UISCE ÉIREANN : IRISH WATER

Water Supply Project

Eastern and Midlands Region

Final Options Appraisal Report

The Preferred Scheme

Volume 1

Main Report

November 2016

Water Supply Project, Eastern and Midlands Region

Irish Water

Final Options Appraisal Report

November 2016

Water Supply Project, Eastern and Midlands Region

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1. Executive Summary

1.1 Background

The Water Supply Project, Eastern and Midlands Region, is a key element of Irish Water's overall nationwide remit as it will meet the domestic, commercial and industrial needs of over 40% of Ireland's population into the medium to long-term future (to 2050).The Final Options Appraisal Report (FOAR) is the fourth in a series of reports published since March 2015 in a process to identify a new major source of water for the Region, and a Preferred Scheme for its development.

The first of these reports was the Project Need Report (PNR) (Feb 2015), published in March 2015, which examined the capacity of existing sources, and the need for the new source. It included a fundamental review of the demographic, economic and sectoral water consumption drivers in overall water demand, as well as a critical appraisal of the resilience of the existing water supplies serving the region. It emphasised the importance of both aspects in considering the question of 'need' and concluded that the existing supply sources and infrastructure for the region do not have the capacity or resilience to meet future requirements. It projected that population and industrial growth will generate a demand for an additional 330 million litres of raw water per day by 2050. The present infrastructure is struggling to meet current need as evidenced by a number of significant and costly outages in Dublin over the past 5 years. Projected water requirements already assume that ambitious leakage control targets will be met and that water conservation initiatives will be successful. These will provide valuable water savings, but they will not provide a long term solution for our water supply requirements. The Project Road Map was published for consultation alongside the Project Need Report. The Project Road Map outlined how a preferred new supply option would be selected and the public consultation milestones involved in that process.

The second report was the Options Working Paper (OWP) (June 2015). It examined the work previously carried out in the Strategic Environmental Assessment of ten options considered in 2010, and it validated four options, identified at that time, as technically viable for consideration in the next stage of options appraisal. It also published, for consultation, the assessment criteria in options appraisal, and the proposed approach to positioning infrastructure to achieve least environmental impact, through the use of constraint mapping.

The third report was the Preliminary Options Appraisal Report (POAR) (November 2015), it considered and evaluated these four options, taking into account preliminary results of investigative surveys and modelling at the time, which have been continuing over the interim period.

The POAR set aside options which abstract from Lough Derg, either directly or with raw water storage in the Midlands, because they would have significant impact on water residence times in Lough Derg in prolonged dry summer conditions. It also did not favour pumping to raw water storage in the Midlands, because of risks of transfer of alien aquatic species, because of construction and environmental risks at the Midlands storage site, and because transferring raw water does not meet Irish Water's broader objectives related to improving treated water supplies to communities in the Midlands Region. It highlighted that abstraction from Parteen Basin (also known as 'Lower Lake'), being sited downstream of Lough Derg, would avoid impacts on lake residence time. It identified abstraction from the River Shannon at the Parteen Basin area, downstream of Lough Derg, as an 'Emerging Preferred Option', subject to continuing surveys and it identified a 2km corridor from Parteen to a termination point in South Dublin where a pipeline route of least environmental impact could be positioned. While Desalination remained as the second ranked viable option, it was noted that it was 'Dublin-centric', and did not address the problems of small isolated water supplies in the Midlands. Desalination also posed a potentially greater environmental impact through its use of chemicals and high energy consumption.

This Final Options Appraisal Report (FOAR), having further examined the options of abstraction from the River Shannon at the Parteen Basin, and desalination of seawater at the coast in Fingal, including a cost benefit analysis of both options, confirms the Preferred Scheme is abstraction from the Shannon in the Parteen Basin area, downstream of Lough Derg, with water treatment nearby at Birdhill and delivery of treated water by pipeline through the Midlands to a termination point reservoir at Peamount in south Dublin. The Final Options Appraisal Report is offered for public consultation along with an EIS Scoping

Report, where comments are invited on the scope and methodologies proposed for Environmental Impact Assessment on the preferred scheme.

1.2 Remaining Sustainable Options

Section 2 of this Report first establishes the chronology and roadmap of work carried out to date. Section 3 recaps on the two technically viable and sustainable options carried forward to this Final Options Appraisal Report:

1) **PARTEEN BASIN DIRECT (OPTION C)**

This would be a constant, all year-round abstraction from Parteen Basin (also known as the Lower Lake) and water treatment nearby at Birdhill, followed by approximately 170km of treated water transfer pipeline, in a configuration which could supply treated water to other communities in a 'benefiting corridor' along the route from the Parteen Basin to Dublin.

2) **DESALINATION (OPTION H)**

This option involves the abstraction of sea water from the Irish Sea in North Fingal and desalination of this water through a Reverse Osmosis (RO) desalination plant, together with the discharge of brine (from the treatment process) back into the Irish Sea. The process includes the pumping of treated water through approximately 35km of pipelines to existing and proposed reservoirs located in northern and western parts of Dublin.

1.3 Consultation

Section 4 of the Report defines how public consultations, on the Project Need Report, on the Options Working Paper and on the Preliminary Options Appraisal Report have been taken into account in the current work. This is accompanied by Appendix J, the Consultation Submissions Report on the Preliminary Options Appraisal Report, which details the submissions received, by theme, and which responds to those submissions.

It also summarises, across all three phases of previous consultation, how the submissions and views expressed have influenced the process of design.

1.4 Interim Demand Review

Section 5 provides an interim review of water demand, in the light of results from conservation initiatives and information which has become available from the domestic metering programme. Water demand will continue to be reviewed, as detail from the CSO Census of 2016 becomes available.

1.5 Abstraction Regime

Section 6 describes how abstraction at Parteen, which lies just upstream of the headrace canal to Ardnacrusha power station, would be supported by an agreement, whereby ESB would reduce water used in hydropower, measure-for-measure with water abstracted for water supply.

1.6 Source Impact

Section 7 provides an update on modelling work to define the potential for impact of abstraction from the Lough Derg and Parteen Basin waterbody, confirming that abstraction from Parteen Basin avoids impacts on lake residence time, ensuring no impact on water quality status or shallow water floral and faunal communities in Lough Derg.

1.7 Economic Appraisal

Section 8 presents the findings of a cost-benefit appraisal, by independent economists, into the investment options to guarantee a continued water supply to the Eastern and Midlands Region and the defined Benefitting Corridor. This appraisal considered both the abstraction from the Shannon at Parteen Basin and the Desalination Option with reference to the "Do Minimum" base scenario; the latter being the mostly likely scenario to prevail should the proposed investment(s) not be undertaken.

The cost – benefit analysis considered the following key costs and benefits:

- Capital costs;
- Operational expenditure;
- Environmental costs;
- Disruption costs of construction works where applicable; and
- Benefitting Corridor costs.

The cost-benefit appraisal concluded that abstraction from the Shannon's Parteen Basin is the most cost effective scheme.

1.8 Preferred Scheme

Section 9 draws the appraisal work into a confirmation of the Preferred Scheme, which is abstraction from the lower Shannon in the Parteen Basin area downstream of Lough Derg; abstraction from here is the most suitable source and option for a new water supply for a number of key reasons:

- It provides treated water, delivered in a way which brings the greatest availability and economic advantages to the widest group of communities in Irish Water's Eastern and Midlands Region. Towns and communities along the proposed pipeline route through the Eastern and Midlands Region will gain a secure water supply to meet future domestic, commercial and industrial water requirements and therefore the opportunity to develop and grow their economies. All consumers will have a reliable and sustainable water supply to international standard of service.

- It enables the delivery of more efficient and up to date supply infrastructure by facilitating the development of fewer and more modern water treatment plants to replace the numerous small, inefficient and outdated plants currently operating across the region. It provides the strategic basis for rationalisation of a number of small public supplies to fewer schemes over time.

- The results of the cost-benefit appraisal of the various investment options suggest that Option C, abstraction of water from Parteen Basin on the Shannon, is the preferable investment choice; as it results in a higher net benefit than the desalination alternative or the net benefit of the Do Minimum scenario. The latter represents the base case.

  The benefit to cost ratio (BCR) of the Shannon abstraction to the Desalination Option in the base case, and following all sensitivity analyses, suggest that it represents the most economically advantageous investment option for the provision of new water supply infrastructure to the Eastern and Midlands region. *Note: A benefit-cost ratio (BCR) is an indicator which summarises the overall value for money of a project or proposal, and is the ratio of the benefits of a project or proposal relative to its costs; both expressed in monetary terms. The BCR for an abstraction from the Shannon, and for the Desalination option, is 3.25 and 1.75 respectively; a higher BCR indicates that it is the better investment choice, and represents a greater return than the "Do Minimum" scenario.*

Desalination has come through the assessment process, as a technically viable option but it is much less suitable than one involving abstraction from Parteen Basin for a number of reasons;

- It is a Dublin-centric solution, so it does not deliver the widespread benefits to towns and communities throughout the Eastern and Midlands Region, which are a necessary feature of a comprehensive scheme aligned with the objectives of the Water Services Strategic Plan.

- It is a less environmentally friendly option than the Parteen Basin option because the provision of desalinated water requires a high energy input leading to a greater carbon footprint.

- The cost of water delivered is significantly more expensive than the preferred scheme.

- The Cost Benefit Analysis indicates, whilst acknowledging that the two options are not directly comparable on a like-for-like basis, that abstraction from the Shannon at the Parteen Basin has a better investment profile.

1.9 Parteen Basin - The Preferred Scheme

Sections 11 and 12 describe the work undertaken to date to identify preferred sites and route corridor associated with the Preferred Scheme.

The proposed abstraction facilities from the would be located on the eastern bank Parteen Basin, north of the Fort Henry embankment, and would abstract water to a maximum of 330 Mld at the year 2050. This water would be treated in a Water Treatment Plant ultimately consisting of four treatment modules, each approximately 80 Mld in treated water capacity, which would be built in phases to match growth in water demand and keeping resilience support to existing sources under review.

Water abstraction from the Parteen Basin would take place under an agreement with ESB so that water levels on Lough Derg and Parteen Basin can be controlled by ESB, as they currently are, within the unchanged normal operating band. Adjustment of water used in power generation would be covered in this agreement, to avoid impact on the normal water level operating band. Minimum statutory flow requirements, or compensation flows, which are maintained below Parteen Weir, would also remain unaffected.

Treated water would be distributed to locations across the Eastern and Midlands Region of the country via an underground pipeline running from the Water Treatment Plant proposed at Birdhill, to a Termination Point Reservoir in South Dublin. This would provide a reliable and sustainable water supply to current and future domestic, commercial and industrial consumers in the Eastern and Midlands Region.

The reasons why abstraction from the Shannon at Parteen Basin is the Preferred Scheme can be summarised as:-

- It has, by far, the least environmental impact of any of the Shannon options which have been under consideration. It is the closest location to the river estuary with all of the water having already flowed naturally through the River Shannon system to the abstraction point in Parteen Basin.

- The pipeline from Parteen has the potential to serve treated water to more Midland locations, towns and communities along the route from Shannon to Dublin than any other option. It has the potential to support more key objectives of Irish Waters' 25-year Water Services Strategic Plan than any other option.

- The Parteen Basin already includes existing regulating assets because of the presence of the hydro-power plant. The proposed abstraction of water is, in essence, an abstraction of water which would otherwise be used in the hydro-power scheme, utilising existing assets. Abstraction of water from hydro- electric power schemes is commonly employed worldwide to enable environmentally sustainable availability of drinking water.

1.10 Community Gain Opportunities

Section 10 of the Report discusses opportunities for Community Gain, which were previously consulted upon on publication of the POAR in November 2015. It discusses Community Gain in a national context, and across the

pipeline route. Irish Water proposes to establish a 'Community Gain Fund' with a view to supporting community-based initiatives, primarily in the Environmental / Sport & Leisure / Training & Education areas, which meet specific criteria and which contribute towards the objectives of the River Basin Management Plans and Conservation Objectives of the Lower Shannon SAC. In doing so Irish Water aims to provide An Bord Pleanála with a realistic, specific, measurable community gain proposal(s), with an associated administrative structure, which the Board can adequately assess, and consider as part of an overall planning application.

1.11 Moving to a Final Decision

The abstraction from the Shannon at Parteen Basin is offered for consultation as the preferred new water supply source for the Eastern and Midlands Region of Ireland, and the reasons for that preference are set out under the relevant criteria and constraints. Additional modelling, engineering design and 'on the ground' route investigations will be undertaken in design development. Public consultation on the FOAR permits all interested parties to contribute their views to shape the project elements prior to making a planning application.

1.11.1 Public Consultation

A fourteen week public consultation process follows the publication of the 'Final Options Appraisal Report'. It asks for views on the findings in relation to the Preferred (Parteen Basin) Scheme.

The Report is offered for public consultation along with an EIS Scoping Report, in parallel, where comments are also invited on the scope and methodologies proposed for Environmental Impact Assessment on the preferred scheme.

The feedback on this upcoming consultation will be included in the preparation of documentation for a Planning Application and in preparing the Environmental Impact Statement for submission to An Bord Pleanála for their assessment. An Bord Pleanála will undertake all necessary statutory consultations on the Planning Application, including Oral Hearings where the views of all parties will be heard by the Board.

2. Introduction

2.1 Background

On 1st January 2014, Irish Water assumed responsibility for managing Ireland's water and wastewater investment and maintenance programmes. On that date, Irish Water also took over the management of the Water Supply Project Eastern and Midlands Region (WSP) from Dublin City Council / Department of Environment, Community and Local Government[1]. The project is currently in the 'project planning' stage.

When responsibility for the 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. 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 (see Figure 2-1). Since the bulk of water supplies from the project will be delivered to the East & Midlands, the project is now known as the 'Water Supply Project Eastern and Midlands Region (WSP)'.

Management of the planning stage of the project is currently focused on achieving a planning submission to An Bord Pleanála by Quarter 4 2017 (Q4) with a view to delivering an additional source of water throughout the Eastern and Midlands Region by 2024/25.

[1] Now the Department of Housing, Planning, Community and Local Government.

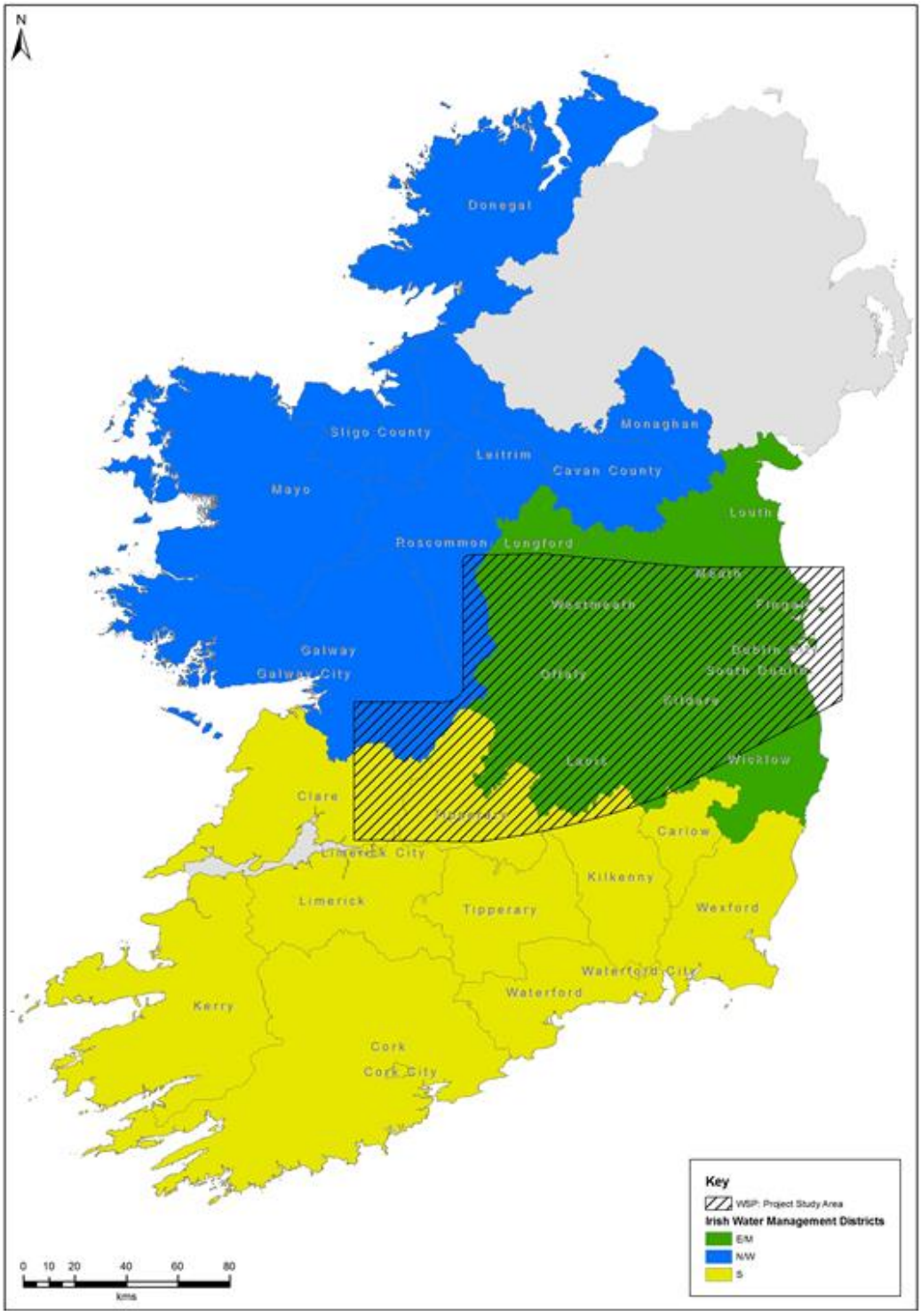


Figure 2-1 Irish Water Regions and WSP Study Area

The transfer of responsibility for managing the project from Dublin City Council to Irish Water has also resulted in an increased focus on potential 'Benefiting Corridors' (see Figure 2-2) which will be created by the water transfer pipelines between potential new water source options and the terminal delivery point. This is because Irish Water has responsibility for ensuring secure, resilient and high quality water supplies in all locations of Ireland and not just in the East of Ireland.

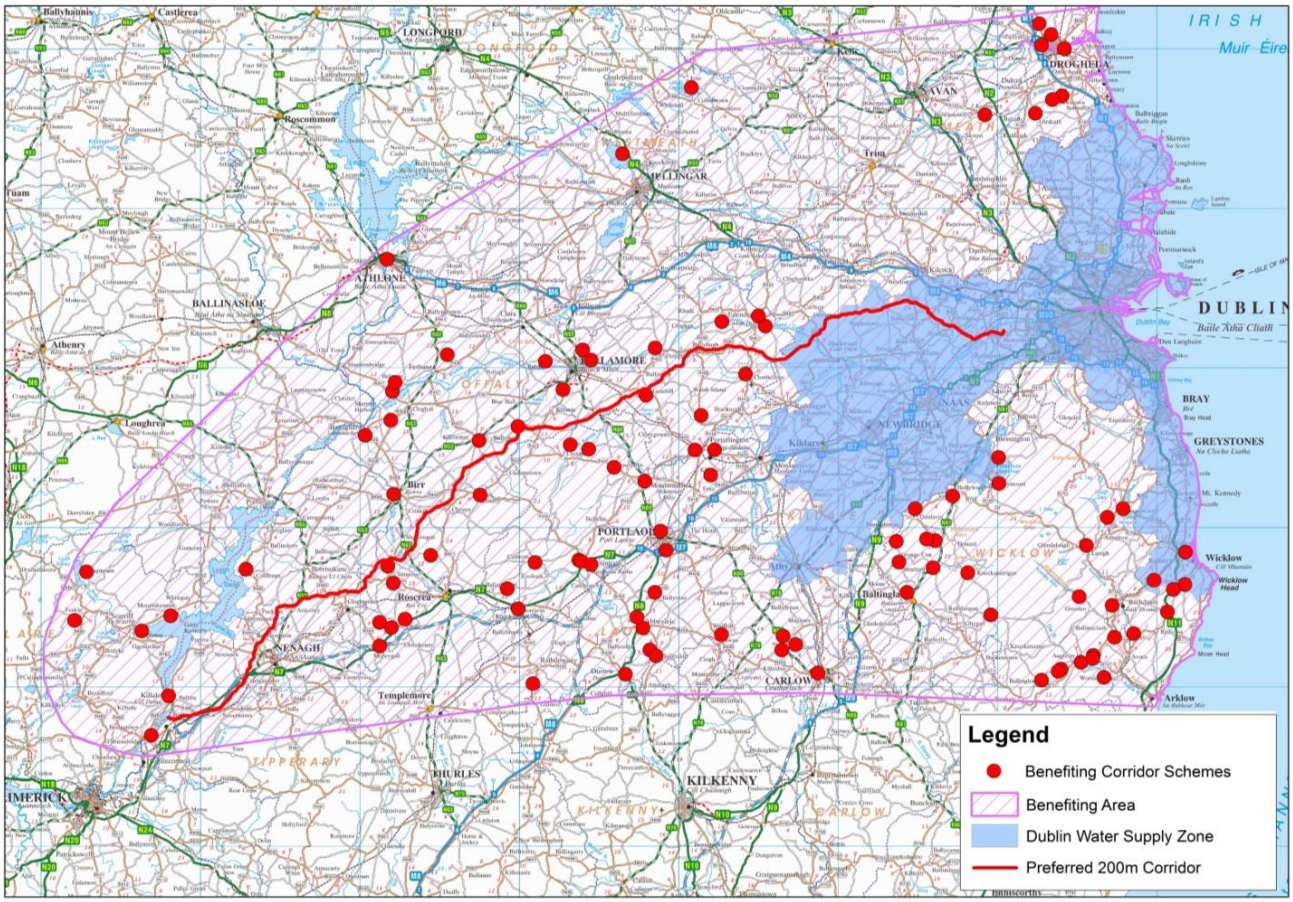


Figure 2-2 Proposed 200m Pipeline Corridor and Existing Water Supplies (Schemes) in potential Benefiting Areas

The ongoing appraisal process[2] first identified four reasonable and alternative water supply options for further consideration, as they were best capable of meeting the projected demands for the Eastern and Midlands Region, or WSP. Three of these options involved a River Shannon-based source, whilst the remaining fourth option (Desalination) relied on source abstraction from the Irish Sea.

These four options were subsequently evaluated[3] and two options which involved abstraction from the north eastern sector of Lough Derg, with or without raw water storage, were not taken forward into the current stage, for environmental reasons related to:

a) Modelled impact on water residence times in Lough Derg;

b) Risk of transfer of invasive species; and

c) The results of ground investigations at an intended raw water storage site at Garryhinch.

Of the two options which remained, the abstraction of water from the Shannon at Parteen Basin was identified as the 'Emerging Preferred Option' over the other remaining option of Desalination. While Desalination remained as the second ranked viable option, it was noted that it was "Dublin-centric", and did not address the problems of small isolated water supplies in the Midlands. Desalination also posed a potentially greater environmental impact through its use of chemicals and high energy consumptions.

This stage of the appraisal is concerned with evaluating both the Emerging Preferred Option and the alternative option of Desalination, in the light of additional modelling data and with the stakeholder feedback from the Preliminary Options Appraisal Report (POAR) public consultation period, in order to identify a Preferred Scheme.

[2] Water Supply Project Eastern and Midlands Region Water Supply Options Working Paper (June 2015)
[3] Preliminary Options Appraisal Report (November 2015)

2.2 Project Consultation Roadmap

The need[4] for a water supply of 330 Ml/d from a new source has been established and Planning consent to abstract, treat and transfer this water must be obtained, so that a Phase 1 Scheme is in place by 2024/25. An interim review of water demand, taking into account developments since March 2015, is presented in Section 5 of this Report, and phasing is discussed in Section 5.4.

The availability of water from the new source at 2024/25 requires adherence to the project programme, or Road Map (Figure 2-3), to make a Planning Application to An Bord Pleanála by Q4, 2017.

[4] Water Supply Project Eastern and Midlands Region Project Need Report (February 2015)

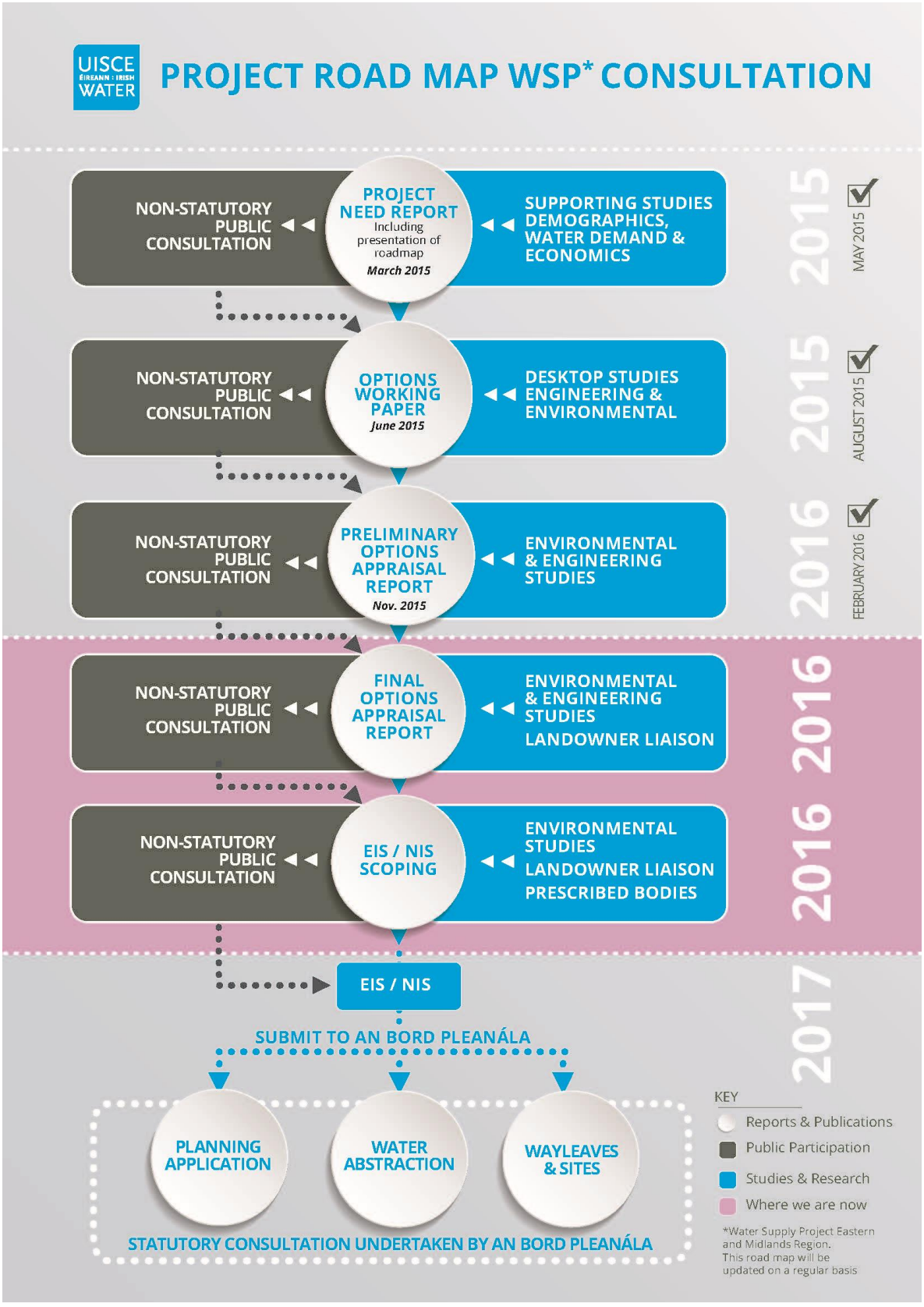


Figure 2-3 Project Consultation Road Map for WSP

The *Project Need Report* (PNR, February 2015), the *Options Working Paper* (OWP, June 2015), and the *Preliminary Options Appraisal Report* (POAR, November 2015) represent Stages 1, 2 and 3 of the Project Road Map respectively.

This document, the *Final Options Appraisal Report*, together with the *EIS Scoping Report*, represents Stage 4 of the Project Road Map; and represents a consultative assessment to identify a Preferred Scheme from the two remaining water supply options evaluated in Stage 3, as well as the proposed scope of the Environmental Impact Statement.

2.3 Previous Work and Reference Studies

The process of identifying an Emerging Preferred Option from the four reasonable alternative options examined in the Preliminary Options Appraisal Report follows a robust programme of previous historical assessments and studies (which are outlined in Figure 2-4), 'on the ground' investigations as well as non-statutory public consultations.

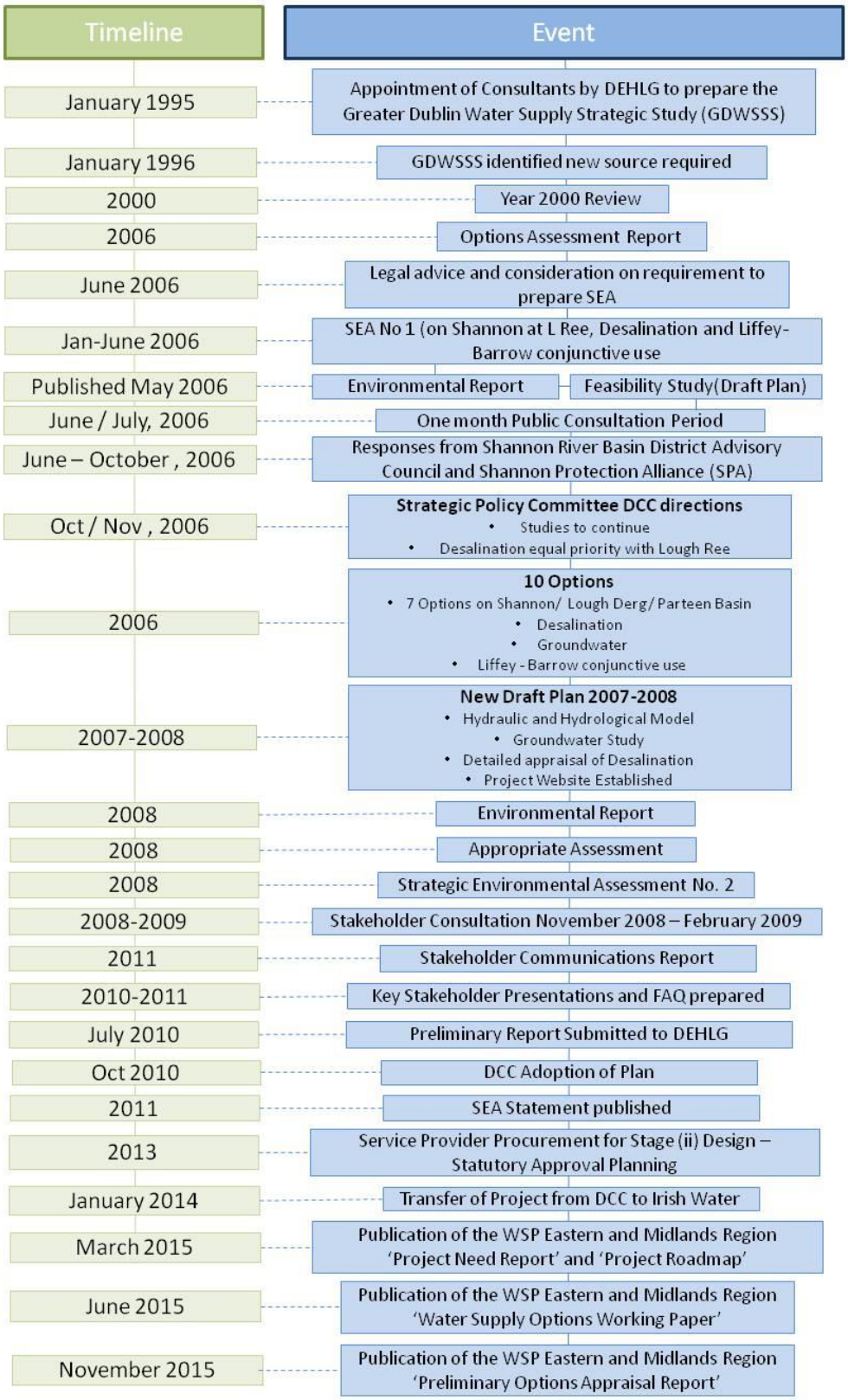


Figure 2-4 Chronological Development of the Project & Historical Datasets/Reporting

The reports detailed in Figure 2-4, and feedback from public consultation, form the starting baseline datasets for this current Stage 4 process.

Figure 2-4 includes the key deliverables that have taken place since the transfer of responsibility for managing the project from Dublin City Council to Irish Water; namely the *Project Need Report*[5] in March 2015, *Options Working Paper* in June 2015, and the *Preliminary Options Appraisal Report* in November 2015.

2.4 Project Need Report and Project Road Map (Road Map Stage 1)

On assuming responsibility at January 1st 2014 for the WSP, which in essence is a nationally strategic water supply project, Irish Water commissioned a review of the fundamental determinants of 'Need' for the project. The *Project Need Report* examined:

a) A range of demographic scenarios, to a planning year of 2050, for Ireland as a whole, for the water supply area served by the existing water sources in the Dublin area, and for those areas likely to benefit from proximity to transfer pipelines from a new source;

b) The fundamentals of every element of the projection of water demand, drawing on currently available data returns from domestic water metering, projecting industrial water requirements, and assuming ambitious targets on water conservation;

c) An independent assessment by professional economists, of the strategic economic importance of secure, resilient water supplies in the Midlands and Eastern areas, for the life and health of people living there, and for the sectors of the economy that sustains their livelihoods; and

d) The importance of resilient connectivity of water resources for the safety, security and reliability of water services.

The Water Services (No. 2) Act 2013 places a statutory obligation on Irish Water under Section 33 of that Act to prepare, and review periodically, a Water Services Strategic Plan (WSSP). Irish Water must state its objectives, and the means to achieve those objectives, for the coming 25 year period, including in relation to, inter alia:

1. Drinking water quality;
2. The prevention or abatement of risks to human health or the environment relating to the provision of water services;
3. The existing and projected demand for water services;
4. Existing and planned arrangements for the provision of water services by Irish Water;
5. Existing and reasonably foreseeable deficiencies in the provision of water services by Irish Water; and
6. Existing and planned water conservation measures.

Section 39 of the Act goes on to require the Commission for Energy Regulation, in the performance of its function as Economic Regulator, to have regard to the need to ensure, *inter alia*,

7. The conservation of water resources;
8. The continuity, safety, security, and sustainability of water services; and
9. That Irish Water can meet all reasonable demands for water both current and foreseeable.

The WSSP represents the Tier 1 Strategic Plan for Irish Water and was published in October 2015 following public consultation on a Draft WSSP and associated Strategic Environmental Assessment (SEA) Environmental Report (19th February to 17th April 2015).The WSP has been in development for almost two decades, and runs parallel to the articulation of Irish Water's WSSP obligations. The discipline of strategic planning, holding a national perspective, embodied in the WSSP, was nonetheless embraced in the review on the *Project Need Report*, and continues to inform the Project.

Conclusions and recommendations drawn from the *Project Need Report* included:

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

[5] The Project Need Report was dated February 2015 but its publication occurred in March 2015.

population of a Benefiting Corridor routed across the Midlands, would rise from 0.53m at 2011, to approximately 0.68m at 2050.

ii. The existing water supply sources serving the Dublin Region Water Supply Area can currently supply 623 Ml/d at full production capacity under stressed conditions, against current average day demand of 550 Ml/d. With respect to water supply management, and best international practices, there is inadequate provision for 'buffering' demand peaks and system outages.

iii. The provision of water to the Dublin Region Water Supply Area and Benefiting Corridor will involve all elements of water conservation, tackling water losses and provision of a new source of supply. The requirement is to both minimise water demand, and to diversify risk from over dependence on existing sources.

iv. The independent review by Indecon Economists underlined the strategic importance of secure, high quality water supplies for the key exporting sectors of the Irish economy. IDA has also emphasized the importance of resilient water supplies, not only for new industry considering locating in Ireland, but also those already established here, and considering expansion. On demographic, economic and water demand projections, and on considerations of resilience of supply, a need for a new water supply source for the Water Supply Area was established.

v. A New Source raw water requirement of 330 Ml/d by the year 2050 was envisaged at March 2015 to be phased to provide 267 Ml/d for an option serving the Eastern and Midlands Region by the year 2022.

The public consultation on 'Need', initiated by issuance of the *Project Need Report*, sought feedback on the work presented, and the conclusions/ recommendations drawn, for due consideration in the next stage.

The Project Road Map was published for consultation alongside the Project Need Report. The Project Road Map outlined how a preferred new supply option would be selected and the public consultation milestones involved in that process.

2.5 Water Supply Options Working Paper (Road Map Stage 2)

The *Water Supply Options Working Paper (OWP)* was the second consultative stage of the Project Road Map (Figure 2-3), and included consideration of the following:

- A review of previous work, consultation submissions and recommendations;
- Identification of changes to National / European Legislation and European Site Designations;
- Identification of other relevant changes or new information that had become available since the completion of the previous work reported in Figure 2-4;
- Incorporation of any legacy items that were raised as part of the earlier Strategic Environmental Assessment (SEA) public consultation process.
- Re-visitation, reassessment, and re-evaluation with updated assessment methodologies, of those water supply options identified previously and outlined in Figure 2-4 to determine:
    - Do those water supply options remain valid?
    - Do those water supply options require further investigation/study?
    - Are there any new water supply options available?
- Identification of the methodology and criteria on which water supply options will be assessed in identification of a Preferred Option.

The earlier SEA assessed ten (10) Options (including sub-options), and ranked the top four technically viable options as follows:

i. Option F2 (Lough Derg with Raw Water Storage in the Midlands)

ii. Option B (Lough Derg Direct)

iii. Option C (Parteen Basin Reservoir Direct)

iv. Option H (Desalination)

As a consequence of this second consultative stage, it was affirmed that these top four technically viable options still remained appropriate, and were to be considered further (during the EIA & Planning Process).

The SEA had expressed a preference at the time for Option F2 (Lough Derg with Raw Water Storage in the Midlands). However, this was provisional and was qualified pending substantiation through additional investigative works. These investigative studies were identified as:

a) Water quality modelling of Lough Derg and Parteen Basin Reservoir; and

b) A full geophysical survey of the soil and bedrock conditions at Garryhinch.

The geophysical investigative studies have been completed in the case of Garryhinch, and the water quality studies are otherwise continuing as part of the WSP Project.

The *Water Supply Options Working Paper* concluded by identifying constraints, which were a range of limiting factors on site selection for infrastructure, and assessment criteria to be applied in further assessment of the identified top four technically viable options.

An initial selection of constraints was mapped, and defined a 'white space' within which project infrastructure would be sited, i.e. a 'space' of least constraints.

A further public consultative process was undertaken on the *Water Supply Options Working Paper*, which sought feedback on:

- The range of identified constraints – in order to establish whether additional relevant constraints should be given due consideration; and
- The proposed assessment criteria to be used in further appraisal of Options at the next stage.

That feedback in turn informed the Preliminary Options Appraisal Report.

2.6 Preliminary Options Appraisal Report (Road Map Stage 3)

The *Preliminary Options Appraisal Report* (POAR) was the third consultative stage of the Project Road Map as outlined in Figure 2-3, and it included:-.

- A review, and consideration, of all the submissions received as part of the public consultation process on the *Water Supply Options Working Paper*;
- Identification of any other relevant changes or new information that became available since publication of the *Water Supply Options Working Paper*;
- A relative assessment of the top four technically viable options identified in the *Water Supply Options Working Paper*, on the basis of 'people related' and 'environment related' impacts. These impacts were considered under the following broad categories:
    - Biodiversity, Flora and Fauna
    - Fisheries
    - Water (including Water Framework Directive)
    - Air/Climatic Factors
    - Material Assets (Energy)
    - Sustainability
    - Cultural Heritage (including Architecture & Archaeology)
    - Landscape & Visual
    - Material Assets (Land use)

    - Tourism
    - Population
    - Human Health
    - Soils, Geology and Hydrogeology
- A relative assessment of the top 4 technically viable options identified on the basis of other 'technical' impacts such as:
    - Safety
    - Planning Policy
    - Engineering and Design
    - Capital and Operating Costs
    - Sustainability
    - Consideration of Risk.

The Preliminary Options Appraisal Report identified an Emerging Preferred Option from the top four (4) technically viable options identified in the *Water Supply Options Working Paper*, two of which were set aside in the appraisal process for environmental reasons.

2.7 Final Options Appraisal Report & Environmental Impact Statement Scoping (Road Map Stage 4)

The *Final Options Appraisal Report* (FOAR) summarises the defining characteristics of the two remaining options and the published basis of the preference for abstraction from the River Shannon at Parteen Basin.

It examines the feedback from public consultation which was carried out over the November 2015 - March 2016 period on the POAR, and it also defines the significant influence of all three prior consultation stages, on decision-making by Irish Water and on the design process.

An interim review of water demand from the PNR is presented, in the light of submissions and developments since it was estimated in late 2014, but keeping in mind that a full review will require the preliminary results of Census 2016, which will become available later in Q4 of 2016. The proposed phasing of infrastructure to meet the need reflects the expected time profile of the developing water demand, as well as the requirement for resilience[6] and headroom[7] in the system as a whole.

The abstraction of water for municipal water supply at Parteen Basin will be accompanied by an Agreement with ESB which will define how a very small reduction in the use of water for hydropower will counterbalance the water supply abstraction, and Section 6 of this Report describes how management of water levels on Lough Derg by the ESB will result in no change to the normal operating band of water level, and with no change to the compensation water flows to the Old River Shannon at Parteen Weir.

The costs and benefits of the two remaining options are then assessed, leading to identification of the Preferred Scheme, which is abstraction from the Lower Shannon at Parteen Basin.

The component parts of the Preferred Scheme are then described, including the site selection and component sizing processes for the raw water intake/pumping station, the Water Treatment Plant and treated water pumping station, the transfer pipeline and the Break Pressure Tank and Termination Point Reservoir.

In parallel with consultation on the Final Options Appraisal Report, Irish Water is also consulting on the scoping of the EIS and NIS to be prepared on the preferred scheme. This is further discussed under 'Next Steps' in Section 4.3.

[6] Resilience of a water supply system is its capacity to maintain levels of service to customers even when availability of a source is disrupted.
[7] Headroom is defined as the difference between the amount of water a utility has available for use and the volume of water it expects to introduce into its network to meet demand.

The Environmental Impact Statement (EIS) Scoping Report sets out the proposed scope of work and methods to be applied in the development of an EIS for the proposed Water Supply Project Eastern and Midlands Region (hereafter referred to as the proposed development). The purpose of the EIS Scoping Report is to initiate early engagement, with prescribed bodies, ahead of upcoming environmental baseline surveys, so as to inform the EIS. The FOAR confirms a final preferred scheme for which a planning application, with a supporting EIS will be submitted to An Bord Pleanála in Q4 of 2017.

2.8 Final Options Appraisal Report - Report Structure

The Report is structured as follows:

Section 1 – Executive Summary

Section 2 – This section (Introduction and Background)

Section 3 – Introduces and summarises the remaining Viable Options under consideration, and the basis for the emerging preference at POAR stage.

Section 4 – Introduces the submissions that were received as part of the Public Consultation process for the *Preliminary Options Appraisal Report;* it details the responses prepared, and it defines the influence the consultation to date has had on the project scope and design.

Section 5 – Describes an interim review of water demand pending publication of detailed Census 2016 results, and outlines the approach to phasing within the Preferred Scheme.

Section 6 – Sets out the approach to water abstraction, updates the modelling of its effects, and the approach to management of the abstraction alongside hydropower generation.

Section 7 – Provides the updated position on hydrodynamic modelling of the Lough Derg / Parteen Basin area.

Section 8 – Outlines the Economic Analysis of the two remaining viable options.

Section 9 – The two options are evaluated, and the Preferred Scheme is identified.

Section 10 – This section deals with the topic of Community Gain.

Section 11 – Discusses the components of the Preferred Scheme, from abstraction, through water treatment and pumping, to pipeline infrastructure, reservoir storage, and integration with the existing network.

Section 12 – Details the routing of the transfer pipeline, and the influences in determining the preferred corridor.

Section 13 – Contains the concluding statement;

Section 14 – Outlines the next preparatory steps in overall project development.

The Report is supported by a number of appendices (listed below) which provide the detailed information on the reviews/ assessments which were undertaken in support of the preparation of this FOAR.

Appendix A	Interim Midlands and GDA Water Resource Plan
Appendix B	Hydrodynamic and Water Quality Modelling Report
Appendix C	Cost Benefit Analysis of Water Supply Projects for the Eastern and Midlands Region
Appendix D	Review of Treatment Technology
Appendix E	Raw Water Abstraction Site Selection
Appendix F	Water Treatment Plant Site Selection
Appendix G	Break Pressure Tank Site Selection
Appendix H	Termination Point Reservoir Site Selection
Appendix I	Transmission Pipeline Route Corridor Selection
Appendix J	Preliminary Options Appraisal Report – Consultation Submissions Report

3. Remaining Viable Options

3.1 Introduction

The Water Supply Options Working Paper (June 2015) endorsed four viable options which were originally identified from the initial grouping of 10 proposed within the SEA. These included two options involving abstraction from the north east sector of Lough Derg (with and without raw water storage), as well as abstraction from Parteen Basin downstream of Lough Derg, and desalination of seawater abstracted from the Irish Sea.

The Preliminary Options Appraisal Report (POAR) examined these four options, and concluded that the two options involving abstraction from Lough Derg would have a significant impact on lake residence times[8], and were considered to have a high likelihood of significant impact on the aquatic ecology of the Lough, compromising the ability of these options to comply with the Habitats Directive. Consequently, it shortlisted the two remaining reasonable and technically viable options, namely:

- Abstraction from the Shannon and Parteen, and
- Desalination of Seawater from the Irish Sea

Abstraction from the Shannon at Parteen was the original Option C in the SEA and Desalination was Option H in that document.

3.2 Desalination (Option H)

Desalination draws saline water from the Irish Sea at a point north of Balbriggan. Integration of this new source into the Dublin Water Supply Network was proposed at Ballycoolin Reservoir, with reconfiguration of the Dublin network through Leixlip providing ultimate connection to Irish Water's existing facility at Peamount and to the new Termination Point Reservoir.

A 2km wide route of least constraint for the transmission pipeline between point of abstraction and Ballycoolin Reservoir was defined; traversing a linear distance of 35km. Water treatment through a desalination process would take place at source. Supply to the benefitting corridor of the Midlands Region, via an arterial main passing through the region, as would be the case with abstraction at Parteen Basin (Option C), would not be a feature of the Desalination option. This places the desalination option in a different category with respect to the delivery of key objectives in Irish Water's Water Services Strategic Plan; around consolidation of smaller, isolated and vulnerable water supplies. Accordingly, there is not strict 'like-for-like' comparability between Desalination and abstraction from Parteen Basin, in that abstraction from Parteen permits a coherent rationalisation strategy of more than 100 Midlands water supply schemes, as discussed in Section 5 of this Report, whereas Desalination addresses the water supply issues of Dublin alone, with the Midlands schemes having to be dealt with on a different strategic basis.

The Least Constrained Route Corridor for Option H is shown on Figure 3-1.

[8] A lake residence time is the amount of time taken for water (or some dissolved substance) introduced into a lake to flow out of it again, and is especially important in managing pollutants.

Figure 3-1 Option H Least Constrained Route Corridor (2km)

A preliminary review of desalination treatment technologies proposed a Reverse Osmosis (RO) plant on account of its technical efficiency and cost effectiveness. Both abstraction, and waste brine, would be returned off shore via long intake and outfall pipelines, to avoid tidal effects, enhance water quality at intake and assist discharge and dispersal of return brine from the desalination process. The Reverse Osmosis process would be supported by extensive pre-treatment following abstraction and post treatment remineralisation to provide treated water of similar hardness and taste to current supply sources.

3.3 POAR – The Emerging Preferred Option (Parteen Basin, Option C)

A relative comparison of the Options within the POAR, based on data available at that time, identified abstraction at Parteen Basin (Option C) as the Emerging Preferred Option as it offers, over Desalination (Option H), these key differentiators:

- A transfer pipeline between Parteen Basin Reservoir and a termination point in Peamount provides a ‘Benefitting Corridor’ water supply to the communities en route, which is a key objective of Irish Water;
- A transfer pipeline between Parteen Basin Reservoir and a termination point in Peamount offers greatest strategic flexibility for the supply and distribution of a key National Resource;
- A transfer pipeline between Parteen Basin Reservoir and a termination point in Peamount allows for rationalisation of the existing abstraction / water treatment resources, particularly where they are under ‘stress’ conditions, in the Midlands;
- A conventional water treatment plant, in terms of capital and operational costs, provides much greater value to the consumer.

4. Preliminary Options Appraisal Report (POAR) – Public Consultation

This section should be read in conjunction with *Appendix J: Preliminary Options Appraisal Report - Consultation Submissions Report* which presents the findings from the POAR consultation.

4.1 Introduction

Public consultation was undertaken on the POAR between the period 26th November 2015 and 4th February 2016. Recognising the difficulties imposed on stakeholders in the lower Shannon region by exceptional flooding in the December-January period, briefings and consultation meetings continued through March 2016, and Appendix J reports on submissions received up until 11th March 2016.

Consultation on the POAR was the third non-statutory public consultation stage in the WSP Road Map (refer to Section 2.2) and sought feedback on, but was not limited to, the following questions:

1) Has Irish Water taken all relevant factors into account in reaching the findings outlined in the Preliminary Options Appraisal Report?
2) How would you like to be communicated with as the project progresses?

As in previous consultation periods, advertisements, press releases and other forms of distribution of the key messages (such as sending all report documentation to the County Libraries and Planning Departments of the County Councils in the study area) were used to help promote consultation and to ensure that as wide an audience as possible was made aware of the project and its consultation and engagement opportunities.

A dedicated project website continues to be provided at www.watersupplyproject.ie. The project website outlines the project development to date, includes the Project Road Map, details of the public consultation process and full details on the various Information Services available for contacting the Project Team. Downloadable copies of all project documentation are available in full on the publication page of the project website, including all documentation from the previous three consultation stages on the Project Need Report (PNR) & Project Road Map, Options Working Paper (OWP) and the POAR, as well as from the current consultation stage on the FOAR and EIS Scoping Report. The project documentation also includes Non-Technical Summaries and Newsletters which synopsise the key findings of the various reports. There is also a dedicated Frequently Asked Questions (FAQ) page on the website relating to common queries received throughout the life cycle of the project.

In addition to publicising the consultation period, Irish Water issued written briefings outlining the key findings of the POAR and details of the consultation process to 850 stakeholders, including members of the public who had previously registered their interest in the WSP, Elected Representatives and County Councils in the study area, and various stakeholder groups. Many of these stakeholders were also offered face-to-face briefings with the Project Team, with over 40 meetings being held during the POAR public consultation period. In addition, four Public Open Days were held in key locations along the Benefitting Corridor to extend the face-to-face briefings with the Project Team to all interested parties. An Oireachtas Open Day was held for Ministers, Teachtaí Dála (TDs) and Senators at the launch of the public consultation period.

The feedback received in stakeholder meetings, public consultation days, Oireachtas open days, and stakeholder submissions (via email, post and phone) during this third public consultation period has been thoroughly reviewed by the Project Team to inform the assessment and selection of the Preferred Scheme, as well as the development of the EIS Scoping procedure for it.

4.2 Consultation Feedback

There were 78 incoming emails, letters and phone calls from stakeholders during the POAR consultation period. Four public open days were also held in the WSP Study Area during the consultation period. The Project Team met with over 60 individuals at the open days including landowners and local residents, Elected Representatives, and members of public and private local organisations. The Project Team briefed the

attendees (on a one-to-one basis) on the key findings of the POAR and discussed any stakeholder feedback. All feedback received during these Open Days was taken into account by the Project Team and informed the project development.

4.2.1 Submissions Received

Submissions and discussions in stakeholder meetings and public open days covered a broad range of themes, as shown below, many of which had been raised in previous consultation periods, such as leakage and water conservation, alternative options such as rainwater harvesting, and the importance of environmental protection and a nationally coherent approach to spatial planning. New issues also emerged during the most recent consultation period, such as flooding and energy usage, which did not receive the same level of stakeholder focus in earlier stages. The stakeholder feedback received under each theme is discussed in detail in Section 3 of the Consultation Submissions Report in Appendix J. Each submission is also summarised in Appendix J of the Consultation Submissions Report.

