal location is rated as **High** due to the number of WFD related protected areas and the status of the Newtown waterbody.

2.1.5 Parteen Basin Reservoir



Figure E5 – 5 Parteen Basin Reservoir

Parteen is the largest of the locations, see Figure E5 – 5. Table E5 - 7 details the WFD waterbodies within the Parteen abstraction location.

Waterbody Name	Waterbody Type	EU WFD Code	WFD Status
Lough Derg pHMWB	Lake	IE_SH_25_191b	Moderate
Lower Shannon Waterbody	River/Stream	IE_SH_25_3904_2	Unassigned
Rinnaman Point Waterbody	River/Stream	IE_SH_25_3904_1	Unassigned
Feenlea Waterbody	River/Stream	IE_SH_25_3904_1	Unassigned
Heritage Centre Killaloe Waterbody	River/Stream	IE_SH_25_3904_1	Unassigned
Grange Waterbody	River/Stream	IE_SH_25_3904_1	Unassigned
Roolagh Waterbody	River/Stream	IE_SH_25_3904_1	Unassigned
Ballyteige Waterbody	River/Stream	IE_SH_25_3904_1	Unassigned
Kilmastulla Waterbody	River/Stream	IE_SH_25_3881	Moderate
Ardclooney Waterbody	River/Stream	IE_SH_25_2596	High
Black Waterbody	River/Stream	IE_SH_25_3838	Good
Fairy hall	River/Stream	IE_SH_25_3904_2	Unassigned
O Briensbridge	River/Stream	IE_SH_25_3904_2	Unassigned

Table E5 - 7 WFD Waterbodies

There are a number of WFD related protected areas within and adjacent to the location as follows:

- The entirety of Lough Derg is classified under the WFD as a Drinking Water and a Nutrient Sensitive Area;
- There is one recreational are within the location the Ballycuggeran;
- There are a number of Salmonid Waterbodies of interest, though none designated under the salmonid regulations; and
- Lough Derg (Shannon) SPA [004058], Lower River Shannon cSAC [002165] are also within the location.

The Lough Derg Management Unit Action Plan lists the pressures/risks to Lough Derg as including:

- Nutrient sources;
- Wastewater Treatment Plants (WWTP);and
- Industrial Discharges, morphology and abstraction.

The sensitivity of the Parteen location is rated as **High** due to the number of WFD related protected areas and the status of the Black and Fairyhall waterbodies.

2.2 Lough Derg Modelling Report

Reference has been made to Appendix C – Hydrodynamic Modelling Report. The objective of this study it to assess the existing flushing characteristics of Lough Derg and Parteen Basin and examine abstraction options considered in the original Plan to determine if any changes in the flushing characteristics could be discerned.

A number of scenarios were developed as part of the model, including baseline conditions for winter and summer with abstraction from the Northeast of Lough Derg and Parteen Basin for the same. The key findings of the first pass report are:

- There was also a significant difference in the flushing times between summer and winter periods under baseline conditions.

- The areas with the longest flushing times were predicted to be the slowest to respond to changing pollutant loadings, and thus susceptible to excess nutrient accumulations.
- The scenario involving abstraction from Parteen Basin at constant rate during winter high flow conditions exhibits no change in flushing time characteristics when compared with the baseline conditions.
- Scenarios involving an abstraction from northeast of Lough Derg at either constant or variable rates during winter high flow conditions exhibit a reduction in the flushing time to the west of the abstraction point, and a corresponding increase in flushing time to the east of the abstraction point.
- Scenarios involving an abstraction from the northeast of Lough Derg at either constant or variable rates during summer low flow conditions exhibit a large increase (maximum +42 days) in flushing times in the middle and southern portions of Lough Derg when compared with the baseline conditions.
- Scenarios involving an abstraction from Youghal Bay at a variable rates during summer low flow conditions exhibit a large increase (maximum +42 days) in flushing times in the southern portions of Lough Derg when compared with the baseline conditions.
- The scenario involving abstraction from Parteen Basin at a constant rate during summer low flow conditions exhibit a slight improvement to flushing time characteristics (3 days decrease) in the southernmost regions Lough Derg and Parteen Basin when compared with the baseline conditions.

2.3 Comparative Discussion

Table E5 - 8 summarise the key constraints within Lough Derg and Parteen Basin locations.

Location	Rivers / Streams	Lake	WFD good or higher status	Drinking water	Shellfish Area	Recreational Waters	Nutrient Sensitive	cSAC & SPA	Salmonid
Slevoir	√√	√√		√√		√	√√	√√	
Mota	√	√√		√√			√√	√√	
Dromineer	√√	√√		√√			√√	√√	
Youghal Bay	√√	√√	√√	√√			√√	√√	
Parteen Basin	√√	√√	√√	√√		√√	√√	√√	√√

√ - Within close proximity
√√ - Within location

Table E5 - 8 Summary of WFD Constraints

All the areas that were subject to this surface water assessment were found to be highly constrained. Of all the locations Mota and Dromineer are considered to be the least constrained. Parteen is highly constrained however, it is noted the Parteen location is significantly larger than the other Lough Derg locations

The WFD Lough Derg Management Unit Action Plan lists the pressures/risks to Lough Derg as including:

- Nutrient sources;
- Wastewater Treatment Plants (WWTP);and
- Industrial Discharges, morphology and abstraction.

The construction phase engineering works has the potential to release lubricants, fuels and other hazardous substances into the surface waters. During construction, engineering works are likely to temporarily alter the water quality at the waterbodies for the construction of the pipeline network. However, construction impacts are likely to be mitigatable by utilising best practice techniques.

Impacts from the operation of the abstraction point at Lough Derg relate primarily to abstraction of water from the lake. Abstraction pressures manifest in lakes as increased fluctuations in water level and a change in residence time and they can also result in the deterioration of the ecological health of the lake². The water quality in Lough Derg is principally determined by the flushing time of water³. The Hydrodynamic and Water Quality Modelling study of Lough Derg found that " ... abstracting from Lough Derg / Parteen Basin during summer (low flow) conditions indicate that there were significant changes in flushing times in Lough Derg / Parteen Basin when abstracting from the northeast of Lough Derg versus abstracting from Parteen Basin." In addition to potential change to the residence time and water levels there is a potential to alter the morphology of the lake shore as a result of the installation of the plant and pipe network.

Based primarily on the outcome of the first pass Water Quality Modelling Study Parteen Basin Reservoir is considered the least constrained location of all the Lough Derg/Parteen Basin options. Therefore, this has been given a lower potential impact relative to the other location options to reflect this.

It is noted that the assessment impact category is precautionary and is considered a likely worst case scenario. In reality adverse impact levels can be reduced by careful siting, project design and tailored mitigation measures. Further desk and field based studies, modelling works and detailed information on the construction and design will further inform the potential impacts associated with the Project at the future stages.

² Department of the Environment Heritage and Local Government (2010) Eastern River Basin District Programmes of Measures 2009 – 2015.

³ WSP Hydrodynamic and Water Quality Modelling DA2.2: First Pass Modelling Report.

2.4 Matrix of Multi Criteria Analysis

Criteria	Location 1 - Slevoir	Location 2 - Mota	Location 3 - Dromineer	Location 4 - Youghal Bay	Location 5 - Parteen Basin
Water					
- Potential to impede the objectives of the WFD (Potential to impact on the water quality, ecology and hydromorphology of WFD waterbodies) - Potential to impact on WFD Annex IV - Protected Areas: A) Waters used for the abstraction of drinking water B) Areas designated to protect economically significant aquatic species C) Recreational Waters D) Nutrient Sensitive Areas E) Areas designated for the protection of habitats or species	Potential for impacts on the objectives of the WFD are considered to be very high.	Potential for impacts on the objectives of the WFD are considered to be very high.	Potential for impacts on the objectives of the WFD are considered to be very high.	Potential for impacts on the objectives of the WFD are considered to be very high.	Potential for impacts on the objectives of the WFD are considered to be high.

Table E5 - 9 Summary of the MCA for Lough Derg/Parteen Basin

3 Desalination

3.1 Desalination Locations

An assessment of the potential abstraction locations was carried out for the following options:

- Option H (Desalination)

3.1.1 South Dublin

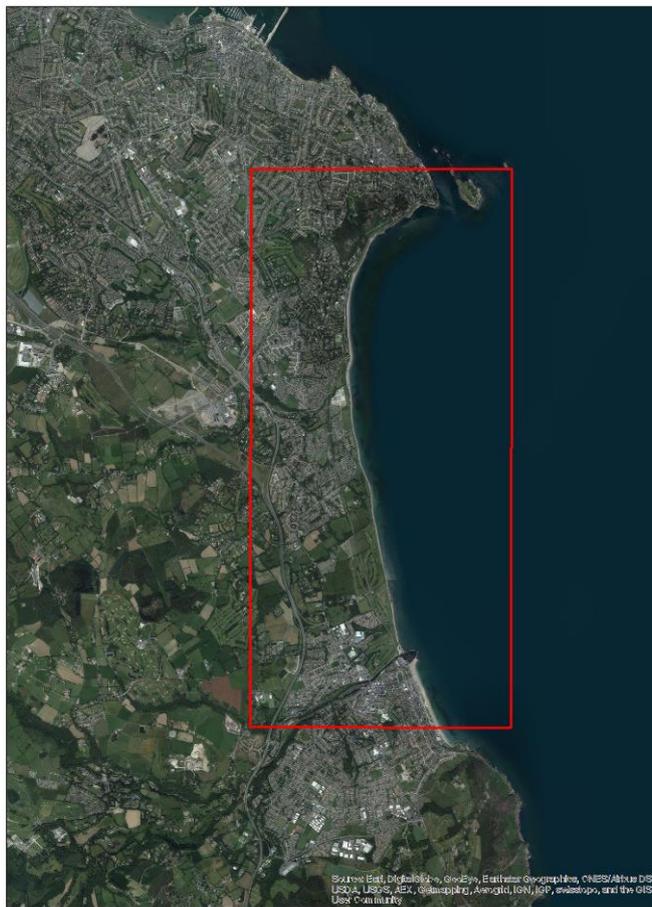


Figure E5 – 6 South Dublin

Table E5 – 10 details the WFD waterbodies within the South Dublin desalination location.

Waterbody Name	Waterbody Type	EU WFD Code	WFD Status
Killiney Bay	Coastal	IE_EA_100_0000	Good
Shanganagh waterbody	River/Stream	IE_EA_10_1219	Poor
Grange waterbody	River/Stream	IE_EA_10_1570	No status
Dargle River	River/Stream	IE_EA_10_1275	Moderate
Dargle Estuary	Transitional	IE_EA_110_0100	Moderate

Table E5 - 10 WFD Waterbodies

There are a number of WFD related protected areas within and adjacent to the location, as follows:

- There are two recreational areas within the location, Killiney and Bray South Promenade;
- The Dargle River is a salmonid river under the European Communities (Quality of Salmonid Waters) Regulations (S.I. No. 293 of 1988);
- Rockabill to Dalkey Island candidate Special Area of Conservation (cSAC) [003000⁴] is within the location and the Bray Head cSAC is 500m south of the location; and
- The Dalkey Islands Special Protection Area (SPA) [004172] is located within the location.

The Eastern River Basin District (ERBD) Programme of Measures (POM) Summary Report⁵ lists the main pressures/risks to Killiney Bay as:

- physical modifications (morphological); and
- wastewater/industrial discharges (physio-chemical).

The main pressures/risks to the Dargle River and Estuary are listed as:

- physical modifications (morphological);
- abstraction (hydrological); and
- wastewater/industrial discharges (physio-chemical).

The sensitivity of the South Dublin location is rated as **High** due to the number of WFD related protected areas and the status of Killiney Bay.

⁴ Site code

⁵ The POM Summary Report accompanies the Eastern RBD River Basin Management Plan (the Plan) published in August 2009.

3.1.2 Loughshinny North



Figure E5 – 7 Loughshinny North

Table E5 – 11 details the WFD waterbodies within the Loughshinny North desalination location.

Waterbody Name	Waterbody Type	EU WFD Code	WFD Status
Northwestern Irish Sea	Coastal	IE_EA_020_0000	High
Balcunnin waterbody	River/Stream	no EU WFD code	Not assigned

Table E5 - 11 WFD Waterbodies

There are a number of WFD related protected areas within and adjacent to the location as follows:

- Loughshinny beach is located approx. 200 north of the location;
- The Balbriggan/Skerries Shellfish Area is also within the location;
- The Rockabill to Dalkey Island cSAC [003000] is c. 1.5 km off the coast; and
- There are a number of SPA's within 5km of the location.

The ERBD POM Summary Report lists the main pressures/risks to the Northwestern Irish Sea as:

- physical modifications (Morphological); and
- wastewater/industrial discharges (Physio-Chemical).

The sensitivity of the Loughshinny North location is rated as **High** due to the number of WFD related protected areas and the status of the Northwestern Irish Sea.

3.1.3 Loughshinny South



Figure E5 – 8 Loughshinny South

Table E5 - 12 details the WFD waterbodies within the Loughshinny South desalination location.

Waterbody Name	Waterbody Type	EU WFD Code	WFD Status
Northwestern Irish Sea	Coastal	IE_EA_020_0000	High
Lane waterbody	River/Stream	no EU WFD code	Not assigned

Table E5 - 12 WFD Waterbodies

There are a number of WFD related protected areas within and adjacent to the location as follows:

- Loughshinny beach is located approx. 200 south of the location;
- The Balbriggan/Skerries Shellfish Area is within the location;
- The Rockabill to Dalkey Island cSAC [003000] is c. 1.5 km off the coast; and
- There are a number of SPA's within 5km of the location.

The ERBD POM Summary Report lists the main pressures/risks to the Northwestern Irish Sea as:

- physical modifications (Morphological); and
- wastewater/industrial discharges (Physio-Chemical).

The sensitivity of the Loughshinny North location is rated as **High** due to the number of WFD related protected and the status of the Northwestern Irish Sea.

3.1.4 Balbriggan



Figure E5 – 9 Balbriggan

Table E5 - 13 details the WFD waterbodies within the Balbriggan desalination location.

Waterbody Name	Waterbody Type	EU WFD Code	WFD Status
Northwestern Irish Sea	Coastal	IE_EA_020_0000	High

Table E5 - 13 WFD Waterbodies

There are a number of WFD related protected areas within and adjacent to the location as follows:

- The Balbriggan Front Strand Beach is less than 1km south of the location;
- The Balbriggan/Skerries Shellfish Area is less than 500m east of the location;
- The Rockabill to Dalkey Island cSAC [003000] is approximately 8km off the coast; and

- There are a number of SPA’s within 15km of the location.

The ERBD POM Summary Report lists the main pressures/risks to the North-western Irish Sea as:

- physical modifications (morphological); and
- wastewater/ industrial discharges (physio-chemical).

The sensitivity of the Balbriggan location is rated as **High** due to the number of WFD related protected areas and the status of the Northwestern Irish Sea.

3.2 Desalination Modelling Study

Reference has been made to the previous desalination study carried out for the project. This study modelled report the discharge of brine and pollutants associated with the operation of a desalination plant was modelled. This modelling identified that a discharge point 2km from shore was required to ensure environmental sustainability of brine dispersion.

3.3 Comparative Discussion

Table E5 - 15 outlines the key WFD constraints in the desalination locations.

Location	Rivers / Streams	Transitional Water	Coastal Water	WFD good or higher status	Drinking water	Shellfish Area	Recreational Waters	Nutrient Sensitive	cSAC & SPA	Salmonid
South Dublin	√√	√√	√√	√√			√√		√√	√√
Balbriggan	√√		√√	√√		√	√		√	
L North	√√		√√	√√		√√	√		√	
L South	√√		√√	√√		√√	√		√	

√ - Within close proximity
 √√ - Within Location

Table E5 - 14 Summary of WFD Constraints for the Desalination Options

All the areas were found to be highly constrained and therefore of high sensitivity. As shown in Table E5 - 15, Balbriggan is considered to be the least constrained of all the desalination locations. However, it is also noted that this is also the smallest of all the desalination locations.

The construction phase engineering works has the potential to release lubricants, fuels and other hazardous substances into the surface waters. During construction, engineering works are likely to temporarily alter the water quality at the coastline for the construction of the pipeline network. However, construction impacts are likely to be mitigatable subject to utilising best practice construction techniques.

During the operation of the desalination plant there is likely to be a release of brine into coastal waters. The release of brine, in the vicinity of the discharge location, is likely to change the water quality; temperature, chemical constituents and salinity. The desalination modelling report identified that a discharge point of 2km from shore was required to ensure environmental sustainability of brine dispersion. In addition

there is a potential to alter the morphology of the coastline as a result of the installation of the plant and pipe network.

Potential impacts associated with the location of the desalination option (i.e. potential to impede the WFD objectives) are considered to be potentially high for all locations. It is noted that the assessment impact category is precautionary and is considered a likely worst case scenario. In reality adverse impact levels can be reduced by careful siting, project design and tailored mitigation measures. Further desk and field based studies, modelling works and detailed information on the construction and design will further inform the potential impacts associated with the Project at the future stages.

In relation to the desalination location regard would also need to be given to the Marine Strategy Framework Directive (2008/56/EC) which is currently being implemented in Ireland by the Department of Environment, Community and Local Government (DEHLG). The Directive is very similar to the WFD but for the marine environment. Progress to date, includes the initial assessment describing the 2012 status of Ireland's marine environment. The current on-going work is the development of Monitoring Programmes, which will be used to collect data on the status of the marine environment. The next stage of the implementation is the establishment a Programme of Measures (POM) to achieve Good Ecological Status (GES) of the marine waters.

3.4 Matrix of Multi Criteria Analysis

Criteria	South Dublin	Loughshinny N.	Loughshinny S.	Balbriggan
Water				
- Potential to impede the objectives of the WFD (Potential to impact on the water quality, ecology and hydromorphology of WFD waterbodies) - Potential to impact on WFD Annex IV - Protected Areas: A) Waters used for the abstraction of drinking water B) Areas designated to protect economically significant aquatic species C) Recreational Waters D) Nutrient Sensitive Areas E) Areas designated for the protection of habitats or species	Potential for impacts on the objectives of the WFD are considered to be high.	Potential for impacts on the objectives of the WFD are considered to be high.	Potential for impacts on the objectives of the WFD are considered to be high.	Potential for impacts on the objectives of the WFD are considered to be high.

Table E5 - 15 Summary of the MCA for Desalination

4

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- Eastern River Basin District Project Abstractions - National POM/Standards Study Revised Risk Assessment Methodology for Surface Water Abstractions from Lakes January 2009 Final Report
- National Road Authority (2009). Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.
- RPS (2008) Strategic Environmental Assessment (SEA) Environmental Report for the Water Supply Project Plan.
- Suzanne, M., Pierson, B. J., Rosenbaum, L. D. McKay and Dewald, T. G., (2008). Strahler Stream Order and Strahler Calculator Values in NHDPlus.
- The Office of Public Works (OPW); Flood Extent Mapping from the Preliminary Flood Risk Assessment (PFRA) (2011).
- WSP Hydrodynamic and Water Quality Modelling DA2.2: First Pass Modelling Report.
- Water Supply Project - Dublin Region (DRAFT PLAN) (Previously titled: Greater Dublin Water Supply - Major Source Development (Draft Plan)) - Desalination Study Report (2008).

Figures



Figure 1: Desalination and Terminal Locations

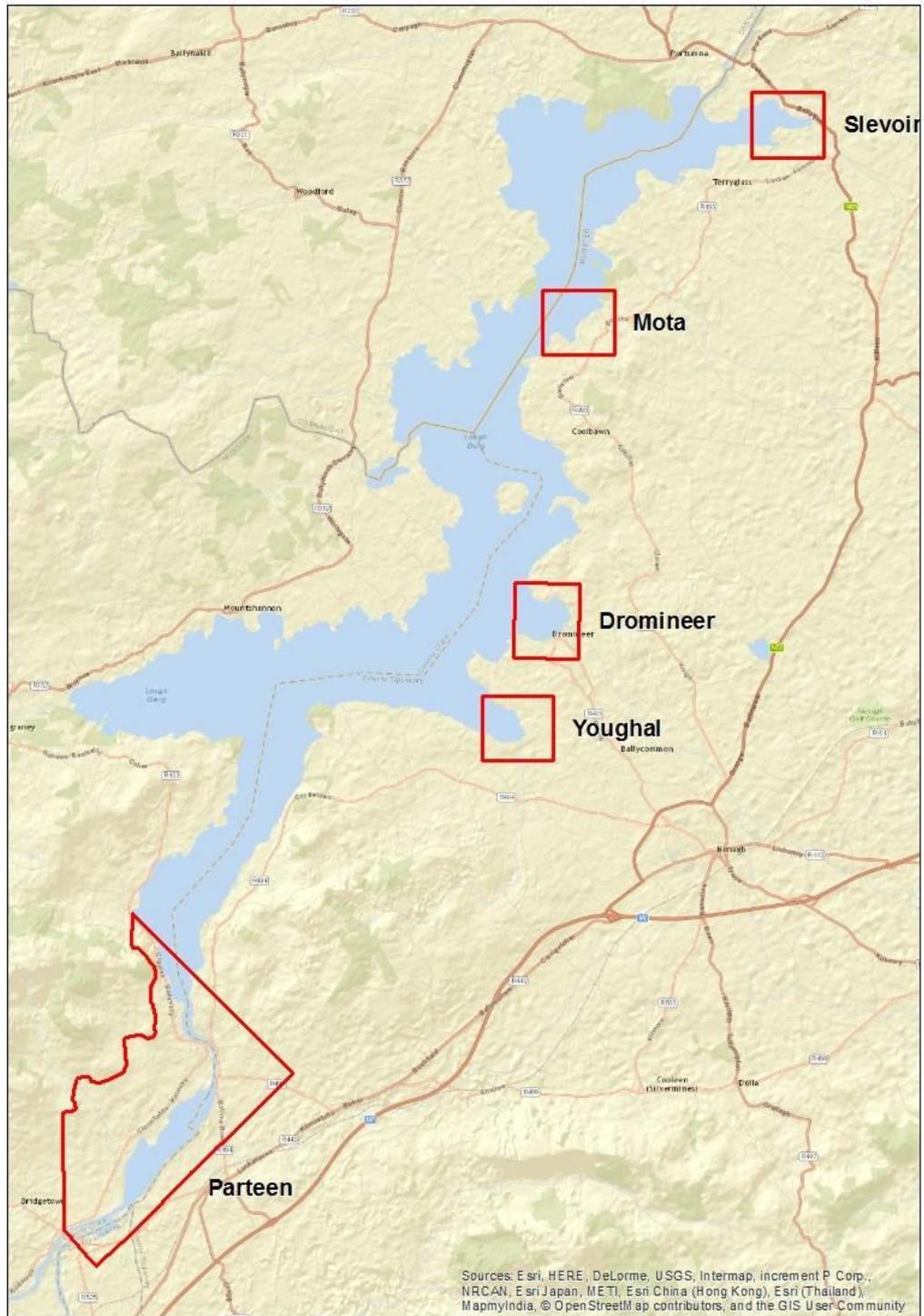


Figure 2: Lough Derg and Parteen Basin Locations

Annex A - WFD Register of Protected Areas

The register consists of an inventory of protected area sites representing the protected area categories outlined below:

- Waters used for the abstraction of drinking water.
- Areas designated to protect economically significant aquatic species - These are protected areas established under earlier EC directives aimed at protecting shellfish (79/923/EEC) and freshwater fish (78/659/EEC).
- Recreational Waters - These are bathing waters designated under the Bathing Water Directive (76/160/EEC).
- Nutrient Sensitive Areas - These comprise nitrate vulnerable zones designated under the Nitrates Directive (91/676/EEC) and areas designated as sensitive under the Urban Waste Water Treatment Directive (91/271/EEC).
- Areas designated for the protection of habitats or species - These are areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection. These are designated under the Birds Directive (79/409/EEC) and the Habitats Directive (92/43/EEC).

Water Supply Project Eastern and Midlands Region (WSP)

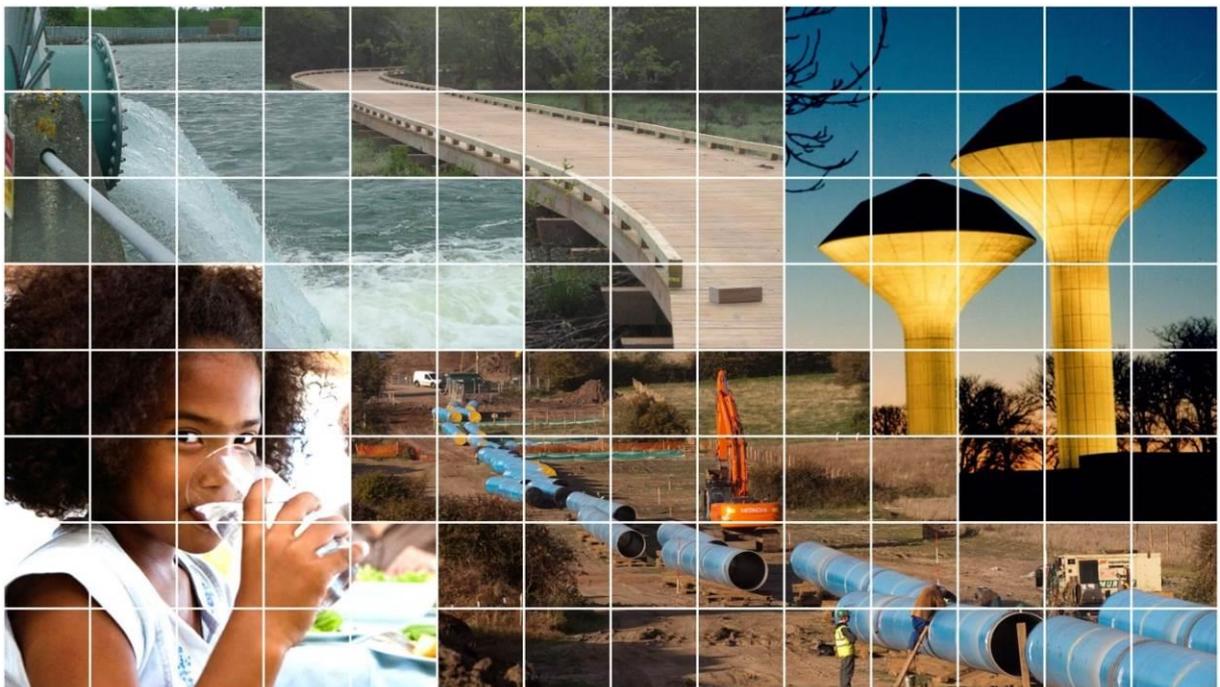
Abstraction Location MCA

Appendix E6: Air



October 2015

F02



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1.1 Introduction

Four reasonable alternative options have been identified from previous studies – refer to the *Water Supply Options Working Paper* (Project Road Map Stage 2). These are reconfirmed below.

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)
- Option H (Desalination)

This report describes the decision making process used to appraise the abstraction locations associated with each of the reasonable alternative options.

To undertake the appraisal of abstraction locations a range of specialists were engaged, in their applicable fields, to conduct a comparative assessment of abstraction locations. The following disciplines were engaged:

- i. **Ecology** – the consideration of impact on animals, plants and their environment.
- ii. **Water** – the consideration of impacts on the surface water environment.
- iii. **Air and Noise** - the consideration of air and noise pollution
- iv. **Cultural Heritage** - the consideration of existing archaeological and built heritage
- v. **Soils, Geology and Hydrogeology** – the consideration of impact on soils, geology and hydrogeology.
- vi. **Landscape and visual** – the consideration of landscape and visual impact.
- vii. **Agronomy** – the consideration of impact on land based enterprise.
- viii. **People** – the consideration of impacts on people
- ix. **Planning** – the consideration of planning and land use policy in relation to proposed works
- x. **Engineering** - the consideration of technical challenges associated with proposed works.
- xi. **Traffic** - the consideration of impact on traffic and road network

The specialists independently assessed each location relative to appraisal criteria applicable to their field of expertise. This process, or methodology, is referred to as Multi-Criteria Analysis and explicitly considers multiple criteria (see Table E6 - 1), within a decision-making environment.

Environmental Criteria	Technical Criteria	Risk Criteria
Biodiversity, Flora and Fauna	Safety	Technical Risk relating to the Source
Fisheries	Planning Policy	Technical Risk relating to Infrastructure and Operations
Water	Engineering and Design	Environmental and Planning Risk
Air/Climatic Factors	Capital and Operational Costs	Financial Risk
Material Assets (Energy)	Sustainability	Socio-economic risk
Cultural Heritage (including Architecture & Archaeology)		
Landscape & Visual		
Material Assets (Land use)		
Tourism		
Population		
Human Health		
Soils, Geology and Hydrogeology		

Table E6 - 1 Appraisal Criteria

The assessments are presented as individual statements within this Appendix E.

This Appendix E6 is a statement on the specialism Air and describes the decision making process used in identifying the least constrained abstraction locations associated with the reasonable alternative options.

The Site Selection Methodology in Appendix B outlines the process employed in identifying least constrained locations. This report should be read in conjunction with the *Site Selection Methodology*.

1.2 Methodology

This is ‘Non-linear Site Methodology – Step 1’ as described in the *Site Selection Methodology*.

To effectively determine the least constrained abstraction locations for the reasonable alternative options, the potential abstraction locations were assessed under 8 no. Air sub-criteria.

- Potential for Construction phase Air Quality impact at Sensitive receptors
- Potential for Operational phase Air Quality impact at Sensitive receptors
- Proximity to EPA Waste Licensed facility
- Proximity to EPA IPPC Licensed Intensive Agriculture facility
- EPA Air Quality Zone Classification
- Wind Rose Assessment
- Construction Phase Impact rating
- Operational Phase Impact rating

The NRA document entitled Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes (NRA, 2011) provided guidance on the selection assessment procedures applied. The primary aspects of the assessment relate to existing ambient air quality and the proximity of sensitive locations.

1.2.1 Desk study

A desk study exercise of the potential abstraction locations was carried out using the software package *ArcReader*. The supplied datasets and information are as described in the *Site Selection Methodology*.

1.2.2 Categories of impact

The relative analysis of potential locations to define a “least constrained” location is based upon a subjective assessment by each Specialist in their discipline of expertise. This judgement is presented as weighted impact; colour coded for ready identification.

Very high	Dark blue
High	Blue
Mid-range	Green
Low	Light Green
Very low	Cream

In the current assessment, air quality constraints such as the number of residential properties, baseline air quality conditions and the presence of IPPC licenced facilities and quarries have been investigated for each of the potential locations. There is the potential for a number of emissions to the atmosphere during the operational phase of the development. In particular, vehicle related air emissions may generate quantities of air pollutants such as NO₂, CO, VOC and PM₁₀/PM_{2.5}. The pollutants of most concern are NO₂ and PM₁₀, as these pollutants are generated as a direct result of vehicles and have the greatest potential to exceed the air quality standards. However, for this project it is considered that significant increases in traffic associated with the project are unlikely.

The greatest potential impact on air quality during the construction phase of the proposed development is from construction dust emissions and the potential for nuisance dust. While construction dust tends to be deposited within 200m of a construction site, the majority of the deposition occurs within the first 50m. Due to the nature of activities undertaken on a construction site, there is potential for generation of significant levels of dust. However, the application of mitigation measures will ensure dust impacts will not be significant.

Dust minimisation for the construction phase of the project may be required, as construction activities are likely to generate some dust emissions. Material handling activities, including excavation and backfill, on site may typically emit dust. Dust is characterised as encompassing particulate matter with a particle size of between 1 and 75 microns (1-75 µm). Deposition typically occurs in close proximity to each site and potential impacts generally occur within 500 metres of the dust generating activity as dust particles fall out of suspension in the air. Larger particles deposit closer to the generating source and deposition rates will decrease with distance from the source. Sensitivity to dust depends on the duration of the dust deposition, the dust generating activity, and the nature of the deposit. Therefore, a higher

tolerance of dust deposition is likely to be shown if only short periods of dust deposition are expected and the dust generating activity is either expected to stop or move on. In particular, it is proposed that various practices be adopted during construction, including:

- Vehicles using site roads shall have their speeds restricted where there is a potential for dust generation. Vehicles delivering material with dust potential to an off-site location shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust.
- Vehicles exiting the site shall make use of a wheel wash facility where appropriate, prior to entering onto public roads, to ensure mud and other wastes are not tracked onto public roads. Public roads outside the site shall be regularly inspected for cleanliness, and cleaned as necessary. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions.
- Material handling systems and site stockpiling of materials shall be designed and laid out to minimise exposure to wind. Water misting or sprays shall be used as required if particularly dusty activities are necessary during dry or windy periods.
- The dust minimisation plan shall be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures.

At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust would be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

2

Lough Derg/Parteen Basin**2.1 Lough Derg/Parteen Basin Locations**

An assessment of the potential abstraction locations was carried out for the following options:

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)

There are no EPA Waste Licensed facilities or IPPC Licensed Intensive Agriculture facilities present in any of the Lough Derg/Parteen Basin Study areas. Shannon Airport is the most representative meteorological monitoring station for the area. Windroses from the period of 2010-2014 identifies west-south west prevailing wind. As part of the implementation of the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), four air quality zones have been defined in Ireland for air quality management and assessment purposes. Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 23 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000, is defined as Zone D. The study areas are all within Zone D.

2.1.1 Slevoir



Figure E6 – 1 Lough Derg - Slevoir

With regards to the proposed abstraction at this location, the most significant potential impact from an air quality point of view is the potential for dust emissions during the construction phase. The area is considered rural with a small number of low density residential dwellings. With consideration of standard good practice measures (as discussed in section 1.2.2) for the control of dust during construction, there will likely be a low impact on these receptors during the construction phase of this proposed abstraction location.

With regards to impacts during the operational phase of the proposed abstraction location, operational traffic is likely to be the only air quality impact. There may be some fixed mechanical plant / pumps which will generate emissions, however these not predicted to be significant if present. Considering that the proposed abstraction will lead to a minimal increase in annual average daily traffic on the surrounding road network, there will be a very low air quality impact during the operational phase.

2.1.2 Mota



Figure E6 – 2 Lough Derg - Mota

With regards to the proposed abstraction at this location, the most significant potential impact from an air quality point of view is the potential for dust emissions during the construction phase. The area is considered rural with a small number of low density residential dwellings and a hotel. With consideration of standard good practice measures for the control of dust during construction, there will likely be a low impact on these receptors during the construction phase of this proposed abstraction location.

With regards to impacts during the operational phase of the proposed abstraction, operational traffic is likely to be the only air quality impact. Considering that the proposed abstraction will lead to a minimal increase in annual average daily traffic on the surrounding road network, there will be a very low air quality impact during the operational phase.

2.1.4 Youghal



Figure E6 – 4 Lough Derg - Youghal

With regards to the proposed abstraction at this location, the most significant potential impact from an air quality point of view is the potential for dust emissions during the construction phase. The area is considered rural with a small number of low density residential dwellings. With consideration of standard good practice measures for the control of dust during construction, there will likely be a low impact on these receptors during the construction phase of this proposed abstraction location.

With regards to impacts during the operational phase of the proposed abstraction, operational traffic is likely to be the only air quality impact. Considering that the proposed abstraction will lead to a minimal increase in annual average daily traffic on the surrounding road network, there will be a very low air quality impact during the operational phase.

2.1.5 Parteen Basin Reservoir



Figure E6 – 5 Parteen Basin Reservoir

With regards to the proposed abstraction at this location, the most significant potential impact from an air quality point of view is the potential for dust emissions during the construction phase. The area is considered rural/suburban with a number of low density residential dwellings and also a number of larger residential settlements such as Ballina and Killaloe. With consideration of standard good practice measures for the control of dust during construction, there will likely be a low impact on these receptors during the construction phase of the proposed abstraction location.

With regards to impacts during the operational phase of the proposed abstraction, operational traffic is likely to be the only air quality impact. Considering that the proposed abstraction will lead to a minimal increase in annual average daily traffic on the surrounding road network, there will be a very low air quality impact during the operational phase.

2.2 Matrix of Multi Criteria Analysis

Criteria	Slevoir	Mota	Dromineer	Youghal Bay	Parteen Basin
Potential for Construction phase Air Quality impact at Sensitive receptors	Rural Area with Sparse Settlement. Potential for dust emissions during construction phase.	Rural Area with Sparse Settlement. Potential for dust emissions during construction phase.	More settlement in this area with Dromineer Village. Potential for dust emissions during construction phase.	Rural Area with Sparse Settlement. Potential for dust emissions during construction phase.	More settlement in this area with Ballina and Killaloe. Potential for dust emissions during construction phase.
Potential for Operational phase Air Quality impact at Sensitive receptors	Very low impacts during operational phase, only operational impacts would be due to traffic generated from staff.	Very low impacts during operational phase, only operational impacts would be due to traffic generated from staff.	Very low impacts during operational phase, only operational impacts would be due to traffic generated from staff.	Very low impacts during operational phase, only operational impacts would be due to traffic generated from staff.	Very low impacts during operational phase, only operational impacts would be due to traffic generated from staff.
Proximity to EPA Waste Licensed facility	No facilities present in study area.				
Proximity to EPA IPPC Licensed Intensive Agriculture facility	No facilities present in study area.				
EPA Air Quality Zone Classification	Zone D.				
Wind Rose Assessment	West-south-west prevailing wind.				
Construction Phase Impact rating	Low impact from construction dust emissions.				
Operational Phase Impact rating	Very low impact due to additional traffic (likely to be minimal) generated by abstraction.	Very low impact due to additional traffic (likely to be minimal) generated by abstraction.	Very low impact due to additional traffic (likely to be minimal) generated by abstraction.	Very low impact due to additional traffic (likely to be minimal) generated by abstraction.	Very low impact due to additional traffic (likely to be minimal) generated by abstraction.

2.3 Comparative Discussion

Once consideration is given to standard good practice measures (as described in section 1.2.2) to control air emissions during the construction and operational phases, it is considered that all five options could be developed whilst having a negligible air quality impact.

It is considered that the Slevoir, Mota and Youghal bay sites would be least constrained from an air quality perspective due lower density of residential abstraction. The Parteen Basin Reservoir site, covering the largest area, is noted to have the highest overall number of residential dwellings followed by the Dromineer site.

3 Desalination

3.1 Desalination Locations

An assessment of the potential abstraction locations was carried out for the following options:

- Option H (Desalination)

There are no EPA Waste Licensed facilities or IPPC Licensed Intensive Agriculture facilities present in any of the desalination study areas. Dublin Airport is the most representative meteorological monitoring station for the area. Windroses from the period of 2010-2014 identifies a south-west prevailing wind. As part of the implementation of the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), four air quality zones have been defined in Ireland for air quality management and assessment purposes. Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 23 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000, is defined as Zone D.

3.1.1 South Dublin

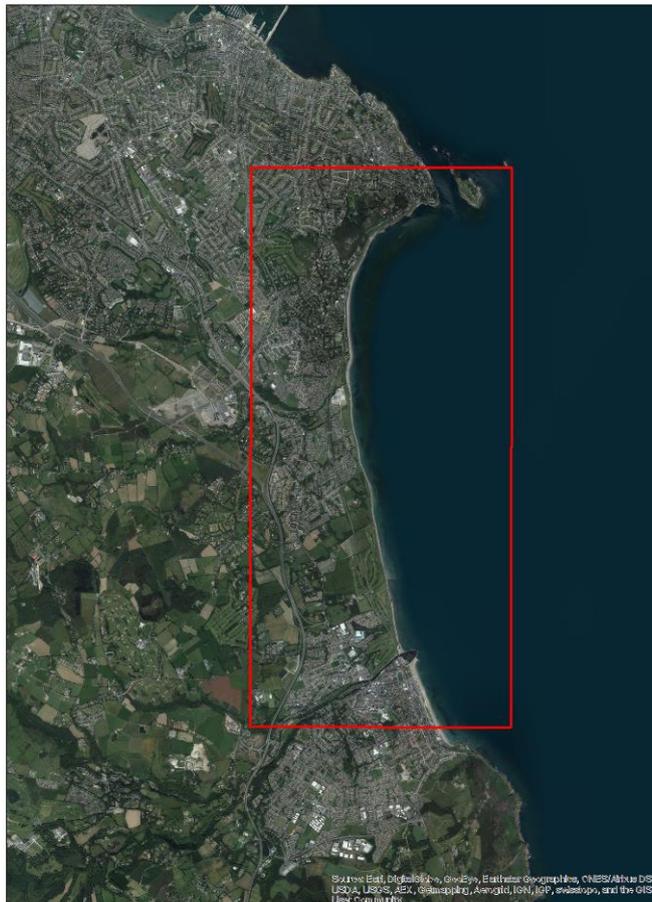


Figure E6 – 6 South Dublin

With regards to the proposed abstraction at this location, the most significant potential impact from an air quality point of view is the potential for dust emissions

during the construction phase. The area is predominantly suburban with mixed high density residential abstraction. As a result of this, there will likely be a mid-range impact on these receptors as a result of the construction phase of the proposed desalination plant.

With regards to impacts during the operational phase of the proposed abstraction, operational traffic is likely to be the only air quality impact. There may be some fixed mechanical plant / pumps which will generate emissions, however these not predicted to be significant if present. Considering that the proposed abstraction will lead to a minimal increase in annual average daily traffic on the surrounding road network, there would be a very low air quality impact during the operational phase.

3.1.2 Loughshinny North



Figure E6 – 7 Loughshinny North

With regards to the proposed abstraction at this location, the most significant potential impact from an air quality point of view is the potential for dust emissions during the construction phase. The area is considered rural with a small number of low density residential dwellings. With consideration of standard good practice measures for the control of dust during construction, there will likely be a low impact on these receptors during the construction phase of this proposed desalination location.

With regards to impacts during the operational phase of the proposed abstraction, operational traffic is likely to be the only air quality impact. Considering that the proposed abstraction will lead to a minimal increase in annual average daily traffic

on the surrounding road network, there will be a very low air quality impact during the operational phase.

3.1.3 Loughshinny South



Figure E6 – 8 Loughshinny South

With regards to the proposed abstraction at this location, the most significant potential impact from an air quality point of view is the potential for dust emissions during the construction phase. The area is considered rural/suburban with a small number of low density residential dwellings and a larger housing development “St Catherine’s Estate” on the Rush side of Loughshinny South. With consideration of standard good practice measures for the control of dust during construction, there will likely be a low impact on these receptors during the construction phase of this proposed desalination location

With regards to impacts during the operational phase of the proposed abstraction, operational traffic is likely to be the only air quality impact. Considering that the proposed abstraction will lead to a minimal increase in annual average daily traffic on the surrounding road network, there will be a very low air quality impact during the operational phase.

3.1.4 Balbriggan



Figure E6 – 9 Balbriggan

With regard to the proposed abstraction at this location, the most significant potential impact from an air quality point of view is the potential for dust emissions during the construction phase. The area is considered rural with a small number of low density residential dwellings. With consideration of standard good practice measures for the control of dust during construction, there will likely be a low impact on these receptors during the construction phase of this proposed desalination location.

With regards to impacts during the operational phase of the proposed abstraction, operational traffic is likely to be the only air quality impact. Considering that the proposed abstraction will lead to a minimal increase in annual average daily traffic on the surrounding road network, there will be a very low air quality impact during the operational phase.

3.2 Matrix of Multi Criteria Analysis

Criteria	South Dublin	Loughshinny North	Loughshinny South	Balbriggan
Potential for Construction phase Air Quality impact at Sensitive receptors	High density residential area, as a result potential for dust emissions during construction phase will likely have a Mid-range Impact.	Predominantly rural area with little residential settlement, some quarries/pits located in area. Low Impact at sensitive receptors.	Predominantly rural area with residential settlement to the south i.e. north Rush Village. Low impact at sensitive receptors.	Low Density Residential Area with high density residential to south of study area. Low impact from construction phase.
Potential for Operational phase Air Quality impact at Sensitive receptors	Very low impacts during operational phase, only operational impacts would be due to traffic generated from staff.	Very low impacts during operational phase, only operational impacts would be due to traffic generated from staff.	Very low impacts during operational phase, only operational impacts would be due to traffic generated from staff.	Very low impacts during operational phase, only operational impacts would be due to traffic generated from staff.
Proximity to EPA Waste Licensed facility	No facilities present in study area.	No facilities present in study area.	No facilities present in study area.	No facilities present in study area.
Proximity to EPA IPPC Licensed Intensive Agriculture facility	No facilities present in study area.	No facilities present in study area.	No facilities present in study area.	No facilities present in study area.
EPA Air Quality Zone Classification	Zone A.	Zone D.	Zone D.	Zone C.
Wind Rose Assessment	South west prevailing wind.	South west prevailing wind.	South west prevailing wind.	South west prevailing wind.
Construction Phase Impact rating	Mid-range impact from construction dust emissions	Low impact from construction dust emissions	Low impact from construction dust emissions	Low impact from construction dust emissions
Operational Phase Impact rating	Very low impact due to additional traffic (likely to be minimal) generated by abstraction.	Very low impact due to additional traffic (likely to be minimal) generated by abstraction.	Very low impact due to additional traffic (likely to be minimal) generated by abstraction.	Very low impact due to additional traffic (likely to be minimal) generated by abstraction.

3.3 Comparative Discussion

Once consideration is given to standard good practice measures (as described in section 1.2.2) to control air quality emissions during the construction and operational phases, it is considered that all four options could be developed whilst having a negligible air quality impact.

It is considered that the Loughshinny and Balbriggan sites would be least constrained from an air quality perspective due to the absence of dense residential populations which are apparent at the South Dublin site.

Water Supply Project Eastern and Midlands Region (WSP)

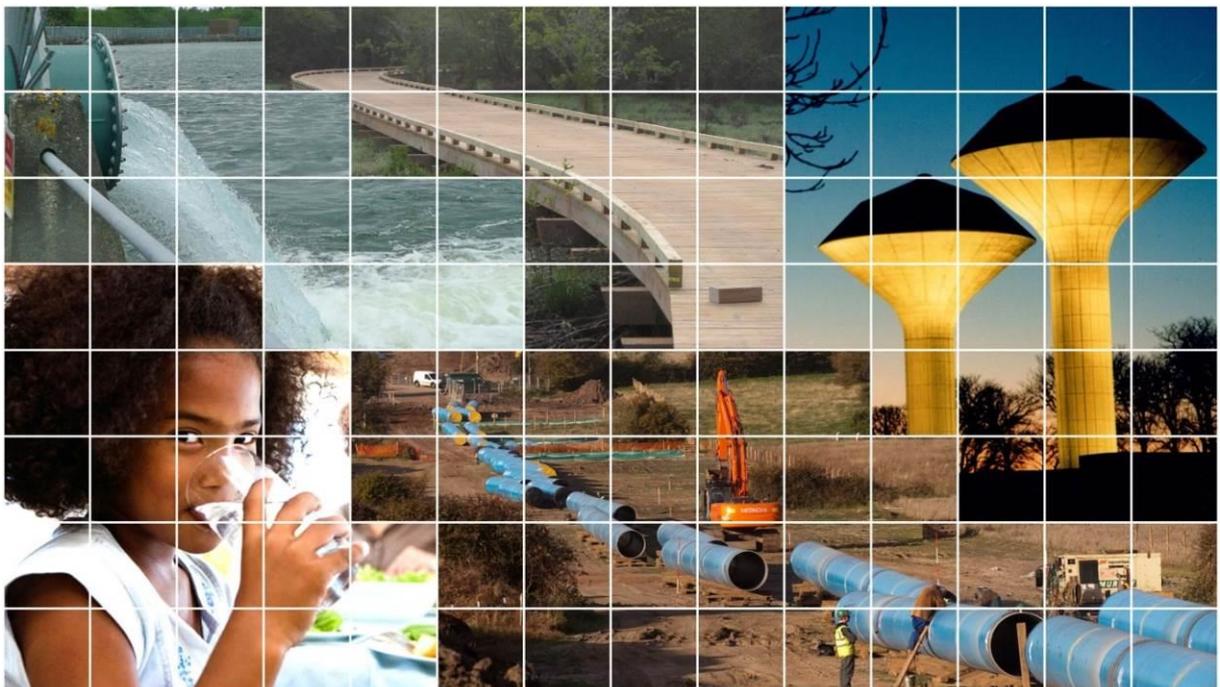
Abstraction Location MCA

Appendix E7: Noise



October 2015

F02



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1.1 Introduction

Four reasonable alternative options have been identified from previous studies – refer to the *Water Supply Options Working Paper* (Project Road Map Stage 2). These are reconfirmed below.

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)
- Option H (Desalination)

This report describes the decision making process used to appraise the abstraction locations associated with each of the reasonable alternative options.

To undertake the appraisal of abstraction locations a range of specialists were engaged, in their applicable fields, to conduct a comparative assessment of abstraction locations. The following disciplines were engaged:

- i. **Ecology** – the consideration of impact on animals, plants and their environment.
- ii. **Water** – the consideration of impacts on the surface water environment.
- iii. **Air and Noise** - the consideration of air and noise pollution
- iv. **Cultural Heritage** - the consideration of existing archaeological and built heritage
- v. **Soils, Geology and Hydrogeology** – the consideration of impact on soils, geology and hydrogeology.
- vi. **Landscape and visual** – the consideration of landscape and visual impact.
- vii. **Agronomy** – the consideration of impact on land based enterprise.
- viii. **People** – the consideration of impacts on people
- ix. **Planning** – the consideration of planning and land use policy in relation to proposed works
- x. **Engineering** - the consideration of technical challenges associated with proposed works.
- xi. **Traffic** - the consideration of impact on traffic and road network

The specialists independently assessed each location relative to appraisal criteria applicable to their field of expertise. This process, or methodology, is referred to as Multi-Criteria Analysis and explicitly considers multiple criteria (see Table E9 - 1), within a decision-making environment.

Environmental Criteria	Technical Criteria	Risk Criteria
Biodiversity, Flora and Fauna	Safety	Technical Risk relating to the Source
Fisheries	Planning Policy	Technical Risk relating to Infrastructure and Operations
Water	Engineering and Design	Environmental and Planning Risk
Air/Climatic Factors	Capital and Operational Costs	Financial Risk
Material Assets (Energy)	Sustainability	Socio-economic risk
Cultural Heritage (including Architecture & Archaeology)		
Landscape & Visual		
Material Assets (Land use)		
Tourism		
Population		
Human Health		
Soils, Geology and Hydrogeology		

Table E9 - 1 Appraisal Criteria

The assessments are presented as individual statements within this Appendix E.

This Appendix E7 is a statement on the specialism Noise and describes the decision making process used in identifying the least constrained abstraction locations associated with the reasonable alternative options.

The Site Selection Methodology in Appendix B outlines the process employed in identifying least constrained locations. This report should be read in conjunction with the *Site Selection Methodology*.

1.2 Methodology

This is 'Non-linear Site Methodology – Step 1' as described in the *Site Selection Methodology*.

To effectively determine the least constrained abstraction locations for the reasonable alternative options, the potential abstraction locations were assessed under 5 no. Noise sub-criteria.

- Potential for Construction phase noise impact at Sensitive receptors
- Potential for Operational phase noise impact at Sensitive receptors
- Existing Ambient Noise Climate in the Area (significant noise sources)
- Construction Phase Impact rating
- Operational Phase Impact rating

This section considers a selection of potential options of the SEA locations proposed for the Eastern and Midlands Region Water Supply Project in terms of Noise. For the purposes of this option selection study the requirements outlined in the National Roads Authority's (NRA) *Guidelines for the Treatment of Noise and Vibration in*

National Road Schemes (Rev 1, October 2004) have been used as a basis for this report. The primary aspects of the assessment relate to the proximity to noise sensitive locations.

1.2.1 Desk study

A desk study exercise of the potential abstraction locations was carried out using the software package *ArcReader*. The supplied datasets and information are as described in the *Site Selection Methodology*.

1.2.2 Categories of impact

The relative analysis of potential locations to define a “least constrained” location is based upon a subjective assessment by each Specialist in their discipline of expertise. This judgement is presented as weighted impact; colour coded for ready identification.

Very high	Dark blue
High	Blue
Mid-range	Green
Low	Light Green
Very low	Cream

In the current assessment, noise constraints such as the number of residential properties and the presence of cultural heritage areas (which may have a more stringent criteria for vibration) have been investigated for each of the potential options.

With regards to noise, the potential impacts of the proposed development will be considered during both the construction and operational phases.

The most significant potential impact from a project of this nature is typically related to noise emissions during the construction phase. Typical construction noise sources in this context include fixed and mobile plant and machinery that will be required for ground works and for construction of the proposed development and associated infrastructure. Due to the nature of activities undertaken on a construction site, there is potential for generation of significant levels of noise. However, the application of limits along with implementation of appropriate noise and vibration control measures (as discussed in outline form in the section 2.2) will ensure that noise and vibration impacts will not be excessive.

In the operational context, the proposed development would have potential to result in increased traffic flows on the existing road network that could potentially lead to increased noise emissions. However for this project it is considered that significant increases in traffic noise associated with the project are unlikely due to the small amount of infrastructure required along the majority of the route. Additionally there will be some fixed mechanical plant / pumps which will generate noise. In this context, noise emissions will be considered at the detailed design stage and standard noise mitigation measures (i.e. attenuators, acoustic screens/enclosures etc.) will be provided in order to reduce noise emissions to within acceptable limits, where required.

2 Lough Derg/Parteen Basin

2.1 Lough Derg/Parteen Basin Locations

An assessment of the potential abstraction locations was carried out for the following options:

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)

2.1.1 Slevoir



Figure E9 – 1 Lough Derg - Slevoir

The existing ambient noise climate is likely to be low. Nearby noise sources are likely to consist of traffic from local roads and the N65 and other anthropogenic sources.