The Submission themes are as follows:

1) Alternative Options
    - Desalination
    - Reservoir Storage
    - Rainwater Harvesting
    - Greywater Reuse
2) Leakage & Water Conservation
    - Leakage
    - Water Demand & Conservation
3) Environment & Fisheries
    - Environment & Ecology
    - River Shannon water levels
    - Fisheries
    - Flooding
4) Tourism & Amenity
5) Communities / Benefitting Corridor
    - Community gain
    - Water allocation to the benefitting counties
6) Engineering & Planning
7) Public Consultation Process
8) Sustainability
    - Sustainability & Carbon Footprint
    - Energy

4.2.2 Response to submissions

Each and every submission and query received during the POAR consultation period was reviewed, logged and acknowledged by the Project Team, and specific responses were issued, where possible, to address the various points raised in each submission and to answer all questions posed in each query. As discussed above,

all submissions were compiled according to key themes at the end of the consultation period and were thoroughly reviewed by the Project Team to extract all of the stakeholder opinions and suggestions for input into this subsequent project stage; the identification of the Preferred Scheme and the drafting of the proposed scope for the EIS for this option. In preparing the EIS Scoping Report, which is now offered for public consultation, the views of environmental stakeholders was sought, and incorporated, at drafting stage.

Section 4 of the Consultation Submissions Report in Appendix J outlines the responses issued to all submissions, according to the submission themes.

Appendix J also includes a review of each of the issues raised in the PNR, OWP and POAR consultation periods, the Irish Water responses to the issues, and the influence of the stakeholder feedback on project development. The main elements of this review are summarised in Table 4.1.

Table 4.1: Summary of Consultation issues & Responses

Submission theme	Issues Raised	Influence on Project Development
• Alternative Options	• Reconsider alternative SEA options, Shannon (Lough Ree, Lough Derg, with and without storage).	• Mid Shannon Options eliminated due to water availability & Habitats Directive issues. • Abstraction from L Derg eliminated due to modelling, geotechnical investigations & environmental risk
• Desalination	• No issue on available water. • Modular development possible. • High cost, high carbon emissions, high energy required, waste brine disposal.	• 'Dublin centric' solution. • Not 'like-for-like' comparable on key WSSP objectives on Midlands water supplies. • No risk diversification for existing sources. • Desalination deemed technically possible but does not address all project objectives.
• Reservoir Storage - Garryhinch	• Potential environmental benefits. • Potential Tourism benefits in Midlands. • Possible flood relief.	• As per feedback from SEA consultation a hydrodynamic model was produced for Lough Derg/ Parteen Basin and ground investigation surveys were undertaken at Garryhinch. • Modelling shows no residence time benefits in drought. • Storage would have insignificant impact on flood flows. • Invasive species transfer risk • Raw water storage not proceeded with.
• Rainwater Harvesting	• Rainwater harvesting should be implemented. • Improve sustainability of commercial water usage. • Potential for rainwater harvesting on farms.	• Irish Water supports rainwater harvesting in new build designs. • Water need cannot be met by rainwater harvesting. • Resources needed to adapt existing dwellings. • Water conservation grant introduced in 2015.

Submission theme	Issues Raised	Influence on Project Development
• Greywater Reuse	• Reuse water to reduce demand for potable water. • Water reuse will become a standard part of water supply • Consider environmental flow replacement on Liffey.	• Greywater reuse not a primary source option. • Absence of European standards for greywater reuse. • Environmental flow replacement on Liffey not sustainable.
• Groundwater	• Aquifers have untapped potential. • Newbridge test bore yielded largest flow rate in State. • Use water extracted at mines.	• Groundwater alone not enough to supply demand. • Large aquifer yield with predicted yield of 33-41 Mld, proved at just 22Mld on testing. • Environmental issues. • Groundwater considered best developed as local supplementary option.
Leakage & Water Conservation		
• Leakage	• Leakage reduction could negate need for a new water source. • Project costs unjustifiable given the high levels of leakage. • Increased investment needed in pipe repairs and leakage reduction.	• Irish Water has committed to reducing leakage. • Ambitious leakage reduction targets included in water demand calculation. • Reducing leakage lower than the sustainable economic level of leakage (~20%) is very expensive, and would not provide a sustainable resilient solution to meet demand. • Aiming to achieve 63.9 Mld saving from leakage reduction at 2041.
• Water Demand & Conservation	• Demand could drop if leakage is reduced. • Dublin / Benefitting Corridor water demand will vary with population changes, agriculture, industry, and weather conditions. • Accurate 35-year forecasts are not possible. • Dublin urgently needs additional supply. • Water conservation mechanisms needed to reduce demand.	• Water demand projections already include leakage targets. • Demographic projections developed by specialist planning advisers and demographers. • Planning for a resilient water supply must take place independently of progress on water conservation. Irish Water is committed to water conservation • Phasing proposals permit capacity to match demand • Irish Water is encouraging water conservation “Be Water Smart” and other initiatives.
Environment & Fisheries		
• Environment & Ecology	• Potential impacts of the WSP on water levels, and environment / ecology of the River Shannon.	• Extensive hydrodynamic, water quality and phyto-dynamics surveys being undertaken in Parteen Basin

Submission theme	Issues Raised	Influence on Project Development
	• Impact on nutrient balance of Parteen Basin, increased pH of supplies to Dublin, impacts on Freshwater Pearl Mussel. • Significant impact on lake ecology & biodiversity.	and L Derg. State of the art model has been produced to analyse impacts of the abstraction. • Water levels will be managed within the same water level 'normal operating band' as currently applies. • Residence time of water, important for the Lough Derg ecosystem, will remain unaffected. • Extensive environmental investigations, including fish surveys are underway.
• River Shannon water levels	• Impacts on River Shannon water levels and local businesses / boating in the area. • Peak water demand and reduced water levels during dry weather	• Abstraction would be within the normal operating range that currently applies • Navigation and tourism will experience the same operating water level range as normal. • Dry weather will not exert an unforeseen impact, already factored into projections.
• Fisheries	• Impacts on fishing, angling and boating. • Support for a fish pass improvement at Parteen.	• Water quality survey contract continuing. • Loss of spawning ground is not expected. • Fish stock surveys undertaken with IFI. • Fisheries specialist engaged to advise on fisheries issues. • Engagement with fisheries authorities underway
• Flooding	• Taking 2% out of flow would reduce flooding downstream of Parteen Weir. • Abstraction could be increased when flooding is forecast.	• Scale of flooding too large compared to water supply abstraction. • Difficult to develop a single hybrid solution effective in achieving water supply and flood reduction. • A marginal reduction in flood flow would not result in a significant reduction in flood water level.
• Alien Invasive Species	• Concerns around spread of invasive species.	• Key challenge in Water Services Strategic Plan. • Taken into account in discounting raw water storage (Garryhinch) option. • Risks considered in options appraisal overall.
Tourism & Amenity	• Impacts on tourism and amenity.	• Abstraction will operate within the

Submission theme	Issues Raised	Influence on Project Development
	• Tourism benefits of Garryhinch storage option.	same water level range as currently applies on Lough Derg & Parteen Basin. • Modelling showed that water residence time impacts of abstraction on Lough Derg not mitigated by storage capacity at Garryhinch.
Communities / Benefitting Corridor		
• Community gain	• Potential job opportunities with the pipeline construction, • Advantages of strategic infrastructure in the Midlands Region.	• Community gain aims to provide lasting benefits • Irish Water propose to fund community initiatives through a Community Gain Fund. • Fund would be targeted at tourism, environmental projects, training & education or sport and leisure.
• Water allocation in the Benefitting Corridor	• Counties in the Midlands included in the water supply proposal are not in need of additional supply.	• Over 100 schemes in the region can benefit from WSP. • Irish Water aims to consolidate existing schemes relying on smaller vulnerable water sources of unreliable yield as per the objectives of the WSSP.
Engineering & Planning	• Surrounding lands would be compromised by location of terminal reservoir	• Location & elevation of reservoir are under development with due regard to surrounding lands.
Public Consultation Process	• Engagement with stakeholders & criticism of the project's public consultation process. • Consultation documents are long, extensive, detailed and technical.	• Non-statutory public consultation has been carried out at each project stage. • The FOAR is the fourth such consultation. • Summaries included with reports produced and individual sections partitioned on the project website. • Alternative means for accessing project documentation and information are being developed for the fourth phase of consultation, including a document library and explanatory animation
Sustainability		
• Sustainability, Carbon Footprint, Climate Change	• WSP is Dublin-centric. • Unsustainable development capacity in Greater Dublin Area. • Project will have a big carbon footprint, impacting on efforts to address climate change.	• As per Irish Water's remit, the WSP now to supply water in Eastern & Midlands Region, not just Dublin Area. • Sustainable development involves planning for future growth. • Climate change is being considered

Submission theme	Issues Raised	Influence on Project Development
	•	in the design development and in the EIS.
• Energy	• Reduction of renewable energy generation capacity at Ardnacrusha does not fit in with government policy to realise a low carbon/energy economy	• Irish Water & ESB are discussing curtailing power generation water usage by an equal amount to the water abstracted for water supply. • Replacement from sustainable sources being considered. • Energy recovery in the WSP infrastructure is being considered
Constraints & Assessment Criteria	• Assessment criteria were unclear / lacking	• The Options Working paper consultation outlined the assessment criteria and asked if anything else needed to be considered. • The case on each of the options was transparently presented • The project team recognise the extent and volume of information that was reported on. • A document library is being developed to try and assist in people accessing information more easily.
Economic Development	• WSP a positive economic development, losses to economy if additional supply is not provided	• IW strive to ensure water services enable economic development.
Water Framework (WFD) & Habitats Directive	• Project should not be contrary to aims / objectives of WFD. • Concern about adverse effects on SPA.	• Options will be assessed for compliance with WFD. • Meeting Habitats Directive is a primary objective of IW.

4.3 Next Steps

As can be seen in the Project Road Map in Section 2.2, public consultation and engagement is a crucial element in the development of the WSP. All of the feedback received during the first three non-statutory public consultation periods was analysed in detail and it assisted in and was considered as part of the selection process for the Preferred Scheme, as identified in the FOAR. The fourth consultation period commencing in November 2016 seeks feedback on this preferred scheme, including the proposals in the FOAR and EIS Scoping Report for the scope of the environmental assessments, design and construction of this option.

The feedback from this consultation period alongside further technical and environmental studies and engagement with landowners and the general public will inform the selection of the final scheme. This will be detailed in the EIS and will accompany Irish Water's planning application to An Bord Pleanála. In this way, Irish Water has from the beginning sought, and continues to invite, feedback from as wide an audience as possible to assist them in shaping the project.

During this consultation period a number of landowner evenings and eight public open days will be held at various locations along the proposed pipeline route where members of the project team will be available to answer any questions.

Following on from the conclusion of the consultation process in early 2017, Irish Water will be in direct contact with landowners affected by the proposed pipeline route.

An Bord Pleanála will undertake all necessary statutory consultations including Oral Hearings where everyone will again be entitled to have their say, following which the An Bord Pleanála will determine whether consent should be granted.

5. Interim Demand Review and Phasing of Supply

5.1 Introduction

Irish Water proposes to carry out a detailed review of the Water Demand Projection for the Water Supply Project - Eastern and Midlands Region, when the detailed results of Census 2016 are available later this year. At the time of preparation of this Final Options Appraisal Report, an interim review is presented below, which takes into account the analysis of domestic metering readings from over 825,000 installed meters, as well as the results of more than 15 months operation of the 'Free First Fix' scheme which assists domestic customers to deal with customer-side leakage.

Feedback from the consultation process to date related to water demand is also taken into account in this interim review.

5.2 Interim Water Demand Review

5.2.1 The Project Need Report

5.2.1.1 The Project Need Report Scenario 2 'Most Likely' Demand position, as published in March 2015, is shown in Table 5.1. It estimated domestic consumption on the basis of population projections which were applied to per capita consumption of approximately 125 litres per capita per day, declining marginally to 121 litres per capita per day at 2050.

5.2.1.2 It separately accounted for customer side leakage (CSL), expecting this to decrease from a then estimated 66 litres per property per day, to 25 litres per property per day by 2031.

5.2.1.3 It estimated current Unaccounted for Water (UFW) at 178.1 Mld, which when taken with CSL of 40.8 Mld, totals 218.9 Mld.

5.2.2 Developments in the interim period February 2015 to August 2016

5.2.2.1 The installation of over 825,000 domestic meters nationally and the analysis of metering data, has identified consumption 'per connection' as a basis on which the most reliable directly measured statistical data of domestic water consumption is available. Consumption per connection per day also now includes CSL.

5.2.2.2 Taking the Eastern Region, and a sample size of 386,553 available properties, the average consumption over all properties (including properties not permanently occupied) was 363 litres/ per connection/d in December 2015, with a seasonal range from 389 litres/connection/d (summertime) to 356 litres/connection/d (October 2015). A figure of 365 l/connection/day is therefore adopted as the current domestic consumption rate.

5.2.2.3 Submissions received and discussions with Dublin City Council have clarified that baseline industrial consumption is more reliably estimated at 110.1 Mld rather than the previously estimated 126.5 Mld.

5.2.2.4 Submissions received from Kildare County Council indicate that deployable water supply from Srowland WTP near Athy should be reviewed and reduced, so that overall expected capacity of existing sources, after 2026, is estimated at 650 Mld, marginally down from the previous 658 Mld. Climate change review of the possible erosion of the yield of existing sources has not yet been updated. For water demand projection purposes, it has also been assumed that the maximum treated water capacity available is always available.

5.2.3 Interim Updating assumptions on the PNR position

5.2.3.1 Table 5.2 presents the PNR Scenario 2 'Most Likely' position, adjusted for the above interim developments, and for the assumptions below. The originally projected organic growth profile in non-domestic consumption is added to the adjusted baseline figure in Table 5.1.

5.2.3.2 Irish Water has confirmed that the current best estimate of UFW in the Dublin Water Supply Zone is 204.7 Mld.

5.2.3.3 It is assumed that 'consumption per connection' will trend downwards as occupancy rate does, but early indications from Census 2016 are that the rate of household formation lags behind population growth to a greater extent than anticipated. If occupancy at 2050 reaches 2.2 per residential unit, then 305 l/connection/d is a proportionate figure for 2050.

5.2.3.4 Per-connection consumption is therefore assumed to trend downwards from the current 365 l/connection per day, to 305 l/connection per day at 2050.

5.2.3.5 Irish Water is preparing a Water Conservation Strategy and work is progressing on this. In projecting UFW, it is assumed and noted that Irish Water will commit to a Leakage Targets Policy in work currently in progress (see Section 5.2.4), rather than the Sustainable Economic Level of Leakage (SELL) Base Case. The water demand profiles would be different, and would project a higher production requirement, if the SELL Base Case scenario were followed.

5.2.3.6 In profiling demand in the Benefitting Corridor, Irish Water projected figures have been used, as outlined in the Irish Water Interim Midlands and Greater Dublin Area (GDA) Water Resource Plan in Appendix A, interpolating figures where necessary. Previous estimates were based on individual assessments by Local Authorities which have now been collectively analysed and updated by Irish Water.

5.2.3.7 In accordance with the Water Services Strategic Plan guidelines for large urban settlements (Dublin, Cork, Limerick/Shannon, Galway and Waterford); headroom has been adjusted to 20%. Review of the recent profile of water demand on both domestic consumption and overall has prompted a reduction in peaking factor to 15%. Peaking is not applied to leakage, or to strategic industrial water demand.

Table 5.1: Scenario 2 - 'Most Likely Growth' as published in the PNR (March 2015)

Scenario 2 - 'Most Likely Growth'										
Component		**Element**	**Units**	**2011**	**2021**	**2026**	**2031**	**2041**	**2046**	**2050**
Accounted for Water (AFW)	Domestic Demand	Population	Nr.	1,516,133	1,642,391	1,742,226	1,842,060	2,003,156	2,081,225	2,154,252
		PCC	l/hd/d	125.50	120.40	120.60	120.70	120.90	121.00	121.00
		Domestic Demand	Mld	190.3	197.7	210.1	222.3	242.2	251.8	260.7
	Household (Customer Side) Losses	Occupancy Rate	Nr.	2.64	2.48	2.40	2.32	2.16	2.08	2.00
		Nr of Households	Nr.	618,460	728,480	798,520	873,391	1,020,126	1,100,648	1,184,839
		CSL rate	l/prop/d	66	40	35	25	25	25	25
		CSL	Mld	40.8	29.1	27.9	21.8	25.5	27.5	29.6
	Non-Domestic Demand	Non-Domestic Demand	Mld	126.5	138.3	146.2	154.8	168.7	175.3	181.1
		Strategic Allowance for Major Water Using Industry	Mld	0	34	50	75	100	100	100
	Operational Use	Operation Use Factor[9]	%	1%	1%	1%	1%	1%	1%	1%
		Operational Use Allowance	Mld	3.6	3.7	3.8	4.0	4.4	4.5	4.7
	Accounted for Water (AFW)		Mld	361.2	402.8	438.1	478.0	540.7	559.2	576.1
Unaccounted for Water (UFW) / Distribution Losses		UFW	Mld	178.1	164.8	146.0	140.8	130.0	130.0	130.0
		as % of Average Demand	%	33.0%	29.0%	25.0%	22.8%	19.4%	18.9%	18.4%
		cubic metres per km per day	m^3/km/d	19.42	17.97	15.92	15.35	14.18	14.18	14.18
Average Demand			Mld	539.3	567.6	584.1	618.8	670.7	689.2	706.1
Peak Demand		Peaking Factor	%	20%	20%	20%	20%	20%	20%	20%
		Peaking Allowance	Mld	72.2	73.8	77.6	80.6	88.1	91.8	95.2
Average Day - Peak Week Demand (ADPW)			Mld	611.5	641.4	661.8	699.4	758.9	781.0	801.3
Allowance for Risk and Uncertainty		Headroom & Outage Factor	%	17.5%	17.5%	17.5%	15.0%	15.0%	15.0%	15.0%
		Headroom & Outage Allowance	Mld	63.2	64.5	67.9	60.4	66.1	68.9	71.4
Production Requirement			Mld	**674.7**	**705.9**	**729.7**	**759.8**	**825.0**	**849.9**	**872.7**
		Existing Sources			623	633	658	658	658	658
		Production Deficit			82.9	96.7	101.8	167.0	191.9	214.7
		Benefitting Corridor				90.8	92.5	95.4	97.0	99.1
		Production Requirement				**187.5**	**194.3**	**262.4**	**288.9**	**313.8**

[9] (1% of (Domestic Demand + CSL + Non-Domestic Demand)

Table 5.2: Scenario 2 - 'Most Likely Growth' adapted for' per connection' approach, recalculated UFW, and Benefitting Corridor demand

Scenario 2 - 'Most Likely Growth'									
Component	**Element**	**Units**	**2011**	**2021**	**2026**	**2031**	**2041**	**2046**	**2050**
Accounted for Water (AFW)	Domestic Demand	Population	Nr.	1,516,133	1,642,391	1,742,226	1,842,060	2,003,156	2,081,225	2,154,252
	Household (Customer Side) Losses	Occupancy Rate	Nr.	2.69	2.48	2.37	2.32	2.25	2.20	2.20[10]
		Nr of Households[11]	Nr.	591,798	695,366	771,871	833,690	934,805	993,311	1,028,165
		Consumption per connection[12]	l/prop/d	365	360	350	335	315	310	305
		Domestic Consumption	Mld	216.0	250.3	270.2	279.3	294.5	307.9	313.6
	Non-Domestic Demand	Non-Domestic Demand	Mld	110.1[13]	125.0	135.0	145.0	155.0	160.0	165.0[14]
		Strategic Allowance for Major Water Using Industry	Mld	0	34	50	75	100	100	100
	Operational Use	Operation Use Factor[15]	%	1%	1%	1%	1%	1%	1%	1%
		Operational Use Allowance	Mld	3.3	3.8	4.1	4.2	4.5	4.7	4.8
	Accounted for Water (AFW)		Mld	329.4	413.1	459.2	503.5	554.0	572.6	583.4
Unaccounted for Water (UFW) / Distribution Losses		UFW[16]	Mld	**204.7**[17]	165.9[18]	153.1	145.0	140.8[19]	140.8	140.8
		as % of Average Demand	%	38.3%	28.7%	25.0%	22.4%	20.3%	19.7%	19.4%
		cubic metres per km per day	m^3/km/d	22.32	18.09	16.69	15.81	15.35	15.35	15.35
Average Demand			Mld	534.1	579.0	612.3	648.5	694.8	713.4	724.2
Peak Demand		Peaking Factor	%	15%	15%	15%	15%	15%	15%	15%
		Peaking Allowance	Mld	49.4	56.9	61.4	64.3	68.1	70.9	72.5
Average Day - Peak Week Demand (ADPW)			Mld	583.5	635.8	673.7	712.8	762.9	784.3	796.7
Allowance for Risk and Uncertainty		Headroom & Outage Factor	%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%
		Headroom & Outage Allowance	Mld	65.9	75.8	81.8	85.7	90.8	94.5	96.7
Production Requirement			Mld	**649.4**	**711.7**	**755.5**	**798.5**	**853.6**	**878.8**	**893.4**
	Existing Sources				623	633	650[20]	650	650	650
	Production Deficit				88.7	122.5	148.5	203.6	228.8	243.4
	Benefitting Corridor	**Interpolated from IW data**[21]				26.87	30.6	43.4	51.1	56.0
		Corridor source risk provision				16	16	16	16	16
	Production Requirement					**165.4**	**195.2**	**263.0**	**295.9**	**315.3**

[10] initial Census 2016 indicates occupancy of 2.0 may not be reached
[11] including properties not permanently occupied
[12] Assuming downward trending per connection consumption
[13] Adjusted to align with Table 3.2.8 non-domestic figures
[14] Assuming the 55 Mld organic growth applies
[15] (1% of (Domestic Demand + CSL + Non-Domestic Demand)
[16] Assuming Leakage Targets Policy off UFW 204.7 Mld
[17] IW communication on UFW Jul 2016
[18] 38.8 Mld is the UFW recovered on current work-in-progress at 2021; CSL recovery included in 'per connection' rate
[19] 63.9 Mld is the UFW recovered on current work-in-progress at 2040. CSL recovery is included in 'per connection' rate
[20] Reduction in view of KCC comments on Srowland capacity
[21] Interpolated

5.2.4 Adopting challenging Water Conservation targets for WSP

5.2.4.1 Linked Strategies

Water Conservation is a vital part of the overall strategy to provide safe and secure water supplies in the Eastern & Midlands Region. This has been Irish Water's position from the outset in the Project Need Report (February 2015) and it is reiterated in the appended Interim Midlands and GDA Water Resource Plan.

Public consultation over the past 18 months, has repeatedly emphasised the importance of fixing leaks and of water conservation overall. Demand projections are based on achieving ambitious targets in these areas.

5.2.4.2 Two basic approaches

There are two kinds of conservation strategy being examined in the Water Conservation Strategy Project being implemented by Irish Water, these are work-in-progress at this time and are outlined below. The Sustainable Economic Level of Leakage, or 'SELL', is the level at which the combined cost of water and the cost of leakage management, are minimised. The Water Conservation Strategy being considered by Irish Water includes both a SELL Base Case and a Leakage Targets Policy.

The **SELL Base Case** approach would seek to recover 39 Mld in the six year period to 2021, and then prevent leakage from rising thereafter. It assumes that the Water Supply Project comes on stream at 2025.

The **Leakage Targets Policy,** following the leakage targets set out in the Project Need Report, would recover a greater 63.9 Mld substantively by 2031.

5.2.5 An update on the UFW level

The latest estimate of network UFW in the Dublin Water Supply Area by Irish Water, excluding Customer Side Leakage (CSL) exceeds the published position in the WSP Project Need Report 18 months ago, but the progress made with customer side leakage is better than expected. When the PNR estimate is now adjusted for recent, better '*per connection'* metered data, and in one other area around industrial consumption, a UFW in the network of 204.7 Mld emerges.

In February 2015, UFW in the Dublin Water Supply Area was estimated in the PNR at 178.1 Mld, but CSL was separately estimated at 40.8 Mld, giving a total of 218.9 Mld.

The declared ambition in the PNR of March 2015 was to save 48 Mld off the UFW by 2041, and a further 15.3 Mld was to be cut from CSL, giving a total UFW+CSL saving of 63.4 Mld.

5.2.6 Customer Side Leakage

Irish Water has vigorously tackled the problem of Customer Side Leakage through its *Free First Fix* Scheme (http://www.water.ie/water-supply/first-fix/) and has reported excellent returns on the Scheme to date.

At March 2016, the report to the CER on the Free First Fix Scheme identified 48.5 Mld of savings to date, nationally, 26 Mld of which was achieved in Irish Water's East & Midlands Regions. If we assume that 80% of this was in the Dublin Water Supply Area, then almost 20.7 Mld of growing demand has already been offset by this scheme, and value for money is clear from the report to the CER. This would mean that the CSL recovery projected for 2031 in the PNR has already been achieved.

The future returns from the scheme will diminish since the larger leaks are prioritised and are resolved earliest, but Irish Water will continue to work with customers to help them to conserve water.

5.2.7 Irish Water Initiatives

5.2.7.1 Network Resilience Schemes

Irish Water is pursuing a number of schemes, which are intended to improve the ability to move water around the Dublin Water Supply network. These projects will improve the Deployable Output (DO) (see Section 5.5.2) and bring it closer to the actual Distribution Input. The current schemes are:-

(a) No 1:- Peamount Distribution Area and Network Upgrades
(b) No 2:- Old Kilcullen Pumping Station and Rising Main
(c) No 3:- Peamount Pumping Station and Trunk Main
(d) No 4:- Vartry upgrade

These schemes increase Deployable Output collectively, but they do not appreciably increase source water availability. Heretofore, WSP has subtracted the summed sustainable output of existing sources, with any assumed upgrades, (623 Mld at 2015, 633Mld at 2022 and 658 Mld at 2026) from the gross calculated future requirement.

The current operational experience is that the nominal 623 Mld maximum sustainable output availability up to 2021 is nearer 600 Mld (or less) in practice.

To this extent, these projects increase the likelihood that source capacity can be deployed generally where needed across the network, but they essentially bring the position on the ground towards where WSP demand calculation has already assumed it to be for projecting future demand requirements.

5.2.7.2 The Leakage Targets Policy

The Leakage Targets Policy has been assumed in the interim water demand projections and will give the following profile of UFW:

Table 5.3: Leakage Targets Policy

	2011	2021	2026	2031	2041
UFW (Mld)	**204.7**	165.9	153.5	145.0	140.8
Reduction in period (Mld)		38.8	12.4	8.5	4.2
Cumulative Reduction (Mld)		**38.8**	**51.2**	**59.7**	**63.9**

5.3 Option C (Parteen Basin Reservoir Direct)

Option C sources water from the Parteen Basin (Lower Lake) of the River Shannon system, downstream of Lough Derg. It involves abstraction on the shore of Parteen Basin, at a constant abstraction rate of 330 Mld throughout the year. This is equivalent to 3.82m^3/s over a 24 hour day, but it is expected that the daily volume of water will be flow balanced over 20 hours to avoid peak pumping tariffs.

Water treatment would take place near the abstraction point, and a treated water supply would be pumped to a high level Break Pressure Tank and piped gravitationally onwards to the Midlands and the Eastern Region. This permits the transmission pipeline to provide potable water to communities through a 'benefitting corridor' in the Eastern and Midlands Region.

Integration of this new source into the Dublin Water Supply Network is proposed at a Termination Point Reservoir in close proximity to Irish Water's existing reservoir facility at Peamount.

In addition, the POAR defined a Least Constrained Route Corridor, 2km wide, for this transmission pipeline between the point of abstraction at Parteen Basin and the Termination Point Reservoir in Peamount; traversing a linear distance of approximately 165km.

The Least Constrained Route Corridor for Option C is shown on Figure 5-1.

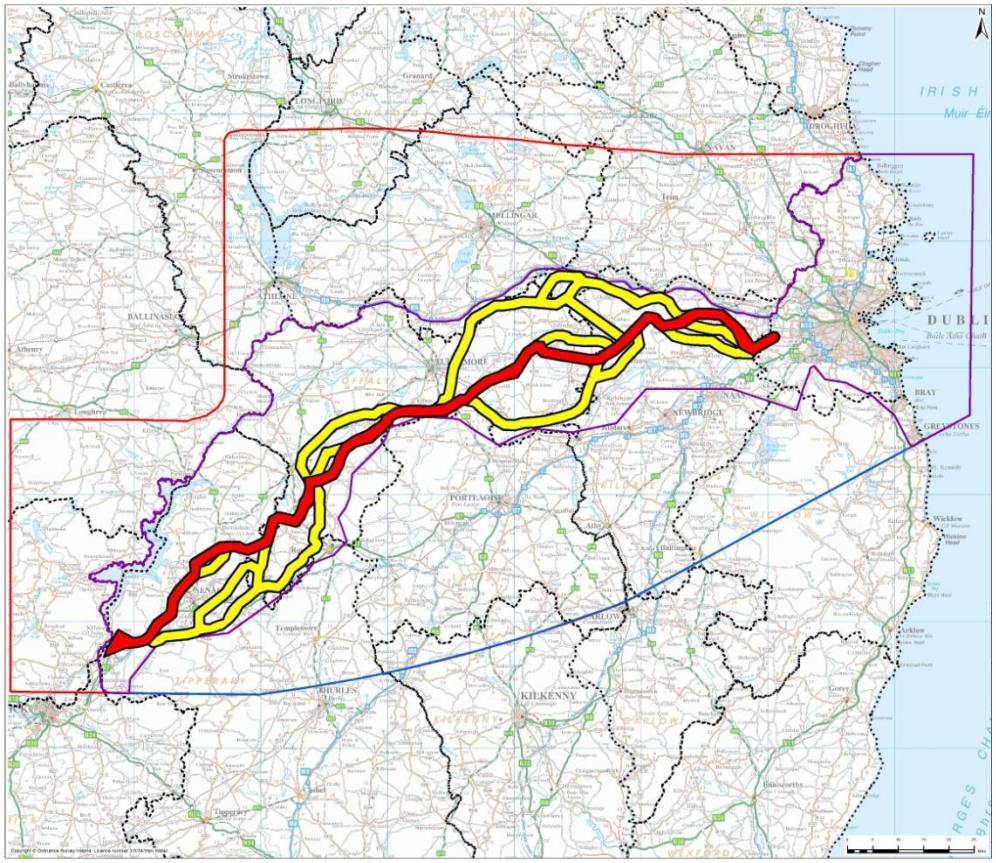


Figure 5-1 Option C Least Constrained Route Corridor (2 Km)

A preliminary review of treatment plant technologies in the POAR proposed a conventional modular stream process, with the sizing and configuration reflective of the expected profile of water demand over time. The presence of alien aquatic species, such as zebra mussels and Asian clams within the raw water source, was also recognised in the design of the raw water abstraction structure, preliminary screening and raw water rising main configuration.

5.3.1 Benefitting Corridor Demand

5.3.1.1 Introduction

At the time of preparation of the Project Need Report (March 2015), a preliminary estimate of the requirements of the Benefitting Corridor was prepared, based on individual county 'need assessments' prepared by Local Authorities, which predated Irish Water's assumption of responsibility for overall National Water Resource Planning. Public Consultation has also emphasized the need to continuously review the public water schemes in the Midlands Benefitting Corridor, and maximise the use of those schemes and sources which offer the best prospects of sustainable abstraction. Therefore, in the interim period since the Project Need Report of March 2015, Irish Water has reviewed the WSP need, based on detailed analysis and risk assessment of 105 existing water supply schemes, based on the 25-year rationalisation objectives of the Water Services Strategic Plan, whilst accounting for necessary upgrade works which have had to proceed in advance of the WSP, due to pressing water quality issues at some locations.

The treated water pipeline would pass through Counties Tipperary, Offaly, Kildare and South Dublin, but the headworks infrastructure and the Termination Point Reservoir connection to the existing Dublin network also permits review of schemes in Counties Clare, Laois, Westmeath, Louth and Wicklow. The Irish Water review of the water supplies in the Benefitting Corridor is appended in Appendix A as the Interim Midlands and GDA Water Resource Plan, it is work-in-progress and it envisages that the 105 existing schemes in the Benefitting Corridor will be consolidated to fewer schemes by the year 2050.

The expected water demand profile for the Benefitting Corridor is composed of two parts, the direct requirement for the excess of projected demand over expected supply from the schemes likely to be retained, and a provision for risk (see Section 5.3.1.2) related to the retained schemes overall.

5.3.1.2 Risk factors

Future abstraction regime:- Ireland, through the Department of Housing, Planning, Community and Local Government, is working to develop an abstraction registration and licencing programme as required by the Water Framework Directive. At present, it is unclear what the requirements of abstraction licencing applied to existing abstractions will be.

Many of the current surface water abstractions were established prior to the introduction of Environmental Impact Assessments or Habitats Directive assessments and retrospective review could determine that the level of proposed abstraction in some instances is not sustainable. A licencing programme with retrospective implications presents an unknown risk to the production capacity of schemes which it is proposed to retain in the Midlands region, particularly for abstractions where there has been no recent upgrade, which would have assessed the environmental impacts.

Particular Risks:- Irish Water has reviewed the larger Water Treatment Plants which it is anticipated will remain at 2050 to establish if any may be at risk due to changing legislation in relation to abstractions, or for other reasons. From these there is a potential that the following abstractions fall into this category:-

- The Portloman WTP (Westmeath), which draws from Lough Owel has a current yield available to Irish Water which is estimated to be 13.6Mld. Because the Royal Canal has been returned to navigability, and under the terms of agreements made in relation to water requirements for the canal, ancillary to the original Water Rights Order in 1985, a prudent provision needs to be made against some potential long term non-availability of this 13.6 Mld.
- Clonsalee WTP (Offaly), the surface water sources from the Clodiagh & Gorragh Rivers, involving 1Mld are considered to be at risk in low flow conditions.
- The Tullamore, Co Offaly groundwater supplies (Arden and Clonsalee WTP's), totalling 3.4 Mld are considered to be at risk.
- Laois is totally dependent on groundwater and may be at risk as a whole. The Portlaoise Water Supply (8.4 Mld), in particular, is known to experience high levels of drawdown following dry conditions, and has been the subject of consultation submissions by Laois Co. Council related to strategic backup support.

*Catchment Risks:-*Although most of the water treatment plants likely to be retained will be upgraded to include multiple treatment barriers and to address risks, identified through Irish Waters' Drinking Water Safety Plan risk assessments, catchment risk management is outside the direct control of Irish Water, and there is a real risk that a source contamination event could cause the loss of any one source. In connection with consolidation of smaller Midland water schemes, it is notable, from recent HSE work[22] related to incidence of reported cases of *cryptosporidium* infection, that (referring to HSE regions), the incidence in the Midlands was found to be 15.2 per 100,000 population, whereas the comparable figure in the Eastern region was 1.4 cases per 100,000 population. The quality control benefits of large water treatment plants are evident in these figures.

Climate Change: Climate change assessments are likely over time to reduce the reliable yield of sources, although the degree of reduction is unknown at this stage, the future impact must also be considered.

[22] EPA Research Report 177:- Economic Assessment of the Waterborne, Outbreak of *Cryptosporidium hominis* in Galway, 2007

Group Water Schemes (GWS) and Developer Provided Infrastructure (DPI):- Irish Water is not the managing authority for Group Water Schemes, or for independently operated Developer Provided Infrastructure, however there is a 'taking-in-charge' process by which such infrastructure may transfer to the public water network. It is unclear at this time how many Group Water Schemes and Developer Provided Infrastructure will be taken in charge by Local Authorities or later transferred to Irish Water, but there is a significant number of Group Water Schemes and DPI in a category that may transfer to Irish Water, placing potential additional demand on existing Irish Water abstraction and treatment capacity.

Provision for Risk Factors

The foregoing risk factors have not been included in the detailed water demand projections, and it would not be proportionate to provide for the full exposure in every instance. However, Irish Water believes it is prudent to provide a minimum contingency of 16Mld to deal with unforeseeable abstraction restrictions, contamination events, or demand increases in the Midlands area in particular. This allowance is just under 10% of overall demand in the corridor, and it is proportionate to the exposure at Portlaoise, or Portloman.

5.3.1.3 Overall Benefitting Corridor Demand

The overall demand profile for the Benefitting Corridor is as follows:-

Table 5.4: Benefitting Corridor Water Demand'

	2026	2031	2041	2046	2050
Benefitting Corridor (Mld)	26.87	30.6	43.4	51.1	56.0
Corridor source risk provision (Mld)	16	16	16	16	16
Totals (Mld)	**42.87**	**46.6**	**59.4**	**67.1**	**72**

The profile ranges from 42.9 Mld at 2026 to 72 Mld at 2050, and is reduced compared to the projections made in the Project Need Report of March 2015.

5.3.1.4 Schemes to be retained or consolidated

At the time of writing this Report, the water supply schemes in the Benefitting Corridor that are currently envisaged to be retained or consolidated by 2050 under Irish Water's rationalisation plans are:-

Table 5.5: Schemes to be consolidated or retained

Scheme to be retained or consolidated	Number of WTPs to be retained or consolidated
Clare	**7**
Feakle PWS	1
Flagmount PWS	1
Kilkeedy PWS	1
Killaloe PWS	1
Mountshannon PWS	1
O'Briens Bridge PWS	1
Scarriff PWS	1
Laois	**26**
Abbeyleix 1 PWS	1
Abbeyleix 2 PWS	1
Arles 2 PWS	1

Scheme to be retained or consolidated	Number of WTPs to be retained or consolidated
Ballinakill 1 PWS	1
Ballinakill 2 PWS	1
Ballyroan PWS	1
Borris in Ossory PWS	1
Camross PWS	1
Coolenaugh PWS	1
Durrow 1 PWS	1
Graiguecullen PWS	1
Lough PWS	1
Meelick PWS	1
Mountmellick 1 PWS	1
Mountrath 2 PWS	1
Mountrath 3 PWS	1
Mountrath PWS	1
Portarlington 1 PWS	1
Portarlington 2 PWS	1
Portlaois PWS	1
Rathdowney PWS	1
Reary WTP	1
Rosenallis PWS	1
SE Regional Scheme	1
Swan PWS	1
The Strand PWS	1
Louth	**5**
Collon	1
Drybridge	1
Kilineer	1
Rosehall	1
Staleen	1
Meath	**4**
Danestown	1
East Meath	1
Hollymount	1
Woodview	1
Offaly	**29**
Banagher RWSS PWS	2
Birr PWS	1
Clara/Ferbane PWS	2
Clara/Ferbane RWSS PWS	1
Clonbullogue PWS	1
Coolbawn WTP (New)	1
Coolderry PWS	1
Daingean PWS	1
Dunkerrin PWS	3
Edenderry PWS	2
Geashill PWS	1
Kilcormac PWS	1
Kinnitty PWS	1
Moneygall PWS	1
Mountbolus P.W.S.	1
Rahan - Agall/Hollimshill P.W.S.	1
Rahan - Tully P.W.S.	1
Rhode PWS	1
Shinrone/Brosna PWS	2

Scheme to be retained or consolidated	Number of WTPs to be retained or consolidated
Tullamore PWS	3
Walsh Island PWS	1
Westmeath	**3**
Athlone WSS	1
Ballany High Level Reservoir	1
Frewin Hill High Level Reservoir	1
Wicklow	**31**
Aughrim Annacurra Public Supply	1
Avoca Ballinaclash Public Supply	1
Ballinglen (Preban Bridge)	1
Ballinteskin Public Supply	1
Ballycoog Public Supply	1
Ballymorris 3	1
Ballymorris Public Supply	1
Baltinglass Public Supply	1
Barndarrig Public Supply	1
Dunlavin Public Supply	1
Glenealy Public Supply	1
Grangecon Public Supply	1
Hollywood Donard Public Supply	1
Killyballyowen (Annacurra) Public Supply	1
Killyballyowen (Aughrim) Public Supply	1
Kirikee Public Supply	1
Knockanarrigan Davidstown Public Supply	1
Knoxtershill	1
Lacken Public Supply	1
Laragh Annamoe Public Supply	2
Loughmogue (Dunlavin)	1
Mullans North	1
Rathdangan Public Supply	1
Rathdrum Public Supply	1
Redcross Conary Public Supply	1
Roscath	1
Roundwood Public Supply	1
Stratford Public Supply	1
Valleymount/Ballyknockan Public Supply	1
Wicklow Regional WSS	1
Grand Total	**105**

5.4 Phasing of Supply

The profile of projected treated water production requirement, over time, is summarised below:-

Table 5.6: Treated Water Production Requirement

Element	2026	2031	2041	2046	2050
Treated Water Production Requirement (Mld)	165.4	195.2	263.0	295.9	315.3

'Phasing of Infrastructure' attempts to align the required investment, with the developing position on water requirement, within a system which operates well throughout its working life.

In developing phasing proposals, it is necessary to consider not only the growing volumetric water requirement, but also the other elements of 'need', the diversification of risk with the existing sources, and the requirement to bring resilience and headroom to the overall system. It is also necessary to geographically distribute this headroom, by operating existing sources, and particularly Ballymore Eustace and Leixlip at not more than 85% of full output, so that routine maintenance of treatment streams can take place, without impacting output.

5.4.1 Issues to be considered in Phasing the Water Supply Project

The Intake, Raw Water Pumping Station and twin Raw Water Rising Mains would be constructed for the full raw water abstraction of 330 Mld, because these either include dual elements, one of which must have the facility to be taken out of service for maintenance, or it involves civil engineering construction near the source waterbody, where phased construction would not be practical. Pumping plant within the Raw Water Pumping Station would be phased, with space within the station provided to add pumpsets with increasing demand.

Many pipeline configurations and options have been considered, including single pipe, dual pipes, and phased dual pipes. Options which involve a gravitational supply from a high level Break Pressure Tank near the Tipperary/Offaly border, as well as combined gravitational / booster pumping have also been considered.

If a Phase 1 configuration were curtailed strictly to 160 Mld, which is of the order of 50% of the long term requirement at 2050, and which might be considered with a phased dual pipe, it would only match projected demand at the mid 2020's and it would not cover both demand at that level, and resilience support if supply elsewhere is disrupted. Neither would it cover a system needing to be operated at above average flows over a short period, to refill storage drawn down in an emergency, particularly in Dublin.

It should be recalled that risk to existing major sources was discussed in the Project Need Report (February 2015), and this continues to be a major factor in project need and in considerations of phasing. The experience of a large UK water utility, in Summer 2015, where one million customers were affected by a cryptosporidium outbreak at a major water treatment plant, despite the presence of strong barriers to this microorganism in its treatment process, is a reminder of the need to properly plan for potential outage at sources. Due to its location in the catchment and its proximity to highly populated areas, with a large waste water treatment plant upstream, the Leixlip WTP is considered by Irish Water to be vulnerable to pollution events, and this is an influencing factor in WSP phasing recommendations. With any phasing of a dual pipe, the second pipe would have to be laid alongside a live operating main. The required permanent wayleave for a position where twin configuration is planned would need to be wider than 20m, to accommodate a separation of 7m-10m between the pipes. Construction of a second pipeline adjacent to a live Phase 1 pipeline carries risks, particularly if thrust blocks are required with the initial pipe.

It could not be assumed with certainty that the same wayleave could be used for the second of a twin pipeline in a completely separate Planning Application.

Farming organisations in public consultation have warned against double disruption within a short time period, for dual pipe construction, where it can take land several years to recover full productivity. Attempting to manage demand risk by phasing twin pipelines carries a significant disruption risk if demand growth is faster than expected and the effective life of Phase 1 is overestimated.

A greater than anticipated, or earlier than expected erosion of safe yield on the existing sources in the Dublin WSA and Midlands, with climate change, would also disrupt the effectiveness of a Phase 1, if sized inflexibly in the region of 160 Mld.

Irish Water considers as optimum, a single pipeline configuration with a diameter of the order of 1700mm diameter in the rising pressure section from the Water Treatment Plant to the Break Pressure Tank, and of the order of 2000mm diameter pipeline from there to the Termination Point Reservoir at Peamount.

The proposed single pipeline would be sized to deliver the full demand, but it would have an element of phasing in its design, being sized to operate gravitationally for flows up to 245 Mld, with later booster pumping being employed to deliver the balance up to 315.3 Mld by 2050.

5.4.2 Phase 1 of 240 Mld delivering in a full sized 315 Mld pipeline.

A Phasing proposal of 240 Mld would comprise 3 No 80 Mld treated water streams, in covered building units. This would provide capacity for a start-up flow of the order of 160 Mld, and a resilience margin of 80 Mld to support and de-risk existing sources in the Midlands and Eastern Region, and to provide a working margin for large diameter arterial main maintenance works.

Water would be delivered through a single pipeline sized for the ultimate 315.3 Mld, but operating initially at 165.4 Mld, and capable of delivering 240 Mld on a gravity mode of operation from the Break Pressure Tank, and finally at 315.3 Mld , with boosting, by 2050.

5.5 "Do Minimum" Position

5.5.1 Introduction

It is necessary, in order to place the Water Supply Project in its proper strategic context, to compare the water supply position with WSP in place, compared to that which would have to be pursued in the absence of the new source.

The WSP is a planned and phased response to a carefully estimated unfolding position; the other 'Do Minimum' position is an intensification of current efforts to recover more water.

It is recognised that there are clear qualitative differences in these opposite positions: one provides additional water to meet growing demand, meeting modern water utility standards of service and resilience, the other expends increasing effort to stretch the existing resources, accepting the escalating attendant risks to increasingly compromised standards of service (e.g. outages). These are very different water supply positions. Ultimately the water just will not be available from ever more intensive burdens placed upon existing sources and options for water recovery from leakage management and water conservation. That ultimately means water rationing.

Long before that point, even when water is mostly, if unreliably, available at the tap, there will still be an escalating risk-of-outage environment around that. That kind of risk environment forces hard choices on customers and businesses which depend upon reliable water supplies; unacceptable frequency of substandard service is a factor in the strategic planning function of any water-using enterprise. Businesses and Industry monitor risks on all their inputs, including water, and investment decisions are informed by such risk appraisals.

The escalating risk environment also erodes the flexibility around all operations which attempt to underpin water supply, and it frustrates any planned approach to asset management. All of that impairs the ability of Irish Water to function as a level-of-service driven efficient utility, as would be expected with power supply, gas or telecommunications utilities.

5.5.2 Deployable Water

There is a difference between potential Deployable Output, if water can be moved efficiently around the system, compared to 'Current Deployable Output', where 'pinch-points' in the network prevent full deployment of water.

Potential Deployable Output around 623 Mld currently, is not *actually* deployable, all year round, throughout the network, above 560-600 Mld. Irish Water is addressing this issue, the foregoing sections already reference four network 'resilience projects' which will improve this position, but it is again emphasized that they do not bring any extra water to the system, they rather ensure that existing water treated at several sources, can be made truly available wherever it is needed in the network.

By subtracting 650 Mld, from the calculated overall demand, to define the required additional water, the WSP already assumes full availability of that water; it already assumes the effectiveness of the 'resilience projects'.

5.5.3 Intensification of recovery of leakage

The WSP already assumes UFW recovery of 63.9 Mld in the Dublin Water Supply Area by the year 2041 which is just over 20% of projected average demand in that year.

Under a 'Do Minimum' approach of intensified and accelerated effort to recover more leakage, the implications of striving to recover a further 15 Mld by 2021, and a further 15 Mld again by 2026, have been examined.

In the first instance, it is extremely doubtful if the available resources and the watermain rehabilitation industry could service such an intensified effort over this time scale. Based on established water recovery productivity in Dublin city, it would take rehabilitation of an additional 593 km of water mains to recover the initial additional 15 Mld, and a further 693 km of rehabilitated mains to yield the next 15 Mld. Costs to recover the first 15 Mld of the intensified yield are estimated at €111m, with the next 15 Mld costing €210m, yielding a potential 30 Mld in total for an outlay of €321m. The social costs in terms of disruption with an intensified effort on this scale would also be very substantial.

An intensified effort to recover an extra 30 Mld leakage recovery at 2026, on top of the 51.2 Mld already included in the WSP demand position at 2026, would bring UFW in ten years to below 20%, a leakage recovery performance that few UK water companies or utilities of similar scale have managed to reach. In the UK, it took more than 20 years of sustained investment in water conservation and mains replacement/rehabilitation to get UFW down to between 20% and 25%.

In summary, the WSP already has ambitious leakage recovery targets assumed in its water demand calculation, and intensified effort under a 'Do Minimum' approach will rapidly approach diminishing returns at escalating social and monetary cost.

5.5.4 Beyond 'Do Minimum'

The Preliminary Options Appraisal Report has already considered the position with more intensive use of existing water supplies on the Liffey, and of groundwater development, and the position in relation to these is reviewed below.

5.5.4.1 Intensified development of surface waters

Over 84% of Dublin's' water treatment capacity is now dependent upon the River Liffey, over 40% of the mean annual flow from the catchment is used in water supply, and diversification of the water supply sources serving the city is an important part of 'resilience planning' in order to manage risks such as climate change impacts on existing sources and existing water supply source pollution.

The maximum sustainable availability of raw water from the River Liffey is 533 Mld, based on average annual abstraction in 1975/76 drought conditions which was the most extreme drought on the Liffey in historic drought analysis from more than 50 years of record. The Water Treatment Plants at Ballymore Eustace and Leixlip are already developed to treat water at this maximum sustainable yield level. Options to expand that yield were described in the Preliminary Options Appraisal Report, but are not sustainable. The potential impact of climate change on this yield must also be planned for, as must the obligations for river management for effective flood control and the requirements of the Water Framework Directive (e.g. raising of water quality status requirements).

The sustainable raw water yield of the existing sources, and particularly the Liffey, has been determined based on average demand over the year. A seasonal variation in water demand profile in a prolonged drought is an additional burden on impounded raw water storage and must be provided for.

It has not been assumed, in considering raw water requirements, that the 'peak week' is an isolated anomaly of a week's duration in an otherwise average profile over the year. In a drought situation, demand above average, (but below the peak week level) is likely to persist over a prolonged period of weeks or months. Raw water volume is required to support prolonged demand at above average conditions.

The Pollaphuca reservoir is finite in raw water volume, the available volume has been closely studied for reliable yield, and with considerations on safe management of the reservoir for flood attenuation, it is possible that the upper normal operating water level may be reduced, impacting the yield of the existing Liffey source.

A treatment plant may have an installed treatment capacity, summed over all its modules, which on first consideration appears higher than the source yield. An ability to treat the required flow at any treatment plant even with some modules out of service is important for day-to-day operation, where for example a treatment stream must be taken out of service for maintenance, or a reservoir must be refilled as quickly as possible after an outage, but it must be clearly understood that while treatment plants might have an ability to produce more during a peak week, or for a short time to support an outage in a plant elsewhere, they cannot operate over sustained periods in excess of the reliable yield of the source, without risking failure of the water supply. The overall position must also allow for prolonged operation at elevated seasonal demand in dry weather.

Other river catchments nearer Dublin, such as the Boyne, and Barrow are already significantly developed for water supply. Abstraction at Roughgrange from the Boyne already supplies Drogheda and East Meath, and the new Treatment Plant at Srowland near Athy in Co. Kildare is designed to abstract at the sustainable limit of low flow on the River Barrow at that location.

The Vartry Reservoir and the Ballyboden sources are all operating at or near their sustainable yields.

5.5.4.2 Groundwater

Groundwater throughout a region of 80km in radius centred on Dublin was assessed in 2008. This work was reviewed in the Options Working Paper (http://www.watersupplyproject.ie/wp-content/uploads/2015/05/150525WSP1_AppendixBSource_A011.pdf) and it was concluded that groundwater on its own would not be able to supply the projected demand, and the best use of the limited resource would be in a supplementary capacity.

Since 2008, the definition of 'available groundwater resource' in the Groundwater Regulations (2010) introduces a complex linkage with the Water Framework Directive, when it says:-

> *"available groundwater resource…….means the long term annual average recharge of the body of groundwater less the long term annual rate of flow required to achieve the ecological quality objectives for associated surface waters specified under Article 4 of Directive 2000/60/EC to avoid any significant diminution in the ecological status of such waters and to avoid any significant damage to associated terrestrial ecosystems".*

The Curragh aquifer, for example, is one of the larger groundwater bodies in Leinster, but is also a source of water for the Pollardstown Fen, an internationally important ecological habitat. Groundwater also indirectly feeds the Grand Canal system through the Milltown Feeder. The Kildare wellfields, developed over the past decade under the Kildare Water Strategy, and Bog of the Ring are operating at their assessed sustainable yields which emerged from an appraisal of all groundwater resources in Co. Kildare

Groundwater test drillings were carried out at multiple locations in the Fingal/Meath border area, and extending into South Louth. Thirteen test areas were examined, at Rath and Curragha near Dunboyne, at Rathfeigh and Duleek, in the River Nanny valley towards Mosney and Donnycarney, in the southern environs of Drogheda at Donore, Staleen, Kiltrough and Bryanstown, and at Ballymakenny in south Louth. It is notable that yield estimation, based on two years' research and more than 60 boreholes drilled in an area of 675 sq. km in extent,

north of Bog of the Ring, was estimated to have a sustainable yield, which would not risk Water Framework Directive quantitative objectives on surface waters, of just 22 Mld. Compared with the originally predicted yield estimates of 33-41 Mld, this is an indication that true availability of the groundwater resource in that region calls for a much more conservative approach.

Eleven groundwater bodies within 80 km of Dublin currently enjoy 'Good' status under the WFD. Five of them are classified as 'at risk of not achieving good status' in future, (including the existing Bog of the Ring abstraction, part of the source capacity for the Dublin Water Supply Area) and two more are 'possibly at risk' of not achieving good status. The estimated potential regional resource of 115 Mld over an area of the order of 10,000 sq.km, is not adequate to meet both projected demand and resilience rapid response requirements. It would have to be located, tested & proven not to involve significant impact on terrestrial ecosystems dependent upon groundwater, and it would have to be sustainably developed as well fields, where water rights can be obtained and water quality protected by extensive land use restrictions.

Mine dewatering was previously investigated and is complicated by large cones of groundwater depression extending tens of square kilometres, by prolonged discharge of pumped groundwater into surface water systems, which have come into environmental equilibrium with the imported flows. The pumped water has become part of established flow in adjacent surface water systems, and some serve to improve background quality in receiving waters. Mining facilities are engaged under licence with extensive decommissioning and aftercare obligations and Irish Water must take such factors into account. Such options are best developed for auxiliary or local supply.

The 2008 conclusion that groundwater has a potential role as a proven, sustainable supplementary source, capable of augmenting alongside a primary supply from an alternative source, is correct and it places groundwater in its proper context, in time, in scale, and in planning risk.

5.5.5 Operating conditions under "Do Minimum"

5.5.5.1 Risk of rationing under tightening supply

The yield of water through intensified leakage recovery would struggle to match water demand from the early 2020's, and increased risk of rationing would then prevail. In discussing a drift towards rationing, the first point to understand is that to maintain customer service to match expectation, it is always necessary to meet the maximum daily demand in each area of the network, not just the overall average daily demand. Where industries such as brewing have a seasonal peak demand it must also be met. The distinction between trunk mains (which should move water in bulk) and distribution mains (which deliver water to connected customers) has become blurred in the city over decades, which makes operating a pressure management and rationing strategy difficult.

The first step in demand management is to 'trim' network pressures, or generally reduce them to the lowest tolerable operational levels. This creates difficulty where many 2-3 storey buildings and apartment blocks, which should have booster pumps on their internal systems, do not have. They lose the ability to fill high level storage tanks, so that some customers lose supply. One hospital has a water supply which is directly mains fed, so that reduction in mains water pressure immediately impacts healthcare service there.

With deeper night time pressure reductions, and with night time rationing, this affects any business or industry operating evenings or shift work. It also means that attic storage tanks which have been drawn down after mains supply is curtailed during the night, will all seek to simultaneously refill when pressure returns the following day. This will significantly distort flow patterns from late morning to late afternoon.

When night rationing is introduced, in sections of the city on rotation, teams of operatives must manually operate isolating valves, each evening, and again the following morning. The change in pressure from 'no flow' to 'resumed high flow' itself leads to additional bursts, and water quality is impaired as sediments in mains are mobilized by the flow surges. Prolonged night rationing leads to a customer coping response through irregular water storage, and when associated with increased burst frequency in older mains, is ultimately self-defeating.

More importantly, in a system which suffers extensive leakage at joints, bringing the internal pressure down to low levels when flows are cut off during rationing, risks contaminated groundwater entering the mains, and this is a public health risk, which requires boosted chlorination to mitigate it.

5.5.6 Summary overview

The 'Do Minimum' position involves a very expensive intensification of an already ambitious leakage recovery effort, with diminishing returns and extensive socio-economic impacts, on a tight programme, towards leakage levels not achieved by others in the UK in comparable conditions, despite investment in a regulated environment over several decades.

Where existing abstractions have already been incrementally increased over decades to the reliable yield of the water bodies from which they draw, then intensification of these abstractions can only take place against increasing risk of failure in drought conditions. Multiple dispersed development of wellfields, to develop groundwater resources, has attendant legal, planning and sustainability risks.

Where the requirement is to bring resilience to the expanded water supply system, and to diversify risks associated with it, taking the existing sources and new source operating together, then neither the 'Do Minimum' nor the available courses of action beyond it, address this aspect of need at all.

5.6 Conclusions

5.5.1 Interim review of water demand indicates that treated water demand at 2026 will be 165.4 Mld, rising to 315.3 Mld at 2050.

5.5.2 This projection already includes an assumed leakage recovery of 63.9 Mld by 2041.

5.5.3 A 'Do Minimum' intensification of UFW recovery to yield a further 30 Mld within a decade, would require rehabilitation of more than 1,286km of additional mains and would cost an estimated additional €321m in addition to the significant social cost of disruption that would be caused by such works.

5.5.4 The recommended Phase 1 project would provide 245 Mld of treated water, in a three-module treatment plant, with space for a fourth module for the total projected treated water requirement of 318.5 Mld. Raw water abstraction may exceed these figures, due to water used in the treatment process, and the abstraction of 330 Mld identified in the POAR is confirmed.

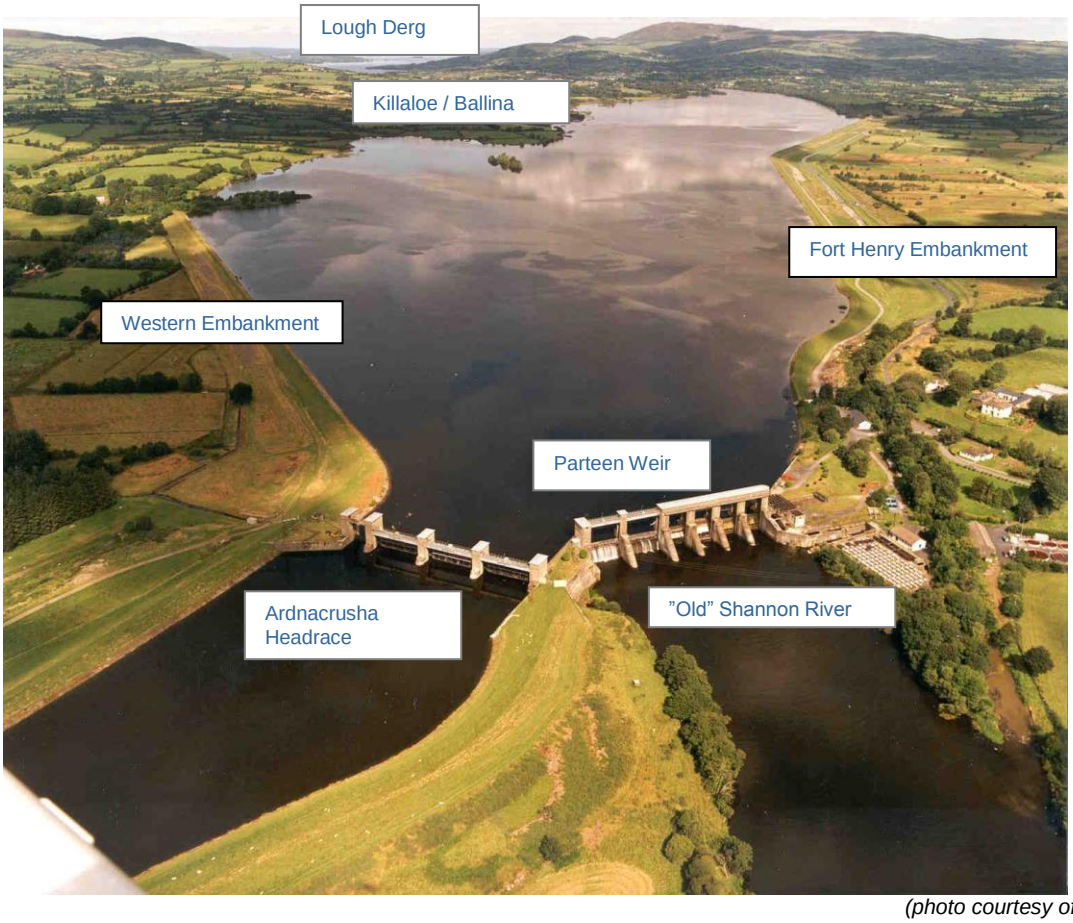
6. Source Abstraction Regime

6.1 Introduction

6.1.1 Parteen Basin

Parteen Basin, also known locally as the “Lower Lake”, was constructed under the Shannon Hydro-Electric Scheme in the late 1920’s. It floods an area through which the Shannon once flowed as a river, and the old channel is still recognisable in depth surveys of the bed of the flooded basin. It is regulated both by the Parteen Weir, and by the flow through Ardnacrusha. Much of its perimeter is formed by high linear engineered embankments, which are inspected daily by ESB staff; visible left and right in Figure 6-1 below.

Parteen Basin allows the Ardnacrusha power station to change its generation rate reasonably quickly; it thereby fulfils a necessary role of maintaining a relatively constant water level within the headrace canal of Ardnacrusha, which is connected to it, and so maintains steady water pressure on the generators in the station, as water is drawn from the Basin at rates which can vary widely. Water drawn from Parteen Basin is replenished from Lough Derg via flows through the Killaloe channel, which links Lough Derg to Parteen Basin, resulting in a wider normal operating band in Parteen Basin, than in Lough Derg upstream.



(photo courtesy of ESB)

Figure 6-1 Parteen Basin (Lower Lake)

The control of water level at Parteen Weir is such that a narrow operating band, 460mm (18 inches approximately) in depth, extends over the surface of the natural Lough Derg. ESB manage water levels very carefully within this normal operating band, across a wide range of flows, as part of their management of the hydro-electric scheme. Water levels in Lough Derg rise above the normal operating band during flood periods.

Accordingly, the normal operating band of water level employed for power generation at Ardnacrusha can be envisaged as a thin 'band of water' on top of, and extending over, the whole area of Lough Derg and Parteen Basin. This is presented schematically, along with the range of historical inflows, in Figure 6-2.

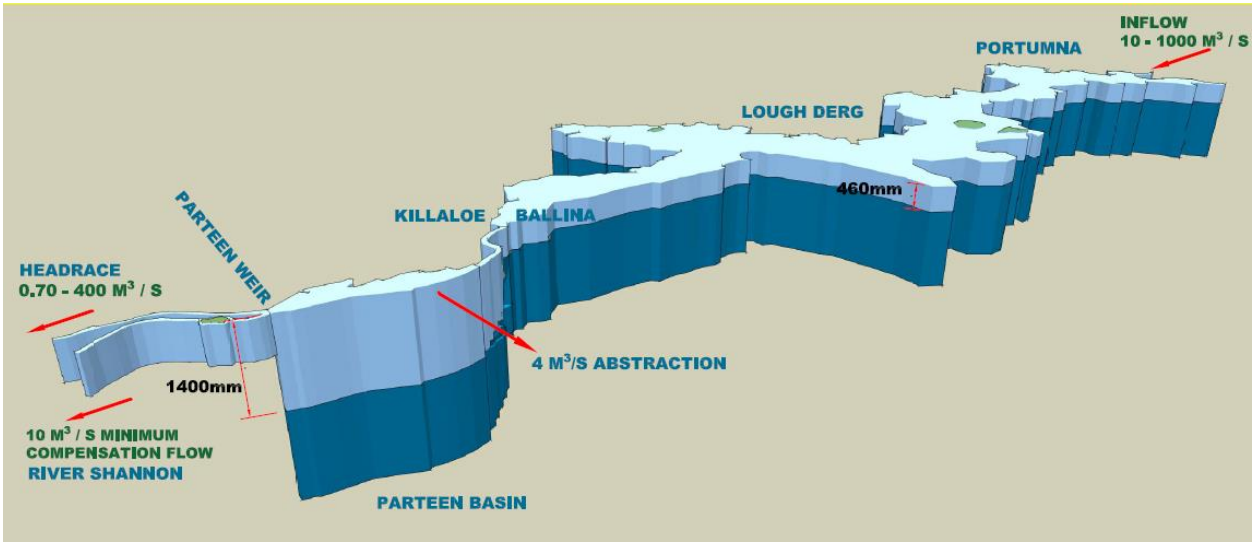


Figure 6-2 Schematic Illustration of the narrow Normal Operating Bands

6.2 Abstraction Regime

The proposed water supply would abstract 330Mld (3.82 m^3/s) as a continuous average at the year 2050. The facility to abstract this 330 Mld of water in 20 hours, rather than 24 hrs, is being sought from ESB, so that avoidance of peak power for pumping and associated higher costs can be considered in detailed design.

There is also a facility being sought, whereby in exceptional circumstances, if supply were interrupted for a period of two days, then the same volume normally abstracted over a 7 day period, could be abstracted in 5 days, to permit refilling of a treated water reservoir in South Dublin, or refilling of sections of pipeline, in the event of an outage. In summary, the flexibilities being sought are summarised in Table 6.1.

Table 6.1 Proposed Abstraction Regime

Description	2050		Flow		Note
Abstraction Requirement (per day)	**330 Mld**		3.82 m^3/s	over 24 hours	average continuous flow rate
			4.58 m^3/s	over 20 hours	normal abstraction
Abstraction volume over 7 days	**2310 Ml**				Volume per week
Recovery abstraction rate		**462 Mld**	5.34 m^3/s	over 24 hours for five days	In exceptional circumstances; the weekly volume is abstracted over 5 days.
Abstraction volume over year	**120,450 Ml**				

The proposed abstraction of water will use a small fraction (approximately 2%) of the annual average flow through Parteen Basin. Abstraction of water from hydro-electric power schemes is commonly employed worldwide to enable environmentally sustainable availability of water for public supply. The proposed abstraction of water is in essence, an abstraction from water normally used in the hydro-power plant, using the

same existing water level controls, and therefore avoiding having to construct a new impoundment. Water levels on Lough Derg & Parteen Basin will be managed within the same water level 'normal operating band' as currently applies. Irish Water, as part of an overall agreement with ESB, will agree the small adjustment in generation water on a continuous year round basis. The statutory compensation water of 10 cubic metres per second (m³/s) spilled from Parteen Weir into the 'Old Shannon River' will remain unchanged and undiminished under this proposal. Navigation and beneficial uses focused on tourism will experience the same operating water level range as normal.

6.3 ESB operations

ESB control water levels on Lough Derg and the movement of water at / through Parteen Basin using both the Shannon Hydroelectric station, and the Parteen Weir. The normal operating band[23] on Lough Derg, referred to below, is managed to achieve this. The overall runoff from the catchment, and the volumes of water passing each way, depend on 'wet' and 'dry' years, and on the profiles of floods and dry weather across any given year. Over 25 years from 1990 to 2015, between 68% and 94% of flow at Parteen Basin, passed through Ardnacrusha, The lower percentage reflects either a dry year overall, or a wet year with substantive flood peaks. In broad scale terms, approximately 90%-95% of the long-term average annual flow in the Shannon at Parteen Weir (approx. 180 m^3/s), is directed through Ardnacrusha, with a minimum statutory compensation water flow of $10m^3/s$ directed to the lower Shannon at Parteen Weir.

It is important to note that the normal operating water level range, while it permits the water supply abstraction and the minimum compensation flow to be provided, it is narrow and quite small in terms of storage for flood attenuation, when flood flows are many orders of magnitude greater than the proposed water abstraction flow.

Ardnacrusha can take a maximum flow of 400 m^3/s on full load to the four generators there, and when inflow to Lough Derg is high, and water level exceeds 30.86 m OD, which is the upper end of the Normal Operating Band, then flow to the old course of the River Shannon is necessarily increased, to safely pass the flood and return water levels to within the Normal Operating Band.

ESB tend to maintain levels at the lower end of the Normal Operating Band in late autumn, in anticipation of the need to operate in higher flow conditions in Autumn/ Winter.

ESB monitor the falling hydrograph in Spring before intervening to retain water towards the upper end of the band. The ESB approach is to manage the water level towards the upper end of the normal operating band in late spring and summer, and to retain it there with due regard to the River Shannon statutory compensation flow obligations, subject to prevailing conditions.

With summertime flood conditions, the need to maintain water levels towards the upper end of the normal operating band is temporarily suspended, generation through Ardnacrusha is increased and Lough Derg is thereby managed by ESB for the safe passage of floods, as normally happens at present. A resumption of the 'low flow regime' takes place once the flood has passed and the falling hydrograph is established and monitored, as before.

Normal Operating Water Levels

At present, water level on Lough Derg and on Parteen Basin is managed to normally lie between the limits set out in Table 6.2:

[23] The 'band' being the normal operating levels between the upper and lower limits.

Table 6.2 Normal Operating Water Levels Lough Derg and Parteen Basin (Metres over Ordnance Datum)

Normal Operating Limits	Lough Derg		Parteen Basin	
	OD Malin Head (m)	OD Poolbeg (m)	OD Malin Head (m)	OD Poolbeg (m)
Upper level	30.86	33.56	30.86	33.56
Lower level	30.40	33.10	30.00	32.70

In this Report, reference to water levels henceforth will be to Ordnance Datum at Malin Head.

As part of the commitment by ESB to management of the available hydropower reserve on the network in exceptional circumstances, a 100mm deep band of water is currently held in a higher category of reserve, so that the Normal Operating Band limits, allowing for this reserve, are as set out in Table 6.3.

Table 6.3 Operating Levels with provision for Reserve Allowance

Operating Limits incorporating Reserve Allowance	Lough Derg		Parteen Basin	
	OD Malin Head (m)	OD Poolbeg (m)	OD Malin Head (m)	OD Poolbeg (m)
Upper level	30.86	33.56	30.86	33.56
Lower level with generation reserve allowance	30.50	33.20	30.00*	32.70*

*Assumed that levels in Parteen are determined by hydraulics of flow range to Ardnacrusha

Other key levels are as shown in Table 6.4 (Malin Head Datum):-

Table 6.4 Key levels on Lough Derg and Parteen Basin (Lower Lake)

Other Key Levels	High Water Level	Low Water Level
Lough Derg		
Maximum Normal Operating Water Level	30.86 m OD	
Minimum Normal Operating Water Level (currently)		30.40 m OD
Minimum Statutory Low Water Level		29.30 m OD
Parteen Basin (Lower Lake)		
Minimum required Water Level Ardnacrusha		28.80 m OD
Dam Crest Level (Embankments Parteen Basin)	32.30 m OD	
Maximum Water Level Parteen Basin	31.30 m OD	
Minimum Water Level Parteen Basin		30.00 m OD

6.4 Calibrated Modelling

There are two linked models employed in analysing the effects of water abstraction.

(a) Hydrodynamic Model of Lough Derg/ Parteen Basin, and
(b) Hydrological Model of the historic record, with and without abstraction.

The hydrodynamic model, developed by the project team, examines the water circulation and water quality within the lake, and is described in Section 7 of this Report.

The hydrological model is linked to the hydrodynamic model; and was also developed by the project team to assess the impact of the proposed abstraction on Lough Derg water levels. The model examines the historical record (supplied by ESB) and compares these recorded levels with simulated levels; as if the proposed water supply abstraction of 3.82m^3/s was in place at that time. The model also modifies the water discharged through Ardnacrusha hydropower station to allow for that abstraction, when such discharges are being made by ESB.

6.5 Environmental Assessment of Source Impact

The environmental impact of the proposed abstraction on the water source will be assessed fully in the Environmental Impact Statement (EIS) and Natura Impact Statement (NIS), and will be informed by the results of the hydrological modelling.

Differential Between Pre-Works and Post-Works Levels

The model analyses daily water levels across the 83 year period from 1932 to 2015. It examines the historic flow position, along with the power generation flows, as if the water supply abstraction had been in place throughout this period. The difference between the pre-works (recorded) and post-works (simulated) levels, across the whole data set, have been examined. It is important to appreciate that this comparison is based on

the historical pattern of hydropower generation. It does not yet take into account the beneficial impact of an adjusted pattern of hydropower generation, which would be subject to agreement with ESB, which is described in Section 6.6 below. In any year where generation would have taken place on a consistent basis throughout the year, the curtailment of flows to generation to match water abstraction, results in no effective difference between water level as recorded historically, and water level which would have occurred if the abstraction had been taking place in those particular years.

A different situation occurs if historic generation in a particular year was ceased by ESB in response to a period of dry weather. In such years, a period would exist after generation had ceased, where the presence of the water abstraction could not be compensated for, since generation would already have ceased, and which therefore would open some differential between historic recorded level (without abstraction) and modelled water level (with abstraction).

It was found that some differential between the water levels with and without abstraction would have been generated in 68 of the 83 years analysed. The degree of differential varies with the severity of the dry weather. Table 6.5 shows the range of maximum deviation in water levels with and without abstraction, assuming the historic pattern of power generation remained unchanged.

Table 6.5 Deviation between Recorded and Simulated Levels in Lough Derg, 1932 – 2015,

Maximum Deviation in Recorded and Simulated Water Levels at Killaloe (mm)	No. of Years in which reduction occurs
0-10mm	42
10-20mm	10
20-30mm	4
30-40mm	3
40-50mm	3
50-60mm	2
60-70mm	4
> 70mm	0

The maximum difference across the 83 years occurs in the drought year of 1995 when the simulated levels with abstraction in place deviate by up to 68mm from the pre-works recorded levels, without abstraction. The results of the simulation for the years 1994 and 1995 are shown in Figure 6-3 below.

The modelled daily water levels are represented by the 'pink line' and the actual recorded daily water levels at Killaloe by the 'blue' line. *Periods where the 'blue' line is not visible are as a result of the 'pink' line being superimposed over the 'blue' line due to there being no difference between recorded and modelled water levels.*

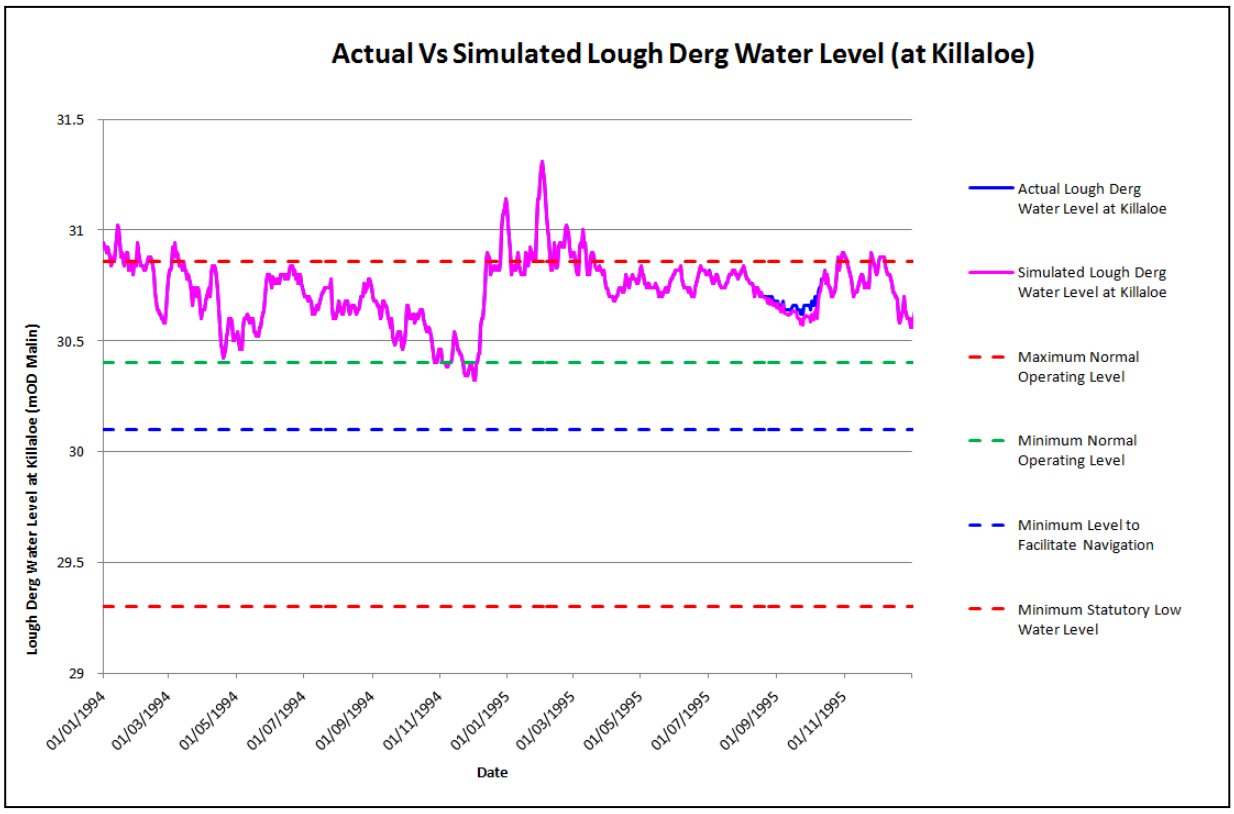


Figure 6-3 Actual Vs Simulated (1994-1995) Lough Derg Water Level for Abstraction = 330Mld (3.82m³/s) plus Fish Pass Flow (0.7 m³/s) and Compensation Flow of 10m³/s

The simulation shows that an abstraction for water supply of 3.82m³/s, together with compensation flow of 10m³/s, and Fish Pass flow of 0.7m³/s, is sustainable within the same normal operating water level band.

For the most part there is no difference between recorded and modelled water levels. This is achievable because the extent of generation during these periods is such that it can be reduced to account for the water abstraction, thus resulting in a net zero effect on lake operations and water level.

In 1995, the simulated and recorded water levels are different, because of the long period (19/08/1995 to 05/10/1995) when there was minimal power generation taking place, and therefore the combined 14.52m³/s outflow, i.e. Old River Shannon compensation flow plus Fish Pass flow of 0.7 m³/s plus Water Supply Project abstraction, would have been provided from storage, compared to the pre-works 10m³/s plus Fish Pass flow of 0.7 m³/s. The water levels would still have been managed within the normal operating water level band, but levels would have been lower during this period by a maximum of 68mm, within that band.

6.6 Control of Water Levels with Water Supply Abstraction

Overall, on an average annual basis, it is expected that approximately 2% of the annual average flow at Parteen Basin will be redirected to water supply. Generation will continue to take place at the same flow rates through the generators, but the duration of generation will be reduced to reflect the proposed water abstraction.

Even in prolonged extreme dry weather, such as was experienced in 1995, it would have been possible to abstract while still maintaining water levels within the normal operating band. Historically, in 1995, recorded flows through Ardnacrusha indicate that power generation was continuing, for at least some hours on most days, right into August of that year.

In 1995, Ardnacrusha continued generating up until August 18th of that year, and for some isolated days after that date. Had abstraction been in place at that time, it would have been met after that date from a combination of storage and inflow. Modelling with the historic pattern of ESB generation, the incremental drawdown due to

the modelled water supply abstraction simulated in that year would have reached the peak of value of (–68mm) on 05/10/1995, but this would have been within the normal operating water level band.

A reduction of generation would not present a technical or generation difficulty, but this is subject to agreement between ESB and Irish Water.

Following the dry weather event, lake levels could be allowed to realign with historic levels/lake management protocols at the onset of autumn / winter wet weather events.

Operation of Lough Derg, post works, will feel and look very similar to the way it currently operates, and there will not be a visible day to day difference. Water being abstracted for water supply will be measured by flow meter, statutory compensation water released to the Old River Shannon will be provided and verified as before, and the water used in generation will be reduced as necessary to keep water levels within the normal operating band.

6.7 Conclusions

The proposed abstraction of water is in essence, an abstraction from water normally used in the hydro-power plant, using the same existing water level controls. Water levels on Lough Derg & Parteen Basin will be managed within the same water level 'Normal Operating Band' as currently applies.

Irish Water will enter into an agreement with ESB, whereby water used in hydropower generation at Ardnacrusha will be reduced to take account of water abstracted for water supply.

Modelling of abstraction under these conditions shows that the abstraction is sustainable within the existing normal operating water level range. Operation of Lough Derg, post works, will feel and look very similar to the way it currently operates, and there will not be a visible day to day difference.

The next stage of the planning process requires the environmental impact assessment and Stage 2 Appropriate Assessment of the proposed abstraction. The proposed scope of the EIS to inform these assessments is set out in the EIS Scoping Report which is offered for public consultation alongside this Final Options Appraisal Report.

7. Appraisal of Source Impact

This section should be read in conjunction with Appendix B: which describes the methodology employed, and ongoing progress made, in the development of a three dimensional hydrodynamic and solute transport model for Lough Derg and Parteen Basin, “the water quality model”.

The water quality model serves two functions. It has been employed through its development to assist a comparison of potential impact(s) between the various options[24], which were based on a source water abstraction from either Lough Derg or the Parteen Basin waterbody. When finalised, it will be used to inform the assessment, and mitigation, of potential environmental impacts at the abstraction location.

The development of the water quality model is reliant upon collation of datasets from the Lough Derg and Parteen Basin waterbody; sourced from an ongoing continuous monitoring survey across the waterbody. Datasets from the waterbody are being used to ensure agreement and replication of modelled scenarios with recorded in water conditions. These datasets cover a number of measurable parameters on the waterbody, from the year 2015 through to the present, including:

- Water depths (bathymetric survey),
- Water flow and current;
- Water Quality
- Water treatability
- Water temperature
- Meteorological conditions; and
- Aquatic organisms such as establishing plankton levels.

In conjunction with the ‘growing’ data sets being recorded from these surveys, the water quality model has, and is being refined towards, a final verified model capable of accurate scenario replication of recorded lough conditions. A four step process towards model verification is being followed:

1. Construction of an uncalibrated hydrodynamic model (POAR);
2. Calibration of the hydrodynamic model (post POAR);
3. Solute transport modelling and calibration of the water quality model; and
4. Verification of the water quality model.

The Preliminary Options Appraisal Report (POAR) presented work on the construction of the hydrodynamic model (Step 1), a computational numerical model able to describe or represent the motion of water.

7.1 Hydrodynamic Modelling

The objective of the hydrodynamic model is to assess the existing flushing characteristics[25] in Lough Derg and Parteen Basin, and how an abstraction may impact on it.

[24] Originally, the POAR considered water abstraction from two locations in Lough Derg and a farther location in the Lower Lake. The latter was the ‘Emerging Preferred Option’, or Option C (Parteen Basin Reservoir Direct)

[25] Flushing, or lake retention, time is a calculated quantity expressing the mean time that water (or some particular dissolved substance) spends in the lake and expresses the amount of time taken for a substance introduced into a lake to flow out of it again.

At the POAR (Stage 3) various abstraction options were assessed; at two locations in Lough Derg and a farther downstream location in Parteen Basin.

The flushing characteristics were assessed for the period from October 1994 to December 1995, this being the reference period for the calibration of models and options appraisal in the original SEA process, and also because it encompassed periods of very high flow on the Shannon (January 1995) as well as periods of extreme low flows (August -September 1995).

To determine if modelled abstraction options resulted in significant changes, flushing characteristics were compared, and difference calculated, from the baseline (no-abstraction) flushing time. Ten modelled scenarios were chosen as eliciting the fullest understanding of the behavioural characteristics within the Lough Derg/ Parteen Basin water body.

When compared, scenarios involving an abstraction from the northeast of Lough Derg exhibited a large increase (maximum +42 days) in flushing times in the middle and southern portion of Lough Derg when compared with baseline conditions (Figure 7-1), whereas scenarios that involved abstraction from Parteen Basin were considerably better (Figure 7-2).

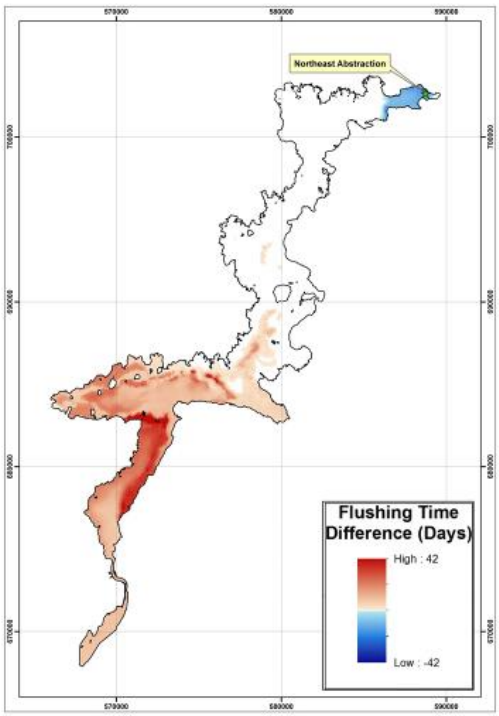


Figure 7-1 Northern Abstraction - Impact on Flushing Times against Baseline Conditions (POAR)

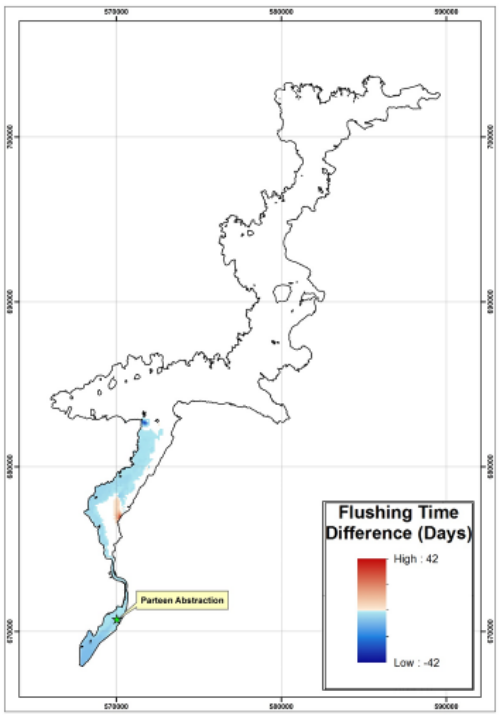


Figure 7-2 Southern Abstraction - Impact on Flushing Times against Baseline Conditions (POAR)

The increase in flushing time associated with abstraction in the north east of Lough Derg was considered 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, removing the possibility to say, with certainty, that there would be no negative impact on the conservation status of the SAC.

This potential for negative impact resulting from abstraction in the north east of Lough Derg informed the emerging preference towards abstraction from Parteen Basin.

7.2 Model Development

Since completion of the initial modelling carried out for the POAR, a growing dataset of in lough conditions recorded from deployed instruments within Lough Derg and Parteen Basin has been collated and a detailed Bathymetry Survey (Water Depths) completed.

These datasets provided the baseline on which the hydrodynamic model calibration could commence[26] (step 2). In this process the model was adjusted to take account of critical climatic parameters e.g. wind, evaporation, precipitation and solar radiation and their influence on the hydraulic action of the waterbody.

Through an iterative process of adjustment, model predictions were compared against recorded datasets from instruments, and updated until model functions were found to show good agreement with recorded datasets.

Figure 7-3 provides an example of model agreement reached between recorded data (black line) and simulated model prediction (red line) for both surface water level and current speed parameters.

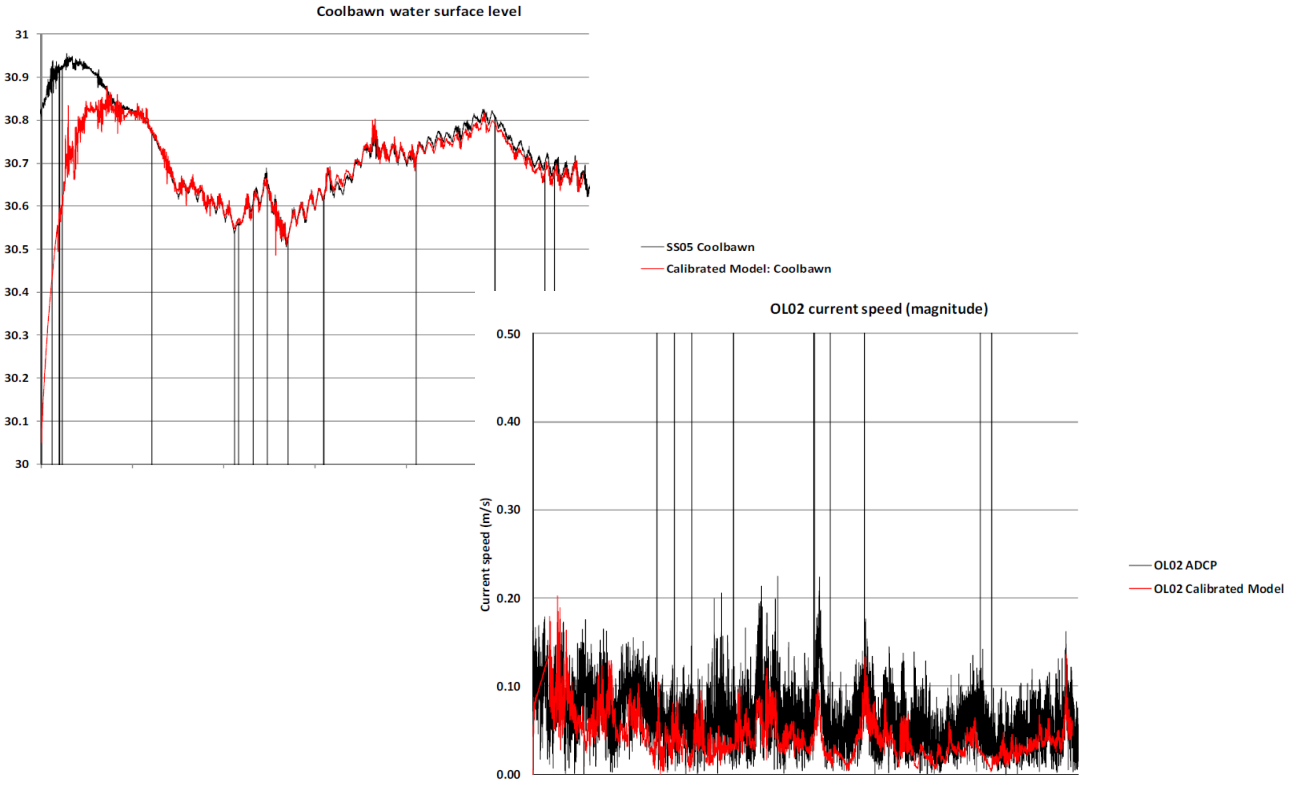


Figure 7-3 Sample Hydrodynamic Model Calibration

[26] Model calibration is the process of adjustment of model parameters to obtain a model representative of hydraulic conditions that satisfies (has a goodness of fit with) available and recorded data.

7.3 Model Scenarios

As previously noted, flushing characteristics were assessed, for a number (10) scenarios, to cover the period from October 1994 to December 1995. The 1995 period being considered to approximate a worst case scenario, as one of the longest recorded periods of drought flows in the river Shannon.

The modelled scenarios considered both a baseline (no abstraction) and abstraction profiles for options sourcing water from the Lough Derg and Parteen Basin namely:

I. Option F2 (North East Lough Derg with Storage)

II. Option B (North East Lough Derg Direct)

III. Option C (Parteen Basin Reservoir Direct)

Scenarios were run for both high flow winter conditions and low flow summer conditions, and expanded to include an expanded winter storage and alternative abstraction location (see Table 7.1).

The prevailing climate of late 2015 and 2016 has been one characterised by above average rainfall levels, peaking through the destructive flooding period late 2015 and early 2016, and continuing on into the spring and summer months of 2016. Reflecting this, recorded hydraulic data is in excess of comparable data recorded through the 1995 period and not representative of drought flows in the river Shannon.

To support a robust assessment of impact, the 1995 data was retained for the purposes of model simulation, but amalgamated with the 2016 calibrated model conditions to represent the most accurate assessment available of flushing characteristics during drought conditions in Lough Derg and Parteen Basin.

Of the ten previously modelled scenarios in the Preliminary Options Appraisal Report, scenarios 1 through 4 considered flushing time characteristics that arise during high flow winter conditions, with little or no changes found, these scenarios were not revisited using the calibrated model. Scenario 10 was also not revisited, with the impact of abstraction established to be largely unaffected by altering the abstraction location in the northern or central areas of Lough Derg.

The remaining 5 were modelled and reported on (see Appendix B). These and their findings are summarised in Table 7.1.

Table 7.1 Abstraction Scenarios Modelled

Scenario No.	Description	Notes	Comment
1	Winter - baseline (no abstraction)	Existing hydrodynamic regime in Lough Derg during winter flow conditions.	Residence times are low in Lough Derg in winter but some spatial variation evident in bays.
2	Winter - constant abstraction (350 Ml/d) in northeast Lough Derg (**Option B**)	Option B - hydrodynamic regime in Lough Derg during winter flow conditions	Low impact on residence times in Lough Derg due to difference in relative magnitude of flows. Slight local reduction in residence time in the immediate vicinity of the abstraction intake.
3	Winter - variable abstraction in northeast Lough Derg (410 Ml/d:50 Ml/d) (**Option F2**)	Option F2 - hydrodynamic regime in Lough Derg during winter flow conditions with variable abstraction.	Abstraction in winter conditions has low impact on residence times in Lough Derg due to difference in relative magnitude of flows. Little difference between variable abstraction and constant abstraction under winter conditions
4	Winter - constant abstraction (350 Ml/d) in Parteen Basin (**Option C**)	Option C - hydrodynamic regime in Lough Derg during winter flow conditions with constant abstraction.	No impact on residence time in Lough Derg.
5	Summer - baseline (no abstraction)	Existing hydrodynamic regime in Lough Derg during summer low flow conditions.	Spatial variation evident in residence time under existing natural conditions from north to south and in lateral bays. Southern section above Killaloe has residence time above average for lake as a whole.
6	Summer - constant abstraction (350 Ml/d) in northeast Lough Derg (**Option B**)	Option B - hydrodynamic regime in Lough Derg during summer low flow conditions with constant abstraction	Worst case residence time impacts of the order of 16 days in the southern region of the lake where baseline residence time is also elevated (see Figure 7-4).
7	Summer - variable abstraction in northeast Lough Derg (410 Ml/d:50 Ml/d) (**Option F2**)	Option F2 - hydrodynamic regime in Lough Derg during summer flow conditions with a variable abstraction.	Two months raw water storage does not appreciably mitigate residence time effects in southern Lough Derg over the Scenario 6 outcome. Prolonged duration of the drought in 1995 would bring about residence time impacts that could not be mitigated by raw water storage (see Figure 7-5).
8	Summer - constant abstraction(350 Ml/d) in Parteen Basin (**Option C**)	Option C - hydrodynamic regime in Lough Derg during summer flow conditions with constant abstraction.	No prolongation of residence times anywhere in Lough Derg. Intake in Parteen Basin would slightly reduce (improve) existing baseline residence time in the Basin and in the area north of Killaloe (see Figure 7-6).
9	Summer (450 Mld:50 Ml/d) variable abstraction in northeast Lough Derg	Hydrodynamic regime in Lough Derg during summer flow conditions with a prolonged variable abstraction. 50% increase in storage at Garryhinch.	Does not produce residence time improvements significantly different from Scenario 7. Duration of the drought in 1995 would still bring about local residence time impacts in the southern section of the lake, even with an increased balancing storage volume.
10	Summer – (410 Ml/d:50 Ml/d) variable abstraction in Youghal Bay	Hydrodynamic regime in Lough Derg during summer flow conditions with a variable abstraction.	Changing the point of abstraction from the north east of Lough Derg to Youghal Bay does not bring about a significant difference compared to Scenario 7.

7.3.1 Option B (North East Lough Derg Direct)

Figure 7-4 presents the distribution of impact on flushing times from continuous abstraction in northeast Lough Derg.

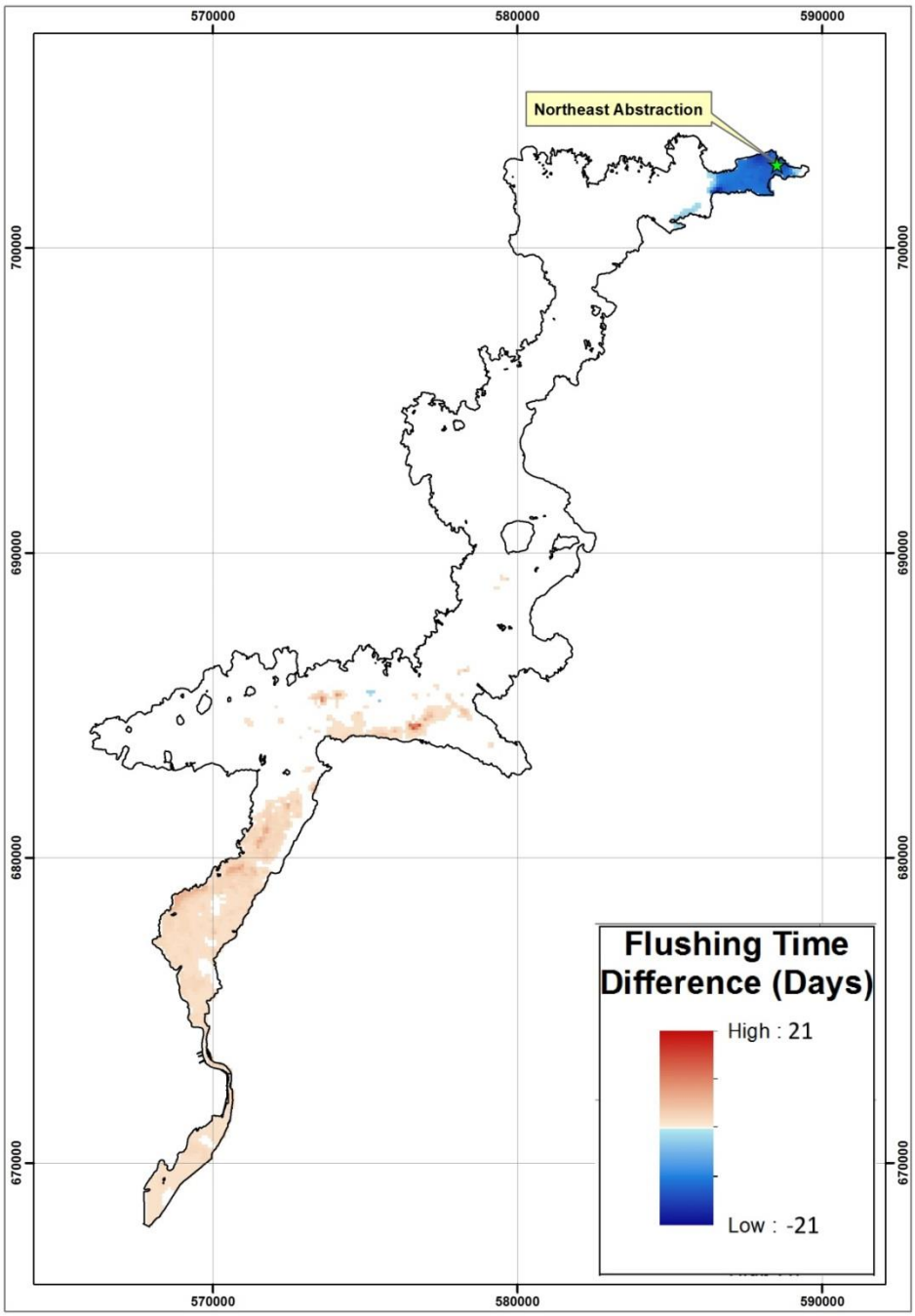


Figure 7-4 Option B – Impact on Flushing Time

7.3.2 Option F2 (North East Lough Derg with Storage)

Figure 7-5 presents the distribution of impact on flushing times from variable abstraction in northeast Lough Derg.

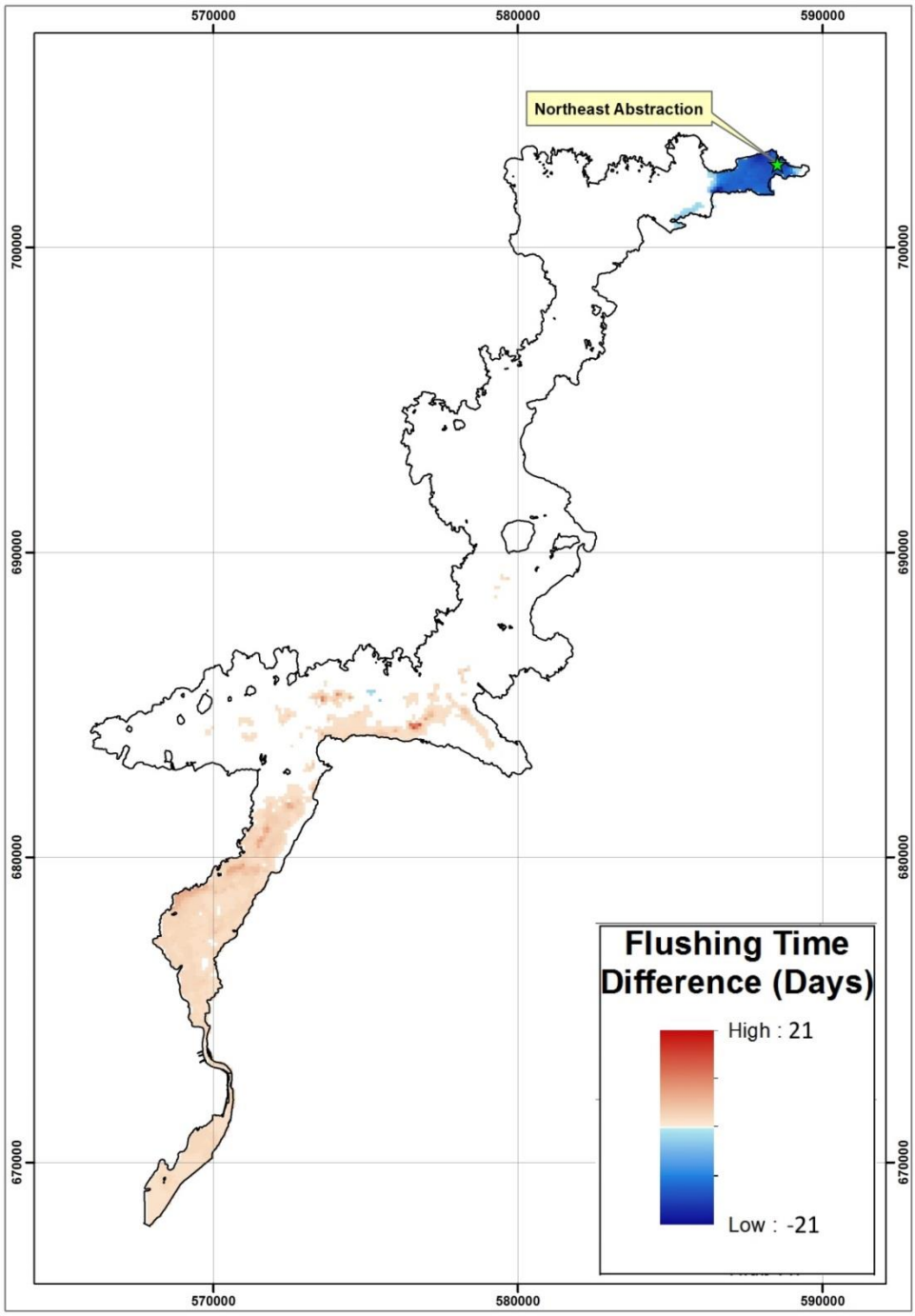


Figure 7-5 Option F2 – Impact on Flushing Time

7.3.3 Option C (Parteen Basin Reservoir Direct)

Figure 7-6 presents the distribution of impact on flushing times from variable abstraction in Parteen Basin.