With regards to the proposed development at this location, the most significant potential impact from a noise point of view is the potential for noise emissions during the construction phase. The area is considered rural with a small number of low density residential dwellings. With consideration of standard good practice

noise from fixed plant will be considered and standard noise mitigation measures will be provided to minimise impacts. Noise impacts are expected to be very low.

2.1.3 Dromineer



Figure E9 – 3 Lough Derg - Dromineer

The existing ambient noise climate is likely to be low. Nearby noise sources are likely to consist of traffic from local / regional roads and other anthropogenic sources.

With regards to the proposed development at this location, the most significant potential impact from a noise point of view is the potential for noise emissions during the construction phase. The area is considered rural with a small number of low density residential dwellings and a larger residential settlement at Dromineer. With consideration of standard good practice measures for the control of noise during construction, there will likely be a low impact on these receptors during the construction phase of this proposed abstraction location.

Operational traffic is likely to have small noise impact and there will be some fixed mechanical plant / pumps which will generate noise. At the detailed design stage noise from fixed plant will be considered and standard noise mitigation measures will be provided to minimise impacts. Noise impacts are expected to be low.

2.1.4 Youghal



Figure E9 – 4 Lough Derg - Youghal

The existing ambient noise climate is likely to be low. Nearby noise sources are likely to consist of traffic from local / regional roads and other anthropogenic sources.

With regards to the proposed development at this location, the most significant potential impact from a noise point of view is the potential for noise emissions during the construction phase. The area is considered rural with a small number of low density residential dwellings. With consideration of standard good practice measures for the control of noise during construction, there will likely be a low impact on these receptors during the construction phase of this proposed abstraction location.

Operational traffic is likely to have small noise impact and there will be some fixed mechanical plant / pumps which will generate noise. At the detailed design stage noise from fixed plant will be considered and standard noise mitigation measures will be provided to minimise impacts. Noise impacts are expected to be very low.

2.1.5 Parteen Basin Reservoir



Figure E9 – 5 Parteen Basin Reservoir

The existing ambient noise climate is likely to be low. Nearby noise sources are likely to consist of traffic from local / regional roads and other anthropogenic sources.

With regards to the proposed development at this location, the most significant potential impact from a noise point of view is the potential for noise emissions during the construction phase. The area is considered rural/suburban with a number of low density residential dwellings and also a number of larger residential settlements, Killdoe / Ballina. With consideration of standard good practice measures for the control of noise during construction, there will likely be a low impact on these receptors during the construction phase of this proposed abstraction location.

Operational traffic is likely to have small noise impact and there will be some fixed mechanical plant / pumps which will generate noise. At the detailed design stage noise from fixed plant will be considered and standard noise mitigation measures will be provided to minimise impacts. Noise impacts are expected to be low.

2.2 Matrix of Multi Criteria Analysis

Criteria	Slevoir	Mota	Dromineer	Youghal Bay	Parteen Basin
Potential for Construction phase noise impact at Sensitive receptors	The area is considered rural with a small number of low density residential dwellings.	The area is considered rural with a small number of low density residential dwellings and a hotel.	The area is considered rural with a small number of low density residential dwellings and a larger residential settlement at Dromineer.	The area is considered rural with a small number of low density residential dwellings.	The area is considered rural/suburban with a number of low density residential dwellings and also a number of larger residential settlements.
Potential for Operational phase noise impact at Sensitive receptors	Operational traffic is likely to have small noise impact, mechanical plant/pumps noise mitigation measures will be provided to minimise impacts.	Operational traffic is likely to have small noise impact, mechanical plant/pumps noise mitigation measures will be provided to minimise impacts.	Operational traffic is likely to have small noise impact, mechanical plant/pumps noise mitigation measures will be provided to minimise impacts.	Operational traffic is likely to have small noise impact, mechanical plant/pumps noise mitigation measures will be provided to minimise impacts.	Operational traffic is likely to have small noise impact, mechanical plant/pumps noise mitigation measures will be provided to minimise impacts.
Existing Ambient Noise Climate in the Area (significant noise sources)	Existing ambient noise climate likely to be low. Nearby noise sources are likely to consist of traffic from local roads and the N65 and other anthropogenic sources	Existing ambient noise climate likely to be low. Nearby noise sources are likely to consist of traffic from local/regional roads and other anthropogenic sources.	Existing ambient noise climate likely to be low. Nearby noise sources are likely to consist of traffic from local/regional roads and other anthropogenic sources.	Existing ambient noise climate likely to be low. Nearby noise sources are likely to consist of traffic from local/regional roads and other anthropogenic sources.	Existing ambient noise climate likely to be low. Nearby noise sources are likely to consist of traffic from local/regional roads and other anthropogenic sources.
Construction Phase Impact rating	Low noise impact expected during construction phase.	Low noise impact expected during construction phase.	Low noise impact expected during construction phase.	Low noise impact expected during construction phase.	Low noise impact expected during construction phase.
Operational Phase Impact rating	Very low noise impact expected during operational phase.	Very low noise impact expected during operational phase.	Very low noise impact expected during operational phase.	Very low noise impact expected during operational phase.	Very low noise impact expected during operational phase.

2.3 Comparative Discussion

It is considered that the Slevoir, Mota and Youghal bay sites would be least constrained from a noise perspective due lower density of residential development. The Parteen basin site is noted to have the highest overall number of residential dwellings followed by the Dromineer site. It should also be noted that the Parteen basin site is the site with the largest overall study area.

Once consideration is given to standard good practice measures to control noise emissions during the construction and operational phases, it is considered that all five options could be developed whilst having a negligible noise impact.

In terms of construction noise mitigation, the contractor will be obliged to give due regard to British Standard BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites*, which offers detailed guidance on the control of noise and vibration from construction activities. In particular, it is proposed that various practices be adopted during construction, including:

- Limiting the hours during which site activities likely to create high levels of noise are permitted;
- Establishing channels of communication between the contractor, local authority and residents;
- Appointing a site representative responsible for matters relating to noise, and;
- Monitoring typical levels of noise during critical periods and at sensitive locations.

Furthermore, it is envisaged that a variety of practicable noise control measures will be employed, including:

- Selection of plant with low inherent potential for generation of noise, and;
- Siting of noisy plant as far away from sensitive properties as permitted by site constraints.

In terms of the operational phase of the development, any increase in noise associated with additional AADT traffic movements on existing roads is expected to be small and insignificant. Should there be any fixed plant required during the operational phase of the development, noise emissions will be considered at the detailed design stage and standard noise mitigation measures (i.e. attenuators, acoustic screens/enclosures etc.) will be provided in order to reduce noise emissions to within acceptable limits.

3

Desalination

3.1 Desalination Locations

An assessment of the potential abstraction locations was carried out for the following options:

- Option H (Desalination)

3.1.1 South Dublin

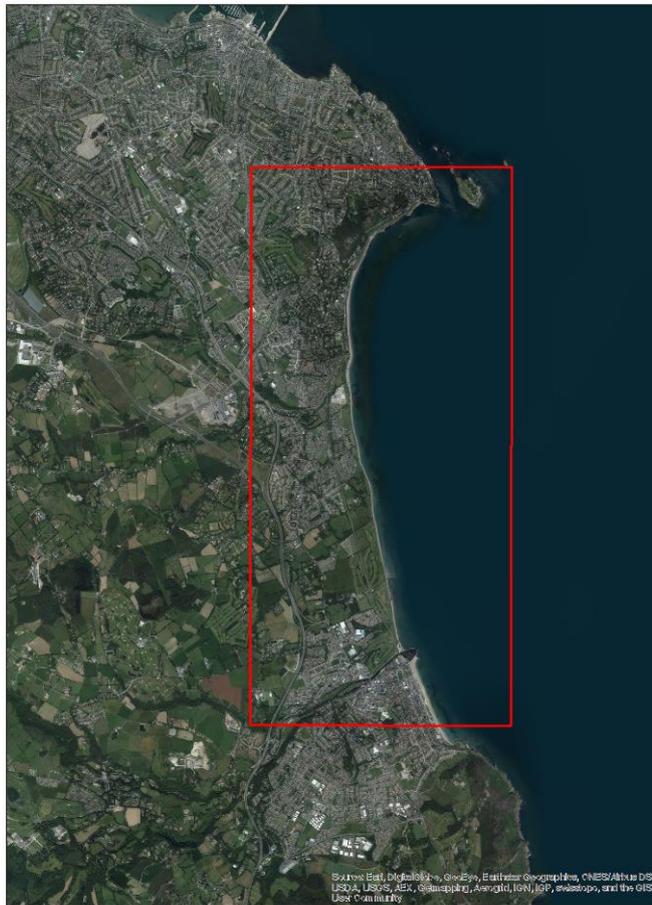


Figure E9 – 6 South Dublin

This potential location includes residential settlements at Killiney, Ballybrack, Shankill and Bray. The existing ambient noise climate is likely to be reasonably low. Nearby noise sources are likely to consist of traffic from local / regional roads / N11 along with rail traffic noise and other anthropogenic sources.

With regards to the proposed development at this location, the most significant potential impact from a noise point of view is the potential for noise emissions during the construction phase. The area is predominantly suburban with mixed density residential development. With consideration of standard good practice measures for the control of noise during construction, there will likely be a low impact on these receptors during the construction phase of this proposed desalination location

Operational traffic is likely to have small noise impact and there may be some fixed mechanical plant / pumps which will generate noise. At the detailed design stage noise from fixed plant will be considered and standard noise mitigation measures will be provided to minimise impacts. Considering that the proposed development will lead to a minimal increase in AADT on the surrounding road network, there will be a low noise impact due to traffic. Noise impacts are expected to be low.

3.1.2 Loughshinny North



Figure E9 – 7 Loughshinny North

The existing ambient noise climate is likely to be low. Nearby noise sources are likely to consist of traffic from local / regional roads and other anthropogenic sources.

With regards to the proposed development at this location, the most significant potential impact from a noise point of view is the potential for noise emissions during the construction phase. The area is considered rural with a small number of low density residential dwellings. With consideration of standard good practice measures for the control of noise during construction, there will likely be a low impact on these receptors during the construction phase of this proposed desalination location

Operational traffic is likely to have small noise impact and there may be some fixed mechanical plant / pumps which will generate noise. At the detailed design stage noise from fixed plant will be considered and standard noise mitigation measures will be provided to minimise impacts. Considering that the proposed development

will lead to a minimal increase in AADT on the surrounding road network, there will be a very low noise impact due to traffic. Noise impacts are expected to be very low.

3.1.3 Loughshinny South



Figure E9 – 8 Loughshinny South

The existing ambient noise climate is likely to be low. Nearby noise sources are likely to consist of traffic from local / regional roads and other anthropogenic sources.

With regards to the proposed development at this location, the most significant potential impact from a noise point of view is the potential for noise emissions during the construction phase. The area is considered rural/suburban with a small number of low density residential dwellings and a larger estate at St Catherine’s, Skerries Road, Rush. With consideration of standard good practice measures for the control of noise during construction, there will likely be a low impact on these receptors during the construction phase of this proposed desalination location

Operational traffic is likely to have small noise impact and there may be some fixed mechanical plant / pumps which will generate noise. At the detailed design stage noise from fixed plant will be considered and standard noise mitigation measures will be provided to minimise impacts. Considering that the proposed development will lead to a minimal increase in AADT on the surrounding road network, there will be a very low noise impact due to traffic. Noise impacts are expected to be very low.

3.1.4 Balbriggan



Figure E9 – 9 Balbriggan

The existing ambient noise climate is likely to be low. Nearby noise sources are likely to consist of traffic from local / regional roads, along with rail traffic and other anthropogenic sources.

With regards to the proposed development at this location, the most significant potential impact from a noise point of view is the potential for noise emissions during the construction phase. The site is absent of residential development, there are nearby residential dwellings that are outside of the zone marked. With consideration of standard good practice measures for the control of noise during construction, there will likely be a very low impact on these receptors during the construction phase of this proposed desalination location

Operational traffic is likely to have small noise impact and there may be some fixed mechanical plant / pumps which will generate noise. At the detailed design stage noise from fixed plant will be considered and standard noise mitigation measures will be provided to minimise impacts. Considering that the proposed development will lead to a minimal increase in AADT on the surrounding road network, there will be a very low noise impact due to traffic. Noise impacts are expected to be very low.

3.2 Matrix of Multi Criteria Analysis

Criteria	South Dublin	Loughshinny North	Loughshinny South	Balbriggan
Potential for Construction phase noise impact at Sensitive receptors	The area is predominantly suburban with mixed density residential development.	The area is considered rural with a small number of low density residential dwellings.	The area is considered rural/suburban with a small number of low density residential dwellings and a larger estate at St Catherine's.	The site is absent of residential development, there are nearby residential dwellings that are outside of the zone marked.
Potential for Operational phase noise impact at Sensitive receptors	Operational traffic is likely to have small noise impact, mechanical plant/pumps noise mitigation measures will be provided to minimise impacts.	Operational traffic is likely to have small noise impact, mechanical plant/pumps noise mitigation measures will be provided to minimise impacts.	Operational traffic is likely to have small noise impact, mechanical plant/pumps noise mitigation measures will be provided to minimise impacts.	Operational traffic is likely to have small noise impact, mechanical plant/pumps noise mitigation measures will be provided to minimise impacts.
Existing Ambient Noise Climate in the Area (significant noise sources)	Existing ambient noise climate likely to be reasonably low. Nearby noise sources are likely to consist of traffic from local/regional roads/N11 along with rail traffic noise and other anthropogenic sources.	Existing ambient noise climate likely to be low. Nearby noise sources are likely to consist of traffic from local/regional roads and other anthropogenic sources.	Existing ambient noise climate likely to be low. Nearby noise sources are likely to consist of traffic from local/regional roads and other anthropogenic sources.	Existing ambient noise climate likely to be low. Nearby noise sources are likely to consist of traffic from local/regional roads, along with rail traffic and other anthropogenic sources.
Construction Phase Impact rating	Low noise impact expected during construction phase.	Low noise impact expected during construction phase.	Low noise impact expected during construction phase.	Very low noise impact expected during construction phase.
Operational Phase Impact rating	Low noise impact expected during operational phase.	Very low noise impact expected during operational phase.	Very low noise impact expected during operational phase.	Very low noise impact expected during operational phase.

3.3 Comparative Discussion

It is considered that the Balbriggan site would be least constrained from a noise perspective due to the absence of residential development followed by Loughshinny North, Loughshinny South and then the South Dublin site which has a higher number of residential dwellings in the zone.

Once consideration is given to standard good practice measures to control noise emissions during the construction and operational phases, it is considered that all four options could be developed whilst having a negligible noise impact.

In terms of construction noise mitigation, the contractor will be obliged to give due regard to British Standard BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites*, which offers detailed guidance on the control of noise and vibration from construction activities. In particular, it is proposed that various practices be adopted during construction, including:

- Limiting the hours during which site activities likely to create high levels of noise are permitted;
- Establishing channels of communication between the contractor, local authority and residents;
- Appointing a site representative responsible for matters relating to noise, and;
- Monitoring typical levels of noise during critical periods and at sensitive locations.

Furthermore, it is envisaged that a variety of practicable noise control measures will be employed, including:

- Selection of plant with low inherent potential for generation of noise, and;
- Siting of noisy plant as far away from sensitive properties as permitted by site constraints.

In terms of the operational phase of the development, any increase in noise associated with additional AADT traffic movements on existing roads is expected to be small and insignificant. Should there be any fixed plant required during the operational phase of the development, noise emissions will be considered at the detailed design stage and standard noise mitigation measures (i.e. attenuators, acoustic screens/enclosures etc.) will be provided in order to reduce noise emissions to within acceptable limits.

Water Supply Project Eastern and Midlands Region (WSP)

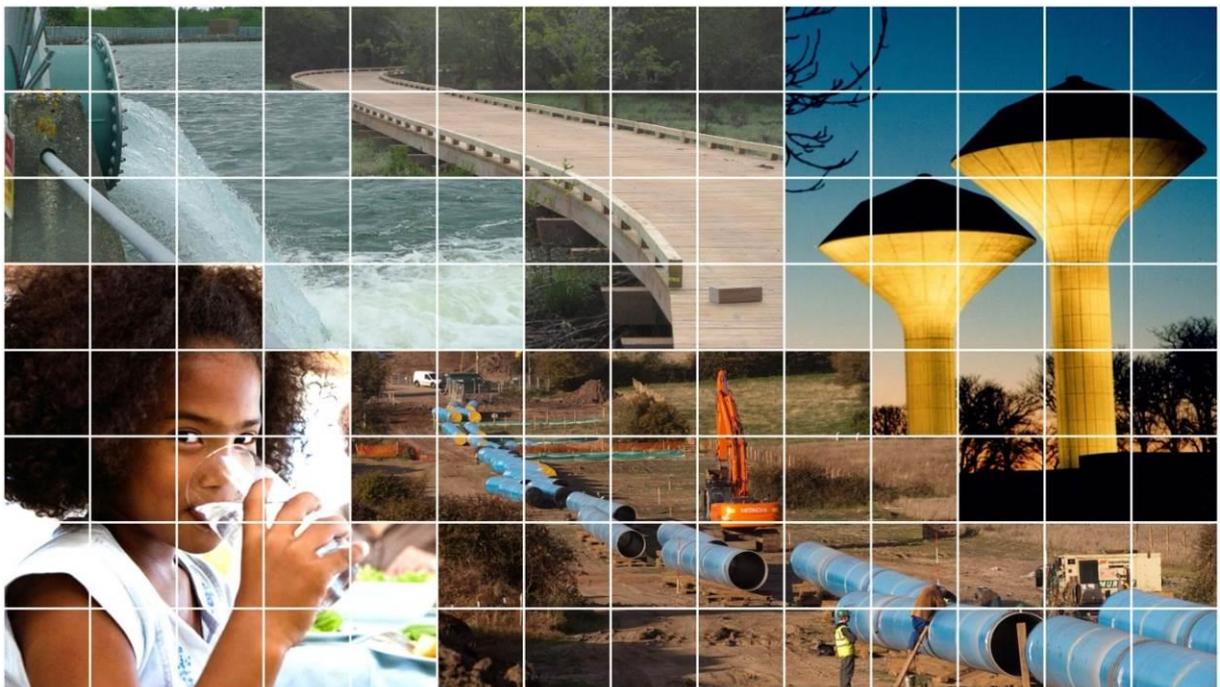
Abstraction Location MCA

Appendix E8: Cultural Heritage



October 2015

F02



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1.1 Introduction

Four reasonable alternative options have been identified from previous studies – refer to the *Water Supply Options Working Paper* (Project Road Map Stage 2). These are reconfirmed below.

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)
- Option H (Desalination)

This report describes the decision making process used to appraise the abstraction locations associated with each of the reasonable alternative options.

To undertake the appraisal of abstraction locations a range of specialists were engaged, in their applicable fields, to conduct a comparative assessment of abstraction locations. The following disciplines were engaged:

- i. **Ecology** – the consideration of impact on animals, plants and their environment.
- ii. **Water** – the consideration of impacts on the surface water environment.
- iii. **Air and Noise** - the consideration of air and noise pollution
- iv. **Cultural Heritage** - the consideration of existing archaeological and built heritage
- v. **Soils, Geology and Hydrogeology** – the consideration of impact on soils, geology and hydrogeology.
- vi. **Landscape and visual** – the consideration of landscape and visual impact.
- vii. **Agronomy** – the consideration of impact on land based enterprise.
- viii. **People** – the consideration of impacts on people
- ix. **Planning** – the consideration of planning and land use policy in relation to proposed works
- x. **Engineering** - the consideration of technical challenges associated with proposed works.
- xi. **Traffic** - the consideration of impact on traffic and road network

The specialists independently assessed each location relative to appraisal criteria applicable to their field of expertise. This process, or methodology, is referred to as Multi-Criteria Analysis and explicitly considers multiple criteria (see Table E8 - 1), within a decision-making environment.

Environmental Criteria	Technical Criteria	Risk Criteria
Biodiversity, Flora and Fauna	Safety	Technical Risk relating to the Source
Fisheries	Planning Policy	Technical Risk relating to Infrastructure and Operations
Water	Engineering and Design	Environmental and Planning Risk
Air/Climatic Factors	Capital and Operational Costs	Financial Risk
Material Assets (Energy)	Sustainability	Socio-economic risk
Cultural Heritage (including Architecture & Archaeology)		
Landscape & Visual		
Material Assets (Land use)		
Tourism		
Population		
Human Health		
Soils, Geology and Hydrogeology		

Table E8 - 1 Appraisal Criteria

The assessments are presented as individual statements within this Appendix E.

This Appendix E8 is a statement on the specialism Cultural Heritage and describes the decision making process used in identifying the least constrained abstraction locations associated with the reasonable alternative options.

The Site Selection Methodology in Appendix B outlines the process employed in identifying least constrained locations. This report should be read in conjunction with the *Site Selection Methodology*.

1.2 Methodology

This is ‘Non-linear Site Methodology – Step 1’ as described in the *Site Selection Methodology*.

To effectively determine the least constrained abstraction locations for the reasonable alternative options, the potential abstraction locations were assessed under 7 no. Cultural Heritage sub-criteria.

- Potential to impact (direct/indirect) on National Monuments/ sites with Preservation Orders (designated sites)
- Potential to impact (direct/indirect) on RMPs (designated sites)
- Potential to impact (direct/indirect) on RPSs (designated sites)
- Potential to impact (direct/indirect) on NIAHs
- Potential to impact (direct/indirect) on historic designed landscapes
- Potential to impact on ACAs
- Recorded shipwreck sites/ underwater archaeology

1.2.1 Desk study

A desk study exercise of the potential abstraction locations was carried out using the software package *ArcReader*. The supplied datasets and information are as described in the *Site Selection Methodology*.

1.2.2 Categories of impact

The relative analysis of potential locations to define a “least constrained” location is based upon a subjective assessment by each Specialist in their discipline of expertise. This judgement is presented as weighted impact; colour coded for ready identification.

Very high	Dark blue
High	Blue
Mid range	Green
Low	Light Green
Very low	Cream

2 Lough Derg/Parteen Basin

2.1 Lough Derg/Parteen Basin Locations

An assessment of the potential abstraction locations was carried out for the following options:

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)

2.1.1 Slevoir



Figure E8 – 1 Lough Derg – Slevoir

Table E8 - 2 details the Cultural Heritage constraints that have been identified within the Slevoir Abstraction location.

Site Type	ID Number	Classification	Statutory Protection
RPS	S162	Firmount House	Yes
RPS	S239	Cottage	Yes
RPS	S240	Cottage	Yes

Designed landscape	DL 51	Slevoir House	Principal structure is in RPS
Designed landscape	DL 52	Firmount House	Principal structure is in RPS

Table E8 - 2 Cultural Heritage Constraints

Slevoir is a relatively unconstrained area from an archaeological and architectural heritage perspective. There are no recorded archaeological sites within the area, although it is possible that previously unrecorded archaeological sites survive on land and within Lough Derg itself. Three protected structures are located within the area, but no NIAH structures are present. Due to the rural nature of the landscape, no ACAs are present. Two designed landscapes have been identified within the area, both of which are associated with protected structures.

2.1.2 Mota



Figure E8 – 2 Lough Derg - Mota

Table E8 - 3 details the Cultural Heritage constraints that have been identified within the Mota Abstraction location.

Site Type	ID Number	Classification	Statutory Protection
RPS/ NIAH	S290/ 22400260	Mota House	Yes
RPS	S291	Waterloo House	Yes
RPS	S537	Kilgarvan House	Yes
Designed landscape	DL 54	Mota House	Principal structure is in RPS
Designed landscape	DL 55	Brookfield House	Principal structure is in RPS
Designed landscape	DL 53	Kilgarvan House	Principal structure is in RPS

Table E8 - 3 Cultural Heritage Constraints

Mota again is a relatively unconstrained area from an archaeological and architectural heritage perspective. There are no recorded archaeological sites within the area, although it is possible that previously unrecorded archaeological sites survive on land and within Lough Derg itself. Three protected structures are located within the area, one of which is also listed within the NIAH. Due to the rural nature of the landscape, no ACAs are present. Three designed landscapes have been identified within the area, all of which are associated with protected structures.

2.1.3 Dromineer



Figure E8 – 3 Lough Derg - Dromineer

Table E8 - 4 details the Cultural Heritage constraints that have been identified within the Dromineer Abstraction location.

Site Type	ID Number	Classification	Statutory Protection
RMP	TN014-002----	Ringfort - rath	Yes
RMP	TN014-003----	Enclosure	Yes
RMP	TN014-004001-4	Castle - hall-house Church Bawn Settlement deserted Graveyard	Yes
RPS	S395	Cottage	Yes
RPS	S391	House	Yes
RPS	S568	Dromineer Quay	Yes
RPS/ NIAH	S360/ 22401412	Hazel Point Cottage	Yes
RPS/ NIAH	S361-2/ 22401413	Kilteelagh House & outbuildings	Yes
RPS/ NIAH	S157/ 22401421	Cottage	Yes
RPS/ NIAH	S392/ 22401402	St. David's	Yes
RPS/ NIAH	S393/ 22401401	St David's Lodge	Yes
RPS/ NIAH	S569 22401415	Navigational Store	Yes
NIAH	22401418	House	No
NIAH	22401417	House	No
NIAH	22401416	House	No
Designed landscape	DL 56	Kilteelagh House	Principal structure is in RPS
Designed landscape	DL 57	St. David's House	Principal structure is in RPS

Table E8 - 4 Cultural Heritage Constraints

Dromineer contains slightly more archaeological and architectural heritage constraints than Slevoir and Mota. There are three recorded archaeological sites within the area, although none are listed as National Monuments or with Preservation Orders. As with the other areas it is possible that previously unrecorded archaeological sites survive on land and within Lough Derg itself. There are nine protected structures within the area, six of which is also listed within the NIAH. There are also three additional NIAH structures located within the area. Due to the rural nature of the landscape, no ACAs are present. Two designed landscapes have been identified within the area, both of which are associated with protected structures.

2.1.4 Youghal



Figure E8 – 4 Lough Derg - Youghal

Table E8 - 5 details the Cultural Heritage constraints that have been identified within the Slevoir Abstraction location.

Site Type	ID Number	Classification	Statutory Protection
RMP	TN014-040----	Ringfort - rath	Yes
RMP	TN014-039----	Castle - tower house	Yes
SMR	TN014-043----	Redundant record	No
RMP	TN014-044001-2	Ritual site - holy well Ritual site - holy tree/bush	Yes
SMR	TN014-050----	Redundant record	No
RMP	TN014-037/001-	Castle - unclassified Settlement deserted - medieval	Yes
RPS/ NIAH	S576/ 22401436	Limekiln	Yes
Designed landscape	58	Shannon Hall	No
Designed landscape	59	Youghal House	Principal structure is in RPS

Table E8 - 5 Cultural Heritage Constraints

Youghal also contains slightly more archaeological and architectural heritage constraints than Slevoir and Mota but not as many as Dromineer. There are four recorded archaeological sites within the area, although none are listed as National Monuments or with Preservation Orders. Two redundant records are also listed. As with the other areas it is possible that previously unrecorded archaeological sites survive on land and within Lough Derg itself. There is one protected structure within the area, which is also listed within the NIAH. Due to the rural nature of the landscape, no ACAs are present. Two designed landscapes have been identified within the area, one of which is associated with a protected structure.

2.1.5 Parteen Basin Reservoir



Figure E8 – 5 Parteen Basin Reservoir

Table E8 – 6 details the Cultural Heritage constraints that have been identified within the Parteen Basin Abstraction location.

Site Type	ID Number	Classification	Statutory Protection
RMP	TN025-008----	Weir - regulating	Yes
RMP	TN025-004----	Ringfort - rath	Yes
RMP	TN025-013----	Enclosure	Yes
RMP	TN025-015----	Castle - hall-house	Yes
RMP	TN025-016001-2	Church Graveyard	Yes

RMP	TN025-094001-3	Historic town Bridge Castle - tower house Weir - regulating	Yes
RMP	TN025-025----	Standing stone	Yes
RMP	TN025-021----	Ritual site - holy well	Yes
RMP	TN025-017----	Ringfort - rath	Yes
RMP	TN025-018----	Ringfort - rath	Yes
RMP	TN025-019001-2	Standing stone Standing stone	Yes
RMP	TN025-020001-2	Ringfort - rath Ringfort - rath	Yes
RMP	TN025-022001-2	Church Burial ground	Yes
RMP	TN025-023----	Ringfort - rath	Yes
RMP	TN025-024----	Enclosure	Yes
RMP	CL045-017----	Enclosure	Yes
RMP	CL045-018----	Enclosure	Yes
RMP	CL045-021----	Enclosure	Yes
RMP	CL045-022----	Enclosure	Yes
RMP	CL045-023----	Enclosure	Yes
RMP	CL045-024----	Enclosure	Yes
RMP	CL045-025----	Enclosure	Yes
RMP	CL045-026----	Enclosure	Yes
RMP	CL045-027----	Enclosure	Yes
RMP	CL045-028----	Standing stone	Yes
RMP	CL045-029----	Standing stone	Yes
RMP	CL045-030----	Standing stone	Yes
National Monument/ Preservation Order/ RMP	CL045-031001-3	Ringfort – unclassified House – unclassified Castle – ringwork	Yes
RMP	CL045-032----	Ritual site - holy well	Yes
RMP	CL045-041----	Enclosure	Yes
RMP	CL045-042----	Enclosure	Yes
RMP	CL045-044----	Enclosure	Yes
RMP	CL045-045----	Enclosure	Yes
RMP	CL045-046----	Enclosure	Yes
RMP	CL045-047----	Fulacht fia	Yes
RMP	CL045-048001-3	Standing stone	Yes
RMP	CL045-049----	Enclosure	Yes
RMP	CL045-050----	Cross	Yes
RMP	CL045-054001-2	Children's burial ground Ritual site - holy well	Yes
RMP	CL045-055----	Megalithic structure	Yes
RMP	CL045-057----	Enclosure	Yes
RMP	CL054-004----	Bridge	Yes
RMP	CL054-005----	Cist	Yes
RMP	CL054-006----	Enclosure	Yes

RMP	CL054-007001-2	Church Graveyard	Yes
RMP	CL054-008----	Enclosure	Yes
RMP	CL045-059----	Standing stone	Yes
RMP	CL045-061----	Burnt mound	Yes
RMP	CL045-031002-3	House - indeterminate date Castle - ringwork	Yes
RMP	CL045-060----	Standing stone	Yes
National Monument/ RMP/ RPS	CL045-033003-15,18/ 252	Historic Town Cross - High cross (present location) Ogham stone Architectural fragment Cathedral Cross-slab Cross - High cross Church Cross-slab Font Memorial stone Ritual site - holy well Sheela-na-gig Church (present location) Graveyard	Yes
RMP	LI001-005----	Bridge	Yes
RMP	LI001-006----	Graveyard	Yes
RMP	LI001-014----	Castle - unclassified	Yes
RMP	CL037-019----	Ritual site - holy well	Yes
RMP	CL037-020001-2	Earthwork Enclosure	Yes
RMP	CL037-021001-2	Ringfort - unclassified House - early medieval	Yes
RPS	S677	Garryneal	Yes
RPS	S679	Fort Henry	Yes
RPS	S680	Fort Henry Lodge	Yes
RPS	S705	Parteen Villa	Yes
RPS	S706	Parteen Wier	Yes
RPS	S673	Post Box	Yes
RPS/ NIAH	S671/ 22306004	Ferns Hollow Gate	Yes
RPS/ NIAH	S672/ 210 22306005/ 20300803	Killaloe Bridge	Yes
NIAH/ RPS	S674/ 22306007	Church of Our Lady and St Lua	Yes
RPS	S675	Parochial House	Yes
RPS	S676	House	Yes
NIAH	22306001	Lakeside House	Yes
RPS	583	Pier Head and dry dock	Yes

RPS	584	Johnson's House	Yes
RPS	585	Killaloe Canal	Yes
RPS	586	Lock Bridge	Yes
RPS	587	Slipway and quay	Yes
RPS	588	Ardcloony Bridge	Yes
RPS	089	Two Mile Gate Cottage	Yes
RPS/ NIAH	153/ 20300803	St. Flannan's Church Col Cathedral	Yes
RPS/ NIAH	133/ 20404516	Sacred Heart Catholic Church	Yes
RPS/ NIAH	155/ 20300806	St. Flannan's Catholic Church	Yes
RPS/ NIAH	442/ 20300811	Courthouse	Yes
RPS/ NIAH	439/ 20300807	Abbey House	Yes
RPS/ NIAH	441/ 20404514	Clarisford Palace	Yes
RPS/ NIAH	445/ 20404508	The Deanery	Yes
RPS/ NIAH	440/ 20404510	Gate lodge	Yes
RPS/ NIAH	443/ 20300801	Main St, Killaloe	Yes
RPS/ NIAH	444/ 20300802	Main St, Killaloe	Yes
NIAH	20404517	Ross House	No
NIAH	20404518	Bridge	No
RPS/ NIAH	193/ 215/ 599 20405401, 20405402	O'Brien's Bridge & Canal Bridge	Yes
NIAH	21900105	Public House	No
NIAH	21900106	House	No
Designed landscape	60	Fairy Mount	No
Designed landscape	61	Parteen Villa	Principal structure is in RPS
Designed landscape	62	Fort Henry	Principal structure is in RPS
Designed landscape	63	Glebe House	Principal structure is in RPS
Designed landscape	64	Clarisford House	Principal structure is in RPS
Designed landscape	65	Mount Prospect	No
Designed landscape	66	Ballyvally House	No
Designed landscape	69	Glebe House	No
Designed landscape	70	Ross House	No
Designed	68	Mid Brook	No

landscape			
Designed landscape	71	Ardcloony House	No
Designed landscape	72	Kincora Lodge	No
ACA	N/a	Killaloe town centre	Yes
ACA	N/a	O'Brienbridge Village	Yes

Table E8 - 6 Cultural Heritage Constraints

The Parteen area contains a large amount of archaeological and architectural heritage constraints. This is due partly to the large area size and the fact it contains the historic settlements of Ballina and Killaloe. There are multiple archaeological sites recorded within the area, along with the National Monument of St. Molua's Church, which is located in Killaloe. In addition, to the north of the town there is a ringfort that is listed as a National Monument and also has a Preservation Order. Killaloe is also included within an Architectural Conservation Area and there are multiple protected structures and NIAH structures located within the area. To the south of Killaloe and Ballina there is a lower potential impact on the underwater archaeological resource, as to the south of Parteen, the watercourse has been artificially constructed around the course of the river.

2.2 Matrix of Multi Criteria Analysis

Criteria	Slevoir	Mota	Dromineer	Youghal Bay	Parteen Basin
Potential to impact (direct/indirect) on National Monuments (designated sites)	Very low as none are present.	Very low as none are present.	Very low as none are present.	Very low as none are present.	Low as only two are recorded in a large area.
Potential to impact (direct/indirect) on RMPs (designated sites)	Very low as none are present.	Very low as none are present.	Low as only three are recorded in a relatively large area.	Low as only four are recorded in a relatively large area.	Mid-range as a large amount of sites are recorded within the area, although the areas itself is relatively large.
Potential to impact (direct/indirect) on RPS (designated sites)	Low as only three are recorded in a relatively large area.	Low as only three are recorded in a relatively large area.	Low as whilst there are a number listed for the area, these are mostly clustered together in a relatively large area.	Very low as only one structure is recorded within the area.	Low although there are a number of structures recorded within the area most are focused on existing built up areas.
Potential to impact (direct/indirect) on NIAH	Very low as none are present.	Very low as only one structure is recorded within the area.	Low as whilst there are a number listed for the area, these are mostly clustered together in a relatively large area.	Very low as only one structure is recorded within the area.	Low although there are a number of structures recorded within the area most are focused on existing built up areas.
Potential to impact (direct/indirect) on historic designed landscapes	Low as only two are recorded in a relatively large area.	Mid-range as three demesnes are recorded in the area all of which are associated with protected structures.	Low as only two are recorded within a relatively large area.	Low as only two are recorded within a relatively large area.	Mid-range as a number of demesnes are recorded within the area, although many are no longer extant.
Potential to impact on ACA	Very low as none are present.	Very low as none are present.	Very low as none are present.	Very low as none are present.	Very low as only two are present in the area, which include the centres of Killaloe and O'Briensbridge.

<p>Recorded shipwreck sites/underwater archaeology</p>	<p>Mid-range due to the fact that infrastructure associated with the abstraction of water may impact on underwater archaeology within the lough.</p>	<p>Mid-range due to the fact that infrastructure associated with the abstraction of water may impact on underwater archaeology within the lough.</p>	<p>Mid-range due to the fact that infrastructure associated with the abstraction of water may impact on underwater archaeology within the lough.</p>	<p>Mid-range due to the fact that infrastructure associated with the abstraction of water may impact on underwater archaeology within the lough.</p>	<p>Low as the watercourse to the south of Killaloe and Ballina is artificially built.</p>
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2.3 Comparative Discussion.

The least constrained abstraction areas consist of Slevoir, Mota and Youghal Bay. None of the areas contained National Monuments, or sites with preservation orders. In addition, due to the rural nature of the area, none were found to contain Architectural Conservation Areas. With regards to the remaining constraints, only a small number of recorded archaeological sites, protected structures, NIAH structures and designed landscapes were identified. Dromineer was slightly more constrained, but still to a relatively low degree. However, all of the four Lough Derg sites share a potential mid-range impact on the underwater archaeological resource. This is due to infrastructure associated with the abstraction point being located within the lough itself.

Whilst the Parteen area is more constrained in terms of recorded archaeological and built heritage sites, it does have a lower potential impact on the underwater archaeological resource, as to the south of Parteen, the watercourse has been artificially constructed around the course of the river. There are a large amount of recorded archaeological sites and protected structures within the Parteen area, although this is to be expected due to its larger size and the presence of the settlements of Killaloe and Ballina. There are several national monuments recorded within the town of Killaloe, as well as an Architectural Conservation Area. To the north of the town and adjacent to Lough Derg, a ringfort is recorded as a national monument and this site also has a preservation order.

In consideration of the archaeological, architectural and cultural heritage constraints, the four sites in Lough Derg (Slevoir, Mota, Youghal Bay, Dromineer) would be considered as more preferable for an abstraction point. It is, however, plausible that a site could be identified in the Parteen area during later consultation, that would have minimal impact upon the cultural heritage resource.

3 Desalination

3.1 Desalination Locations

An assessment of the potential abstraction locations was carried out for the following options:

- Option H (Desalination)

3.1.1 South Dublin

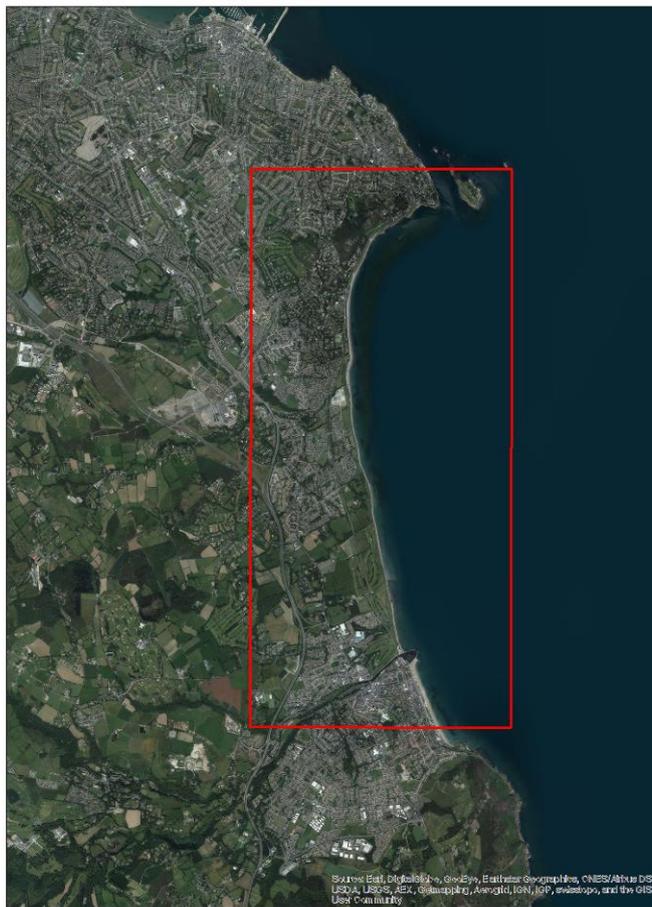


Figure E8 – 6 South Dublin

Table E8 – 7 details the Cultural Heritage constraints that have been identified within the South Dublin desalination location.

Site Type	ID Number	Classification	Statutory Protection
RMP	DU026-054001, 2, 3, 5	Cross Building Martello tower Defensive redoubt	Yes
RMP	DU026-009----	Earthwork	Yes
RMP	DU026-010----	Megalithic structure	Yes
RMP	DU026-011----	Martello tower	Yes

RMP	DU026-012----	Battery	Yes
RMP	DU026-089----	Martello tower	Yes
RMP	DU026-116----	Fulacht fia	Yes
RMP	DU026-120----	Castle - unclassified	Yes
RMP	DU026-124----	Linear earthwork	Yes
National Monument/ RMP	DU026-013001-8	Church Graveyard Inscribed stone Ritual site - holy tree/bush Font Cross Cross Ecclesiastical enclosure	Yes
RMP	DU026-014001-2	Martello tower Earthwork	Yes
RMP	DU026-029001-2	Castle - unclassified House - 16th/17th century	Yes
RMP	DU026-030----	Megalithic tomb - portal tomb	Yes
RMP	DU026-031001-2	Castle - tower house Water mill - unclassified	Yes
RMP	DU026-032----	Enclosure	Yes
RMP	DU026-033----	Enclosure	Yes
National Monument/ RMP	DU023-029001, 2, 3, 4, 5, 6, 7, 9, 11, 12	Promontory fort - coastal Midden Church Cross-inscribed stone Ritual site - holy well Burial ground Field system Martello tower Battery Cross-inscribed stone	Yes
RMP	DU023-039----	Linear earthwork	Yes
RMP	DU026-054001, 2,4	Cross Church Graveyard	Yes
RMP	DU026-066001-2	Church Graveyard	Yes
RMP	DU026-067----	Burial	Yes
RMP	DU026-068001-2	Church Graveyard	Yes
RMP	DU026-069----	Ritual site - holy well	Yes
RMP	DU026-070----	Martello tower	Yes
RMP	WI004-001001-6	Castle - tower house Historic town Cross-slab Redundant record Castle - unclassified Church	Yes
RMP	WI004-002----	Martello tower	Yes

RMP	WI004-003----	Martello tower	Yes
RMP	WI004-004----	Burial	Yes
RMP	WI004-005----	Linear earthwork	Yes
RMP	WI004-006----	Pier/Jetty	Yes
RPS	1816	Wayside (formerly Clontra Lodge)	Yes
RPS	1811	Clontra House	Yes
RPS	1810	Carnegie Library	Yes
RPS	1847	Ellerslie	Yes
RPS	1844	Cornerstown House	Yes
RPS	1837	Aubrey House	Yes
RPS	1836	Locksley	Yes
RPS	1834	Rosedale House	Yes
RPS	1860	Askefield House	Yes
RPS	1863	Saint James's Church	Yes
RPS	1862	Beauchamp House	Yes
RPS	1869	Corke Lodge & The Coach House	Yes
RPS	1871	Woodbrook Front Lodge	Yes
RPS	1874	Woodbrook Side Lodge	Yes
RPS	1873	Wilford	Yes
RPS	1885	Thornhill (Saint Gerard's School)	Yes
RPS	1882	Graigueconna	Yes
RPS	1881	Old Bawn	Yes
RPS	1875	Old Connaght House	Yes
RPS	1850	Crinken Cottage (former Gate Lodge to Shanganagh Castle)	Yes
RPS	1838	Plaque (Opposite Shankill Post Office)	Yes
RPS	1880	Graveyard	Yes
RPS	1831	Sylan Mount	Yes
RPS	1866	The Aske	Yes
RPS	1886	Vallambrosa	Yes
RPS	1870	Woodbrook House	Yes
RPS	1868	Cuilin	Yes
RPS	1845	Shanganagh Castle	Yes
RPS	1858	Shanganagh Marble and Stone Centre (formerly Hackett Memorial Hall)	Yes
RPS	1816	Wayside (formerly Clontra Lodge)	Yes
RPS	1885	Thornhill (Saint Gerard's School)	Yes
RPS	1863	Saint James's Church	Yes
RPS	1876	Palermo	Yes
RPS	1858	Shanganagh Marble and Stone Centre (formerly Hackett Memorial Hall)	Yes
RPS	1871	Woodbrook House Lodge	Yes
RPS	1609	Sorrento House	Yes

RPS	1608	2 Sorrento Terrace, Sorrento Road, Dalkey	Yes
RPS	1607	3 Sorrento Terrace, Sorrento Road, Dalkey	Yes
RPS	1605	4 Sorrento Terrace, Sorrento Road, Dalkey	Yes
RPS	1604	5 Sorrento Terrace, Sorrento Road, Dalkey	Yes
RPS	1603	6 Sorrento Terrace, Sorrento Road, Dalkey	Yes
RPS	1601	7 Sorrento Terrace, Sorrento Road, Dalkey	Yes
RPS	1600	8 Sorrento Terrace, Sorrento Road, Dalkey	Yes
RPS	1559	Kilcross House	Yes
RPS	1589	Monte Alverno House	Yes
RPS	1544	Queenstown Castle	Yes
RPS	1628	Strawberry Hill	Yes
RPS	1622	San Elmo	Yes
RPS	1616	Torca Cottage (Shaw Cottage)	Yes
RPS	1594	2 Mount Salus Rd, Dalkey	Yes
RPS	1593	1 Mount Salus Rd, Dalkey	Yes
RPS	1560	The White House	Yes
RPS	1586	The Four Winds	Yes
RPS	1549	Lios Mor	Yes
RPS	1550	Ardburgh House	Yes
RPS	1537	Santa Maria	Yes
RPS	1532	Ardfallen	Yes
RPS	1531	Harvieston	Yes
RPS	1519	Victoria House	Yes
RPS	1528	2 Grosvenor Terrace, Dalkey	Yes
RPS	1527	1 Grosvenor Terrace, Dalkey	Yes
RPS	1526	Bronte Cottage	Yes
RPS	1521	Clonbeg	Yes
RPS	1520	Sherrington	Yes
RPS	1535	Fairlawn House	Yes
RPS	1625	Killiney Castle Hotel	Yes
RPS	1633	Church of the Holy Trinity	Yes
RPS	1637	Killiney Hill Park	Yes
RPS	1636	Church of Saint Stephen	Yes
RPS	1651	5 Killiney Hill Cottages	Yes
RPS	1650	4 Killiney Hill Cottages	Yes
RPS	1646	Camelot	Yes
RPS	1642	Killiney Hill Park	Yes
RPS	1669	Fernside	Yes
RPS	1668	Cliff House	Yes
RPS	1664	Illerton (The Neale)	Yes
RPS	1659	Ayesha Castle	Yes
RPS	1681	Undercliff	Yes

RPS	1672	The Grove Nursing Home	Yes
RPS	1665	Carrigrenane	Yes
RPS	1663	Saint George's	Yes
RPS	1685	Kilmore House	Yes
RPS	1703	Martello Tower	Yes
RPS	1702	Steeplewood House	Yes
RPS	1698	Carrig Brae (formerly Killiney Town Hall)	Yes
RPS	1694	Druid Hill	Yes
RPS	1747	Evergreen Lodge	Yes
RPS	1744	Straide (Land League Lodge)	Yes
RPS	1742	1 Shanganagh Terrace	Yes
RPS	1741	2 Shanganagh Terrace	Yes
RPS	1739	4 Shanganagh Terrace	Yes
RPS	1740	3 Shanganagh Terrace	Yes
RPS	1738	5 Shanganagh Terrace	Yes
RPS	1725	Abbeylands	Yes
RPS	1722	Abbeylands East	Yes
RPS	1724	Middle Abbeylands	Yes
RPS	1718	Kildoon	Yes
RPS	1713	Rose Cottage	Yes
RPS	1714	Abbeylea (Austrian Embassy, formerly Marino)	Yes
RPS	1712	Montebello House	Yes
RPS	1710	Ard Einin	Yes
RPS	1706	Lucca (formerly The Chalet)	Yes
RPS	1701	Summerhill	Yes
RPS	1697	The Victorian Villa	Yes
RPS	1699	Clonard Lodge	Yes
RPS	1737	Mentone	Yes
RPS	1735	Eversley	Yes
RPS	1736	Lotherien	Yes
RPS	1734	Aghern or Roseneath	Yes
RPS	1723	Winterslow	Yes
RPS	1721	Killeen	Yes
RPS	1716	Saint Leonard	Yes
RPS	1707	Galleen	Yes
RPS	1709	Eirene	Yes
RPS	1525	Proby	Yes
RPS	1757	Vartry Lodge	Yes
RPS	1755	Dunmara	Yes
RPS	1753	Carrig na Mara	Yes
RPS	1751	Casa Sara	Yes
RPS	1745	Killacoona (Society of Holy Child Convent School)	Yes
RPS	1748	Ballybrack House	Yes
RPS	1754	Albany House	Yes
RPS	1750	Kilmarnock (formerly The Cenacle)	Yes

RPS	1765	Saint Aubyn's House	Yes
RPS	1764	Seacroft	Yes
RPS	1763	The Red House	Yes
RPS	1760	Stonehurst	Yes
RPS	1759	Avonmore	Yes
RPS	1752	Ridge Hall	Yes
RPS	1761	Martello Tower	Yes
RPS	1766	Hamp House	Yes
RPS	1768	Loughlinstown House	Yes
RPS	1789	Parc na Silla House	Yes
RPS	1786	Saint Rita's	Yes
RPS	1785	Barn Close	Yes
RPS	1784	Beechlands	Yes
RPS	1781	Florencevill (Millfield)	Yes
RPS	1795	Saint Brendan's	Yes
RPS	1799	Rathmichael Parish Primary School	Yes
RPS	1803	Thomond	Yes
RPS	1797	Eaton Brae Lodge	Yes
RPS	1794	Eaton Brae House	Yes
RPS	1800	Saint Anne's	Yes
RPS	1801	Beechfield Manor Nursing Home	Yes
RPS	1796	Ardvarna	Yes
RPS	1611	Church	Yes
RPS	1591	Martello Tower	Yes
RPS	1619	Telegraph Tower	Yes
RPS	1641	Killiney Hill Park	Yes
RPS	1644	Mount Eagle	Yes
RPS	1556	Nerano House	Yes
RPS	1558	Coastguard Cottage	Yes
RPS	1557	Coastguard Cottage	Yes
RPS	1555	Coastguard Cottage	Yes
RPS	1552	Coastguard Cottage	Yes
RPS	1551	Coastguard Cottage	Yes
RPS	1618	Saint Joseph of Cluny (formerly Bellevue Park)	Yes
RPS	1719	Saint Alphonsus & Saint Columba's Church	Yes
RPS	1647	1 Killiney Hill Cottages	Yes
RPS	1648	2 Killiney Hill Cottages	Yes
RPS	1649	3 Killiney Hill Cottages	Yes
RPS	1652	7 Killiney Hill Cottages	Yes
RPS	1653	6 Killiney Hill Cottages	Yes
RPS	1522	Saint Michaels	Yes
RPS	1523	Saint Michaels	Yes
RPS	1529	Montpellier	Yes
RPS	1530	Laragh	Yes
RPS	1596	Mount Salus House	Yes
RPS	1726	13 Shanganagh Terrace	Yes
RPS	1727	12 Shanganagh Terrace	Yes
RPS	1728	11 Shanganagh Terrace	Yes
RPS	1731	10 Shanganagh Terrace	Yes

RPS	1732	9 Shanganagh Terrace	Yes
RPS	1692	Druid Lodge	Yes
RPS	1661	Killiney House	Yes
RPS	1656	Glenalua Lodge	Yes
RPS	1686	St. Mathias's Church	Yes
RPS	1782	Abingdon House	Yes
RPS	1776	Mill House	Yes
RPS	1780	Corn Kiln	Yes
RPS	1779	Millpond	Yes
RPS	1778	Mill	Yes
RPS	1805	Saint Anne's	Yes
RPS	1733	8 Shanganagh Terrace	Yes
RPS	1627	Saint Germans	Yes
RPS	1670	Kenah Hill	Yes
RPS	1711	Vevay House	Yes
RPS	1749	Ash Hurst House	Yes
RPS	1792	Shanganagh Park House	Yes
RPS	1890	Templeville	Yes
RPS	1898	Colliemore Harbour	Yes
RPS	1887	Woodfield House	Yes
RPS	1637	Killiney Hill Park	Yes
RPS	1699	Clonard	Yes
RPS	1772	Shanganagh Bridge (Over River)	Yes
RPS	1547	Bridge (Over Railway)	Yes
RPS	1613	Tunnel	Yes
RPS	1773	Ford	Yes
RPS/ NIAH	Multiple entries	Bray Town and Environs	Yes
ACA	Killiney	Killiney	Yes
ACA	King Edward Road	Bray	Yes
ACA	Sidmonton Square	Bray	Yes
Designed landscape	1	Eagle Lodge	No
Designed landscape	2	Angelsea	No
Designed landscape	3	Springhill	No
Designed landscape	4	Aldborough House	Principal structure is in RPS
Designed landscape	5	Shamrock Cottage, Braganza	No
Designed landscape	6	Braganza	No
Designed landscape	7	Dalkey	No
Designed landscape	8	Ballinlea	No
Designed landscape	9	Killiney Castle	Principal structure is in RPS
Designed	10	Ballinlea	No

landscape			
Designed landscape	11	Ballinclea	No
Designed landscape	12	Ballinclea	No
Designed landscape	13	Sarahvilla	No
Designed landscape	14	Wyattville	No
Designed landscape	15	Dorset Lodge/Percy Lodge	No
Designed landscape	16	Kilmarnock House	No
Designed landscape	17	Albany Cottage	No
Designed landscape	18	Rockfield/Ballybrack Lodge	No
Designed landscape	19	Obelisk Cottage	No
Designed landscape	20	Rosetta	Principal structure is in RPS
Designed landscape	21	Martello House	Principal structure is in RPS
Designed landscape	22	Ballybrack Grove	No
Designed landscape	23	Loughlinstown	No
Designed landscape	24	Cherrywood	No
Designed landscape	25	Cherrywood	No
Designed landscape	26	Old Abington	No
Designed landscape	27	Shanganagh House	No
Designed landscape	28	Claremont	No
Designed landscape	29	Clifton	No
Designed landscape	30	Sherrington/Cricken	No
Designed landscape	31	Cricken	No
Designed landscape	32	Sylvan Mount/Springfield/Ballybride	Principal structure is in RPS
Designed landscape	33	Ellerslie	Principal structure is in RPS
Designed landscape	34	Mount Eden/Jubilee Hall/Sea View	No
Designed landscape	35	Ballyman House	No
Designed landscape	36	Old Connaught House/Walcot	Principal structure is in RPS

		Lodge/Wilfort	
Designed landscape	37	Bay View	No
Designed landscape	38	Wood Brook/Cork Abbey/Ravenswell	Principal structure is in RPS
Designed landscape	39	Bray Lodge	No
Designed landscape	40	Bray Lodge	No
Designed landscape	41	Palermo	No
Designed landscape	42	Thornhill	Principal structure is in RPS
Designed landscape	43	Newcourt Demesne	No
Designed landscape	44	Shanganagh Castle	Principal structure is in RPS
Designed landscape	45	Shanganagh House	No
Designed landscape	46	Glenagarey, Rochestown	No
Designed landscape	47	Rochestown House	No
Designed landscape	48	Druid Lodge/Killiney Park	No

Table E8 - 7 Cultural Heritage Constraints

The South Dublin area is highly constrained by recorded archaeological and architectural heritage sites. This is primarily due to the high number of protected structures recorded within the area. Although the landscape has been subject to suburban development, during the post medieval period it was utilised by the landed gentry as a place to establish their large houses, often accompanied by demesne landscapes. Many of these structures have survived, along with buildings such as boundary walls, cottages and gate lodges that formed part of the overall demesne. The most significant archaeological site within the area is Dalkey Island, which is listed as a National Monument. Killiney Church, at the centre of the area, is also listed as a National Monument. In addition there are a number of recorded archaeological sites within the landscape, some of which survive in undeveloped areas. It is also likely that any marine infrastructure associated with the desalination plant would result in impacts on the marine archaeological resource, such as the site of shipwrecks. These are subject to statutory protection.