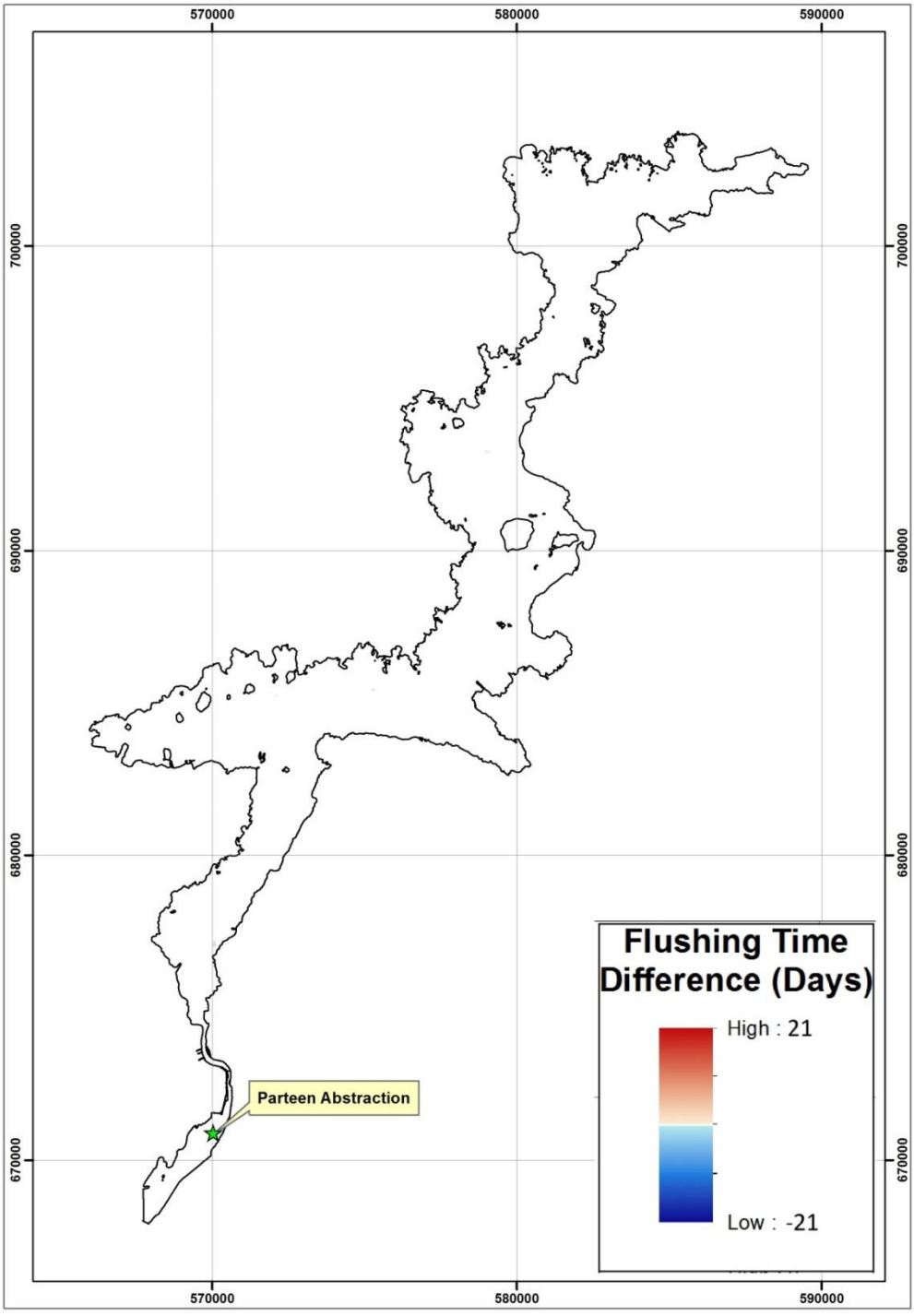


Figure 7-6 Option C – Impact on Flushing Time

The Hydrodynamic Model Report is included in Appendix B. Figure 7-4, Figure 7-5 *and* Figure 7-6 *have been re-produced from this Report; where they are labelled Figure 24, Figure 25 and Figure 26 respectively.*

7.4 Interpretation of model results

Figures 7-4 through 7-6 show the effects of abstracting from Lough Derg / Parteen Basin during the summer (low flow) conditions of 1995 and indicate that there were significant changes in flushing times in Lough Derg /

Parteen Basin when abstracting from the northeast of Lough Derg when compared with the alternative from Parteen Basin.

Scenarios involving an abstraction from the northeast of Lough Derg, at either constant or variable rates, during summer low flow conditions exhibit an increase (maximum +16 days) in flushing times in the southern portions of Lough Derg when compared with the baseline conditions (Figure 7-4 and Figure 7-5). The scenario involving abstraction from Parteen Basin at a constant rate during summer low flow conditions show no change to flushing time characteristics in any region of Lough Derg and Parteen Basin when compared with the baseline conditions (Figure 7-6).

While representing a reduction in impact from a maximum of + 42 days to + 16 days[27], the locations featuring the shorter values of flushing time are predicted to be faster to respond to changes in pollutant concentrations from the principal riverine input, namely the River Shannon. The corollary is that 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, which would affect water quality status in these areas. This in turn would impact the distribution of shallow water floral and faunal communities, removing the possibility to say, with certainty, that there would be no negative impact on the conservation status of the SAC.

This potential for negative impact resulting from abstraction in the north east of Lough Derg confirms the assessments underpinning the preference towards abstraction from Parteen Basin.

7.5 Next Step

At the time of preparing this report, data continues to be gathered from the ongoing survey; for incorporation within the model, and to facilitate continuous improvements to the model, and accuracy of predictions.

Model development will conclude with the calibration and validation of the solute transport model (steps 3 and 4 of the model verification process), that together with the calibrated hydrodynamic model, will form the final water quality model and allow pollutant specific modelling beyond the general physical mixing processes depicted to date. Modelling results will be presented as part of the EIS submission to be provided to An Bord Pleanála.

[27] Model predictions display sensitivity to very small changes in water level (in the order of 5mm). The change in maximum flushing times has been attributed to a recognised discrepancy in modelled water levels in the first pass model (step 1) that has now been corrected in the calibrated hydrodynamic model (step 2).

8. Economic Appraisal

As discussed in Section 5, Irish Water commissioned a review of the fundamental determinants of 'Need' for the project. This included an independent assessment by professional economists (Indecon) on the strategic economic importance of secure resilient water supplies in the Midlands and Eastern areas, for the life and health of people living there, and for the sectors of the economy that sustains their livelihoods[28].

The Economic Needs Report outlined the economic case for the provision of a new water supply source to the Eastern and Midlands region in light of likely future water demand levels given medium to long-term population projections and economic growth forecasts.

Since publication of the Project Need Report, and Economic Needs Report contained therein, the number of available options has been reduced to the following:

- Abstraction from the Shannon and Parteen, and
- Desalination of Seawater from the Irish Sea

Abstraction from the Shannon at Parteen was the original Option C in the SEA and Desalination was Option H in that document.

A Cost-Benefit Appraisal (CBA) has been conducted by Indecon on these remaining options.

The CBA Report is included in Appendix C and the findings are presented in this Section 8.

8.1 Cost – Benefit Analysis (CBA) Methodology and Key Parameters

The CBA considered investment options in line with the latest guidance documents from both the Irish government and the European Commission, and has followed the key principles outlined in the European Union guidance in terms of:

- Undertaking a detailed demand forecast – this was done for the Economic Needs Report and the results have been used in this CBA;
- Undertaking a detailed options appraisal process – this has been done as part of the Preliminary Options Appraisal Report (POAR);
- Identification of the key costs including capital, operational and environmental costs of the proposed investment(s);
- The economic benefits of the proposed project. This CBA focuses on the benefits of an increased supply of water, and increased reliability of this supply, in the Eastern and Midlands Region.

The analysis undertaken in the CBA report makes use of the key parameter values suggested in government guidance in the Public Spending Code published by the Department of Public Expenditure and Reform. The analysis includes a discount rate of 5% and an adjustment for all public expenditure in the project to reflect the shadow price of public funds[29] of 130%. The valuing of capital and operational cost draws upon an updated position on available treatment technologies (see Appendix D), while, for the purposes of valuing the environmental costs associated with a proposed project, the carbon price forecasts suggested in the Public Spending Code have been utilised.

[28] http://www.watersupplyproject.ie/wp-content/uploads/2015/03/Vol-3_WSP-Economic-Needs-Report.pdf
[29] The Public Spending Code requires the use of a shadow price of public funds of 130%. This is applied to account for the distortionary economic impacts of taxation used to raise funds for public expenditure

8.2 The "Do Minimum" Scenario - CBA

A key component of any CBA is an accurate definition of the 'Do Minimum' scenario. This is the scenario which is most likely to prevail should the proposed investment, or investments, not be undertaken; and represents the key comparative basis for the investment scenarios.

The "Do Minimum" scenario incorporated within this CBA included:

- The likely steps in terms of additional leakage reduction that Irish Water would be forced to undertake should no new source of water supply be developed;
- The costs associated with this additional leakage reduction;
- The likely probability of water supply outage over the appraisal period should no additional water supply be developed;
- The costs of this increased probability of outage to the population and economy of the Eastern and Midlands Region.

Leakage Reduction

Leakage reduction activities will recover additional water for use in supply and distribution, but this is a finite undertaking with a diminishing rate of return. It is estimated that an additional 30 Ml/d could be yielded by the year 2026 at a cost of just over €310 million in net present value (NPV) terms and adjusted for the shadow price of public funds.

In addition, there will be environmental costs associated with this additional leakage reduction activity; estimated to be of the order of €2.3 million in net present terms.

Water Supply Outage

As part of the formulation of the "Do Minimum" scenario a forecast has been made on the expected property days of water supply disruption over the appraisal period; and represents the likely impact of water supply deficits on the residential sector in the Eastern and Midlands Region. It has been determined that the number of expected days per annum of water supply restriction are forecast to rise from 0.90 currently (2016) to 4.01 by 2050. The water supply disruption has a monetary impact. For the residential sector a per capita daily cost of €44[30] is assumed, which represents a prudent assumption as it is to the lower end of values suggested by international research[31].

The total cost, in net present value terms, to the residential sector is €2.1 billion.

Beyond the costs to residential water users, an increasingly unreliable water supply will also impact on the commercial and industrial sectors of the economy; water intensive firms, in particular. Given the uncertainty surrounding the likely impact of water restrictions on individual firms and sectors, for the purposes of this cost-benefit analysis, estimates of the output costs of water supply outages were restricted to the main internationally traded sectors which are most water intensive as these may be particularly sensitive to water insecurity given the ability of the firms in these sectors to divert production to other sites.

Consequently, the CBA was focused on the most water intensive industries in the internationally traded manufacturing sector, namely:

- Chemical manufacturing;
- Pharmaceuticals manufacturing; and
- Computer and electronics manufacturing.

[30] http://www.watersupplyproject.ie/wp-content/uploads/2015/03/Vol-3_WSP-Economic-Needs-Report.pdf ; Table 5.7
[31] FEMA method (2009) presented in Aubuchon and Morley (2013)

If water restrictions were imposed due to disruption in water supply, it was assumed that the manufacturing sector would reduce output by 10%[32]. This equated to €990 million in net present value terms.

Benefitting Corridor

In the eventuality that the Water Supply Project were not developed Irish Water would be required to bear the costs in providing alternative water sources, within the Benefitting Corridor, for their existing assets, i.e. the continued use of water treatment plants. Over the time period of this analysis (to the year 2050), it has been estimated that the associated additional costs will be of the order of €477 million in absolute terms and €348 million in net present value terms; after accounting for the shadow price of public funds.

"Do Minimum" Cost Summary

The table below presents a summary of the total costs in the Do Minimum scenario. This summary represents the baseline scenario in which output in the internationally traded sector falls by 10%. Under these assumptions there is a total cost to the economy of €3.8 billion in net present value terms over the appraisal period.

Table 8.1 Summary of Costs in the "Do Minimum" Scenario

Cost	€ Million – NPV
Leakage Reduction Costs	310.5
Environmental Costs	2.3
Benefitting Corridor Costs	348.4
Residential Outage Costs	2,123.2
Economic Output Costs	989.8
Total Costs	**3,774.2**

8.3 Option C (Parteen Basin Reservoir Direct) – CBA

The CBA analysis for abstraction from the Shannon at Parteen Basin, or the Lower Lake, includes costs related to the following:

- Capital expenditure;
- Operational expenditure;
- Environmental costs;
- Disruption costs of construction works; and
- Benefitting Corridor costs.

The proposed benefits of Option C are directly linked to the costs of additional outage forecast in the "Do Minimum" scenario, and are the avoidance of these costs of outage.

Note: The environmental costs, which include associated traffic disruption, have been prepared in line with the forecasts for the cost of carbon and value of time suggested in the Public Spending Code.

Table 8.2 outlines the total costs and benefits of Option C and illustrates the overall net benefit of the proposed investments at €1,635 million. Details of the capital and operational cost breakdown are presented in Appendix C. The Benefit to Cost Ratio (BCR) for the proposed investments is 3.25. This suggests that the proposed investments for Option C would bring about considerable benefit to the economy of the Eastern and Midlands region over the course of the assessment period, relative to the "Do Minimum" scenario.

[32] Assumed reductions in output ranged between 5% and 15% but may be considerably higher where major investments to be foregone due to a potential impact of water restrictions on their production processes.

Table 8.2 Option C - Net Benefit and BCR

Costs	€ Millions - NPV
Capital Expenditure	487.1
Operational Expenditure	152.3
Environmental Costs	20.2
Traffic Disruption	0.1
Costs of existing scheme rationalisation in Benefitting Corridor	66.4
Total Costs	726.1
Benefit	
Reduced Outage Costs to Residential Sector	1,371.4
Reduced Economic Output Costs	989.8
Total Benefits	2,361.2
Net Benefit of Option C	1,635.1
BCR	3.25

8.4 Option H (Desalination) - CBA

The CBA analysis for abstraction from the Irish Sea at a point north of Balbriggan includes costs related to the following:

- Capital expenditure;
- Operational expenditure;
- Environmental costs; and
- Benefitting Corridor costs.

As was the case with Option C, the proposed benefits of Option H are directly linked to the costs of additional outage forecast in the “Do Minimum” scenario, and are the avoidance of these costs of outage.

Table 8.3 outlines the total costs and benefits of the Option H and illustrates the overall net benefit of the proposed investments at €1,013 million. The BCR for the proposed investments is 1.75. This suggests that the proposed investment for Option H is lower than that for Option C; and suggests under the baseline assumptions, that Option C represents the investment with the best economic return.

Table 8.3 Option H - Net Benefit and BCR

Costs	€ Millions - NPV
Capital Expenditure	473.8
Operational Expenditure	450.6
Environmental Costs	75.6
Costs in Benefitting Corridor	348.4
Total Costs	1,348.4
Benefit	
Reduced Outage Costs to Residential Sector	1,371.4
Reduced Economic Output Costs	989.8
Total Benefits	2,361.2
Net Benefit of Option H	**1,012.8**
BCR	**1.75**

8.5 CBA Findings and Sensitivity Analysis

A number of sensitivity tests were carried out to ensure the robustness of the CBA findings. These sensitivity tests flexed the assumptions on the amount of output lost in the water intensive firms in the internationally traded sector. Given the uncertainty around how these firms would respond to water restrictions, it was prudent that the CBA be run with a range of alternatives in this regard. These findings are presented in Table 8.4 as on the basis of higher and lower impact assumptions. Indecon assumed in the higher impact scenario that output falls by 15% and in the lower impact scenario that output falls are limited to 5%.

Table 8.4 Summary of CBA Findings - Sensitivity Scenarios

Low Impact Scenario		
	Net Benefit (€ Million)	**BCR**
Option C: Shannon Abstraction	993.5	2.14
Option H: Desalination	517.9	1.38
High Impact Scenario		
	Net Benefit (€ Million)	**BCR**
Option C: Shannon Abstraction	2,130.0	3.93
Option H: Desalination	1,507.7	2.12

Under each scenario the net benefit of both options remains positive and the BCR remains greater than 1. Under each scenario the net benefit and BCR of Option C exceeds that of the Option H. The abstraction from the Shannon, at Parteen Basin, investment option represents the most economically beneficial of the two options appraised.

8.6 CBA Summary

The baseline results for the cost-benefit appraisal of the two investment options, namely Option C and Option H are presented in Table 8.5. These results indicate that the abstraction from the Shannon at Parteen Basin represents the most cost effective project.

Table 8.5 CBA Summary - Comparison of Option C and Option H

Option	Net Benefit (€ Million)	BCR
Option C: Parteen Basin Abstraction	1,635.1	3.25
Option H: Desalination	1,012.8	1.75

The results of the cost-benefit appraisal on the proposed investment options suggest that Option C is the preferable investment choice; and results in a higher net benefit than the desalination alternative or the “Do Minimum” scenario. The BCR of the Shannon abstraction option also exceeds that of the desalination option in the base case and all sensitivity analyses. These findings suggest that Option C represents the most economically advantageous investment option for the provision of new water supply infrastructure to the Eastern and Midlands region.

9. Preferred Scheme

The Preliminary Options Appraisal Report identified two options as sustainable and technically viable:-

- Abstraction from the Shannon and Parteen, and
- Desalination of Seawater from the Irish Sea

Abstraction from the Shannon at Parteen was the original Option C in the SEA and Desalination was Option H in that document.

These options however have different merits in terms of meeting the Project Need requirements, particularly in light of the national objectives of the Water Services Strategic Plan in consolidating smaller public water supplies drawing from vulnerable water sources. Through a comparative analysis Option C (Parteen Basin Reservoir Direct) was recognised as the 'Emerging Preferred Option' since it offered, in comparison with Option H (Desalination), these key distinct differences:

- A benefitting corridor through the Eastern and Midlands Region is associated with the Parteen Basin Option where a transfer pipeline is able to supply communities en route with a reliable and resilient source of supply;
- Least risk in terms of environmental, technical, financial, economic and socio-economic factors;
- The direct cost of construction, commissioning and operation are considerably more economical to the consumer than the alternative; and
- Most likely to deliver the objectives of the Water Services Strategic Plan.

While there was an emerging preference towards Option C (Parteen Basin Reservoir Direct), the alternative Option H (Desalination) was recognised to remaining as a technically viable option to serve the Dublin water supply area.

It is not, however, 'like-for-like comparable' in terms of meeting the strategic requirements of the Eastern and Midlands Region on a consistent basis across the region. In this regard, Option H (Desalination) would call for a strategically 'partitioned' rather than 'integrated' solution across the region. Water demand shortfalls in Dublin would be satisfied, but without existing source risk diversification. Rationalisation of smaller Midlands public water supplies towards the best existing sources, supported by a treated water pipeline, as envisaged in Section 5, would have to give way to more expensive scheme-by-scheme local upgrades, accepting long term yield limitations of smaller local sources.

These key distinct differences have framed the assessments undertaken and presented in the preceding Sections 5 through 8 of this report. These assessments are summarised in this section, and the key differentiators reviewed in light of new information to confirm, or otherwise, the emerging preference in the Preliminary Options Appraisal Report.

9.1 Options – The Key Differentiators

9.1.1 Benefitting Corridor

Initial work on the Benefitting Corridor in the Project Need Report has been reviewed, with the outcome of this assessment presented in Section 5.

The initial estimate of demand in the Benefitting Corridor, prepared based on individual county 'needs assessments', has been replaced with a detailed analysis and risk assessment into the ongoing viability and sustainability, of the existing Midlands water supply schemes. It is envisaged that these can be consolidated to fewer schemes by 2050 under the Interim Midlands and GDA Water Resource Plan (see Appendix A).

The expected water demand for the Benefitting Corridor is now profiled to reach 72Mld at year 2050, comprising a direct requirement for the excess projected demand over expected supply from the rationalised schemes, and provision for risk to deal with unforeseeable abstraction restrictions, contamination events, or demand increases in the Midlands area in particular.

9.1.2 Abstraction Regime

The proposed water supply would abstract 330Mld (3.82 m^3/s) as a continuous average at the year 2050.

Section 6 details how this abstraction of water from the Parteen Basin (Lower Lake) would operate in parallel with ESB hydro-electric power generation at Ardnacrusha; mirroring a worldwide relationship often used to enable an environmentally sustainable availability of water for public supply.

Reduction in water used in hydropower generation at Ardnacrusha to take account of water abstracted for water supply would offset impact of abstraction in most operating conditions. The hydrodynamic model, which has been developed (Sections 6 and 7), confirms that abstraction under these conditions is sustainable within the existing normal operating water level range in all years of historic Shannon flow data on record.

Irish Water will enter into an agreement with ESB to ensure that abstraction of water will take place in such a manner that the existing normal operating water level band on Lough Derg and Parteen Basin, and the statutory minimum flow in the River Shannon to the tidal limit remain unchanged.

9.1.3 Environmental and Technical Factors

Hydrodynamic modelling of abstraction on Lough Derg and Parteen Basin, as presented within the Preliminary Options Appraisal Report, highlighted the reduced risk, in terms of environmental, technical, financial, economic and socio-economic factors, due to abstraction from Parteen Basin when compared with the position where water is sourced from the north east of Lough Derg.

Section 7 presents an updated position on the hydrodynamic modelling, with collated within-the-lake datasets employed to calibrate the hydrodynamic model and allow more accurate assessment of impact from abstraction. Modelled scenarios confirmed abstraction from Parteen Basin at a constant rate during summer low flow conditions to show no change to flushing time characteristics in any region of Lough Derg and Parteen Basin when compared with the baseline conditions.

Abstraction from Parteen Basin, without impact on the baseline flow conditions through the lake, confirms a reduced risk position for the Lough Derg environmental baseline overall and for the communities, tourism, and businesses that rely on its function.

9.1.4 Economics

Section 8 presents the findings of a cost-benefit appraisal, by independent economists, into the investment options to guarantee a continued water supply to the Eastern and Midlands Region. In addition to the two options, it considered the “Do Minimum” base scenario; the latter being the mostly likely scenario to prevail should the proposed investment not be committed. The benefit to cost ratio (BCR) of Option C when compared to Option H, and following all sensitivity analyses, suggest that it represents the most economically advantageous investment option for the provision of new water supply infrastructure to the Eastern and Midlands region.

> *Note: A benefit-cost ratio (BCR) is an indicator which summarises the overall value for money of a project or proposal, and is the ratio of the benefits of a project or proposal relative to its costs; both expressed in monetary terms. The BCR for a Shannon abstraction and for the Desalination option is 3.25 and 1.75 respectively where a higher BCR indicates is a good investment when compared using the base case scenario.*

9.1.5 Water Services Strategic Plan

Irish Water has published its Water Services Strategic Plan (WSSP), approved by government in October 2015, since publication of the Project Need Report for the Eastern and Midlands Region project. The issue of a large number of public water supplies which are isolated and dependent upon small sources, many of which are vulnerable to pollution and of low yield, was recognised as a particular challenge.

Chapter 2 of the WSSP, entitled *Challenges and Strategic Priorities*, states:-

A comparison with water services in Scotland is instructive. Scottish Water operates around a quarter of the number of water treatment plants as Irish Water to serve 2.4 million domestic households. The higher number of smaller water treatment plants controlled by Irish Water (many of which rely on small vulnerable sources) are more difficult and expensive to operate and we need to reduce this number through rationalisation where funding permits.

Within this chapter, and under Objective WS2a, the WSSP indicates:-

We will prepare risk assessments for all water supply sources to determine short, medium and long term risks to water supply capacity. Based on these risk assessments, we will identify and develop our plans for sustainable water sources nationally. Measures to achieve this will include rationalisation of water supply zones to utilise larger sources and interconnection of networks to ensure security of supply.

Under Objective WS3b in the same chapter, the WSSP indicates:-

Minimising the unit cost of delivering water to the customer whilst meeting environmental compliance will result in the rationalisation of water supply areas over time and, subject to funding ability, will focus on a smaller number of high quality, sustainable sources with standardised treatment processes. This rationalisation approach will be developed within the National Water Resources Plan by the end of 2017.

Chapter 8, entitled *Invest in our Future*, at Objective IF1b, expresses the intention:-

To deliver operational cost efficiencies, meet capacity and performance needs and improve system resilience, through rationalisation and strategic forward planning.

Review of the benefitting corridor has confirmed the potential for Option C: (Parteen Basin Reservoir Direct) to serve treated water to a wide range of Midland locations, towns and communities along the route from the River Shannon to Dublin, supporting its potential to align with more key objectives of Irish Water's 25-year Water Services Strategic Plan. The Desalination Option is not 'like-for-like comparable' in terms of meeting these strategic requirements of the Eastern and Midlands Region on a consistent basis across the region, and would call for an entirely different strategy for dealing with small public water supplies, dependent upon scheme-by-scheme local upgrades, accepting the continuing long term yield limitations of smaller local sources.

9.2 Preferred Scheme

With reference to Section 9.1 Option C: Parteen Basin Reservoir Direct emerges as the Preferred Scheme for the Water Supply Project Eastern and Midlands Region for a number of key reasons:

- It provides treated water, delivered in a way which brings the greatest availability and economic advantages to the widest group of communities in Irish Water's Eastern and Midlands Region. Towns and communities along the proposed pipeline route through the Eastern and Midlands Region will gain a secure water supply to meet future domestic, commercial and industrial water requirements and therefore the opportunity to develop and grow their economies. All consumers will have a reliable and sustainable water supply to international standard of service.

- It enables the delivery of more efficient and up to date supply infrastructure by facilitating the development of fewer and more modern water treatment plants to replace the numerous small, inefficient and outdated plants currently operating across the region. It provides the strategic basis for rationalisation of a number of small public supplies to fewer schemes over time.

- The results of the cost-benefit appraisal of the various investment options suggest that Option C is the preferable investment choice; as it results in a higher net benefit than the desalination alternative or the net benefit of the 'Do Minimum scenario'. The latter represents the base case.

- Modelled abstraction from Parteen Basin at a constant rate during summer low flow conditions in a drought of 1995 severity shows no change to flushing time characteristics in any region of Lough Derg and Parteen Basin when compared with the natural baseline conditions.

The Preferred Scheme will comprise a number of ancillary components of infrastructure that collectively make up the water supply system. These are discussed in Sections 11 and 12.

10. Community Benefit Opportunities

As with all strategic infrastructure projects, the planning process requires that due consideration of community gain is undertaken by the planning applicant. Irish Water has already set out its approach to community gain for the Water Supply Project Eastern & Midlands Region (WSP) in Section 10 of the Preliminary Options Appraisal Report (POAR) published in November 2015. Section 10 in the POAR indicates that there is potential for a significant element of community gain for those living and working in the area selected for the new Eastern and Midlands Region water supply.

10.1 Legislation

The Planning and Development Act 2000 (as amended by the Planning and Development (Strategic Infrastructure) Act 2006 Section 37 G (7)(d))[33] specifies that in the event that planning permission is granted for a Strategic Infrastructure Development, An Bord Pleanála (*the Board*) can make provision for community gain arising out of the development:

The Board may attach a condition providing for community gain[34] which may require the construction or the financing, in whole or in part, of a facility or the provision of a service in the area in which the proposed development would be situated and which the Board considers would constitute a substantial gain to the community.

10.2 Community Gain at a national level

The project will provide necessary treated water, delivered in a way which brings a secure and sustainable supply to over 40% of the Country's population resident in the Eastern and Midlands Region.

This will facilitate economic development in suitable locations throughout the entire area of the pipeline. Resilient utilities rank second only to access to finance, in decisions to locate industry in Ireland.

Overall the project will demonstrate to potential inward investors (FDI) that Ireland offers a modern, efficient and sustainable water supply infrastructure to support the needs of their businesses well into the future.

10.3 Community Gain – Across the Pipeline Route

In addition to improved and sustainable domestic and commercial water supplies, there are some specific additional benefits to communities along the route of the pipeline.

The project represents approximately €700–€900m of investment in equipment, facilities etc. Many products and services will be sourced from local businesses within the Pipeline Corridor allowing them to grow in size and skills.

The project will deliver up to 1000 construction jobs in the three to four years it will take to build the head works, pipeline, and ancillary infrastructure many of which may go to local people and all of which will bring business to the area in terms of workers needing accommodation, meeting catering requirements and spending money in local shops and businesses.

Irish Water propose to engage with Local Authorities and other relevant bodies with a view to sponsoring training schemes to enable those local businesses/ workers to develop the necessary skills to be employed on the project - e.g. welding, metalwork, plant operators, skilled operatives, general operatives. Irish Water also proposes to contribute towards achieving the conservation objectives of the Lower Shannon Special Area of Conservation (SAC) and the objectives of the River Basin Management Plans, and the development of environmental education and protection initiatives and sports & leisure facilities.

[33] http://www.irishstatutebook.ie/eli/2006/act/27/section/3/enacted/en/html
[34] As specified in section 34(4) of the 2000 Act.

The project will deliver up to 15 permanent jobs in the water treatment plant and pumping stations in Tipperary which is an integral part of the project. In addition to permanent jobs, the project will give rise to numerous (50+) contract / part time jobs necessary for on-going operation and maintenance of the new water scheme.

By making potable water supplies available at a consistent quality and reliability across the Midlands, matched by commensurate wastewater treatment capacity where required, the attractiveness of the region for foreign direct investment in water-using industrial sectors will be increased. Irish Water will ensure that both incoming water supply, and outgoing wastewater infrastructure, will not become an impediment to regional economic development.

10.4 Additional Community Benefits – Based on further research and feedback from Consultation

Irish Water proposes to establish a 'Community Gain Fund' with a view to supporting community-based initiatives, primarily in the Environmental / Sport & Leisure / Training & Education areas, which meet specific criteria and / or contribute to achieving the objectives of the River Basin Management Plans and conservation objectives of the Lower River Shannon SAC. These community based initiatives would be assessed on their ability to improve the environment or support the community.

10.5 Proposed Approach for the Administration of Additional Community Benefits

Irish Water aims to provide An Bord Pleanála with a realistic, specific, measurable community gain proposal(s), with an associated administrative structure, which the Board can adequately assess, and consider as part of the overall planning application. The proposed approach for the administration of additional community benefits is outlined below:

1. Community and Environmental Needs Analysis Study to be conducted.
2. Set the parameters and criteria under which funding can be allocated.
3. Establish an administrative structure to administer the fund.
4. Allocation of Fund by principal categories is established and applications are sought from clubs, associations, and other such groups in the locality for support for various environmental and community-based initiatives and improvement projects.
5. Irish Water administers each scheme and an awards committee is drawn from the local communities. This committee decides which projects are granted financial support. The funding has the potential to benefit the environment, schools, sports clubs, general amenity, social initiatives, as well as community facilities.

11. Preferred Scheme – Infrastructure Sites

The POAR examined four technically viable options carried forward from the Options Working Paper, it set aside two of them involving abstraction from Lough Derg, on environmental grounds, and it established that, of the remaining two options, abstraction of water from the Shannon at the Parteen Basin, or Lower Lake, was emerging as preferable to the alternative which involved Desalination of seawater from the Irish Sea in North Fingal.

The earlier chapters of this FOAR have carried out an interim review of water demand, and have also examined how the proposed abstraction at Parteen Basin can be accommodated, within the normal operating water level band on Lough Derg/Parteen Basin. Additional modelling work has been carried out, which supports the basis for identification of the 'Emerging Preferred Option'.

The review of water demand (Section 5), and the proposals for phasing, have both confirmed the requirement for a scheme to meet the increasing demands of the Eastern and Midlands Region, and have addressed how capacity can be matched to growing demand. Additional modelling work has been carried out, which supports the basis for identification of the 'Emerging Preferred Option', (Section 7). The economic factors in cost-benefit analysis have been considered (Section 8) for the preferred option of abstraction at Parteen, vis-à-vis the other alternative options of Desalination or the 'Do Minimum' scenario. 'Do Minimum' is the default scenario which is most likely to persist should the proposed investment, or investments, in a new source option are not undertaken.

On the basis of these assessments, Option C (Parteen Basin Reservoir Direct), or the 'Emerging Preferred Option', is affirmed as the Preferred Scheme, on environmental grounds, on cost-benefit grounds, and in terms of meeting the fundamental objectives of the Water Services Strategic Plan and of the WSP itself (refer to Section 9).

In this regard, the issue of best water source option is confirmed at this point, and the question turns to selection of the preferred sites for the different components of the Preferred Scheme.

The Preferred Scheme will comprise a number of constituent components of infrastructure that collectively make up the water supply system (Figure 11.1). These can broadly be defined as:

> Non – Linear Infrastructure, including the Raw Water Abstraction Works, Water Treatment Plant, Break Pressure Tank and Termination Point Reservoir(Section 11.2) and
>
> The Transmission Pipeline (Linear Infrastructure).

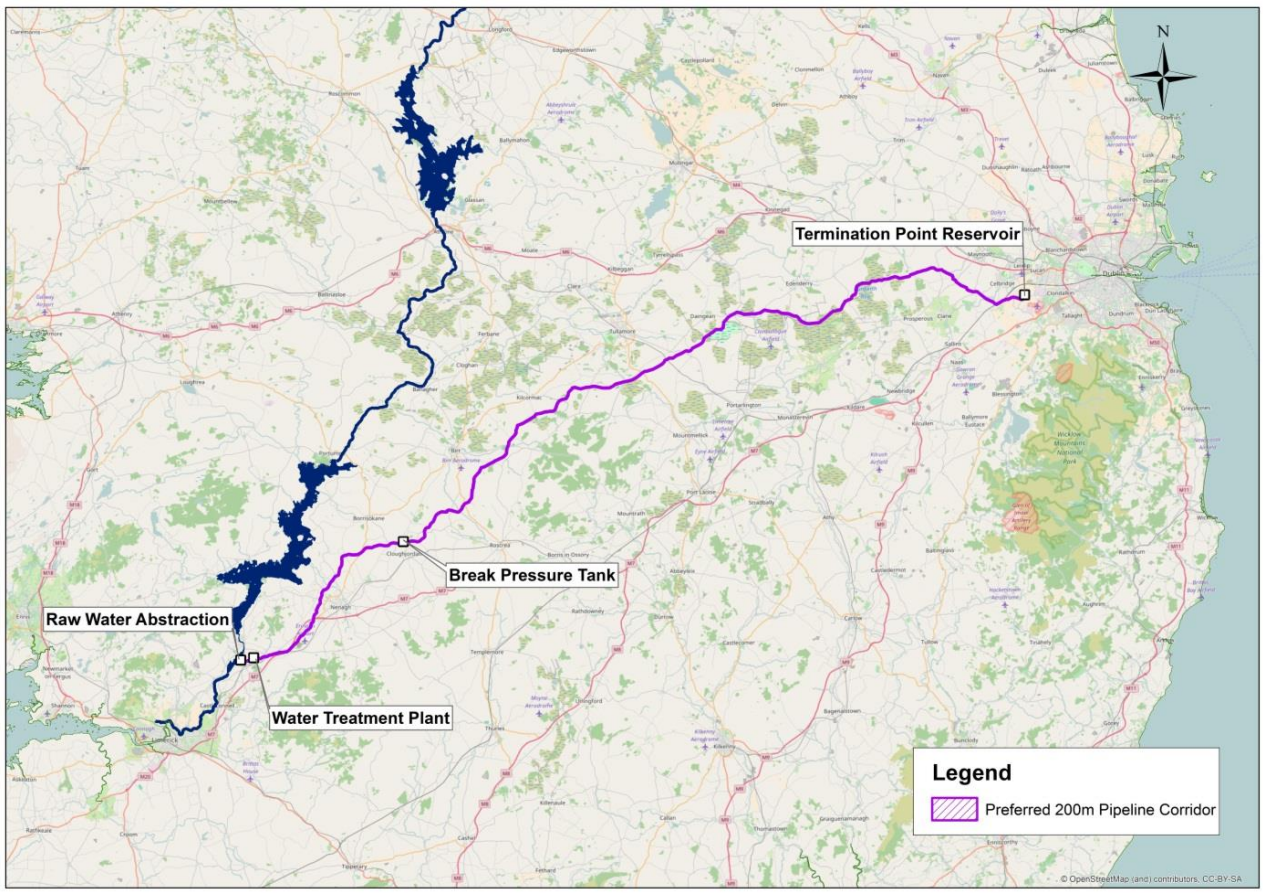


Figure 11.1 The Transmission Pipeline (Linear Infrastructure) and Other (Non – Linear Infrastructure)

Sections 11 and 12 discuss how the different siting options for these components were developed to minimise impact on their environment and, taken with Appendices E to I, they detail the appraisal of these site and route options. They set out multi-criteria analyses (MCA) of the options available, to identify a preferred site for each component from the multiple sites considered (Section 11), and to identify the preferred pipeline route corridor in a similar way (Section 12), with recommendations on preferred sites and pipeline routes.

Before proceeding to development of site options and site option appraisal, it should be recalled that the Options Working Paper consulted upon the appraisal criteria, and on the list of environmental datasets which have been used to define land areas of different degrees of constraint. The positioning of site options for the proposed raw water intake, water treatment plant, break pressure tank, termination point reservoir, and linear pipeline, has been done with the aim of least environmental impact, through good positional design from the outset, avoiding, where possible, known areas of environmental and technical constraint from the many datasets published in the Options Working Paper.

The sequence of work has been to position site and route options, in the 'white space' or less constrained areas. These are then evaluated by the specialists in a workshop structure to identify the 'least constrained'. This is followed by fieldwork surveys to verify conditions on the ground, and by review of consultation feedback, to determine the 'preferred site' in each case. The Environmental Impact Statement and Natura Impact Statement are then prepared on the Scheme incorporating the preferred sites and pipeline route.

11.1 Multi Criteria Analysis (MCA) – Methodology

Comparing alternative options calls for a framework to integrate the views of the different specialists on the options. Multi criteria analysis (MCA) is a mechanism that explicitly considers multiple criteria within a decision-making environment. The fundamental approach is to utilise Specialist expertise to conduct the analysis. Comparing alternatives against multiple objectives and criteria through MCA allows for a collective balancing of

different impact types, understanding of the merits of each option, and the establishment of a preference ranking, in a collective way; informing and justifying the decision making process. In the assessment of sites to identify one of least constraint (for each main infrastructure component), the following specialisms and disciplines were involved. Appendices E to I inclusive set out the detailed considerations of the specialists in forming their views.

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 following methodology was employed:

1. Each of the specialist disciplines (identified above) assessed the site options against the criteria of Table 11.1 to determine the site option for each ancillary component with the overall least impact from their specialist perspective.
e.g. The ecology specialist assessed the four raw water abstraction sites against Biodiversity, Flora and Fauna, Fisheries criteria to determine the site option with least impact from an ecology perspective.

2. The preliminary position of each Specialist, on each ancillary component, presented in matrix format, was collated for each of the ancillary components and presented at a workshop where all the Specialists were represented.
e.g. The ecology specialist assessment for raw water abstraction sites was compiled with the assessments of Air and Noise etc. to present a complete MCA assessment of the sites.

3. In this workshop setting, the matrix of preliminary individual assessments for each individual component was presented to the collective specialist group. The position of each of the specialists was then discussed to reach a consensus of agreement on a preferred site for each main infrastructure component, from the various alternatives.
e.g. The ecology specialist assessment was balanced against that of the other specialists to inform an overall ranking of raw water abstraction sites, and support preference towards one.

A breakdown of the criteria employed by each of the specialisms is presented in Table 11.1.

Table 11.1 Applicable Criteria for each Specialism

Specialism	Applicable Criteria
Ecology	Biodiversity, Flora and Fauna, Fisheries
Air and Noise	Air/Climatic Factors
Cultural Heritage	Cultural Heritage (including Architecture & Archaeology)
Soils, Geology and Hydrogeology	Soils, Geology and Hydrogeology
Landscape and visual	Landscape & Visual
Agronomy	Material Assets (Land use)
Water	Water and the Water Framework Directive
Engineering	Material Assets (Energy), Safety, Engineering and Design, Capital and Operational Cost, Sustainability, Risk
Planning	Planning Policy
People	Tourism, Population, Human Health

The Specialists, in completing the MCA, also incorporated feedback from the POAR consultation process, primarily to establish if the process had identified any new information which needed to be included in the assessment process for relevant individual specialists. This was to establish if the consultation submissions contained additional information relevant to the MCA and to determine any impact on the individual assessments, or collective arrangements facilitated by the workshop setting.

Appendices E to I inclusive contain the various MCA, and supporting Statements from each of the Specialists, that were completed on each of the various ancillary components of infrastructure.

A simple classification was used for the MCA - one of five categories of impact were applied to each of the locations of ancillary components under consideration; colour coded for ready identification.

These were:

Impact Category	Colour Code
Very high	**Dark blue**
High	**Blue**
Mid-range	**Green**
Low	**Light Green**
Very low	**Cream**

11.2 Non – Linear Infrastructure Components in Water Supply

The non – linear infrastructure components comprise of the followings assets which are explored individually in the following sections:

Intake and Raw Water Pumping Station (Section 11.3 and Appendix E)

Abstraction of raw water will be from the Lower Lake (Parteen Basin) via a submerged pipeline or open channels, which will extend a relatively short distance out into the basin. The abstraction works will incorporate a raw water pumping stations which will deliver raw water to the proposed water treatment plant.

Water Treatment Plant (Section 11.4 and Appendix F)

The water treatment plant will treat the raw water from Parteen Basin to Drinking Water Standards for human consumption in accordance with relevant legislation. The water treatment plant will also incorporate a high lift pumping station to deliver treated water to a Break Pressure Tank.

Note: The transmission pipeline is discussed in Section 12.

Break Pressure Tank (Section 11.5 and Appendix G)

A Break Pressure Tank (BPT) will be located at the highest elevation of the transmission pipeline and is required to manage the water pressures that will be generated in the operation of the transmission pipeline. The tank is the point at which the transmission line will change from a pumped to a gravity flow. In practice, treated water will be pumped from the water treatment plant to this tank, and the water will flow by gravity from the tank to the termination point reservoir. It will act as a balancing tank for pumped flows, e.g. from the WTP, it will help to limit variability in operating pressures, and it will provide sufficient storage such that there is adequate reserve flow to maintain the on-going pipe full after the pumps have stopped or tripped.

Termination Point Reservoir (Section 11.6 and Appendix H)

Located at the end of the transmission pipeline, the Termination Point Reservoir (TPR) acts as storage facility for the treated water; providing capacity to serve the varying demand profile of the Dublin Water Supply Area. The TPR will be integrated with the existing water distribution system (Section 11.7) at Peamount in south Dublin, ensuring onward transmission to end users.

11.3 Raw Water Abstraction Site

A preliminary screening of potential Raw Water Abstraction (RWA) sites on Lough Derg and Parteen Basin was conducted as part of the preparation of the POAR. The POAR identified Parteen Basin as the preferred location for raw water abstraction. An assessment of possible sites for raw water abstraction works at Parteen Basin is set out in Sections 11.3.1 and 11.3.2.

11.3.1 Identification of Raw Water Abstraction Sites

Abstraction will constitute an open channel or intake pipe along the shoreline of the Parteen Basin. Based on the preferred location at the Parteen Basin, or the Lower Lake, a number of potential RWA areas were identified. Collectively, these areas cover the available perimeter on both sides of the Basin, and also a small area downstream of Lough Derg on the eastern bank which is not designated as a Natura 2000 site. These areas are presented in Figure 11.2 and included the following:

- Western shore of Parteen Basin (RWA1)
- Eastern shore of Parteen Basin (RWA2)
- Eastern bank of River Shannon, immediately downstream of Lough Derg (RWA3)

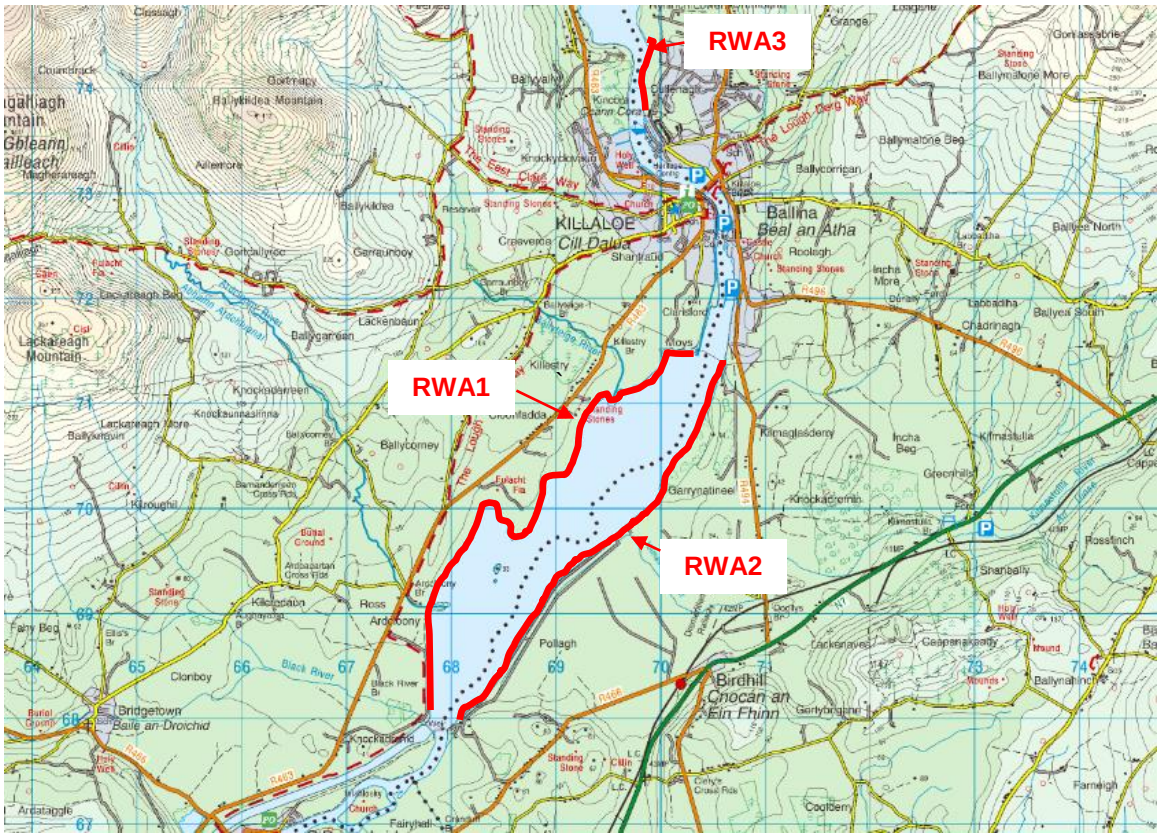


Figure 11.2 Potential Raw Water Abstraction Areas in Parteen Basin

Note: the identification of a likely suitable site within the confines of the urban areas of Killaloe and Ballina precluded these from consideration.

In broad terms, the eastern bank offers potential for siting raw water abstraction infrastructure best aligned with the treated water pipeline route; the western bank is feasible but is impacted by the additional works which would be required to convey, via tunnelling, raw water through a pipeline beneath Parteen Basin. *The disruptive impacts, of alternatively routing a large diameter pipeline from the western bank northwards to cross the river in the Ballina/ Killaloe urban area, have been taken into consideration*. RWA3 covers an area of the eastern bank

which is outside the Natura site designation, and which offered some advantage in that regard, but it also has challenges in routing a pipe through Ballina and its environs. Consequently, due to the extent of the existing urban development, and steep terrain, RWA3 was discounted from any further consideration.

With regard to RWA1 and RWA2, any identified site would be constrained by the presence of the ESB embankments[35], (refer to Section 6) and the requirement to avoid potential impact on these through construction activities.

A detailed assessment was undertaken of RWA1 and RWA2 and four potential sites were identified (refer to Appendix E), which were considered potentially suitable having regard to available size, bathymetry, clearance from the engineering embankments, land topography and position with respect to environmental features and receptors; two sites on the eastern shore of Parteen Basin and a further two sites on the western shore, as shown in Figure 11.3.

The proximity to the ESB embankment along the eastern shore ruled out a number of potential locations for sites; other considerations included nearness to existing developments, the requirement to minimise the impact on designated sites and archaeological sites, local topography, access, etc. Further details are provided in Appendix F.

Figure 11.3 Potential Raw Water Abstraction Sites

[35] These are linear embankments which were constructed as part of the Shannon Hydroelectric Scheme (Ardnacrusha), and are managed by the ESB. These can be seen in Figure 6-1.

11.3.2 RWA Sites – MCA Comparison

The 4 RWA sites were subject to MCA analysis, employing the methodology outlined in Section 11.1. A summary of the analysis is presented in Table 11.2. For ease of reference the colour legend is repeated as follows:-

Impact Category	Colour Code
Very high	Dark blue
High	Blue
Mid-range	Green
Low	Light Green
Very low	Cream

Table 11.2 – MCA – Comparison between RWA Sites

Constraint	RWA Site 1	RWA Site 2	RWA Site 3	RWA Site 4
Terrestrial Ecology				
Aquatic Ecology				
Surface Water				
Air Quality				
Noise				
Cultural Heritage				
Landscape and Visual				
Agronomy				
People				
Soils, Geology & Hydrogeology				
Planning Policy				
Traffic				
Engineering & Design				
Overall Ranking	**4**	**3**	**1**	**2**

With reference to the appraisal criteria presented in Table 11.2, where the sites are ranked in order of preference and least constraint, RWA Site 3 represents the preferred location for the siting of a raw water abstraction facility for the following reasons:

- RWA Site 1 and 2 require additional pipeline construction through Parteen Basin which will incur higher potential for ecological/archaeological and technical constraints; while haulage routes to the M7 during construction would be forced through residential, commercial and industrial developments in Limerick city.
- RWA Site 4 is located within a wetter woodland broadly corresponding to the priority Annex I habitat, 'Alluvial forest'.
- RWA site 3 is well screened, south of the Fort Henry demesne lands and provides no obstruction to views of Parteen Basin from the western bank.

11.4 Water Treatment Plant Site

The POAR established that abstraction of water from the Shannon at Parteen Basin, with raw water treatment at source, was preferable to the alternative which involved Desalination of seawater from the Irish Sea in North Fingal.

For water abstraction from the Shannon, a conventional water treatment plant (WTP) would be constructed. It is desirable that the WTP site for the project be located in close proximity to the raw water abstraction point; to minimise the length of raw water mains required. These mains, since they carry raw water, may be subject to colonisation by invasive species present in Lough Derg, or to deposition of raw water sediments, and the maintenance burden would be proportionately larger with longer mains.

The WTP would be constructed under a number of phases. It is estimated that the final phase would bring the treated water output from the plant to 314 Mld by 2050. Four modular water treatment streams, each capable of producing approximately 80 Mld of treated water, would be needed to meet these output requirements.

11.4.1 Identification of Water Treatment Plant Sites

Based on a preferred location for abstraction along the eastern shore of Parteen Basin, as set out in Section 11.3.2, a number of potential WTP site areas were identified.

Figure 11.4 shows the preferred location of the raw water abstraction point and three potential areas for siting a WTP in close proximity (less than 3km) to it. Also shown on **Figure 11.4** are the extents of the Lower River Shannon Special Area of Conservation and other constraints that exist within each of these areas.

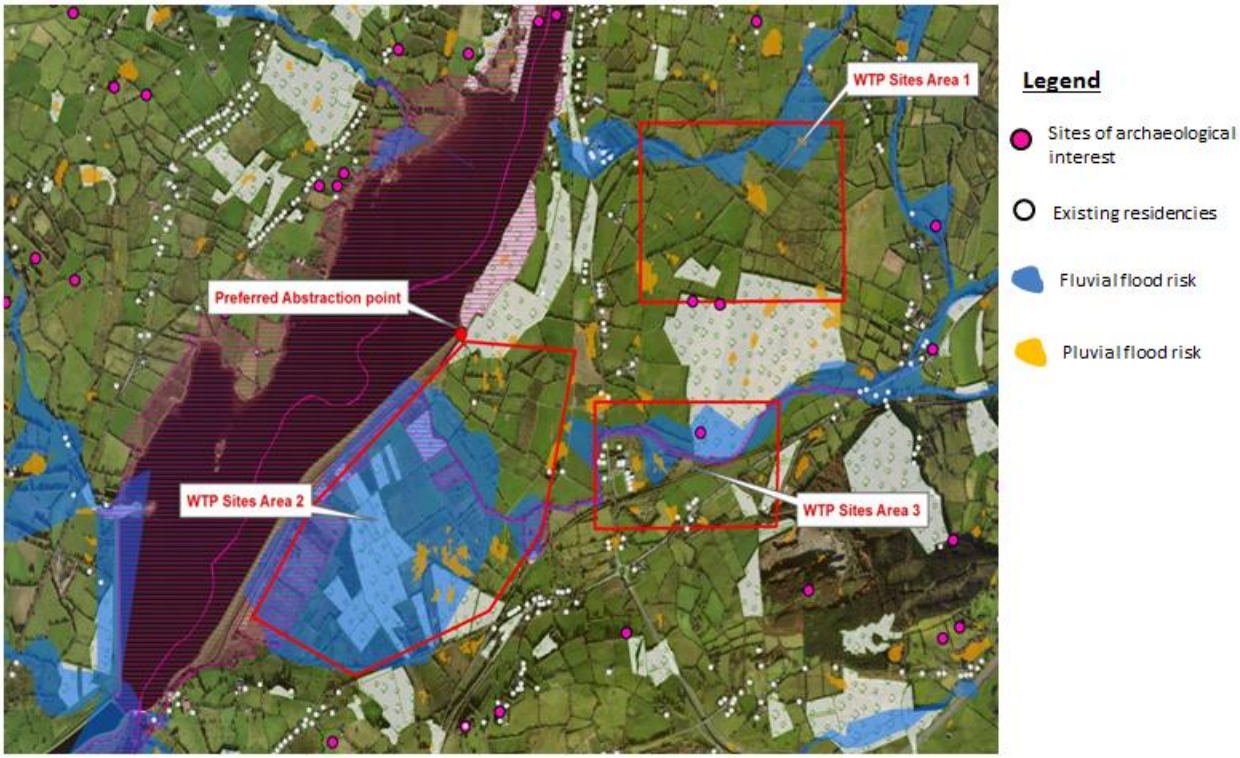


Figure 11.4 Potential Water Treatment Plant Site Areas

Area 1 was identified as the least constrained area for siting a WTP as it is largely composed of open farmland, with no direct impact on properties or priority habitats. Area 2 is environmentally constrained by the Lower Shannon SAC, including the Kilmastulla River; the area also lies within the flood plain of the Kilmastulla River. Area 3 encompasses considerable existing development, including residential properties. It also includes the Shannonside Business Park, and could therefore be considered as having an established use upon which a

large WTP would have a less significant impact than it would have on the more rural settings in Areas 1 and 2. However, the presence of the Kilmastulla River (which is in the SAC), the Limerick-Nenagh railway line and the R445 (old N7) road makes identification of a land parcel of adequate size for the WTP, and which does not infringe upon one of these constraints, difficult to ascertain.