3.1.2 Loughshinny North



Figure E8 – 7 Loughshinny North

Table E8 – 8 details the Cultural Heritage constraints that have been identified within the Loughshinny North desalination location.

Site Type	ID Number	Classification	Statutory Protection
RMP	DU005-174001-	Ring-ditch	Yes
RMP	DU005-174002-	Ring-ditch	Yes
RMP	DU005-174003-	Ring-ditch	Yes
RMP	DU005-174004-	Ring-ditch	Yes
RMP	DU005-175001-	Enclosure	Yes
RMP	DU005-175002-	House - indeterminate	Yes
RMP	DU005-176001-	Ring-ditch	Yes
RMP	DU005-176002-	Ring-ditch	Yes
RPS	248	Lime kiln	Yes

Table E8 - 8 Cultural Heritage Constraints

Loughshinny North is not as constrained as the other options. It contains eight recorded monuments and one protected structures. However, it is in close proximity to a recorded promontory fort to the south, which is further protected with a Preservation Order. This, along with a cluster of prehistoric monuments recorded within the area, means that the development of plant in this area would still likely have a high impact on the cultural heritage resource. It is also likely that any marine infrastructure associated with the desalination plant would result in impacts on the

marine archaeological resource, such as the site of shipwrecks, which are subject to statutory protection.

3.1.3 Loughshinny South



Figure E8 – 8 Loughshinny South

Table E8 – 9 details the Cultural Heritage constraints that have been identified within the Loughshinny South desalination location.

Site Type	ID Number	Classification	Statutory Protection
RMP/ RPS	DU008-003/ 254	Castle - tower house	Yes
RMP/ RPS/ NIAH	DU008-004001-3/ 256/ 11324029	Church Graveyard Tomb - unclassified	Yes
RMP/ RPS	DU008-005/ 257	Ritual site - holy well	Yes
Preservation Order/ RMP/ RPS/ NIAH	DU008-006001-3, 8, 9/ 252/ 253/ 11318004	Promontory fort - coast Martello tower Well Ring-ditch Ring-ditch	Yes
RMP	DU008-094----	Enclosure	Yes
RPS/ NIAH	258 11324028	Portico of Kenure Park House	Yes
RPS	255	Balluster Lodge	Yes

RPS/ NIAH	251 11318002	Lizzie's Cottage	Yes
NIAH	11318003	Gate Lodge	No
Designed landscape	49	Kenure Park	No

Table E8 - 9 Cultural Heritage Constraints

Loughshinny South contains significant archaeological and architectural heritage constraints. The landscape is characterised by the presence of a large landmark promontory fort, which is subject to a Preservation Order under the National Monuments Act and is also recorded within the RMP and RPS. There are a number of other protected structures and recorded monuments within the area, as well as one designed landscape. It is also likely that any marine infrastructure associated with the desalination plant would result in impacts on the marine archaeological resource, such as the site of shipwrecks, which are subject to statutory protection.

3.1.4 Balbriggan



Figure E8 – 9 Balbriggan

Table E8 – 10 details the Cultural Heritage constraints that have been identified within the Balbriggan desalination location.

Site Type	ID Number	Classification	Statutory Protection
Preservation Order/ RMP/ RPS	DU002-001003-	Megalithic tomb - passage tomb	Yes

Preservation Order/ RMP/ RPS	DU002-001004-	Megalithic tomb - passage tomb	Yes
Preservation Order/ RMP/ RPS	DU002-001005-	Megalithic tomb - passage tomb	Yes
Preservation Order/ RMP/ RPS	DU002-001002-	Megalithic tomb - passage tomb	Yes
RMP	DU002-001006-	Fulacht fia	Yes
RMP	DU002-013----	Barrow - unclassified	Yes
RMP	DU002-005----	Settlement cluster	Yes
RMP	DU002-015----	Quay	Yes

Table E8 - 10 Cultural Heritage Constraints

The Balbriggan area, whilst not containing a large amount of constraints, is highly constrained due to the presence of a prehistoric passage tomb cemetery adjacent to the coast line. This site is protected with a preservation order as well as being included within the RMP and further protected under the Planning and Development Act as a protected structure. There are no other recorded protected structures, NIAH structures or designed landscapes located within this area. However, as with the other coastal locations, it is likely that any marine infrastructure associated with the desalination plant would result in impacts on the marine archaeological resource, such as the site of shipwrecks, which are subject to statutory protection.

3.2 Matrix of Multi Criteria Analysis

Criteria	South Dublin	Balbriggan	Loughshinny North	Loughshinny South
Potential to impact (direct/indirect) on National Monuments (designated sites)	Low due to only two recorded in the area.	Very high due to the presence of a passage tomb complex that are protected by a preservation order.	Very high due to the presence of a promontory fort and associated features, that are protected with a preservation order.	Mid-range due to the presence of the promontory fort to the south.
Potential to impact (direct/indirect) on RMPs (designated sites)	Mid-range as 30 sites or groups of sites are recorded within the area and some of those occupy areas that to date have not been developed to any great extent.	Mid-range due to the presence of the passage tomb cemetery that has associated features recorded within the RMP.	Very high due to the presence of a promontory fort and associated features, along with additional sites.	High due to the presence of a large cluster of prehistoric sites recently discovered as part of the Discovery Programme research.
Potential to impact (direct/indirect) on RPS (designated sites)	High due to the multiple recorded structures and associated curtilages.	Mid-range due to the fact that the passage tomb cemetery is also listed as a protected structure.	Very high due to the presence of a number of landmark structures in the area and the fact that the promontory fort is also a protected structure.	Mid-range due to the presence of the promontory fort to the south.
Potential to impact (direct/indirect) on NIAH	Low in most of the area due to the fact that the NIAH survey for Dun Laoghaire Rathdown has yet to be carried out.	Very low as none are present.	High as there are a number of NIAH structures throughout the study area. Many of these are also RMPs and RPSs.	Very low as none are present.
Potential to impact (direct/indirect) on historic designed landscapes	High due to multiple landscapes, some of which survive as open spaces or in association with protected structures.	Very low as none are present.	Low as only one is recorded in the area and this has already been impacted upon by development.	Very low as none are present.
Potential to impact on ACA	Mid-range due to the presence of several ACAs and the fact that they can cover a wider area than RPS or NIAH designations.	Very low as none are present.	Very low as none are present.	Very low as none are present.

<p>Recorded shipwreck sites/underwater archaeology</p>	<p>High due to the coastal resource. Any outfall or marine infrastructure has a high potential to impact on previously unrecorded wrecks.</p>	<p>High due to the coastal resource. Any outfall or marine infrastructure has a high potential to impact on previously unrecorded wrecks.</p>	<p>High due to the coastal resource. Any outfall or marine infrastructure has a high potential to impact on previously unrecorded wrecks.</p>	<p>High due to the coastal resource. Any outfall or marine infrastructure has a high potential to impact on previously unrecorded wrecks.</p>
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3.3 Comparative Discussion

All of the areas that were subject to an assessment of the cultural heritage constraints were found to be highly constrained. This was either due to the amount of recorded sites and landscapes within the area, or the significance of the constraints. The most significant constraints have been identified in the Loughshinny South area, due to the presence of a large landmark promontory fort, which is subject to a preservation order under the National Monuments Act and is also recorded within the RMP and RPS. A landmark Martello Tower is recorded within the fort itself, which is also subject to protection under the National Monuments Act and Planning and Development Act. Development of infrastructure in this area would not be possible without having a significant impact on the setting of the fort and associated features.

Whilst Loughshinny North was not found to be as constrained as the southern option, the proximity to the promontory fort to the south, along with a cluster of prehistoric monuments recorded within the area, would mean that the development of plant in this area would still likely have a high impact on the cultural heritage resource.

The Balbriggan area, whilst not containing a large amount of constraints, is highly constrained due to the presence of a prehistoric passage tomb cemetery adjacent to the coast line. This site is protected with a preservation order as well as being included within the RMP and further protected under the Planning and Development Act as a protected structure. The open nature of the landscape would mean that the construction of plant would likely lead to a significant impact on the setting of the cemetery.

The South Dublin area was found to be highly constrained, mostly due to the amount of protected structures recorded within the area. Although the landscape has been subject to suburban development, it was, during the post medieval period, utilised by the landed gentry as a place to establish their large houses, often accompanied by demesne landscapes. Many of these structures have survived, along with buildings such as boundary walls, cottages and gate lodges that formed part of the overall demesne. The most significant archaeological site within the area is Dalkey Island, which is listed as a National Monument. Killiney Church, at the centre of the area, is also listed as a National Monument. In addition there are a number of recorded archaeological sites within the landscape, some of which survive in undeveloped areas.

One potential area of impact, which has been classed as very high, is common to all four areas. This is the potential to impact on marine archaeology (recorded or unrecorded ship wreck sites). These are all subject to protection under the National Monuments Act. It is likely that any marine infrastructure associated with any of the four areas would result in impacts on this resource.

Despite the multiple constraints within the study area, it is more likely that further studies could result in the identification of a site in the South Dublin location that would have less of an impact on the cultural heritage resource than the other three options in the north of the county.

Appendix: Cultural Heritage Constraints & Designations

Constraints

Record of Monuments and Places (RMP) Section 12 (1) of the National Monuments Act (1994 amendment) provides that the Minister for Arts, Heritage, Gaeltacht and the Islands (now the Minister for Arts, Heritage and the Gaeltacht) shall establish and maintain a record of monuments and places (RMP) where the Minister believes that such monuments exist. The record comprises of a list of monuments and relevant places and a map or maps showing each monument and relevant place in respect of each county in the State. Sites recorded on the Record of Monuments and Places all receive statutory protection under the National Monuments Act.

Sites and Monuments Record (SMR) holds documentary evidence and field inspections of all known archaeological sites and monuments. Some information is also held about archaeological sites and monuments whose precise location is not known e.g. only a site type and townland are recorded. These are known to the National Monuments Section as 'un-located sites' and cannot be afforded legal protection due to lack of locational information. As a result these are omitted from the Record of Monuments and Places. SMR sites are also listed on a website maintained by the DoAHG – www.archaeology.ie.

National Monuments in State Care Database is a list of all the National Monuments in State guardianship or ownership. Each is assigned a National Monument number whether in guardianship or ownership and has a brief description of the remains of each Monument.

A national monument receives statutory protection and is described as 'a monument or the remains of a monument the preservation of which is a matter of national importance by reason of the historical, architectural, traditional, artistic or archaeological interest attaching thereto' (National Monuments Act, 1930, Section 2).

The Minister for the Department of Environment, Heritage and Local Government (now the Minister for Arts, Heritage and the Gaeltacht) may acquire national monuments by agreement or by compulsory order. The state or local authority may assume guardianship of any national monument (other than dwellings). The owners of national monuments (other than dwellings) may also appoint the Minister or the local authority as guardian of that monument if the state or local authority agrees. Once the site is in ownership or guardianship of the state, it may not be interfered with without the written consent of the Minister.

Preservation Orders List and/or Temporary Preservation Orders can be assigned to a site or sites that are deemed to be in danger of injury or destruction. These are allocated under the 1930 Act. Preservation Orders make any interference with the site illegal. Temporary Preservation Orders can be attached under the 1954 Act. These perform the same function as a Preservation Order but have a time limit of six months, after which the situation must be reviewed. Work may only be undertaken on or in the vicinity of sites under Preservation Orders with the written consent, and at the discretion, of the Minister (DoAHG).

Shipwreck Inventory of Ireland includes all known wrecks for the years up to and including 1945 and approximately 12,000 records have been compiled and

integrated into the shipwreck database to date. Wrecks over 100 years old and archaeological objects found underwater are protected under the National Monuments (Amendment) Acts 1987 and 1994. Significant wrecks less than 100 years old can be designated by Underwater Heritage Order (UHO) on account of their historical, archaeological or artistic importance.

Development Plans contain a catalogue of all the Protected Structures, and Architectural Conservation Areas within every county. The development plans for Fingal County, South Dublin County, Dun Laoghaire-Rathdown, Clare and Tipperary (North) were examined as part of this study. All protected structures receive statutory protection under the Planning and Development Act (2000).

The National Inventory of Architectural Heritage is a government based organisation tasked with making a nationwide record of significant local, regional, national and international structures, which in turn provides county councils with a guide as to what structures to list within the Record of Protected Structures. Inclusion within the NIAH does not mean a building is necessarily subject to statutory protection. However, it may be added to the RPS at a later date.

Historic Ordnance Survey Mapping has been used as part of this study in order to identify all potential demesne (or designed) landscapes within the study areas. Whilst these landscapes might not necessarily be subject to any statutory protection (if not associated with a protected structure), they form an important part of the historic Irish landscape and are considered to be key constraints. The first edition six inch OS map from each county were analysed as these maps depict the extent of designed landscapes.

Designations

National Monuments: Archaeological sites of national importance, which can be under the ownership or guardianship of the state. Subject to statutory protection under the National Monuments Act (1930-2004).

RMP (Recorded Monument and Place): These are archaeological sites that subject to statutory protection under the National Monuments Act (1930-2004). Each site possesses its own unique number, which is prefixed by the county designation – in this case DU for Dublin. This is followed by the Ordnance Survey sheet number for the county and then a unique number i.e. DU008-009.

RPS (Record of Protected Structures): These are architectural heritage sites that are subject to statutory protection under the Planning & Development Act (2000). They are defined within the relevant County Development Plans.

ACA (Architectural Conservation Area): These areas are designated within the County Development Plan and define areas characterised by structures and features of architectural heritage importance.

NIAH (National Inventory of Architectural Heritage): Structures are included within the NIAH survey in order to inform county councils in the development of the record of protected structures.

Designed Landscapes: These areas consist of the ornamental designed landscapes that were often established around country houses during the 19th century. They survive today in varying states of preservation, with many having

been subsumed back into the landscape. Some demesnes are protected as curtilage associated with protected structures.



Water Supply Project Eastern and Midlands Region (WSP)

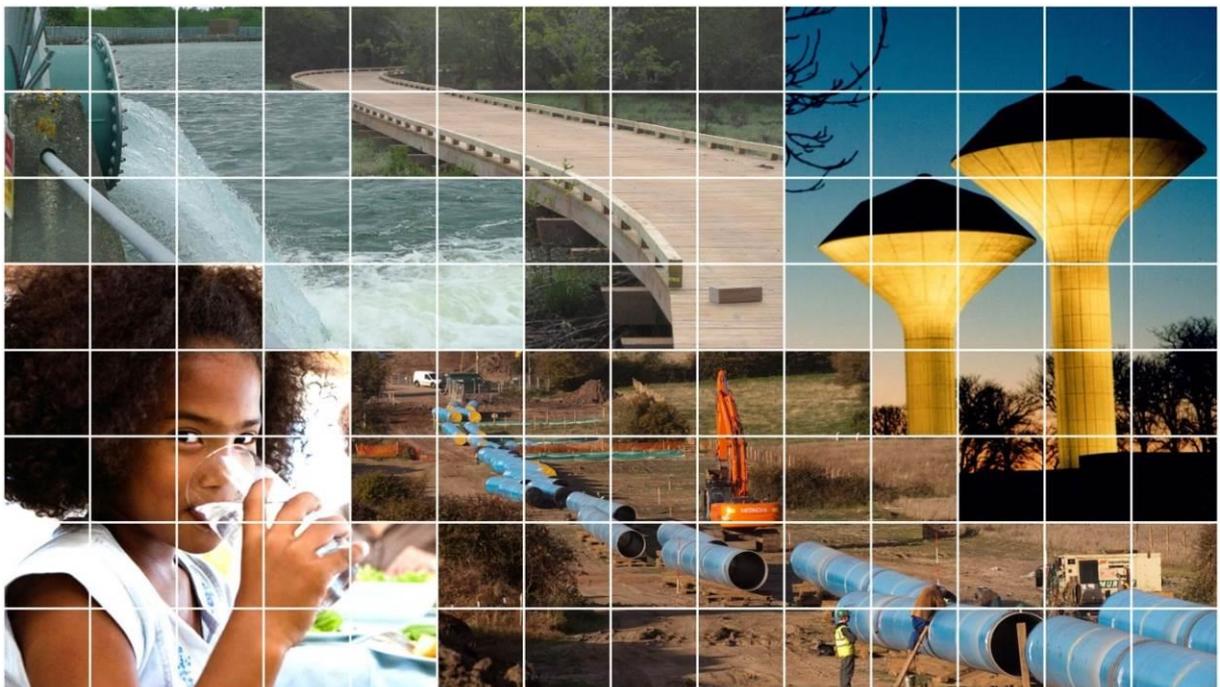
Abstraction Location MCA

Appendix E9: Landscape and Visual



October 2015

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1.1 Introduction

Four reasonable alternative options have been identified from previous studies – refer to the *Water Supply Options Working Paper* (Project Road Map Stage 2). These are reconfirmed below.

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)
- Option H (Desalination)

This report describes the decision making process used to appraise the abstraction locations associated with each of the reasonable alternative options.

To undertake the appraisal of abstraction locations a range of specialists were engaged, in their applicable fields, to conduct a comparative assessment of abstraction locations. The following disciplines were engaged:

- i. **Ecology** – the consideration of impact on animals, plants and their environment.
- ii. **Water** – the consideration of impacts on the surface water environment.
- iii. **Air and Noise** - the consideration of air and noise pollution
- iv. **Cultural Heritage** - the consideration of existing archaeological and built heritage
- v. **Soils, Geology and Hydrogeology** – the consideration of impact on soils, geology and hydrogeology.
- vi. **Landscape and visual** – the consideration of landscape and visual impact.
- vii. **Agronomy** – the consideration of impact on land based enterprise.
- viii. **People** – the consideration of impacts on people
- ix. **Planning** – the consideration of planning and land use policy in relation to proposed works
- x. **Engineering** - the consideration of technical challenges associated with proposed works.
- xi. **Traffic** - the consideration of impact on traffic and road network

The specialists independently assessed each location relative to appraisal criteria applicable to their field of expertise. This process, or methodology, is referred to as Multi-Criteria Analysis and explicitly considers multiple criteria (see Table E9 - 1), within a decision-making environment.

Environmental Criteria	Technical Criteria	Risk Criteria
Biodiversity, Flora and Fauna	Safety	Technical Risk relating to the Source
Fisheries	Planning Policy	Technical Risk relating to Infrastructure and Operations
Water	Engineering and Design	Environmental and Planning Risk
Air/Climatic Factors	Capital and Operational Costs	Financial Risk
Material Assets (Energy)	Sustainability	Socio-economic risk
Cultural Heritage (including Architecture & Archaeology)		
Landscape & Visual		
Material Assets (Land use)		
Tourism		
Population		
Human Health		
Soils, Geology and Hydrogeology		

Table E9 - 1 Appraisal Criteria

The assessments are presented as individual statements within this Appendix E.

This Appendix E9 is a statement on the specialism Landscape & Visual and describes the decision making process used in identifying the least constrained abstraction locations associated with the reasonable alternative options.

The Site Selection Methodology in Appendix B outlines the process employed in identifying least constrained locations. This report should be read in conjunction with the *Site Selection Methodology*.

1.2 Methodology

This is ‘Non-linear Site Methodology – Step 1’ as described in the *Site Selection Methodology*.

To effectively determine the least constrained abstraction locations for the reasonable alternative options, the potential abstraction locations were assessed under 18 no. Landscape and Visual sub-criteria.

The Guidelines for Landscape and Visual Impact Assessment (GLVIA-2013) recommend that landscape impacts and visual impacts be addressed separately. The first 6 no. criteria relate to landscape designations, landscape character and landscape features. Whereas, the remaining 12 no. criteria relate to scenic view designations and sensitive visual receptor locations:

- Potential to impact on designated areas of ‘Highly Sensitive Landscape’
- Potential to impact on rare or distinctive landscape elements (rock outcrops, water bodies etc.)
- Potential to disrupt landscape structure (treelines / hedgerows / field pattern etc.)
- Potential to impact on woodlands and significant tree groups

- Potential to impact on historic designed landscapes
- Potential to alter the prevailing landscape character
- Potential to impact on designated scenic routes / views
- Potential to impact on views from heritage/tourist/amenity features of national or regional importance
- Potential to impact on views from settlements
- Potential to impact on views from dwellings / local roads
- Potential to impact on views from motorways
- Potential to impact on views from other major roads (national or regional roads)
- Potential to impact on views from rail lines
- Potential to impact on arrival views from Airports including aerial approach and vehicular egress
- Potential to impact on views from national 'way marked' walking routes
- Potential to impact on local walks
- Potential to impact on views from angling or swimming locations (rivers, lakes, sea)
- Potential that landscape screening measures will be ineffective or incongruous

A key element of the study was a review of each of the relevant County Development Plans (CDPs) in respect of the potential water abstraction locations. For the desalination abstraction options the relevant development plans were the Dun Laoghaire Rathdown CDP and the Fingal CDP. For the Shannon abstraction options, the relevant development plans included the Clare County CDP and the North Tipperary CDP.

The County Development Plans are required by the Planning and Development Act (2000) to incorporate a Landscape Character Assessment of the county. These typically divide the County into a series of Landscape Character Types (LCT) and geographically distinct Landscape Character Areas (LCA). These documents would also typically provide classifications for each of the landscape character areas in terms of sensitivity, value and/or vulnerability. This analysis of least constrained abstraction and terminal point locations was concerned with those landscape character areas that might have been attributed a high sensitivity, high value or high vulnerability classification.

Although generally separate to the County Landscape Character Assessment, most County Development Plans also provide a map and schedule indicating designated scenic routes and/or designated scenic views. These designations were also of interest to this appraisal of least constrained locations.

1.2.1 Desk study

A desk study exercise of the potential abstraction locations was carried out using the software package *ArcReader*. The supplied datasets and information are as described in the *Site Selection Methodology*.

1.2.2 Categories of impact

The relative analysis of potential locations to define a “least constrained” location is based upon a subjective assessment by each Specialist in their discipline of expertise. This judgement is presented as weighted impact; colour coded for ready identification.

Very high	Dark blue
High	Blue
Mid-range	Green
Low	Light Green
Very low	Cream

2 Lough Derg/Parteen Basin

2.1 Lough Derg/Parteen Basin Locations

An assessment of the potential abstraction locations was carried out for the following options:

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)

An important distinction in the assessment is that visual receptors are people and groups of people whose sensitivity varies depending on the activity they are likely to be engaged in at a particular location. By contrast, landscape impact assessment considers the landscape as a resource in its own right, with landscape receptors being physical features, elements and patterns that contribute to landscape character.

2.1.1 Slevoir



Figure E9 – 1 Lough Derg - Slevoir

The Slevoir location is at the north-eastern end of Lough Derg near the small Lakeside settlement of Terryglass. The landform in this area is gently rolling and the land cover consists of pastoral farmland interspersed with more naturalistic areas of riparian marshland and riparian woodland at the edge of the Lough. This is a sparsely populated area with occasional dwellings dispersed along local roads and the R493 regional road. The N65 National Secondary route also passes through the north-eastern portion of this location. The landscape character in this area is that of a tranquil rural setting encompassing some elements of the naturalistic, particularly in close proximity to the shores of Lough Derg.

In terms of landscape designations in the North Tipperary County Development Plan, this area is indicated as being within an 'amenity' zoning. It is not clear whether the zoning relates to landscape character and sensitivity or recreational and residential amenity.

North Tipperary planners have indicated that a revision to the County Development Plan is currently being undertaken and that landscape sensitivity classifications would be applied to all areas as part of a consolidation of the Landscape Character Assessment that has already been completed for the County in 2009.

Based on descriptions within the Landscape Character Assessment for '*LCA2 - Upper Lough Derg*', '*LCA3 - Arra Mountains*' and '*LCA5 - River Shannon - Newport*', it is reasonable to consider that the landscape bordering Lough Derg will be attributed a high sensitivity rating. It should be noted that this scenario applies to all five of the potential abstraction locations along the shores of Lough Derg and the Parteen Basin.

A section of the R493 regional road, a short distance to the south-east of this location, is designated as a scenic route and this affords slightly elevated views towards the Lough.

The main landscape and visual constraints to developing an abstraction facility at this location are the scenic route designation on the R493 regional road and the likelihood that this area will be imminently classified as a high sensitivity landscape. Although an abstraction facility could be assimilated relatively well within this landscape in terms of screen planting mitigation, such a facility is likely to appear ambiguous in this tranquil lakeside landscape, which is currently characterised by low levels of built development. Views from the small lakeside settlement of Terryglass may also be adversely affected by such development.

2.1.2 Mota



Figure E9 – 2 Lough Derg - Mota

The Mota abstraction location is contained within a tranquil lakeside landscape of gently rolling fields and hedgerows as well as substantial areas of riparian woodland and, as such, it has something of an Arcadian character. Also contained within this location is a lakeside amenity area and marina at Coolbawn, which includes residential development and tourist accommodation.

The R493 regional road runs parallel to the shores of the lough less than 1 km to the east and part of this is designated as a scenic route in the North Tipperary Development Plan.

The main landscape and visual constraints to constructing an abstraction facility at this location are the potential disruption of riparian woodlands and visual impacts from the Coolbawn lakeside amenity area. There is also potential to impact on the designated scenic route associated with the R493 to the east of this location. An abstraction facility is also likely to conflict with the tranquil pastoral setting of this location, which is generally characterised by a low level of built development. Notwithstanding, it is considered that mitigation screen planting could reduce visual impacts from surrounding receptors to a reasonable degree, whilst blending with existing vegetation structures in this area.

As with all of the Lough Derg and Parteen Basin abstraction locations, imminent changes to the County development plan are likely to see the Lough Derg landscape character areas attributed a high order sensitivity rating.

2.1.3 Dromineer



Figure E9 – 3 Lough Derg - Dromineer

The Dromineer abstraction location is focused around the small lakeside settlement of Dromineer. Contained within the settlement is the Lough Derg Yacht Club, several marinas and a promenade at the lake edge with commercial and residential development setback slightly from the lough. Beyond the immediate setting of the settlement is a patchwork of fields that are frequently lined by mature tree-lined boundaries and woodlands. There are a number of stately houses and demesne landscapes in the vicinity, which contribute to an Arcadian landscape character and sense of heritage. Broad bands of riparian woodland also flank the shores of Lough Derg in this area.

The R495 regional road enters the Dromineer location from the east and part of this is designated as a scenic route in the North Tipperary Development Plan. The local road that enters Dromineer from the south-east is also designated as a scenic route in the Development Plan and both of these roads also form part of the Nenagh Cycle Loop.

There are considerable landscape and visual constraints to the development of a water abstraction facility at this location. These principally relate to the two scenic route designations on the roads approaching the settlement of Dromineer. Also, the potential to impact on views from the settlement enjoyed by residents, water based recreationalists and tourists. There is also a strong potential for such a facility to

appear incongruous within this tranquil landscape setting, which is characterised, in part, by designed heritage landscapes.

2.1.4 Youghal



Figure E9 – 4 Lough Derg - Youghal

The abstraction location at Youghal is focused around the head of Youghal Bay, which is a deeply incised inlet near the southern end of Lough Derg. Riparian woodland occurs at the edge of the lake and then gives way to a gently rolling pastoral landscape of fields and hedgerows. There are several dispersed settlements lining the local roads in the vicinity that link between the R494 regional road and the Lakeshore. These include Youghal Village and the settlement at Ballyvaughan. There are small marinas and dedicated swimming locations associated with each of the settlements. The slightly larger settlement of Pallas Derg occurs approximately 1 km south of this location further away from the Lough. The predominant landscape character in this area is a rural one, but it is influenced by the proximity to the Lough and the amenity features associated with this.

Slightly elevated and open views towards the Lough are afforded from a scenic route designation approximately 1 km the south-west of this location. The Lough Derg way, which is a National Way-Marked walking route, also passes around the shores of Youghal Bay at this location.

The key constraints from a landscape and visual perspective at this location are the potential impacts on lakeside amenity areas and the Lough Derg way. There is also potential to disrupt the riparian vegetation that occurs along the shoreline at this

location. It is also likely that an abstraction facility would appear incongruous in this tranquil rural area given the current low levels of built development.

2.1.5 Parteen Basin Reservoir

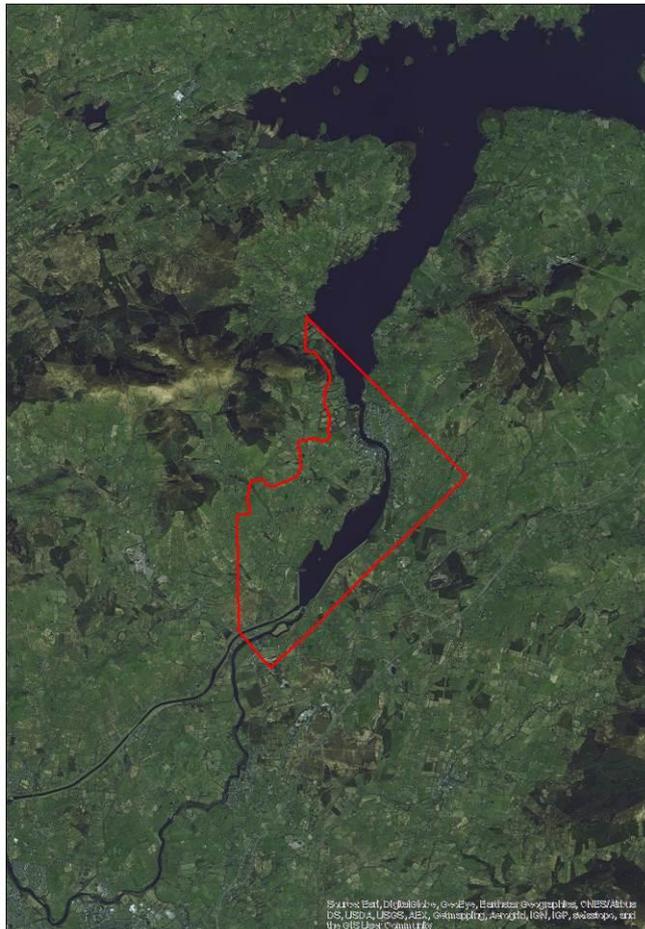


Figure E9 – 5 Parteen Basin Reservoir

This is the largest location considered in respect of the five Shannon options. It takes in the southern reaches of Lough Derg and all of the Parteen Basin. At the northern end of this location are the twin settlements of Killaloe and Ballina on opposite sides of the Shannon in County Clare and County Tipperary respectively. These are popular tourist and amenity settlements. To the south of the settlements is a rural landscape surrounding both sides of the Parteen Basin Reservoir that consists of fields and hedgerows. There are also some substantial patches of riparian woodland, particularly along the north-eastern banks of the Parteen Basin Reservoir. The eastern side of the reservoir consists of a linear constructed embankment and diverted channel for the Kilmustulla River, which forms part of the works required for the Parteen Weir and the associated Ardnacrusha Headrace. These features were constructed as part of a hydroelectric power scheme at Ardnacrusha. By comparison, the western side of the Parteen Basin Reservoir has a more natural shoreline.

The landscape to the west of the reservoir within County Clare rises relatively steeply towards the Slieve Bernagh range. The lakeside landscape is identified as a highly sensitive landscape in the Clare County Development Plan and there are several elevated scenic view designations from the roads surrounding the reservoir

to the west. There is also a designated scenic route identified in the North Tipperary County development plan, which emanates from the northern end of this location along Lough Derg beyond the settlement of Ballina.

Both the Lough Derg Way and the East Clare Way, which are national way-marked walking routes, pass through this location converging on the settlements of Killaloe and Ballina at the northern end of the Parteen Basin Reservoir.

There are a number of landscape and visual constraints contained within the northern portion of the Parteen location. These are mainly associated with the settlements of Killaloe and Ballina, which contain a number of heritage features and are popular tourist destinations. There are comparatively much fewer constraints that might influence the construction of an abstraction facility in the southern reaches of the Parteen Basin Reservoir, which is much more sparsely populated and has fewer sensitive receptors. Furthermore, it is considered that such a facility could be accommodated in the southern portion of the Parteen location without a sense of being incongruous within a landscape that has already been modified for the purposes of the hydroelectric scheme at Ardnacrusha. It is also considered that mitigation screen planting would be successful in reducing visual impacts associated with the abstraction facility at this location.

2.2 Matrix of Multi Criteria Analysis

Criteria	Slevoir	Mota	Dromineer	Youghal Bay	Parteen Basin
Potential to impact on designated areas of 'Highly Sensitive Landscape'	High: (precautionary) Not currently specified in CDP or County Landscape Character Assessment - awaiting update (6 weeks).	High: (precautionary) Not currently specified in CDP or County Landscape Character Assessment - awaiting update (6 weeks).	High: (precautionary) Not currently specified in CDP or County Landscape Character Assessment - awaiting update (6 weeks).	High: (precautionary) Not currently specified in CDP or County Landscape Character Assessment - awaiting update (6 weeks).	High: (precautionary) Not currently specified in CDP or County Landscape Character Assessment - awaiting update (6 weeks) 'Heritage Landscape' designation on County Clare side.
Potential to impact on rare or distinctive landscape elements (rock outcrops, water bodies etc.)	Mid-range: Shores of Lough Derg.				
Potential to disrupt landscape structure (treelines / hedgerows / field pattern etc.)	Low: Potential disruption of riparian vegetation and field boundaries.	Mid-range: Potential disruption of riparian woodlands around Cooldoney.	Mid-range: Potential disruption of riparian woodlands and mature tree line field boundaries.	Low: Potential disruption of riparian vegetation and field boundaries.	Low: Potential disruption of riparian vegetation and field boundaries.
Potential to impact on woodlands and significant tree groups	Low: Some dense bands of riparian vegetation.	Mid-range: Potential disruption of riparian woodlands around Cooldoney.	Mid-range: Potential disruption of riparian woodlands and mature tree line field boundaries.	Low: Some dense bands of riparian vegetation.	Mid-range: Some areas of mature riparian woodland and 3no. Clare coco TPOs at northern end of basin.
Potential to impact on historic designed landscapes	Low: National monument <1km west see cultural heritage appraisal.	Low: National monument <1km west see cultural heritage appraisal.	Mid-range: Appear to be several stately houses and demesnes with designed views towards the Lough.	Low: National monument <1km N & S see CH appraisal.	Mid-range: Numerous national monuments particularly around northern end of basin.

Potential to alter the prevailing landscape character	Mid-range: Tranquil amenity location with some naturalistic elements and low levels of built development.	Mid-range: Tranquil amenity location with some naturalistic elements and arcadian character.	Mid-range: Tranquil amenity location with some naturalistic elements and arcadian character.	Low: Some degree of lakeside tranquillity but also a productive rural character.	Low: Some degree of lakeside tranquillity but also a productive rural character, considerable built development and Parteen Weir.
Potential to impact on designated scenic routes / views	Mid-range: Elevated pastoral views towards lough from R493 <1km SE.	Low: Elevated but filtered pastoral views towards lough from R493 <1km S.	High: Lakeside scenic views from NE and elevated Lough views from S.	Low: Slightly elevated and open views towards lough from scenic route <1km SW.	Mid-range: Nth Tipp scenic route emanates from northern end of focus area (R494) and Clare coco have designated R463 on western side of basin as a designated scenic route.
Potential to impact on views from heritage/tourist/amenity features of national or regional importance	Very Low: Does not appear to be any major heritage or amenity features in the immediate vicinity.	Mid-range: Coolbawn Quay tourist and amenity area.	Mid-range: Lough Derg Yacht club, marinas, accommodation, restaurants.	Very Low: Does not appear to be any major heritage or amenity features in the immediate vicinity.	Mid-range: Killaloe/Ballina popular tourist villages.
Potential to impact on views from settlements	Low: Terryglass <2km SW.	Very Low: No significant settlements within 2km.	Mid-range: Dromineer at centre of abstraction area.	Low: Pallas Derg circa 1 km S.	Mid-range: Principally Killaloe/Ballina but also O'Briensbridge to the south.
Potential to impact on views from dwellings / local roads	Low: Small number of rural dwellings within 1km.	Low: Small number of rural dwellings within 1km.	Low: Scattering of local residences outside the settlement of Dromineer.	Low: Sparse scattering of dwellings close to the Lough but relatively dense and dispersed rural community within 1-2km S & SW.	Low: Outside of settlements sparse scattering of dwellings close to the Lough but relatively dense and dispersed rural community within 1-2km S & SW.

Potential to impact on views from motorways	Very Low.	Very Low.	Very Low.	Very Low.	Very Low.
Potential to impact on views from other major roads (national or regional roads)	Mid-range: Elevated views from R493 <1km SE (designated scenic view).	Low: Elevated but filtered pastoral views towards lough from R493 (scenic route) <1km S.	Low: R495 approaches Dromineer from the east.	Low: R494 affords slightly elevated views from within 1.5km to the South.	Low: Old barge loop immediately S (O'Briensbridge) and Crag Wood Walk c. 2km NE on higher ground.
Potential to impact on views from rail lines	Very Low.	Very Low.	Very Low.	Very Low.	Low: National railway line passes through Birdhill <1km SE.
Potential to impact on arrival views from Airports including aerial approach and vehicular egress	Very Low.	Very Low.	Very Low.	Very Low.	Very Low.
Potential to impact on views from national 'way marked' walking routes	Very Low - (Hymany Highway c. 3km NW).	Very Low.	Mid-range: Southern approach to Dromineer (scenic route) is part of Lough Derg Way.	Mid-range: Lough Derg Way passes around Youghal Bay adjacent to the Lough.	Mid-range: Lough Derg Way and the East Clare Way passes through focus area converging on Killaloe.
Potential to impact on local walks	Very Low.	Low - Nenagh Cycle Loop runs along R493 (scenic route) <1km S.	Mid-range: Nenagh Cycle Loop passes through Dromineer.	Low - Nenagh Cycle Loop runs along R494 within 1.5km to the South.	Low - Old barge loop immediately S (O'Briensbridge) and Crag Wood Walk c. 2km NE on higher ground.
Potential to impact on views from angling or swimming locations (rivers, lakes, sea)	Low - Marina and foreshore amenity area at Terryglass <2km SW.	Mid-range: Coolbawn Quay tourist and amenity area.	Mid-range: Jetties and promenade at Dromineer.	Mid-range: Dedicated swimming location at Youghal Village.	Mid-range: Lough Derg and Parteen basin renowned for water based recreation generally.

<p>Potential that landscape screening measures will be ineffective or incongruous</p>	<p>Low: Screen planting can be assimilated into riparian vegetation patterns but elevated views afforded</p>	<p>Low: Screen planting can be assimilated into riparian vegetation patterns but elevated views afforded</p>	<p>Very Low: Screen planting can be assimilated into prevailing vegetation patterns and built development</p>	<p>Very Low: Screen planting can be assimilated into prevailing vegetation patterns</p>	<p>Very Low: Screen planting can be assimilated into prevailing vegetation patterns and built development</p>
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2.3 Comparative Discussion

In respect of the Shannon abstraction location options, the landscape and visual constraints tend to be similar for all locations. That is, there are scenic route designations within or in close proximity to all of the locations and the landscape character areas that border Lough Derg and the Parteen Basin Reservoir are all likely to be attributed high sensitivity landscape status in the upcoming revision to the North Tipperary Development Plan. There is generally a pleasant rural character of gently rolling fields and hedgerows with a low degree of built development. There is also a strong sense of lakeside tranquillity and amenity. Indeed, small lakeside villages and amenity areas consisting of marinas and swimming jetties can be found along most sections of Lough Derg. Notwithstanding, there are varying degrees to which these constraints apply to each of the potential abstraction locations.

It is considered that the most constrained location is the Dromineer location due to the strong sense of heritage in this rural landscape and the village of Dromineer itself, which offers lakeside amenity and recreational facilities. There are also two designated scenic routes within this location and a section of the Nenagh cycle loop. The next most constrained location is considered to be Mota as it also has a lakeside amenity area at Coolbawn Quay and wide bands of riparian woodland. It has a strong sense of tranquillity as well as a section of designated scenic route a small distance to the south. Slevoir has a slightly different character to most of the other locations as there is a stronger sense of the naturalistic in this area due to the presence of lakeside marshes and riparian scrub, which penetrates further into the surrounding landscape than the riparian vegetation at most of the other locations. This is also a quiet tranquil landscape within which the abstraction facility may be difficult to integrate without causing significant impacts on the landscape character. Of the Lough Derg locations, Youghal Bay is considered to be the least constrained in a landscape and visual sense. This has a more typical rural landscape character with the dispersed moderate level of residential development lining the local roads in the vicinity. Notwithstanding, there is a scenic route designation approximately 1.5 km to the south and the Lough Derg way passes through this location. There are also several small marinas and swimming jetties punctuating the riparian vegetation along the shores of the Lough at this location.

Although the MCA matrix indicates a number of potentially significant constraints in relation to the Parteen Basin Reservoir, it is important to remember that the location up for consideration is much larger than the other Shannon abstraction options. In this instance the constraints predominantly relate to the northern end of the Parteen location in the vicinity of the heritage and tourist settlements of Killaloe and Ballina at the southern end of Lough Derg. By contrast, the southern end of the Parteen location is much less constrained by landscape and visual designations particularly on the eastern side, which is contained within North Tipperary. This side of the Parteen Basin Reservoir is also characterised by engineered landform and structures required to install the Parteen Weir and the Ardnacrusha Headrace that are located at the southern end of the Parteen Basin. For these reasons the Parteen location is considered to be the least constrained of the Shannon abstraction options overall.

3.1 Desalination Locations

An assessment of the potential abstraction locations was carried out for the following options:

- Option H (Desalination)

An important distinction in the assessment is that visual receptors are people and groups of people whose sensitivity varies depending on the activity they are likely to be engaged in at a particular location. By contrast, landscape impact assessment considers the landscape as a resource in its own right, with landscape receptors being physical features, elements and patterns that contribute to landscape character.

3.1.1 South Dublin

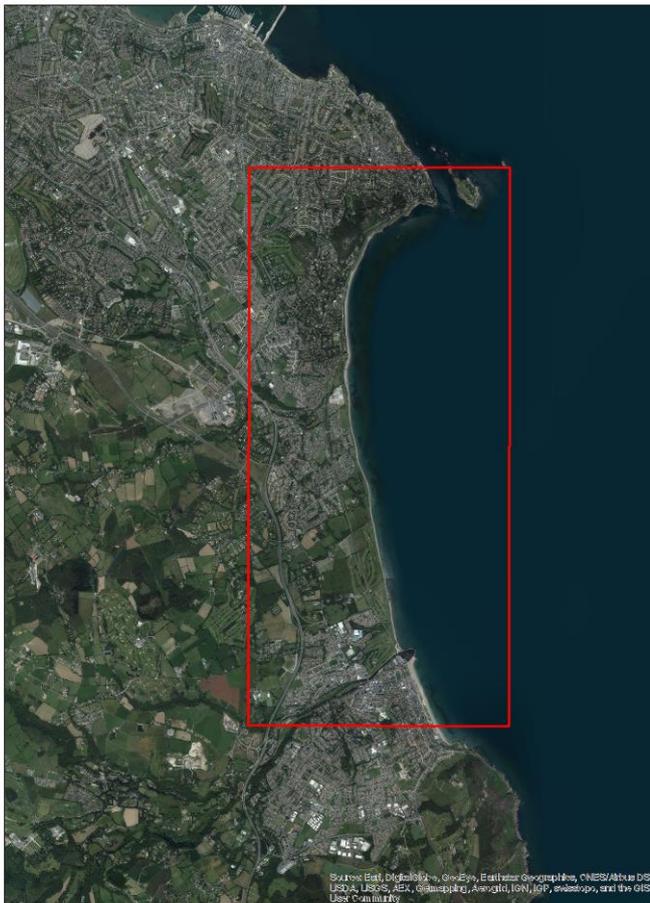


Figure E9 – 6 South Dublin

The South Dublin option is the largest of the potential desalination locations, stretching from Dalkey Island in the north to Bray Harbour at its southern extents. It takes in a combination of steep rocky shoreline at the northern end and a flatter pebble beach towards the southern end. This is also a highly urbanised area with the considerable residential development of South County Dublin’s suburbs

occurring immediately inland of the coastline. The subject section of coastline is also navigated by the main railway line that serves south Dublin commuters (DART) and the south-east of the country. The Shanganagh wastewater treatment facility also occurs close to the coastline near the central portion of this location at Shankhill. Elevated southerly coastal views are afforded from Killiney Hill Park and the Vico Road, which runs along the steep section of coastline at the northern end of this location. These are designated views in the Dun Laoghaire Rathdown County Development Plan and much of Killiney is identified as an Architectural Conservation Area (ACA).

A Landscape Character Assessment has not been carried out for this area, as urban areas were not included in the study when the document was prepared for Dun Laoghaire Rathdown County Council in 2009. Consequently, there is currently no specific value or sensitivity classification applied to the landscape in this urban coastal area. It is reasonable to consider that this section of coastline, particularly the northern end at Killiney, would be considered highly sensitive in any future Landscape Character Assessment that is likely to include urban areas.

The main landscape and visual issues relating to a desalination facility at this location are associated with elevated designated scenic views from Killiney Hill, the Vico Road and from the dwellings in this area, which are contained within an Architectural Conservation Area. These views are also enjoyed by recreational users of Killiney Hill Park and Killiney Beach. There is also a high potential to impact on views from residential areas throughout this location due to the high population density.

There is a strong potential to impact on high amenity coastal views enjoyed by commuters on the dart rail service along this section of coastline. There is also potential to impact on designed views associated with Rosedale House and demesne, as well as views from Shanganagh Park and Woodbrook Golf Course, which occur at the southern end of this location.

In general it is considered that the northern end of this location would be more sensitive to landscape and visual impacts arising from the proposed desalination facility than the southern end. Given the range and degree of existing development in this area generally, there is some potential for a desalination facility to be incorporated in the southern portion of this location that may not result in significant landscape and visual effects, if an appropriate site could be found.

3.1.2 Loughshinny North



Figure E9 – 7 Loughshinny North

The potential desalination location at Loughshinny North is contained within a gently undulating coastal plain midway between the settlements of Rush, to the south, and Skerries to the north. The rural area is relatively sparsely populated with most residential development concentrated along the link road between the R128 regional road and the harbour at Loughshinny. The field sizes are relatively large with a limited degree of enclosure provided by low windswept hedgerows. The coastline consists of low sea cliffs that provide a distinct and abrupt transition between the coastal plain and the shoreline which consists of rocky outcrops and pebbled coves. The main Dublin - Belfast railway line passes in a north-south direction a short distance inland from this location.

The main landscape and visual issues associated with a potential desalination facility at this location relate to landscape and visual designations. The entire coastal zone in this area is designated as a 'Highly Sensitive Landscape' in the Fingal County Development Plan. The R128 regional road that follows the coast is also designated as a scenic route along this section and there are coastal walks indicated on the Development Plan 'Green Infrastructure' maps.

The low sea cliffs that form the coastline in this area are a distinctive and sensitive landscape feature that could be impacted upon by any desalination proposal. Furthermore, the landscape character of this area is that of an open coastal landscape with a relatively low degree of built development. There is a strong

potential that a desalinisation facility would appear ambiguous in this landscape and would be difficult to mitigate in the surrounding context of low windswept vegetation.

Coastal views from the Dublin Belfast railway line could also be affected by any proposed desalinisation facility at this location.

3.1.3 Loughshinny South



Figure E9 – 8 Loughshinny South

The potential desalinisation location at Loughshinny South is located a short distance from the location described above at Loughshinny North. Indeed, the main variation is the nearer proximity of the Loughshinny South location to the settlement of Rush. In almost all other respects the description provided for Loughshinny North is also relevant to the Loughshinny South location. So too are the potential landscape and visual impacts that would arise from a desalinisation plant at this location. See above.

3.1.4 Balbriggan



Figure E9 – 9 Balbriggan

This location occupies an area of land between the northern outskirts of the settlement of Balbriggan and the border between County Meath and County Dublin. The location is contained in large farmed fields on a relatively open coastal plain where field boundaries are defined by low windswept hedgerows. The Dublin Belfast railway line passes through the area along with the R132 regional road. A short section of the R132 contained within this location is designated as a scenic route in the Fingal County Development Plan. The entirety of this coastal zone is identified as a ‘Highly Sensitive Landscape’ in the Fingal County Development Plan.

The most sensitive aspects of this location in landscape and visual terms, are the ‘highly Sensitive Landscape’ zoning, the short section of designated scenic route applied to the R132 at this location and the distinctive rocky shoreline and low sea cliffs that form the coastline here. There is also potential to impact on views from the main Dublin - Belfast railway line.

Given the open nature of the rural landscape in this area an industrial facility such as a desalination plant may appear incongruous and be difficult to screen. Effective screen vegetation would be difficult to establish and would not easily blend with the low windswept hedgerows in the vicinity. A potential site nearer the southern end of this location and the settlement of Balbriggan would be most appropriate in terms of reducing potential impacts on landscape character; however, this would also increase the potential for visual impacts from dwellings in the northern outskirts of Balbriggan

3.2 Matrix of Multi Criteria Analysis

Criteria	South Dublin	Balbriggan	Loughshinny North	Loughshinny South
Potential to impact on designated areas of 'Highly Sensitive Landscape'	Mid-range: No specific landscape value or sensitivity designation but northern end of focus area contained in NHA and ACAs.	Very High: Coastal area identified as a 'highly Sensitive Landscape' in the Fingal CDP.	Very High: Coastal area identified as a 'highly Sensitive Landscape' in the Fingal CDP.	Very High: Coastal area identified as a 'highly Sensitive Landscape' in the Fingal CDP.
Potential to impact on rare or distinctive landscape elements (rock outcrops, water bodies etc.)	Mid-range: Rocky shoreline particularly around Killiney.	Very High: Rocky shoreline and coves along this section of coast.	Very High: Distinctive low sea cliffs along this section of coast.	Very High: Distinctive low sea cliffs along this section of coast.
Potential to disrupt landscape structure (treelines / hedgerows / field pattern etc.)	Very Low: Varied urban setting.	Low: Large coastal fields with little boundary definition.	Low: Field boundaries.	Low: Field boundaries.
Potential to impact on woodlands and significant tree groups	Low: Several TPOs and woodland areas associated with Killiney Hill, Shanganagh Park and Woodbrook Golf Course.	Very Low: none identified.	Very Low: none identified.	Very Low: none identified.
Potential to impact on historic designed landscapes	Mid-range: Killiney ACA, Sorrento Terrace ACA and Rosedale House.	Low: Several RMP features near point but not designed landscapes.	Low: Several RMP features but not designed landscapes.	Low: Several RMP features but not designed landscapes.
Potential to alter the prevailing landscape character	Low: Varied urban landscape with Dart line and Shanganagh Sewage works. Greater potential to impact on landscape character around Killiney.	Mid-range: Rugged open coastal character with relatively low levels of built development.	Mid-range: Rugged coastal character with relatively low levels of built development.	Mid-range: Rugged coastal character with relatively low levels of built development.

Potential to impact on designated scenic routes / views	Mid-range: Coastal scenic views at northern end of focus area but not south of Killiney.	Mid-range: Short section of R132 coastal road designated as a scenic route along this section of coast.	Very High: R128 coastal road designated as a scenic route along this section of coast plus small section of elevated local road adjacent to Popeshall.	Very High: R128 coastal road designated as a scenic route along this section of coast plus small section of elevated local road adjacent to Popeshall.
Potential to impact on views from heritage/tourist/amenity features of national or regional importance	Mid-range: Elevated views from Killiney Hill, Sorrento Terrace, and Dalkey Island all at northern end of focus area.	Low: Coastal settlement of Balbriggan a popular tourist and amenity location.	Low: Coastal settlements of Rush and Skerries popular tourist and amenity locations.	Low: Coastal settlements of Rush and Skerries popular tourist and amenity locations.
Potential to impact on views from settlements	Very High: Densely populated coastal suburbs of Dublin City.	Mid-range: Balbriggan immediately adjacent to the south.	Mid-range: Loughshinny immediately adjacent and Rush and Skerries c. 2km S and N.	Mid-range: Loughshinny immediately adjacent and Rush and Skerries c. 2km S and N.
Potential to impact on views from dwellings / local roads	Very High: As above.	Low: Sparse rural population north of Balbriggan.	Low: Relatively sparse rural / seasonal population outside of main settlements.	Low: Relatively sparse rural / seasonal population outside of main settlements.
Potential to impact on views from motorways	Very Low.	Very Low: M1 motorway c.3km W but heavily screened along this section.	Very Low.	Very Low.
Potential to impact on views from other major roads (national or regional roads)	Mid-range: R119 (Vico Road) affords elevated views of rocky coastline along south eastern Flank of Killiney Hill.	Mid-range: R132 coastal road (short section designated as a scenic route) runs along this section of coast	Very High: R128 coastal road designated as a scenic route along this section of coast.	Very High: R128 coastal road designated as a scenic route along this section of coast.
Potential to impact on views from rail lines	Very High: Heavily utilised coastal DART section passes through focus area.	Very High: Main Belfast Dublin rail line passes through this focus area.	Mid-range: Main Belfast Dublin rail line passes c. 1km to the west.	Mid-range: Main Belfast Dublin rail line passes c. 1km to the west.
Potential to impact on arrival views from Airports including aerial approach and vehicular egress	Very Low.	Very Low: Possibly visible from Dublin Airport flight path but without material consequence.	Very Low: Possibly visible from Dublin Airport flight path but without material consequence.	Very Low: Possibly visible from Dublin Airport flight path but without material consequence.

Potential to impact on views from national 'way marked' walking routes	Very Low.	Very Low.	Very Low.	Very Low.
Potential to impact on local walks	Mid-range: Local walks associated with Killiney Hill, Shangannagh park and the coastline.	Mid-range: Coastal walks along this section of coastline identified under specific objectives of Fingal CDP.	Mid-range: Coastal walks along this section of coastline identified under specific objectives of Fingal CDP.	Mid-range: Coastal walks along this section of coastline identified under specific objectives of Fingal CDP.
Potential to impact on views from angling or swimming locations (rivers, lakes, sea)	Mid-range: Swimming, fishing, sailing and sea kayaking all popular water based pursuits along this section of coastline.	Mid-range: Beaches accessible from Balbriggan.	Mid-range: Beaches and Harbour at Loughshinny.	Low: Beaches and Harbour at Loughshinny.
Potential that landscape screening measures will be ineffective or incongruous	Low: Relatively open coastal strip could be interrupted by mitigation planting.	Mid-range: Prevailing vegetation in this area is low and windswept - proposals for taller vegetation may be incongruous and difficult to establish.	Mid-range: Prevailing vegetation in this area is low and windswept - proposals for taller vegetation may be incongruous and difficult to establish.	Mid-range: Prevailing vegetation in this area is low and windswept - proposals for taller vegetation may be incongruous and difficult to establish.

3.3 Comparative Discussion

The most constrained locations from a landscape and visual perspective are considered to be the Loughshinny North and Loughshinny South locations. This is due to the highly sensitive landscape designation for this coastal area and the designated scenic route designation applied to the full length of the R128 that passes through these locations. Views from the Dublin Belfast railway line would also be affected by a desalination plant at either of these locations. Another important consideration is that mitigation by screen planting is unlikely to be successful at these locations because it would be difficult to establish and would be incongruous in relation to the low windswept hedgerows and generally open nature of the coastal plain at these locations. Though many of the same issues are associated with the Balbriggan location it is considered to be slightly less constrained because only a small section of the R132 that passes through the location is designated as scenic route. Furthermore, it is considered that the southern end of this location proximal to the outskirts of Balbriggan could more readily absorb a desalination facility in terms of landscape character. There would also be improved potential for mitigation to be successfully integrated into the existing landscape setting at the southern end of this location.

There are considerable landscape and visual constraints associated with the South Dublin location, particularly relating to elevated views from designated scenic routes and high amenity receptors at its northern end. This is the most heavily populated of the potential desalination locations containing dense residential development in all aspects except near the southern end where Woodpark Golf Course and Shanganagh Park occupy a significant portion of land. Whilst there is potential for a desalination facility to be incorporated into this landscape without undue impact on landscape character there are likely to be impacts on views from a substantial number of residential receptors.

Overall, it is considered that the least constrained locations from a landscape and visual perspective are the Balbriggan location and the southern end of the South Dublin location. The latter would only be a viable if an appropriate site that buffered effects from the many sensitive receptors could be found. The constraints relating to the Balbriggan location are of a more general nature.

Water Supply Project Eastern and Midlands Region (WSP)

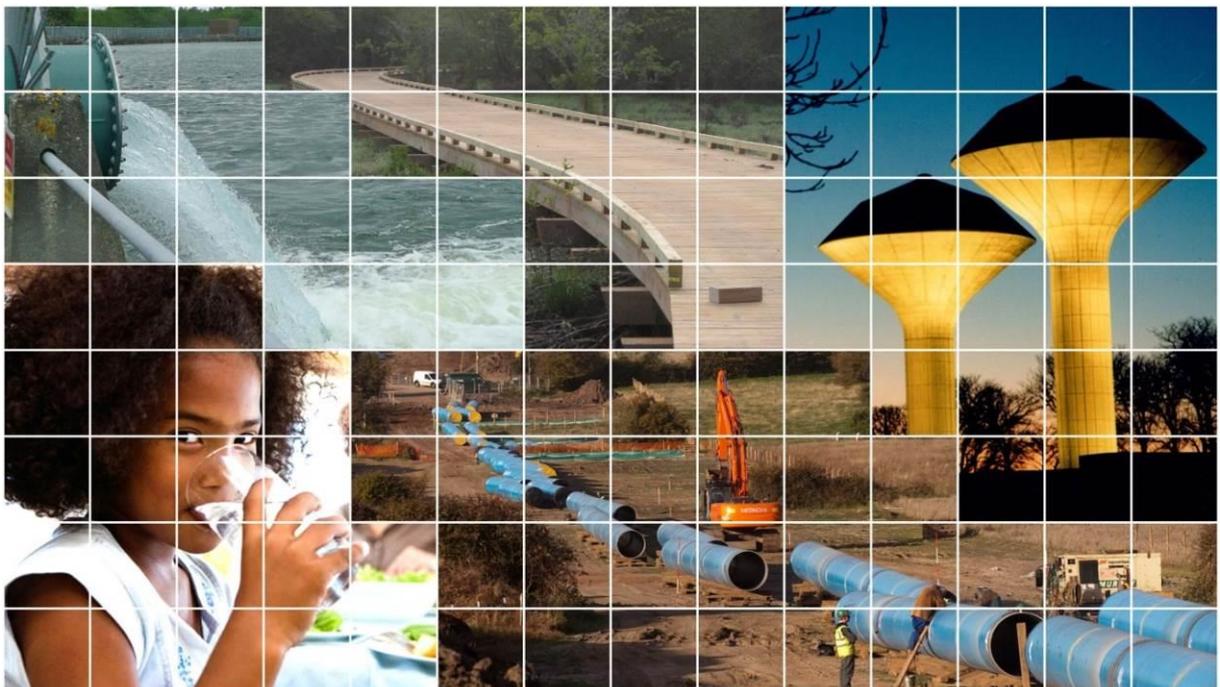
Abstraction Location MCA

Appendix E10: Agronomy



October 2015

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1

Introduction

1.1 Introduction

Four reasonable alternative options have been identified from previous studies – refer to the *Water Supply Options Working Paper* (Project Road Map Stage 2). These are reconfirmed below.

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)
- Option H (Desalination)

This report describes the decision making process used to appraise the abstraction locations associated with each of the reasonable alternative options.

To undertake the appraisal of abstraction locations a range of specialists were engaged, in their applicable fields, to conduct a comparative assessment of abstraction locations. The following disciplines were engaged:

- i. **Ecology** – the consideration of impact on animals, plants and their environment.
- ii. **Water** – the consideration of impacts on the surface water environment.
- iii. **Air and Noise** - the consideration of air and noise pollution
- iv. **Cultural Heritage** - the consideration of existing archaeological and built heritage
- v. **Soils, Geology and Hydrogeology** – the consideration of impact on soils, geology and hydrogeology.
- vi. **Landscape and visual** – the consideration of landscape and visual impact.
- vii. **Agronomy** – the consideration of impact on land based enterprise.
- viii. **People** – the consideration of impacts on people
- ix. **Planning** – the consideration of planning and land use policy in relation to proposed works
- x. **Engineering** - the consideration of technical challenges associated with proposed works.
- xi. **Traffic** - the consideration of impact on traffic and road network

The specialists independently assessed each location relative to appraisal criteria applicable to their field of expertise. This process, or methodology, is referred to as Multi-Criteria Analysis and explicitly considers multiple criteria (see Table E10 - 1), within a decision-making environment.

Environmental Criteria	Technical Criteria	Risk Criteria
Biodiversity, Flora and Fauna	Safety	Technical Risk relating to the Source
Fisheries	Planning Policy	Technical Risk relating to Infrastructure and Operations
Water	Engineering and Design	Environmental and Planning Risk
Air/Climatic Factors	Capital and Operational Costs	Financial Risk
Material Assets (Energy)	Sustainability	Socio-economic risk
Cultural Heritage (including Architecture & Archaeology)		
Landscape & Visual		
Material Assets (Land use)		
Tourism		
Population		
Human Health		
Soils, Geology and Hydrogeology		

Table E10 - 1 Appraisal Criteria

The assessments are presented as individual statements within this Appendix E.

This Appendix E10 is a statement on the specialism Agronomy (Land use) and describes the decision making process used in identifying the least constrained abstraction locations associated with the reasonable alternative options.

The Site Selection Methodology in Appendix B outlines the process employed in identifying least constrained locations. This report should be read in conjunction with the *Site Selection Methodology*.

1.2 Methodology

This is ‘Non-linear Site Methodology – Step 1’ as described in the *Site Selection Methodology*.

To effectively determine the least constrained abstraction locations for the reasonable alternative options, the potential abstraction locations were assessed under 8 no. Agronomy sub-criteria.

- Approximate % Reduction in overall farm holding
- Farming Enterprise
- Number of landowners impacted within site boundary
- Land Quality
- Severance based on site location within overall land holdings
- Potential Impacts on landholdings
- Crop rotation practiced
- Overall Impact

1.2.1 Desk study

A desk study exercise of the potential abstraction locations was carried out using the software package *ArcReader*. The supplied datasets and information are as described in the *Site Selection Methodology*.

1.2.2 Categories of impact

The relative analysis of potential locations to define a “least constrained” location is based upon a subjective assessment by each Specialist in their discipline of expertise. This judgement is presented as weighted impact; colour coded for ready identification.

Very high	Dark blue
High	Blue
Mid-range	Green
Low	Light Green
Very low	Cream

From an agricultural point of view the following constraints are relevant to the selection of an abstraction location:

While it is likely that only one or two individual farms will be affected by the actual site, none the less each location is assessed under the following relevant agronomy sub criteria:

- Farming Enterprise
- Number of landowners impacted within site boundary
- Land Quality
- Crop rotation practiced
- Overall Impact

The above criteria are considered relevant in selecting the least constrained abstraction location. It is to be noted that without knowledge of the precise location it is not possible at constraints stage to identify impacts on individual farms. This desk top study is at a high level and no individual farm impact studies were carried out.

Land quality data was derived from EPA Soil Series Maps,
Ref: gis.teagasc.ie/isis/help.php

At constraints study stage it is not possible to examine the effect of the proposed scheme on the following sub criteria

- Approximate reduction on overall farm holding
The effect on an individual farm or the reduction in the farmholding will only become clear when the actual site location has been chosen and it is then possible to identify the farm or farms impacted
- Severance based on site location within overall land holding
It is only possible to assess the severance caused when the actual site location has been chosen and its effects on the individual farm or farms can then be assessed as regards severance.
- Potential Impacts on land holding
The actual impacts on a land holding will vary from farm to farm depending on size, enterprise, rotation of crops and animals. These impacts will be assessed in full when the exact location has been selected. It should be

noted that the impact of land loss on an individual farm may range from high to very high.

2**Lough Derg/Parteen Basin****2.1 Lough Derg/Parteen Basin Locations**

An assessment of the potential abstraction locations was carried out for the following options:

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)

Five potential abstraction locations were identified. Each of these potential abstraction locations was examined from an Agricultural perspective with the objective of identifying the least constrained location. All of the identified locations are primarily devoted to agriculture. The sighting of an abstraction facility within any of the selected locations will have a localised impact. It is likely that any impacts will be limited to one or two farm holdings.

The principal permanent impact will be the loss of agricultural land. The severance of land within a holding may occur. The principal short term impacts would be disturbance, such as temporary loss of land, noise, dust or access difficulties during construction.

2.1.1 Slevoir



Figure E10 – 1 **Lough Derg - Slevoir**

Slevoir, located adjacent to Portumna, is at the north-eastern end of Lough Derg. The identified study area is rural in character and consists predominantly of farm land.

(a) Farm Enterprise

The predominant farm enterprise in the area is grass based and mainly cattle and sheep production. In addition, there are small areas of tillage with some forestry. The farms are arranged in traditional style with fields of varying sizes separated by hedges and ditches. The desktop study does not reveal the presence of any intensive dairy or equine farms.

(b) Number of Landowners impacted within site boundary

The study area contains approximately four to five individual farms. The farms are considered residential and each farm has an associated range of farm buildings. The farms vary in size but as the boundaries of the extraction location are extensive the precise farm or farms to be potentially affected cannot be identified at this phase in the study.

(c) Land Quality

According to the EPA's Soil Classification of Ireland, the soils in the region consist in the main of a fine loamy drift with a limestone base. These soils are suitable for a wide range of uses and particularly suited to grassland. In addition, some peats occur in the area and the potential use range of these soils would be more restricted none the less these areas are used for agricultural production. The land quality would be considered medium to good quality with most individual farms containing both medium and good quality land.

(d) Crop Rotation Practised

The most predominant crop within the study area is permanent pasture there are some areas of tillage, mainly cereal production and it is likely that these areas are rotated within individual farms. At the level of the desk top study it is not possible to identify the precise crop rotation practised within individual farms.

(e) Overall Impact

No farms of national significance were identified during the desk top study. The study area does not contain any intensive dairy, equine or horticultural farm. It is deemed that the overall impact of the location of an abstraction facility within the identified study area would be low.

2.1.2 Mota

Mota, located on the Eastern shore of Lough Derg consists of an area of mixed use agricultural land



Figure E10 – 2 Lough Derg - Mota

(a) Farm Enterprise

The predominant farm enterprise in the area is grass based and mainly cattle and sheep production. In addition, there are small areas of tillage. The farms are arranged in traditional style with fields of varying sizes separated by hedges and ditches. The desktop study does not reveal the presence of any intensive dairy or equine farms.

(b) Number of Landowners impacted within site boundary

The study area contains approximately five to ten individual farms. The farms are considered residential and each farm has an associated range of farm buildings. The farms vary in size but as the boundaries of the extraction location study area are extensive the precise farm or farms to be potentially affected cannot be identified at this phase in the study.

(c) Land Quality

According to the EPAs Soil Classification of Ireland, the soils in the region consist in the main of a fine loamy drift with a limestone base. These soils are suitable for a wide range of uses and particularly suited to grassland. In addition, some peats occur in the area and the potential use range of these soils would be more restricted none the less these areas are used for agricultural production. The land quality would be considered medium to good quality with most individual farms containing both medium and good quality land.

(d) Crop Rotation Practised

The most predominant crop within the study area is permanent pasture there are some areas of tillage, mainly cereal production and it is likely that these areas are rotated within individual farms. At the level of the desk top study it is not possible to identify the precise crop rotation practised within individual farms.

(e) Overall Impact

No farms of national significance were identified during the desk top study. The study area does not contain any intensive dairy, equine or horticultural farm. It is deemed that the overall impact of the location of an abstraction facility within the identified study area would be low.

2.1.3 Dromineer



Figure E10 – 3 Lough Derg - Dromineer

Dromineer is located along the eastern shore of Lough Derg. Mixed use agricultural land, predominantly grazing, some tillage.

(a) Farm Enterprise

The predominant farm enterprise in the area is grass based and mainly cattle and sheep production. In addition, there are small areas of tillage with some forestry.

The farms are arranged in traditional style with fields of varying sizes separated by hedges and ditches. The desktop study does not reveal the presence of any intensive dairy or equine farms.

(b) Number of Landowners impacted within site boundary

The study area contains approximately four to nine individual farms. The farms are considered residential and each farm has an associated range of farm buildings. The farms vary in size but as the boundaries of the extraction location are extensive the precise farm or farms to be potentially affected cannot be identified at this phase in the study.

(c) Land Quality

According to the EPAs Soil Classification of Ireland, the soils in the region consist in the main of a fine loamy drift with a limestone base and areas of river alluvium. These soils are suitable for a wide range of uses and particularly suited to grassland. The land quality would be considered to be very good quality with most individual farms containing good and very good quality land.

(d) Crop Rotation Practised

The most predominant crop within the study area is permanent pasture there are some areas of tillage, mainly cereal production and it is likely that these areas are rotated within individual farms. At the level of the desk top study it is not possible to identify the precise crop rotation practised within individual farms.

(e) Overall Impact

No farms of national significance were identified during the desk top study. The study area does not contain any intensive dairy, equine or horticultural farm. It is deemed that the overall impact of the location of an abstraction facility within the identified study area would be low.

2.1.4 Youghal



Figure E10 – 4 Lough Derg - Youghal

Youghal Bay is located in the south eastern shore of Loch Derg the area comprises mixed use agricultural land, predominantly grazing, and some tillage.

(a) Farm Enterprise

The predominant farm enterprise in the area is grass based and mainly cattle and sheep production. In addition, there are small areas of tillage with some forestry. The farms are arranged in traditional style with fields of varying sizes separated by hedges and ditches. The desktop study does not reveal the presence of any intensive dairy or equine farms.

(b) Number of Landowners impacted within site boundary

The study area contains approximately five to ten individual farms. The farms are considered residential and each farm has an associated range of farm buildings. The farms vary in size but as the boundaries of the extraction location are extensive the precise farm or farms to be potentially affected cannot be identified at this phase in the study.

(c) Land Quality

According to the EPAs Soil Classification of Ireland, the soils in the region consist in the main of a fine loamy drift with a limestone base and areas of river alluvium.

These soils are suitable for a wide range of uses and particularly suited to grassland. The land quality would be considered to be very good quality with most individual farms containing good and very good quality land.

(d) Crop Rotation Practised

The most predominant crop within the study area is permanent pasture there are some areas of tillage, mainly cereal production and it is likely that these areas are rotated within individual farms. At the level of the desk top study it is not possible to identify the precise crop rotation practised within individual farms.

(e) Overall Impact

No farms of national significance were identified during the desk top study. The study area does not contain any intensive dairy, equine or horticultural farm. It is deemed that the overall impact of the location of an abstraction facility within the identified study area would be low.

2.1.5 Parteen Basin Reservoir

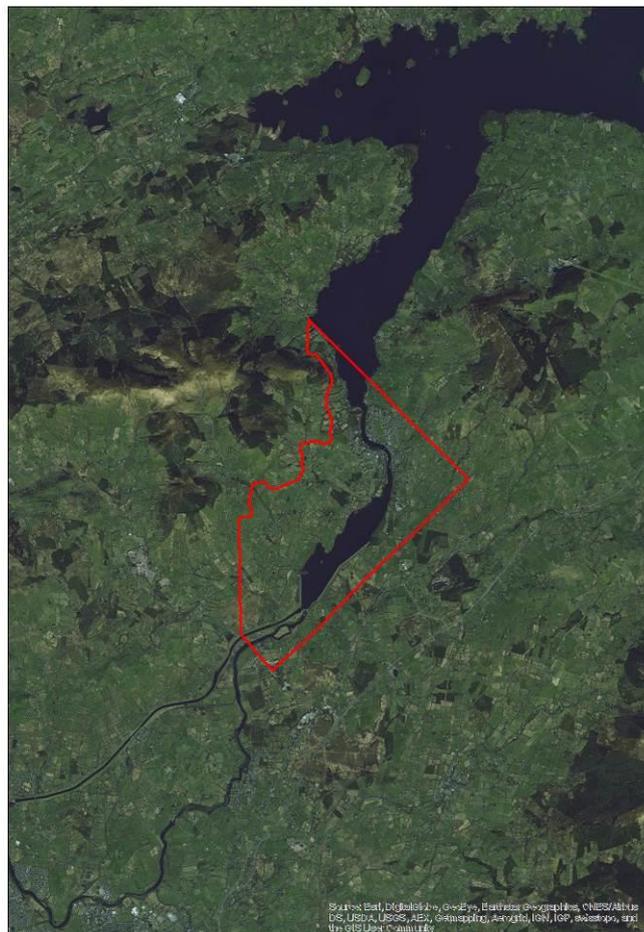


Figure E10 – 5 Parteen Basin Reservoir

Located at the southern end of Lough Derg comprises mixed use agricultural land, predominantly grazing, some tillage.

(a) Farm Enterprise

The predominant farm enterprise in the area is grass based and mainly cattle and sheep production. In addition, there are small areas of tillage with some forestry. The farms are arranged in traditional style with fields of varying sizes separated by hedges and ditches. The desktop study does not reveal the presence of any intensive dairy or equine farms.

(b) Number of Landowners impacted within site boundary

The study area contains approximately six to twelve individual farms. The farms are considered residential and each farm has an associated range of farm buildings. The farms vary in size but as the boundaries of the extraction location are extensive the precise farm or farms to be potentially affected cannot be identified at this phase in the study.

(c) Land Quality

According to the EPAs Soil Classification of Ireland, the soils in the region consist in the main of a fine loamy drift with a limestone base over a sandstone base and some silty river alluvium. These soils are suitable for a wide range of uses and particularly suited to grassland. The land quality would be considered good to very good quality with most individual farms containing good quality land.

(d) Crop Rotation Practised

The most predominant crop within the study area is permanent pasture there are some areas of tillage, mainly cereal production and it is likely that these areas are rotated within individual farms. At the level of the desk top study it is not possible to identify the precise crop rotation practised within individual farms.

(e) Overall Impact

No farms of national significance were identified during the desk top study. The study area does not contain any intensive dairy, equine or horticultural farm. It is deemed that the overall impact of the location of an abstraction facility within the identified study area would be low.

2.2 Matrix of Multi Criteria Analysis

Criteria	Slevoir	Mota	Dromineer	Youghal Bay	Parteen Basin
Approximate % Reduction in overall farm holding	Exact site location unknown; reduction on holding unknown.	Exact site location unknown; reduction on holding unknown.	Exact site location unknown; reduction on holding unknown.	Exact site location unknown; reduction on holding unknown.	Exact site location unknown; reduction on holding unknown.
Farming Enterprise	Predominantly beef, tillage and small amount of forestry.	Predominantly beef, some tillage.	Predominantly beef, some tillage and sheep.	Predominantly beef, some tillage and dairy.	Predominantly beef, some tillage and dairy.
Number of landowners impacted within site boundary	Study area contains between 4 and 8 landowners. The exact number impacted will be known when the exact location decided.	Study area contains between 5 and 10 landowners. The exact number impacted will be known when the exact location decided.	Study Area contains between 4 and 9 landowners. The exact number impacted will be known when exact location decided.	Study Area contains between 5 and 10 landowners. The exact number impacted will be known when exact location decided.	Study Area contains between 6 and 12 landowners. The exact number impacted will be known when exact location decided.
Land Quality	Good.	Generally good, some patches of scrub.	Very good.	Very good.	Good.
Severance based on site location within overall land holdings	Individual farm Impact to be evaluated when exact location decided.	Individual farm Impact to be evaluated when exact location decided.	Individual farm Impact to be evaluated when exact location decided.	Individual farm Impact to be evaluated when exact location decided.	Individual farm Impact to be evaluated when exact location decided.
Potential Impacts on landholdings	Loss of land, possible severance and injurious affection.	Loss of land, possible severance and injurious affection.	Loss of land, possible severance and injurious affection.	Loss of land, possible severance and injurious affection.	Loss of land, possible severance and injurious affection.

Crop rotation practiced	Predominantly permanent pasture, some tillage (20%) and forestry (10%).	Predominantly permanent pasture, some tillage (20%).	Predominantly permanent pasture, some tillage (20%).	Predominantly permanent pasture, some tillage (25%).	Predominantly permanent pasture, some tillage (20%).
Overall Impact	Low impact - slight at national level.	Low impact - slight at national level.	Low impact - slight at national level.	Low impact - slight at national level.	Low impact - slight at national level.

2.3 Comparative Discussion

From an Agricultural perspective the five potential abstraction locations, namely, Slevoir, Mota, Dromineer, Youghal Bay and Parteen basin reservoir have broadly similar characteristics. A desk top study of each of the potential locations has been carried out for the purpose of establishing the least constrained abstraction location.

The study was carried out having regard to agricultural practises within the broad locations identified. Individual farm studies were not conducted.

The five selected abstraction locations as outlined above have broadly similar land quality and farming patterns.

In the absence of the identification of the exact location of a proposed facility within each individual location it is concluded that the overall impact at any location would be low at farm and local level and would be slight at national level. Therefore, from an Agronomy impact perspective, no location is more or less constrained than another.

3 Desalination

3.1 Desalination Locations

An assessment of the potential abstraction locations was carried out for the following options:

- Option H (Desalination)

3.1.1 South Dublin

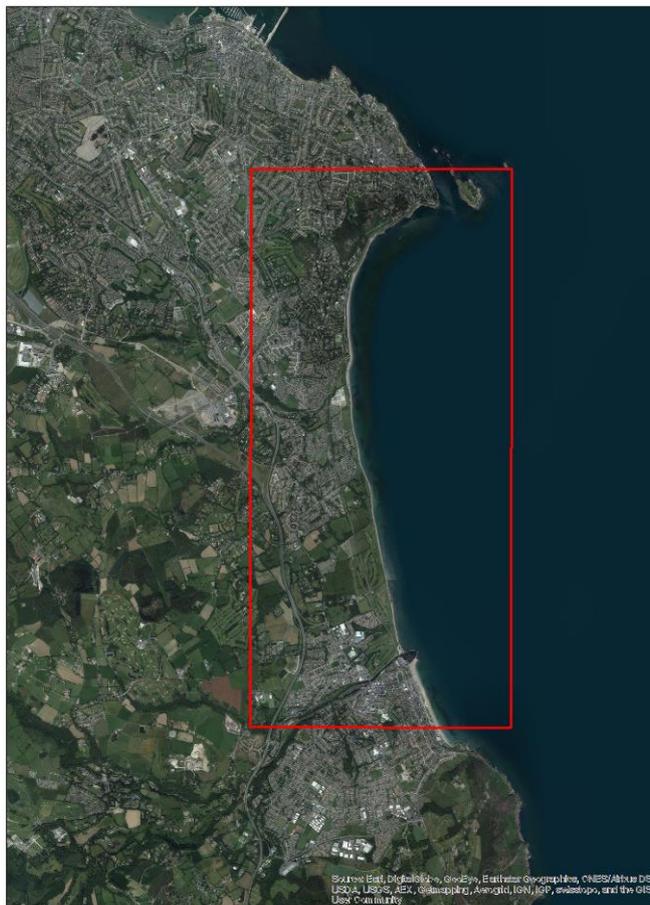


Figure E10 – 6 South Dublin

The abstraction study area identified in south Dublin, while adjacent to urban areas is mainly devoted to agriculture.

(a) Farm Enterprise

The predominant farm enterprise in the area is grass based and mainly cattle and sheep production. In addition, there are small areas of tillage with some forestry. There are a number of farms with small equine enterprises. The farms are arranged in traditional style with fields of varying sizes separated by hedges and ditches. The desktop study does not reveal the presence of any intensive dairy, horticulture or equine farms.

(b) Number of Landowners impacted within site boundary

The study area contains approximately four to eight individual farms. The farms are considered residential and each farm has an associated range of farm buildings. The farms vary in size but as the boundaries of the extraction location are extensive the precise farm or farms to be potentially affected cannot be identified at this phase in the study.

(c) Land Quality

According to the EPAs Soil Classification of Ireland, the soils in the region consist in the main of a fine loamy drift with a limestone base over a sandstone base and some silty river alluvium. These soils are suitable for a wide range of uses and particularly suited to grassland. The land quality would be considered good to very good quality with most individual farms containing good quality land.

(d) Crop Rotation Practised

The most predominant crop within the study area is permanent pasture there are some areas of tillage, mainly cereal production and it is likely that these areas are rotated within individual farms. At the level of the desk top study it is not possible to identify the precise crop rotation practised within individual farms.

(e) Overall Impact

No farms of national significance were identified during the desk top study. The study area does not contain any intensive dairy, equine or horticultural farm. It is deemed that the overall impact of the location of an abstraction facility within the identified study area would be low.

3.1.2 Loughshinny North



Figure E10 – 7 Loughshinny North

Lough Shinnny North located north of Dublin city comprises mixed agricultural land, tillage and grass. Low intensity equine enterprises.

(a) Farm Enterprise

The predominant farm enterprise in the area is grass based and mainly cattle and sheep production. In addition, there are areas of tillage. There are a number of farms with small equine enterprises. The area is especially suited to horticultural production and there are a number of such enterprises present. The farms are arranged in traditional style with fields of varying sizes separated by hedges and ditches. The desktop study does not reveal the presence of any intensive dairy or equine farms.

(b) Number of Landowners impacted within site boundary

The study area contains approximately one to five individual farms. The farms are considered residential and each farm has an associated range of farm buildings. The farms vary in size but as the boundaries of the extraction location are extensive the precise farm or farms to be potentially affected cannot be identified at this phase in the study.

(c) Land Quality

According to the EPAs Soil Classification of Ireland, the land quality in the area would be regarded as good to very good and the soils are particularly suited to horticultural production. The land quality would be considered good to very good quality with most individual farms containing both good quality lands.

(d) Crop Rotation Practised

The most predominant crop within the study area is permanent pasture there are some areas of tillage, mainly cereal production and it is likely that these areas are rotated within individual farms in addition there are areas devoted to horticultural production. At the level of the desk top study it is not possible to identify the precise crop rotation practised within individual farms.

(e) Overall Impact

No farms of national significance were identified during the desk top study. It is deemed that the overall impact of the location of an abstraction facility within the identified study area would be low.

3.1.3 Loughshinny South



Figure E10 – 8 Loughshinny South

Lough Shinny South located north of Dublin city comprises mixed agricultural land, tillage and grass. Low intensity equine enterprises.

(a) Farm Enterprise

The predominant farm enterprise in the area is grass based and mainly cattle and sheep production. In addition, there are areas of tillage. There are a number of farms with small equine enterprises. The area is especially suited to horticultural production and there are a number of such enterprises present.

The farms are arranged in traditional style with fields of varying sizes separated by hedges and ditches. The desktop study does not reveal the presence of any intensive dairy or equine farms.

(b) Number of Landowners impacted within site boundary

The study area contains approximately three to seven individual farms. The farms are considered residential and each farm has an associated range of farm buildings. The farms vary in size but as the boundaries of the extraction location are extensive the precise farm or farms to be potentially affected cannot be identified at this phase in the study.

(c) Land Quality

According to the EPAs Soil Classification of Ireland, the land quality in the area would be regarded as good to very good and the soils are particularly suited to horticultural production. The land quality would be considered good to very good quality with most individual farms containing both good quality lands.

(d) Crop Rotation Practised

The most predominant crop within the study area is permanent pasture there are some areas of tillage, mainly cereal production and it is likely that these areas are rotated within individual farms in addition there are areas devoted to horticultural production. At the level of the desk top study it is not possible to identify the precise crop rotation practised within individual farms.

(e) Overall Impact

No farms of national significance were identified during the desk top study. It is deemed that the overall impact of the location of an abstraction facility within the identified study area would be low.

3.1.4 Balbriggan



Figure E10 – 9 Balbriggan

Balbriggan located north of Dublin city comprises mixed agricultural land, tillage and grass. Low intensity equine enterprises.

(a) Farm Enterprise

The predominant farm enterprise in the area is grass based and mainly cattle and sheep production. In addition, there are areas of tillage. There are a number of farms with small equine enterprises. The area is especially suited to horticultural production and there are a number of such enterprises present.

The farms are arranged in traditional style with fields of varying sizes separated by hedges and ditches. The desktop study does not reveal the presence of any intensive dairy or equine farms.

(b) Number of Landowners impacted within site boundary

The study area contains approximately one to five individual farms. The farms are considered residential and each farm has an associated range of farm buildings. The farms vary in size but as the boundaries of the extraction location are extensive the precise farm or farms to be potentially affected cannot be identified at this phase in the study.

(c) Land Quality

According to the EPAs Soil Classification of Ireland, the land quality in the area would be regarded as good to very good and the soils are particularly suited to horticultural production. The land quality would be considered good to very good quality with most individual farms containing both good quality lands.

(d) Crop Rotation Practised

The most predominant crop within the study area is permanent pasture there are some areas of tillage, mainly cereal production and it is likely that these areas are rotated within individual farms in addition there are areas devoted to horticultural production. At the level of the desk top study it is not possible to identify the precise crop rotation practised within individual farms.

(e) Overall Impact

No farms of national significance were identified during the desk top study. It is deemed that the overall impact of the location of an abstraction facility within the identified study area would be low.

3.2 Matrix of Multi Criteria Analysis

Criteria	South Dublin	Balbriggan	Loughshinny North	Loughshinny South
Approximate % Reduction in overall farm holding	Exact site location unknown; reduction on holding unknown.	Exact site location unknown; reduction on holding unknown.	Exact site location unknown; reduction on holding unknown.	Exact site location unknown; reduction on holding unknown.
Farming Enterprise	Beef, Tillage.	Tillage.	Tillage.	Tillage and beef.
Number of landowners impacted within site boundary	Study area contains between 4 and 8 landowners. The exact number impacted will be known when the exact location decided.	Study area contains between 1 and 5 landowners. The exact number impacted will be known when the exact location decided.	Study area contains between 1 and 5 landowners. The exact number impacted will be known when the exact location decided.	Study area contains between 3 and 7 landowners. The exact number impacted will be known when the exact location decided.
Land Quality	Very good.	Very good.	Very good.	Very good.
Severance based on site location within overall land holdings	Individual farm Impact to be evaluated when exact location decided.	Individual farm Impact to be evaluated when exact location decided.	Individual farm Impact to be evaluated when exact location decided.	Individual farm Impact to be evaluated when exact location decided.
Potential Impacts on landholdings	Loss of land, possible severance and injurious affection.	Loss of land, possible severance and injurious affection.	Loss of land, possible severance and injurious affection.	Loss of land, possible severance and injurious affection.
Crop rotation practiced	Permanent pasture, tillage.	Tillage.	Tillage.	Permanent pasture, tillage.

Overall Impact	Low impact - slight at national level. Woodbrook golf course is located between Bray and Shankill 53.218805, -6.109332.	Low impact - slight at national level.	Low impact - slight at national level.	Low impact - slight at national level.
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3.3 Comparative Discussion

Four potential abstraction locations on the east coast were considered namely South Dublin, Lough Shinny north, Lough Shinny south, Balbriggan.

A desk top study of each of the potential locations has been carried out for the purpose of establishing a least constrained abstraction location.

This study was carried out having regard to agricultural practices within the broad locations identified. Individual farm studies were not conducted.

The five selected abstraction locations as outlined above have broadly similar land quality and farming patterns.

In the absence of the identification of the exact location of a proposed facility within each individual location it is concluded that the overall impact at any location would be low local level and would be slight at national level. However due to the presence of equine enterprises in the Dublin South study area and the presence of a greater number of intensive horticultural enterprises at the Loughshinny north and Loughshinny south locations, Balbriggan is deemed to be the least constrained abstraction option.

Water Supply Project Eastern and Midlands Region (WSP)

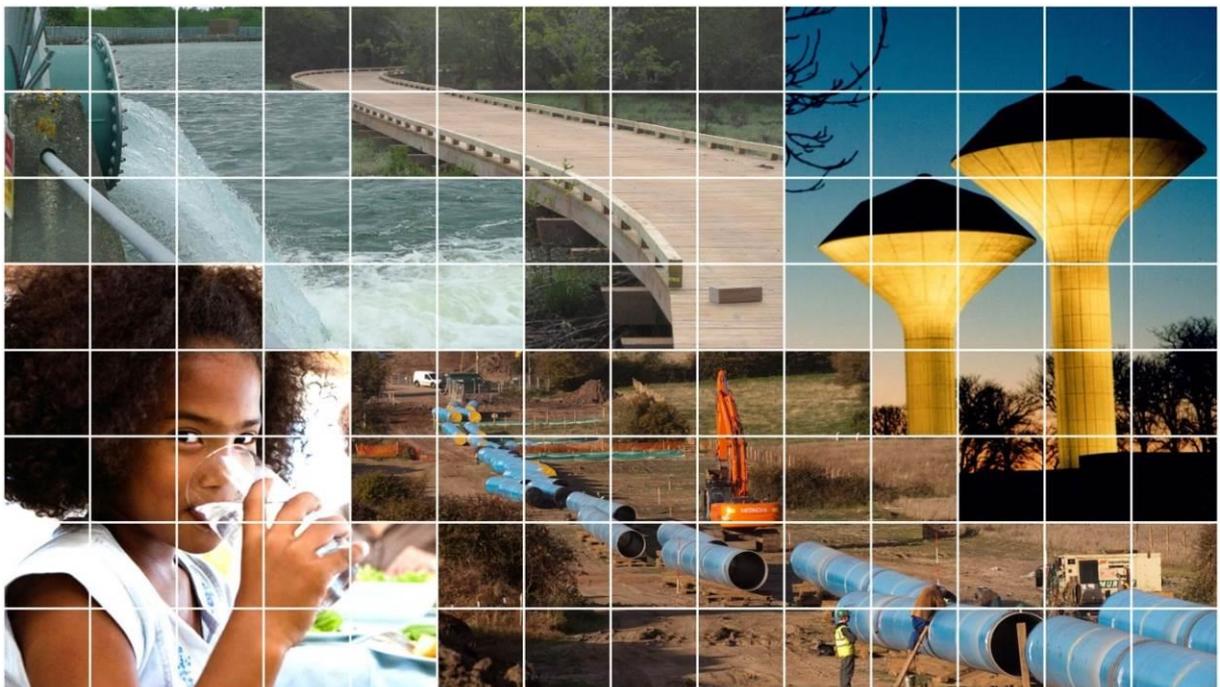
Abstraction Location MCA

Appendix E11: Tourism



October 2015

F02



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1.1 Introduction

Four reasonable alternative options have been identified from previous studies – refer to the *Water Supply Options Working Paper* (Project Road Map Stage 2). These are reconfirmed below.

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)
- Option H (Desalination)

This report describes the decision making process used to appraise the abstraction locations associated with each of the reasonable alternative options.

To undertake the appraisal of abstraction locations a range of specialists were engaged, in their applicable fields, to conduct a comparative assessment of abstraction locations. The following disciplines were engaged:

- i. **Ecology** – the consideration of impact on animals, plants and their environment.
- ii. **Water** – the consideration of impacts on the surface water environment.
- iii. **Air and Noise** - the consideration of air and noise pollution
- iv. **Cultural Heritage** - the consideration of existing archaeological and built heritage
- v. **Soils, Geology and Hydrogeology** – the consideration of impact on soils, geology and hydrogeology.
- vi. **Landscape and visual** – the consideration of landscape and visual impact.
- vii. **Agronomy** – the consideration of impact on land based enterprise.
- viii. **People** – the consideration of impacts on people
- ix. **Planning** – the consideration of planning and land use policy in relation to proposed works
- x. **Engineering** - the consideration of technical challenges associated with proposed works.
- xi. **Traffic** - the consideration of impact on traffic and road network

The specialists independently assessed each location relative to appraisal criteria applicable to their field of expertise. This process, or methodology, is referred to as Multi-Criteria Analysis and explicitly considers multiple criteria, see Table E11 - 1, within a decision-making environment.

Environmental Criteria	Technical Criteria	Risk Criteria
Biodiversity, Flora and Fauna	Safety	Technical Risk relating to the Source
Fisheries	Planning Policy	Technical Risk relating to Infrastructure and Operations
Water	Engineering and Design	Environmental and Planning Risk
Air/Climatic Factors	Capital and Operational Costs	Financial Risk
Material Assets (Energy)	Sustainability	Socio-economic risk
Cultural Heritage (including Architecture & Archaeology)		
Landscape & Visual		
Material Assets (Land use)		
Tourism		
Population		
Human Health		
Soils, Geology and Hydrogeology		

Table E11 - 1 Appraisal Criteria

The assessments are presented as individual statements within this Appendix E.

This Appendix E11 is a statement on the Tourism criteria and describes the decision making process used in identifying the least constrained abstraction locations associated with the reasonable alternative options.

The Site Selection Methodology in Appendix B outlines the process employed in identifying least constrained locations. This report should be read in conjunction with the *Site Selection Methodology*.

1.2 Methodology

This is ‘Non-linear Site Methodology – Step 1’ as described in the *Site Selection Methodology*.

To effectively determine the least constrained abstraction locations for the reasonable alternative options, the potential abstraction locations were assessed under 2 no. Tourism criteria.

- Potential to impact on known community amenities and facilities within 1km from site boundary.
- Likely Impact from a Fisheries Perspective

A key element of the tourism assessment was a review of the Heritage Council’s Heritage Maps and a review of each of the relevant County Development Plans (CDPs)¹.

¹ For the desalination abstraction locations the relevant development plans were the Dun Laoghaire Rathdown CDP and the Fingal CDP. For the Shannon abstraction locations, the relevant development plans included the Clare County CDP and the North Tipperary CDP.

The assessment linked to and drew upon the review of CDPs by other specialists, namely:

- Landscape and Visual Assessment, which considers potential landscape and visual constraints relating to scenic view designations and landscape character.
- Planning Policy Review, which considered relevant planning and land use considerations as set out in the CDPs

The Ecology assessment was also considered, informing the consideration of potential impact on inshore fishing grounds, based on regional fisheries datasets.

Further details on these referenced assessments can be found in the relevant appendices.

1.2.1 Desk study

A desk study exercise of the potential abstraction locations was carried out using the software package *ArcReader*. The supplied datasets and information are as described in the *Site Selection Methodology*.

1.2.2 Categories of impact

The relative analysis of potential locations to define a “least constrained” location is based upon a subjective assessment by each Specialist in their discipline of expertise. This judgement is presented as weighted impact; colour coded for ready identification.

Very high	Dark blue
High	Blue
Mid range	Green
Low	Light Green
Very low	Cream

2 Lough Derg/Parteen Basin

2.1 Lough Derg/Parteen Basin Locations

An assessment of the potential abstraction locations was carried out for the following options:

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)

The “Lough Derg Sustainable Marina, Recreational & Tourism Development Study” (2008) describes Lough Derg/ Parteen Basin as *“a well-managed activity destination in its own right, which has an international reputation for its natural beauty within the Irish Lakeland’s and Inland Waterways and Shannon areas and retains all of its qualities as an internationally important wetland. It has a reputation for excellence in its activity provision, cultural interest, accommodation and services and excels in providing family holidays and cruising breaks. Water based and wildlife activities are both strong contributors to the local economy.*

Local people and communities benefit from increased visitor activity and are fully engaged in providing activities, hospitality and services for visitors”.

A tourism audit of Lough Derg was carried out in 2012 as part of the “Lough Derg Life at the Lake, A Roadmap for Experience Development and Destination Marketing 2014-2017”. An objective of this audit was to set the overall context for tourism in the area, the key identified strengths and opportunities identified are outlined in Table E11 - 2 below;

	Strengths	Opportunities
Visitor Markets	<p>Easy access from the major inter urban motorways, 200km from Dublin (capital city & major international airport) and 65km from Shannon Airport.</p> <p>There is an approximate 50:50 split between those who have visited previously and those arriving in the regions for the first time.</p>	<p>The Shannon and The West regions, combined, attract around 2 million tourism trips per annum from overseas visitors.</p> <p>The main overseas market is Britain, with Mainland Europe and North America being the other key markets.</p> <p>Less than 1 in 7 travel to the regions as a family group. Most (around 4 in 10) travel alone.</p>
Key Visitor Attractions	<p>The main attractors for Lough Derg are the scenic value and natural resource of the lake and its surrounds in conjunction with the character and services offered by towns such as Killaloe Ballina, Portumna, and Scarriff,</p>	<p>New opportunities include;</p> <ul style="list-style-type: none"> • Improving orientation • Lough Derg cycle trails • Improving lakeside

	Strengths	Opportunities
	<p>and the villages of Mountshannon, Dromineer, Garykennedy and Terryglass.</p> <p>Portumna Forest Park, which is managed by Coillte, is one of the main recreational assets of the area, with the park facilitating safe and secure walking and cycling within an attractive woodland and lakeland setting.</p>	<p>experiences</p> <ul style="list-style-type: none"> • Portroe lookout development • A Lough Derg canoe/ kayak trail • Enhanced facilities at University of Limerick Activity Centre • Lough Derg Activity Map & Natural Heritage Guide
Visitor Activities	<p>Cruise hire is the most popular form of watersport. Other commercial activities include golf and fishing, with 5 golf courses in close proximity to the lake and 4 angling services known to be available, although this figure is likely to be higher for angling.</p> <p>There are a series of walking trails including the Lough Derg Way (which travels from Dromineer to Limerick City via Killaloe Ballina).</p> <p>A series of short trails are available, and it is known that there is an aspiration to develop more trails of this nature. It should be noted that short trails are, by and large, the more popular form of walking trail for visitors.</p> <p>Horse riding appears to be well supported through 7 equestrian centres that reside within the wider area.</p>	<p>There is potential for other watersports including a canoe/ kayak trail.</p> <p>There is one outdoor activity centre on the lake at present, with the University of Limerick Activity Centre (ULAC) supporting predominantly courses and school groups.</p>
Visitor Accommodation	<p>There are an estimated 64 accommodation establishments within the immediate Lough Derg area, the majority of which are small scale B&Bs and self-catering units.</p> <p>Altogether, these bedspaces provide a capacity of 365,000 available bednights for sale annually. Assuming an average occupancy of 40% and an average duration of 2 nights, it can be estimated that over 73,000 tourism trips are made to Lough Derg per annum.</p>	<p>Assuming an average spend of €75 per night, visitors contribute over €10.95 million per annum in direct spend to the local economy.</p> <p>The natural resource of the lake and woodlands would suggest that there are opportunities for alternative types of accommodation such as ecolodges, yurts etc.</p>

Table E11 - 2 Lough Derg & Parteen Basin Reservoir Tourism Strengths and Opportunities²

² Source: *Lough Derg Life at the Lake, A Roadmap for Experience Development and Destination Marketing 2014-2017.*

The continued strength of the local angling market will rely on the preservation of existing fish stocks in the Lough Derg and Parteen basin waterbody.

The capacity of Irish lakes to support fish stocks is largely defined by the extent of the euphotic zone in a particular waterbody. The euphotic zone can be defined as the extent of lake bed area where adequate sunlight levels will accommodate a significant level of plant growth. Due to this requirement, euphotic zones are more developed when water levels are stable and unchanged for long periods.

The consideration of impact associated with abstraction is discussed below.

2.1.1 Slevoir



Figure E11 – 1 **Lough Derg - Slevoir**

The Slevoir location is situated approximately 400m north-west of Carrigahorig Village, south-east of Portumna and north-east of Terryglass, and is currently characterised by agricultural/forestry use.

Figure E11 – 2 highlights tourism facilities and attractions local to and within the Slevoir location.

An abstraction at Slevoir could lead to local destabilisation of water levels, therefore affecting the euphotic zone of this area of the Lough (which is relatively sheltered) and subsequently impacting the support system for localised fish stocks.

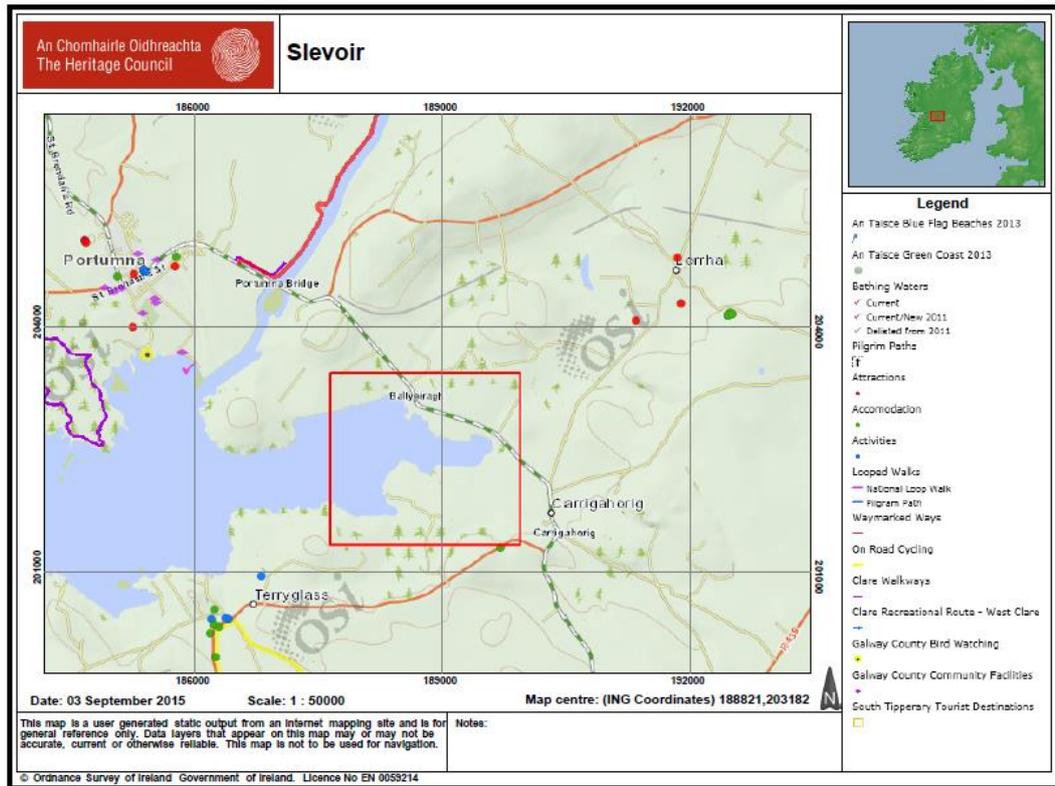


Figure E11 – 2 Tourism facilities and attractions – Slevoir

2.1.2 Mota



Figure E11 – 3 Lough Derg - Mota

The Mota abstraction location study areas contains a lakeside amenity area and marina at Coolbawn, which includes residential development and tourist accommodation.

Approx. 1.3km of the Lough Derg Way walking trail extends through the south-east corner of the study area. More sections of the national trail are within 1km of the study area.

Figure E11 – 2 highlights tourism facilities and attractions local to and within the Mota location.

Given that this abstraction location is located in a natural environment, similar to that of Slevoir above, the same assumptions can be made in regard to the euphotic zones within the Lough and its capacity to negatively impact the support systems of fishery eco-systems.