A detailed assessment was undertaken of Area 1 and three potential sites were identified, as shown in Figure 11.5. Further details are provided in Appendix F.

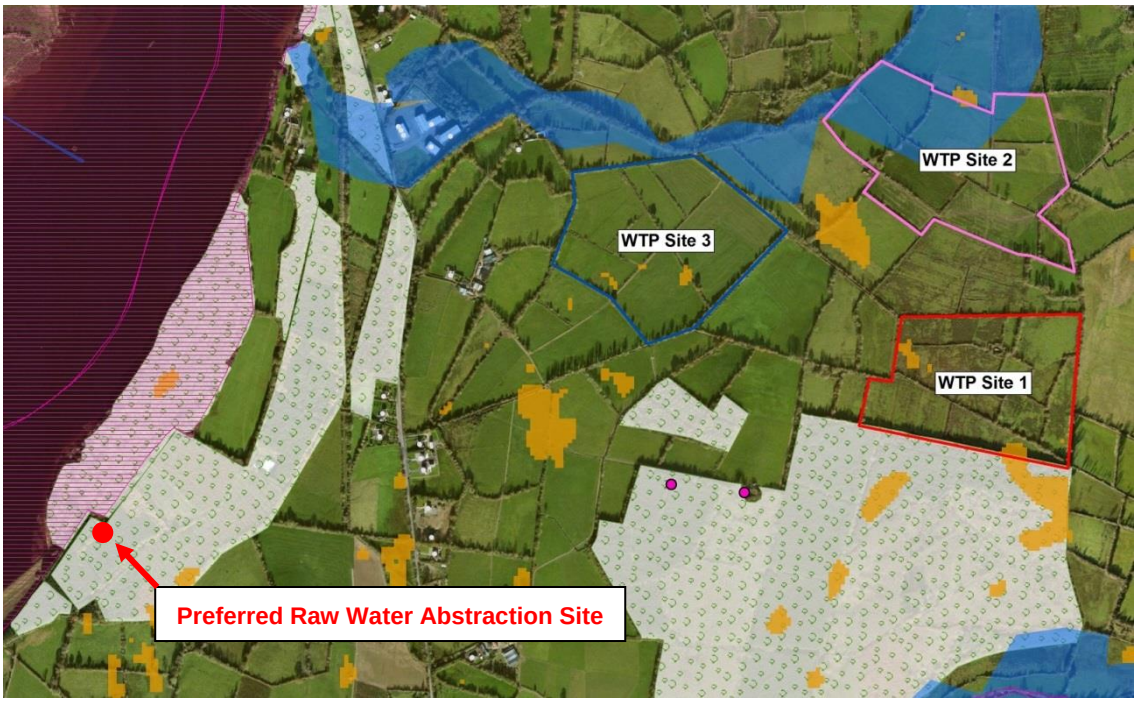


Figure 11.5 Potential Water Treatment Plant Sites

Sites were identified with reference to local constraints, including proximity to housing, the requirement to minimise the impact on designated and archaeological sites, local topography, access, etc.

11.4.2 WTP Sites – MCA Appraisal

The 3 WTP sites were subject to MCA analysis, employing the methodology outlined in Section 11.1. A summary of the analysis is presented in Table 11.3.

Table 11.3 – MCA – Comparison between WTP Sites

Constraint	WTP Site 1	WTP Site 2	WTP Site 3
Terrestrial Ecology			
Aquatic Ecology			
Surface Water			
Air Quality			
Noise			
Cultural Heritage			
Landscape and Visual			
Agronomy			
People			
Soils, Geology & Hydrogeology			
Planning Policy			
Traffic, Engineering & Design			
Overall Ranking	**1**	**2**	**3**

With reference to the appraisal criteria presented in Table 11.3, where the sites are ranked in order of preference and least constraint, WTP Site 1 represents the preferred location for the siting of a water treatment plant for the following reasons:

- WTP Site 1 benefitted from more favourable potential traffic connections to the N7 and ability to significantly mitigate, through avoidance, human health impacts associated with construction and haulage traffic employing regional and local roads in the area.
- WTP Sites 2 and 3 are more constrained by residential and commercial receptors, and proximity to a watercourse which is categorised as ‘moderate status’.

11.5 Break Pressure Tank

The Break Pressure Tank (BPT) is a critical component of the water supply infrastructure, strategically located along the transmission pipeline, for the management of the water pressures that will be generated during the operation of the system.

For the WSP, ideally it is located at, or near, the highest elevation along the transmission pipeline as this gives the greatest opportunity for harnessing the natural topography to convey water, by gravity to the termination point (see Section 11.6).

Initial hydraulic analysis determined that an elevation in excess of 125mOD presents this opportunity.

11.5.1 Identification of suitable elevation for BPT siting

Areas in excess of 125mOD on the transmission pipeline were mapped. In conjunction with other constraints, e.g. environmental (Section 12.3); three potential locations, or areas, were identified for the potential siting of a BPT; as shown in Figure 11.6.

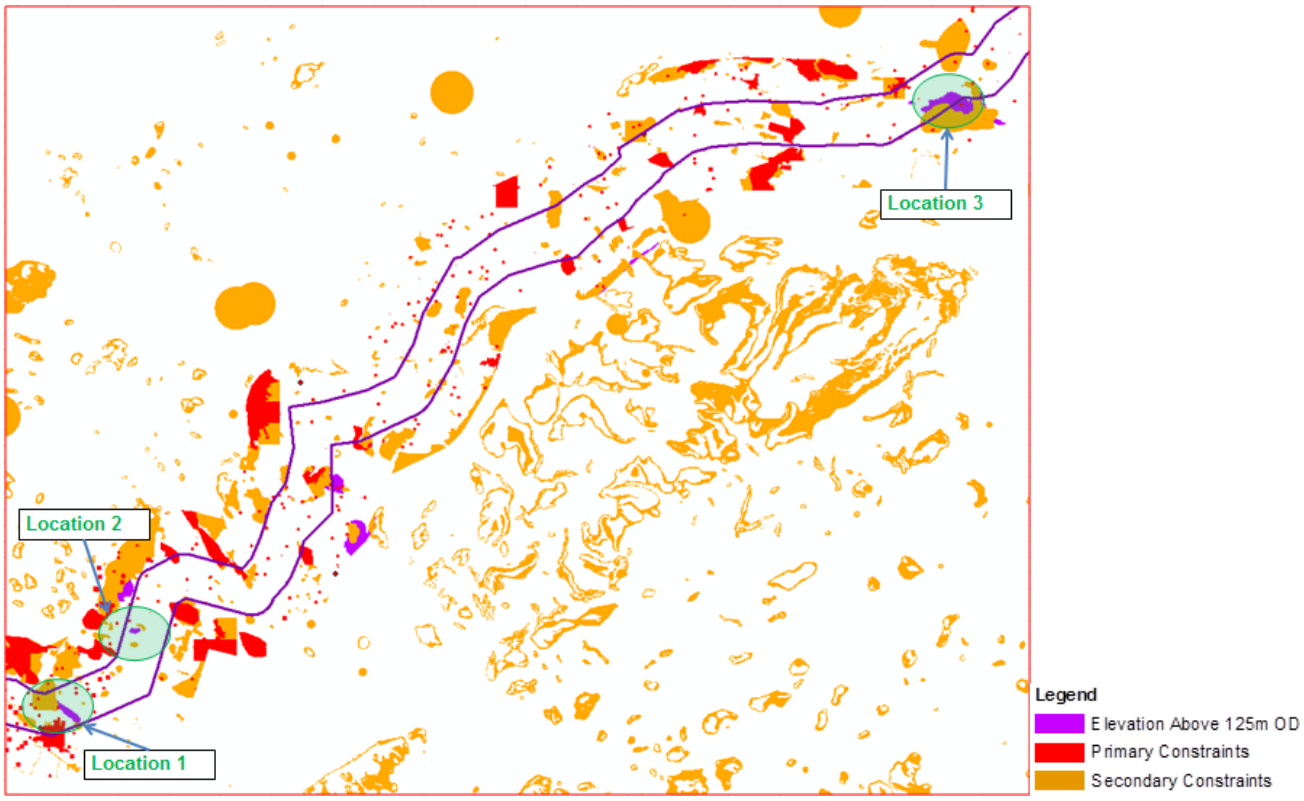


Figure 11.6 – Potential BPT Locations above 125mOD

Location 1 (near Cloughjordan) was deemed preferable to Locations 2 and 3; as it is at a higher elevation than the alternatives, where the additional potential energy head is technically important in the operation of the gravitational section. In addition, it offers the greatest flexibility for siting the BPT as this elevated area is relatively extensive, over 2,200m in width.

Location 2, at a lower elevation (134mOD), was characterised by a much smaller land extent limiting the available construction 'footprint'.

Location 3 is much farther east than either of the other two locations, approximately 65km beyond Location 1; and at an elevation of 145mOD. This would introduce greater operational complexity[36] into the water supply system without any obvious benefit; compounded by the fact that a pipeline would have to be routed through Location 1 in any event.

At Location 1 the highest elevation points (approximately 147mOD) are situated to the north on a prominent ridge; but do also contain a number of local environmental constraints, as shown in Figure 11.7. Siting a BPT in this northern area was investigated further as the increased elevation maximises the opportunity for routing a pipeline, by gravity, to the termination point whilst avoiding the various, and extensive, constraints en route.

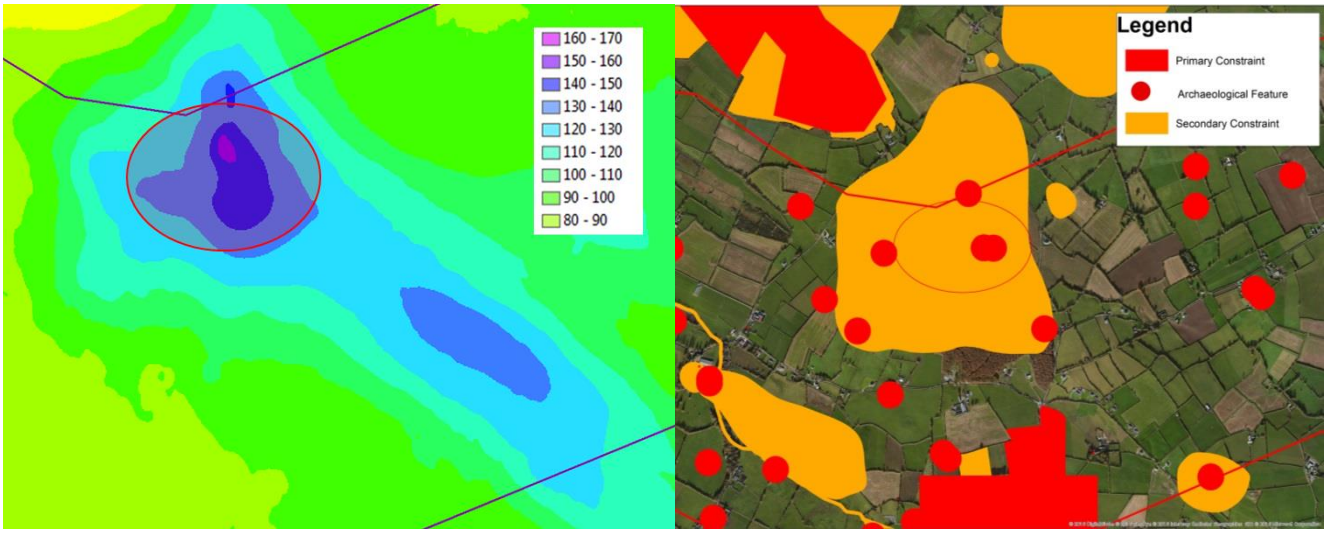


Figure 11.7 – Elevation and Local Constraints at Location 1 (Knockanacree)

An indicative ground elevation of the transmission pipeline, via Location 1, between the abstraction location and the termination point is shown in Figure 11.8. The highest elevation point is situated in the Knockanacree area, near Cloughjordan.

[36] The transmission pipe west of the BPT will be a pumped system whilst it will be operated by gravity to the east of it. Pumped systems are much more complex to operate than gravity systems.

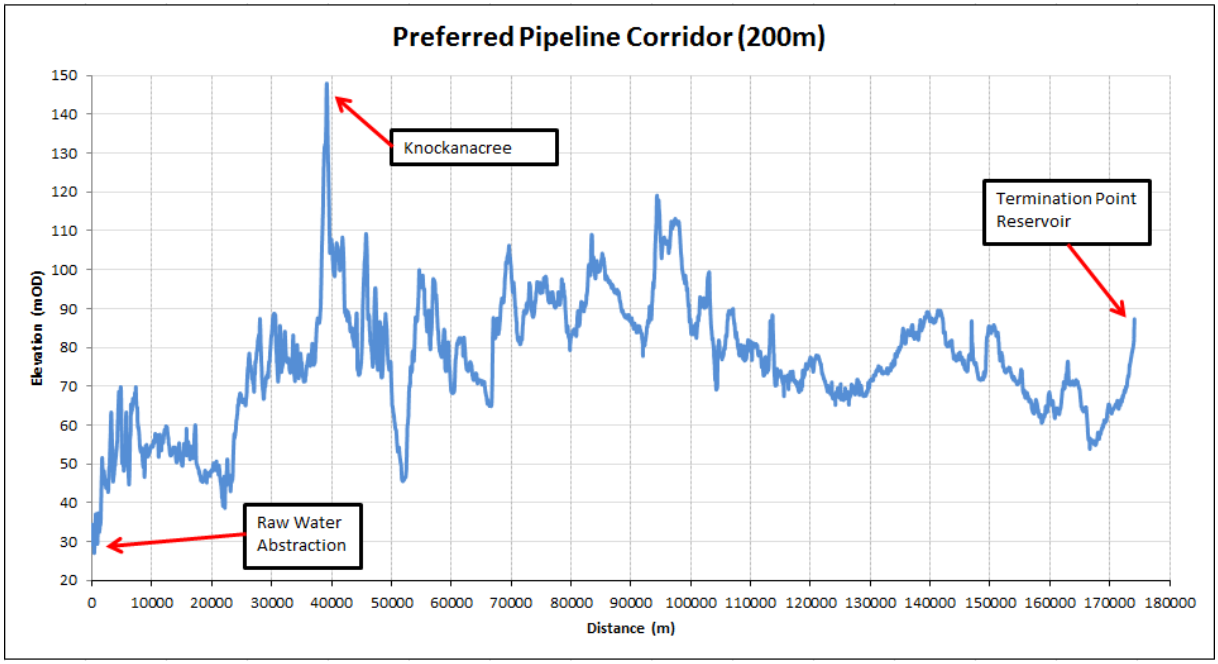


Figure 11.8 – Indicative Ground Elevation (Location 1) of Transmission Pipeline

11.5.2 Appraisal of BPT Sites

Local constraints were considered in the Knockanacree area, subject to satisfying the primary selection criteria (minimum elevation >125mOD). Three sites were identified, as shown in Figure 11.9 and a MCA undertaken for each of them.

Figure 11.9 - BPT Sites at Knockanacree

The appraisal of the three sites, in identifying a preferred BPT location, is presented in this Section.

11.5.3 BPT Sites – MCA Comparison

The 3 BPT sites were subject to MCA analysis, employing the methodology outlined in Section 11.1. A summary of the analysis is presented in Table 11.4.

Table 11.4 – MCA – Comparison between BPT Sites

Constraint	BPT Site 1	BPT Site 2	BPT Site 3
Terrestrial Ecology			
Aquatic Ecology			
Surface Water			
Air Quality			
Noise			
Cultural Heritage			
Landscape and Visual			
Agronomy			
People			
Soils, Geology & Hydrogeology			
Planning Policy			
Traffic			
Engineering & Design			
Overall Ranking	**3**	**2**	**1**

With reference to the appraisal criteria presented in Table 11 3, where the sites are ranked in order of preference and least constraint, BPT Site 3 represents the preferred location for the siting of the Break Pressure Tank for the following reasons:

- It is on a side of the ridge that is less inclined than the other two sites which will facilitate integration of the works into the existing landscape. It would also be screened by the forestry.
- The works associated with the communications mast appear to have been completed whilst maintaining an access through this area. This may suggest previous investigations concluded that was an area of least constraint.
- It maintains its elevation relative to the termination point thereby giving greater flexibility for routing a pipeline whilst still retaining a delivery under gravity.
- Of the three sites it appears, from the various Specialist assessments, to have the least impact collectively.

BPT Site 1 was considered to have the most impact as it would have to be located on the more steeply inclined side of the ridge; and would be difficult to integrate sensitively into the landscape. The final elevation may have to be dropped to affect this, which impacts on the system operation to deliver a gravity supply.

Similarly to the other sites it is the effectiveness of siting this component of infrastructure within the landscape. Whilst the site topography would be more accommodating than BPT Site 1 it is not as favourable as BPT Site 3; the completed works would also have to be at a lower elevation.

Note: the ridge is prominent in the landscape and has a number of recorded archaeological sites. It is important that before a final site for the BPT is selected, in situ investigation be carried out to confirm, or otherwise, the extent of archaeological remains.

11.6 Termination Point Reservoir

A critical piece of infrastructure within the water supply and distribution system is the ‘reservoir’, where clean water is stored after it has been treated in a water treatment plant, and before it is delivered to the end users. Its main purpose is to provide a buffer within the water supply system so that water supplies can be maintained across periods of varying demand.

The ‘reservoir’ is the termination point for the WSP. As the main population centre in the Eastern and Midlands Region, the nation’s capital defines a significant proportion of the need within the region, and the focus for identifying a suitable site for the ‘reservoir’.

The dynamic, and balance, between hydraulic engineering and whole life cycle costs indicates that it would be preferable for the termination point site to be in an elevation range of between 70m and 80mOD. The POAR identified Peamount as the preferred site for the location of a Termination Point Reservoir (TPR).

11.6.1 Identification of TPR Site

The proposed TPR will be integrated with the existing facility at Peamount. To facilitate this integration, maintain system performance and operational flexibility, a termination point at Peamount would reflect the existing levels of the existing reservoir which has a top water level (TWL) of 87.5m. In addition, facilities adjacent to each other, or in close proximity, can benefit from less complex control systems, and minimise extent of likely construction ‘footprint’. On the basis of the foregoing a single location for the TPR site was identified; see Figure 11.10.

Figure 11.10 – TPR Site

The indicative location of this TPR site is gently sloping from east to west (see Figure 11.11); and could be readily integrated into its environs similarly to the existing facility.

Figure 11.11 –TPR Site Elevation Map

11.6.2 Appraisal of TPR Site

A summary of the MCA analysis for the TPR site is presented in Table 11.5 below.

Table 11.5 – MCA – TPR Site

Constraint	TPR Site 1
Ecology	
Surface Water	
Air Quality	
Noise	
Cultural Heritage	
Landscape and Visual	
Agronomy	
People	
Soils, Geology & Hydrogeology	
Planning Policy	
Traffic	
Engineering & Design	
Overall	N/A

The MCA assessment confirmed that the proposed TPR site was a suitable location.

There are a number of additional benefits:

a) A supply to Peamount, discussed further in Section 11.7, maximises the natural topography to bring water from the WTP; limiting the requirement for boosting of flows through other means, i.e. pumping plant;

b) The topography of Peamount allows a TPR site at this location to be readily integrated into its environs;

c) A site at Peamount facilitates integration with both the existing water distribution system, and future proposals being planned by Irish Water in the Dublin Water Supply Area (see Section 11.7).

11.7 Integration into Dublin Network

The Termination Point Reservoir is to be integrated with Irish Water's existing facility at Peamount, south Dublin.

Two of the principal water treatment facilities for the Dublin Water Supply Area (DWSA), both dependent on the River Liffey catchment, are:

- Ballymore Eustace (BME) Water Treatment Plant which abstracts water from an upper stretch of the River Liffey; and
- Leixlip Water Treatment Plant – which abstracts water from a middle stretch of the River Liffey

Whilst there is no direct interconnectivity between BME and Leixlip, Irish Water have proposals in place to rectify this; in order to improve the resilience of the greater supply and distribution system within the Dublin Water Supply Area. Peamount represents a strategic link in achieving this objective.

A Termination Point Reservoir at Peamount will facilitate the transfer of treated water into distribution; or for onward conveyance to other strategic parts of the DWSA network, to augment the supply/ demand imbalance and provide the necessary resilience.

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

12. Preferred Scheme – Transmission Pipeline

As outlined in Section 11 there are a number of infrastructure components that collectively make up the water supply system. These can broadly be defined as:

The Transmission Pipeline (Linear Infrastructure), and

Other (Non – Linear Infrastructure)

Section 11 describes the methodology of site appraisal for the different components of infrastructure, and how that has been applied in bringing the characteristics of each site into formalised comparison in the MCA process and in the MCA table. In doing this, Section 11 and Appendices E to H provides a high level view of how these Non – Linear Infrastructure components interact with the main categories of Environmental Impact Assessment, and have included that information for:

Intake and Raw Water Pumping Station

Water Treatment Plant

Break Pressure Tank

Termination Point Reservoir

This Section 12 is concerned with the Transmission Pipeline (Linear Infrastructure), and similarly its impact on its environment, using the adopted multi-criteria analysis (MCA) outlined in Section 11.1.

12.1 Background

The Preliminary Options Appraisal Report (POAR) identified a “Least Constrained Route Corridor” (2km wide) for siting a supply main, between the water treatment plant and the termination point.

The methodology employed in siting this supply main was documented in the POAR, *Appendix B: Site Selection Methodology*; and its implementation on the Water Supply Project included in its *Appendix F*.

The POAR *Site Selection Methodology*, amongst other things, sets out a 5 step process for identification of pipeline corridors, via a multi-criteria analysis based on the principle of least constraint and the development of constraint mapping, with the objective of determining an “Indicative 50m Pipeline Corridor”

In this regard the “2km Least Constrained Route Corridor” identified in the POAR represented Step 2 in the site selection methodology (Figure 12.1).

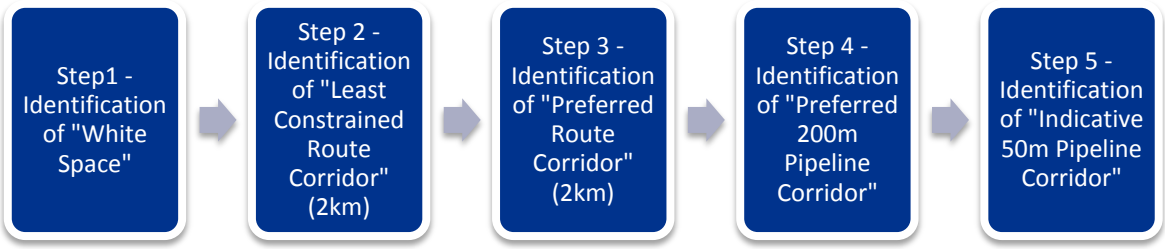


Figure 12.1 - "Linear Corridor Methodology" Process Flow Summary, *Site Selection Methodology*

Since publication of the POAR Step 3, Identification of "Preferred Route Corridor" and Step 4 Identification of "Preferred 200m Pipeline Corridor" have been completed, and are presented in Sections 12.2, 12.3 and 0.

Step 5 in discussed in Section 12.5

12.2 Identification of "Preferred Route Corridor" (2km)

Step 3 of the *Site Selection Methodology* details the methodology employed in confirming the "Preferred Route Corridor" (2km wide); and is based on incorporation of the feedback from the public consultation on the "Preliminary Route Corridors" and "Least Constrained Route Corridor" identified/ consulted upon for Step 2 of the process.

As part of the POAR public consultation process, feedback was received from a number of stakeholders on the "Least Constrained Route Corridor". This feedback formed the basis for a detailed review undertaken by the project team of the "Least Constrained Route Corridor". The review resulted in a number of refinements to this corridor; detailed in Sections 12.2.1 to 12.2.5 below.

The review was supported by site visits onto the lands that potentially could be affected by the proposed scheme, field surveys arranged in consultation with landowners.

Note: The "Least Constrained Route Corridor" was informed by 'desktop' investigation, and contrasts with the development of a 200m corridor which is required to 'prove' a technically viable route. The methodology employed in identification of the 200m corridor is outlined in Sections 12.3 and 0.

It is also important to note that while the 2km corridor was established as 'least constrained' in the POAR, between nodal points and when taken on its overall length, this does not mean that it is fully optimised locally at every location along its route. Subsequent work outlined in Sections 12.2.2 to 12.2.5, outlines where local adjustments have been made, to achieve a locally less constrained position.

12.2.1 Parteen Basin (Lower Lake)

The western boundary of the "Least Constrained Route Corridor" was amended to accurately reflect the riparian boundary of Parteen Basin and the positioning of non-linear infrastructure sites (Section 11); as shown in Figure

12.2. The 2km least constrained corridor was broadened on the approaches to Parteen Basin, to include the areas within which the non-linear infrastructure sites were then proposed and sited, and assessed for 'least constraint' in their own right. Further work on pipeline routing, then concentrates on linking the preferred raw water intake site, with the preferred water treatment plant site as fixed points in this area.

Figure 12.2 – "Least Constrained Route Corridor" and "Preferred Route Corridor" at Parteen Basin

12.2.2 Annaghmore

Due to the high density of constraints identified in the area of Annaghmore, south of Tullamore (Co. Offaly), it was established that a "Preferred 200m Pipeline Corridor" would be difficult to route within the area originally identified for the "Least Constrained Route Corridor" (2km) alignment; as shown in Figure 12.3. The environmental constraints identified included:

- Groundwater vulnerability;
- Additional habitats (raised bogs);
- Woodland habitats; and
- Forestry

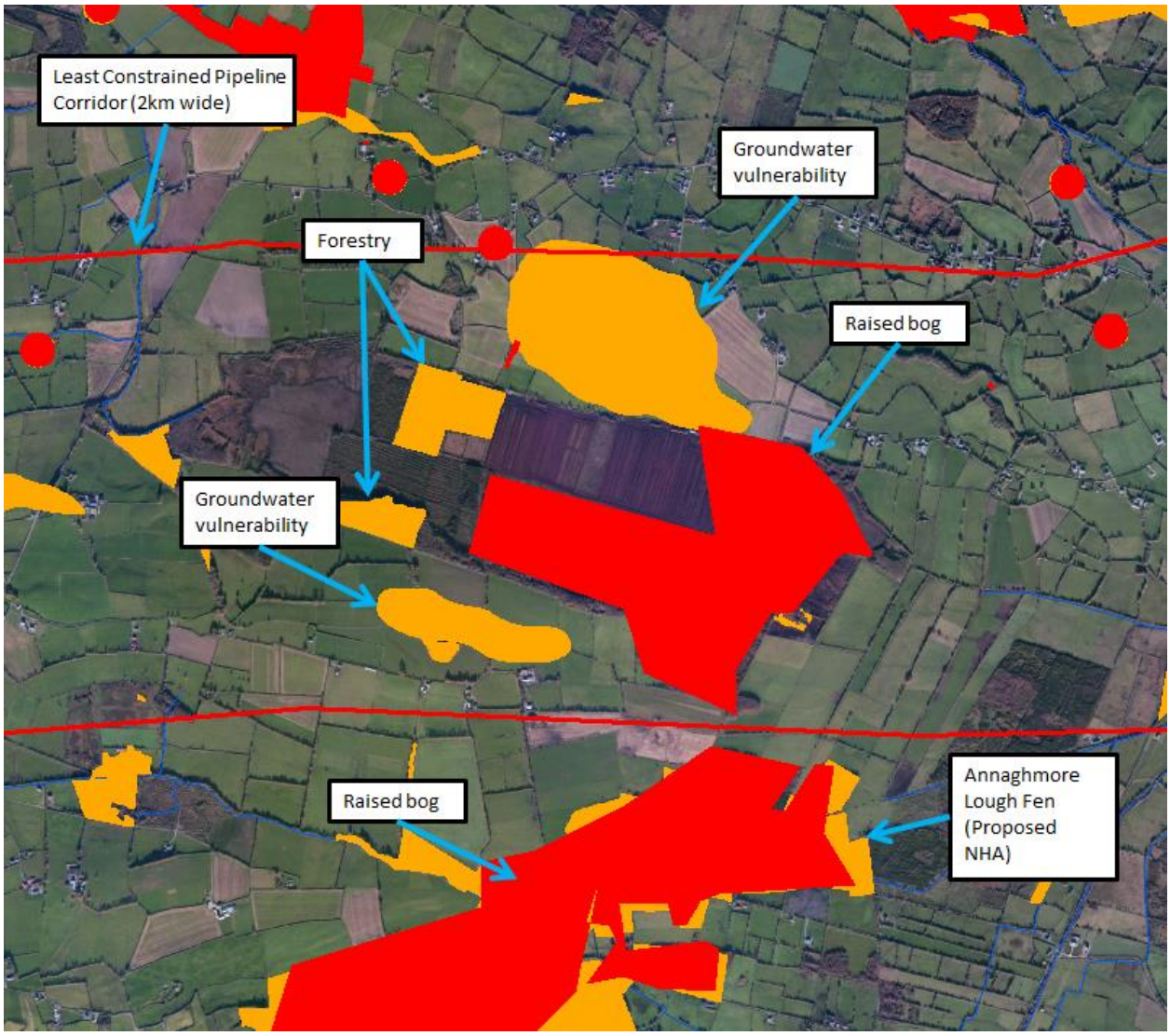


Figure 12.3 – "Least Constrained Route Corridor" at Annaghmore

A detailed review of this area was conducted and a minor positional amendment was made to the "Least Constrained Route Corridor", in consideration of these environmental constraints. The amended corridor allowed the identification of a 200m wide corridor in this area within the known constraints; and became part of the "Preferred Route Corridor" (2km). The amended corridor is re-positioned slightly south of its original position; as shown in Figure 12.4.

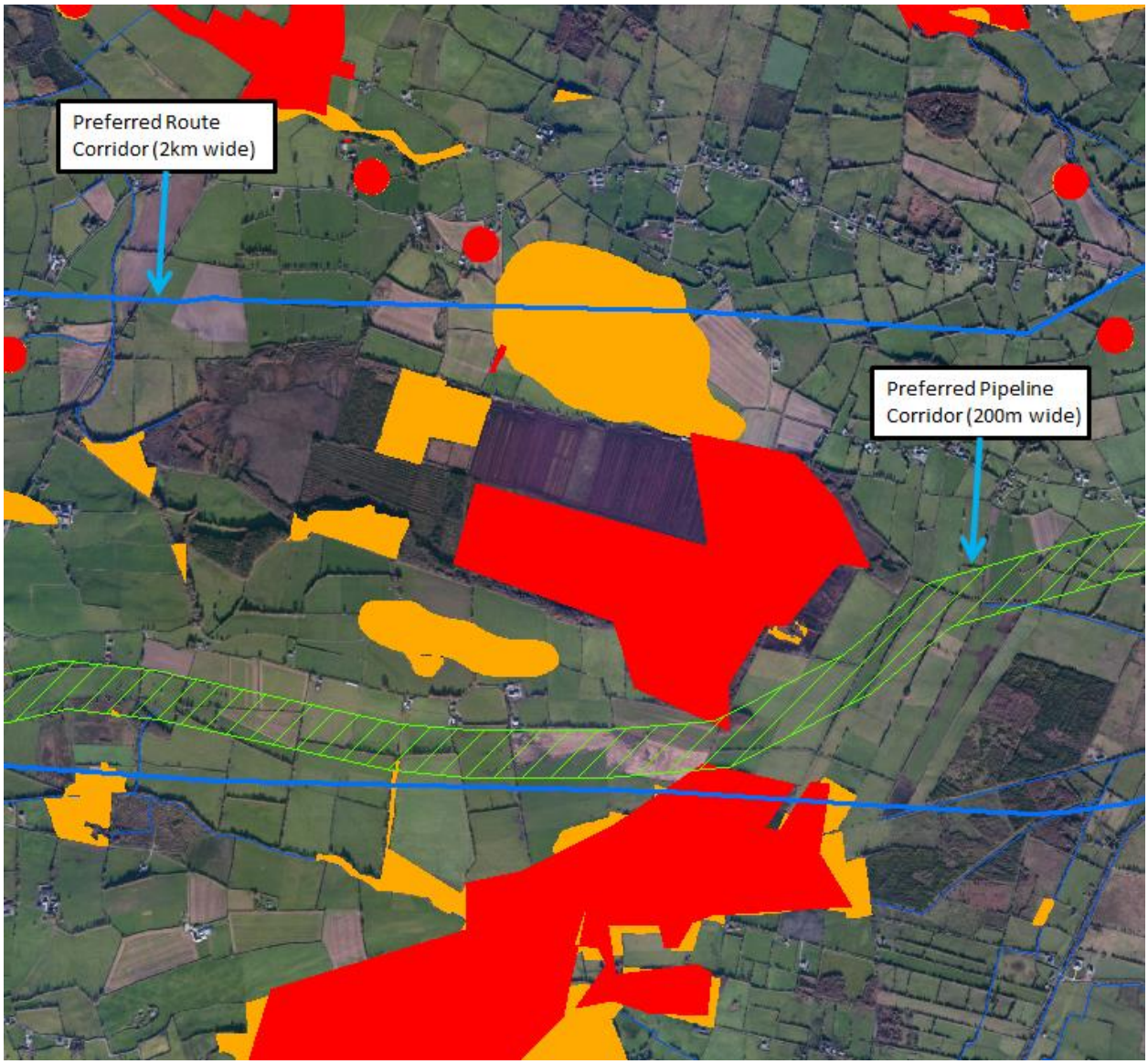


Figure 12.4 – "Preferred Route Corridor" at Annaghmore

12.2.3 Esker Bog

The positioning of the "Least Constrained Route Corridor", to the south west of Edenderry, was shown to pass directly through Esker Bog (see Figure 12.5). It was subsequently confirmed through stakeholder consultation that this bog is currently in production.

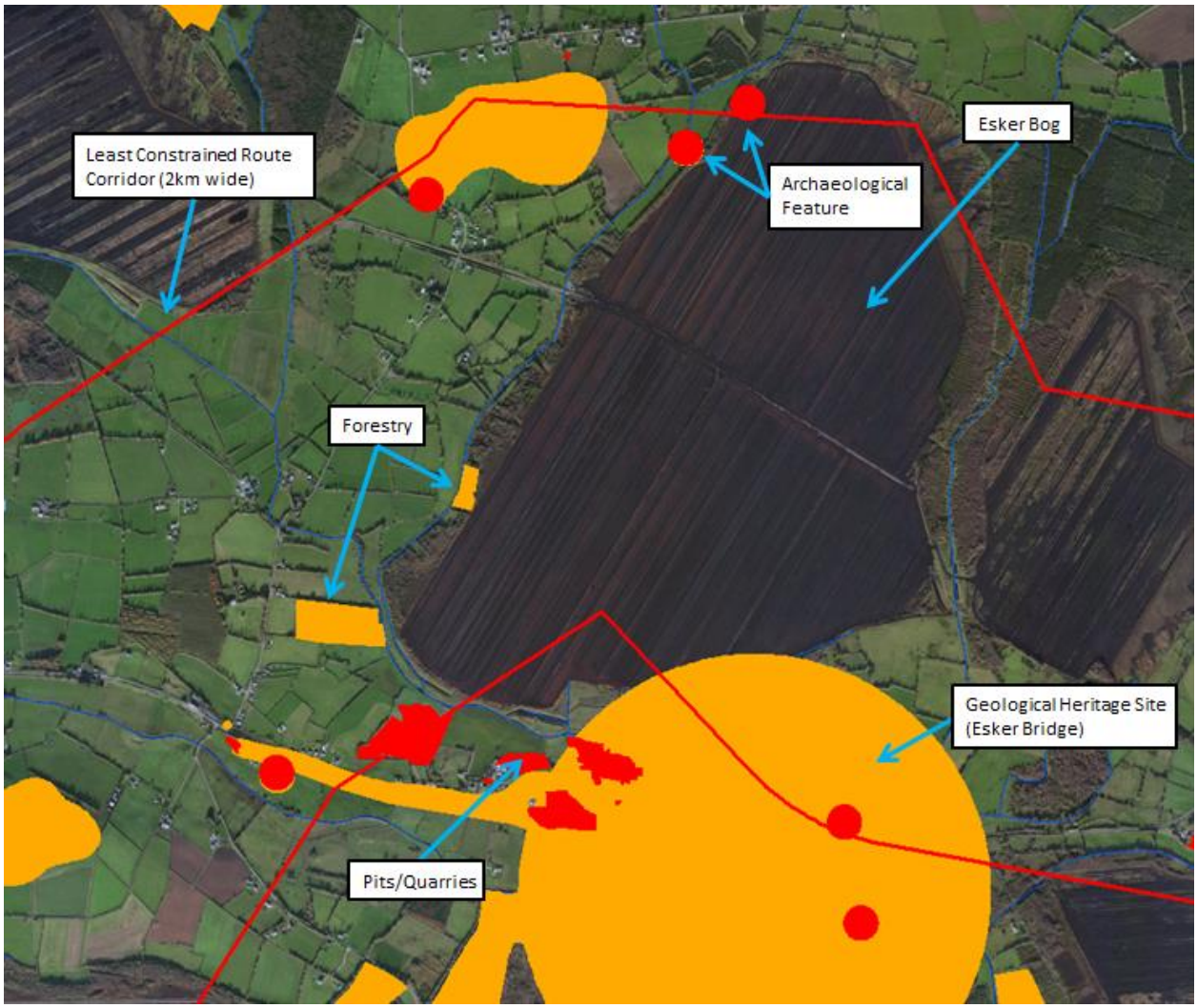


Figure 12.5 – "Least Constrained Route Corridor" at Esker Bog

Consequently, a detailed review of this area was conducted and realignment to the "Least Constrained Route Corridor" was proposed, enabling the identification of a 200m wide corridor in this area within the known constraints. The positioning of the 200m corridor is cognisant, and mitigatory, of the:

Impact on future habitat regeneration plans; and

Impact on active peat production lands

It was determined that the alignment should be re-positioned slightly south of the original location of the "Least Constrained Route Corridor, to allow a 200m corridor to skirt the boundary of the active bog workings (see Figure 12.6). It is noted that no new landowners are affected by this re-alignment. This became part of the "Preferred Route Corridor" (2km).

Figure 12.6 – "Preferred Route Corridor" at Esker Bog

12.2.4 Timahoe North Bog

The positioning of the "Least Constrained Route Corridor", to the south of Enfield, was shown to pass directly through Timahoe North Bog (see Figure 12.7). It was subsequently confirmed through stakeholder consultation that an existing wetland habitat in this area and a section of original undisturbed bog remnant should be avoided, in order to minimise impacts on these habitats.

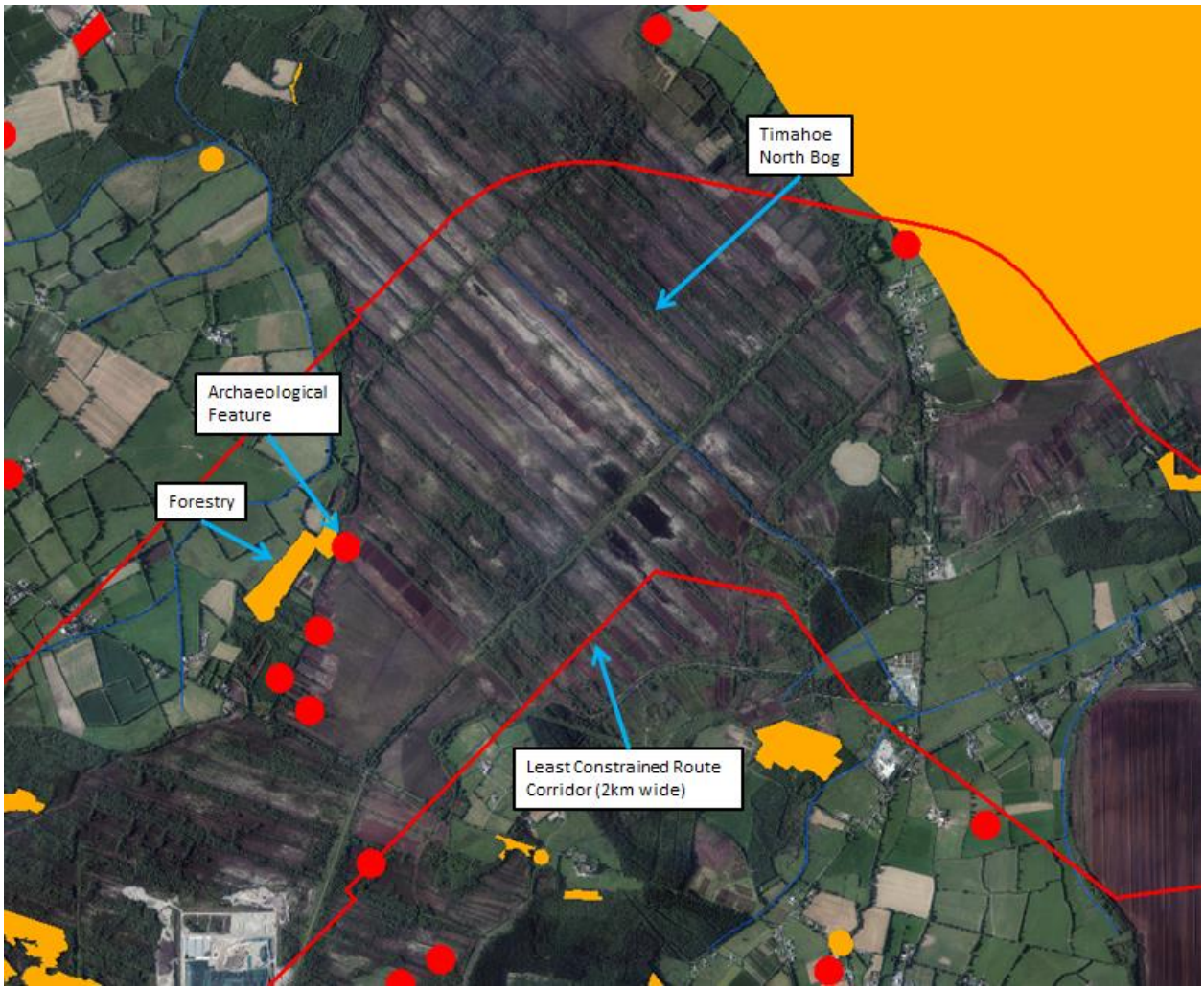


Figure 12.7 – "Least Constrained Route Corridor" at Timahoe North Bog

A detailed review of this area proposed a local amendment to the "Least Constrained Route Corridor", enabling the identification of a 200m wide corridor which would avoid the identified important habitat in this area. The positioning of the 200m corridor is cognisant, and mitigatory, of the:

Impact on existing wetland; and

Impact on original bog remnant

It was determined that the route should be re-positioned slightly south of its original location skirting the boundary of the bog (see Figure 12.8). It is noted that no new landowners are affected by this re-alignment. This became part of the "Preferred Route Corridor" (2km).

Figure 12.8 – "Preferred Route Corridor" at Timahoe North Bog

12.2.5 North Kildare

Feedback received during the POAR public consultation indicated that the positioning of the "Least Constrained Route Corridor", to the south of Maynooth, passed through an area of high constraint density, and directly through a number of large scale local enterprises (see Figure 12.9), which were not immediately identifiable through the earlier 'desktop' investigations. This local constraint density would make it difficult to route a 200m corridor, within the 2km alignment of the overall "Least Constrained Route Corridor".

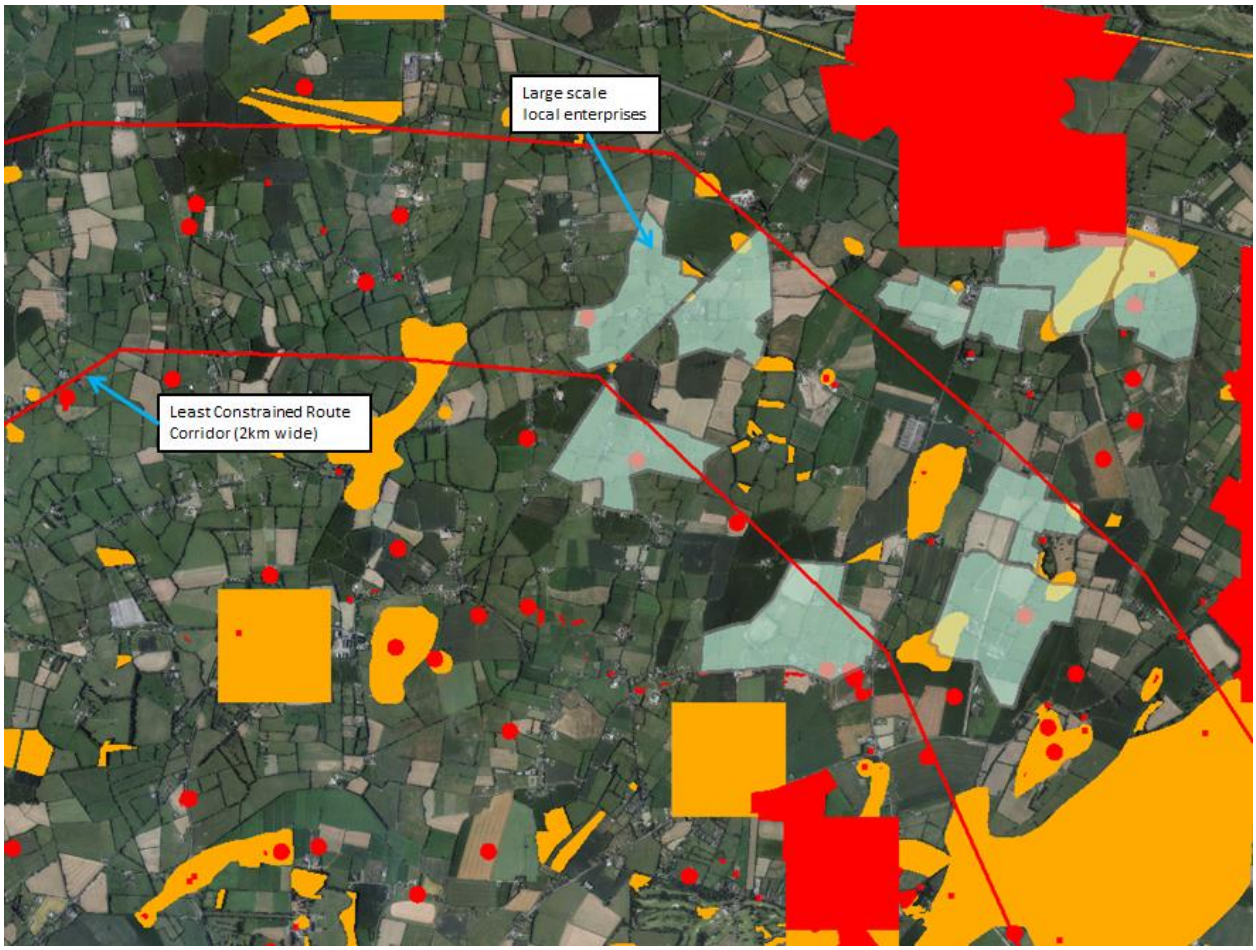


Figure 12.9 – "Least Constrained Route Corridor" in North Kildare

A re-assessment of the potential route corridors in this area, as shown in the area of the Barreen Loop in Figure 12.10, was carried out. These corridors were previously considered as part of the POAR published in November 2015.

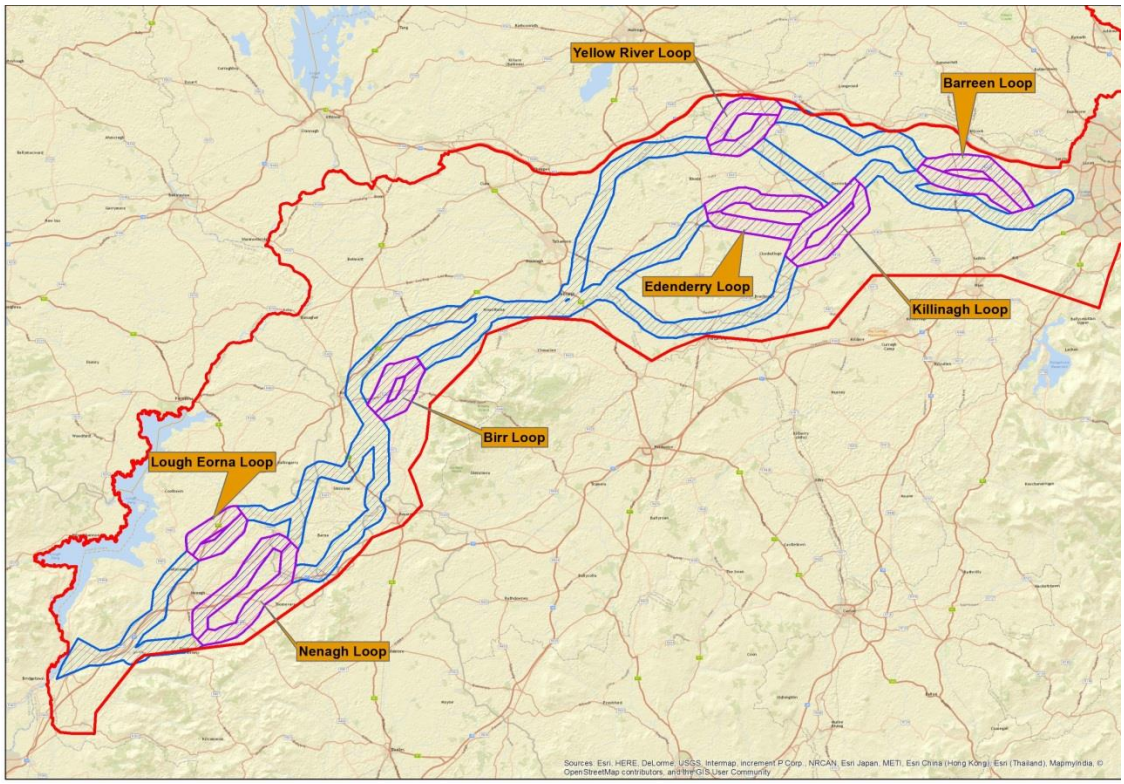


Figure 12.10 – Preliminary Route Corridors and Loops (POAR, November 2015)

As shown on **Figure 12.10** there were a number of options, and sub-options (loops) considered for routing a proposed water supply main. In North Kildare the Barreen Loop, which identified two potential route corridors, is pertinent to this re-assessment. The Multi-Criteria Analysis (MCA) process, originally developed in the POAR, identified the northern loop as the least constrained option for the following reasons:

- It encounters the lowest number of road crossings;
- The southern loop contains two County Geological Sites: Liffey Oxbow Lake and St. Patrick's Well;
- The southern loop contains areas of cutover bog; and
- Lower potential for air and noise impacts

In light of the additional information coming from the on-the-ground surveys, where the earlier conclusion drawn was that this northern loop was the least constrained, a re-examination of the Barreen Loop was conducted.

It was concluded through the MCA, which incorporated the latest up-to-date constraint datasets, that a "Preferred Route Corridor" should incorporate some areas of both the northern and southern stretches of this Barreen Loop, as shown in Figure 12.11.

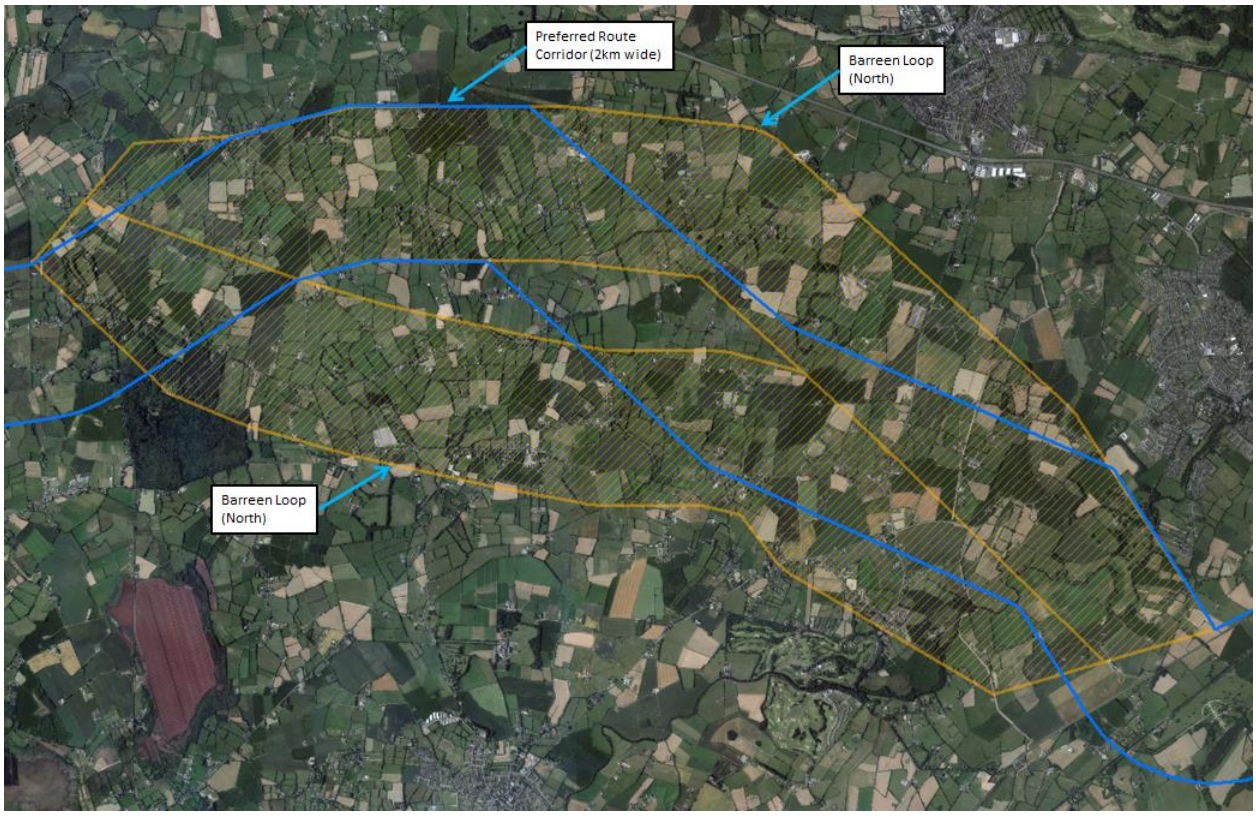


Figure 12.11 – "Preferred Route Corridor" in North Kildare

12.2.6 Summary – Refining the "Least Constrained Route Corridor" (2km)

The POAR identified a "Least Constrained Route Corridor (2km).

Subsequent to feedback from the public consultation on the POAR, and other stakeholders, site visits onto the lands that potentially could be affected by the proposed scheme, and field surveys arranged in consultation with landowners, a number of corrections to the alignment were made to this "Least Constrained Route Corridor (2km). These corrections were made at the following locations:

- Parteen Basin (Lower Lake) (Section 12.2.1)
- Annaghmore (Section 12.2.2)
- Esker Bog (Section 12.2.3)
- Timahoe North Bog (Section 12.2.4)
- North Kildare (Section 12.2.5)

The "Least Constrained Route Corridor (2km), incorporating the re-alignments at Parteen basin (Lower Lake), Annaghmore, Esker Bog, Timahoe North Bog and North Kildare, is the **"Preferred Route Corridor" (2km)**. Refer to Appendix I for mapping.

12.3 Constraints Mapping – "Preferred 200m Pipeline Corridor"

For Step 4 of the linear infrastructure site selection process (see Figure 12.1) the following Specialists/ specialisms were engaged:

- Engineering
- Cultural Heritage
- Ecology
- Noise & Vibration
- Air Quality
- Traffic
- Landscape and Visual
- Agronomy
- Soils/Geology
- Water Quality/Hydrology
- Hydrogeology

The selection of the "Preferred 200m Pipeline Corridor" is based upon the following:

- Constraints, or datasets, are mapped and assigned a red or amber classification by the Specialists/ specialisms (Section 12.3.1); and
- Consideration of technical constraints/requirements including obstructions, ground conditions, accessibility, idealistic elevation and landowner impact (Section 12.3.2).

Step 4 is a further refinement of the site selection process.

12.3.1 Constraints Classification by Specialists

A list of constraints was compiled, classified on the basis of potential impact, by each of the project specialists and incorporated within a GIS database. The following classification system was adopted:

Table 12-1 Classification System

Colour	Classification	Criteria
Red	High	Avoid unless no alternative available
Amber	Medium	Avoid where possible
Green	Low	Minimal impact if encountered

A comprehensive list of constraint datasets is outlined in Appendix I. These were assessed in further detail, and augmented with a number of technical constraints (see Section 12.3.2), to define a viable 200m wide pipeline corridor.

Using the refined data sets, Specialists were employed on the following basis:

1) Individual Specialists were engaged to independently assess the routing option relative to the criteria applicable to their field of expertise, and establish an initial position on the least impact.
2) The initial position of each Specialist was collated and their collective findings presented in a workshop setting.
3) In this workshop setting, the collective findings were discussed to reach a consensus of agreement on a least constrained route

12.3.2 Technical Constraints

The engineering constraints used to augment the environmental constraints were:

- Obstructions;
- Ground Conditions;

- Accessibility;
- Idealistic Elevation; and
- Landowner Impact.

12.3.2.1 Obstructions

Any proposed engineering solution will be directly influenced by the number of physical obstructions impacting the pipeline alignment, e.g. properties (domestic/non-domestic), roads, rivers, railways, etc.

The 'Preferred 200m Pipeline Corridor' will have multiple crossings of major obstructions (e.g. national, primary & secondary roads, major rivers and railways) and minor crossings (e.g. local and regional roads, minor rivers and streams). The engineering intent was to keep the number of these crossings to a minimum.

12.3.2.2 Ground Conditions

The assessment considered the potential ground conditions; in particular, it endeavoured to avoid areas of poor ground (e.g. peat, lake deposits, soils containing alluvial or fluvioglacial deposits, and shallow rock or karst features), wherever possible.

Challenging soil types introduce additional constructability issues e.g. establishing a firm foundation; and can require extensive ground improvement measures (both temporary and permanent) to ensure a robust design. From experience, these soils often require large scale dewatering works during the construction phase. The use of expensive ground stabilisation options, such as mechanically stabilized geogrids and piling, may be necessary.

Likewise, rock, where encountered, can be a challenge requiring local engineering solutions; the use of rock-breaking is employed where shallow rock is encountered. Ground stabilisation, as outlined above and including grouting of voids, may be necessary where karst features are encountered.

12.3.2.3 Access

Sufficient access will be required along the route to allow the Contractor to undertake the works in a timely manner. The works will involve the use of large plant, equipment and materials. The national and regional road networks will be relied upon to facilitate access; subject to confirmation from Transport Infrastructure Ireland and Local Authorities as regards their suitability to facilitate construction activity, including load/width restrictions etc.; and may involve:

- upgrading the existing road network and
- construction of temporary access roads along the route

The identification of suitable access to the pipeline route can have a significant bearing on how construction traffic is managed, and by association, works sequencing. Ultimately, ease of access to the completed works is paramount for operation and maintenance.

12.3.2.4 Elevation Profile

In the development of a preferred route, the selected route will directly influence the engineering solution to be adopted; the ground, or elevation, profile is a critical parameter in this regard as it is a major factor in system operation. Through the constraint mapping, and MCA analysis, a number of observations were made on the route between the abstraction and termination points. The proposed route traverses north east from Parteen Basin Reservoir, but south of Nenagh town through the northern part of County Tipperary and into County Offaly. For the most part the elevation is on an upward trajectory, except for a 'dip' at the Little Brosna River, to a high point in the vicinity of the County Tipperary/ County Offaly border. The route continues to skirt the southern perimeter of County Offaly, maintaining a due east direction through County Kildare and onwards to the Termination Point Reservoir in County Dublin.

This route is typical of the general topography between the Parteen Basin (Lower Lake) and south County Dublin whereby the lands in County Offaly are higher relative to the abstraction and termination points. Consequently, any route through these lands means a high point becomes a key component of any engineering solution, and becomes an integral part of any design.

An engineering solution will look to make use of this topography; and will consider how this elevation can be integrated, and optimised, within the scheme.

Wherever the constraint mapping, and MCA analysis, permits it is preferable to use the topography to create a 'smoother' profile, i.e. one that limits the extent of undulation along the route. This can reduce engineering complexities in system design, and induce efficiencies in operation and maintenance practices.

12.3.2.5 Landowner Impact

A further refinement of the constraint mapping data sets incorporated An Post's Geodirectory which categorises each building as either residential or commercial located to within a metre. The 'Preferred 200m Pipeline Corridor' is aligned to be outside these created Geodirectory buffers.

The 40m buffer dimension reflects a conservative position on the footprint of residential properties/commercial premises and potential outbuildings; while ensuring a minimum buffer from residential dwellings such that construction impacts can be properly managed.

In developing the "Indicative 50m Pipeline Corridor" the extremity of the 50m was routed along the boundaries of fields (where possible) in order to reduce, or minimise, the overall impact of the route on landowners.

12.4 Preferred 200m Pipeline Corridor Selection Methodology

As outlined in Section 12.3 the constraint data sets were refined further to identify areas of least constraint from within the "Preferred Route Corridor" (2km) in order to reduce the study width from 2km to 200m. This reduced width is the 'Preferred 200m Pipeline Corridor'.

The following process was adopted in defining the 'Preferred 200m Pipeline Corridor':

1) The environmental and technical constraints were carried forward and refined within the GIS database;
2) Data from Ordnance Survey Ireland was also mapped to take account of additional buildings e.g. farmhouses, sheds, etc. not previously identified by Geodirectory.
3) Areas were excluded where a constraint, or combination of constraints, ("High" or "Medium" classification) were of sufficient extent to influence the routing of the 200m corridor.

One typical example showing the mapping of environmental constraints is provided in Figure 12.12.

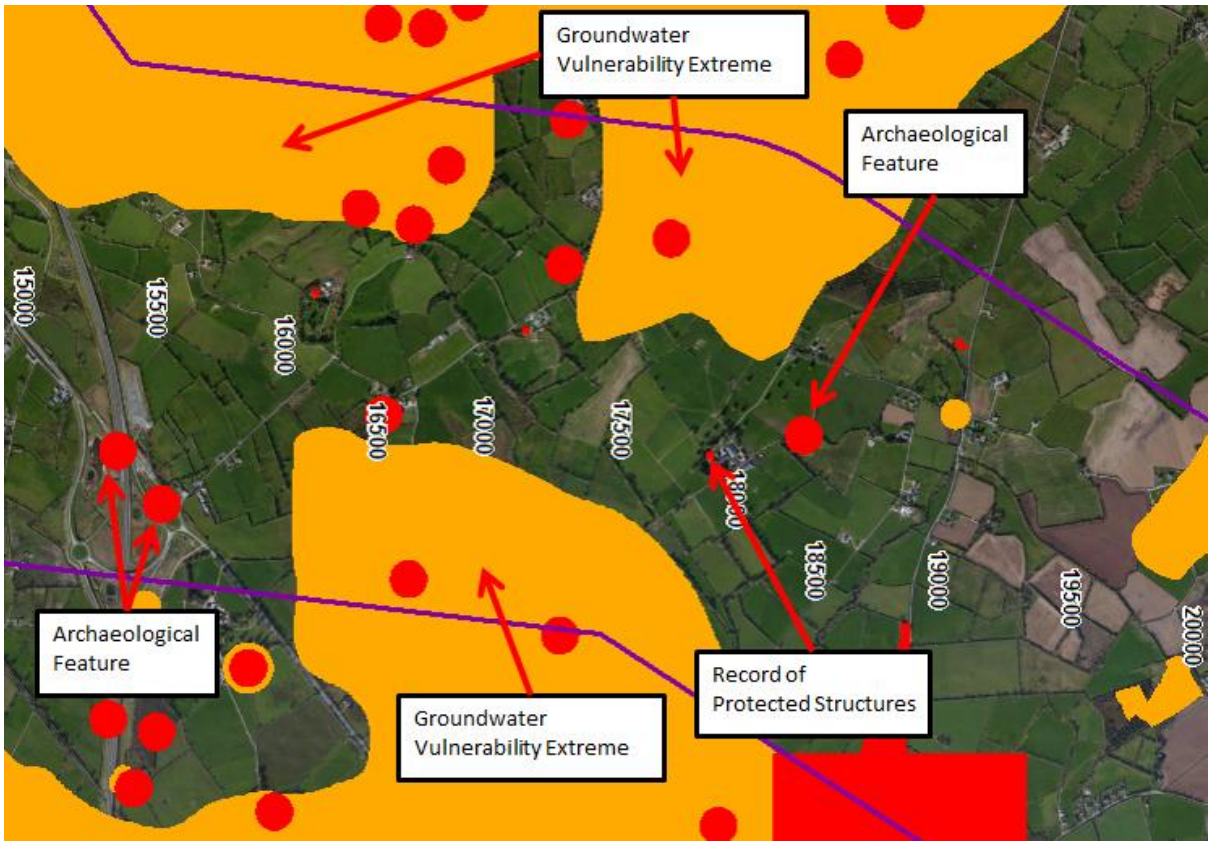


Figure 12.12 – Typical example of environmental constraints identified within the 'Preferred 200m Pipeline Corridor'

This mapping is developed further; technically (see Section 12.3.2) this may have involved, inter alia, the following:

a) Maintaining a pipeline elevation profile to optimise system (engineering) operation;

b) Avoidance of areas of poor ground, where possible;

c) Minimising the number of major obstructions such as road, rail and river crossings

d) Minimising landowner impact;; and

e) Ease of access, both during construction and operation, to the existing road infrastructure.

For the same area extent shown in Figure 12.12 the technical constraints are identified in Figure 12.13.

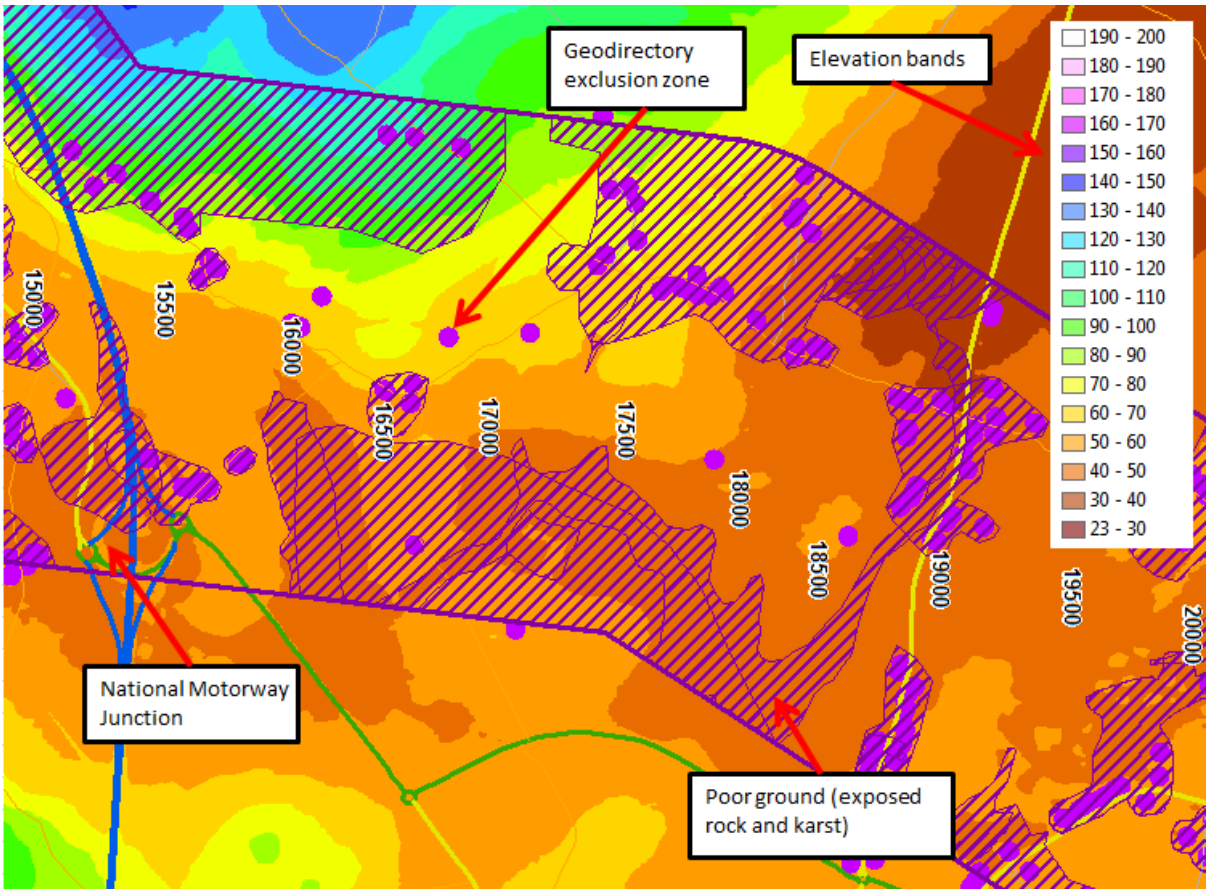


Figure 12.13 – Typical example of technical constraints identified within the 'Preferred 200m Pipeline Corridor'

The combined effect of environmental and technical constraints, informed the decision making process; see Figure 12.14.

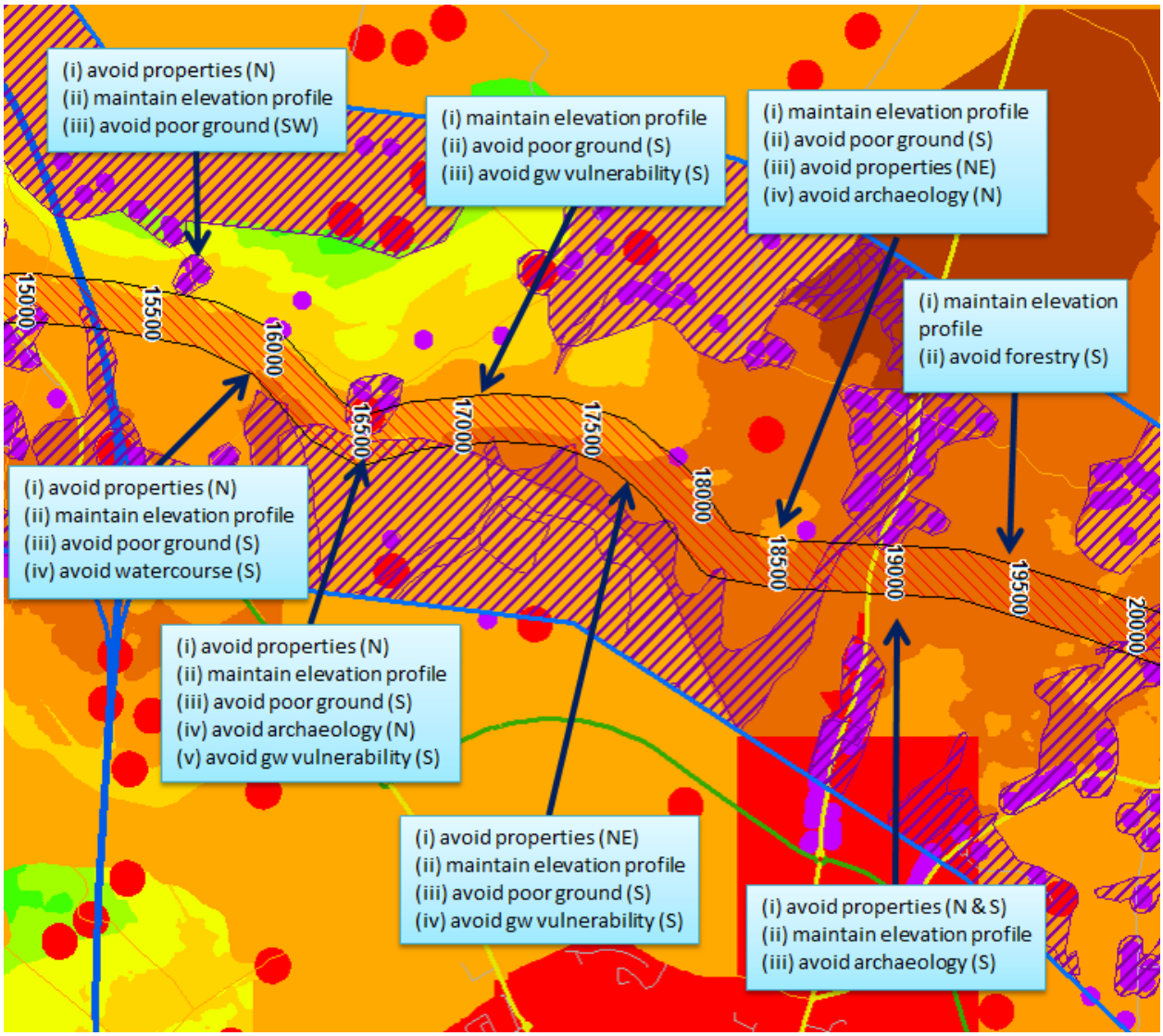


Figure 12.14 – Typical example of decision making process adopted in defining the 'Preferred 200m Pipeline Corridor'

This represented an initial desktop assessment into the identification of a 'Preferred 200m Pipeline Corridor'; reached, by consensus, by the various Specialists/ specialisms

The assessment is an iterative process which affords each of the specialisms opportunity to promote constraints, categorise their importance, and ensure appropriate actions, mitigatory or otherwise, have been taken. Figure 12.15 gives a sample 'snapshot' of how information was recorded from Specialists; and the appropriate correction. *Note: the constraint classification, and consensus reached between specialisms, was paramount in confirming the desktop assessment of the 'Preferred 200m Pipeline Corridor'.*

Specialism Chainage	Biodiversity, Flora and Fauna (terrestrial)	Biodiversity, Flora and Fauna (Aquatic)	Landscape & Visual	Traffic and Transportation	Adjust Corridor
17500	Reduce no of hedgerows	Reduce no of stream crossings	several mature treeline between 17000 - 17500		Corridor adjusted to east between 17500-18500 to avoid mature treelines
18000			several mature tree stands tree lines to be avoided	Low Impact - crossing of local road approx chainage 18000	
18500					
19000			stream crossing and road crossing	Low Impact - crossing of R494 Regional Road approx chainage 19000	No change to corridor.
19500			Mature treelines and copse of trees		

Figure 12.15 – Sample - Specialist Assessments on the 'Preferred 200m Pipeline Corridor'

To validate the 'Preferred 200m Pipeline Corridor', further field investigation was carried out, between May 2016 and October 2016, where the Specialists surveyed this pipeline corridor. This was supported by landowner liaison and consultation with local stakeholders to avail of local advice and knowledge, and to establish known facts that may have a bearing on pipeline routing.

Subsequently, the in situ investigations have resulted in adjustments to the 'Preferred 200m Pipeline Corridor' as originally positioned using environmental and technical datasets, and Geodirectory; see Figure 12.16.

The 'Preliminary 200m Pipeline Corridor', incorporating adjustments from in situ investigations is the **"Preferred 200m Pipeline Corridor".** See Appendix I for mapping.

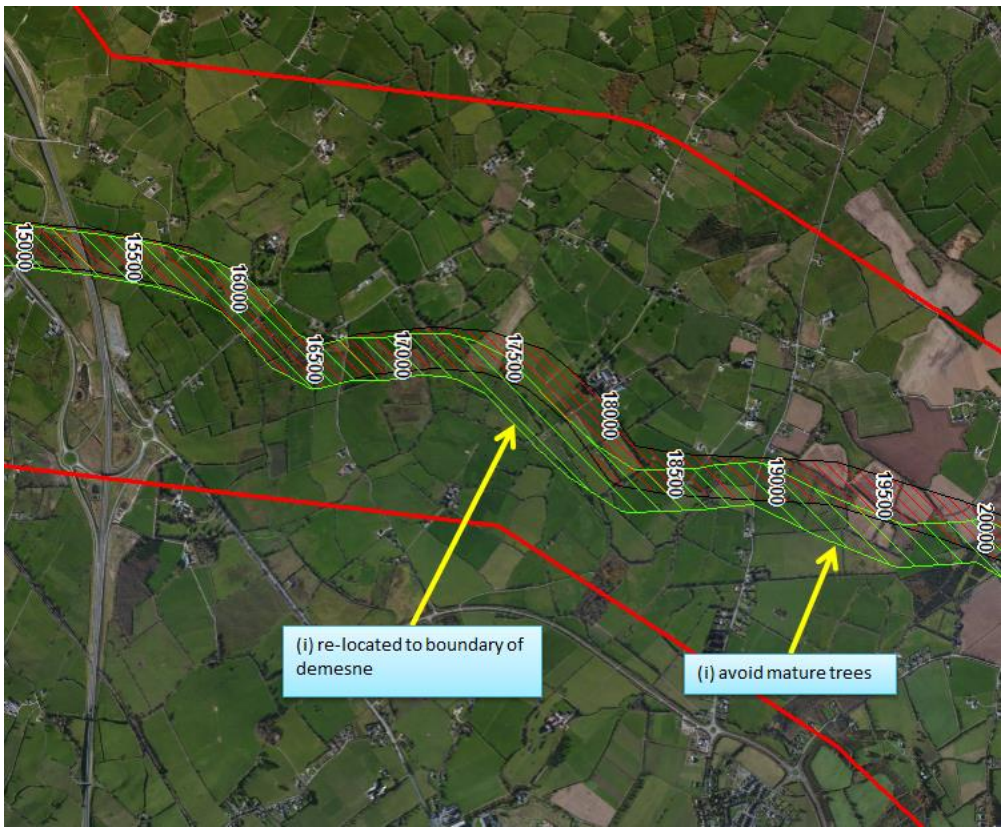


Figure 12.16 – Sample – Identification of 'Preferred 200m Pipeline Corridor' following Environmental Surveys

12.5 Indicative 50m Pipeline Corridor - Selection Methodology

The selection of the "Indicative 50m Pipeline Corridor", the next step in siting of the supply main, has been identified in consideration of known technical and environmental constraints, as well as feedback from landowners as part of the investigative surveys. The final corridor will be subject to the following:

- Feedback from the FOAR public consultation on the "Preferred 200m Pipeline Corridor", and actions arising;
- A further constraints/requirements mapping exercise with the inclusion of an extended constraints/requirements dataset, augmented by additional information upon completion of the environmental surveys, as required;
- Ongoing hydraulic design; and
- Ongoing consultation with landowners.

The "indicative 50m Pipeline Corridor" will be further developed and refined for positional adjustments arising from work outlined in this Section 12.5.

12.5.1 Public Consultation Feedback

This final consultative step in the process will consider, in particular, the public consultation on the "Preferred 200m Pipeline Corridor", any pertinent issues that may have arisen over the intervening period, the corrective actions taken, where required, but ensuring that at all times proposals are aligned with the environmental assessments.

> *Note: Design work is continuing on the "Indicative 50m Pipeline Corridor, within which the final pipeline position will be situated, and some changes are to be expected as part of that process. While such changes will take place after this fourth stage of non-statutory Public Consultation; engagement with affected landowners and communities will be an ongoing process, and the final position of the pipeline route will be part of the planning application documentation, on which An Bord Pleanála will conduct statutory consultation under the planning process.*

12.5.2 Environmental Surveys

Extensive field surveys are required to support the establishment of a robust environmental baseline. The extent and scope of these surveys were identified by the Specialists/ specialisms during the desktop review (during the preparation of the POAR), and undertaken in support of the identification of the 'Preferred 200m Pipeline Corridor' carried out for this FOAR. These surveys will continue, and support, a full and proper impact assessment of the "Indicative 50m Pipeline Corridor" and to enable suitable mitigation to be incorporated, as required.

The FOAR is offered for public consultation along with an *EIS Scoping Report*, where comments are invited on the scope and methodologies proposed for Environmental Impact Assessment on the preferred scheme.

12.5.3 Landowner Engagement

Landowner engagement is currently being carried out by Irish Water via Landowner Liaison Officers (LLOs). The function of LLOs includes relaying issues raised by landowners to the project team for consideration in the identification of the "Indicative 50m Pipeline Corridor.

Landowner engagement is currently being carried out by Irish Water via Landowner Liaison Officers (LLOs). The function of LLOs includes relaying issues raised by landowners to the project team for consideration in the identification of the "Indicative 50m Pipeline Corridor.

> *Note: The "Indicative 50m Pipeline Corridor" refers to the minimum easement required to facilitate construction of the works, generally; however it should be noted that additional space is likely to be*

required, at major road and other infrastructure crossings, and otherwise at intervals of approximately 500m to provide working and stockpiling space for surplus excavated materials.

Because of the large pipeline diameter and route curvature limitations, positional adjustments, where possible, will be undertaken in a collective way, taking these issues into account.

The “Indicative 50m Pipeline Corridor” represents the least constrained route for the construction of a supply main between the water treatment plant and the termination point reservoir, the point of connection to the Dublin Water Supply Area; primarily defined by extensive environmental constraint mapping, and optimised (engineering) to efficiently convey the treated water.

The final route will incorporate those line adjustments which are possible within the engineering constraints of a large diameter pipeline, and developed from a collective consideration of views expressed in consultation with each of the individual landowners, taking account of their advices with regard to their particular lands, and aligned to cause the least impact, during construction and operation.

12.6 Schedule of Drawings

The ‘Preferred 200m Pipeline Corridor’ and “Indicative 50m Pipeline Corridor” are presented in this Report (refer to Schedule of Drawings.

13. Concluding Statement

The Preliminary Options Appraisal Report (November 2015) identified two technically viable options for further study in this Final Options Appraisal Report, against the Project Need requirements, namely:

- Abstraction from the Shannon and Parteen, and
- Desalination of Seawater from the Irish Sea

Abstraction from the Shannon at Parteen was the original Option C in the SEA and Desalination was Option H in that document.

In this regard, the objectives of the Water Services Strategic Plan, to rationalise over time, in an affordable way, the multiple existing water supplies in the Midlands, many of which depend upon isolated, small and vulnerable sources, are relevant.

The Parteen Basin Option and the Desalination Option have quite different characteristics with respect to those objectives. Abstraction and treatment of water at Parteen, with transfer of treated water through the Midlands, provides a strategic basis for bringing more than 100 public water supplies serving Midlands and Eastern communities into a common standard of reliable water supply. Desalination, on the other hand, is a solution to the water quantity dimension of Need, only for Dublin alone, and it would call for a completely different, standalone and sub-optimal strategic approach to Midlands water supplies.

Option C, which involves abstraction from the Parteen Basin, includes the following key components

1. A raw water abstraction point at Parteen Basin;
2. A 330 Ml/d conventional water treatment plant in close proximity to the raw water abstraction point;
3. A supply main, approximately 170km in length between Parteen Basin and a termination point reservoir at Peamount, which is also capable of supplying communities en route.

Option H: Desalination includes the following key components:

4. A seawater abstraction, and brine return point, 3 to 4km off shore near Balbriggan;
5. A desalination plant at Balbriggan; and
6. A supply main, approximately 35km, between Balbriggan and Ballycoolin Reservoir.

Option C (Parteen Basin Direct) was identified as the ‘Emerging Preferred Option’ in the POAR as it offered a number of key distinct differences:

- A benefitting corridor through the Eastern and Midlands Region that is able to supply communities en route with a reliable and resilient source of supply;
- A sustainable abstraction regime which can be managed within the existing ESB operating works level range without prolongation of residence time on Lough Derg;
- Least risk in terms of environmental, technical, financial, economic and socio-economic factors;
- The direct cost of construction, commissioning and operation are considerably more economical to the consumer than the alternative; and
- Most likely to deliver the objectives of the Water Services Strategic Plan.

Public consultation and extensive stakeholder engagement were undertaken on the determination of Option C (Parteen Basin Reservoir Direct) as the 'Emerging Preferred Option' and on the siting of ancillary infrastructure associated with this option.

This consultative assessment, originally carried out on the POAR related to this 'Emerging Preferred Option', has been documented in this Final Options Appraisal Report. The Final Options Appraisal Report includes the following elements, which address issues raised in previous consultations:

a) A review of the submissions from the public consultation on the Preliminary Options Appraisal Report, and documentation of the manner in which this feedback, and that received in earlier stages of consultation, has influenced the development of the project;

b) A review of the supply – demand balance which underpins the Project Need;

c) A clear explanation of current management of water levels in Lough Derg/ Parteen Basin, showing how that abstraction can be accommodated without change to the existing normal operating water level range, regime;

d) An economic appraisal, and comparison, of abstraction from the Shannon with the desalination alternative and with reference to a 'Do Minimum' scenario, in the absence of investment in a new source

e) A water quality survey and model of Lough Derg (ongoing);

f) Field surveys, and Investigative studies, to identify and appraise potential areas for siting the infrastructure elements that would be needed for a scheme to be constructed. *Note – surveys and studies were carried out within a defined extent (typically 2km) which was determined, and consulted upon, in the Preliminary Options Appraisal Report.*

g) A multi-criteria analysis, following the field surveys and investigative studies, to inform the identification of those areas within which the potential exists to site the infrastructure required.

The FOAR has validated a 'waypoint interim review' of water demand, supported by detailed assessment of water supplies in the Benefitting Corridor, which is continuing. It has proposed a phasing approach to development of treatment and pumping capacity, so that capacity can match the expected profile of water demand. The FOAR has set out clearly, how abstraction at Parteen Basin can be managed within the existing hydropower station and water level operating regime of ESB, and how the limits of the normal operating water level range on Lough Derg/Parteen Basin, will not need to change in any way, to accommodate the abstraction. Similarly, statutory compensation flows to the River Shannon will not be changed under the proposed abstraction regime.

Supporting work by independent economists has established the cost-benefit characteristics of both main options, as well as those of a 'Do Minimum' option which would have to be pursued in the event that investment in a new source supply is not pursued. Option C, direct abstraction at Parteen Basin, has been found to have the best cost-benefit ratio of the options examined. Hydrodynamic modelling of the Lough Derg/ Parteen Basin waterbody has confirmed the preliminary conclusions of the POAR, based on uncalibrated modelling work at the time, that abstraction from the Parteen Basin will not have flow residence time impacts on Lough Derg.

The advantages offered by Option C (Parteen Basin Reservoir Direct) when compared to Option H (Desalination), originally identified in the Preliminary Options Appraisal Report and outlined above, are affirmed. The review of Midland water supplies, in the context of the strategic objectives of the Water Services Strategic Plan, have placed Option H (Desalination) in a less than 'like-for-like' comparable position, compared to Option C, in terms of meeting key strategic objectives of Irish Water. In addition, Option C represents the preferable investment choice; as it results in a higher net benefit than the alternatives.

It is accordingly concluded, and affirmed, following the foregoing detailed investigative assessment that **Option C (Parteen Basin Direct) is the Preferred Scheme**.

14. Next Step

Phase four of the consultation process has now begun with the publication of the Final Options Appraisal Report (FOAR) and the Environmental Impact Statement (EIS) Scoping Report. The Final Options Appraisal Report (FOAR) confirms that the preferred scheme is:

- Abstraction of water from the Lower Shannon at Parteen Basin
- Water treatment nearby at Birdhill
- Treated water piped to a termination point reservoir at Peamount in South County Dublin, with supplies of treated water available to Midland communities along the route.

The EIS Scoping Report considers potential issues which may arise from the preferred scheme and describes how any impacts will be assessed.

We are now undertaking a 14 week non-statutory public consultation on these two reports and invite submissions from the general public and key stakeholders. During the consultation period a number of landowner evenings and eight public open days will be held at various locations along the proposed pipeline route where members of the project team will be available to answer any questions.

Following on from the conclusion of the consultation process in early 2017, Irish Water will be in direct contact with landowners affected by the proposed pipeline route.

The feedback from this consultation period alongside further technical and environmental studies and engagement with landowners and the general public will inform the selection of the final scheme. This will be detailed in the EIS and will accompany Irish Water's planning application to An Bord Pleanála.

An Bord Pleanála will undertake all necessary statutory consultations on the Planning Application, including Oral Hearings where the views of all parties will be heard by the Board., following which An Bord Pleanála will determine whether consent should be granted.

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Schedule of Drawings

Preferred 200m Pipeline Corridor &

Indicative 50m Pipeline Corridor

Drawing No.	Title	Map
32105801-FOAR-100	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	1 of 90
32105801-FOAR-101	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	2 of 90
32105801-FOAR-102	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	3 of 90
32105801-FOAR-103	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	4 of 90
32105801-FOAR-104	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	5 of 90
32105801-FOAR-105	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	6 of 90
32105801-FOAR-106	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	7 of 90
32105801-FOAR-107	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	8 of 90
32105801-FOAR-108	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	9 of 90
32105801-FOAR-109	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	10 of 90
32105801-FOAR-110	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	11 of 90
32105801-FOAR-111	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	12 of 90
32105801-FOAR-112	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	13 of 90
32105801-FOAR-113	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	14 of 90
32105801-FOAR-114	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	15 of 90
32105801-FOAR-115	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	16 of 90
32105801-FOAR-116	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	17 of 90
32105801-FOAR-117	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	18 of 90
32105801-FOAR-118	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	19 of 90
32105801-FOAR-119	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	20 of 90
32105801-FOAR-120	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	21 of 90
32105801-FOAR-121	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	22 of 90
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32105801-FOAR-123	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	24 of 90
32105801-FOAR-124	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	25 of 90
32105801-FOAR-125	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	26 of 90
32105801-FOAR-126	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	27 of 90

Drawing No.	Title	Map
32105801-FOAR-127	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	28 of 90
32105801-FOAR-128	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	29 of 90
32105801-FOAR-129	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	30 of 90
32105801-FOAR-130	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	31 of 90
32105801-FOAR-131	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	32 of 90
32105801-FOAR-132	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	33 of 90
32105801-FOAR-133	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	34 of 90
32105801-FOAR-134	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	35 of 90
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32105801-FOAR-136	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	37 of 90
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32105801-FOAR-141	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	42 of 90
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32105801-FOAR-156	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	57 of 90
32105801-FOAR-157	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	58 of 90
32105801-FOAR-158	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	59 of 90

Drawing No.	Title	Map
32105801-FOAR-159	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	60 of 90
32105801-FOAR-160	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	61 of 90
32105801-FOAR-161	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	62 of 90
32105801-FOAR-162	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	63 of 90
32105801-FOAR-163	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	64 of 90
32105801-FOAR-164	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	65 of 90
32105801-FOAR-165	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	66 of 90
32105801-FOAR-166	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	67 of 90
32105801-FOAR-167	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	68 of 90
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32105801-FOAR-169	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	70 of 90
32105801-FOAR-170	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	71 of 90
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32105801-FOAR-172	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	73 of 90
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32105801-FOAR-186	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	87 of 90
32105801-FOAR-187	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	88 of 90
32105801-FOAR-188	Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor	89 of 90
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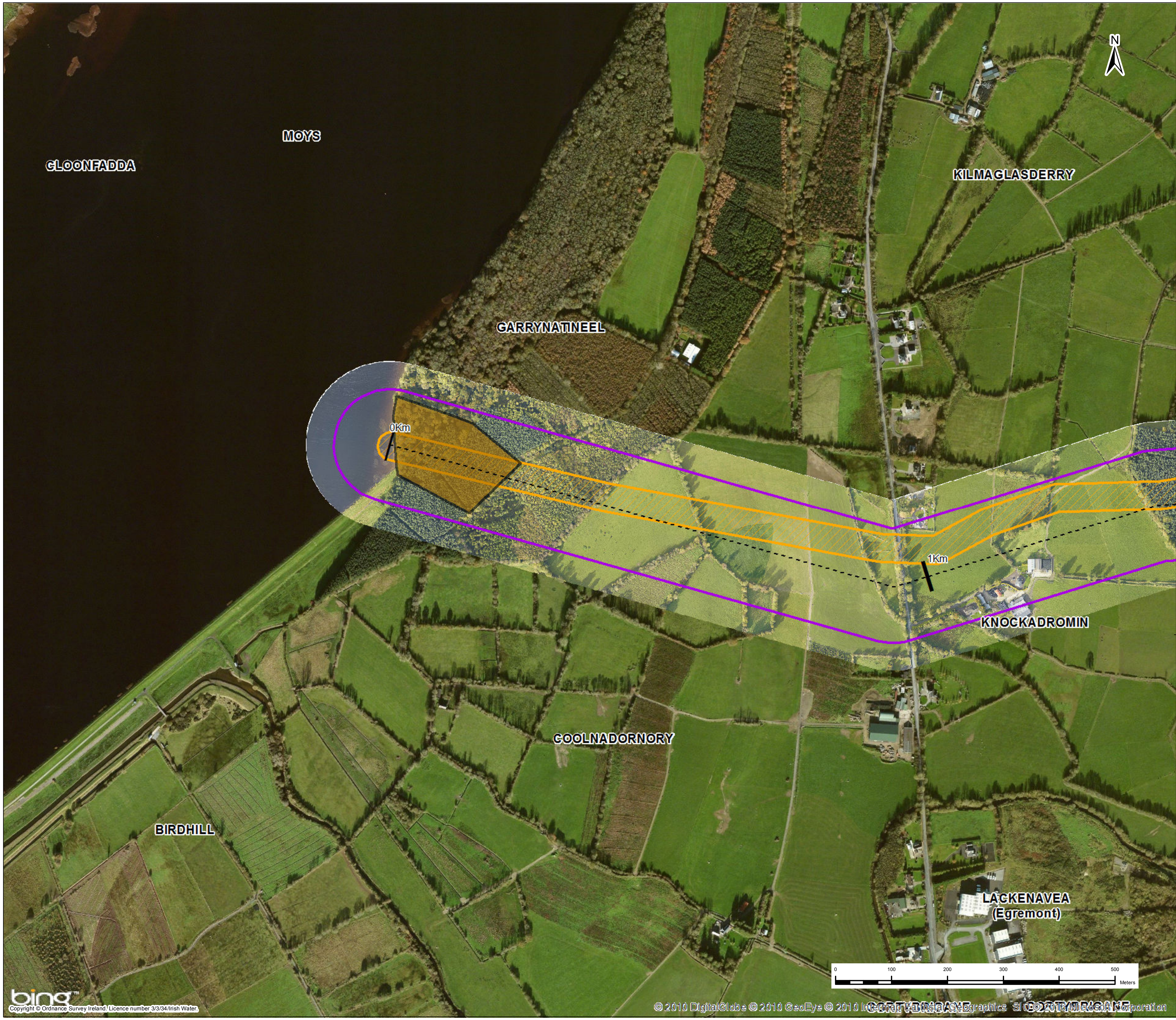

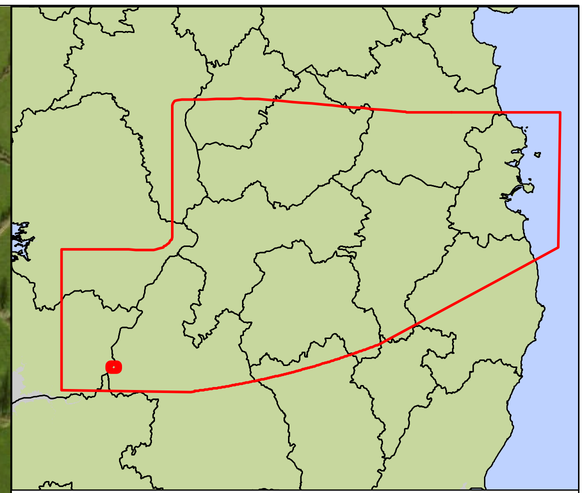

Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS — TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN : IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

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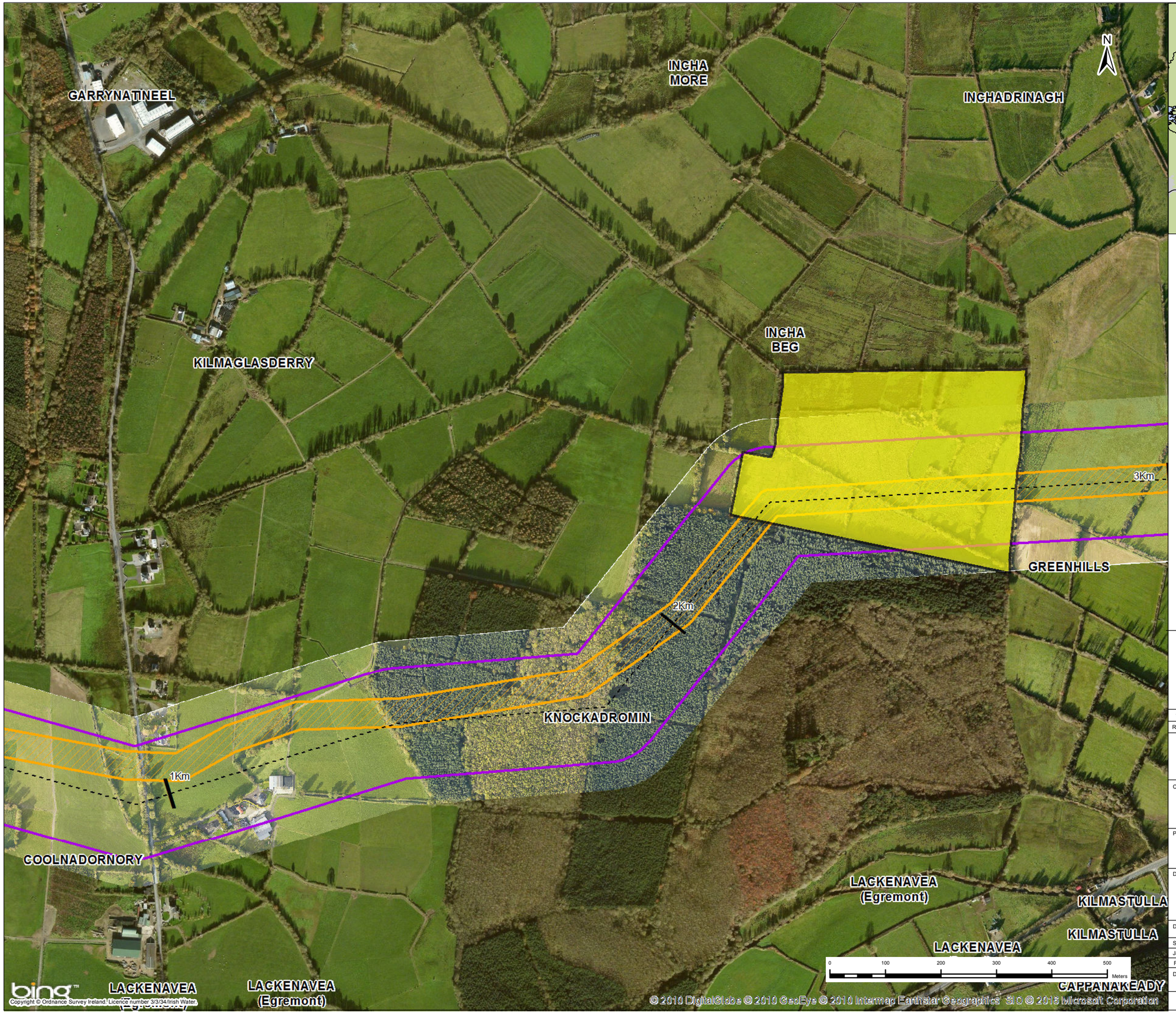

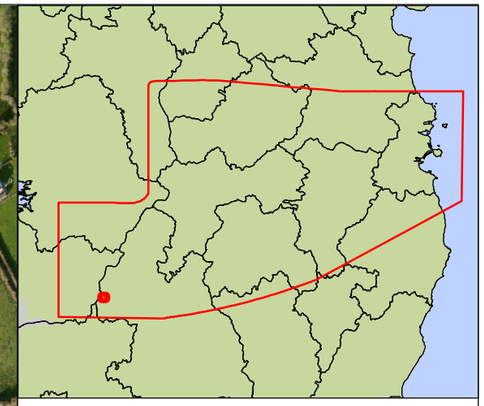

Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
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1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

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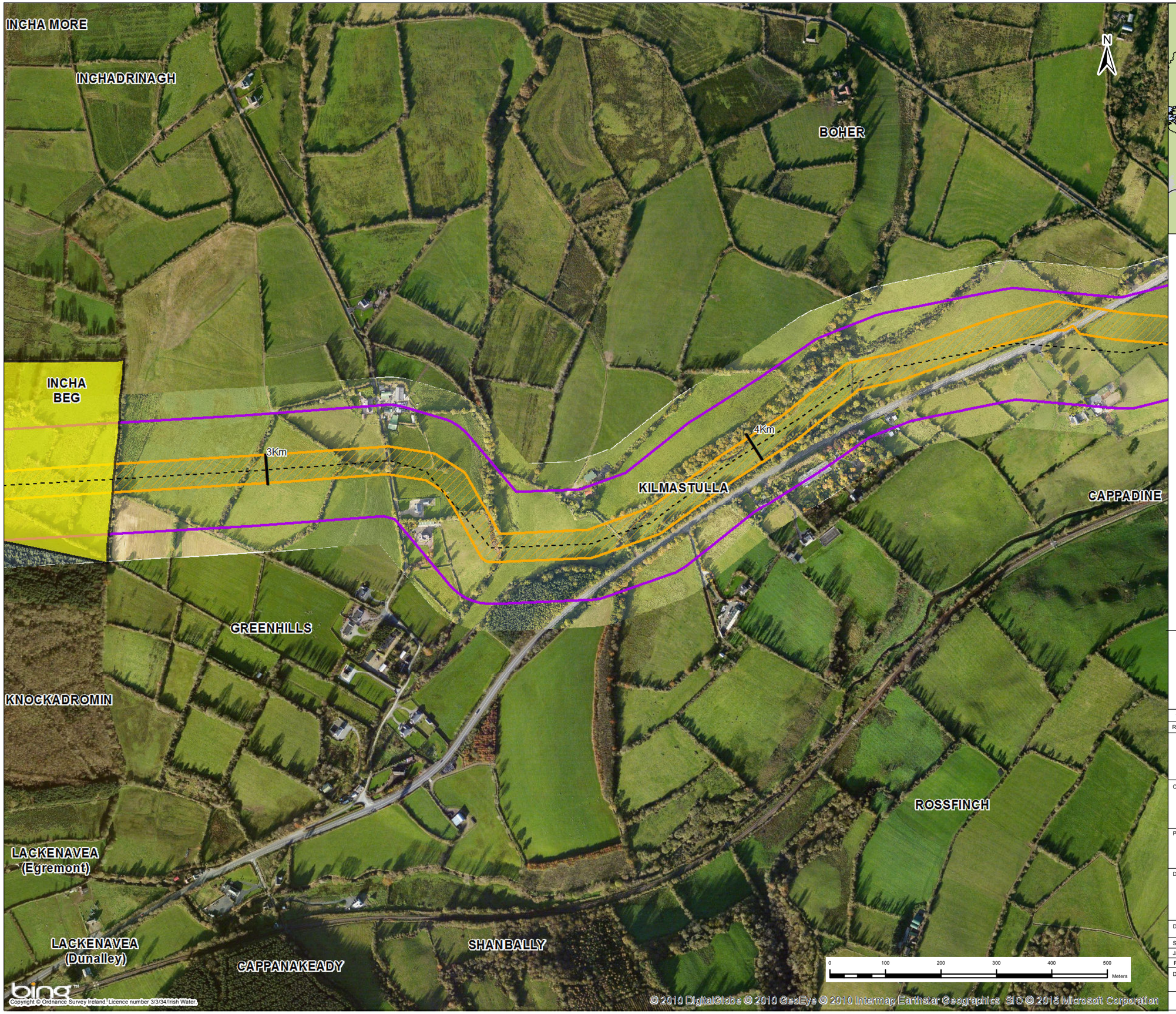