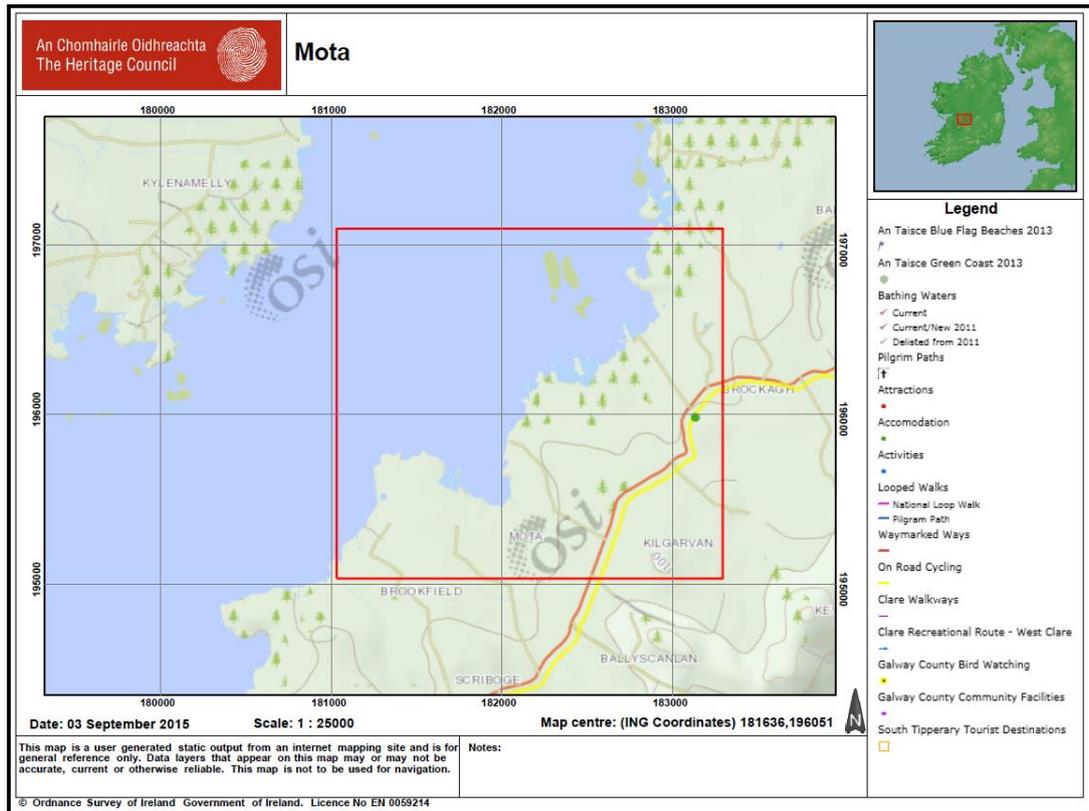


Figure E11 – 4 Tourism facilities and attractions – Mota

2.1.3 Dromineer



Figure E11 – 5 Lough Derg - Dromineer

The Dromineer abstraction location is focused around the small Lakeside settlement of Dromineer. Contained within the settlement is the Lough Derg Yacht Club, several marinas and a promenade at the lake edge with commercial and residential development setback slightly from the lough.

Approx. 1.7km of the Lough Derg Way walking trail is within the study area.

The Settlement Plan for Dromineer village includes zoning for tourism and it's objectives is encourage the development of tourism facilities.

Figure E11 – 2 highlights tourism facilities and attractions local to and within the Dromineer location.

Given that this abstraction location is located in a natural environment, similar to that of Slevoir and Mota above, the same assumptions can be made in regard to the euphotic zones within the Lough and its capacity to negatively impact the support systems of fishery eco-systems.

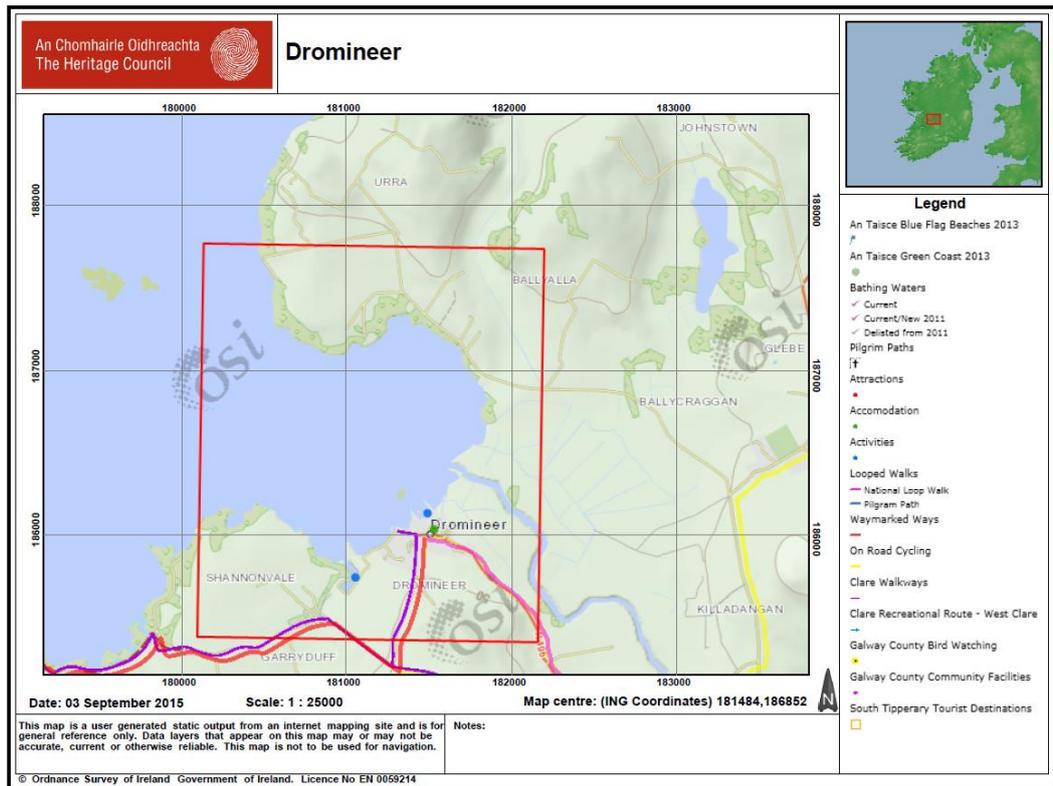


Figure E11 – 6 Tourism facilities and attractions – Dromineer

2.1.4 Youghal



Figure E11 – 7 Lough Derg - Youghal

The abstraction location at Youghal is focused around the head of Youghal Bay. There are several dispersed settlements lining the local roads in the vicinity, these include Youghal Village and the settlement at Ballyvaughan. There are small marinas and dedicated swimming locations associated with each of the settlements.

Approx. 5.4 km of Lough Derg walking trails within the study area to the north and south, respectively.

Figure E11 – 2 highlights tourism facilities and attractions local to and within the Youghal location.

Given that this abstraction location is located in another natural environment, similar to that of Slevoir above, the same assumptions can be made in regard to the euphotic zones within the Lough and its capacity to negatively impact the support systems of fishery eco-systems.

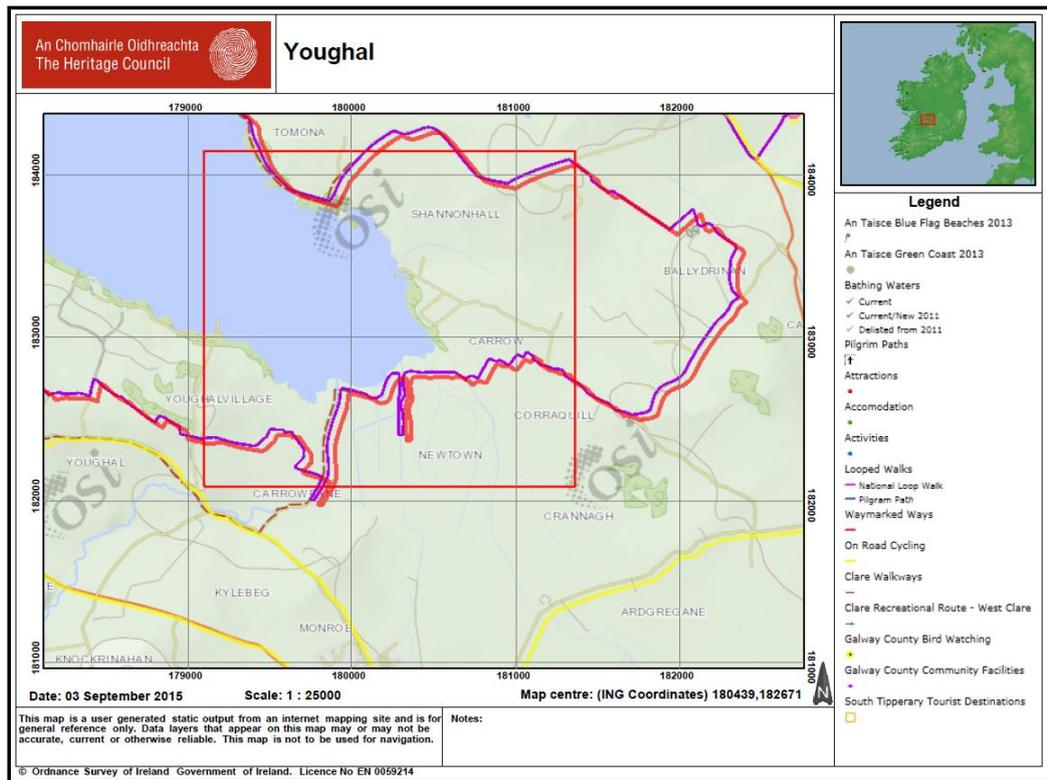


Figure E11 – 8 Tourism facilities and attractions – Youghal

2.1.5 Parteen Basin Reservoir

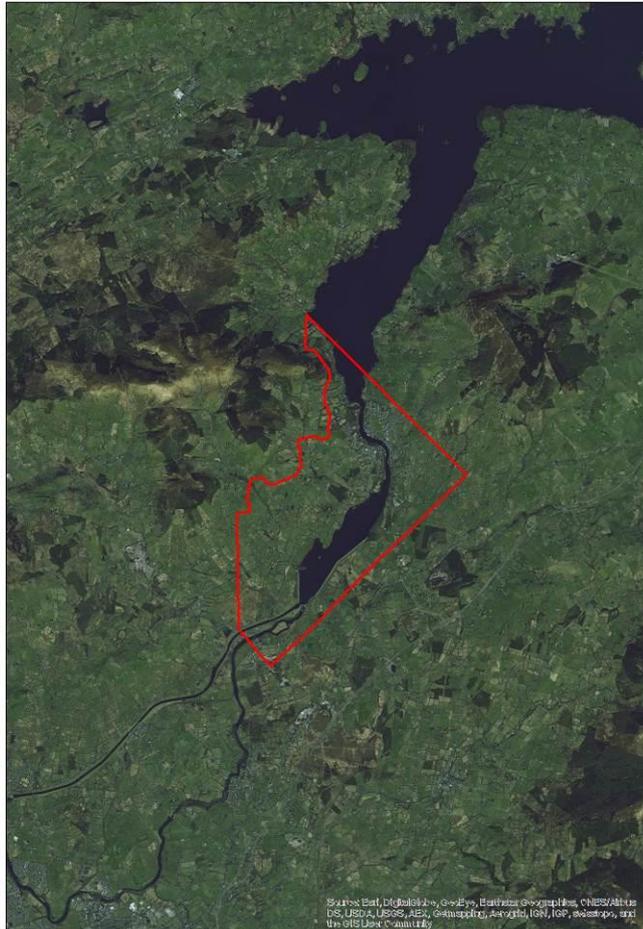


Figure E11 – 9 Parteen Basin Reservoir

At the northern end of the Parteen abstraction option location are the twin settlements of Killaloe and Ballina on opposite sides of the Shannon in County Clare and County Tipperary respectively. These are popular tourist and amenity settlements.

Both the Lough Derg Way and the East Clare Way, which are national way-marked walking routes, pass through this location converging on the settlements of Killaloe and Ballina at the northern end of the Parteen Basin.

Figure E11 – 2 highlights tourism facilities and attractions local to and within the Parteen location.

In contrast to the Lough Derg locations above, Parteen Basin is a man-made reservoir designed to service the hydroelectric dam at Ardnacrusha. As a result, this man-made environment is already subject to substantial and unnatural fluctuations in water-levels and therefore there is a lack of euphotic zones within this waterbody. Due to the lack of euphotic zone in this locality, is unlikely that fishery levels will be affected as a result of an abstraction facility in this location.

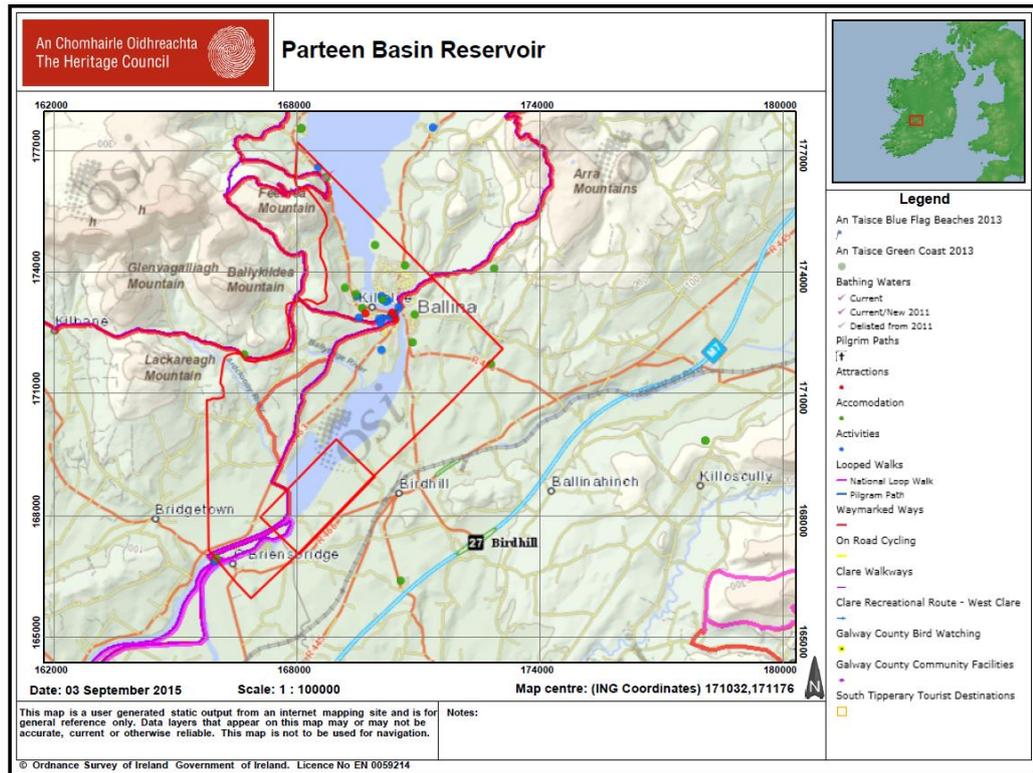


Figure E11 – 10 Tourism facilities and attractions – Parteen Basin Reservoir

2.2 Matrix of Multi Criteria Analysis

Criteria	Slevoir	Mota	Dromineer	Youghal Bay	Parteen Basin
Potential to impact on known community amenities and facilities within 1km from site boundary.	n/a	Approx. 1.3km of national walking trail extends through the south-east corner of the study area. More sections of the national trail are within 1km of the study area.	Approx. 1.7km of the national walking trail within the study area, bending back on itself. More sections of the national trail are within 1km of the study area.	Approx. 1.6 and 3.8km of the national walking trail are within the study area to the north and south, respectively. More of the trail lies within 1km of the study area.	Approx. 15.4km of the national trail lies within the study area, with more lying within 1km of it.
Likely Impact from a Fisheries Perspective	Likely to have a very high/high negative impact as a result of impact on euphotic zones within the Lough Derg waterbody.	Likely to have a very high/high negative impact as a result of impact on euphotic zones within the Lough Derg waterbody.	Likely to have a very high/high negative impact as a result of impact on euphotic zones within the Lough Derg waterbody.	Likely to have a very high/high negative impact as a result of impact on euphotic zones within the Lough Derg waterbody.	Likely to have little or no positive or negative impact on fisheries perspective as a result of lack of existing euphotic zones and other fishery support systems in Parteen Basin.

2.3 Comparative Discussion

In respect of the Shannon abstraction location options, there is a strong sense of lakeside tranquillity and amenity. Small lakeside villages and amenity areas consisting of marinas and swimming jetties can be found along most sections of Lough Derg.

It is considered that the most constrained location is the Dromineer location due to the village of Dromineer which offers lakeside amenity and recreational facilities. There are also two designated scenic routes within this location and a section of the Nina cycle loop.

The next most constrained location is considered to be Mota as it also has a lakeside amenity area at Coolbawn Quay. It has a section of designated scenic route along the south also. This is followed by Youghal with 5.4 km of Lough Derg walking trails passing through this location. There are also several small marinas and swimming jetties punctuating the riparian vegetation along the shores of the Lough at this location.

It is considered that the least constrained location regarding tourism is Parteen Basin Reservoir. Although a number of potentially significant constraints are present in the Parteen Basin Reservoir location, it is important to remember that the location up for consideration is much larger than the other Shannon abstraction options. In this instance the constraints predominantly relate to the northern end of the Parteen location in the vicinity of the tourist settlements of Killaloe and Ballina at the southern end of Lough Derg. By contrast, the southern end of the Parteen location is much less constrained, particularly on the eastern side, which is contained within North Tipperary. In addition, the potential for impact on the angling market is considered to be much reduced at the Parteen Basin Reservoir location.

3 Desalination

3.1 Desalination Locations

An assessment of the potential abstraction locations was carried out for the following options:

- Option H (Desalination)

3.1.1 South Dublin

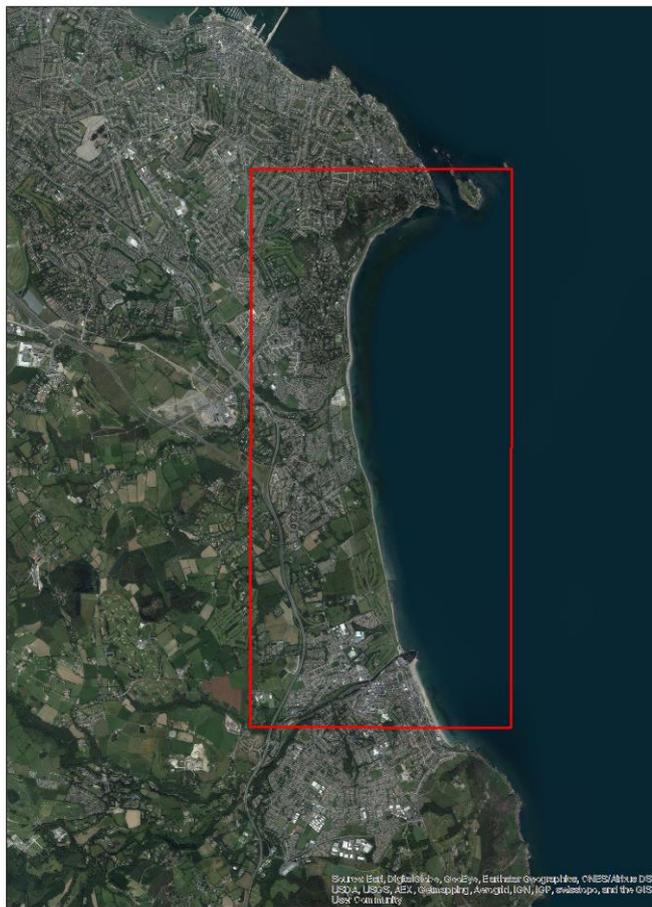


Figure E11– 11 South Dublin

The South Dublin option is the largest of the potential desalination locations, stretching from Dalkey Island in the north to Bray Harbour at its southern extents. It takes in a combination of steep rocky shoreline at the northern end and a flatter pebble beach towards the southern end. This is also a highly urbanised area with the considerable residential development of South County Dublin’s suburbs occurring immediately inland of the coastline.

Killiney beach to the north of the Study Area is a stony beach about 800m in length, sheltered and suitable for bathing, swimming and surfing. Killiney Beach has been awarded a Blue Flag for the past two years.

The Blue Flag is operated in Ireland by An Taisce-The National Trust for Ireland on behalf of the Foundation for Environmental Education (FEE). The Blue Flag is one of the world's most recognised eco-labels. Beaches and marinas that achieve this accolade must comply with a specific set of criteria relating to water quality, information provision, environmental education, safety and beach management.

A number of other beaches are located within the Study Area also, including Shankill Beach, Corbawn Beach and Bray South Promenade Beach, these currently do not hold Blue Flag status.

Bray Sailing Club is based in Bray's harbour about 1.5 miles north of the prominent Bray Head. The harbour is located at the outlet of the River Dargle which flows along its North wall with an outgoing stream throughout the tidal cycle.

Approximately 1 km of The Dublin Mountains Way walking trail is within the study area, across the mountains from Shankill in the east to Tallaght (Sean Walsh Park) in the west, in all approximately 40 kilometres of trail. The entire route from Shankill to Tallaght is now fully waymarked. This route will be classified as one of the national waymarked ways and is waymarked with the standard yellow walking man symbol.

Figure E11 – 2 highlights tourism facilities and attractions local to and within the South Dublin location.

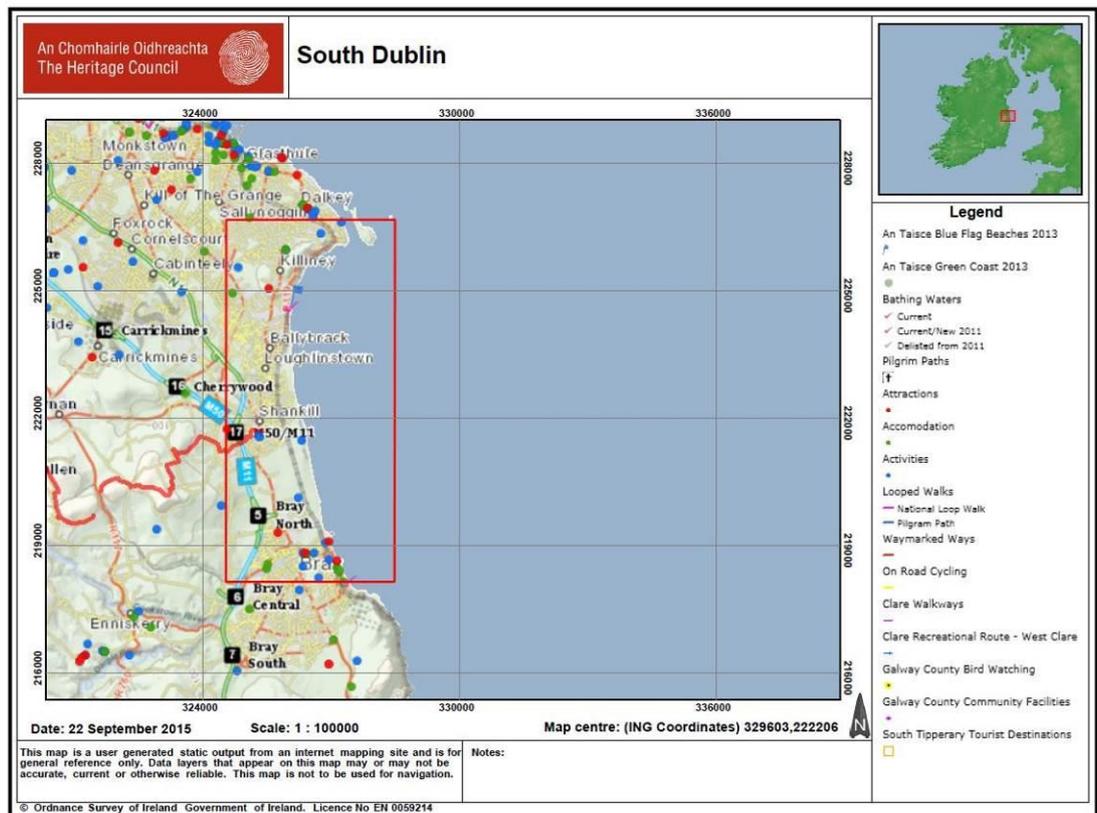


Figure E11 – 12 Tourism facilities and attractions – South Dublin

3.1.2 Loughshinny North



Figure E11 – 13 Loughshinny North

Loughshinny is an attractive seaside village with a beach, a harbour, a circular Millennium Walk and traditional seaside vernacular buildings. It is a predominantly residential settlement with limited services.

The Fingal Development Plan 2011 – 2017 includes the following development strategy for Loughshinny “Consolidate and strengthen the village core, providing for and facilitating mixed-use development including restaurants, cafes, art and cultural uses within the harbour area. All redevelopment within the village should protect and enhance its scenic landscape setting and ensure high quality urban design appropriate to its seaside location”

Loughshinny Beach is located south of the Loughshinny north Study Area, this beach has not been awarded a blue flag since 1996. The fishing spot at Loughshinny is located approximately 150m south of the Loughshinny South Study Area also, to the east of Loughshinny beach

Loughshinny Beach and the fishing spot of Loughshinny are located approx. 360m and 390m north of the Loughshinny North Study Area, respectively.

Figure E11 – 14 highlights tourism facilities and attractions local to and within the Loughshinny North location.

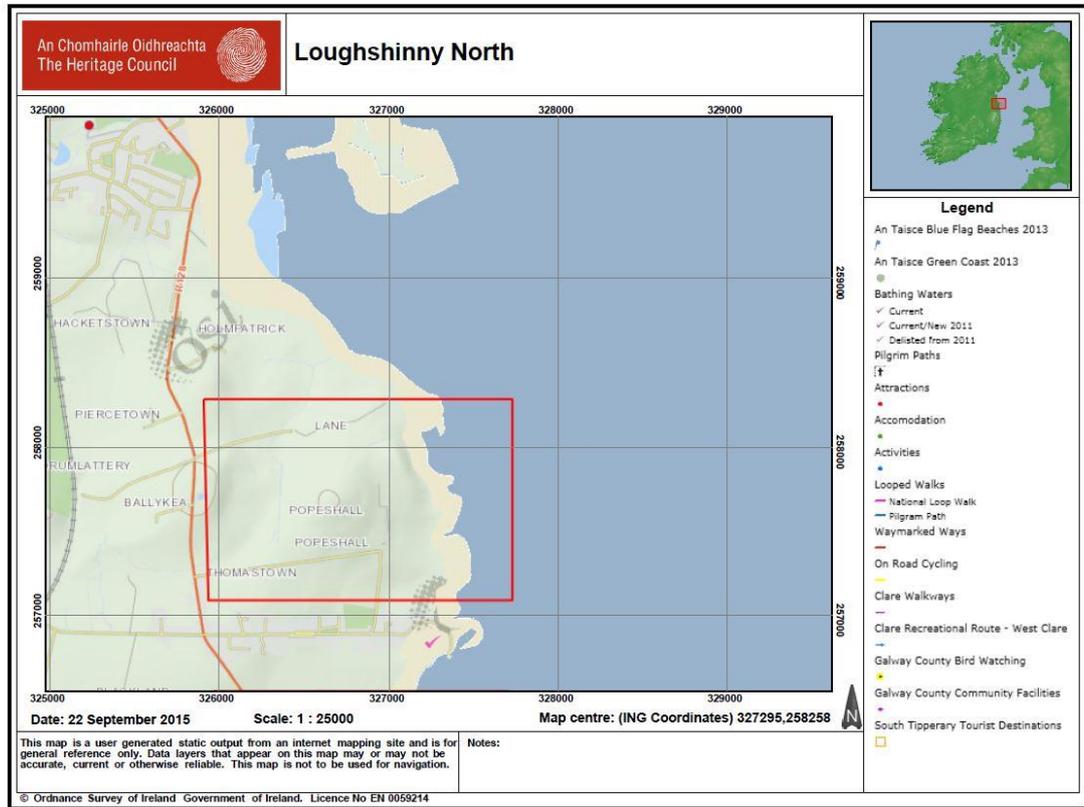


Figure E11 – 14 Tourism facilities and attractions – Loughshinny North

3.1.3 Loughshinny South



Figure E11 – 15 Loughshinny South

Loughshinny is an attractive seaside village with a beach, a harbour, a circular Millennium Walk and traditional seaside vernacular buildings. It is a predominantly residential settlement with limited services.

The Fingal Development Plan 2011 – 2017 includes the following development strategy for Loughshinny “Consolidate and strengthen the village core, providing for and facilitating mixed-use development including restaurants, cafes, art and cultural uses within the harbour area. All redevelopment within the village should protect and enhance its scenic landscape setting and ensure high quality urban design appropriate to its seaside location”

Loughshinny Beach is located approximately 180m south of the Loughshinny South Study Area, this beach has not been awarded a blue flag since 1996. The fishing spot at Loughshinny is located approximately 150m south of the Loughshinny South Study Area also, to the east of Loughshinny beach

Loughshinny Beach and the fishing spot of Loughshinny are located north of the Loughshinny South Study Area, respectively.

Figure E11 – 16 highlights tourism facilities and attractions local to and within the Loughshinny South location.

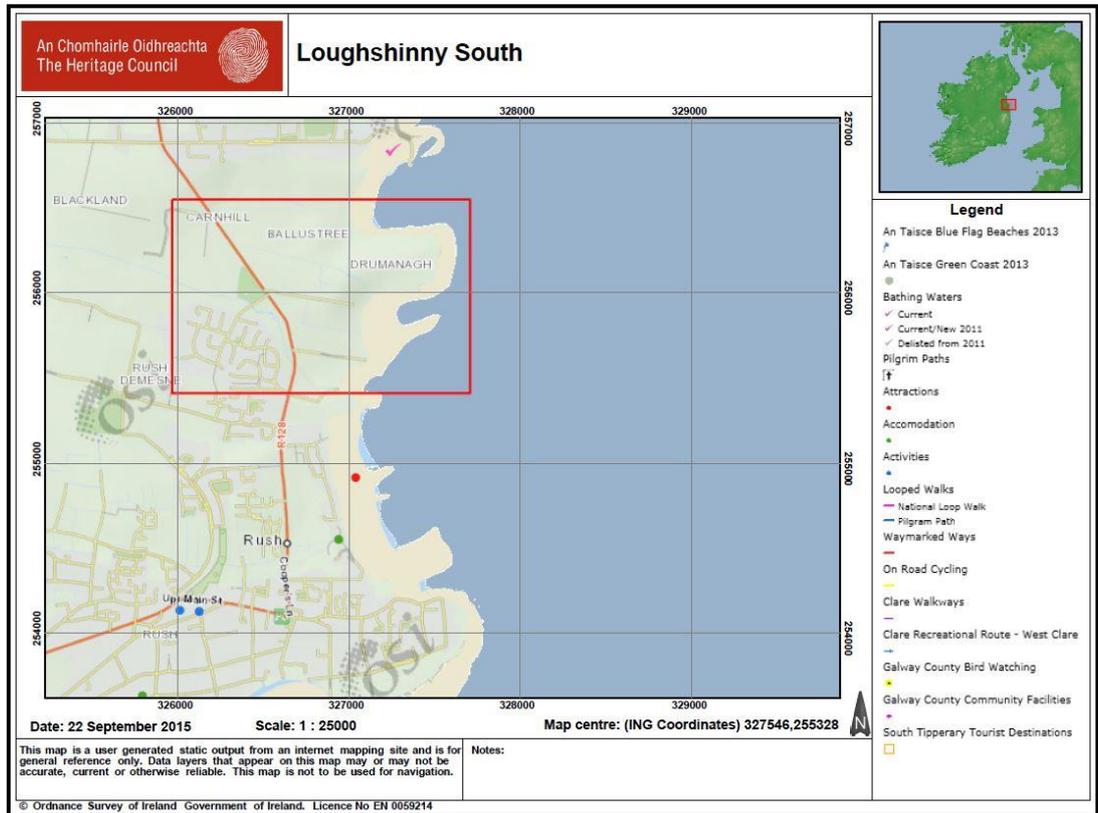


Figure E11 – 16 Tourism facilities and attractions – LoughShinny South

3.1.4 Balbriggan



Figure E11 – 17 Balbriggan

Balbriggan is a coastal town about thirty five kilometres north of Dublin City. Balbriggan has a number of places of interest including a traditional fishing harbour, beside which is a beach overlooked by a Martello Tower. The Railway Viaduct, a strong visual landmark in Balbriggan, was built in 1844, as part of the Dublin to Drogheda railway.

Balbriggan is a rapidly expanding town which has experienced significant residential and commercial development over the past 10 years. Balbriggan has considerable tourism potential in terms of its natural and built heritage and amenities, particularly its coastal location with its sandy beach and harbour.

The Fingal Development Plan 2011 – 2017 includes the following development strategy for Balbriggan “Consolidate and regenerate the town in line with its designation as a Large Growth Town and a secondary economic growth town in the Regional Planning Guidelines. Development will focus on the town becoming a commercial, industrial, retailing and social centre providing for the needs of its developing community and promoting the growth of sustainable local employment in the industry, service and tourism sectors.”

The fishing spot at the Delvin River Mouth is located approx. 970m north-west of the study area and the fishing spot at Balbriggan is located approximately 760m south-east of the study area.

Figure E11 – 18 highlights tourism facilities and attractions local to and within the Balbriggan location.

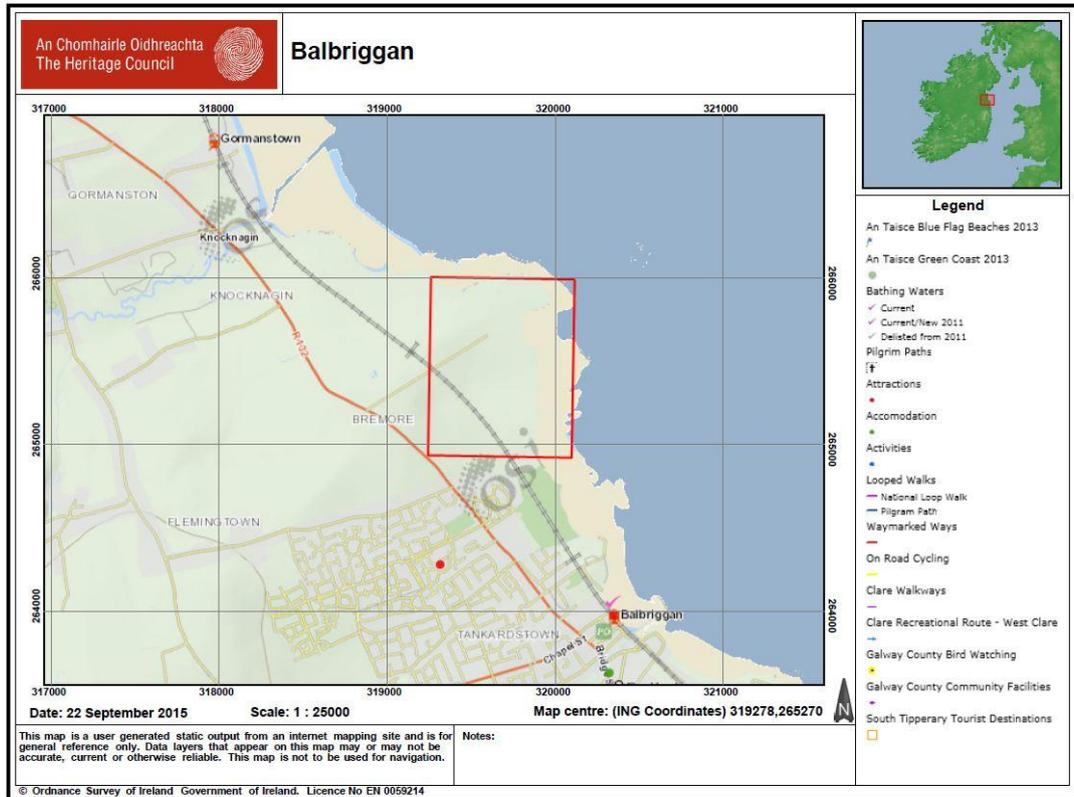


Figure E11 – 18 Tourism facilities and attractions – Balbriggan

3.2 Matrix of Multi Criteria Analysis

Criteria	South Dublin	Loughshinny North	Loughshinny South	Balbriggan
Potential to impact on known community amenities and facilities within 1km from site boundary.	<p>Approx. 1 km of the national trail is within the study area.</p> <p>A number of beaches are located close by, with Killiney Beach awarded a blue flag for the past two years.</p>	<p>Loughshinny Beach is closely and has not been awarded a blue flag since 1996.</p> <p>The fishing spot at Loughshinny is close by.</p>	<p>Rush South Beach has not been awarded a Green Coast award since 2011.</p> <p>Loughshinny Beach and the fishing spot of Loughshinny are located close by.</p>	<p>The fishing spots at Delvin River Mouth and Balbriggan are close by.</p> <p>The fishing port at Balbriggan brings in demersal fish and shellfish.</p>

3.3 Comparative Discussion

Three of the locations are in the rural area of Fingal County Council. The Council's policies with respect to tourism, open space, rural related activities and greenbelts, must be considered when choosing a site at the next stage.

The South Dublin location, being within the urban and metropolitan area of Dublin is considered to be the least constrained from a tourism perspective. This position is influenced by the assumption that a suitable site can be found in the region that will help minimise impact on the visual characteristics of this region and, by extension, impact on the experience of visiting tourists.

Water Supply Project Eastern and Midlands Region (WSP)

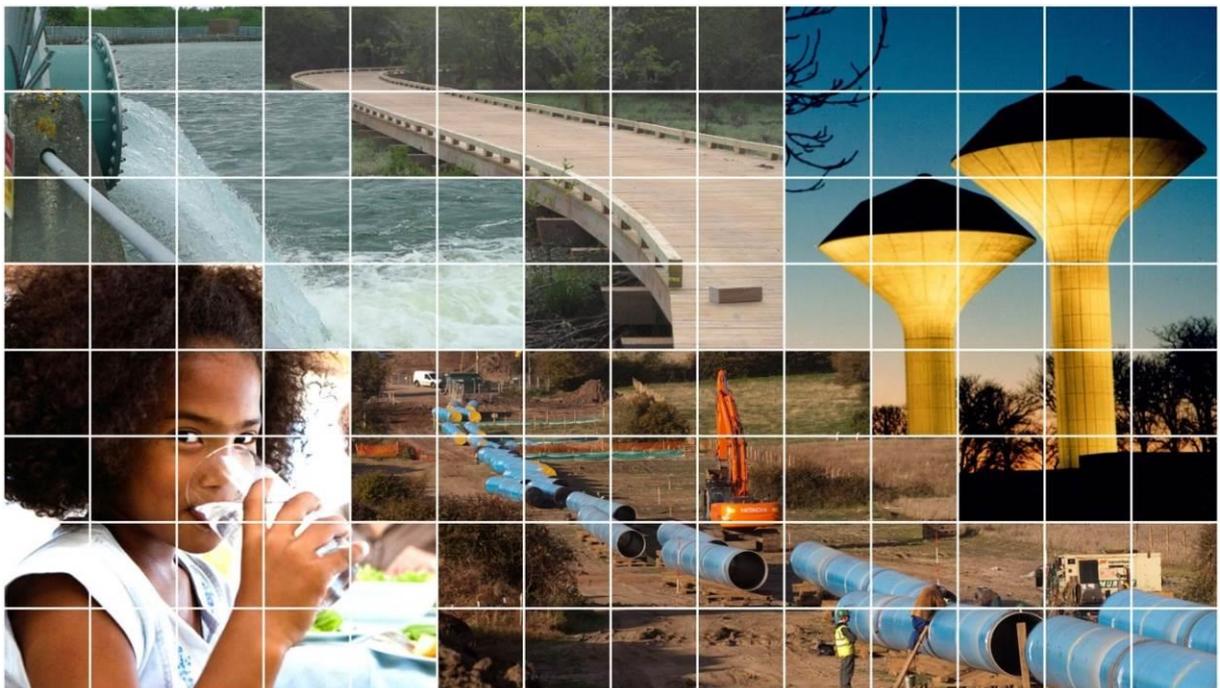
Abstraction Location MCA

Appendix E12: Soils, Geology and Hydrogeology



October 2015

F02



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1.1 Introduction

Four reasonable alternative options have been identified from previous studies – refer to the *Water Supply Options Working Paper* (Project Road Map Stage 2). These are reconfirmed below.

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)
- Option H (Desalination)

This report describes the decision making process used to appraise the abstraction locations associated with each of the reasonable alternative options.

To undertake the appraisal of abstraction locations a range of specialists were engaged, in their applicable fields, to conduct a comparative assessment of abstraction locations. The following disciplines were engaged:

- i. **Ecology** – the consideration of impact on animals, plants and their environment.
- ii. **Water** – the consideration of impacts on the surface water environment.
- iii. **Air and Noise** - the consideration of air and noise pollution
- iv. **Cultural Heritage** - the consideration of existing archaeological and built heritage
- v. **Soils, Geology and Hydrogeology** – the consideration of impact on soils, geology and hydrogeology.
- vi. **Landscape and visual** – the consideration of landscape and visual impact.
- vii. **Agronomy** – the consideration of impact on land based enterprise.
- viii. **People** – the consideration of impacts on people
- ix. **Planning** – the consideration of planning and land use policy in relation to proposed works
- x. **Engineering** - the consideration of technical challenges associated with proposed works.
- xi. **Traffic** - the consideration of impact on traffic and road network

The specialists independently assessed each location relative to appraisal criteria applicable to their field of expertise. This process, or methodology, is referred to as Multi-Criteria Analysis and explicitly considers multiple criteria (see Table E12 - 1), within a decision-making environment.

Environmental Criteria	Technical Criteria	Risk Criteria
Biodiversity, Flora and Fauna	Safety	Technical Risk relating to the Source
Fisheries	Planning Policy	Technical Risk relating to Infrastructure and Operations
Water	Engineering and Design	Environmental and Planning Risk
Air/Climatic Factors	Capital and Operational Costs	Financial Risk
Material Assets (Energy)	Sustainability	Socio-economic risk
Cultural Heritage (including Architecture & Archaeology)		
Landscape & Visual		
Material Assets (Land use)		
Tourism		
Population		
Human Health		
Soils, Geology and Hydrogeology	Engineering and Design	Environmental and Planning Risk

Table E12 - 1 Appraisal Criteria

The assessments are presented as individual statements within this Appendix E.

This Appendix E12 is a statement on the specialism Soils, Geology and Hydrogeology and describes the decision-making process used in identifying the least constrained abstraction locations associated with the reasonable alternative options.

The Site Selection Methodology in Appendix B outlines the process employed in identifying least constrained locations. This Soils, Geology and Hydrogeology report should be read in conjunction with the *Site Selection Methodology*.

1.2 Methodology

This is ‘Non-linear Site Methodology – Step 1’ as described in the *Site Selection Methodology*.

To determine effectively the least constrained abstraction locations for the reasonable options identified, the potential abstraction locations were assessed under fourteen Soils, Geology and Hydrogeology sub-criteria.

- Aquifer Classification - importance of the groundwater resource to a given area
- Vulnerability Classification - potential for groundwater contamination
- GSI Groundwater Protection Response matrix
- Groundwater Supplies - identification of water supply springs and bored wells based on GSI, EPA and FCC records
- Groundwater Source Protection Areas and Zones of Contribution as per available GSI and EPA data
- Potential to impact on Geological Heritage Sites / County Geological Sites

- Potential to interact with contaminated land
- Potential to sterilise mineral resource
- Potential to encounter shallow bedrock during construction (interactions with other disciplines during construction - noise, dust etc.)
- Potential impact on karst features
- Potential to encounter soft ground
- Soils Types
- Sub Soil Types
- Depth to rock.

The assessment of the various locations was completed using relevant Soils, Geology and Hydrogeology databases sourced from the Geological Survey of Ireland (GSI), the Environmental Protection Agency (EPA) and local authority datasets and County Development Plans.

Both desktop studies and site visits were undertaken to inform this assessment.

1.2.1 Desk study

A desk study exercise of the potential abstraction locations was carried out using the software package *ArcReader*. The supplied datasets and information are as described in the *Site Selection Methodology*.

1.2.2 Categories of impact

The relative analysis of potential locations to define a “least constrained” location is based upon a subjective assessment by each Specialist in their area of expertise. This judgement is presented as weighted impact; colour coded, as illustrated below, for ready identification.

Very high	Dark blue
High	Blue
Mid-range	Green
Low	Light Green
Very low	Cream

Each location option is assessed in terms of the number of geological/hydrogeological constraints in each area and the significance of each constraint. The constraints are identified by assessing the area using the sub-criteria listed above.

The constraints that will be of most relevance for Soils, Geology and Hydrogeology are those that may potentially result in a negative impact on the local and/or regional geological and hydrogeological environment during the construction and/or operational phases of the development.

A “significant” constraint is described as a feature or area that has been identified as being particularly vulnerable to disturbance (e.g. peatland or an important groundwater aquifer) or may have recognised value or importance (e.g. a Geological

Heritage Site) and that may potentially be impacted by the proposed development. The constraint is significant if it is confirmed that the impact will be considerable and that it will be difficult to propose and implement mitigation measures to negate the identified potential impact.

Disturbance to features, such as peatland or bog, might result in the release of elevated suspended solids downstream of the development during the construction phase. It also might be preferable to avoid construction in an area identified as having Extreme Groundwater Vulnerability overlying a Regionally Important Karstified Aquifer.

Another example is the identification of a small area of karst on the GIS viewer which will be identified as a constraint as there may be the potential for impact on at least one karst feature in that area during construction. This impact may cause direct contamination of the underlying, potentially vulnerable groundwater aquifer, or an associated downstream habitat.

2 Abstraction - Lough Derg/Parteen Basin

2.1 Abstraction Locations

An assessment of the potential abstraction locations was carried out for the following options:

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)

2.1.1 Slevoir



Figure E12- 1 Lough Derg - Slevoir

The Slevoir location is at the north-eastern end of Lough Derg near the small lakeside settlement of Terryglass. The landform in this area is gently rolling and the land cover consists of managed farmland interspersed with areas of marshland and woodland at the edge of the Lough. This is a sparsely populated area with occasional dwellings, dispersed along local roads and the R493 regional road. The N65 National Secondary route also passes through the north-eastern portion of this location.

The geology in this area is primarily comprised of Cutover Bog and Till with some Rock Outcrop (near the lake edge) overlying a Limestone and Shale bedrock. The underlying aquifer is described as a Locally Important Aquifer (LI) - bedrock which is Moderately Productive only in Local Zones.

No significant constraints, as described in Section 1.2.2 above, were identified at the Slevoir Location.

No Irish Geological Heritage sites were recorded within this study area; however the boundary of the North Tipperary Crags and Tails County Geological Site (CGS) is, as yet, not fully defined in relation to this project and may extend towards Lough Derg. A number of crag and tail landforms are located in the study area.

Although there is potential for areas of High to Moderate vulnerability to be encountered during the construction phase where depth to bedrock is shallow, best practice construction methodologies will largely mitigate the potential for impact.

Best practice construction methods will include the development of a Construction Environmental Management Plan (CEMP) for the project. Measures to address the potential impact of a number of activities on site including the use of fuel on site, the disturbance and on-site stock-piling of overburden, use of machinery on site and preferred seasonal working conditions will be included in the CMP. The potential for encountering shallow bedrock is described as Low.

There is a high possibility that soft ground, including areas of cutover peat and possible intact peat, will be encountered within this location.

There is a moderate possibility that soft ground, including areas of lacustrine soils, will be encountered within this study area.

2.1.3 Dromineer



Figure E12 – 3 Lough Derg - Dromineer

The Dromineer abstraction location is focused around the small lakeside settlement of Dromineer. Contained within the settlement is the Lough Derg Yacht Club, several marinas and a promenade at the lake edge with commercial and residential development setback slightly from the lake. Beyond the immediate setting of the settlement is a patchwork of fields that are frequently surrounded by mature tree-lined boundaries and woodlands. There are a number of stately houses and demesnes in the vicinity. Areas of woodland also flank the shores of Lough Derg in this area. The R495 regional road enters Dromineer from the east.

The geology in this area is primarily comprised of Till, Rock Outcrop and areas of Made Ground and Alluvial Soils (near the lake edge) overlying Waulsortian Limestone bedrock with areas of cherty limestone to the north and west of the area. The underlying aquifer is described as a combination of locally important aquifers (bedrock which is Moderately Productive only in Local Zones) and poor aquifers (bedrock which is Generally Unproductive except for Local Zones).

No significant constraints, as described in Section 1.2.2 above, were identified at the Dromineer Location.

areas of Sandstone bedrock. The underlying aquifer is described as a Locally Important Aquifer (LI) - bedrock which is Moderately Productive only in Local Zones.

No significant constraints, as described in Section 1.2.2 above, were identified at the Youghal Location.

No Irish Geological Heritage sites were recorded within this study area.

Where depth to bedrock is shallow, there is the potential to encounter areas of Moderate vulnerability during the construction phase of the development.

Although the potential for encountering shallow bedrock is Low, as described in Section 2.1.1., best practice construction methodologies will largely mitigate the potential for impact.

There is a moderate possibility that soft ground, including areas of lacustrine soils, will be encountered within this study area.

2.1.5 Parteen Basin Reservoir



Figure E12 – 5 Parteen Basin Reservoir

This is the largest location considered in respect of the five Shannon options. It takes in the southern reaches of Lough Derg and all of the Parteen Basin. At the northern end of this location are the twin settlements of Killaloe and Ballina on opposite sides of the Shannon in County Clare and County Tipperary respectively.

These are popular tourist and amenity settlements. To the south of the settlements is a rural landscape surrounding both sides of the Parteen Basin Reservoir that consists largely of fields and hedgerows, with some areas of woodland.

The eastern side of the reservoir consists of a linear constructed embankment and diverted channel for the Kilmustulla River, which forms part of the works required for the Parteen Weir and the associated Ardnacrusha Headrace. These features were constructed as part of a hydroelectric power scheme at Ardnacrusha. By comparison, the western side of the Parteen Basin Reservoir has a more natural shoreline.

The geology in this area is comprised of a combination of Sandstone and Shale Tills, Alluvial Soils, Sands and Gravels and some Rock Outcrop overlying a Limestone and Sandstone bedrock. The underlying aquifer is described as a Locally Important Aquifer (LI) - bedrock which is Moderately Productive only in Local Zones.

No significant constraints, as described in Section 1.2.2 above, were identified at the Parteen Basin location.

No Irish Geological Heritage sites were recorded within this study area.

There is potential for areas of High to Low vulnerability to be encountered during the construction phase where depth to bedrock is shallow. However, best practice construction methodologies, as described in Section 2.1.1. above, will largely mitigate the potential for negative impact. The potential for encountering shallow bedrock is Moderate to High to the north east of Parteen and Low to south west.

There is a high possibility that soft ground will be encountered to the south of the study area.

2.2 Matrix of Multi Criteria Analysis

Criteria	Slevoir	Mota	Dromineer	Youghal Bay	Parteen Basin
Aquifer Classification - importance of the groundwater resource to a given area	Low potential impact.	Low potential impact.	Low potential impact.	Low potential impact.	Low potential impact.
Vulnerability Classification - potential for groundwater contamination	Mid-range vulnerability.	High Vulnerability.	Mid-range vulnerability.	Mid-range vulnerability.	Mid-range vulnerability.
GSI Groundwater Protection Response matrix	No data available for this area	No data available for this area.	No data available for this area.	No data available for this area.	No data available for this area.
Groundwater Supplies - identification of water supply springs and bored wells based on GSI, EPA and FCC records	No features identified in this area.	2 Features identified: Conlan Borehole, Ballinderry Spring	No features identified in this area.	No features identified in this area.	No features identified in this area.
Groundwater Source Protection Area's and Zones of Contribution as per available GSI & EPA data	None within the vicinity of Slevoir (Lorrha 1km NE of Slevoir).	None within the vicinity of Mota.	None within the vicinity of Dromineer.	None within the vicinity of Youghal Bay.	None within the vicinity of Parteen Basin.
Potential to impact on Geological Heritage Sites / County Geological Sites	North Tipperary Craggs and Tails CGS (possible NHA) near Slevoir	No potential impact identified.	No potential impact identified.	No potential impact identified (the nearest CGS is located 3.6km SW of Youghal Bay - Slate Quarries).	No potential impact identified (the nearest CGS is located 6km NE of Parteen Basin- Slate Quarries).
Potential to interact with contaminated land	Low potential.	Low potential.	Low potential.	Low potential.	Low potential.
Potential to sterilise mineral resource	Low potential.	Low potential.	Low potential.	Low potential.	Low potential.
Potential to encounter shallow bedrock during construction (interactions)	Low potential.	High possibility (but mitigation measures can be	Mid-range potential.	Mid-range potential.	Mid-range to the north/NE of Parteen, low to the

with other disciplines during construction - noise, dust etc)		implemented to reduce the impact).			south/west.
Potential impact on karst features	Low potential.	Low potential.	Low potential.	Low potential (springs identified at Youghal).	Low potential.
Potential to encounter soft ground	High possibility.	Mid-range possibility.	High possibility.	Mid-range possibility.	High possibility.
Soils Types	Peaty soils mainly – potential for increased suspended solids in runoff if disturbed during construction.	Well drained soils with some minor alluvial (rock close to surface to east).	Lacustrine type soils mainly with some well drained soils.	Alluvial Soils.	Alluvial, rock close to surface to the north.
Sub Soil Types	Cutover peat and some possible intact peat.	Mainly Till with some Alluvial.	Lacustrine type soils mainly with some till.	Alluvial soils with Till to north and south of bay.	Mainly Alluvial.
Depth to rock	<3 to >5m Deepest to the centre of the Bay.	<3m along most of the shore.	>10 reducing to 3m to the north and south of bay.	5 to 10m.	>5.

2.3 Comparative Discussion

No significant constraints were identified at the Lough Derg/Parteen Basin Locations which would result in a recommendation to cease further consideration of any one location.

In general, it is considered that the potential impact on Soils, Geology and Hydrogeology features at each location as a result of the proposed development is low.

However, a number of potential constraints have been identified at each location which, when combined, result in a preference for individual sites with respect to Soils, Geology and Hydrogeology.

Slevoir Bay is identified as an option which has a potentially high level of peat or cutover bog on the surface, which could result in difficult ground conditions during the construction stage. Areas of cutover bog may also result in sediment laden run-off water entering nearby water features during construction. In addition, a County Geological Site (CGS) (crag and tail landforms) may extend towards Lough Derg in this area. Further consultation with the Geological Survey of Ireland (GSI) will be required in order to define the extent of this feature.

The Mota option is located in an area where there are potentially large areas of shallow bedrock (susceptible to contamination from works on the surface) and the underlying groundwater aquifer is classified as being of Extreme to High Vulnerability. There are also two borehole and spring features identified in this area.