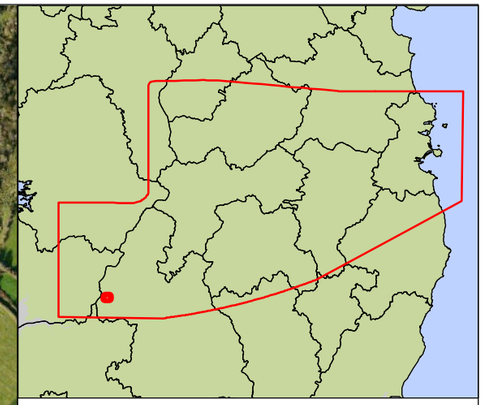

Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
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Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

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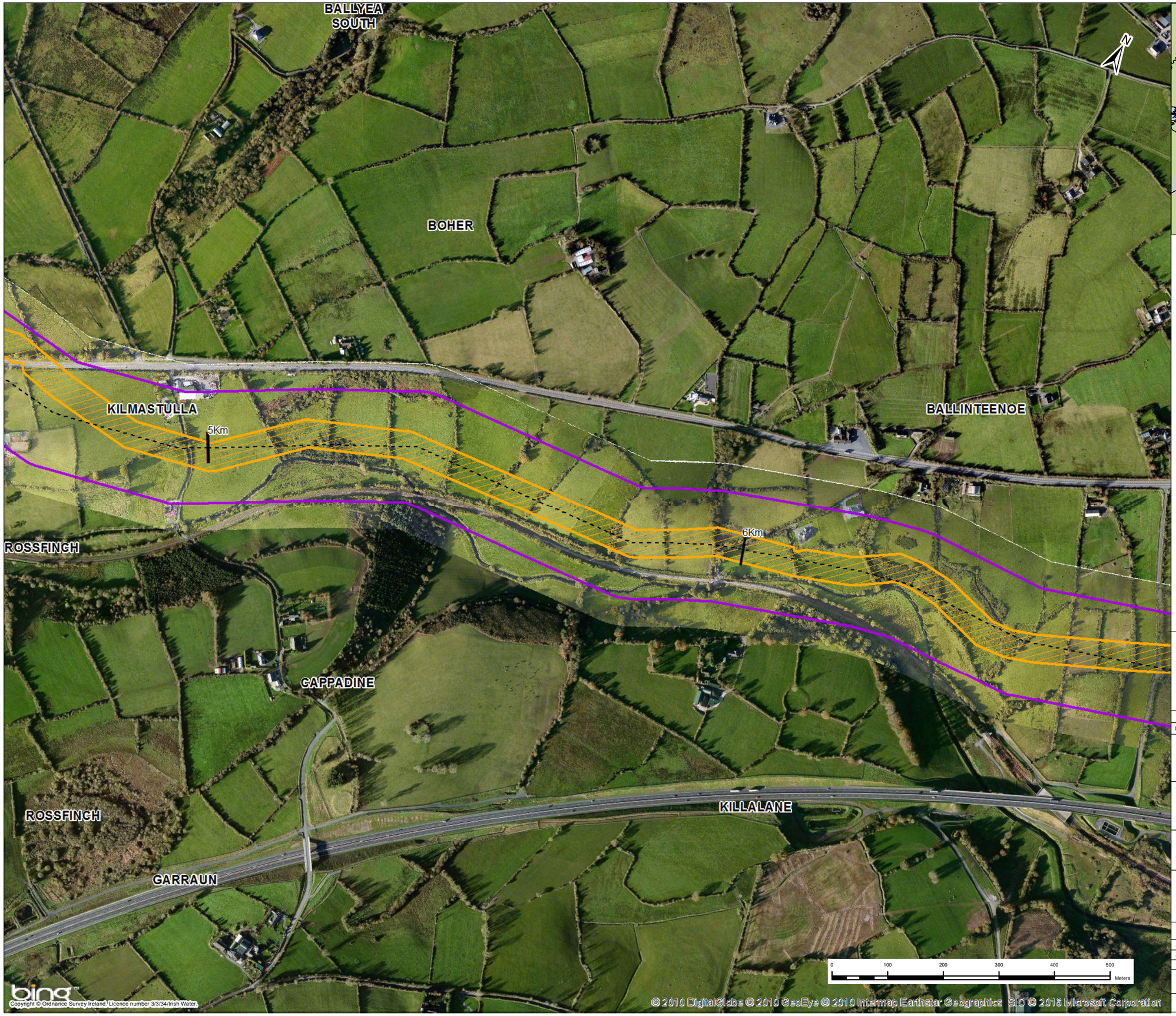
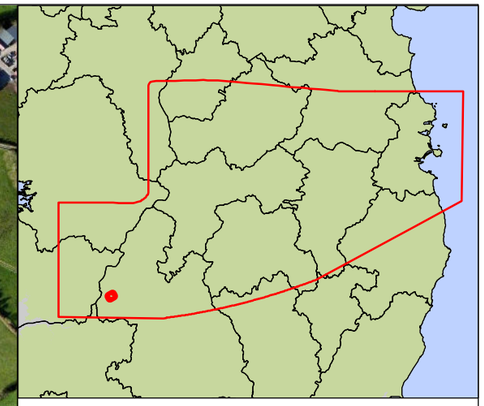
Drawing No. 32105801-FOAR-102





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

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Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

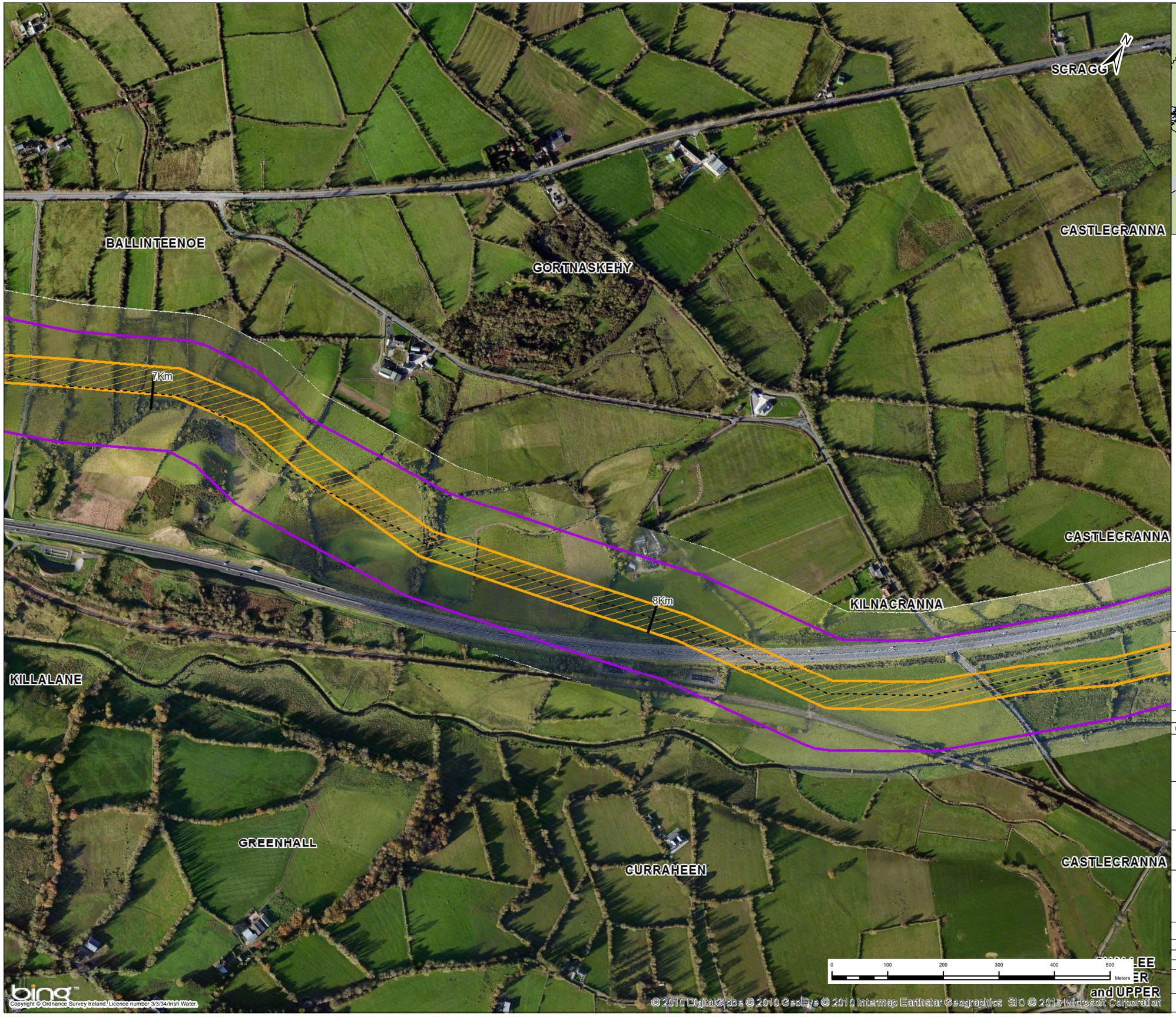
Project: Water Supply Project - Eastern and Midlands Region

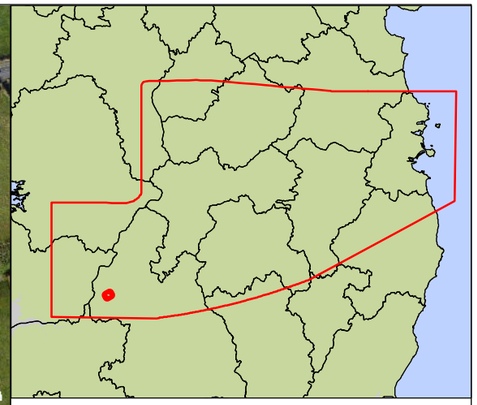
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\32105801 - WSP-DRG\5 Tasks\5_Mxds\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-103





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

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Client
UISCE ÉIREANN / IRISH WATER

Project
Water Supply Project - Eastern and Midlands Region

Drawing Title
Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
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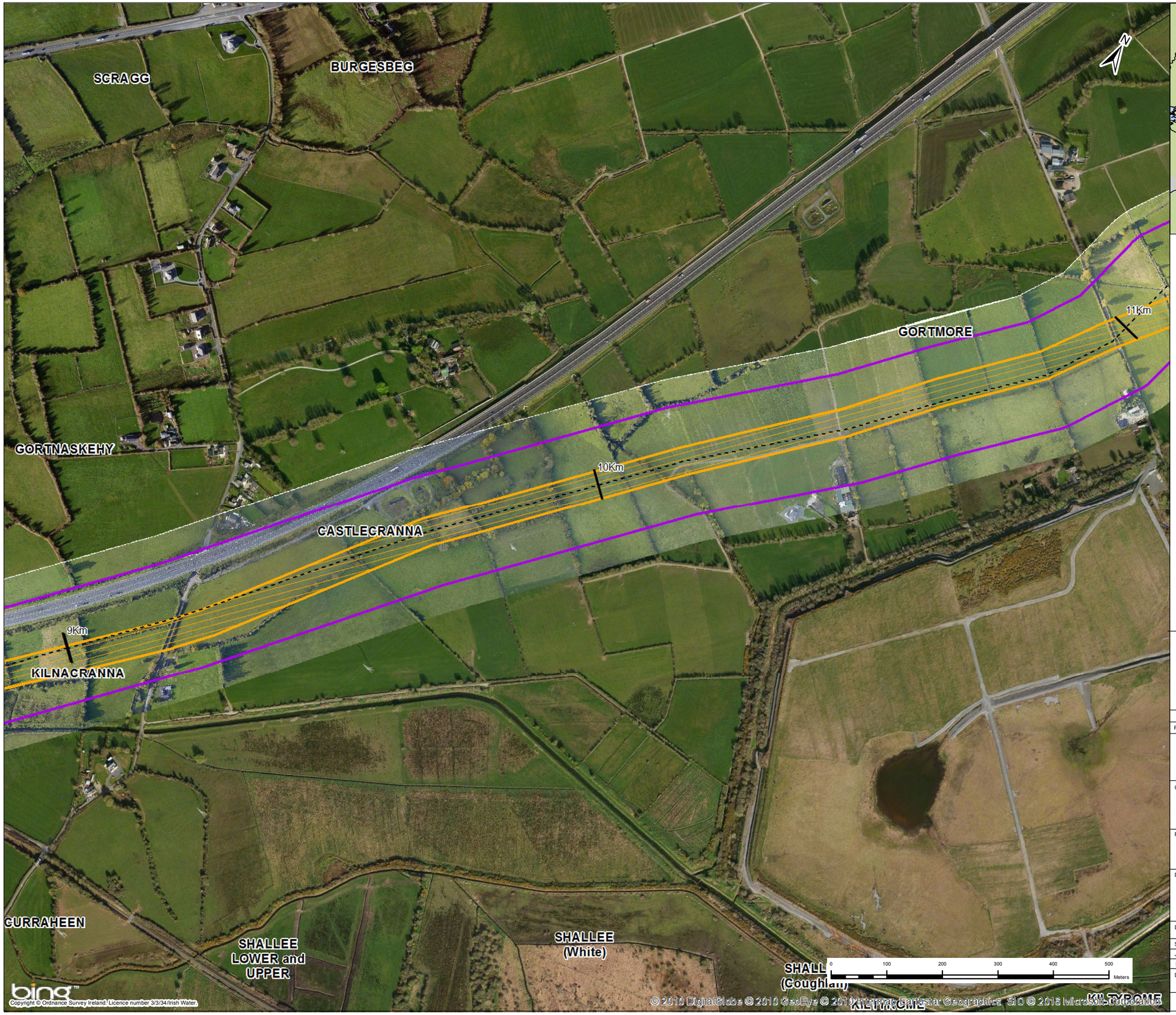
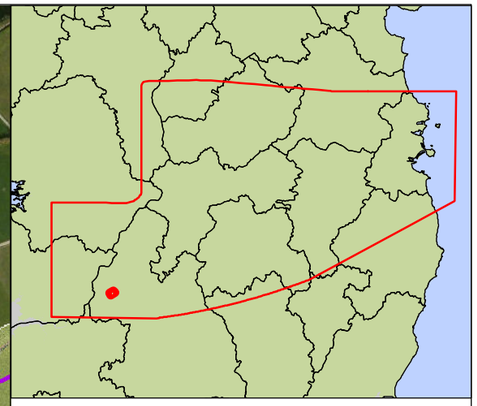
Drawing No.	32105801-FOAR-104		





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

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Client: UISCE ÉIREANN - IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status	**For Issue**		
Scale @A3	1:6,500		DO NOT SCALE
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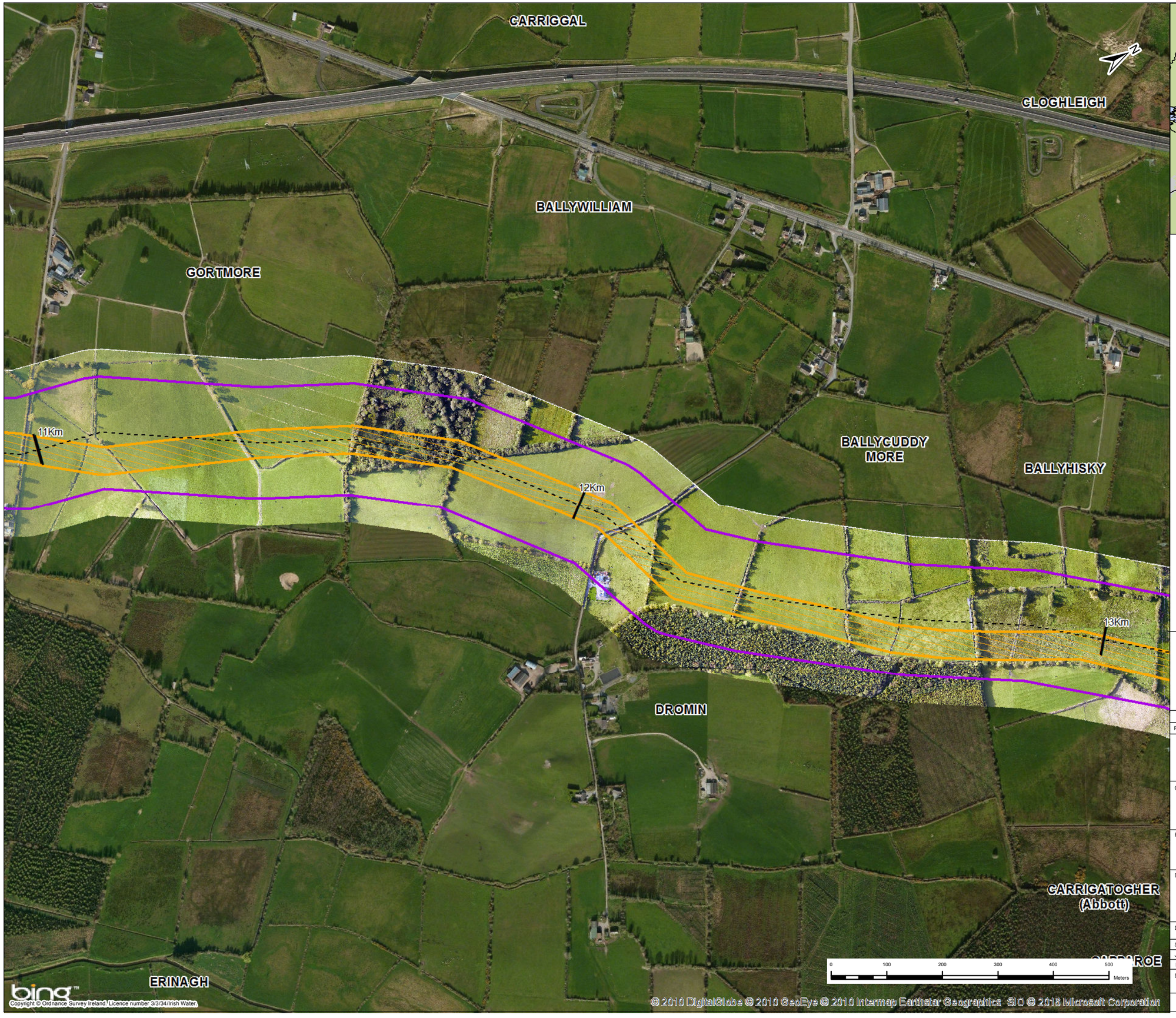
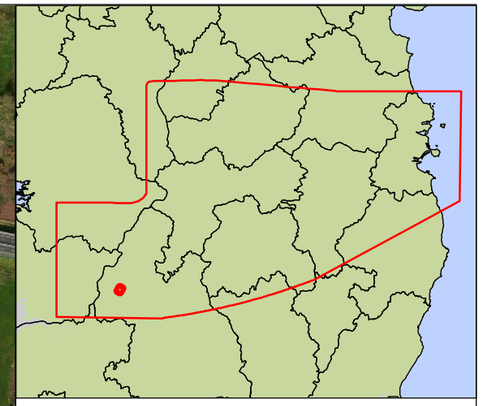
Drawing No. 32105801-FOAR-105





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS® TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
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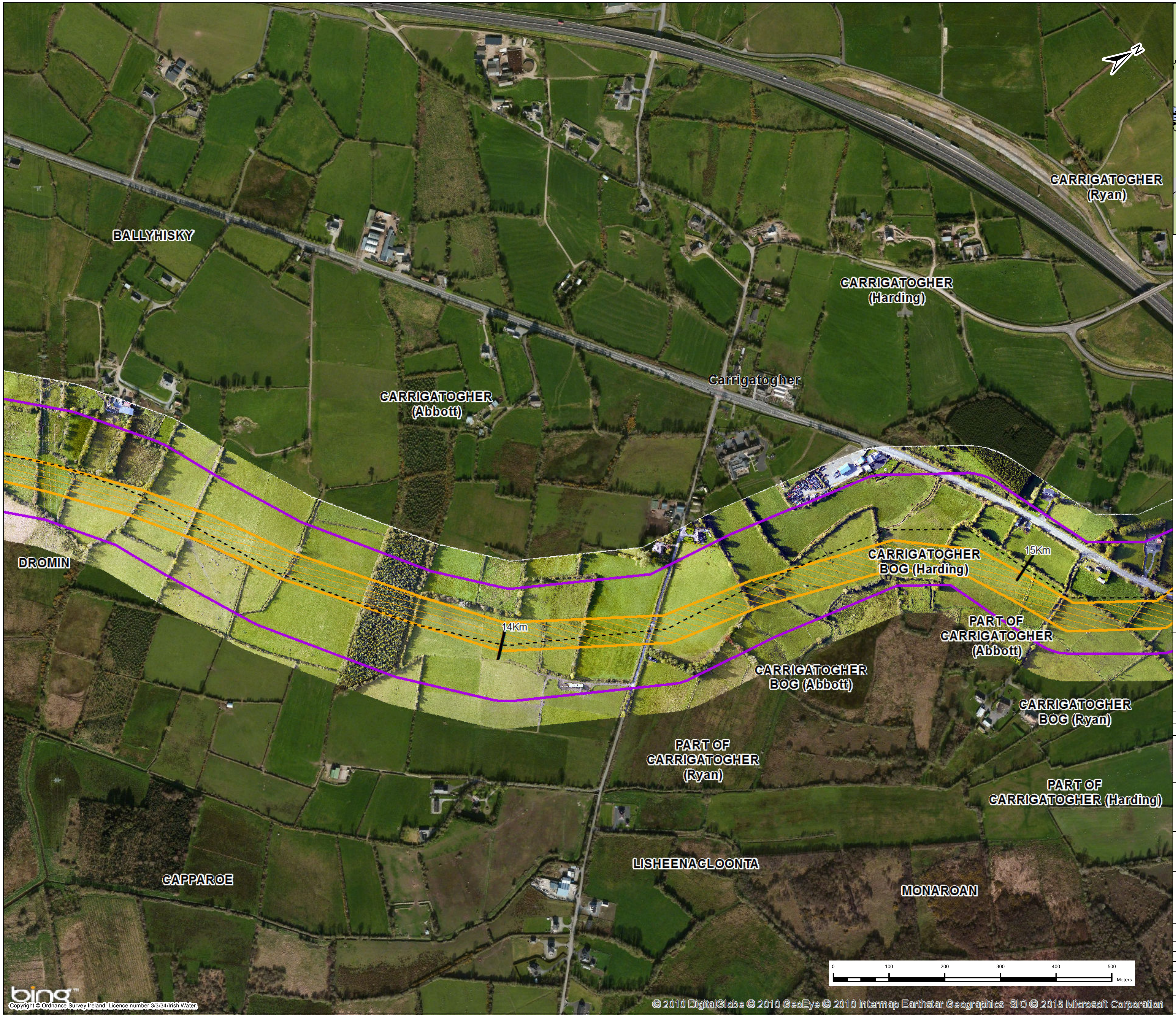
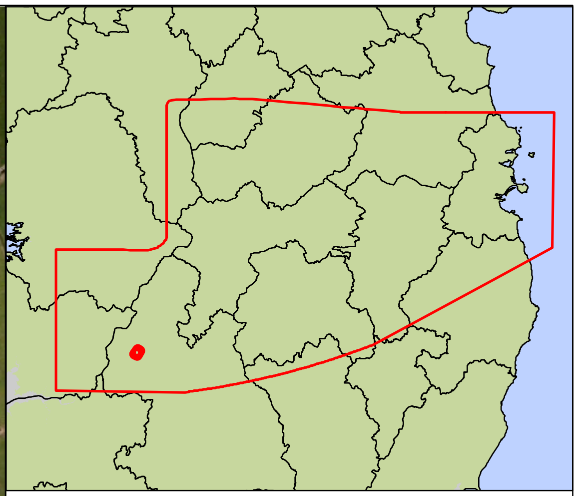
Drawing No.: 32105801-FOAR-106





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client
UISCE ÉIREANN : IRISH WATER

Project
Water Supply Project - Eastern and Midlands Region

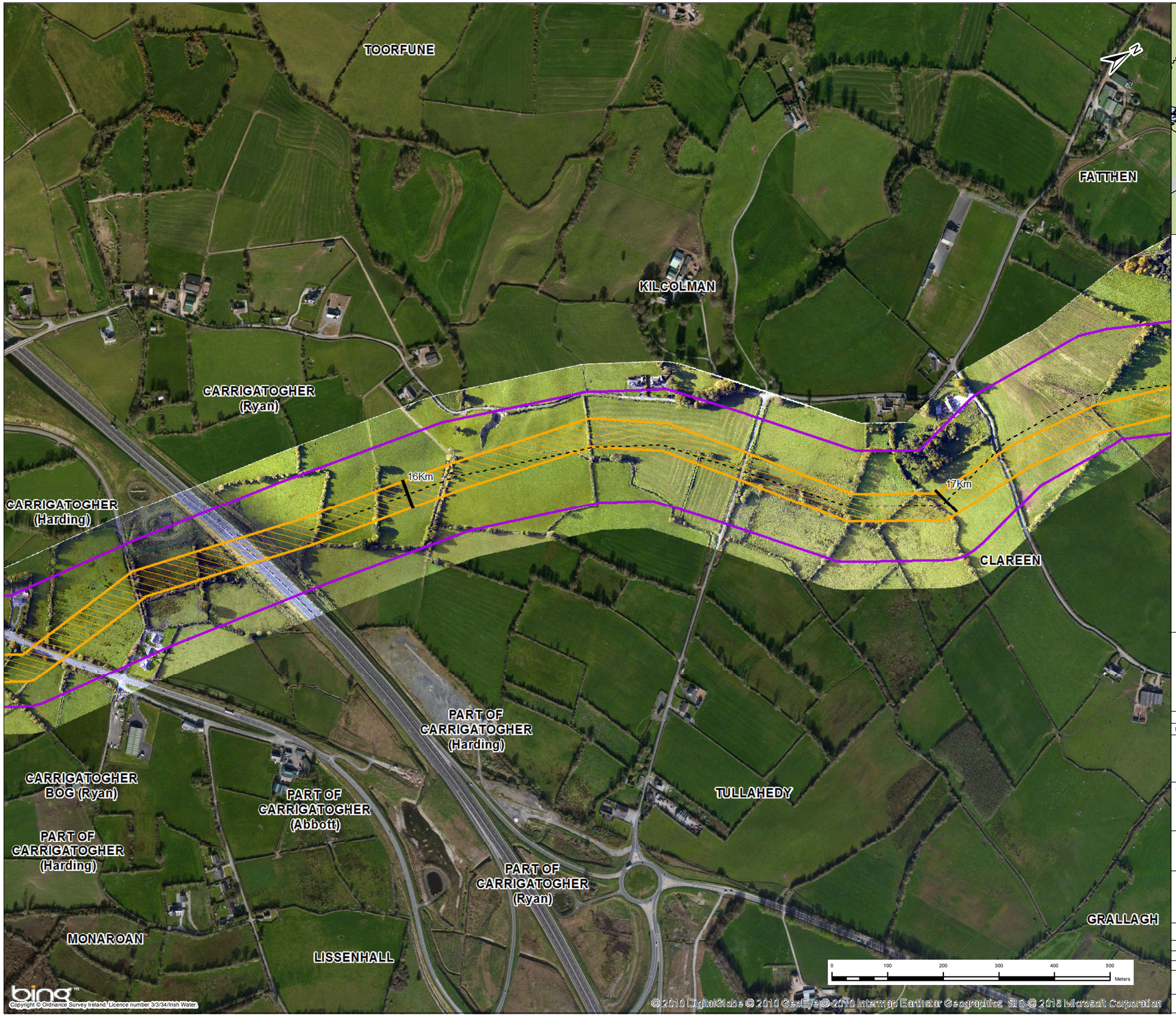
Drawing Title
Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

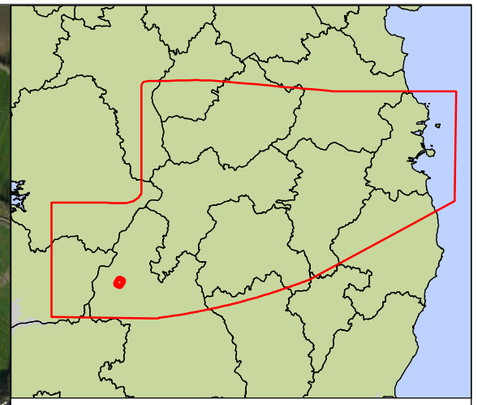
Drawing Status
For Issue

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath			

Drawing No.
32105801-FOAR-107

This drawing is not to be used in whole in or part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

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Client: UISCE ÉIREANN - IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
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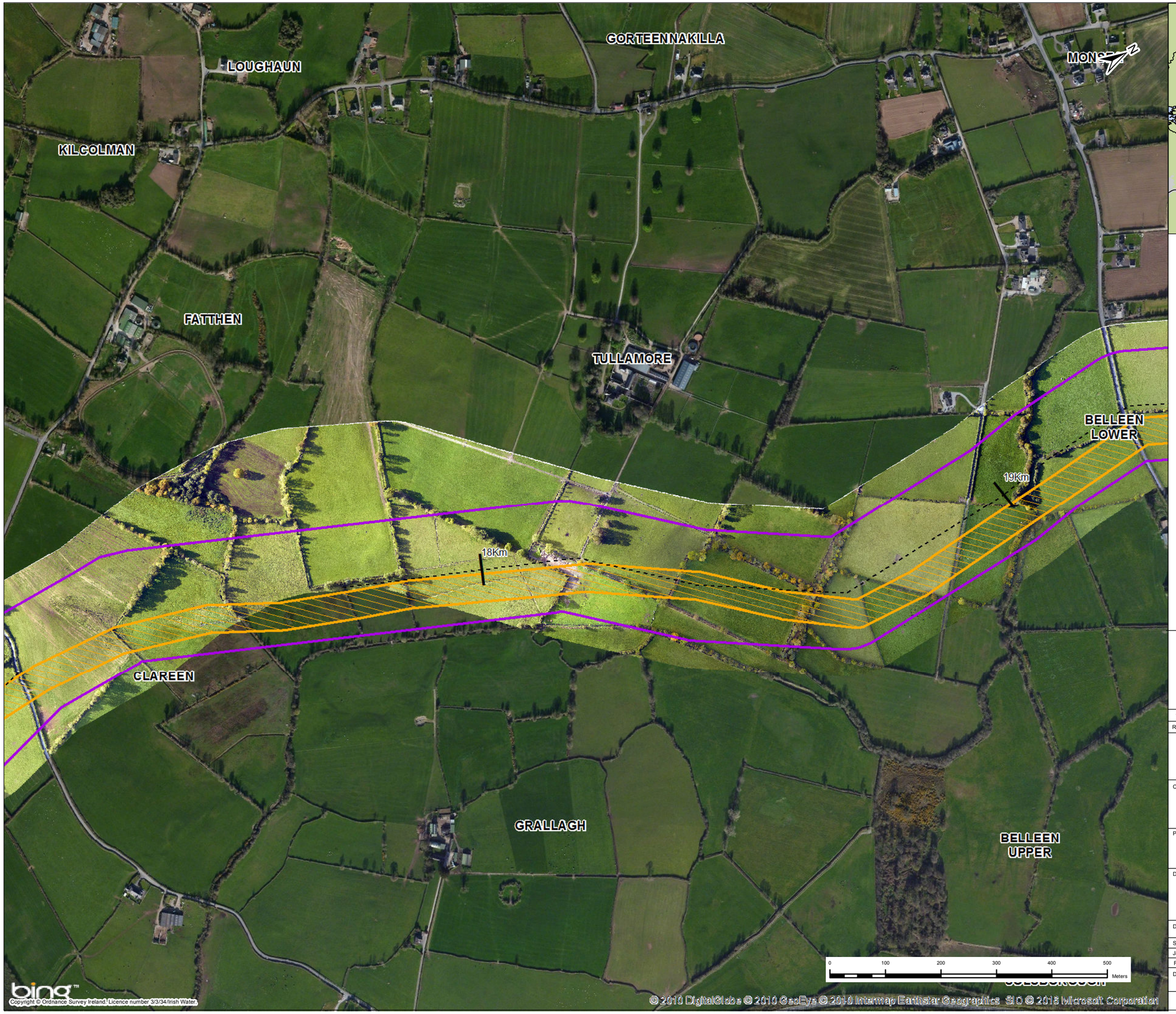
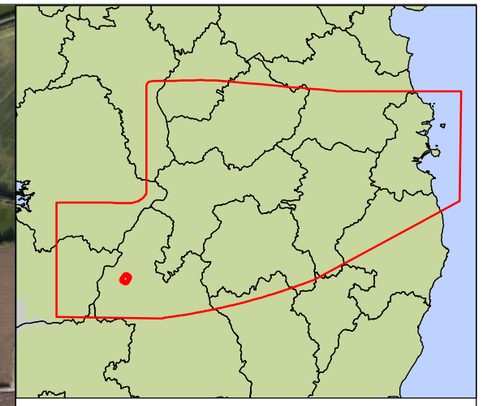
Drawing No. 32105801-FOAR-108





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN / IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
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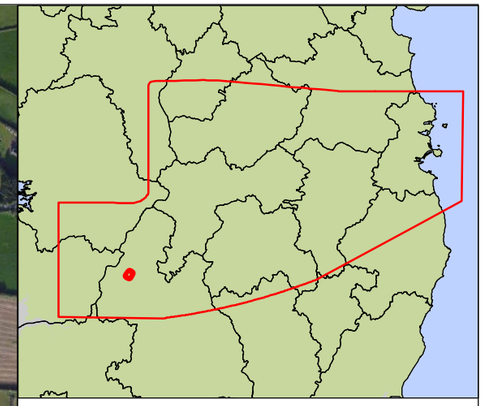
Drawing No. 32105801-FOAR-109



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS® TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN / IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
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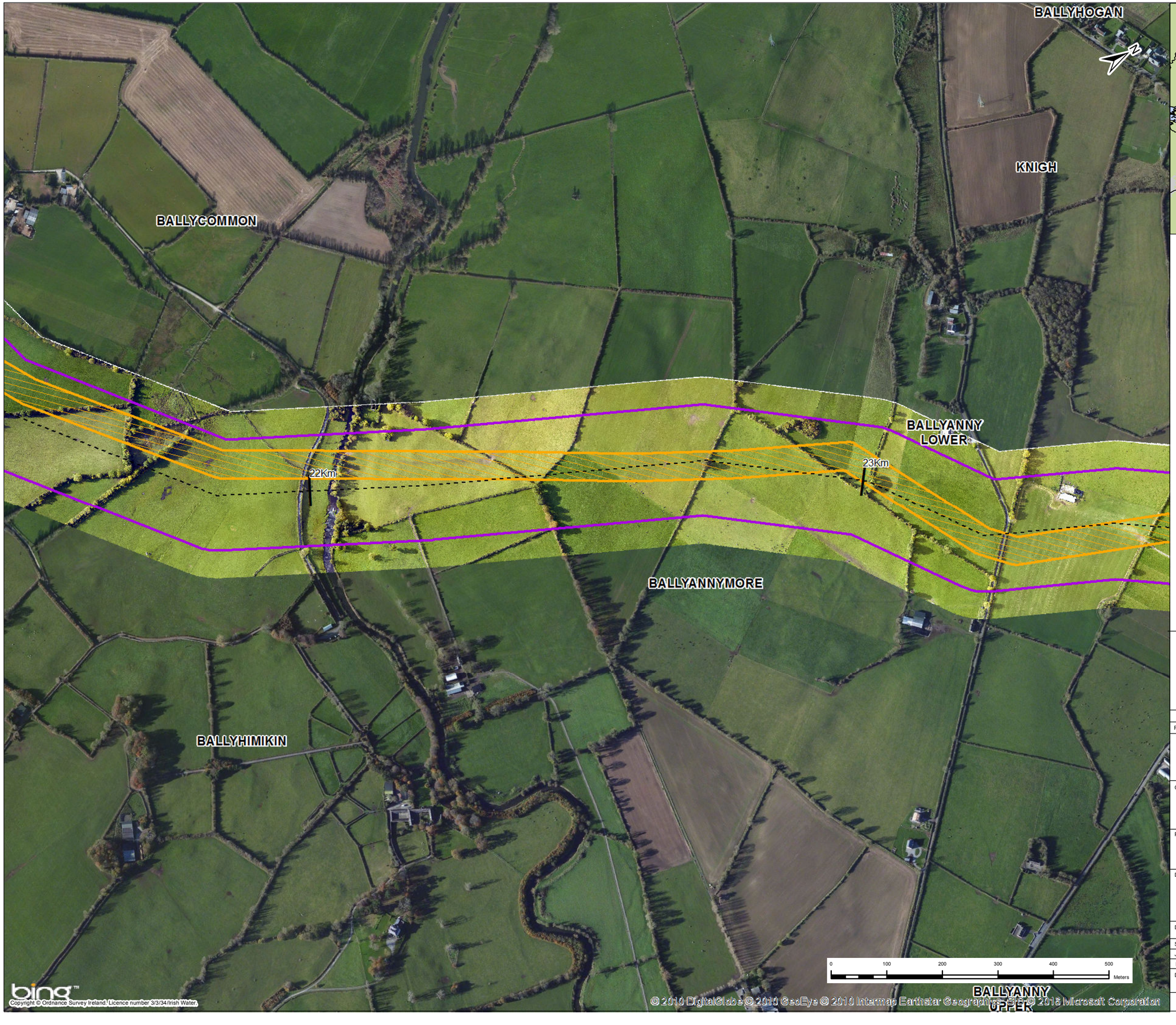
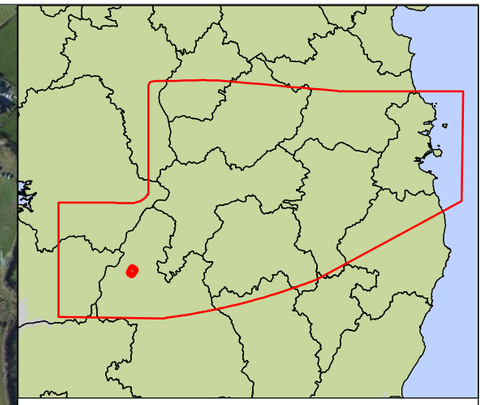
Drawing No. 32105801-FOAR-110





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

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Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN : IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
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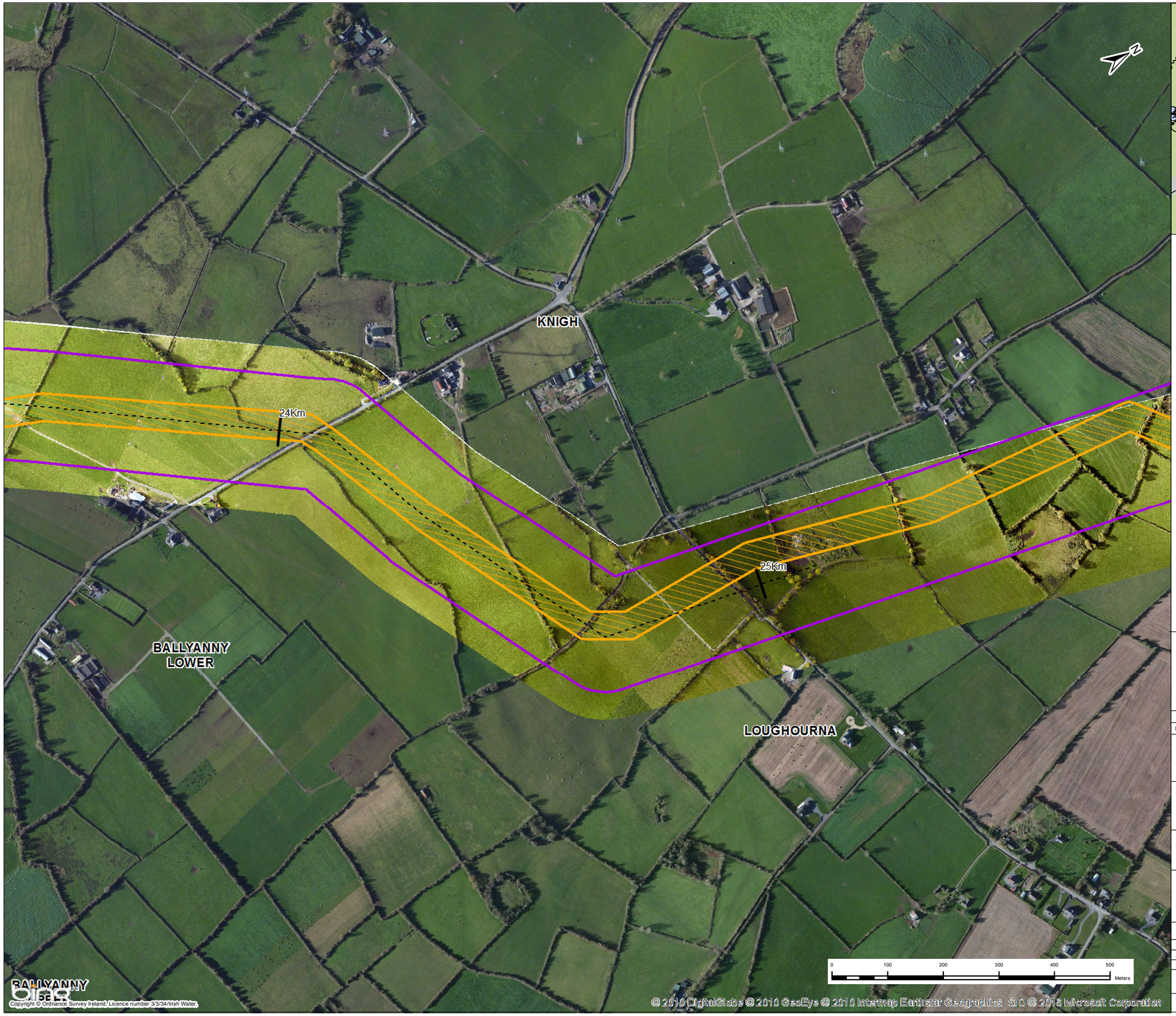
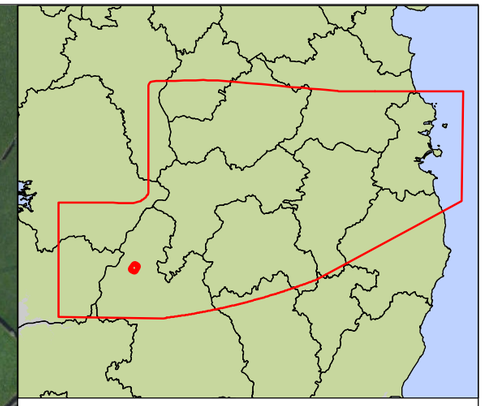
Drawing No. 32105801-FOAR-111





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN IRISH WATER

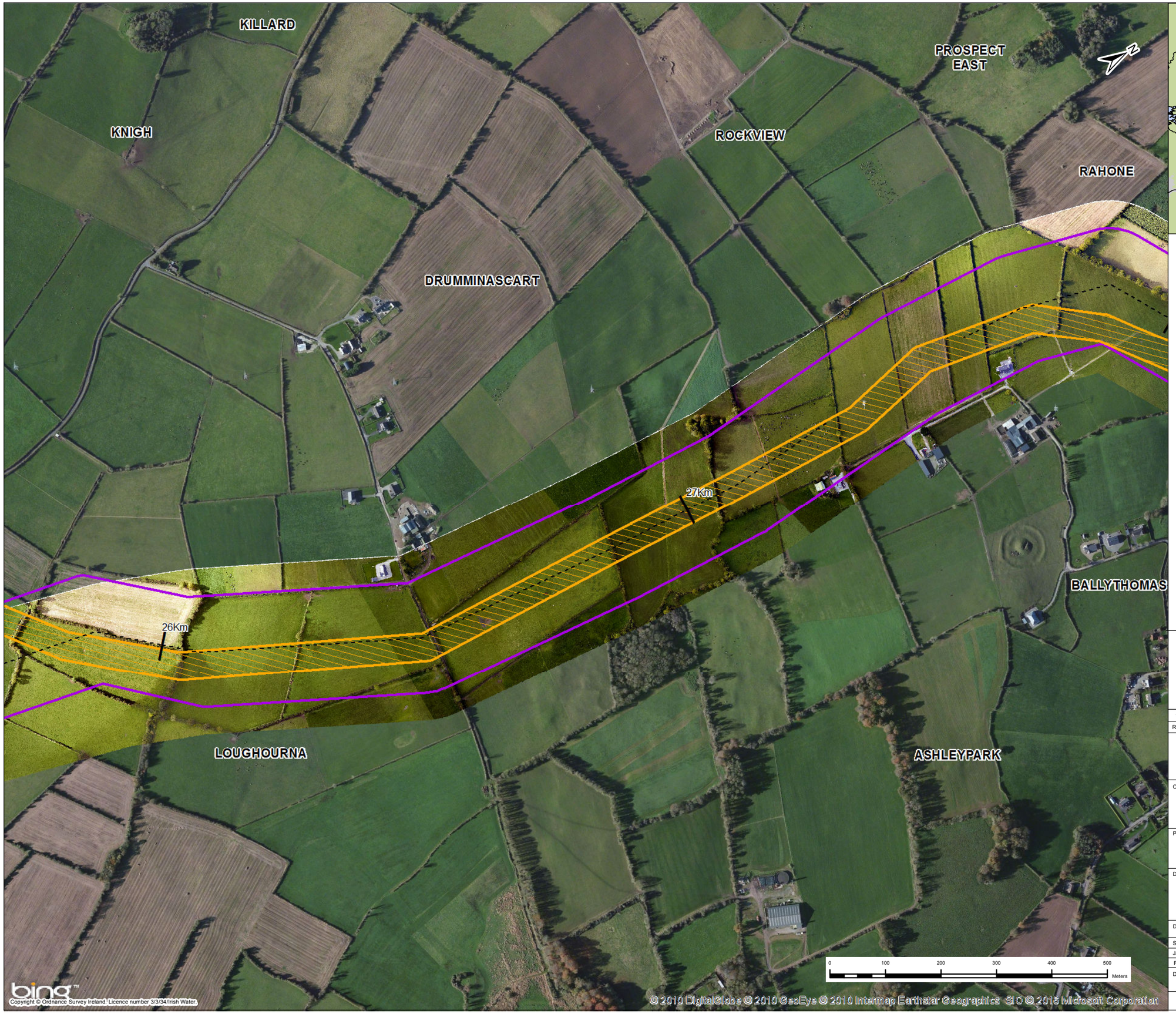
Project: Water Supply Project - Eastern and Midlands Region

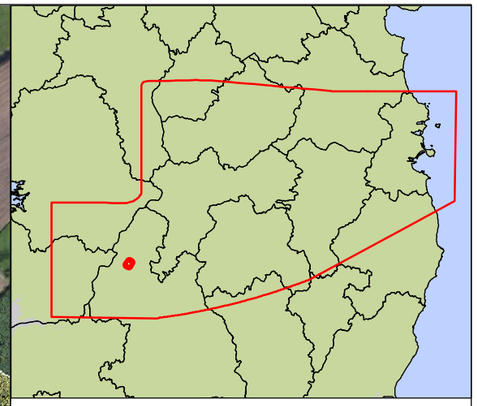
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 WSP-DBO\05 Tasks\05_Mxd\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-112





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS
TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
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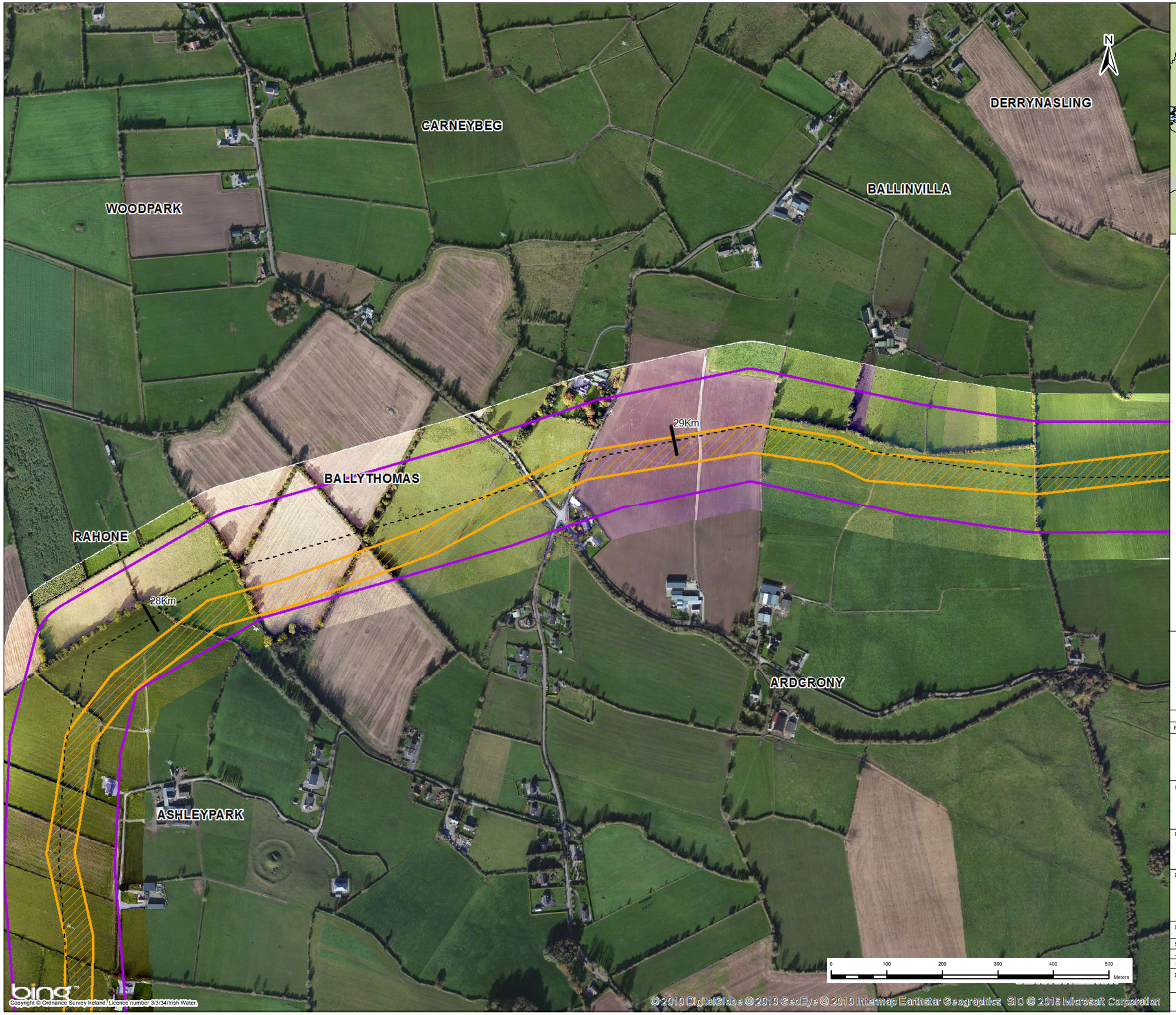
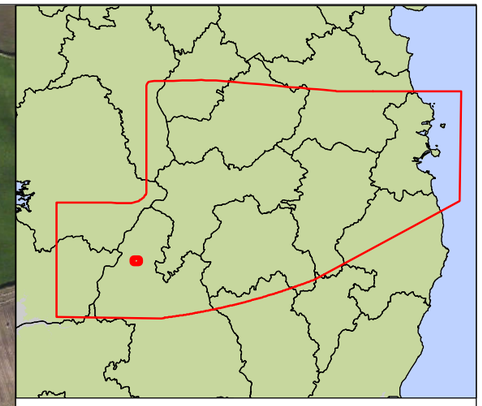
Drawing No. 32105801-FOAR-113





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN · IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
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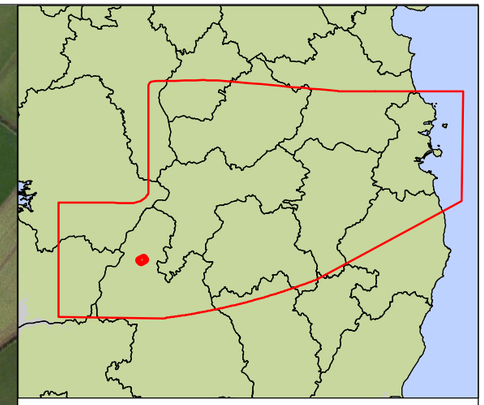
Filepath	G:\IRG\32105801 - WSP-DRGS Tasks\5_Mode Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-114