The constraints identified at Dromineer, Youghal Bay and Parteen Basin are very similar and are not significant with respect to Soils, Geology and Hydrogeology. There are no Geological Heritage Sites in the vicinity of these options. Areas of potentially soft ground (lacustrine, alluvial soils) have been identified at each location.

The Dromineer area includes a defined area of Made Ground (a marina, promenade, residential and commercial settlement). The area of Made Ground is established and should be avoided.

In summary, based on the identification of areas of cutover peat and possible intact peat in a number of locations; Slevoir Bay and Mota are the least preferred options. There is no significant difference between the constraints identified at Dromineer, Youghal Bay or Parteen (with the exception of an area of Made Ground at Dromineer which should be avoided due to established use).

3 Desalination

3.1 Desalination Locations

An assessment of the potential abstraction locations was carried out for the following options:

- Option H (Desalination)

The proposed desalination locations assessed within this report are as follows:

- Irish Sea –South Dublin, Loughshinny North, Loughshinny South and Balbriggan

3.1.1 South Dublin

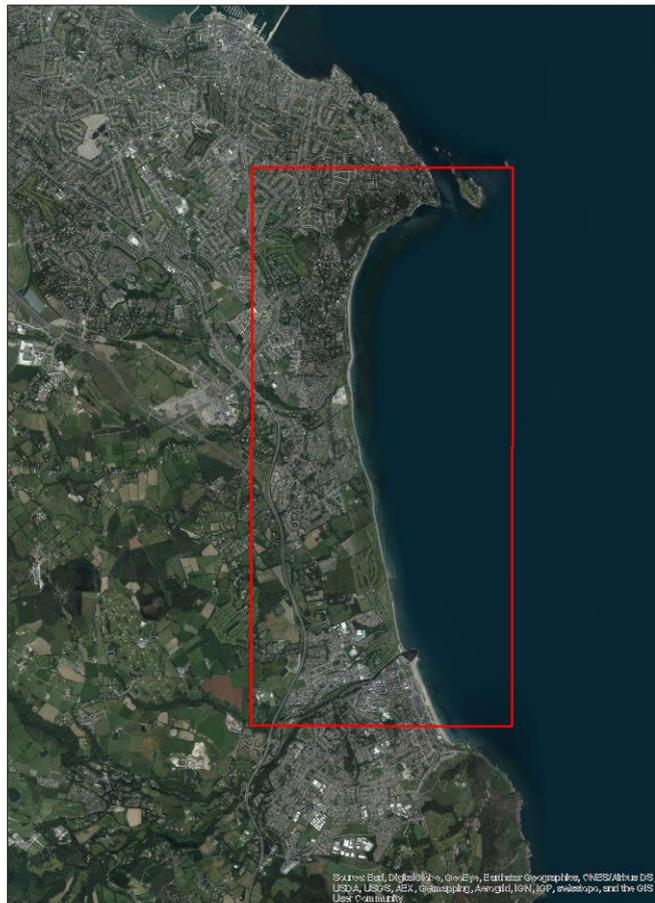


Figure E12 – 6 South Dublin

The South Dublin option is the largest of the potential desalination locations, stretching from Dalkey Island in the north to Bray Harbour at its southern extents. It takes in a combination of steep rocky shoreline at the northern end and a flatter pebble beach towards the southern end. This is also a highly urbanised area with the considerable residential development of South County Dublin’s suburbs running right up to the coastline. The subject section of coastline is also navigated by the

main railway line that serves south Dublin commuters (DART) and links Dublin to the south-east of the country. The Shanganagh wastewater treatment facility also lies close to the coastline near the central portion of this location at Shankill, near Bray.

The geology in this area is primarily comprised of made ground, with small areas of Rock Outcrop overlying a dark blue-grey slate, phyllite and schist bedrock (with areas of granite bedrock to the north and greywacke and quartzite to the south).

The underlying aquifer is described as a local, moderately important aquifer (bedrock which is Moderately Productive only in Local Zones), with areas of poor aquifer (bedrock which is Generally Unproductive except for Local Zones) at the northern and southern corners of the South Dublin location.

No significant constraints, as described in Section 1.2.2 above, were identified at the South Dublin Location.

However, a number of Irish Geological Heritage sites are recorded in this area. Sites include:

- Killiney Bay – 5km coastal section, County Geological Site
- Killiney Hill – coastal hill site, County Geological Site
- Dalkey Hill – large, disused, granite quarry, County Geological Site
- Enniskerry Delta and Bray Head –CGSs at the extreme south of the study area for South Dublin.

Further consultation with the GSI would be required if there was a risk of potential impact to these sites.

Although there is potential for areas of Extreme to Moderate vulnerability to be encountered during the construction phase where depth to bedrock is shallow (especially to the north of the study area), best practice construction methodologies will largely mitigate the potential for impact.

As described for the raw water abstraction options in Section 2 above, best practice construction methods will include the development of a Construction Management Plan (CMP) for the project. Measures to address the potential impact of a number of activities on site including the use of fuel on site, the disturbance and on-site stockpiling of overburden, use of machinery on site and preferred seasonal working conditions will be included in the CEMP.

The location does encompass a notable area of Made Ground, which may include some unknown areas of contaminated land.

Although there is potential for areas of Extreme to Moderate vulnerability to be encountered during the construction phase where depth to bedrock is shallow (especially in the coastal and central areas of the study area), best practice construction methodologies will largely mitigate the potential for impact. These methodologies are described in Section 2.1.1. above.

3.1.3 Loughshinny South

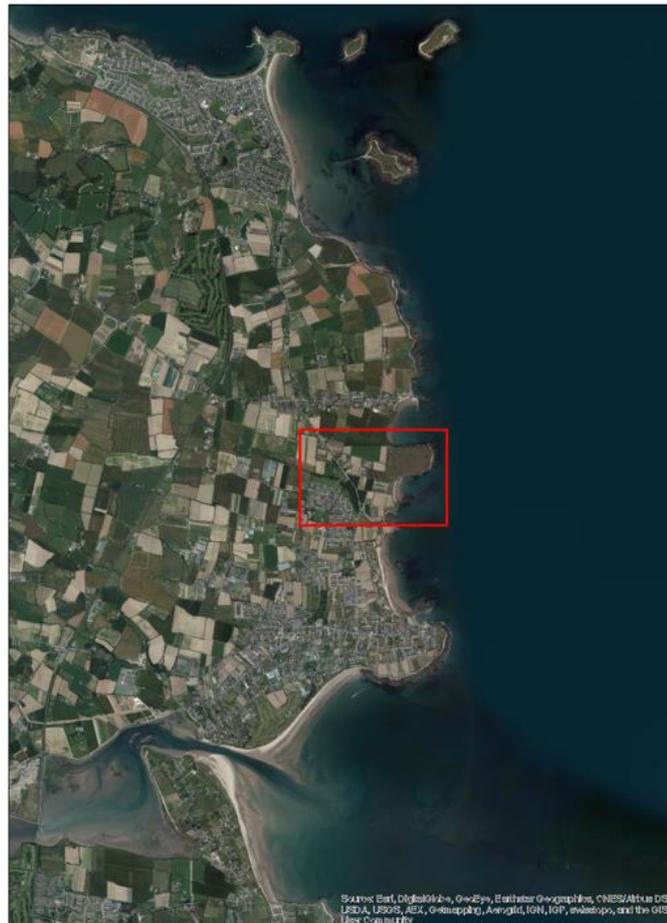


Figure E12 – 8 Loughshinny South

The potential desalination location at Loughshinny South is located a short distance from the location described above at Loughshinny North. Indeed, the main variation is the closer proximity of the Loughshinny South location to the settlement of Rush.

The geology in this area is primarily comprised of Till with a large area of Made Ground in the south western area of this location. The site overlies shale bedrock with a small area of Calp to the south. The underlying aquifer is described as a Local, moderately important aquifer (bedrock which is Moderately Productive only in Local Zones).

No significant constraints, as described in Section 1.2.2 above, were identified at the Loughshinny South Location.

An Irish Geological Heritage site is recorded in this area and is described as a County Geological Site (CGS) - Lower Carboniferous sequence, coastal cliff and

foreshore section. Further consultation with the GSI would be required if there was a risk of potential impact to this site.

Where depth to bedrock is shallow (especially in the coastal and central areas of the study area), there is potential for areas of Extreme to Moderate vulnerability to be encountered during the construction phase of the development. However, best practice construction methodologies will largely mitigate the potential for impact (as described in Section 2.1.1. above).

3.1.4 Balbriggan

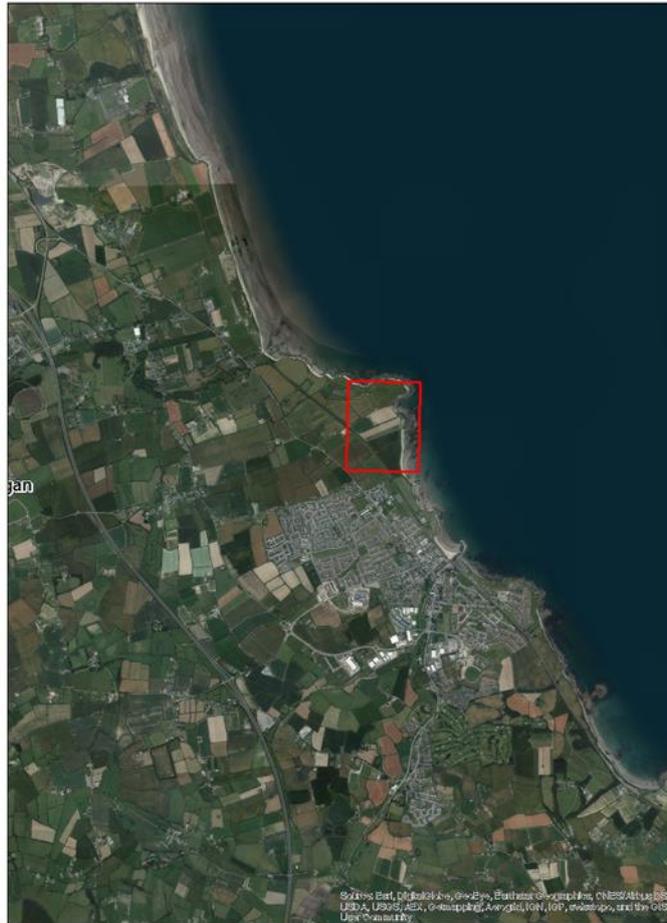


Figure E12 – 9 Balbriggan

This location occupies an area of land between the northern outskirts of the settlement of Balbriggan and the border between County Meath and County Dublin. The location is contained in large farmed fields on a relatively open coastal plain where field boundaries are defined by low windswept hedgerows. The Dublin-Belfast railway line passes through the area along with the R132 regional road.

The geology in this area is primarily comprised of Sandstone and Limestone Till with an area of Rock Outcrop to the north of the location (near the Coastline) overlying a Mudstone, Tuff bedrock. The underlying aquifer is described as a Local, moderately important aquifer (bedrock which is Moderately Productive only in Local Zones).

No significant constraints, as described in Section 1.2.2 above, were identified at the Balbriggan location.

No Irish Geological Heritage sites were recorded in this area. Laytown and Gormanstown coastal plain/sea cliffs County Geological Site is located to the north of the study area.

A significant groundwater abstraction scheme is located in this area of north Dublin, known as the Bog of the Ring abstraction scheme. The outer protection zone for this abstraction scheme is approximately 4.5km from the Balbriggan location. It is therefore considered that development of a desalination plant within the Balbriggan study area would not have the potential to impact on the Bog of the Ring.

Although there is potential for areas of Extreme vulnerability to be encountered during the construction phase where depth to bedrock is shallow, best practice construction methodologies will largely mitigate the potential for impact (see section 2.1.1. above).

3.2 Matrix of Multi Criteria Analysis

Criteria	South Dublin	Loughshinny North	Loughshinny South	Balbriggan
Aquifer Classification - importance of the groundwater resource to a given area	Mid-range permeability. Mid-range importance (poor aquifer, north and south corners).	Mid-range permeability. Mid-range importance.	Mid-range permeability. Mid-range importance.	Mid-range permeability. Mid-range importance.
Vulnerability Classification - potential for groundwater contamination	High Vulnerability.	High Vulnerability.	High Vulnerability.	High Vulnerability.
GSI Groundwater Protection Response matrix	No data available for this area.	No data available for this area.	No data available for this area.	No data available for this area.
Groundwater Supplies - identification of water supply springs and bored wells based on GSI, EPA and FCC records	No features identified in this area.	No features identified in this area.	No features identified in this area.	No features identified in this area.
Groundwater Source Protection Area's and Zones of Contribution as per available GSI & EPA data	None within the vicinity of South Dublin.	None within the vicinity of Loughshinny North.	None within the vicinity of Loughshinny South.	None within the vicinity of Balbriggan.
Potential to impact on Geological Heritage Sites / County Geological Sites	High Potential: liaise with GSI to reduce impact.	Low : Laytown to Gormanstown located to the north of study area.	High Potential: liaise with GSI to reduce impact.	High Potential: liaise with GSI to reduce impact.
Potential to interact with contaminated land	Low to Moderate potential impact.	Low potential impact.	Low potential impact.	Low potential impact.

Potential to sterilise mineral resource	Low potential impact.	Low potential impact.	Low potential impact.	Low potential impact.
Potential to encounter shallow bedrock during construction (interactions with other disciplines during construction - noise, dust etc)	High to Moderate (northern area) - mitigation measures can be implemented to reduce the impact.	High to Moderate (Coastal area and centre of study area) - mitigation measures can be implemented to reduce the impact	High to Moderate (Coastal area and centre of study area) - mitigation measures can be implemented to reduce the impact	High to Moderate (Coastal area and area in centre) - mitigation measures can be implemented to reduce the impact
Potential impact on karst features	Low potential impact.	Low potential impact.	Low potential impact.	Low potential impact.
Potential to encounter soft ground	Low potential impact.	Low potential impact.	Low potential impact.	Low potential impact.
Soils Types	Well drained soils and Made Ground.	Deep poorly drained.	Deep poorly drained.	Deep poorly drained.
Sub Soil Types	Gravel and Made Ground.	Mainly Till.	Mainly Till.	Mainly Till.
Depth to rock	Typically <3m.	At surface to >5m.	Typically >5m.	Typically >5m.

3.3 Comparative Discussion

No significant constraints were identified at the “Desalination–Irish Sea” South Dublin, Loughshinny North, Loughshinny South and Balbriggan locations which would result in a recommendation to cease further consideration of any one location.

In general, it is considered that the potential impact on Soils, Geology and Hydrogeology features at each location as a result of the proposed development is low.

However, a number of potential constraints have been identified at each location which, when combined, result in a preference for an individual site with respect to Soils, Geology and Hydrogeology.

South Dublin is the least preferred location for a Desalination project, based on Soils, Geology and Hydrogeology criteria. This is primarily as a result of the fact that there are a number of Irish Geological Heritage (IGH) sites at this location. Each site is further defined as a County Geological Site (CGS) which is regulated by the local authority. The relevant sites in this area include Killiney Bay, Killiney Hill, Dalkey Hill and Enniskerry Delta and Bray Head.

Killiney Bay, in particular, extends along the coast of South County Dublin for 5km. Any potential impact on this coastal section will need to be discussed with the Geological Survey of Ireland (GSI), in order to propose appropriate mitigation measures to reduce the impact of the development.

There are also large sections of Made Ground within the South Dublin location and, as a result, there may be areas of historical contamination/brownfield sites.

An Irish Geological Heritage site is recorded in the Loughshinny North and Loughshinny South locations and is described as a County Geological Site (CGS) - Lower Carboniferous sequence, coastal cliff and foreshore section. Further consultation with the GSI would be required if there was a risk of potential impact to this site. A substantial area of Made Ground has been identified in the south western area of Loughshinny South.

There is an area of rock outcrop identified to the north of the Balbriggan location (near the coastline). Any development in this area may have a direct impact on the underlying aquifer as there will be no attenuation (soil/subsoil overburden) to protect the aquifer from potential contamination during the construction phase. No Irish Geological Heritage sites are recorded in the Balbriggan area.

All options for Desalination are located in areas where there are potential areas of shallow bedrock which may be susceptible to contamination from works on the surface and the underlying groundwater aquifer is classified as being of Extreme to Moderate Vulnerability.

Overall, the potential impact on Soils, Geology and Hydrogeology features at each Desalination location is low but, based on the identification of geological heritage sites, shallow bedrock and the potential to encounter contaminated soils, South Dublin is the least preferred option, followed by Loughshinny North and South.

The Balbriggan site is, therefore, considered the least constrained location from the point of view of Soils, Geology and Hydrogeology.

Water Supply Project Eastern and Midlands Region (WSP)

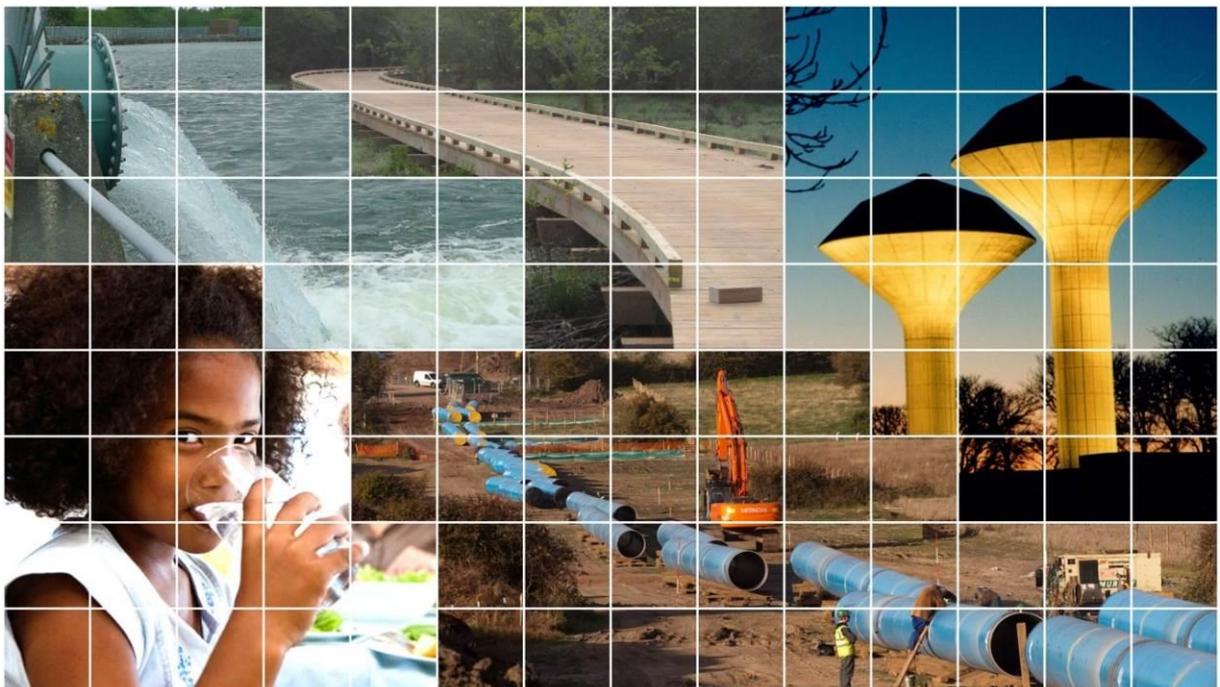
Abstraction Location MCA

Appendix E13: Planning



October 2015

F02



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1.1 Introduction

Four reasonable alternative options have been identified from previous studies – refer to the *Water Supply Options Working Paper* (Project Road Map Stage 2). These are reconfirmed below.

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)
- Option H (Desalination)

This report describes the decision making process used to appraise the abstraction locations associated with each of the reasonable alternative options.

To undertake the appraisal of abstraction locations a range of specialists were engaged, in their applicable fields, to conduct a comparative assessment of abstraction locations. The following disciplines were engaged:

- i. **Ecology** – the consideration of impact on animals, plants and their environment.
- ii. **Water** – the consideration of impacts on the surface water environment.
- iii. **Air and Noise** - the consideration of air and noise pollution
- iv. **Cultural Heritage** - the consideration of existing archaeological and built heritage
- v. **Soils, Geology and Hydrogeology** – the consideration of impact on soils, geology and hydrogeology.
- vi. **Landscape and visual** – the consideration of landscape and visual impact.
- vii. **Agronomy** – the consideration of impact on land based enterprise.
- viii. **People** – the consideration of impacts on people
- ix. **Planning** – the consideration of planning and land use policy in relation to proposed works
- x. **Engineering** - the consideration of technical challenges associated with proposed works.
- xi. **Traffic** - the consideration of impact on traffic and road network

The specialists independently assessed each location relative to appraisal criteria applicable to their field of expertise. This process, or methodology, is referred to as Multi-Criteria Analysis and explicitly considers multiple criteria (see Table E13 - 1), within a decision-making environment.

Environmental Criteria	Technical Criteria	Risk Criteria
Biodiversity, Flora and Fauna	Safety	Technical Risk relating to the Source
Fisheries	Planning Policy	Technical Risk relating to Infrastructure and Operations
Water	Engineering and Design	Environmental and Planning Risk
Air/Climatic Factors	Capital and Operational Costs	Financial Risk
Material Assets (Energy)	Sustainability	Socio-economic risk
Cultural Heritage (including Architecture & Archaeology)		
Landscape & Visual		
Material Assets (Land use)		
Tourism		
Population		
Human Health		
Soils, Geology and Hydrogeology		

Table E13 - 1 Appraisal Criteria

The assessments are presented as individual statements within this Appendix E.

This Appendix E13 is a statement on the specialism Planning and describes the decision making process used in identifying the least constrained abstraction locations associated with the reasonable alternative options.

The Site Selection Methodology in Appendix B outlines the process employed in identifying least constrained locations. This report should be read in conjunction with the *Site Selection Methodology*.

1.2 Methodology

This is ‘Non-linear Site Methodology – Step 1’ as described in the *Site Selection Methodology*.

To effectively determine the least constrained abstraction locations for the reasonable alternative options, the potential abstraction locations were assessed under 8 no. Planning sub-criteria.

- Existing Land Use in location
- Land Use Zoning
- Local Objectives on Site
- Other Local Objectives on Site
- Land Uses present in the vicinity
- Zoning present in the vicinity
- Local Objectives in the vicinity
- Other Local Objectives in the vicinity

The methodology adopted for the preparation of this report entailed a detailed review of relevant planning and land use considerations as set out in the relevant County Development Plan including:

- land use zoning (for the location itself and for surrounding areas)
- the presence of any specific Local Objectives in, or in the vicinity of each location

It should be noted that while this report does provide an overview of the main planning issues associated with each location, it does not address the detailed development management standards which may be relevant to a project of this type.

In addition, the report does not attempt to address other issues addressed in the Development Plan (such as ecology, flooding, visual impact, archaeology, architectural heritage, etc.) which, although related to planning and land use policy, are assessed by the relevant suitably qualified experts.

1.2.1 Desk study

A desk study exercise of the potential abstraction locations was carried out using the software package *ArcReader*. The supplied datasets and information are as described in the *Site Selection Methodology*.

1.2.2 Categories of impact

The relative analysis of potential locations to define a “least constrained” location is based upon a subjective assessment by each Specialist in their discipline of expertise. This judgement is presented as weighted impact; colour coded for ready identification.

Very high	Dark blue
High	Blue
Mid-range	Green
Low	Light Green
Very low	Cream

2.1 Lough Derg/Parteen Basin Locations

An assessment of the potential abstraction locations was carried out for the following options:

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)

2.1.1 Planning Policy Review

This section of the report will provide a brief overview of the relevance of the criteria previously referred to in Section 1.2 above - planning policy associated with each of the Shannon locations, beginning with the land use zoning designations set out in the relevant County Development Plan.

A review of all the relevant County Development Plans, Local Area Plans (where applicable), and Settlement Plans (where applicable), was carried out.

Firstly, each location was considered as identified on the maps provided. The existing land use, the zoning of the land and any local objectives as listed in a statutory plan were considered. Secondly, a review of the land uses, zoning and local objectives for lands within the vicinity of the location were considered.

In light of these considerations, it should be noted that in preparing this report regard was had not only to the development potential of each location with regard to land use zoning etc. but also to the potential impact of the development of the proposed infrastructure on the amenities of more environmentally sensitive zones within the vicinity of the potential locations in order to identify potential planning constraints across a wider area.

Shannon Abstraction Location:

The five locations identified for the Shannon Abstraction point are all located in North Tipperary, namely, Slevoir, Mota, Dromineer, Youghal Bay and Parteen Basin. Whilst the two authorities of North and South Tipperary have now amalgamated, the Development Plans remain in force for each area for the time being. The two County Development Plans both have had their lifetimes extended until a new County Development Plan for the entire county is made. This will commence after new Regional Planning Guidelines are adopted.

There is currently a variation to the Development Plans out for consultation to prepare a new unified vision and strategic planning policy framework for the economic, social and cultural development of the county. Regard has been had to this document; however, it has not been adopted at the time of writing.

The South and North Tipperary County Development Plans were prepared in 2009 and 2010 respectively. The Council has reviewed these documents and the proposed variation was produced as a consequence of this review, establishing policies and objectives which will achieve a coherent approach to development on a county-wide basis. All of the locations are located in the area identified on the 'Core Strategy Map' as being 'Primary Amenities Area'.

With respect to the Primary Amenities Area, the variation states the following objective¹:

Policy LH2: Protection of Visual Amenity and Character of Primary and Secondary Amenity Areas

It is the policy of the Council to ensure the protection of the visual amenity, landscape quality and character of designated Primary and Secondary Amenity Areas. Developments which would have an adverse material impact on the visual amenities of the area will not be permitted. New development shall have regard to the following: a) Developments should avoid visually prominent locations and be designed to use existing topography to minimise adverse visual impact on the character of primary and secondary amenity areas. b) Buildings and structures shall ensure that the development integrates with the landscape through careful use of scale, form, finishes and colour. c) Existing landscape features, including trees, hedgerows and distinctive boundary treatment shall be protected and integrated into the design proposal. d) Developments shall comply with the development standards set out in Chapter 10 of the Plan and, as appropriate, the Rural Design Guidelines contained in Appendix 5.

The variation also includes the following objective with respect to water infrastructure:

Policy TI5: Capital Investment Programme

It is the policy of the Council to work in partnership with Irish Water to facilitate the implementation of priority water and wastewater infrastructure identified on the Capital Investment Plan 2014-2016 (or any amendment thereof) to ensure the sustainable economic and social growth of the county.

The North Tipperary County Development Plan (CDP) came into effect in August 2010. When responsibility for the WSP project was with Dublin City Council, the project was known as the 'Water Supply Project – Dublin Region' as the principal focus was planning for future water supply needs of the East / Dublin Region up to 2050 and beyond. However, the transfer of water services functions to Irish Water has opened a unique opportunity to take a strategic view of providing water services at a national level and as a result the project has now been referenced to the three regions within which Irish Water operates. The North Tipperary Development Plan was adopted prior to this change in focus of the project and therefore does not specifically refer to the WSP project. Regardless, the Council recognise the importance of providing sufficient, reliable drinking water for the future sustainable growth of the County and the abstraction opportunities of the County. The CDP contains the following policies with respect to water supply:

Policy SERV 1: General Policy

It is the policy of the Council to ensure that the capacity of the water services infrastructure i.e. water supply and wastewater treatment, are adequate for any development proposal. The Council may require developers, where it is considered necessary and appropriate, to provide adequate water services infrastructure with capacities equal or in excess of those required by the proposed development, if the Council considers this to be in the interests of the future development of the area or settlement.

¹ This is included in the Draft out for display currently

Policy SERV 2: General Policy

It is the policy of the Council to provide, maintain or expand water services in towns and villages as resources permit. Particular regard will be paid to those settlements which are targeted for strategic expansion in the Settlement Strategy outlined in Chapter 3 of this Plan.

Policy SERV 3: General Policy

It is the policy of the Council to ensure that the provision of water and wastewater facilities is undertaken in accordance with EU policies and directives, national legislation and national/regional policies.

And:

Policy SERV 6: Water Abstraction

It is the policy of the Council to endeavour to facilitate developments, by allowing the potential water resources of the County to be utilised, where possible, subject to appropriate safeguards.

Policy SERV 6(a): Water Abstraction

It is the policy of the Council to work with Statutory Water Authorities, where abstraction is proposed from surface or ground water supplies within North Tipperary, subject to compliance with environmental and ecological legislative requirements.

In relation to the wording of the Development Plan zoning objectives themselves and how they seek to regulate what uses are permitted at a given location, the CDP provides guidance on a number of different types of development. There are no specific references to a Water Treatment Plant or any Utility Structures, but the CDP does note the following with respect to Commercial Development in Rural Areas² :

“Development proposals in the open countryside should satisfy a high standard of location, siting and design to ensure they are satisfactorily assimilated into their rural setting”.

The North Tipperary Development Plan is supported by a number of Local Area Plans (LAP) and Settlement Plans (SP). A number of these Plans were reviewed because some of the five locations overlap the boundaries of those Plans. It is noted that³:

“The aim of the Settlement Plans is to provide a framework for future development over the duration of the plan, to ensure that new development is co-ordinated and contributes to the social and economic fabric of the settlement. The Plans will have a key purpose of informing the general public, statutory authorities and other interested bodies of the broad land use policies to guide development. The Settlement Plans take the form of a zoning map which outlines the land use objectives and a written statement outlining the characteristic features of the settlement and specific development objectives”.

Similarly to the County Development Plan, the Settlement Plans do not have a specific zoning reference for an abstraction point or water treatment facility. However there is a reference to ‘Public Services’ which is permissible or open for consideration in all zoning uses.

² Section 10.12 of the CDP

³ CDP Settlement Plans Introduction

Appendix 5 of the CDP is the ‘List of Protected Views’. V01 to V15 are all considered herein.

2.1.2 Slevoir



Figure E13 – 1 Lough Derg - Slevoir

Location

The Slevoir location is situated approximately 400m north-west of Carrigahorig Village, south-east of Portumna and north-east of Terryglass, and is currently characterised by agricultural/forestry use. There are a number of residential / farming properties situated along the local roads to the west, south and east of the land parcel. The N65 regional road runs to the east.

Land Use Zoning

The location is unzoned. Other land use zonings in the area include the village of Carrigahorig which has a mix of zonings, as expected in a village – existing residential, new residential, commercial etc.

Local Objectives

There are no local objectives for the location. The Settlement Plan for Carrigahorig identifies new areas for residential growth.

Other Objectives

No other relevant Development Plan objectives have been identified within the vicinity.

Overview of Potential Planning Issues

The area is currently 'unzoned' and from a review of the various plans there are no specific future plans. It should be noted that the location of a site within this area must be cognisant of the rural location.

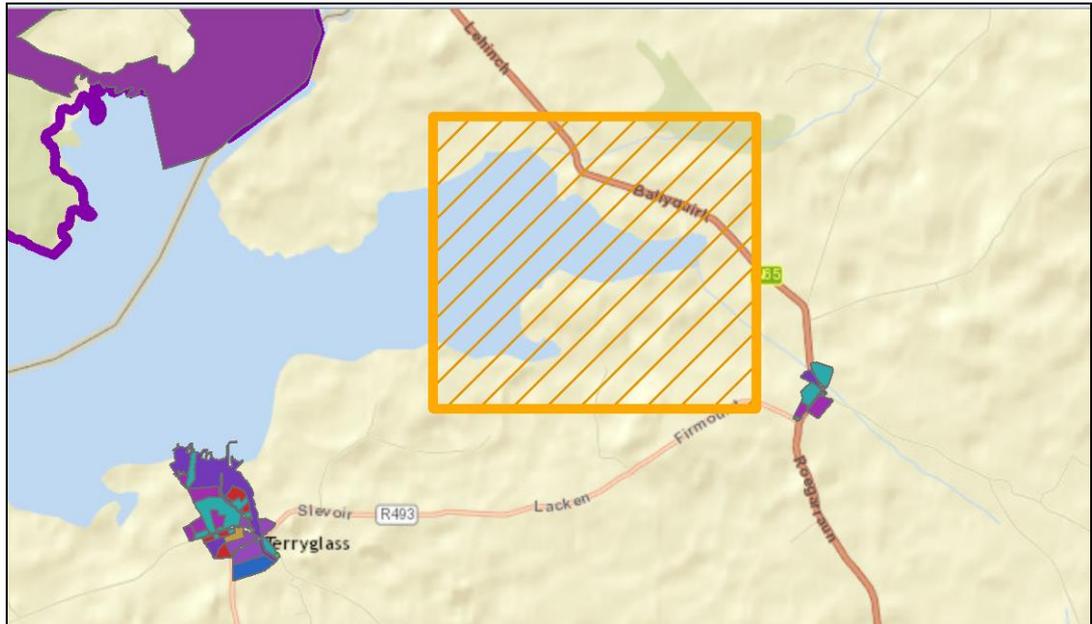


Figure E13 – 2 Zoning in the Slevoir location

2.1.3 Mota



Figure E13 – 3 Zoning in the Mota location

Location

The location is approximately 1.9 km from Ballinderry and 2.6km from Newchapel/Kilbarron village and is currently in agricultural and forestry use.

Land Use Zoning

The location is unzoned as it is outside any defined boundary or area the subject of a Settlement Plan. There is an active quay – Coolbawn quay with adjacent residential development.

Local Objectives

There are no local objectives for the location. The Settlement Plans for Ballinderry and Kilbarron were included in the Variation no.1 of the CDP.

Other Objectives

There is a Protected View - *View 05: Views west of the R493 north of Puckane to Ballinderry.*

Overview of Potential Planning Issues

The location is unzoned and it is outside any settlement plan boundary.

The potential landscape and visual impact of any proposed development will be a consideration in the assessment of this location for the proposed development. The existence of Coolbawn quay must also be factored into any proposal.

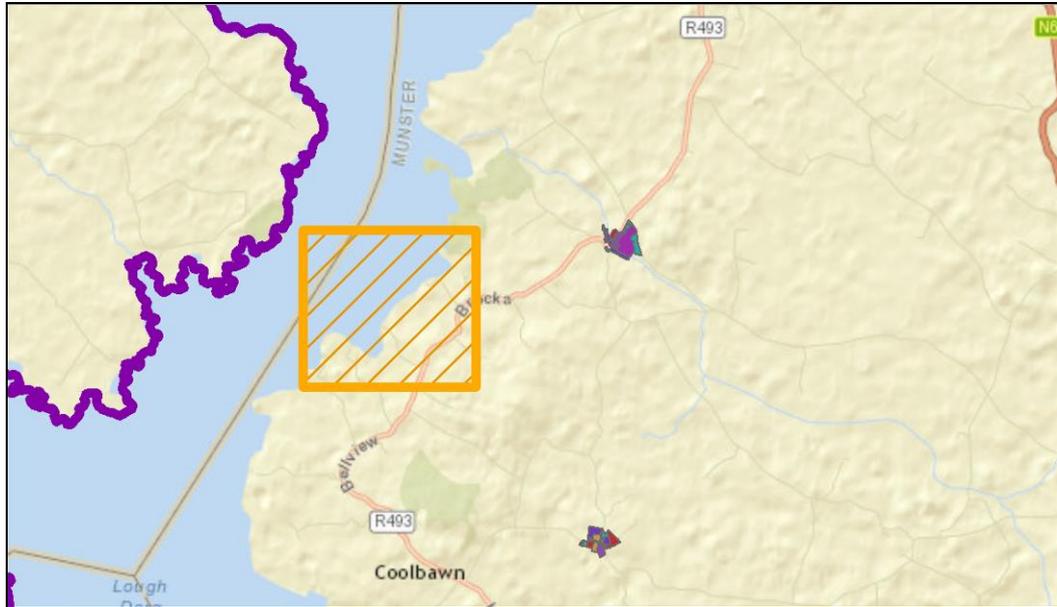


Figure E13 – 4 Zoning in the Mota location

2.1.4 Dromineer



Figure E13 – 5 Lough Derg - Dromineer

Location

The Dromineer location includes the village of Dromineer. The village of Puckane is approximately 1.6km away. There are yacht clubs and sailing clubs in the vicinity. There are cottages and B&B's and a thriving tourism offer in the small village of Dromineer. Outside of the village there are numerous houses along the adjoining roads and agriculture and forestry developments.

Land Use Zoning

The Settlement Plan for Dromineer village includes all zonings expected in a village, including existing residential, tourism, commercial etc.

Local Objectives

The Settlement Plan is encouraging the development of low density housing and tourism facilities.

Other Objectives

There are Protected Views in the locality - *View 03: Views west of the L1023 south of Dromineer* and *View 04 – Views west of the L1026 north of Dromineer*.

Overview of Potential Planning Issues

This location includes the village of Dromineer within its boundary. Dromineer is a small rural lakeside village and it may prove difficult to identify a site that does not impact negatively on the overall tourism and residential aims of the Settlement Plan.

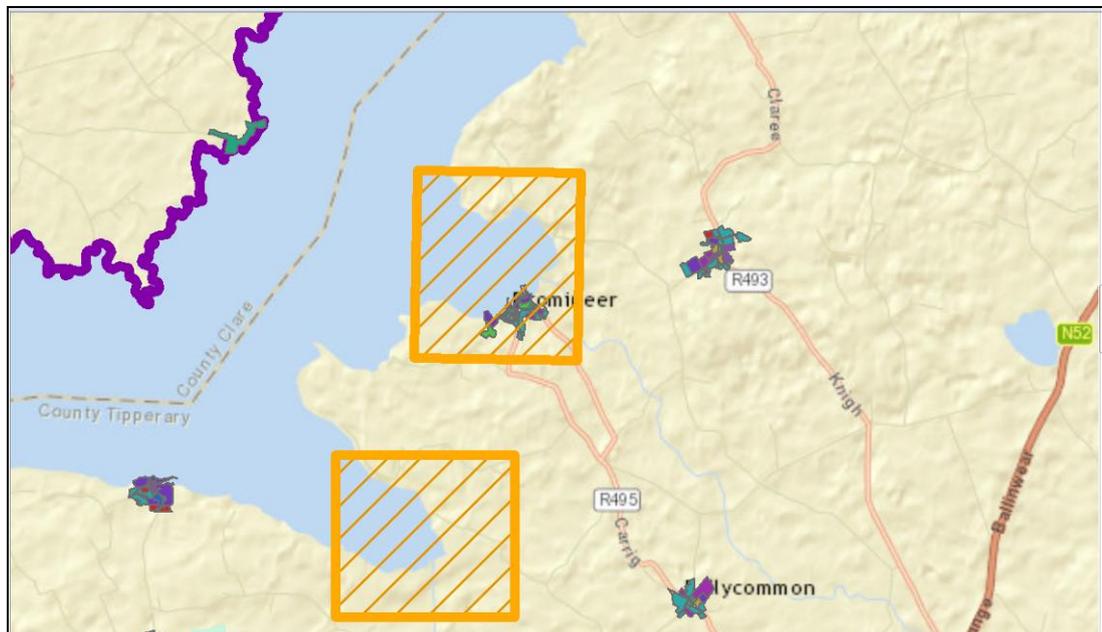


Figure E13 – 6 Zoning in the Dromineer location

2.1.5 Youghal



Figure E13 – 7 Lough Derg - Youghal

Location

This location is currently in agricultural and forestry use. There is some ribbon development in the locality. The village of Ballycommon to the east is approximately 2.3km away; Garrykennedy to the north-west is 2.4km away; Portroe to the south-west is 1.9km away; Newtown/Youghalarra to the south is 1.3km away and Nenagh is 4.5km away. Youghal village comprises a number of road-edge residential developments.

Land Use Zoning

The location is unzoned as it is outside any defined boundary or area the subject of a Settlement Plan.

Local Objectives

Newtown village is the subject of a Settlement Plan which provides for growth expected of a small village.

Other Objectives

Trees along the eastern shore of Lough Derg from Ballina to Youghalarra (T23a to T23b) are protected.

Overview of Potential Planning Issues

This location is currently unzoned. However, if this location is considered further, the residential development along the road to the south of the bay must be considered.

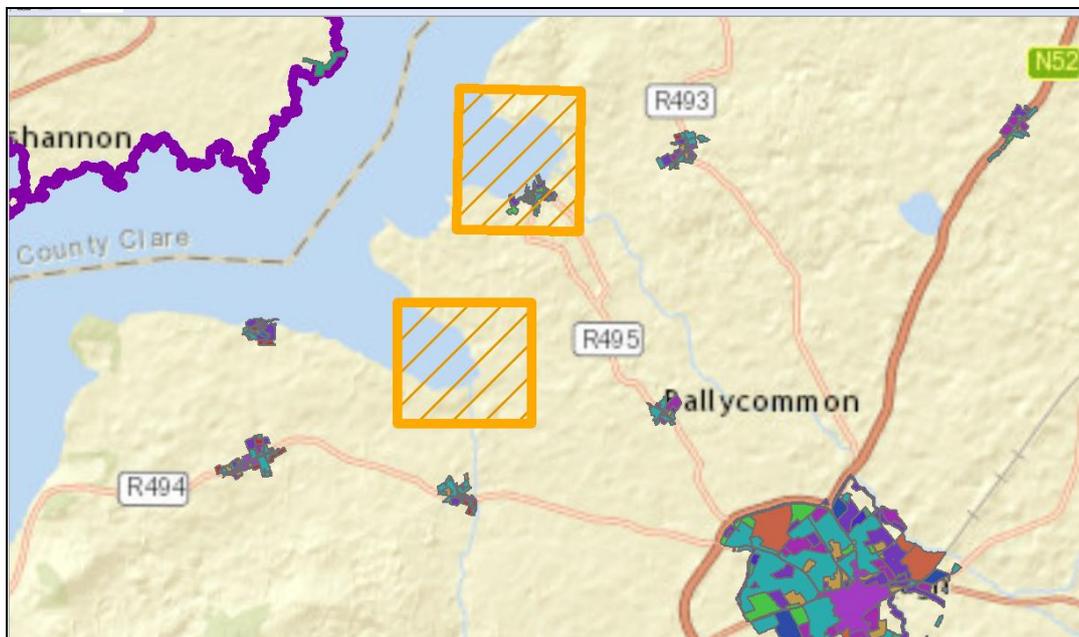


Figure E13 – 8 Zoning in the Youghal location

2.1.6 Parteen Basin Reservoir



Figure E13 – 9 Parteen Basin Reservoir

Location

The location identified is a large area including the villages of Ballina and Killaloe (Clare County Council). The village of Birdhill is located approximately 790m away. The N7 Road runs to the east of the identified location.

Land Use Zoning

Due to the large area identified, there are a wide variety of zoning uses identified including, existing residential, new residential, tourism (including the planned Ardcloney integrated tourism site), retail, open space and mixed use. There are also areas outside the villages included which are unzoned.

Local Objectives

The Settlement Plans for the villages of Ballina and Birdhill include for future development of the areas. Killaloe is included in the East Clare Local Area Plan as a small town. Killaloe and Ballina, whilst in adjoining Counties, are physically linked by the historic bridge across the Shannon at the southern-most tip of Lough Derg. Killaloe and Ballina have been designated as a Heritage Town. Heritage Town status is allocated to towns across Ireland that exhibit unique heritage resources.

Other Objectives

Protection of vistas from Birdhill to Lough Derg is noted.

Overview of Potential Planning Issues

Due to the large location identified, it is quite possible that a suitable site can be identified. However, cognisance must be taken of the fact that there are zoned areas within the towns and every effort should be made to minimise any potential conflicts with the objectives and vision for the town settlements. The two towns have high tourism numbers – there are mooring facilities and a riverside park on the Ballina side, while there are narrow streets and many tourism amenities on both sides of the river. Care needs to be taken with any potential siting of any infrastructure within this overall location.

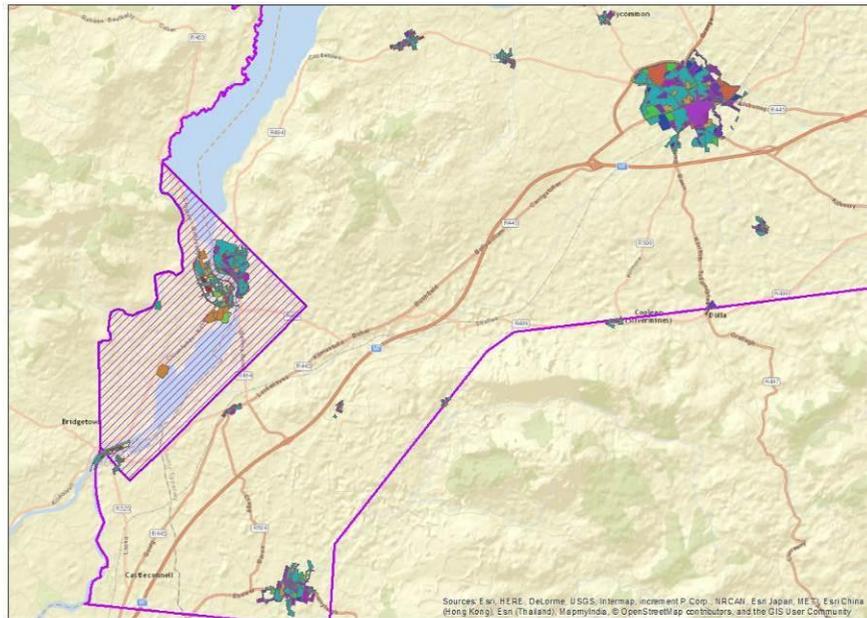


Figure E13 – 10 Zoning in the Parteen location

2.2 Matrix of Multi Criteria Analysis

Criteria	Slevoir	Mota	Dromineer	Youghal Bay	Parteen Basin
Planning Policy					
Existing Land Use	Agriculture/Forestry.	Agriculture/Forestry/ Coolbawn Quay/Low Density Residential.	Dromineer village - quays/residential/ Tourism.	Agriculture/Forestry/ Ribbon Development.	Ballina/Killaloe villages and associated village zonings.
Zoning	No zoning.	No zoning but note existence of Coolbawn Quay and associated Residential development.	Amenity/Residential/ Commercial.	No zoning.	Residential existing and new/Commercial/Retail/ Tourism/Active Open Space/Mixed use.
Local Objectives	N/A.	N/A.	Tourism/low density housing.	N/A.	Tourism/New Residential/Commercial.
Other Local Objectives	None.	None.	Dromineer Settlement Plan.	N/A.	Lough Derg Study.
Land Uses present in the vicinity	Village of Carrigahorig in the vicinity (~400m).	Ballinderry ~1.9km distance; Newchapel/Kilbarron Village ~2.6km distance.	Puckane ~1.6km distance.	Villages of Ballycommon (~2.3km); Garrykennedy (~2.4km); Portroe (1.9km); Newtown/Youghalarra (~1.3km); and (Nenagh (4.5km) distance.	Village of Birdhill ~790m distance.
Zoning present in the vicinity	Carrigahorig village zoning: Existing & New Residential/Amenity/ Commercial. Portumna, Lorrha and Terryglass villages in the vicinity.	No zoning but note existence of Coolbawn Quay and associated residential development.	Dromineer and Puckane Settlement Plans.	Newtown Settlement Plan.	Birdhill Settlement Plan.

Local Objectives in the vicinity	Carrigahorig VDS.	Ballinderry and Kilbarron subject to Variation no.1; Protected View 05.	Protected View 03 and 04.	Newtown Settlement Plan.	Protection of vistas from Birdhill to Lough Derg.
Other Local Objectives in the vicinity	HERT31 and other general policies (see Section 2.1.1 above).	HERT31 and other general policies (see Section 2.1.1 above).	HERT31 and other general policies (see Section 2.1.1 above).	Protect trees along the eastern shore of Lough Derg from Ballina to Youghalarra (from T23a to T23b).	HERT31 and other general policies (see Section 2.1.1 above).

2.3 Comparative Discussion

Three of the five locations chosen for consideration are outside of village and town settlement. Thus, there are no specific zonings associated with these locations. Overall general County Development Plan policies and objectives apply to areas which are 'unzoned', or not subject to Settlement or Local Area Plans.

All the locations are in the area designated as 'Primary Amenity Area' in the proposed variation to the County Development Plan.

For the locations Slevoir, Mota or Youghal Bay which are outside of the Settlement Plan boundaries, the proximity to nearby settlements was reviewed, and the potential impact of the development of a treatment plant, on the nearby villages was considered. In most cases, the nearest villages were in excess of 1-2km away from the locations. Rural housing is present in all locations, which will have to be a factor should one of these locations be taken to the next stage.

If the locations of Slevoir, Mota or Youghal Bay are considered further, the proposed development will have to comply with the overall vision for the county, as well as the policies and objectives.

The Dromineer and the Parteen basin locations include settlements and villages within the identified boundaries. These areas are subject to policies and objectives of Settlement Plans and Local Area Plans.

The Dromineer location is the least preferred, as there are plans for future residential and importantly, tourism development. Dromineer is a small rural lakeside village and it may prove difficult to identify a site that does not impact negatively on the overall tourism and residential policies and objectives of the Settlement Plan.

Similarly, the Parteen basin includes the villages of Ballina and Killaloe. The two towns have high tourism numbers – there are mooring facilities and a riverside park on the Ballina side, while there are narrow streets and many tourism amenities on both sides of the river. There are also plans for an Integrated Tourism Site in Ardcloney. This site is located approximately 3.5km south of the town of Killaloe. This site has been zoned for Integrated Tourism uses, which could include marina and ancillary/complementary uses.

Care needs to be taken with the potential siting of infrastructure within the Parteen basin location. It is likely that due to the scale of the location, there is a possibility of finding a suitable site for the location of the necessary infrastructure. The Parteen basin site is the preferred location for this reason.

3.1 Desalination Locations

An assessment of the potential abstraction locations was carried out for the following options:

- Option H (Desalination)

3.1.1 Planning Policy Review

This section of the report will provide a brief overview of the relevance of the same planning criteria previously discussed associated with each of the Shannon locations, beginning with the land use zoning designations set out in the relevant County Development Plan.

A review of all the relevant County Development Plans and Local Area Plans (where applicable), was carried out.

Firstly, each location was considered as identified on the maps provided with existing land use, the zoning of the land and any local objectives as listed in the statutory plans. Secondly, a review of the land uses, zoning and local objectives for lands within the vicinity of the location were considered.

In light of these considerations, it should be noted that in preparing this report regard was had not only to the development potential of each location with regard to land use zoning etc. but also to the potential impact of the development of the proposed infrastructure on the amenities of more environmentally sensitive zones within the vicinity of the potential locations in order to identify potential planning constraints across a wider area.

Desalination Options:

Of 8 potential locations, 4 were removed from consideration due to identified constraints. Of the 4 remaining locations, three of the four desalination locations are located on the coast of Fingal County Council's administrative area, namely, Balbriggan, Loughshinny South and Loughshinny North. The final location, South Dublin, is located in the Dun Laoghaire-Rathdown County Council area.

The Fingal County Development Plan 2011 notes that the 'Greater Dublin Water Supply Strategic Study' commissioned in 1996, updated in 2001 and again in 2006, states that a new source of water is required. The Fingal CDP includes:

Objective DW02:

Support the Development of a new sustainable water source for the Greater Dublin Area'.

Objective DW07 provides for the schemes listed in table DW01.

The first scheme listed is 'A new water supply source for the Dublin region'.

The Fingal County Development Plan sets out a total of twenty one different land use zoning objectives. The locations identified in Fingal are for the most part zoned, HA – High Amenity; OS – Open Space; and, RU- Rural.

The location to the south of Dublin, is in the administrative area of Dun Laoghaire-Rathdown County Council. The location chosen is a very large section of the county, from north of Dalkey to south of Old Connaght. This area encompasses a wide range of zoning classes.

3.1.2 South Dublin

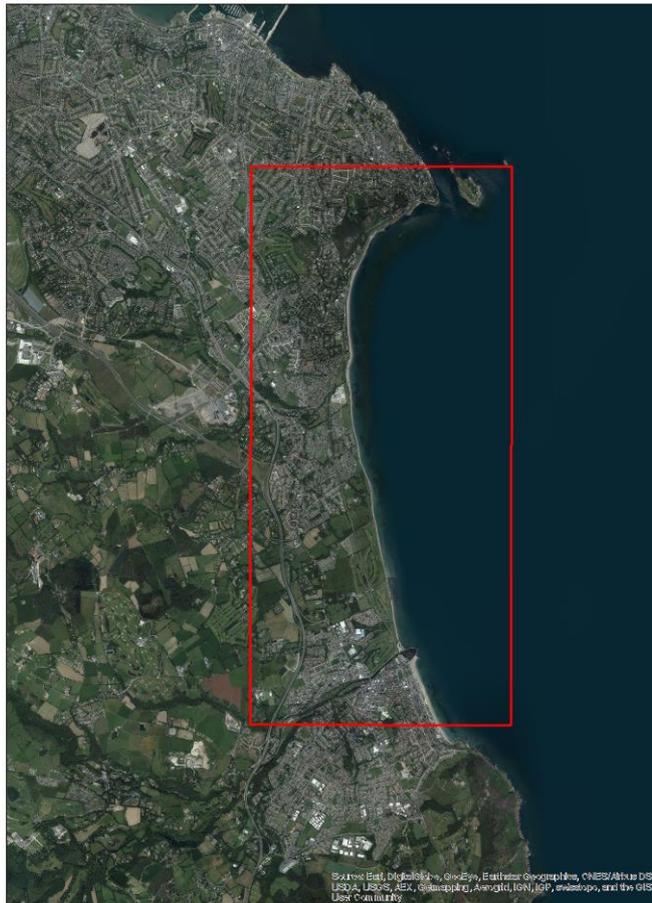


Figure E13 – 11 South Dublin

Location

This very large location stretches from Dalkey to Old Connaught. It encompasses most of the coastline from Dun Laoighaire to north of Bray.

Due to the scale of the location chosen, there is a wide variety of land uses, including residential – both old and new, mixed use, commercial, active recreational areas and open space.

Land Use Zoning

Due to the scale of the location, there is a wide variety of land use zonings. This area is very much part of the urban and metropolitan area of Dublin and the zonings reflect this fact.

Local Objectives

There are numerous Local Area Plans which pertain to areas within the location – Old Connaught, Woodbrook, Rathmichael and Sallynoggin. There is an area subject to an SDZ – Cherrywood, just outside of the boundary.

Other Objectives

The location has not been defined sufficiently to establish specific objectives. When a site is chosen, consideration of any local objectives must be had.

Airport Safety and Noise Zones

The proposed location is not located in any of the designated airport safety or noise zones.

Overview of Potential Planning Issues

The location chosen is very large and a more defined site is required to establish if there are any local objectives which could conflict with the development of the required infrastructure. The area is urban and if a suitably sized site is found this could comply with typical zonings expected in urban areas. This detail will need to be verified when a site is identified.

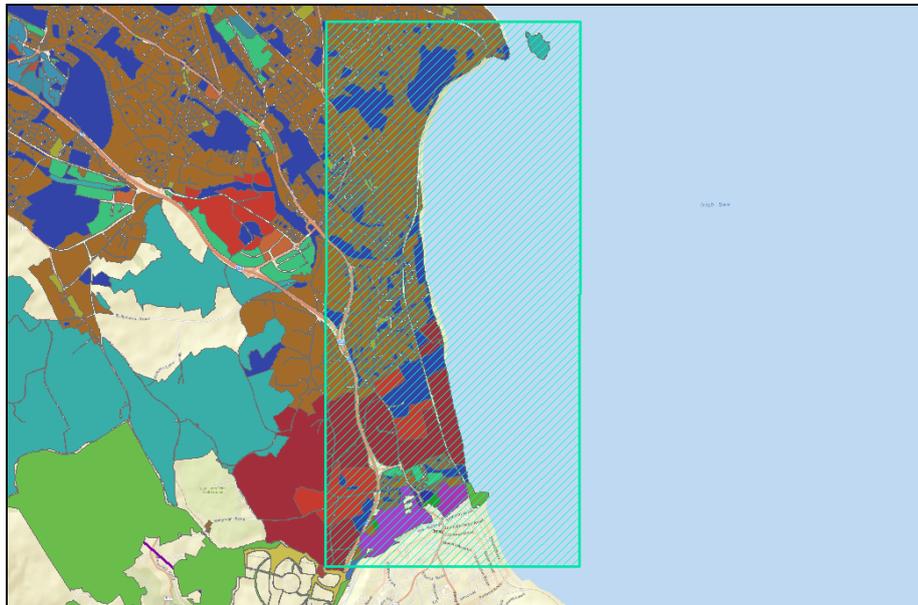


Figure E13 – 12 Zoning in the South Dublin location

3.1.3 Loughshinny North



Figure E13 – 13 Loughshinny North

Location

The area is located just north of Loughshinny village. The R128 road runs to the village of Loughshinny is to the south – the village is mainly linear in form and the small beach and pier are a popular local attraction.

Land Use Zoning

The location includes a variety of zoning including Rural (RU) and Open Space (OS) to the west, HA (High Amenity) to the east.

Local Objectives

There is a Local Objective LO113 – to promote a millennium walkway.

Other Objectives

There are other objectives in the vicinity regarding redevelopment of the harbour (LO118), parking (LO120), pedestrian routes (LO123) and a nursing home development (LO123).

Airport Safety and Noise Zones

The proposed location is not in any of the designated airport safety or noise zones.

Overview of Potential Planning Issues

Similarly to the location to the south, consideration must be given to the location in the rural area of Fingal as well as horticultural businesses.

Figure E13 – 15 Loughshinny South

Location

The area is located just north of Rush and south of Loughshinny.

The area is bisected by the R128 road. It is currently in agricultural use with the south west corner being part of Rush town itself.

Land Use Zoning

This location includes a wide variety of zoning including Rural (RU) and Open Space (OS) to the west, HA (High Amenity) to the east and a mix of town zonings to the south west (mainly existing residential and community use).

Local Objectives

There are a number of Local Objectives in this location – LO126 (restoration of the Martello Tower), and LO127 (public walkway around Drumanagh Fort)

Other Objectives

There are other objectives in the vicinity regarding rural related businesses and coastal walkways.

Airport Safety and Noise Zones

The proposed location is not in any of the designated airport safety or noise zones.

Overview of Potential Planning Issues

Consideration must be given to the location in the rural area to the north of Rush as well as horticultural businesses.

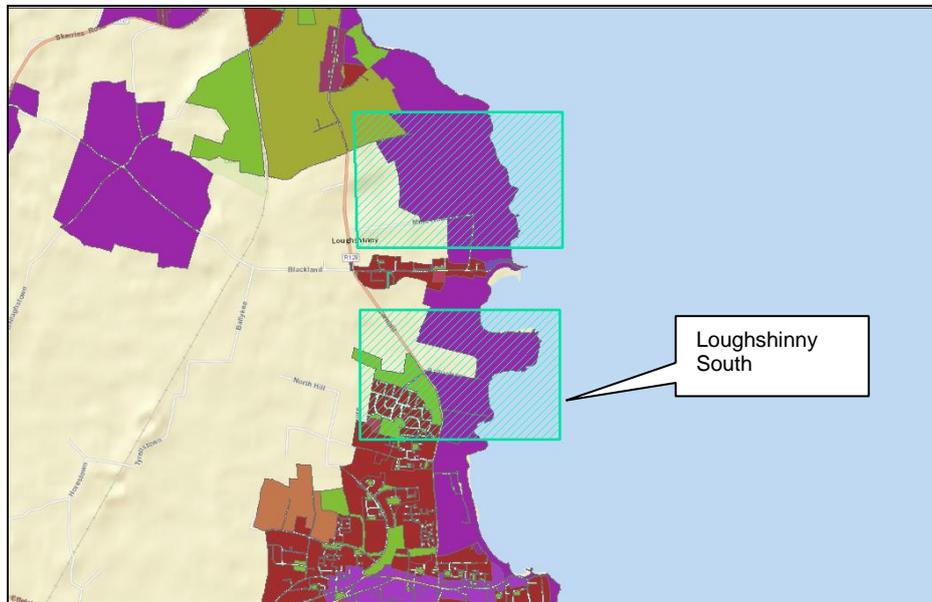


Figure E13 – 16 Zoning in the Loughshinny South location

3.1.5 Balbriggan



Figure E13 – 17 Balbriggan

Location

The area is located just north of the town of Balbriggan, and is currently used for a mix of uses including agriculture. The south-east corner includes part of Balbriggan beach.

The area is bisected by the Dublin-Belfast railway track. There are a small number of residential / farming properties along the R132 to the west.

Land Use Zoning

The southern portion of the location is zoned OS – Open Space, and the remainder of the area is zoned HA - High Amenity. The majority of the location is zoned HA – to protect these highly sensitive and scenic locations from inappropriate development.

In addition, the development boundary for the town of Balbriggan is located just to the south.

Local Objectives

The local objectives for this location include the development of a coastal walk and to preserve the views.

Other Objectives

There are a number of Local Objectives in the vicinity – mainly associated with the town of Balbriggan: LO3, LO4, LO5, LO6 and LO7 (see table for details).

Airport Safety and Noise Zones

The proposed location is not in any of the designated airport safety or noise zones.

Overview of Potential Planning Issues

The location is close to an area of the Fingal/Meath Border. It is in an exposed location and care will have to be taken to determine if there is a site within the identified location that can be screened sufficiently. The Landscape Specialist will need to address this aspect.

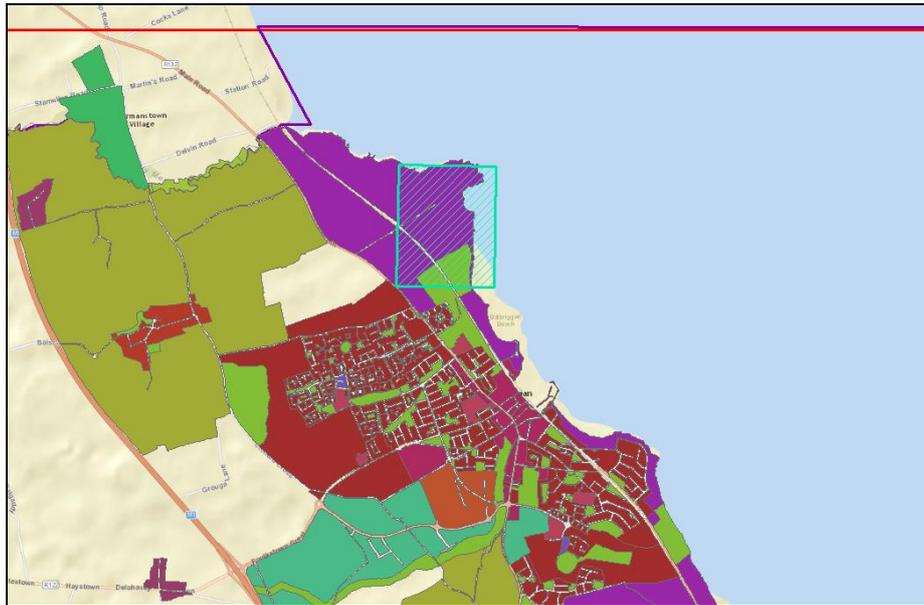


Figure E13 – 18 Zoning in the Balbriggan location

3.2 Matrix of Multi Criteria Analysis

Criteria	South Dublin	Loughshinny North	Loughshinny South	Balbriggan
Existing Land Use	Urban development/Metropolitan Area.	Agriculture/Low density residential.	Agriculture/Residential.	Agriculture.
Location Zoning	High Amenity/Open Space/Residential/Mixed Use/Economic Development/Greenbelt.	High Amenity/Greenbelt/ Agriculture.	Agriculture/High Amenity/Open Space/Residential/ Commercial / Infrastructure.	High Amenity/Open Space.
Local Objectives	Woodbrook LAP; Old Conna LAP; Rathmichael.	High Amenity (HA): Protect these highly sensitive and scenic locations from inappropriate development; Greenbelt (GB): Create a rural/urban Greenbelt zone that permanently demarcates the boundary; Rural (RU) - Protect and promote in a balanced way, the development of agriculture.	HA: Protect these highly sensitive and scenic locations from inappropriate development; Rural (RU) - Protect and promote in a balanced way, the development of agriculture; Open Space (OS): Preserve and provide for open space and amenities; RS: Protected existing Residential amenities; Community Infrastructure (CI): Protect and Provide for community, religious, education, health and social infrastructure.	HA: Protect these highly sensitive and scenic locations from inappropriate development; OS: Preserve and provide for open space and amenities.
Other Local Objectives	Site not defined.	Local Objective (LO) 113: Promote a millennium walkway.	LO126: Encourage the restoration of the Martello tower; LO127: Promote and facilitate a public walkway around the Drumanagh Promontory Fort, providing an attractive pedestrian link from Rush to Loughshinny. Preserve views.	Coastal walk/preserve Views.

Land Uses present in the vicinity	Urban development/Metropolitan Area.	Loughshinny Village to the south of boundary 150m.	Residential/Agriculture/ Tourism related.	Agriculture/Residential.
Zoning present in the vicinity	Site not defined.	Residential/Local centre/Community Infrastructure/General Employment.	Residential/High amenity/Open Space.	Greenbelt/ Rural/Residential/ Community Infrastructure.
Local Objectives in the vicinity	LAP's, SDZ (Cherrywood).	Greenbelt GI07/GI08/GI09.	Rural related business/Residential/ coastal walkways.	Greenbelt GI07/GI08/GI09.
Other Local Objectives in the vicinity	Site not defined.	LO116 - 3 houses; LO118 - redevelopment of harbour; LO119 - cultural/mixed use development; LO120 - parking; LO122 - pedestrian route; LO123 - nursing home; LO124 - existing use.	LO129 - Study for future use of land; LO132 - Retail for farm produce; LO135 - Improve access to beach; LO142 - Horticultural use; LO143 - Prepare a Masterplan for the protection and enhancement of the 'HA' lands at the North Beach, in the interests of environmental sustainability.	LO3 - Prepare a Gateway Strategy for the northern/southern/western and eastern approaches to the town; LO4 - Upgrade the access laneway to the Council's recreational lands and the seashore at Bremore; LO5 - detailed archaeological study; LO6 - Promote and facilitate the development of a Heritage Centre including Civic/Community/Recreational Uses at Bremore Castle; LO7- Promote and facilitate the development of a Civic Theatre at Bremore Castle.

3.3 Comparative Discussion

The four locations considered for a Desalination plant comprise three in Fingal County Council administrative area and one in Dun Laoghaire - Rathdown County Council area.

The south Dublin location spans a large area which presents a range of different zoning. The location in south Dublin is considered to be urban and part of the metropolitan area of 'Dublin and the Mid East region'⁴. If a site can be secured, of the necessary size, this location could potentially be suitable. The location of the site in relation to Shanganagh and its outfall would also have to be considered.

The remaining three locations are in the rural area of Fingal County Council. The Council's policies with respect to open space, rural related activities and greenbelts, must be considered when choosing a site at the next stage. The Council have very clear goals with respect to maintaining the greenbelt 'lungs' throughout Fingal as evidenced in their overarching policies and objectives, stated in Chapter 3, Green Infrastructure, Chapter 5, Natural Heritage, Chapter 8, Rural Fingal and Chapter 9, Land Use Zoning, of the Fingal County Development Plan 2011 - 2017. There are numerous policies and local objectives in existence with respect to maintaining scenic views, providing coastal walks, providing opportunity for countryside access, preventing coalescence of the urban areas and encouraging tourism.

The Loughshinny South location includes part of the village. There are numerous specific Local Objectives (LO) for the village and coastal areas. It may prove more difficult to identify a site in this area that would not compromise the various policies and objectives. The Balbriggan location is considered to be preferable, provided it is possible to find an area where the proposed development and land use can comply with the overall policies and objectives of the Council. The overall site and area chosen for the desalination plant will have to ensure sufficient area is provided for landscaping and minimising impact on scenic views.

⁴ NSS and Regional Planning Guidelines

Water Supply Project Eastern and Midlands Region (WSP)

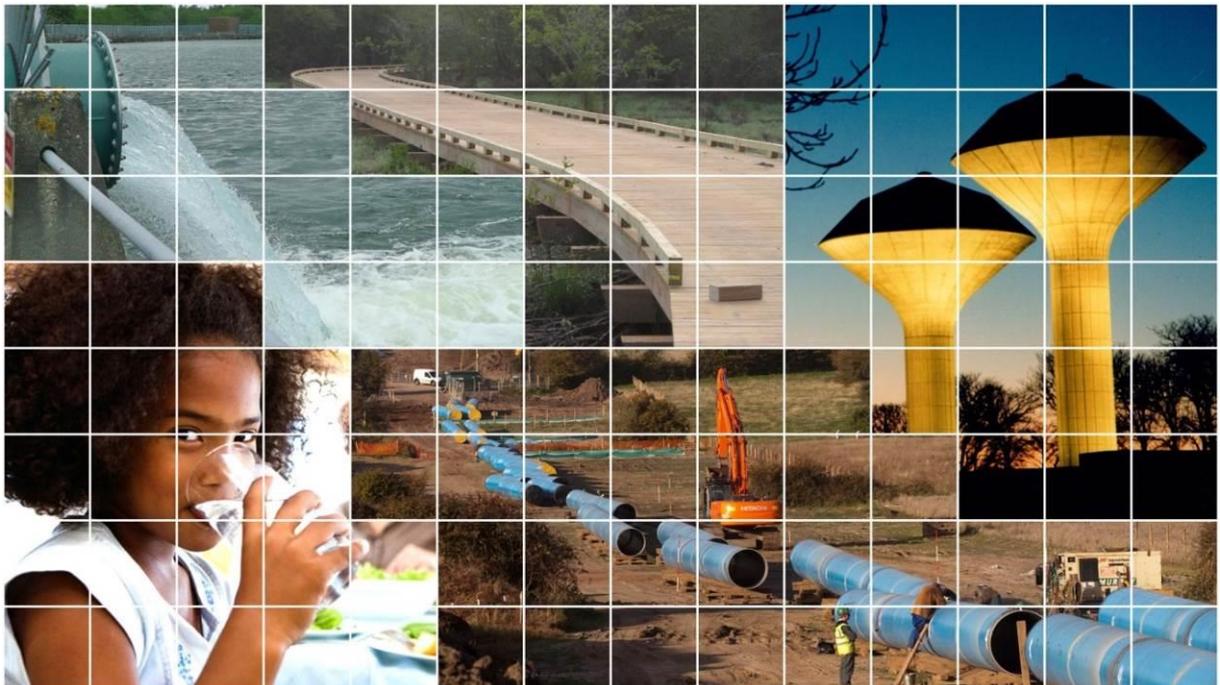
Abstraction Location MCA

Appendix E14: Engineering



October 2015

F02



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1.1 Introduction

Four reasonable alternative options have been identified from previous studies – refer to the *Water Supply Options Working Paper* (Project Road Map Stage 2). These are reconfirmed below.

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)
- Option H (Desalination)

This report describes the decision making process used to appraise the abstraction locations associated with each of the reasonable alternative options.

To undertake the appraisal of abstraction locations a range of specialists were engaged, in their applicable fields, to conduct a comparative assessment of abstraction locations. The following disciplines were engaged:

1. **Ecology** – the consideration of impact on animals, plants and their environment.
2. **Water** – the consideration of impacts on the surface water environment.
3. **Air and Noise** - the consideration of air and noise pollution
4. **Cultural Heritage** - the consideration of existing archaeological and built heritage
5. **Landscape and visual** – the consideration of landscape and visual impact.
6. **Agronomy** – the consideration of impact on land based enterprise.
7. **Soils, Geology and Hydrogeology** – the consideration of impact on soils, geology and hydrogeology.
8. **Planning** – the consideration of planning and land use policy in relation to proposed works
9. **Engineering** - the consideration of technical challenges associated with proposed works.

The specialists independently assessed each location relative to appraisal criteria applicable to their field of expertise. This process, or methodology, is referred to as Multi-Criteria Analysis and explicitly considers multiple criteria; see Table E14-1 within a decision-making environment.

Table E14-1 Appraisal Criteria

Environmental Criteria	Technical Criteria	Risk Criteria
Biodiversity, Flora and Fauna	Safety	Technical Risk relating to the Source
Fisheries	Planning Policy	Technical Risk relating to Infrastructure and Operations
Water	Engineering and Design	Environmental and Planning Risk
Air/Climatic Factors	Capital and Operational Costs	Financial Risk
Material Assets (Energy)	Sustainability	Socio-economic risk
Cultural Heritage (including Architecture & Archaeology)		
Landscape & Visual		
Material Assets (Land use)		
Tourism		
Population		
Human Health		
Soils, Geology and Hydrogeology		

The assessments are presented as individual statements within this Appendix E.

This Appendix E14 is a statement on the specialism Engineering and describes the decision making process used in identifying the least constrained abstraction locations associated with the reasonable alternative options.

The Site Selection Methodology in Appendix B outlines the process employed in identifying least constrained locations. This report should be read in conjunction with the *Site Selection Methodology*.

1.2 Methodology

This is 'Non-linear Site Methodology – Step 1' as described in the *Site Selection Methodology*.

To effectively determine the least constrained abstraction locations for the reasonable alternative options, they were assessed under 6 engineering sub-criteria.

- Fluvial flooding
- Proximity to effluent discharges
- Constructability
- Process waste
- Power availability
- Alignment with Water Services Strategic Plan (WSSP)

The methodology relies upon a review and understanding of the technologies applicable to each location and potential impacts associated with the construction and operation of abstraction works.

1.2.1 Desk study

A desk study exercise of the potential abstraction locations was carried out using the software package *ArcReader*. The supplied datasets and information are as described in the *Site Selection Methodology*.

1.2.2 Categories of impact

The relative analysis of potential locations to define a “least constrained” location is based upon a subjective assessment by each Specialist in their discipline of expertise. This judgement is presented as weighted impact; colour coded for ready identification.

Very high	Dark blue
High	Blue
Mid-range	Green
Low	Light Green
Very low	Cream

2.1 Introduction – Engineering Options (Lough Derg /Parteen Basin)

An assessment of the potential abstraction locations was carried out for the following options:

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)

2.2 Technical Review of the Shannon Options

A conventional Water Treatment Plant (WTP) from a Shannon source itself would need to be sized for a raw water throughput of 330 MI/day. This could be developed as a Phase 1 flow (270 MI/d) in three parallel discrete modular streams, each treating 90 MI/day. A Phase 2 flow (60 MI/d) could be treated in a smaller modular stream catering for 60MI/day. The sizing and configuration of the modular streams are cognisant of the capacity of best available technology.

The WTP would need to incorporate:

- The provision of an inlet /flow splitting chamber;
- Four main treatment streams, which will be fully enclosed (three built in Phase 1 with the fourth to be built in Phase 2);
- A secondary filters process stream for the treatment of process wastes, prior to return to the head of the Works;
- A sludge dewatering facility;
- Provision of a chemical storage dosing building(s);
- Provision of an administration building(s) which may include a control centre, laboratories, welfare facilities, stores, workshops and a visitors' centre.

These key components are represented in Figure E14-1.

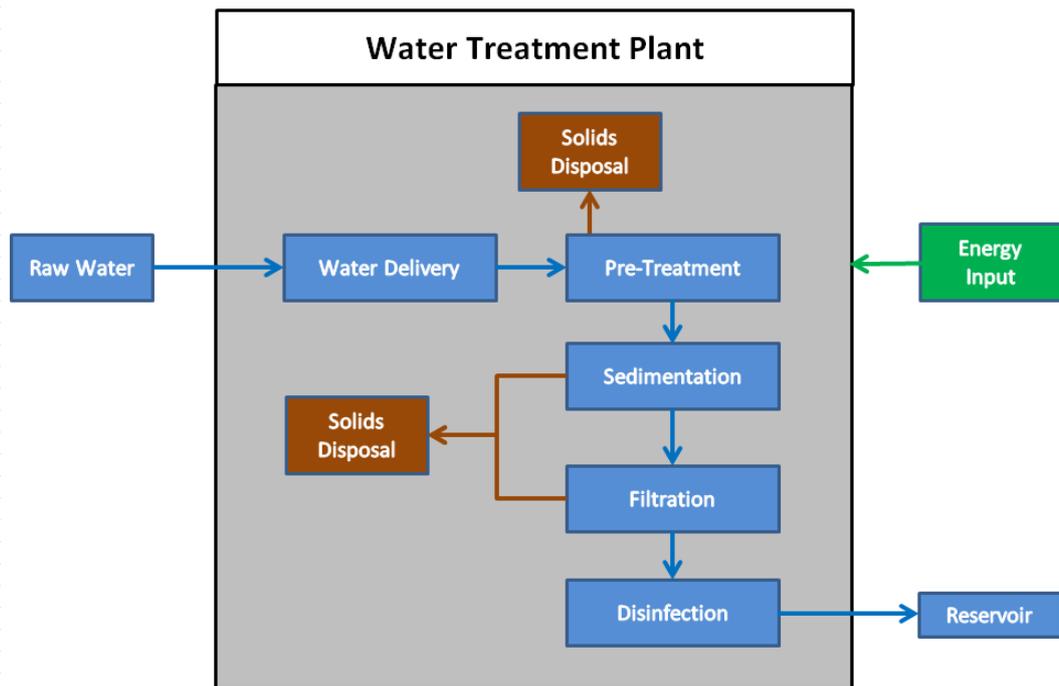


Figure E14-1 Simplified Flow Chart for Conventional Water Treatment Process

Based on a conventional sedimentation and filtration process and the current Irish Water WTP design guidelines, (IW-TEC-900-03 and IW-TEC-900-04), each Phase 1 stream would treat 90,000m³/day and would include units with the following internal (provisional) dimensions:

- Pre-treatment and flocculation tanks (6 tanks, 10.0m x 10.0m each, arranged 3x2);
- 12 flat bottomed lamella clarifiers each measuring 5m wide by 24.0m long (arranged 6x2);
- 11 filters each 5.30m wide by 10.50m long (arranged 11x1); and
- A chlorine contact and clear water storage tank measuring 40m wide by 76m long.

Whilst these units have been provisionally sized in accordance with the recommendations of the current Irish Water guidelines, this tends to result in a large number of tanks. Tank sizes should be reviewed at detailed design stage.

To accommodate a WTP to process a raw water throughput of 330 MI/d, and assuming that the configuration of the tanks are arranged in four parallel streams, (three in Phase 1 with the fourth for Phase 2), a high lift pumping station, control and administration buildings, and access roads, there would be a land requirement (footprint) of approximately 240m by 350m (8.4ha).

If wastewater from the treatment process cannot be discharged from the WTP due to environmental considerations, it may be necessary to provide a higher level of treatment, e.g. a membrane treatment system, specifically for it. A further area of approximately 2.5ha would be required giving a total site area requirement of 10.9ha.

In addition, the abstraction works will need to incorporate protection against infestation of alien species such as zebra mussels or Asian clams or alien vegetation. This can be provided by way of screening and micro-filtration or other methods such as chemical controls, asphyxiation, thermal treatment (heat shocking) ultraviolet irradiation or biological control systems.

There is a concern in this regard when considering the option of storing raw water at Garryhinch. The raw water pumped to Garryhinch will have been screened in some fashion against zebra mussel and will be relatively clear. The Preliminary Report proposed a depth of raw water storage of 5m, in three reservoir cells. Published literature would suggest that raw water storage reservoirs that are less than about 10m deep can allow light to reach the bottom; this may encourage the growth of rooted plants unless the stored waters are sufficiently turbid to reduce light penetration. Shallow reservoirs are therefore generally avoided if there is any likelihood that plant growth could be high.

Furthermore, the characteristics of raw water stored in Garryhinch for long periods may change over time from those of the raw water abstracted from the Shannon system.

The concept of treatment at source is supported by the following:

- Pumping raw water over a distance of up to 62 km would prove troublesome because protection against invasive species carries a different risk. It would entail the cost of providing complex scouring and crossover arrangements on the raw water mains system. It would also result in a lifetime programme of mains cleansing; and notwithstanding the precautionary measures to be developed at source in respect of the mitigation of zebra mussel infestation, there is nevertheless a risk that the scouring systems associated with the raw water mains, which by necessity will require that water is at times scoured into local watercourses, could potentially lead to inter-catchment contamination with zebra mussels.
- In pumping raw water over 62km to Garryhinch there is an additional operational cost because all of the 'process wastes' are being pumped to the storage reservoir whereas removal of these wastes at source would reduce the amount of water to be pumped forward with a significant saving to be made in operational cost.
- A water treatment plant of the size required at Garryhinch would generate large volumes of process waste water, which will have no obvious discharge location other than the River Barrow SAC.

2.3 Lough Derg/Parteen Basin Locations

The following locations were assessed within the Lough Derg/Parteen Basin area:

- Slevoir
- Mota
- Dromineer
- Youghal Bay
- Parteen Basin

2.3.1 Slevoir

The Slevoir location is at the north-eastern end of Lough Derg near the small lakeside settlement of Terryglass. The area has very little residential development, and is characterised primarily by woodland and grassland areas. The N65 National Secondary Road and the R493 regional road bound this location.



Figure E14-2 Lough Derg – Slevoir

(a) Fluvial flooding

There is minimal flooding around the lake shore, the least amount of flooding occurs between Terryglass and Muckloon. There is extensive 1% AEP Fluvial flooding c. 300 m either side of the Carrigahorrig waterbody and c. 200 m either side of the Lorrha waterbody.

(b) Proximity to effluent discharges

Portumna WwTP (3,100pe) discharges treated effluent into the northern end of Lough Derg, to the south of the WwTP. There are several secondary¹ and storm water overflow discharge points within the Portumna network, including a discharge into an ESB open channel which drains to an ESB pumping facility, north east of Portumna, for onwards conveyance to the River Shannon.

¹ A potential, occasional or continuous discharge from the waste water works other than a primary discharge or a storm water overflow.

Terryglass WwTP (400pe) discharges treated effluent into Lough Derg, immediately downstream of the Slevoir location. There are also several secondary and storm water overflow discharge points within the Terryglass collection system.

(c) Constructability

To accommodate a WTP to process raw water and treat process waste on site, there will be a total site area requirement of 10.9 Hectare.

(d) Process waste

Process waste arising from the treatment of raw water will be treated on site and disposed of at the nearest local authority licenced landfill facility.

(e) Power availability

There is an existing 220 kV power line located approximately 3.2km from the Slevoir location. A substation will be required to operate the treatment plant.

(f) Alignment with WSSP

The project is being planned to integrate within the overall strategy of Irish Water and the Water Services Strategic Plan (WSSP). In this context, the project is proposing to make specified quantities of treated water available to local authorities in the full economic zone defined by the source and the water transfer system. A water transfer system sourced in the Shannon and onward to the Dublin region facilitates the potential to deliver new water supplies and support economic development across a significant portion of the State.

(d) Process waste

Process waste arising from the treatment of raw water will be treated on site and disposed of at the nearest local authority licenced landfill facility.

(e) Power availability

There is an existing 220 kV power line located approximately 7.1km from the Mota location. A substation will be required to operate the treatment plant.

(f) Alignment with WSSP

The project is being planned to integrate within the overall strategy of Irish Water and the Water Services Strategic Plan (WSSP). In this context, the project is proposing to make specified quantities of treated water available to local authorities in the full economic zone defined by the source and the water transfer system. A water transfer system sourced in the Shannon and onward to the Dublin region facilitates the potential to deliver new water supplies and support economic development across a significant portion of the State.

(c) Constructability

To accommodate a WTP to process raw water and treat process waste on site, there will be a total site area requirement of 10.9 Hectare.

(d) Process waste

Process waste arising from the treatment of raw water will be treated on site and disposed of at the nearest local authority licenced landfill facility.

(e) Power availability

There is an existing 220 kV power line located approximately 4.1km from the Dromineer location. A substation will be required to operate the treatment plant.

(f) Alignment with WSSP

The project is being planned to integrate within the overall strategy of Irish Water and the Water Services Strategic Plan (WSSP). In this context, the project is proposing to make specified quantities of treated water available to local authorities in the full economic zone defined by the source and the water transfer system. A water transfer system sourced in the Shannon and onward to the Dublin region facilitates the potential to deliver new water supplies and support economic development across a significant portion of the State.

2.3.4 Youghal

The abstraction location at Youghal is focused around the head of Youghal Bay. The Youghal site location is accessed via the narrow Regional Road R495 and very narrow local roads for a distance of some 2.7km.



Figure E14-5 Lough Derg – Youghal

(a) Fluvial flooding

There is minimal 1% AEP Fluvial flooding along the lake shore c. 25m. Extensive fluvial flooding occurs c. 200 m either side of the Nenagh River.

(b) Proximity to effluent discharges

There are no known wastewater treatment plants in the immediate area.

(c) Constructability

To accommodate a WTP to process raw water and treat process waste on site, there will be a total site area requirement of 10.9 Hectare.

(d) Process waste

Process waste arising from the treatment of raw water will be treated on site and disposed of at the nearest local authority licenced landfill facility.

(e) Power availability

There is an existing 220 kV power line located approximately 2.6km from the Youghal location. A substation will be required to operate the treatment plant.

(f) Alignment with WSSP

The project is being planned to integrate within the overall strategy of Irish Water and the Water Services Strategic Plan (WSSP). In this context, the project is proposing to make specified quantities of treated water available to local authorities in the full economic zone defined by the source and the water transfer system. A water transfer system sourced in the Shannon and onward to the Dublin region facilitates the potential to deliver new water supplies and support economic development across a significant portion of the State.

2.3.5 Parteen Basin Reservoir

The Parteen Basin location covers a large area; on the eastern side, accessible from the Regional Roads R494 and R466.



Figure E14-6 Parteen Basin Reservoir

(a) Fluvial flooding

There is extensive 1% AEP fluvial flooding in the southern section of the study area, along the river Lough Derg and Parteen Basin. In addition there is extensive 1% AEP fluvial flooding in the townland of Pollagh. Flooding also occurs either side of the waterbodies c. 50 - 200 m entering Lough Derg.

(b) Proximity to effluent discharges

Ballina WwTP (13,000pe) discharges treated effluent to the Grange River which is passed forward to Lough Derg.

There are several secondary and storm water overflow discharge points within the Ballina/Killaloe collection system.

Clareville Water Treatment Plant currently abstracts water for public consumption approximately 12km downstream of the Ballina WwTP primary discharge point. This treatment plant is in close proximity to the Parteen Basin location.

(c) Constructability

To accommodate a WTP to process raw water and treat process waste on site, there will be a total site area requirement of 10.9 Hectare.

(d) Process waste

Process waste arising from the treatment of raw water will be treated on site and disposed of at the nearest local authority licenced landfill facility.

(e) Power availability

There is an existing 400 kV power line located approximately 1.2km from centre of the Parteen Basin location. A substation will be required to operate the treatment plant.

(f) Alignment with WSSP

The project is being planned to integrate within the overall strategy of Irish Water and the Water Services Strategic Plan (WSSP). In this context, the project is proposing to make specified quantities of treated water available to local authorities in the full economic zone defined by the source and the water transfer system. A water transfer system sourced in the Shannon and onward to the Dublin region facilitates the potential to deliver new water supplies and support economic development across a significant portion of the State.

2.4 Matrix of Multi Criteria Analysis

Criteria	Location 1 - Slevoir	Location 2 - Mota	Location 3 - Dromineer	Location 4 - Youghal Bay	Location 5 - Parteen Basin
Area prone to flooding (PRFA/SCFRAMs) and predicted flood extents within and adjacent to the site. - Proximity to water bodies in terms of flooding and as an indicator of sensitive surface water receptors.	Low: Some flooding does occur within the location but Lands are available outside of the flood zones	Low: Some flooding does occur within the location but Lands are available outside of the flood zones	Low: Some flooding does occur within the location but Lands are available outside of the flood zones	Low: Some flooding does occur within the location but Lands are available outside of the flood zones	Low: More extensive flooding does occur within the location but lands are available outside of the flood zones
Proximity to effluent discharges	Portumna WWTP (3,100pe) and Terryglass WwTP (400pe) discharges to Lough Derg.	N/A	Outfall from Nenagh Agglomeration (13,000pe) is to the Nenagh River which is nutrient sensitive and discharges to Dromineer Bay.	N/A	4,000pe WWTP at Killaloe/Ballina discharges to Lough Derg.
Constructability	No major construction issues envisaged for treatment plant.	No major construction issues envisaged for treatment plant.	No major construction issues envisaged for treatment plant.	No major construction issues envisaged for treatment plant.	No major construction issues envisaged for treatment plant.

Criteria	Location 1 - Slevoir	Location 2 - Mota	Location 3 - Dromineer	Location 4 - Youghal Bay	Location 5 - Parteen Basin
Process waste	On site treatment of process wastes will likely be required.	On site treatment of process wastes will likely be required.	On site treatment of process wastes will likely be required.	On site treatment of process wastes will likely be required.	On site treatment of process wastes will likely be required.
Power availability	220KV Line approx 3.2km from potential site.	220KV Line approx 7.1km from potential site.	220KV Line approx 4.1km from potential site.	220KV Line approx 2.6km from potential site.	400KV Line approx 1.2km from potential site.
Alignment with WSSP	Similar for all sites.				

2.5 Comparative Discussion

With reference to the engineering sub-criteria listed in Section 1.2, the only appreciable differentiator is power availability. Parteen Basin, given its proximity to the existing hydroelectric power facility, has an obvious advantage compared to the other locations.

In consideration of power, cognisance has also to be taken into account of the capacity of this existing supply as water treatment plants can place large demands on the grid. A Parteen Basin location also has this advantage.

3**Desalination****3.1 Introduction – Engineering Option (Desalination)**

An assessment of the potential abstraction locations was carried out for the following options:

- Option H (Desalination)

3.2 Desalination Option – Previous Studies and Technical Review

Prior to transfer of responsibility for managing Ireland's water and wastewater investment and maintenance programmes, Dublin City Council commissioned a number of studies investigating a suitable source of water supply for the Dublin Region. Originally conducted as part of a Feasibility Study undertaken by Dublin City Council's Service Providers in 2005, one option considered was Desalination. This option involves abstraction of sea water from the Irish Sea in north Fingal, desalination of sea water through a Reverse Osmosis (RO) desalination plant, pumping of treated water to Ballycoolen reservoirs via 25 km pipelines, capable of supplying treated water to locations on route, and discharge of brine (from the treatment process) back into the Irish Sea.

This option was developed further by the same Service Providers and concluded with the issuance of the Desalination Study Report (November 2008). The latter included a technical evaluation of a desalinated water supply on the basis of the following approach:

1. Sustainability and availability of water; and
2. Identification of the infrastructural requirements to meet the predicted demand growth at that time. These requirements can be defined as:
 - Water Intake, sea water pipelines and raw water pumping facilities;
 - Water Treatment Plant;
 - Treated Water Pipelines and associated pumping facilities; and
 - Integration (including new storage facilities) with existing supply / distribution infrastructure.

It was concluded that the Desalination Option benefits from an unlimited raw water supply from the Irish Sea, and proximity to the principle demand centre. However, on the downside was the cost of treatment, in particular the energy required and the carbon footprint it entails.

Site selection and pipeline routing were also key considerations. The Desalination Study Report (November 2008) identified North Fingal as the optimum location because of water quality considerations, suitability for construction of intake / outfall infrastructure, energy availability and the relative proximity to the water distribution system within the Dublin Region.

There were a number of desalination processes considered, namely:

- Thermal Evaporation Effect;
- Reverse Osmosis;

- Electro-dialysis Reversal; and
- Solar Stills.

Reverse Osmosis (RO) was recommended as the most appropriate desalination technology principally on account of its technical efficiency, cost effectiveness and environmental impacts.

For an RO Water Treatment Plant there are a number of key components:

- Intake facilities;
- Pre-treatment: disinfection and filtration;
- The Reverse Osmosis Process;
- Post Treatment (mineralisation);
- Reject Stream (Brine); and
- Ancillary facilities - chemical dosing, energy recuperation devices.

These key components are represented in Figure E14-7.

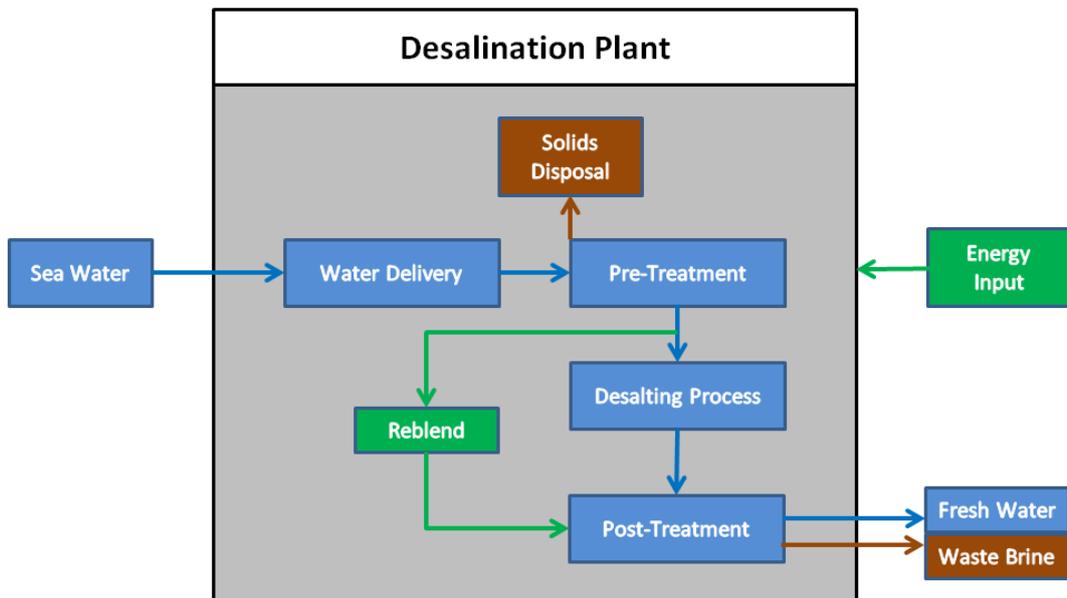


Figure E14-7 Simplified Flow Chart for Desalination Process

From an engineering aspect, the siting of any water treatment plant, whether it is of conventional or desalination design, have common key components irrespective of the location, and choices are influenced primarily by:

1. Sustainability of source yield;
2. Intake facilities; and
3. Outlet arrangements.

Whilst the Irish Sea may have an unlimited raw water supply, to establish the efficacy on this source at any particular location it was important to have an understanding of the impacts, particularly in terms of the Reject Stream (brine).

The optimum abstraction point (intake) would need to be located 3 to 4 km from shore to avoid tidal affects and enhance water intake quality. A sea water intake is influenced by:

- Location: no other discharges should be located near the intake as they may impact on water quality;
- Quality of feed water: directly influences the process treatment provisions and has a direct bearing on the economic viability of the project;
- Space available for intake and means of abstraction and supply: quantity of sea water needed to produce a required flow directly impacts the size of the intake structure; and
- Topography.

A Desalination Plant has effectively two outlets; one where the treated water is passed into supply and a second stream (brine) which represents waste from the water treatment process. This waste will be highly saline and include salts extracted from the raw water and chemicals added during the treatment process. A number of factors can contribute to environmental impacts:

- Salt concentration;
- Temperature above the receiving water (Irish Sea);
- Higher turbidity level;
- Lower oxygen levels;
- Chemicals and salts from the treatment process; and
- Carbon dioxide release.

The brine can be discharged directly to the sea; however the discharge location needs to be selected to effect optimal mixing of the brine takes place in the receiving water.

To assess the impact of brine discharge to the sea a water model was commissioned to assess the likely implications. This is reported in the Desalination Study Report (November 2008), and included the following:

- Simulation of the dispersion of the effluent discharges associated with the desalination process;
- Initial, medium and far dispersion models for brine discharge;
- Impact of effluent discharges without sludge dispersion; and
- Impact of effluent discharges with sludge dispersion.

To ensure long term environmental sustainability of a Desalination Option, the disposal and dispersal of brine from the Desalination Plant would need to occur 2 – 3km from the sea shore.

This assessment informed the sites considered for the Desalination Plant, and associated corridor route selection for conveyance of ‘fresh’ (treated) water to Ballycoolin Reservoir.

3.3 Desalination Locations

The following locations were assessed within the Lough Derg/Parteen Basin area:

- South Dublin
- Loughshinny North
- Loughshinny South
- Balbriggan

3.3.1 South Dublin

South Dublin is the largest of the potential desalination locations, stretching from Dalkey Island in the north to Bray Harbour at its southern extents. There is a high level of existing residential development and road networks in this area.

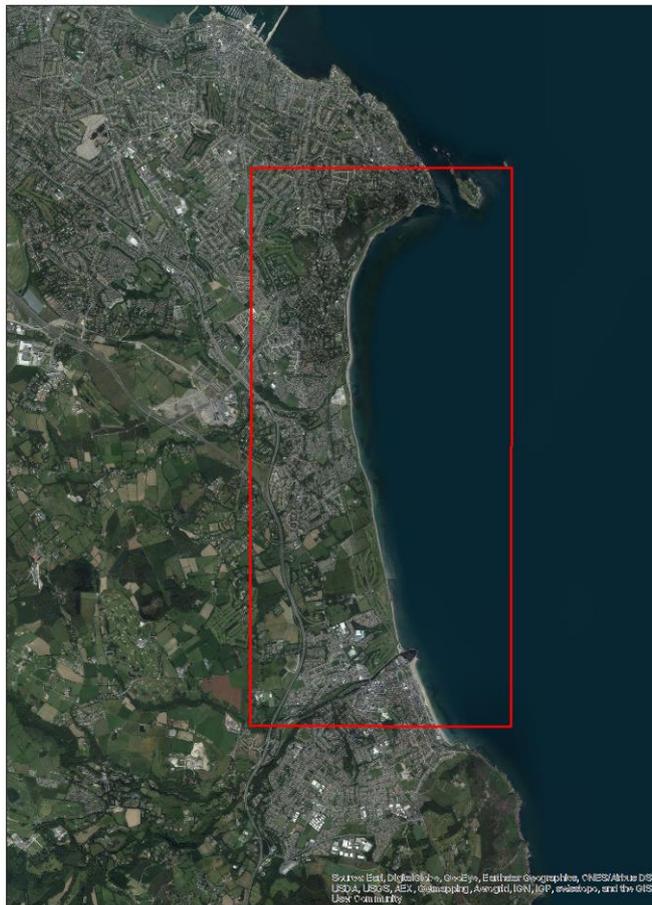


Figure E14-8 South Dublin

(a) Fluvial flooding

There is minimal flooding around the seashore. There 1% AEP Fluvial flooding c. 100 m either side of the Grange Stream and the Shanganagh waterbody. Overall flooding within the Study Area is c. 10%.

(b) Proximity to effluent discharges

Shanganagh WwTP (200,000pe) discharges treated effluent via a long sea outfall to Killiney Bay.

There are several secondary and storm water overflow discharge points within the network.

(c) Constructability

An upper boundary of 15 Hectare (Ha) is considered prudent land provision to accommodate a Desalination Plant for the ultimate water supply demand.

(d) Process waste

Process waste arising from the treatment of raw water will be treated on site and disposed of at the nearest local authority licenced landfill facility.

(e) Power availability

There is an existing 110 kV power line located approximately 1-2km from the centre of the South Dublin location. A substation will be required to operate the treatment plant.

(f) Alignment with WSSP

The project is being planned to integrate within the overall strategy of Irish Water and the Water Services Strategic Plan (WSSP). In this context, the project is proposing to make specified quantities of treated water available to local authorities in the full economic zone defined by the source and the water transfer system. A water transfer system limited to the eastern region constrains the potential to deliver new water supplies and support economic development within the midlands region.

3.3.2 Loughshinny North

The desalination location is situated between Rush to the south and Skerries to the north. The area is less densely populated than South Dublin and is bounded by the R128 regional road.



Figure E14-9 Loughshinny North

(a) Fluvial flooding

There is minimal coastal flooding (0.5% AEP) within the study area and minimal fluvial flooding (1% AEP) from the Lane waterbody. On that basis flooding within the study area is rated as minimal.

(b) Proximity to effluent discharges

Portrane (65,000pe) discharges treated effluent to the Irish Sea.

There are several secondary and storm water overflow discharge points within the network (Lusk, Rush, Portrane, Donabate).

(c) Constructability

An upper boundary of 15 Hectare (Ha) is considered prudent land provision to accommodate a Desalination Plant for the ultimate water supply demand.

(d) Process waste

Process waste arising from the treatment of raw water will be treated on site and disposed of at the nearest local authority licenced landfill facility.

(e) Power availability

There is an existing 38 kV power line located approximately 1.5km from the centre of the Loughshinny North location. A substation will be required to operate the treatment plant.

(f) Alignment with WSSP

The project is being planned to integrate within the overall strategy of Irish Water and the Water Services Strategic Plan (WSSP). In this context, the project is proposing to make specified quantities of treated water available to local authorities in the full economic zone defined by the source and the water transfer system. A water transfer system limited to the eastern region constrains the potential to deliver new water supplies and support economic development within the midlands region.

3.3.3 Loughshinny South

The desalination location is situated between Rush to the south and Skerries to the north. The area is less densely populated than South Dublin and is bounded by the R128 regional road.



Figure E14-10 Loughshinny North

(a) Fluvial flooding

There is minimal coastal flooding (0.5% AEP) within the Study Area. There is minimal fluvial flooding (1% AEP) from the Balcunnin waterbody. Overall flooding within the Study Area is minimal.

(b) Proximity to effluent discharges

Ballbriggan/Skerries WwTP (28,000pe) discharges treated effluent via a long sea outfall from Kelly's Bay to the Irish Sea.

There are several secondary and storm water overflow discharge points within the network (Lusk, Rush, Portrane, Donabate).

(c) Constructability

An upper boundary of 15 Hectare (Ha) is considered prudent land provision to accommodate a Desalination Plant for the ultimate water supply demand.

(d) Process waste

Process waste arising from the treatment of raw water will be treated on site and disposed of at the nearest local authority licenced landfill facility.

(e) Power availability

There is an existing 38 kV power line located approximately 1.5km from the centre of Loughshinny South location. A substation will be required to operate the treatment plant.

(f) Feasibility of connection to the Greater Dublin water supply grid

This site can be connected into the Ballycoolin reservoir.

(g) Alignment with WSSP

The project is being planned to integrate within the overall strategy of Irish Water and the Water Services Strategic Plan (WSSP). In this context, the project is proposing to make specified quantities of treated water available to local authorities in the full economic zone defined by the source and the water transfer system. A water transfer system limited to the eastern region constrains the potential to deliver new water supplies and support economic development within the midlands region.

3.3.4 Balbriggan

The Balbriggan desalination location is the furthest north of all the locations assessed. The area is located north of a densely populated residential area and is served by the R132 regional road.



Figure E14-11 Balbriggan

(a) Fluvial flooding

There is minimal coastal flooding (0.5% AEP) within the Study. There is no fluvial flooding (1% AEP) within the study area. Overall flooding is minimal.

(b) Proximity to effluent discharges

Ballbriggan/Skerries WwTP (28,000pe) discharges treated effluent via a long sea outfall from Kelly's Bay to the Irish Sea.

There are several secondary and storm water overflow discharge points within the network.

(c) Constructability

An upper boundary of 15 Hectare (Ha) is considered prudent land provision to accommodate a Desalination Plant for the ultimate water supply demand. The area

can be accessed from local roads off the R132 regional road to the west; however upgrade works may be required to local roads which cross over the existing Dublin-Belfast railway system. It may be possible to provide some access to this area via the sea.

(d) Process waste arising's

Process waste arising from the treatment of raw water will be treated on site and disposed of at the nearest local authority licenced landfill facility.

(e) Power availability

There is an existing 38 kV power line located approximately 1km from the centre of the Balbriggan location. A substation will be required to operate the treatment plant.

(f) Alignment with WSSP

The project is being planned to integrate within the overall strategy of Irish Water and the Water Services Strategic Plan (WSSP). In this context, the project is proposing to make specified quantities of treated water available to local authorities in the full economic zone defined by the source and the water transfer system. A water transfer system limited to the eastern region constrains the potential to deliver new water supplies and support economic development within the midlands region.

3.4 Matrix of Multi Criteria Analysis

Criteria	Location 1 - South Dublin	Location 2 - Loughshinny North	Location 3 - Loughshinny South	Location 4 - Balbriggan
Area prone to flooding (PRFA/SCFRAMs) and predicted flood extents within and adjacent to the site. - Proximity to water bodies in terms of flooding and as an indicator of sensitive surface water receptors.	Low: Some flooding does occur within the location but Lands are available outside of the flood zones	Low: Some flooding does occur within the location but Lands are available outside of the flood zones	Low: Some flooding does occur within the location but Lands are available outside of the flood zones	Low: Some flooding does occur within the location but Lands are available outside of the flood zones
Proximity to effluent discharges	Shanganagh WwTP (200,000pe) discharges treated effluent via a long sea outfall to Killiney Bay.	Portrane (65,000pe) discharges treated effluent to the Irish Sea.	Portrane (65,000pe) discharges treated effluent to the Irish Sea.	Ballbriggan/Skerries WwTP (28,000pe) discharges treated effluent via a long sea outfall from Kelly's Bay to the Irish Sea.
Constructability	No major construction issues envisaged for treatment plant.	No major construction issues envisaged for treatment plant.	No major construction issues envisaged for treatment plant.	No major construction issues envisaged for treatment plant.

Criteria	Location 1 - South Dublin	Location 2 - Loughshinny North	Location 3 - Loughshinny South	Location 4 - Balbriggan
Process waste	On site treatment of process wastes will likely be required.	On site treatment of process wastes will likely be required.	On site treatment of process wastes will likely be required.	On site treatment of process wastes will likely be required.
Power availability	110 kV power line located approximately 1-2km from the centre of the South Dublin location	38 kV power line located approximately 1.5km from the centre of the Loughshinny North location	38 kV power line located approximately 1.5km from the centre of Loughshinny South location	38 kV power line located approximately 1km from the centre of the Balbriggan location
Alignment with WSSP	Abstraction and Treatment at source can provide up to 40MI/d treated water to the Benefiting Corridor. The ability to link to known areas of demand is constrained by geography of source and terminal point.	Abstraction and Treatment at source can provide up to 40MI/d treated water to the Benefiting Corridor.	Abstraction and Treatment at source can provide up to 40MI/d treated water to the Benefiting Corridor.	Abstraction and Treatment at source can provide up to 40MI/d treated water to the Benefiting Corridor.

3.5 Comparative Discussion

Locations in Loughshinney / Balbriggan will require an upgrade to the existing power grid to meet the heavy demand requirements of a Desalination Plant; a South Dublin location to a lesser extent. However, South Dublin presents a significant challenge in integrating a new source supply with the existing water supply / distribution infrastructure, given the geography of the location relative to the demands being placed on the system. In this regard, a location on the south side of Dublin is considered much less favourable to one on the north side.

Of the 6 engineering sub-criteria listed in Section 1.2, and from an eastern abstraction perspective, it would be considered the key differentiator and the one which has the potential to be the most difficult to mitigate.

Water Supply Project Eastern and Midlands Region (WSP)

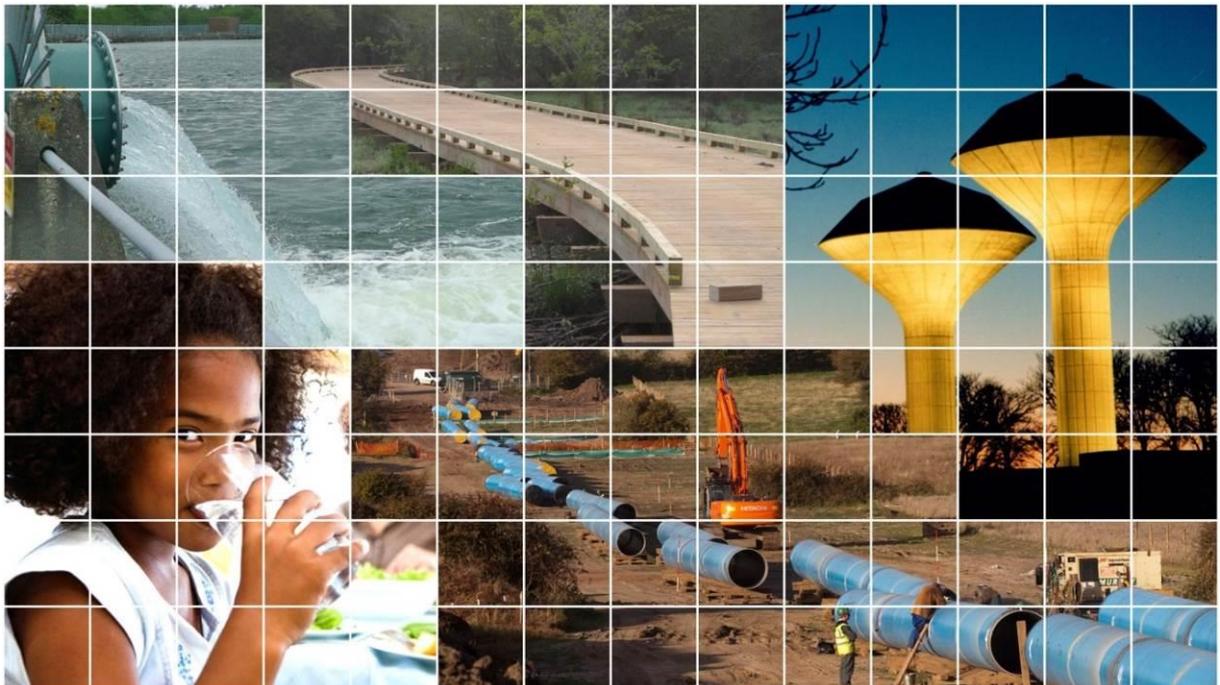
Abstraction Location MCA

Appendix E15: Traffic



October 2015

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1.1 Introduction

Four reasonable alternative options have been identified from previous studies – refer to the *Water Supply Options Working Paper* (Project Road Map Stage 2). These are reconfirmed below.

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)
- Option H (Desalination)

This report describes the decision making process used to appraise the abstraction locations associated with each of the reasonable alternative options.

To undertake the appraisal of abstraction locations a range of specialists were engaged, in their applicable fields, to conduct a comparative assessment of abstraction locations. The following disciplines were engaged:

- i. **Ecology** – the consideration of impact on animals, plants and their environment.
- ii. **Water** – the consideration of impacts on the surface water environment.
- iii. **Air and Noise** - the consideration of air and noise pollution
- iv. **Cultural Heritage** - the consideration of existing archaeological and built heritage
- v. **Soils, Geology and Hydrogeology** – the consideration of impact on soils, geology and hydrogeology.
- vi. **Landscape and visual** – the consideration of landscape and visual impact.
- vii. **Agronomy** – the consideration of impact on land based enterprise.
- viii. **People** – the consideration of impacts on people
- ix. **Planning** – the consideration of planning and land use policy in relation to proposed works
- x. **Engineering** - the consideration of technical challenges associated with proposed works.
- xi. **Traffic** - the consideration of impact on traffic and road network

The specialists independently assessed each location relative to appraisal criteria applicable to their field of expertise. This process, or methodology, is referred to as Multi-Criteria Analysis and explicitly considers multiple criteria (see Table E15 - 1), within a decision-making environment.

Environmental Criteria	Technical Criteria	Risk Criteria
Biodiversity, Flora and Fauna	Safety	Technical Risk relating to the Source
Fisheries	Planning Policy	Technical Risk relating to Infrastructure and Operations
Water	Engineering and Design	Environmental and Planning Risk
Air/Climatic Factors	Capital and Operational Costs	Financial Risk
Material Assets (Energy)	Sustainability	Socio-economic risk
Cultural Heritage (including Architecture & Archaeology)		
Landscape & Visual		
Material Assets (Land use)		
Tourism		
Population		
Human Health		
Soils, Geology and Hydrogeology		

Table E15 - 1 Appraisal Criteria

The assessments are presented as individual statements within this Appendix E.

This Appendix E15 is a statement on the specialism Traffic and describes the decision making process used in identifying the least constrained abstraction locations associated with the reasonable alternative options.

The Site Selection Methodology in Appendix B outlines the process employed in identifying least constrained locations. This report should be read in conjunction with the *Site Selection Methodology*.

1.2 Methodology

This is 'Non-linear Site Methodology – Step 1' as described in the *Site Selection Methodology*.

To effectively determine the least constrained abstraction locations for the reasonable alternative options, the potential abstraction locations were assessed under 9 no. Traffic sub-criteria.

- Length of access road
- Number of crossings required for access road
- Potential Impact on landowners
- Works required to provide safe access entrance
- Potential impact on surrounding local road network
- Frequency of accidents near entrance
- Frequency of accidents on surrounding network
- Road link impacted upon by all construction traffic
- Construction Risk

The methodology relies upon the review and understanding of the technologies applicable to each location and potential impacts associated with the construction and operation of abstraction works.

1.2.1 Desk study

A desk study exercise of the potential abstraction locations was carried out using the software package *ArcReader*. The supplied datasets and information are as described in the *Site Selection Methodology*.

1.2.2 Categories of impact

The relative analysis of potential locations to define a “least constrained” location is based upon a subjective assessment by each Specialist in their discipline of expertise. This judgement is presented as weighted impact; colour coded for ready identification.

Very high	Dark blue
High	Blue
Mid-range	Green
Low	Light Green
Very low	Cream

Land take for abstraction works and a pumping station would not have a significant impact on landowners as the potential sites are located close to the N65 National Primary Road.

2.1.2 Mota



Figure E15 – 2 Lough Derg - Mota

The Mota site location is accessed via a narrow Regional road network (R493) and is located some 12km from the National road network at Carrigahorig and 20km from National roads at Nenagh.

Access from the R493 to the Mota site would be via a narrow one vehicle wide road and consideration would have to be given for to the construction of an independent access route to Mota from the R493 in order to provide a safe entrance.

Land take for abstraction works and pumping station would not have a significant impact on landowners, but a permanent access road from the R493 would likely be required and this would potentially result in land splitting.

2.1.4 Youghal



Figure E15 – 4 Lough Derg - Youghal

The Youghal site location is accessed via the narrow Regional Road R495 and very narrow local roads for a distance of some 2.7km.

Consideration would have to be given to the construction of an independent, permanent access route from the R495 in order to provide a safe entrance. This would result in one crossing of an existing local access road. Any new access road from the R495 would likely be 4.4km on length. An alternative to this would be to widen the local roads.

There is significant works and risks associated with the construction of 4.4km of access road or alternative local road widening.

While land take for abstraction works and pumping station would not have a significant impact on a large number of landowners, a 4.4km long access road from the R495 would potentially result in land splitting and impact on a significant number of landowners. The alternative would be to widen the local roads but this would also impact on a large number of landowners.

2.1.5 Parteen Basin Reservoir



Figure E15 – 5 Parteen Basin Reservoir

The Parteen Basin location covers a large area and on the eastern side it is accessible from the Regional Roads R494 and R466.

Access to an abstraction location on Parteen Basin would likely be direct from the R494 Regional Road with no local road crossings required.

The abstraction location is likely to be a short distance from the R494 so minimal number of landowners are likely to be impacted. An access road would potentially be required to the Treatment Plant site from the regional road that is likely to impact on a number of landowners depending on the selected route.

R494 and R445 are roads identified where a high number of accidents have been caused by speeding.

2.2 Matrix of Multi Criteria Analysis

Criteria	Slevoir	Mota	Dromineer	Youghal Bay	Parteen Basin
Length of access road required	Very Low: Land very accessible from the N65.	Access via narrow Regional road network. 12km from National road at Carrigahorig and 20km from National road at Nenagh.	Regional Road R493 is approx 2.5km from abstraction location. Very narrow local roads for 2.5km - width for one vehicle.	Regional Road R495 is approx 2.7km from abstraction location. Regional Road R494 is approx 4.4km from abstraction location. Very narrow local roads - width for one vehicle.	Regional Road R494 is approx 0.9km from abstraction location - no issues with road width. Good proximity to the M7 and old N7.
Number of crossings required for access road	Land very accessible from the N65 so no crossings required.	An independent access route from the R493 required in order to provide a safe entrance which would result in one crossing of a local access road.	Access road can be routed through agricultural land without the need to cross existing roads.	An independent access route from the R495 required in order to provide a safe entrance which would result in one crossing of a local access road.	Access likely direct from R494 with no road crossings.
Potential Impact on landowners	Short distance from N65 to lake shore so minimal number of landowners impacted. Treatment plant can be located a short distance from the N65 and the abstraction location so minimal number of landowners impacted.	Land take for abstraction and pumping station would not have a significant impact on landowners. However, an access road from the R493 would likely be required and this would potentially result in land splitting. Potential to site the treatment plant in a single land holding near the R493 where there is a wooded area.	Land take for abstraction, pumping station and treatment plant would not have a significant impact on landowners. However, an access road for 1.5km would likely be required and this would potentially result in land splitting and impact on a significant number of landowners.	Land take for abstraction and pumping station would not have a significant impact on landowners. However, an access road for 4.4km would likely be required from the R495 and this would potentially result in land splitting and impact on a significant number of landowners. Alternative would be to widen the local roads.	Short distance from R494 to lake shore so minimal number of landowners impacted. An access road would potentially be required to the Treatment Plant site from the regional road that is likely to impact on a number of landowners depending on the selected route.

Criteria	Slevoir	Mota	Dromineer	Youghal Bay	Parteen Basin
Works required to provide safe access entrance	New access off N65 near bends in road and works will be required to provide relevant sight distances.	Access from R493 to abstraction would be via a narrow one vehicle wide road; consideration would have to be given for the construction of an independent access route from the R493.	An access road for 1.5km would likely be required as the existing local road is only wide enough for a single vehicle.	An access road for 4.4km would likely be required from the R495. Alternative would be to widen the local roads.	New access from R494 would be required for abstraction. New access from R494, or R445 or R496 would be required for treatment plant.
Potential impact on surrounding local road network	New access off N65 near bends in road and works will be required to provide relevant sight distances.	Access from R493 to abstraction would be via a narrow one vehicle wide road; consideration would be given for the construction of an independent access route from the R493.	Regional Road R493 is approx 2.5km from abstraction location. So with 1.5km of new access road there would remain an impact on 1km of local road network.	An access road for 4.4km would likely be required from the R495. Alternative would be to widen the local roads.	For abstraction only impact will be on the R494. For treatment plant site only impact will be on either the R494, or R445 or R496.
Frequency of accidents near entrance	Not an area of frequent accidents.	Not an area of frequent accidents.	Not an area of frequent accidents.	Not an area of frequent accidents.	R494 and R445 are roads identified where a high number of accidents have been caused by speeding.
Frequency of accidents on surrounding network (indication of general road safety issues)	Not an area of frequent accidents.	Not an area of frequent accidents.	Not an area of frequent accidents.	Not an area of frequent accidents.	R494 and R445 are roads identified where a high number of accidents have been caused by speeding.

Criteria	Slevoir	Mota	Dromineer	Youghal Bay	Parteen Basin
Road link impacted upon by all construction traffic (excluding major routes i.e. R132/N32)	Location adjacent to and very accessible from the N65.	Access for construction traffic via narrow Regional road network. Long distance from National road network. 12km from National Road at Carrigahorig and 20km from National road at Nenagh. Also local access road is also access to three residential properties.	Regional Road R493 is approx 2.5km from abstraction location. Very narrow local roads for 2.5km - width for one vehicle.	Regional Road R495 is approx 2.7km from abstraction location. Regional Road R494 is approx 4.4km from abstraction location. Very narrow local roads - width for one vehicle.	Available abstraction possibly located in private estate so as to avoid the embankments. Regional Road R494 is approx 0.9km from abstraction location - no issues with road width. Good proximity to the M7 and old N7.
Construction Risk	Very Low.	Access from R493 to abstraction location is a narrow one vehicle road that is also access to three residential properties, agricultural land and Mota Quay.	Access from the R493 to the abstraction would require travel on 1km of local road to the west of Puckaun.	Significant works and associated risks with construction of 4.4km of access road or alternative local road widening.	Very Low.

2.3 Comparative Discussion

Sites for abstraction works at Mota, Dromineer and Youghal Bay all present difficulties with respect to access and traffic.

Access to the Mota site is via a narrow regional road network and is located 12km from the National Road at Carrigahorig and 20km from the National Road at Nenagh. A new, independent access route from the R493 would be required in order to provide a safe entrance which would result in one crossing of an existing local access road. Land take for an abstraction and pumping station would not have a significant impact on most landowners at Mota. However, an access road from the R493 would likely be required and this would potentially result in land splitting. There is potential to site the treatment plant in a single land holding near the R493 where there is a wooded area.

The Dromineer site is located approximately 2.5km from the R493 Regional Road and there is a very narrow local road linking the R493 and the Dromineer site. A new access road can be routed through agricultural land without the need to cross existing roads; however this would potentially result in land splitting and impact on a significant number of landholdings.

The Youghal Bay site is located approximately 2.7km from the R495 Regional Road and approximately 4.4km from the R494. There is a very narrow local road linking the R494 and R495 with the Dromineer site. An independent access route from the R495 would be required in order to provide a safe entrance which would result in one crossing of an existing local access road. A new access road, 4.4km in length, would potentially result in land splitting and would impact on a significant number of landowners. An alternative would be to widen the local roads but this also has the potential to impact on a significant number of landowners.

Mota, Dromineer and Youghal Bay are not areas of frequent accidents on the local roads.

The Slevoir and Parteen locations are very similar with respect to traffic with a slight preference towards Slevoir.

The Slevoir site is very accessible from the N65 and the short distance from the N65 to lake shore means that a minimal number of landowners would be impacted by the construction of new roads. A treatment plant could be located a short distance from the N65 and the abstraction location, so, again, a minimal number of landowners would be impacted. A new access road would be required off the N65 near bends in the road and works would be required to provide safe and relevant sight distances. The N65 is not a road with frequent accidents.

At Parteen the R494 Regional Road is approximately 0.9km from a potential abstraction location and is in close proximity to the M7 and the old N7. The R494 is located a short distance from the lake shore so a minimal number of landowners would be impacted by the construction of new roads. A new access road would potentially be required from the regional road to a Treatment Plant site and it is likely to impact on a number of landowners depending on the selected location of the Treatment Plant. The R494 and R445 are roads identified where a high number of accidents have been caused by speeding.

3 Desalination

3.1 Desalination Locations

An assessment of the potential abstraction locations was carried out for the following options:

- Option H (Desalination)

3.1.1 South Dublin

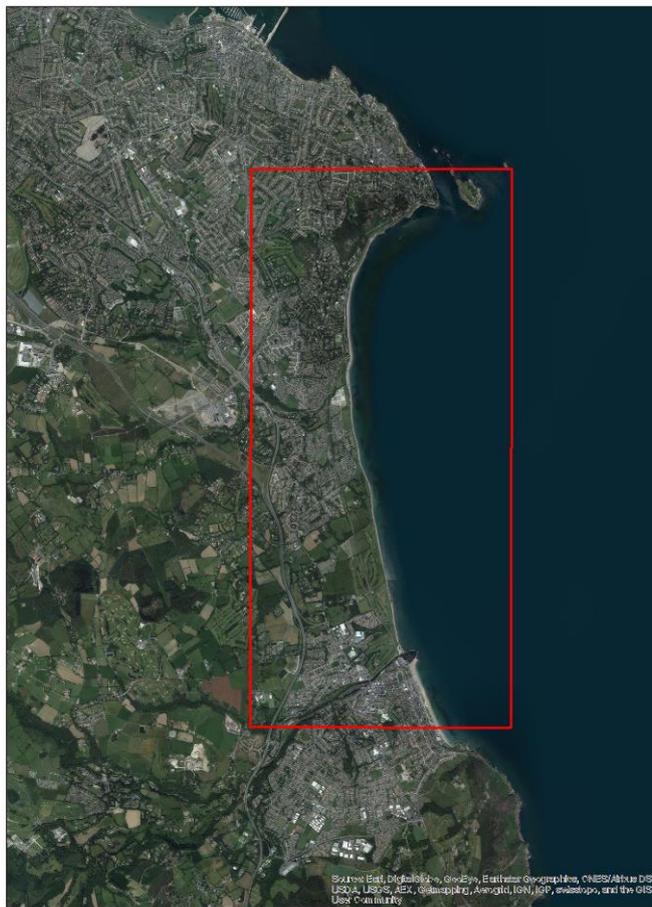


Figure E8 – 6 South Dublin

The South Dublin location covers a large area between Dalkey and Bray. The length of access road required to service a potential site in South Dublin can vary depending on the selected site location within an area with a high density of road network.

Due to the density of the existing road network and the highly urbanised area there is likely to be some impact on the local road network during the construction and operation phases. The highly urbanised area presents a potential risk during the construction phase due to construction traffic.

3.1.2 Loughshinny North



Figure E8 – 7 Loughshinny North

The Loughshinny North site is largely free from development to the east of the R128 Regional Road. There are two local access roads from the R128 running in a west to east direction. The northern most access road is a single vehicle wide tarred road that provides access to farmland and two residential properties at the end of the access road. The southern access road is also a single vehicle wide tarred road and provides access to farm land and a few residential properties. The major part of the site area is located between the two local access roads.

A new access road is potentially required from the R128 to the selected site and this would be of the order of 1.0km in length.

3.1.3 Loughshinny South



Figure E8 – 8 Loughshinny South

The Loughshinny South site is bounded in its western extent by residential development and there is no available space to site a 15 hectare desalination plant. There are lands available to the east of the R128 Regional Road for the location of a 15 hectare desalination plant.

There are two local access roads from the R128 running in a west to east direction. The major part of the site area is located to the north of the two local access roads. The northern most access road is used for access to farmlands and is not surfaced.

A new access road would be required in order to provide a suitable access to a desalination plant site and this would be of the order of 1.0km in length.

The R128 Regional Road has a record of accidents through Rush, which is located immediately south of the Loughshinny South.

3.1.4 Balbriggan



Figure E8 – 9 Balbriggan

The Balbriggan site area is located to the east of the R132 Regional Road and the site area is partitioned by the Dublin / Belfast railway line. The major part of the site area is located to the east of the railway line. A new access road would be required from the R132 to the site over a distance of about 0.7km.

A new access road to the Balbriggan location will potentially require a bridge crossing of the Dublin / Belfast railway line.

The crossing of the railway line during the construction phase would present risks associated with construction traffic.

3.2 Matrix of Multi Criteria Analysis

Criteria	South Dublin	Loughshinny North	Loughshinny South	Balbriggan
Length of access road required	Considered that length of access road required will be less than 0.2km due to density of road network.	Potentially require a new access road from the R128 - Typical length 1.0km.	Potentially require a new access road from the R128 - Typical length 1.0km.	A new access road or an upgraded access road from the R132 - Typical length 0.7km.
Number of crossings required for access road	Due to the density of the existing road network there is likely to be no crossings required.	None - direct route off the R128.	None - direct route off the R128.	Potential crossing of the Railway Line.
Potential Impact on landowners	Undeveloped lands in urban area.	Some landowners in agricultural lands likely to be impacted.	Some landowners in agricultural lands likely to be impacted.	Some landowners in agricultural lands likely to be impacted.
Works required to provide safe access entrance	Due to the density of the existing road network there is likely to be no significant works required to provide a safe entrance.	New access road off the the R128.	New access road off the the R128.	A new access road or an upgraded access road from the R132 - Typical length 0.7km. Railway line crossing also required.
Potential impact on surrounding local road network	Due to the density of road network and the highly urbanised area there is likely to be some impact on the road network.	Only impact would be on the R128.	Only impact would be on the R128.	Only impact would be on the R132.
Frequency of accidents near entrance	Not a significant accident location.	Not a significant accident location.	R128 has record of accidents through Rush.	Not a significant accident location.
Frequency of accidents on surrounding network (indication of general road safety issues)	Not a significant accident location.	R128 has record of accidents through Rush.	R128 has record of accidents through Rush.	R132 north and south of site entrance has high frequency of accidents.

Criteria	South Dublin	Loughshinny North	Loughshinny South	Balbriggan
Road link impacted upon by all construction traffic (excluding major routes i.e. R132/N32)	High density of regional roads so road link impact could be minimal.	No road link impacts other than major routes.	No road link impacts other than major routes.	No road link impacts other than major routes.
Construction Risk	Risk associated with construction works in a highly urbanised area.	No significant construction risks associated with traffic identified at this stage.	No significant construction risks associated with traffic identified at this stage.	Risk associated with crossing of railway line.

3.3 Comparative Discussion

No significant traffic constraints were identified at any of the Desalination Locations; however the crossing of the Dublin / Belfast railway line presents a construction risk associated with the Balbriggan location and the South Dublin location could potentially present construction risks in a highly urbanised area, depending on the selected desalination plant site.

The length of access road required to the South Dublin site can vary depending on the selected site location within an area with a high density of road network but it is considered that the length of new access road required would be less than 0.2km and there is likely to be no crossings required due to the density of the existing road network. The potential sites at Loughshinny North and Loughshinny South would both require new direct access roads from the regional road network and the length of access road would typically be of the order of 1.0km. The Balbriggan site would also require a new access road but in addition is likely to require a bridge crossing of the railway line.

The potential for impact on landowners is very low in the South Dublin area as the site would be located in undeveloped lands in an urban area. The potential impact on landowners at the other three potential site locations would be higher than the South Dublin site but nonetheless would be described as low.

Due to the density of the existing road network and the highly urbanised area there is likely to be some impact on the local road network during the construction and operation phases of a desalination plant in South Dublin. At the other three potential site locations the impact on the surrounding local road network is likely to be restricted to the nearby regional roads.

The highest frequency of accidents near the potential site entrance is associated with the Loughshinny South site. The R128 has a record of accidents through Rush while the R132 north and south of the entrance to a potential site at Balbriggan has a high frequency of accidents.

In terms of construction risk there are high risks associated with the South Dublin site (due to the highly urbanised nature of the area) and associated with the Balbriggan site, due to the potential need to cross the railway line.

The potential impact on traffic at each location is generally low but, based on the identification of potential construction risk in two of the locations, the Loughshinny North site is selected as the least constrained location for a desalination plant from the point of view of traffic.

Water Supply Project Eastern and Midlands Region (WSP)

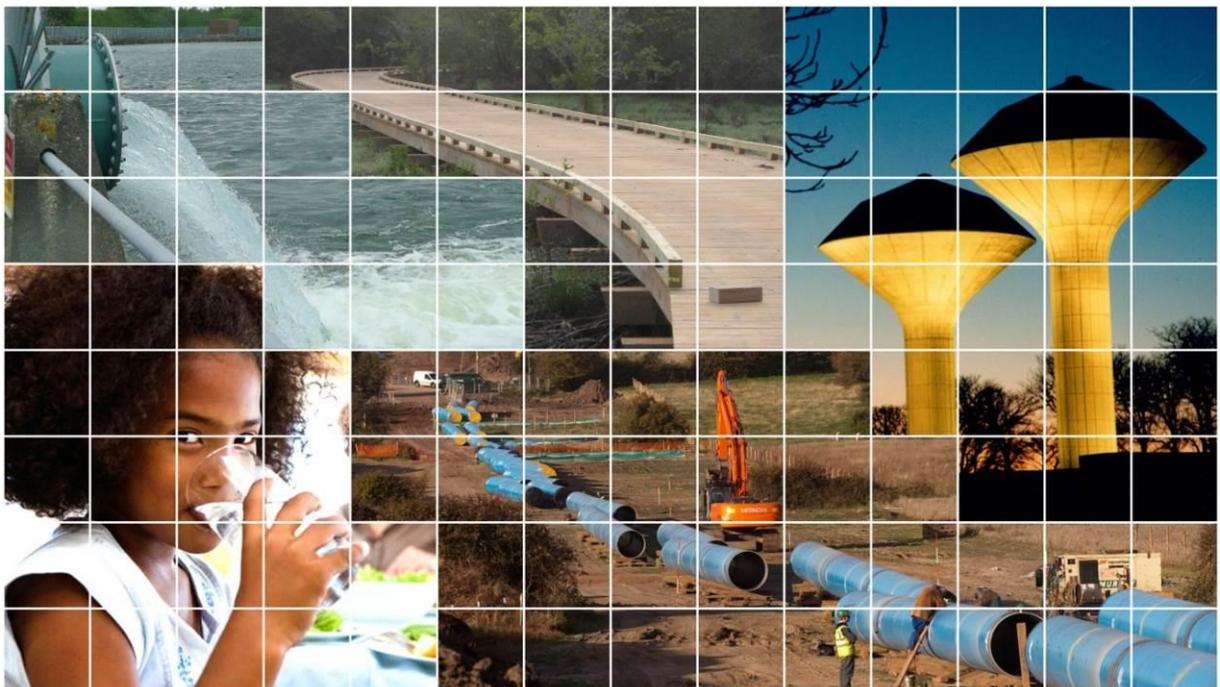
Abstraction Location MCA

Appendix E16: Risk



October 2015

F02



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1.1 Introduction

Four reasonable alternative options have been identified from previous studies – refer to the *Water Supply Options Working Paper* (Project Road Map Stage 2). These are reconfirmed below.

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)
- Option H (Desalination)

This report describes the decision making process used to appraise the abstraction locations associated with each of the reasonable alternative options.

To undertake the appraisal of abstraction locations a range of specialists were engaged, in their applicable fields, to conduct a comparative assessment of abstraction locations. The following disciplines were engaged:

- i. **Ecology** – the consideration of impact on animals, plants and their environment.
- ii. **Water** – the consideration of impacts on the surface water environment.
- iii. **Air and Noise** - the consideration of air and noise pollution
- iv. **Cultural Heritage** - the consideration of existing archaeological and built heritage
- v. **Soils, Geology and Hydrogeology** – the consideration of impact on soils, geology and hydrogeology.
- vi. **Landscape and visual** – the consideration of landscape and visual impact.
- vii. **Agronomy** – the consideration of impact on land based enterprise.
- viii. **People** – the consideration of impacts on people
- ix. **Planning** – the consideration of planning and land use policy in relation to proposed works
- x. **Engineering** - the consideration of technical challenges associated with proposed works.
- xi. **Traffic** - the consideration of impact on traffic and road network

The specialists independently assessed each location relative to appraisal criteria applicable to their field of expertise. This process, or methodology, is referred to as Multi-Criteria Analysis and explicitly considers multiple criteria, see Table E15 - 1, within a decision-making environment.

Environmental Criteria	Technical Criteria	Risk Criteria
Biodiversity, Flora and Fauna	Safety	Technical Risk relating to the Source
Fisheries	Planning Policy	Technical Risk relating to Infrastructure and Operations
Water	Engineering and Design	Environmental and Planning Risk
Air/Climatic Factors	Capital and Operational Costs	Financial Risk
Material Assets (Energy)	Sustainability	Socio-economic risk
Cultural Heritage (including Architecture & Archaeology)		
Landscape & Visual		
Material Assets (Land use)		
Tourism		
Population		
Human Health		
Soils, Geology and Hydrogeology		

Table E15 - 1 Appraisal Criteria

The assessments are presented as individual statements within this Appendix E.

This Appendix E15 is a statement on the Risk Criteria and describes the decision making process used in identifying the least constrained abstraction locations associated with the reasonable alternative options.

The Site Selection Methodology in Appendix B outlines the process employed in identifying least constrained locations. This report should be read in conjunction with the *Site Selection Methodology*.

1.2 Methodology

This is ‘Non-linear Site Methodology – Step 1’ as described in the *Site Selection Methodology*.

To effectively determine the least constrained abstraction locations for the reasonable alternative options, the potential abstraction locations were assessed under 5 no. Risk criteria.

- Technical Risk relating to the Source
- Technical Risk relating to Infrastructure and Operations
- Environmental and Planning Risk
- Financial Risk
- Socio-economic risk

These risk criteria are considered differentiating features where the objective is to achieve a workable planning permission in a timely fashion.

1.2.1 Desk study

A desk study exercise of the potential abstraction locations was carried out using the software package *ArcReader*. The supplied datasets and information are as described in the *Site Selection Methodology*.

1.2.2 Categories of impact

The relative analysis of potential locations to define a “least constrained” location is based upon a subjective assessment by each Specialist in their discipline of expertise. This judgement is presented as a position in a range of impact; colour coded for ready identification.

Very high	Dark blue
High	Blue
Mid range	Green
Low	Light Green
Very low	Cream

2 Lough Derg/Parteen Basin

2.1 Lough Derg/Parteen Basin Locations

An assessment of the potential abstraction locations was carried out for the following options:

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)

2.1.1 Slevoir



Figure E8 – 1 Lough Derg - Slevoir

(a) Technical Risk relating to the Source

Abstraction is possible within ESB normal operating band for water levels. Abstraction will however give rise to increased residence times of water in Lough Derg during dry periods, current estimates range up to 42 days at maximum, and are subject to model verification by hydrodynamic field data. Abstraction will not

result in changes to the normal lake operational range in any years where generation curtailment over summer occurs, provided agreement is reached with ESB to modify generation activities at Ardnacrusha to compensate for water abstracted. In a drought year such as 1995, operation within existing operational level limits is possible, with impact estimated at 60 – 70mm within that band. No impact will occur on compensation water flows to the old Shannon channel downstream of Parteen Weir.

(b) Technical Risk relating to Infrastructure and Operations

Pipeline routes and hydraulic profile from Slevoir in NE Lough Derg to the Terminal Point Reservoir are satisfactory, Water intake and pumping station site options are constrained in this area by the dense environmental constraints in the littoral area at abstraction point. Sourcing power to the site introduces the need for supplementary power supply infrastructure. Disposal of treatment process water in the Northern L Derg area also carries particular dilution and environmental risks.

(c) Environmental and Planning Risk

Abstraction in this location will directly impact on the Lough Derg SAC and SPA, with risks relating principally to residence times at low flows. Planning and environmental risks also exist relating to disposal of process water in operation . Abstraction will result in 1 % - 2% reduction in renewable energy from hydropower. The legal environment of abstraction from the lake source also carries elevated risk.

Abstraction from Lough Derg carries an increased burden of proof of sustainability where the background aquatic environment is under stress or undergoing change in natural conditions under the influence of invasive species.

(d) Financial Risk

The main financial risks are considered to arise from delay due to challenge under Court provisions in 1942 Act or planning problems associated with environmental uncertainty (e.g. conservation objectives at European Sites, lake residence times in low flow periods).

(e) Socio-economic risk

Abstractions can be coordinated and managed in conjunction with ESB to ensure that the operational water level range can be maintained. In prolonged dry years, impact within that range will occur when ESB generation has ceased, this is estimated at 60 – 70mm in ‘worst case’ 1995 drought conditions. There is low risk to navigation/tourism/agriculture/angling/fisheries/ornithology or to the local economy, but the standard of proof would be high and social acceptance of this is less likely where abstraction gives rise to increased residence times of water in Lough Derg during dry periods. Current estimates are up to 42 days at maximum, and are subject to model verification by hydrodynamic field data. Servicing Benefitting Corridor communities and water supply requirements would be marginally less effective from this location, related to Irish Waters WSSP objectives, due to its location related to these communities.

2.1.2 Mota



Figure E8 – 2 Lough Derg - Mota

(a) Technical Risk relating to the Source

Abstraction is possible within the ESB normal operating band for water levels. Abstraction will however give rise to increased residence times of water in Lough Derg during dry periods, current estimates are up to 42 days at maximum, and are subject to model verification by hydrodynamic field data. Abstraction will not result in changes to the normal lake operational range in any years where generation curtailment over summer occurs, provided agreement is reached with ESB to modify generation activities at Ardnacrusha to compensate for water abstracted. In a drought year such as 1995, operation within existing operational level limits is possible, with impact estimated at 60 – 70mm within that band. No impact will occur on compensation water flows to the old Shannon channel downstream of Parteen Weir.

(b) Technical Risk relating to Infrastructure and Operations

Pipeline routes and the hydraulic profile from the Mota area of Lough Derg to the Terminal Point Reservoir are satisfactory, Water intake and pumping station site options are constrained in this area by the navigation channel and environmental constraints at the abstraction point and its environs. Sourcing power to the site introduces the need for supplementary power supply infrastructure. Disposal of treatment process water in the Mid L Derg area also carries particular dilution and environmental risks.

(c) Environmental and Planning Risk

Abstraction in this location will directly impact on the Lough Derg SAC and SPA, with risks relating principally to residence times at low flows. Planning and environmental risks exist relating to disposal of process water in operation . Abstraction will result in 1 % - 2% reduction in renewable energy from hydropower. The legal environment of abstraction from the lake source carries elevated risk.

Abstraction from Lough Derg carries an increased burden of proof of sustainability where background aquatic environment is under stress or undergoing change under natural conditions under the influence of invasive species.

(d) Financial Risk

The main financial risks are again considered to result from delay due to challenge under Court provisions in the 1942 Act or planning problems associated with environmental uncertainty (e.g. conservation objectives at European Sites, lake residence times in low flow periods).

(e) Socio-economic risk

Abstractions can be coordinated and managed in conjunction with ESB to ensure that the operational water level range can be maintained. In prolonged dry years, impact within that range will occur when ESB generation has ceased, this is estimated at 60 – 70mm in 1995 drought conditions. There is low risk to navigation/tourism/agriculture/angling/fisheries/ornithology or to the local economy, but the standard of proof would be high and social acceptance of this is less likely where abstraction gives rise to increased residence times of water in Lough Derg during dry periods. Current estimates are up to 42 days at maximum, and are subject to model verification by hydrodynamic field data. Servicing Benefitting Corridor communities and water supply requirements would be marginally less effective from this location, related to Irish Waters WSSP objectives, due to its location related to these communities.

(c) Environmental and Planning Risk

Abstraction in this location will directly impact on the Lough Derg SAC and SPA, with risks relating principally to residence times at low flows. Planning and environmental risks also exist relating to disposal of process water in operation. Abstraction will result in 1 % - 2% reduction in renewable energy from hydropower. The legal environment of abstraction from the lake source also carries elevated risk.

Abstraction from Lough Derg carries an increased burden of proof of sustainability where background aquatic environment is under stress or undergoing change in natural conditions under the influence of invasive species.

(d) Financial Risk

The main financial risks are considered to result from delay due to potential challenge under Court provisions in 1942 Act or planning problems associated with environmental uncertainty (e.g. conservation objectives at European Sites, lake residence times in low flow periods).

(e) Socio-economic risk

Abstractions can be coordinated and managed in conjunction with ESB to ensure that the operational water level range can be maintained. In prolonged dry years, impact within that range will occur when ESB generation has ceased, this is estimated at 60 – 70mm in 'worst case' 1995 drought conditions. There is low risk to navigation/tourism/agriculture/angling/fisheries/ornithology or to the local economy, but the standard of proof would be high and social acceptance of this is less likely where abstraction gives rise to increased residence times of water in Lough Derg during dry periods. Current estimates are up to 42 days at maximum, and are subject to model verification by hydrodynamic field data. Servicing Benefitting Corridor communities and water supply requirements would be marginally less effective from this location, related to Irish Waters WSSP objectives, due to its location related to these communities.

(c) Environmental and Planning Risk

Abstraction in this location will directly impact on the Lough Derg SAC and SPA, with risks relating principally to residence times at low flows. Planning and environmental risks exist relating to disposal of process water in operation. Abstraction will result in 1 % - 2% reduction in renewable energy from hydropower. The legal environment of abstraction from lake source carries elevated risk.

Abstraction from Lough Derg carries an increased burden of proof of sustainability where the background aquatic environment is under stress or undergoing change in natural conditions under the influence of invasive species.

(d) Financial Risk

The main financial risks are considered to arise from delay due to potential challenge under Court provisions in 1942 Act or planning problems associated with environmental uncertainty (e.g. conservation objectives at European Sites, lake residence times in low flow periods).

(e) Socio-economic risk

Abstractions can be coordinated and managed in conjunction with ESB to ensure that the operational water level range can be maintained. In prolonged dry years, impact within that range will occur when ESB generation has ceased, this is estimated at 60 – 70mm in 'worst case' 1995 drought conditions. There is low risk to navigation/tourism/agriculture/angling/fisheries/ornithology or to the local economy, but the standard of proof would be high and social acceptance of this is less likely where abstraction gives rise to increased residence times of water in Lough Derg during dry periods. Current estimates are up to 42 days at maximum, and are subject to model verification by hydrodynamic field data. Servicing Benefitting Corridor communities and water supply requirements would be marginally less effective from this location, related to Irish Waters WSSP objectives, due to its location related to these communities.

2.1.5 Parteen Basin Reservoir

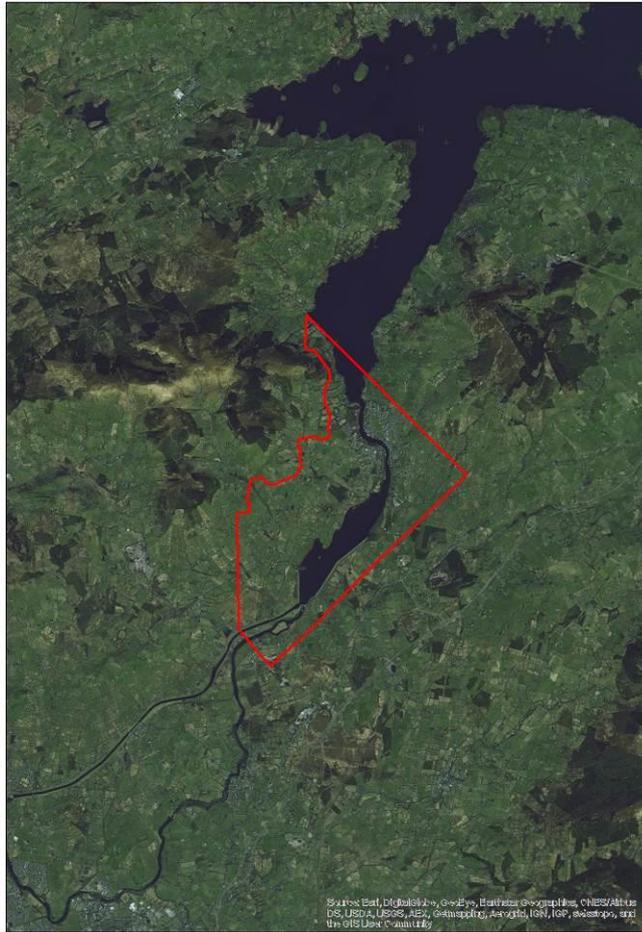


Figure E8 – 5 Parteen Basin Reservoir

(a) Technical Risk relating to the Source

Abstraction is possible at Parteen within ESB normal operating band for water levels. Abstraction will not give rise to any significant residence time impacts in Lough Derg during dry periods, since entire natural flow has passed through the Lough to the abstraction point. Abstraction will not result in changes to lake operational levels in any years where generation curtailment over summer occurs, provided agreement is reached with ESB to modify generation activities at Ardnacrusha to compensate for water abstracted. In a year such as 1995, operation within existing operational level limits is possible, with impact estimated at 60 – 70mm within that band. There is no impact on compensation water flows to the old Shannon channel downstream of Parteen Weir.

(b) Technical Risk relating to Infrastructure and Operations

The pipeline route and hydraulic profile from the Shannon at Parteen Basin to the Terminal Point Reservoir is satisfactory but is longer than other Shannon options. The abstraction location is spatially constrained by adjacent ESB embankments and operations, and by the lower Shannon SAC, but suitable sites are available for abstraction and water treatment. Disposal of treatment process water in vicinity of lower Shannon SAC carries particular dilution and environmental risks.

(c) Environmental and Planning Risk

Abstraction will directly impact the lower Shannon SAC and SPA but no significant risks exist relating to increased low flow durations, or water body retention times. Abstraction will result in 1 % - 2% reduction in renewable energy from hydropower. Legal process risk is reduced with abstraction from a manmade impoundment environment.

(d) Financial Risk

The main financial risk would result from working close to ESB infrastructure and near or within the lower Shannon SAC, e.g. planning problems associated with environmental uncertainty (establishment of conjunctive use resilience with existing sources).

(e) Socio-economic risk

Abstractions can be coordinated and managed with ESB to ensure that the operational water level range can be maintained. Abstracted water is taken from the flow proportion dedicated to hydropower at the most downstream location. In prolonged dry years, impact within the ESB operating range will occur when ESB generation has ceased, in summer time this is estimated at 60 – 70mm in 'worst case' 1995 drought conditions. There is insignificant risk to navigation/tourism/agriculture/angling or to the local economy and there is no infrastructural presence in Lough Derg proper. Abstraction will not increase residence times in Lough Derg during low flow periods - consequently limiting the risk of water quality impacts related to residence time. Servicing communities and water supplies in the Benefitting Corridor is most effective from this location, related to Irish Waters WSSP objectives.

2.2 Matrix of Multi Criteria Analysis on Risk

Criteria	Slevoir	Mota	Dromineer	Youghal Bay	Parteen Basin
Technical Risk relating to the Source	High	High	High	High	Low
Technical Risk relating to Infrastructure and Operations	High	High	High	High	Low
Environmental and Planning Risk	High	High	High	High	Mid Range
Financial Risk	Mid Range	Mid Range	Mid Range	Mid Range	Mid Range
Socio-economic risk	High	High	High	High	Low

2.3 Comparative Discussion

The Parteen Basin Reservoir is considered least constrained from a Risk perspective, principally because the other abstraction locations on the lake will not avoid residence time impacts, even if a variable abstraction regime is associated with 2 months raw water storage at Garryhinch in the Midlands.

With the currently available information from the investigative studies, abstraction from any of the points on the eastern shoreline of Lough Derg carries a higher risk related to achieving its primary objectives of a variable abstraction regime from Lough Derg which will achieve the objectives of the Water Services Strategic Plan, which meets the standard of proof of sustainability related to residence time impacts on Lough Derg, related to invasive species transfer risks, and water chemistry risks in a raw water storage. It has residual risks from an infrastructural design/construction/operation viewpoint, and from a planning and environmental perspective, at both the Lough Derg abstraction point, but also at a raw water storage location in the upper Barrow catchment.

With an abstraction point lying downstream of Lough Derg, and abstracting water which has already passed through the Lough in natural circumstances, abstraction at the Parteen Basin has lesser environmental risks than an abstraction which is present in the lake, in circumstances where the aquatic ecology of the lake is undergoing change under the influence of invasive species, and other natural causes. It offers the prospect of an abstraction regime, with treatment at source, which does not impact on residence time in the lake. It is better aligned with the objectives of the Water Services Strategic Plan, with respect to meeting water supply needs to Midland and Eastern communities.

It is not without significant challenges however. These centre on meeting the concerns of stakeholders on the details of an abstraction, and on protection of the Lough Derg and lower Shannon environment, particularly the environmental requirements of the Lower Shannon SAC, and the other nearby European sites.

3 Desalination

3.1 Desalination Locations

An assessment of the potential abstraction locations was carried out for the following options:

- Option H (Desalination)

3.1.1 South Dublin

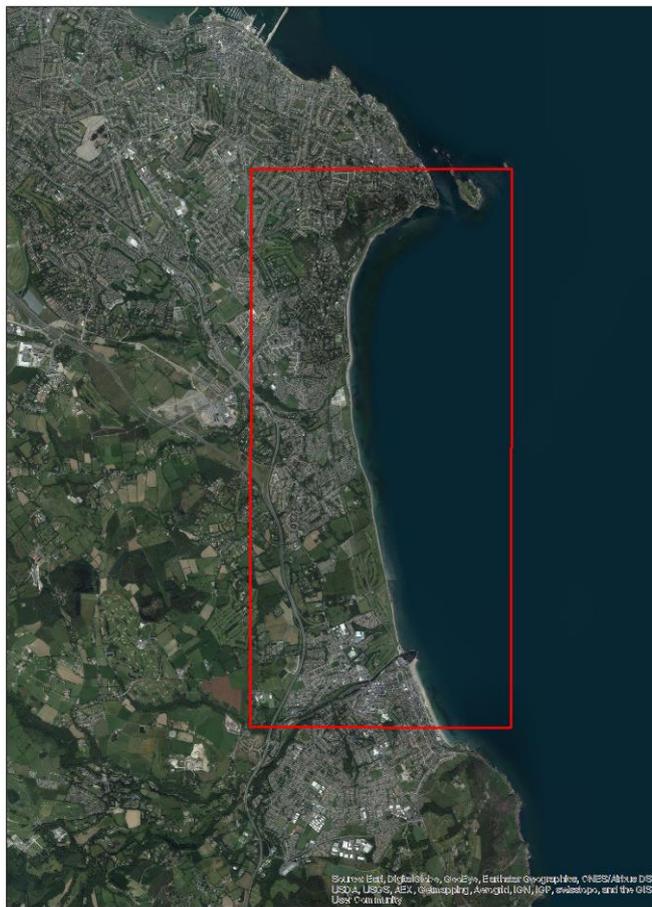


Figure E8 – 6 South Dublin

(a) Technical Risk relating to the Source

No limitation on abstraction quantity is relevant with sea water. Water quality will be heavily saline, and brine return and dispersal to environmental standards will be required. Long intake and brine dispersion pipelines will be required to extend into a marine environment close to European sites. Desalination requires expensive treatment and remineralisation involving high energy requirements.

(b) Technical Risk relating to Infrastructure and Operations

Desalination has high capex and opex costs, and high unit cost of water supplied and large carbon footprint. Significant membrane and renewables costs and complexity of treatment does result if operation with existing sources is intermittent. Desalination provides greater modular expansion potential, helping to de-risk water demand projections. A large infrastructural land parcel is required in a sensitive coastal environment, and significant disruption will be likely with a water pipeline corridor traversing a semi urban environment. Access to the large diameter trunk main network on the western side of the south city from the coastal area of south Dublin would involve significant cost and disruption.

(c) Environmental and Planning Risk

Abstraction and brine return have the potential to impact on coastal SACs and SPAs. Issues exist relating increased greenhouse gases and carbon footprint based energy from national grid containing mix of renewable fossil fuel. CER Regulatory Framework prohibits direct use of dedicated renewable energy.

(d) Financial Risk

Delays from the planning process, including foreshore licence procedures, and potential contractual problems would constitute the main financial risks.

(e) Socio-economic risk

Desalination has high capex and opex costs, high energy requirements, large carbon footprint and high unit cost of water supplied, particularly if operation is intermittent. It includes a large infrastructural land requirement in a sensitive coastal environment, with significant disruption associated with the water pipeline corridor. Brine dispersion into the marine environment requires careful design and management. It is a Dublin-centric solution, servicing of Benefitting Corridor communities and water supply requirements is least effective from this location, related to Irish Waters WSSP objectives, due to coastal location related to these communities.

3.1.2 Loughshinny North



Figure E8 – 7 Loughshinny North

(a) Technical Risk relating to the Source

No limitation on abstraction quantity is relevant with sea water. Water quality will be heavily saline, and brine return and dispersal to environmental standards will be required. Long intake and brine dispersion pipelines will be required to extend into a marine environment close to European sites. Desalination requires expensive treatment and remineralisation involving high energy requirements.

(b) Technical Risk relating to Infrastructure and Operations

Desalination has high capex and opex costs, and high unit cost of water supplied and large carbon footprint. Significant membrane and renewables costs and complexity of treatment does result if operation with existing sources is intermittent. Desalination provides greater modular expansion potential, helping to de-risk water demand projections. A large infrastructural land parcel is required in a sensitive coastal environment, and significant disruption will be likely with a water pipeline corridor traversing a semi urban environment. Access to the large diameter trunk main network on the western side of the north city from the coastal area of north Dublin would involve significant cost and disruption.

(c) Environmental and Planning Risk

Abstraction and brine return have the potential to impact on coastal SACs and SPAs. Issues exist relating increased greenhouse gases and carbon footprint based energy from national grid containing mix of renewable fossil fuel. CER Regulatory Framework prohibits direct use of dedicated renewable energy.

(d) Financial Risk

Delays from the planning process, including foreshore licence procedures, and contractual problems would constitute the main financial risks.

(e) Socio-economic risk

Desalination has high capex and opex costs, high energy requirements, large carbon footprint and high unit cost of water supplied, particularly if operation is intermittent. It includes a large infrastructure land requirement in sensitive coastal environment, with significant disruption associated with the water pipeline corridor. Brine dispersion into marine requires will require careful management. It is a Dublin-centric solution, servicing of Benefitting Corridor communities and water supply requirements is least effective from this location, related to Irish Waters WSSP objectives, due to coastal location related to these communities.

3.1.3 Loughshinny South



Figure E8 – 8 Loughshinny South

(a) Technical Risk relating to the Source

No limitation on abstraction quantity is relevant with sea water. Water quality will be heavily saline, and brine return and dispersal to environmental standards will be required. Long intake and brine dispersion pipelines will be required to extend into a marine environment close to European sites. Desalination requires expensive treatment and remineralisation involving high energy requirements.

(b) Technical Risk relating to Infrastructure and Operations

Desalination has high capex and opex costs, and high unit cost of water supplied and large carbon footprint. Significant membrane and renewables costs and complexity of treatment does result if operation with existing sources is intermittent. Desalination provides greater modular expansion potential, helping to de-risk water demand projections. Large infrastructure land requirement is required in a sensitive coastal environment, and significant disruption will be likely with a water pipeline corridor traversing a semi urban environment.

(c) Environmental and Planning Risk

Abstraction and brine return have the potential to impact on coastal SACs and SPAs. Issues exist relating increased greenhouse gases and carbon footprint based energy from national grid containing mix of renewable fossil fuel. CER Regulatory Framework prohibits direct use of dedicated renewable energy.

(d) Financial Risk

Delays from the planning process, including foreshore procedures and potential contractual problems would constitute the main financial risks.

(e) Socio-economic risk

Desalination has high capex and opex costs, high energy requirements, large carbon footprint and high unit cost of water supplied, particularly if operation is intermittent. It includes a large infrastructure land requirement in sensitive coastal environment, with significant disruption associated with the water pipeline corridor. Brine dispersion into marine requires will require careful management. It is a Dublin-centric solution, servicing of Benefitting Corridor communities and water supply requirements is least effective from this location, related to Irish Waters WSSP objectives, due to coastal location related to these communities.

3.1.4 Balbriggan



Figure E8 – 9 Balbriggan

(a) Technical Risk relating to the Source

No limitation on abstraction quantity is relevant with sea water. Water quality will be heavily saline, and brine return and dispersal to environmental standards will be required. Long intake and brine dispersion pipelines will be required to extend into a marine environment close to European sites. Desalination requires expensive treatment and remineralisation involving high energy requirements.

(b) Technical Risk relating to Infrastructure and Operations

Desalination has high capex and opex costs, and high unit cost of water supplied and large carbon footprint. Significant membrane and renewables costs and complexity of treatment does result if operation with existing sources is intermittent. Desalination provides greater modular expansion potential, helping to de-risk water demand projections. A large infrastructural land parcel is required in a sensitive coastal environment, and significant disruption will be likely with a water pipeline corridor traversing a semi urban environment.

(c) Environmental and Planning Risk

Abstraction and brine return have the potential to impact on coastal SACs and SPAs. Issues exist relating increased greenhouse gases and carbon footprint based

energy from national grid containing mix of renewable fossil fuel. CER Regulatory Framework prohibits direct use of dedicated renewable energy.

(d) Financial Risk

Delays from the planning process, including foreshore procedures and potential contractual problems would constitute the main financial risk.

(e) Socio-economic risk

Desalination has high capex and opex costs, high energy requirements, large carbon footprint and high unit cost of water supplied, particularly if operation is intermittent. It includes a large infrastructure land requirement in sensitive coastal environment, with significant disruption associated with the water pipeline corridor. Brine dispersion into marine requires will require careful management. It is a Dublin-centric solution, servicing of Benefitting Corridor communities and water supply requirements is least effective from this location, related to Irish Waters WSSP objectives, due to coastal location related to these communities.

3.2 Matrix of Multi Criteria Analysis on Risk

Criteria	South Dublin	Loughshinny North	Loughshinny South	Balbriggan
Technical Risk relating to the Source	Mid range	High	High	Mid Range
Technical Risk relating to Infrastructure and Operations	High	High	High	High
Environmental and Planning Risk	Mid Range	High	High	Mid Range
Financial Risk	Mid Range	Mid Range	Mid Range	Mid Range
Socio-economic risk	High	Mid Range	Mid Range	Mid Range

3.3 Comparative Discussion

The risks associated with the desalination option are not considered to be heavily influenced by the location of abstraction and in this regard no one location is differentiated from the others as least constrained through consideration of the risk criteria.

The desalination option would have reasonable potential for successful planning consent but the availability of a less risky, preferable sustainable alternative could create some planning / implementation difficulties