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS

TOBIN
Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

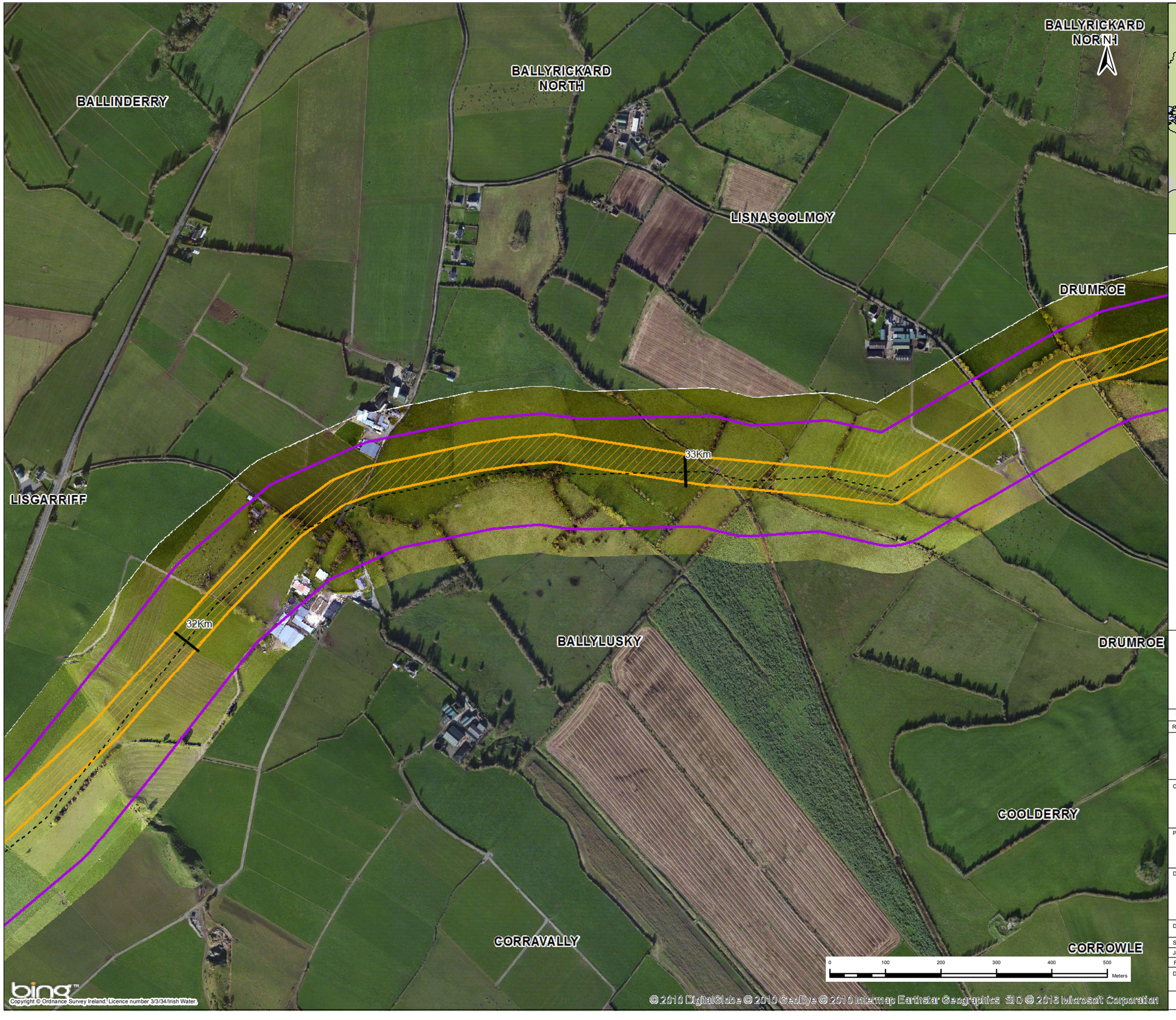
Project: Water Supply Project - Eastern and Midlands Region

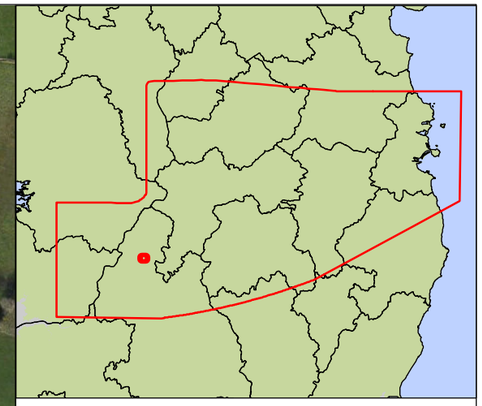
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 WSP-DAGS Tasks\5_Iss.de\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-115





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS® TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN IRISH WATER

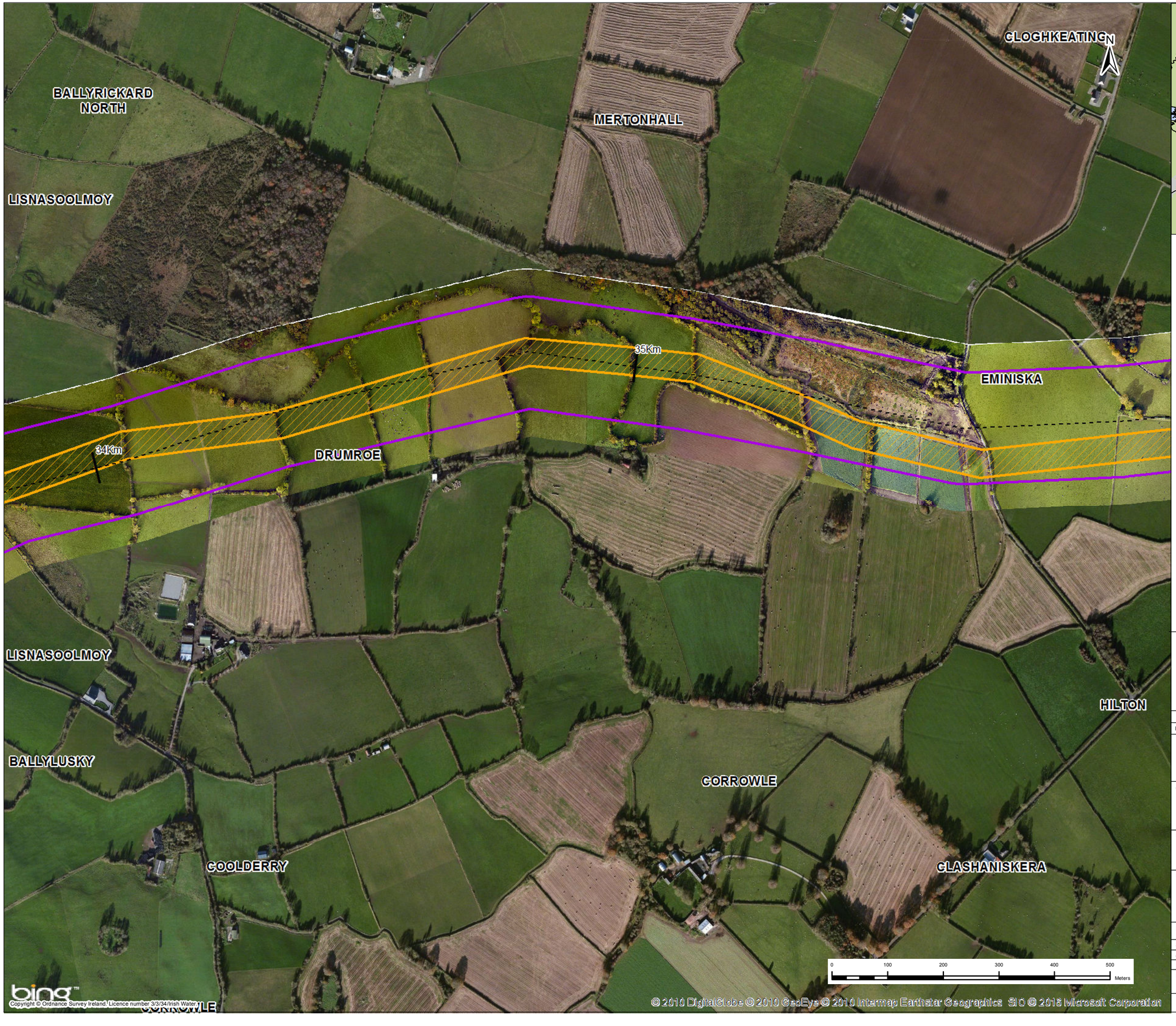
Project: Water Supply Project - Eastern and Midlands Region

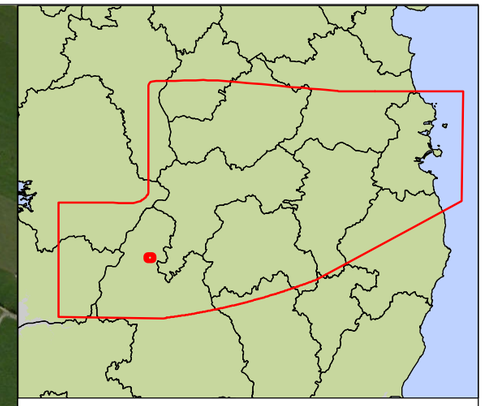
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 - WSP-DRGS Tarbert_Moanbrack Mapping\50m Corridor Maps.mxd		

Drawing No.: 32105801-FOAR-116





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS® TOBIN Patrick J. Tobin & Co. Ltd.

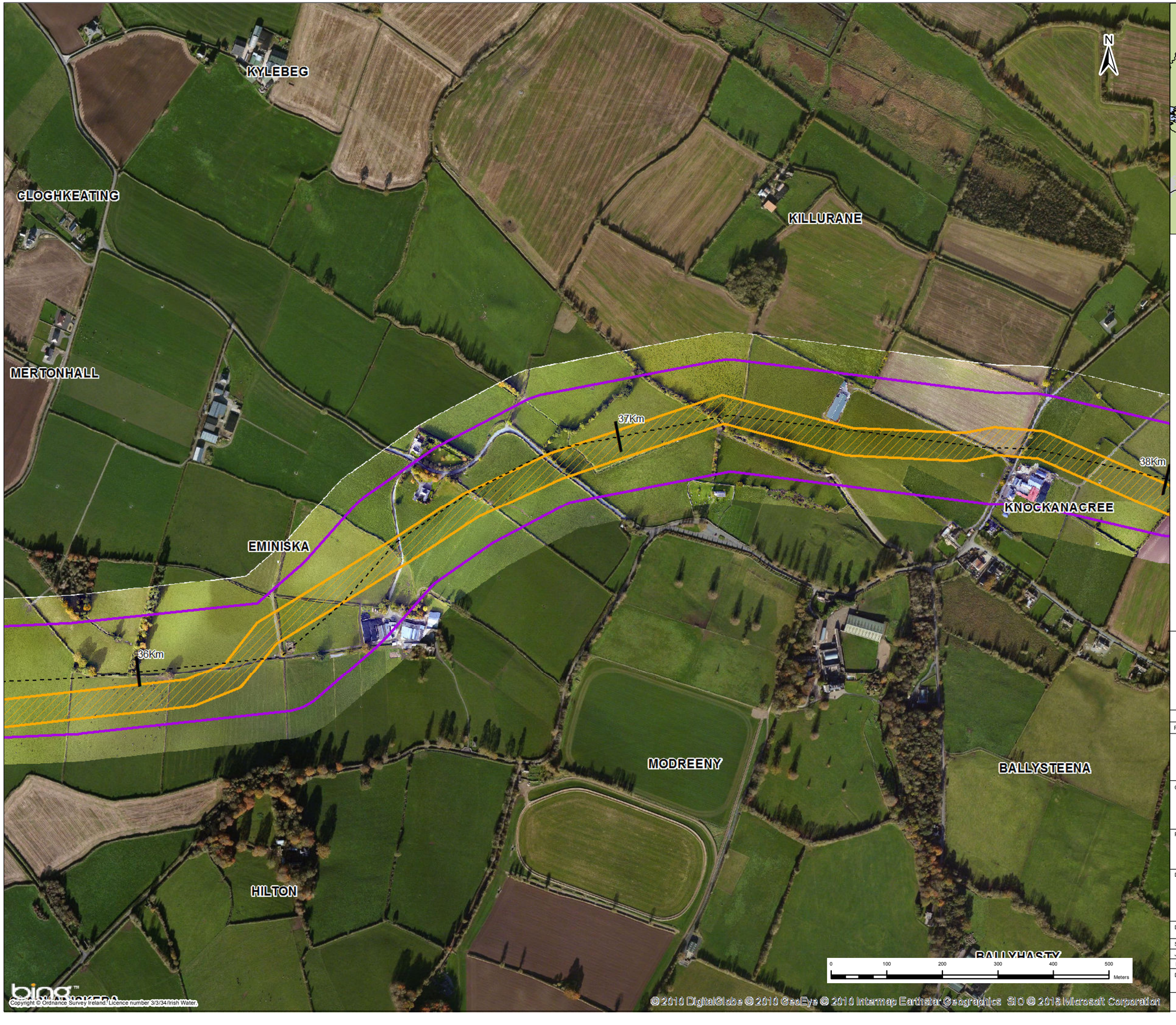
Client: UISCE ÉIREANN · IRISH WATER

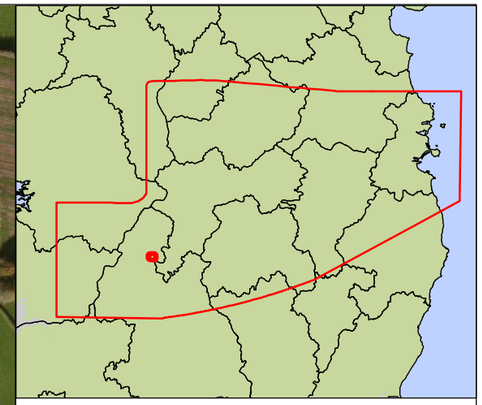
Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status	**For Issue**		
Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 - WSP-DRGB Tasks\5_Mxd\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-117





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN / IRISH WATER

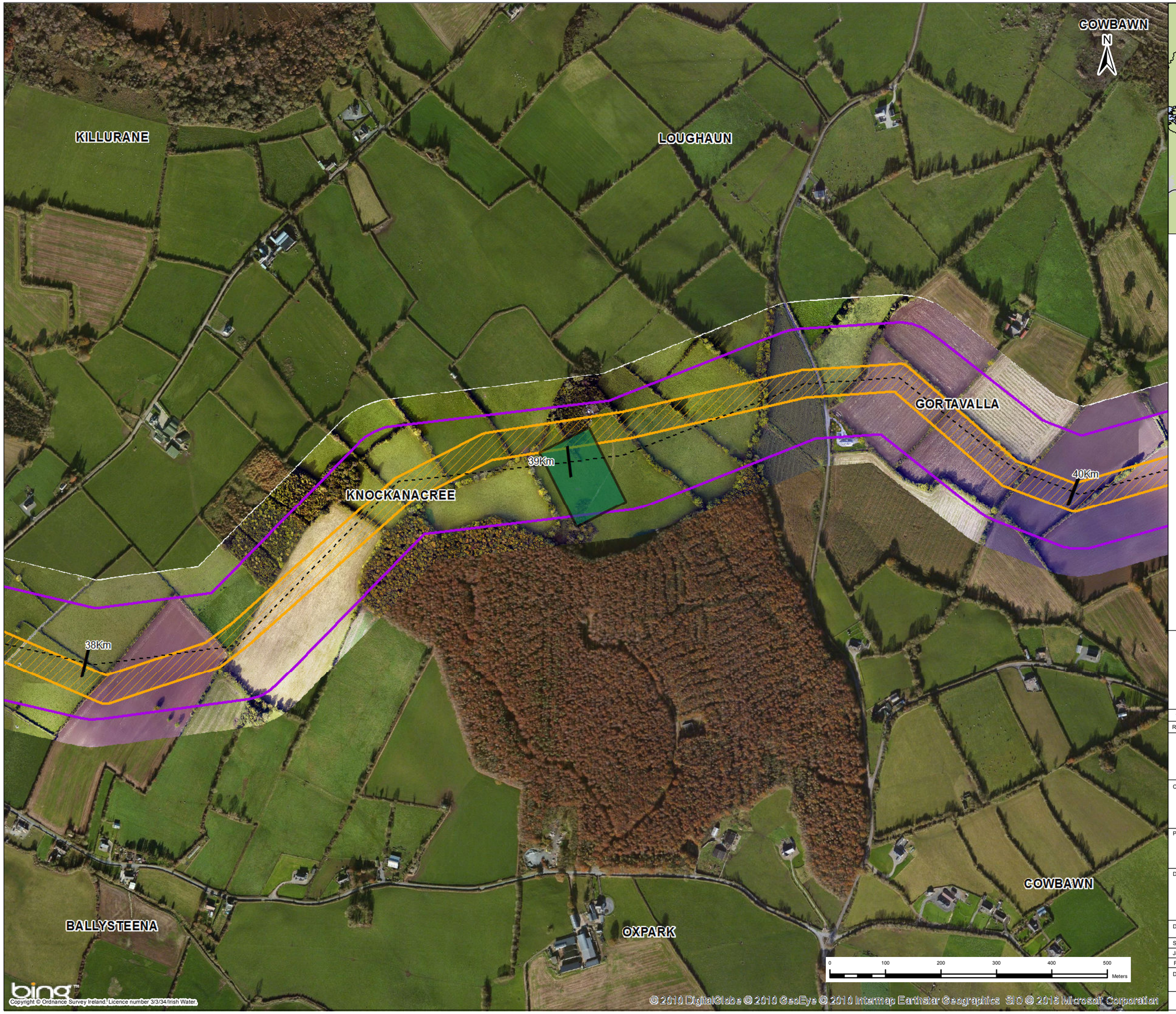
Project: Water Supply Project - Eastern and Midlands Region

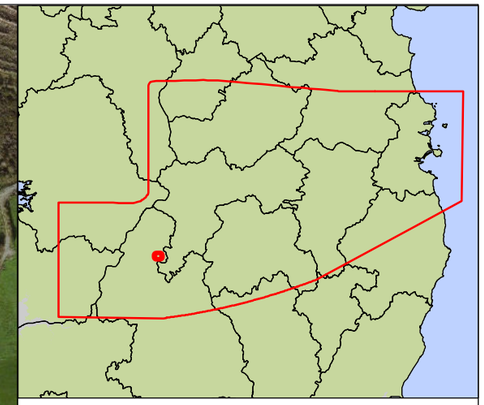
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 WSP-DAGS Tasks\5_Issue\Route Mapping\Drn Corridor Maps.mxd		

Drawing No. 32105801-FOAR-118





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

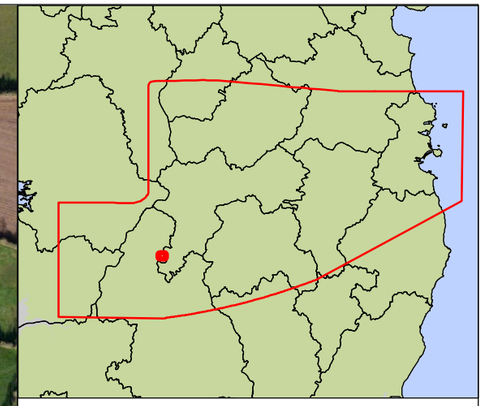
Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IS\GIS\32105801 - WSP-DIR\GIS Tasks\5_Mandrake Mapping\50m Corridor Maps.mxd		

Drawing No.: 32105801-FOAR-119



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

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Patrick J. Tobin & Co. Ltd.

Client
UISCE EIREANN / IRISH WATER

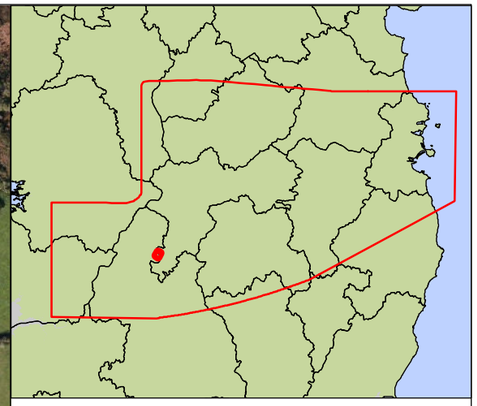
Project
Water Supply Project - Eastern and Midlands Region

Drawing Title
Preferred 200m Pipeline Corridor
and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 WSP-DAGS Tasks\5_Iris Art Route Mapping\50m Corridor Maps.mxd		

Drawing No.
32105801-FOAR-120



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

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Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

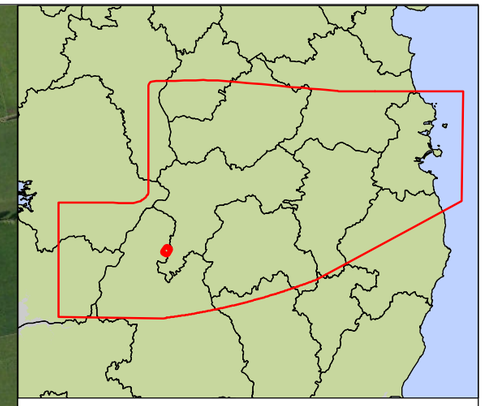
Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 - WSP-DIR\GIS Tasks\5_Mxd\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-121



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS

TOBIN
Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

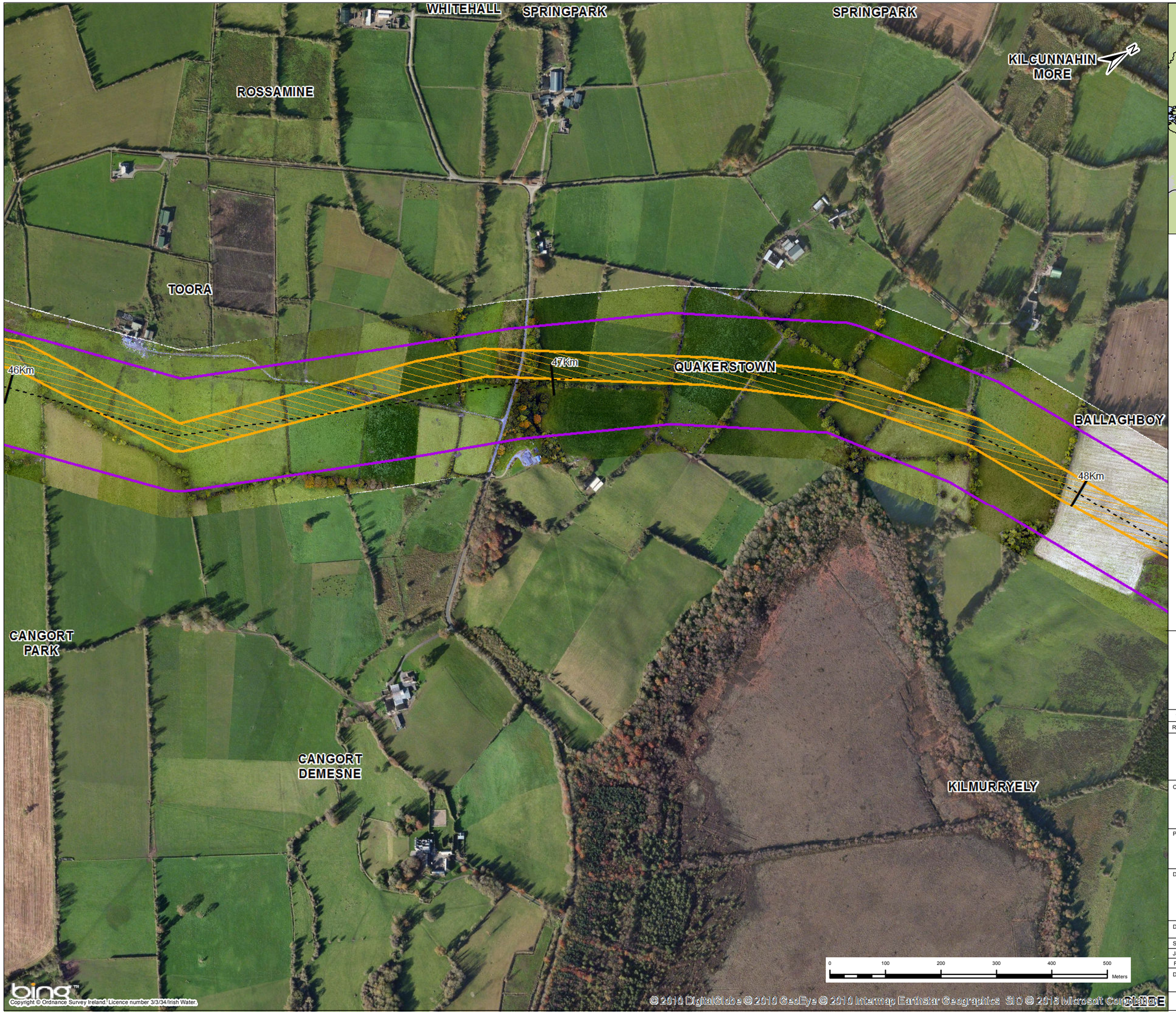
Project: Water Supply Project - Eastern and Midlands Region

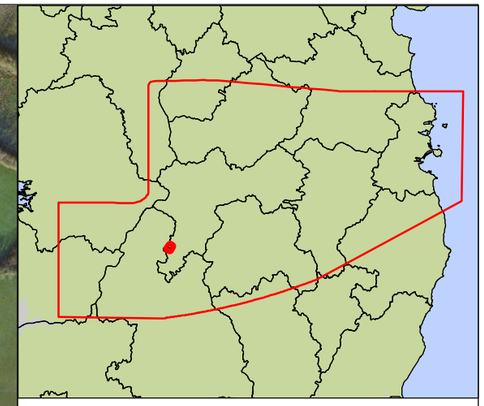
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRISH\32105801 - WSP-DRIGS Tasks\5_Mode\Route Mapping\50m Corridor Maps.mxd		

Drawing No.: 32105801-FOAR-122





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

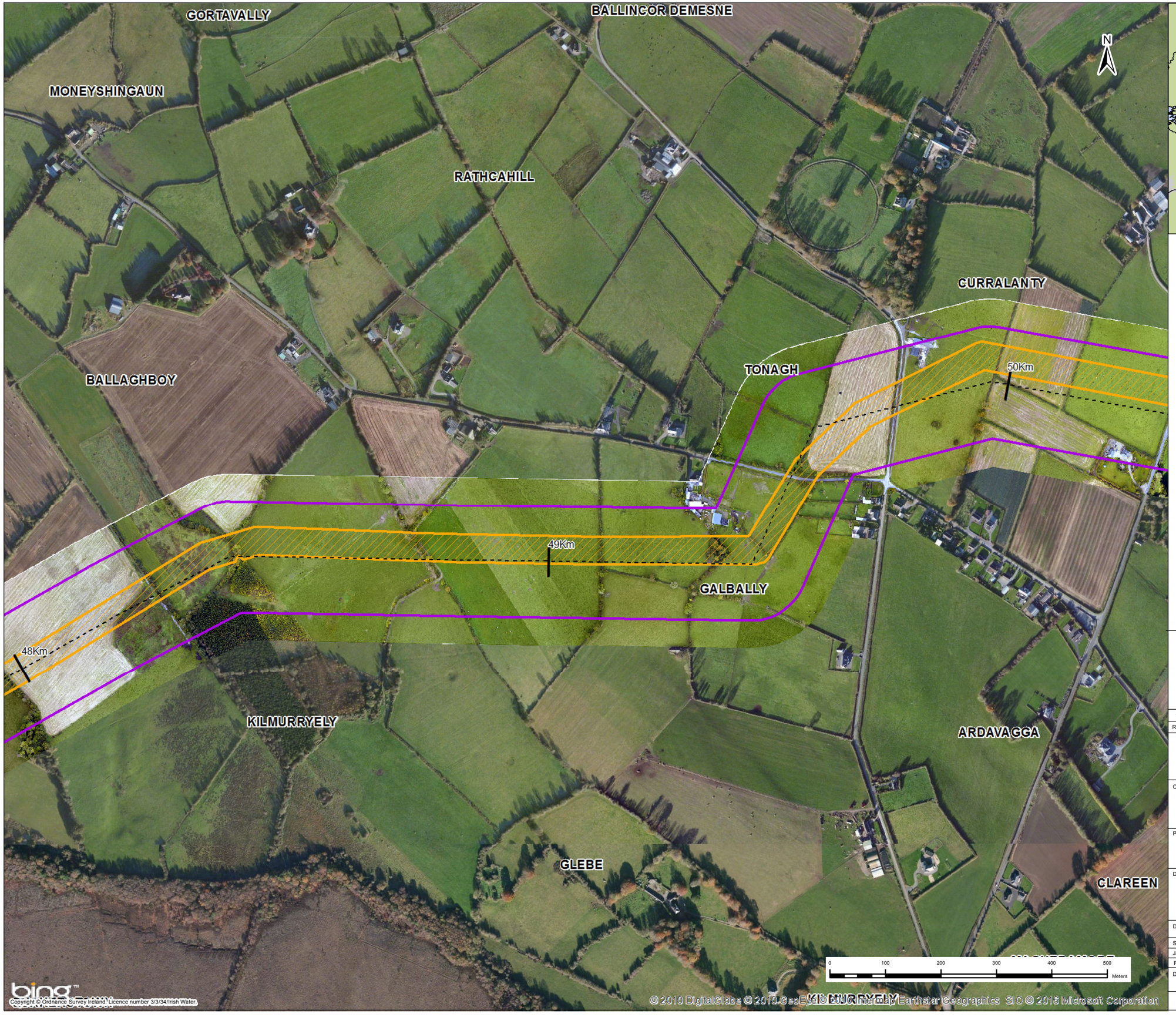
Project: Water Supply Project - Eastern and Midlands Region

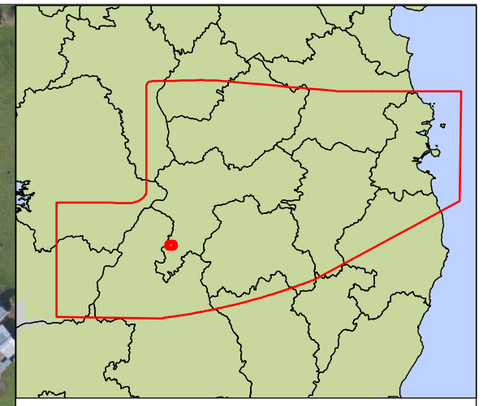
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 WSP-DAGS Tasks\5_Mxd\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-123





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN : IRISH WATER

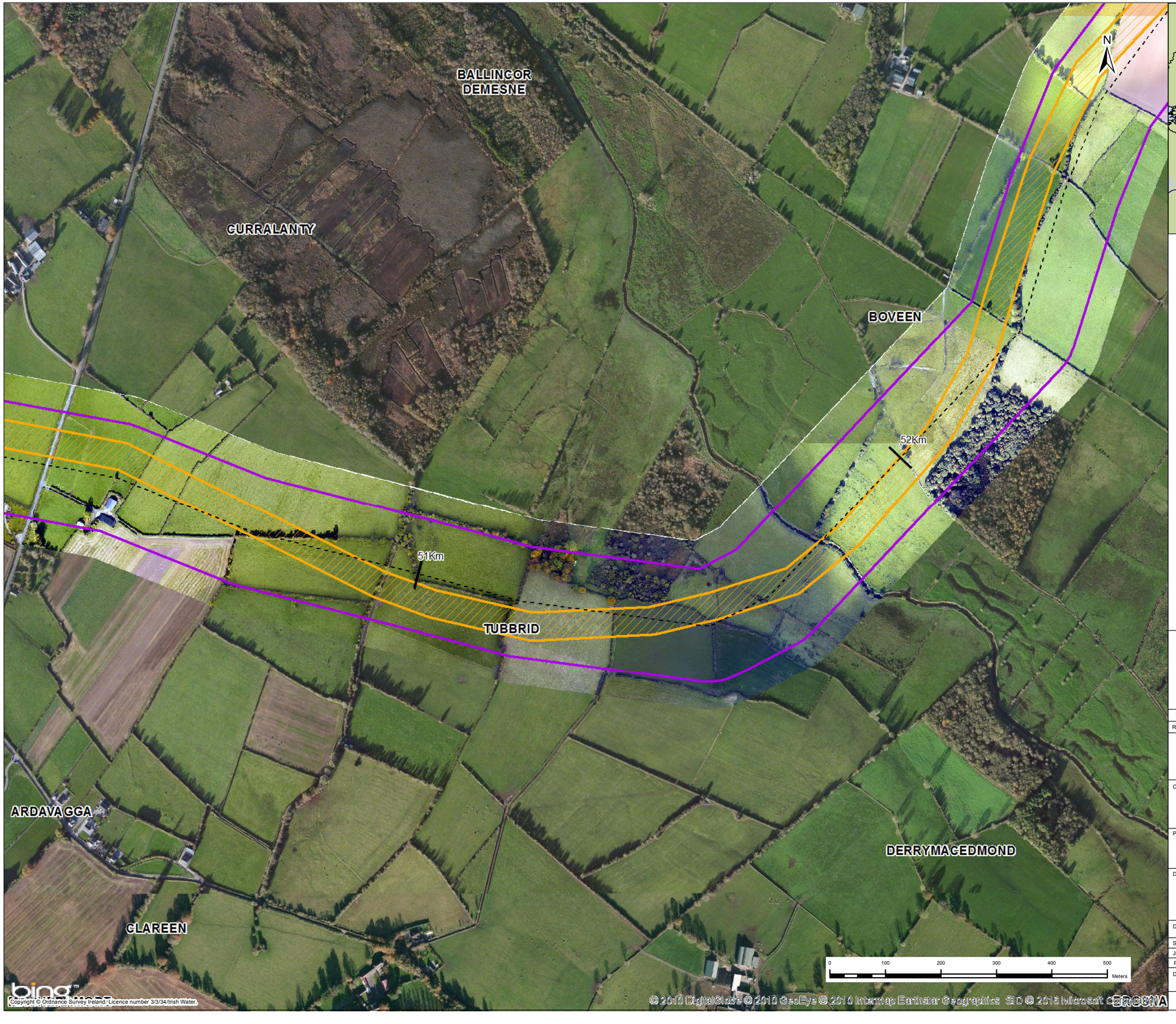
Project: Water Supply Project - Eastern and Midlands Region

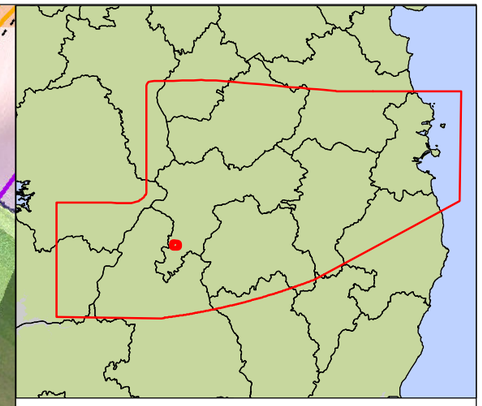
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 WSP-DAGS Tasks\5_Mxd\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-124





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

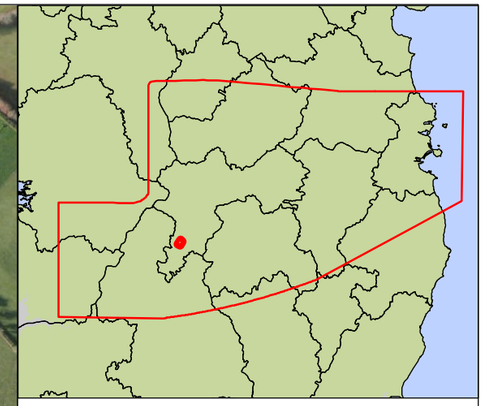
Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 WSP-DAGS Tasks\5_Iss.de\Raw Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-125



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

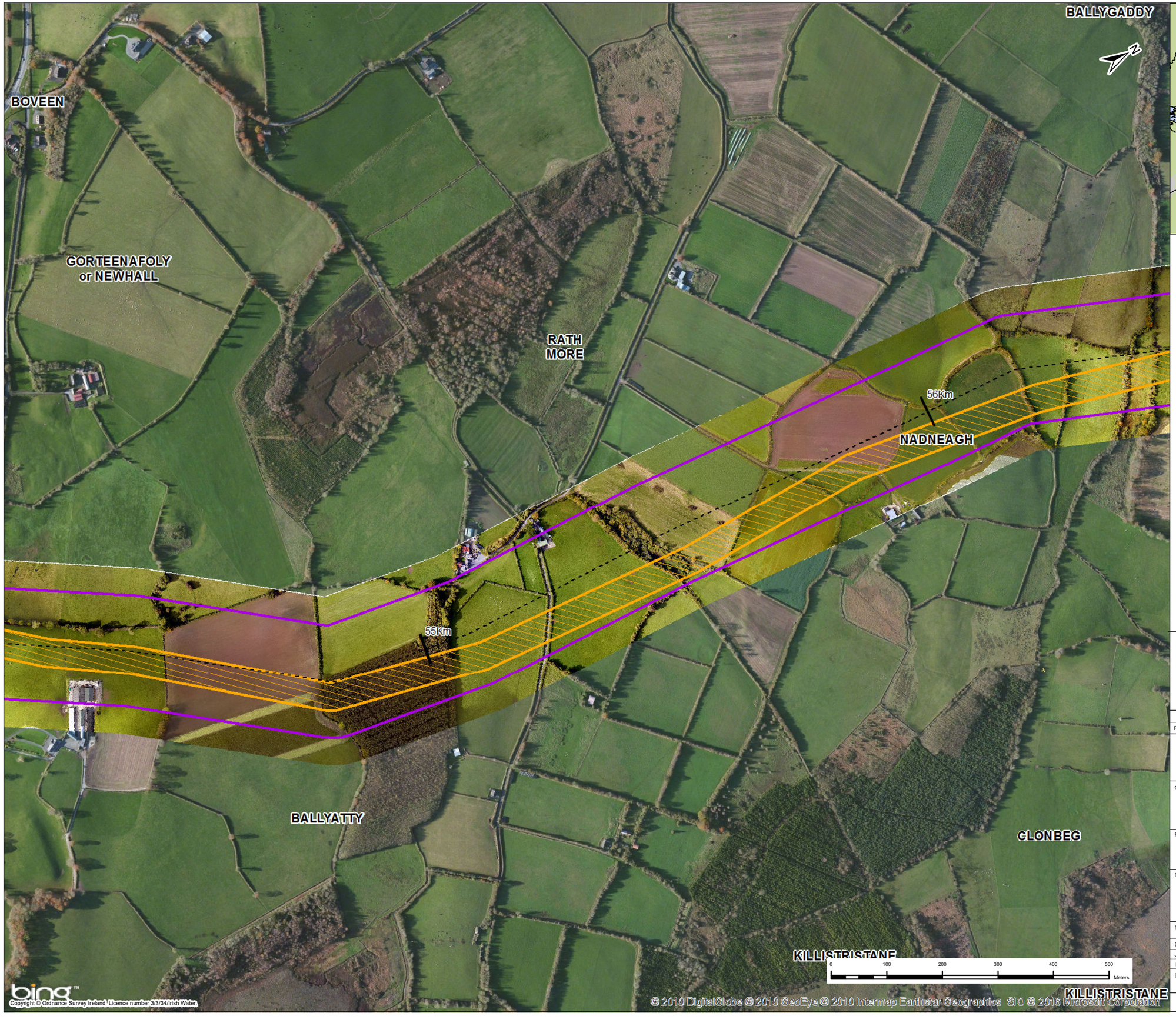
Project: Water Supply Project - Eastern and Midlands Region

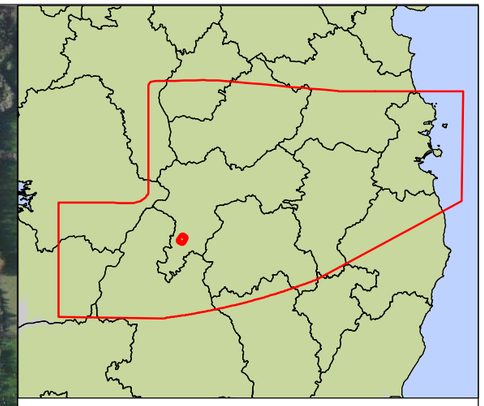
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\IS\32105801 - WSP-DRG\5 Tasks\5_Mode\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-126





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN : IRISH WATER

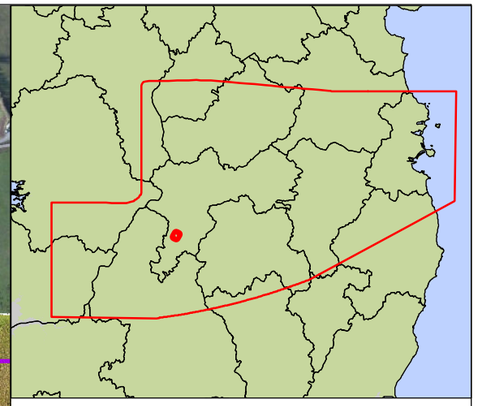
Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 WSP-DAGS Tasks\5_Mxd\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-127



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS® TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN IRISH WATER

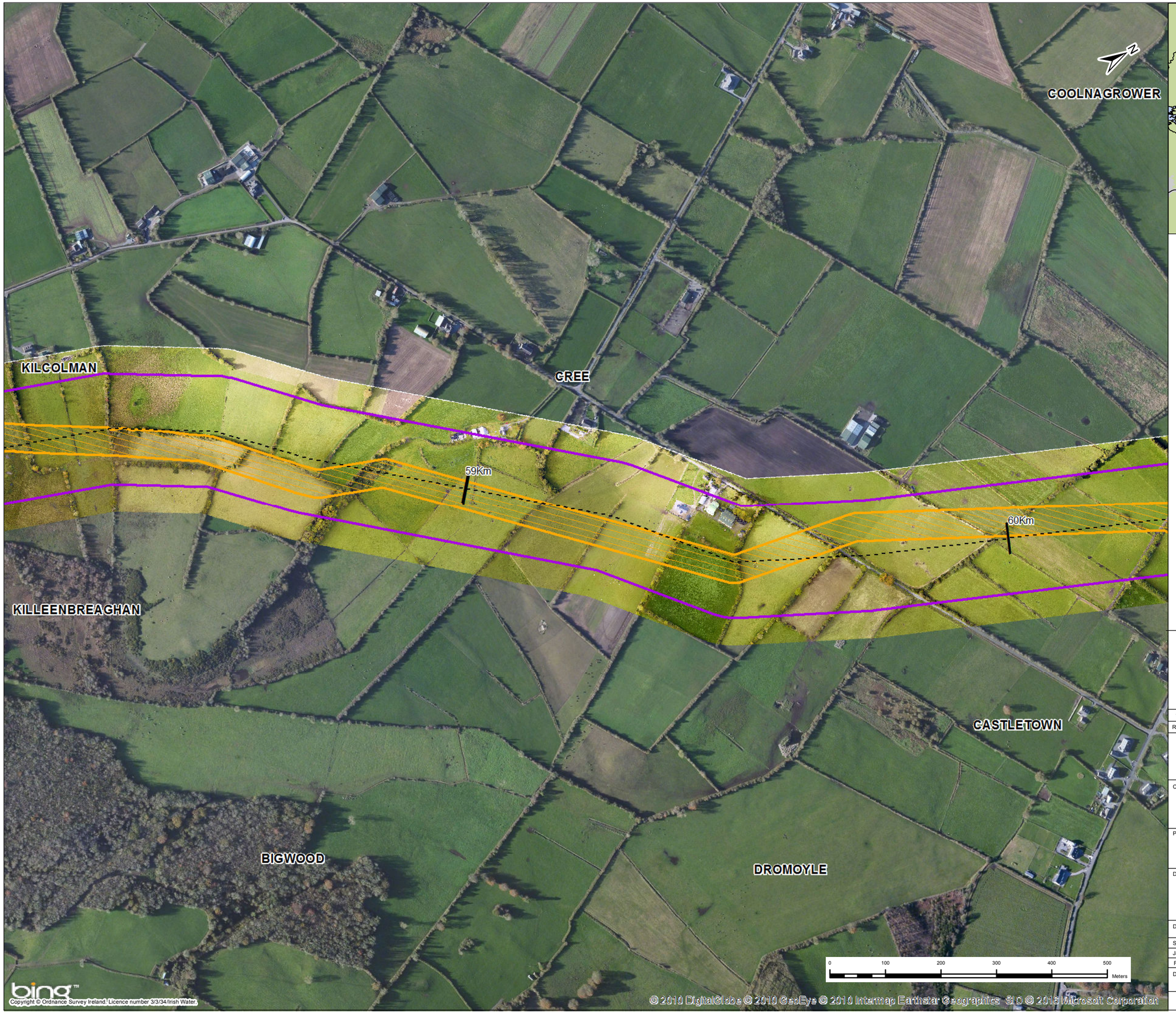
Project: Water Supply Project - Eastern and Midlands Region

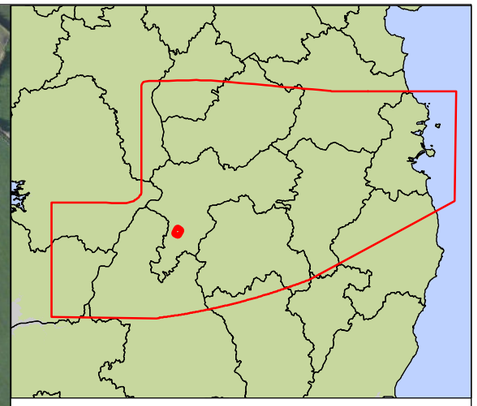
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 WSP-DBO\05 Tasks\5_Mxd\Route Mapping\Rm Corridor Maps.mxd		

Drawing No. 32105801-FOAR-128





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS

TOBIN
Patrick J. Tobin & Co. Ltd.

Client

UISCE ÉIREANN - IRISH WATER

Project

Water Supply Project - Eastern and Midlands Region

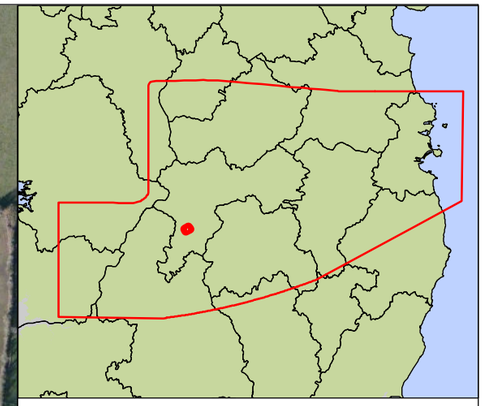
Drawing Title

Preferred 200m Pipeline Corridor
and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 - WSP-ORGS Tarbert_Midd\Route Mapping\50m Corridor Maps.mxd		

Drawing No.
32105801-FOAR-129



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

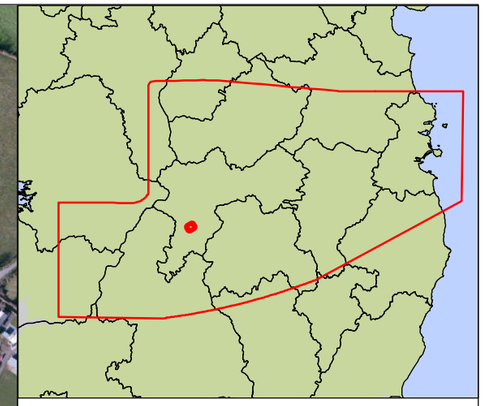
Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\IS\32105801 - WSP-DRG\5 Tasks\5_Mxd\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-130



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN : IRISH WATER

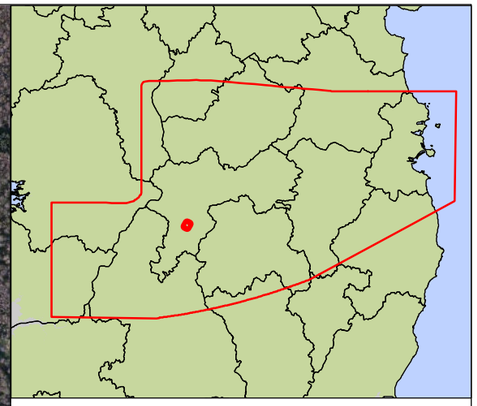
Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 WSP-DRGS Tasks\5_Iss.de\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-131



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN · IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
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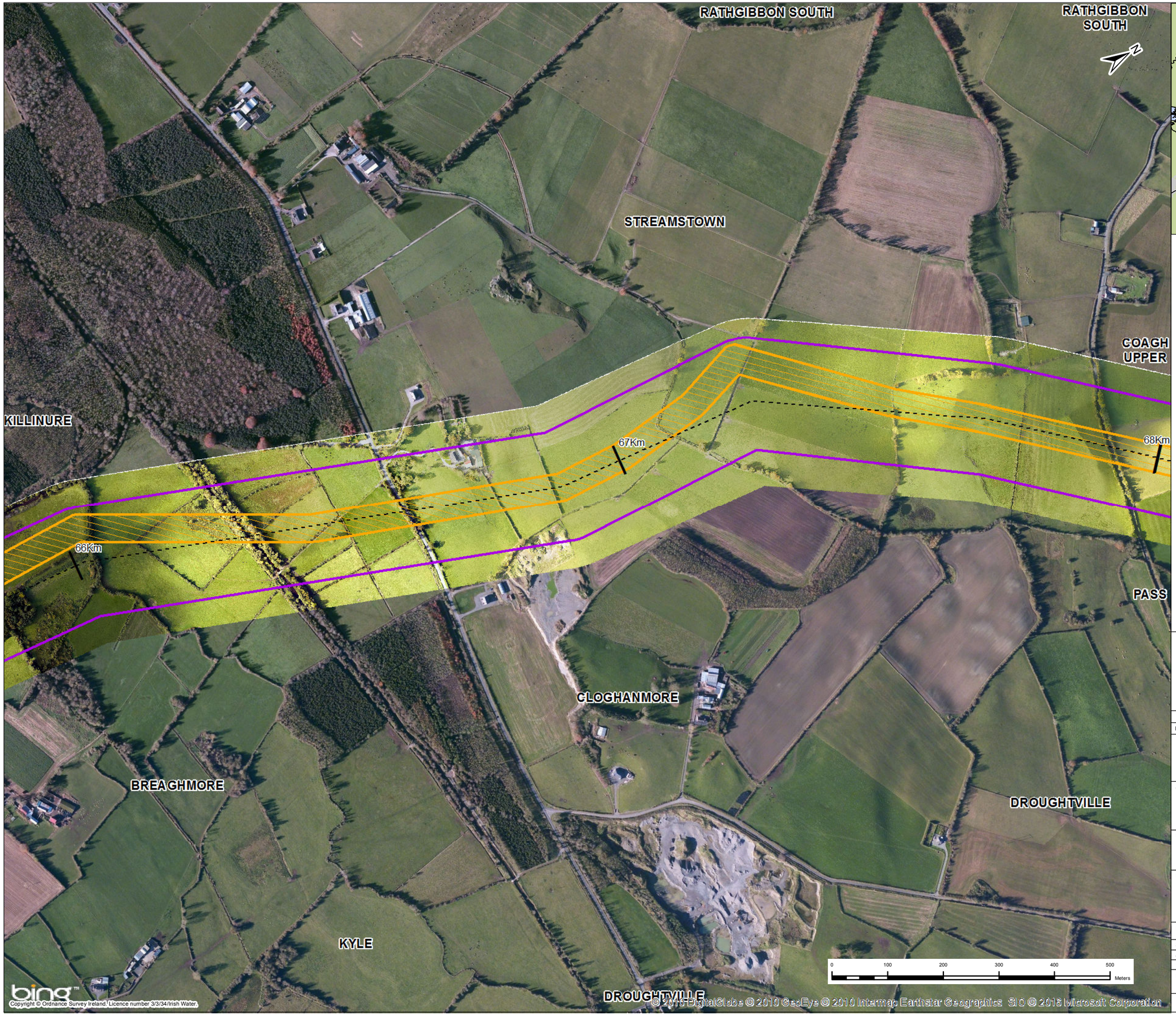
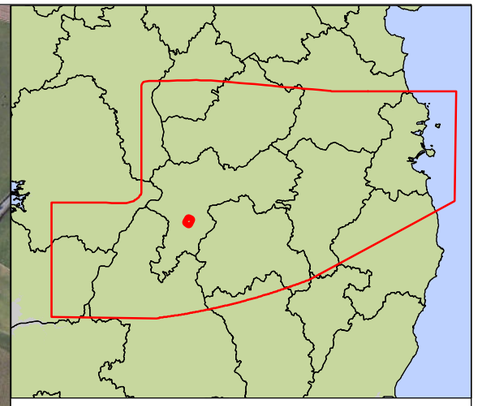
Filepath	G:\IRG\32105801 - WSP-DRG\5 Tasks\5_Mxds\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-132





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

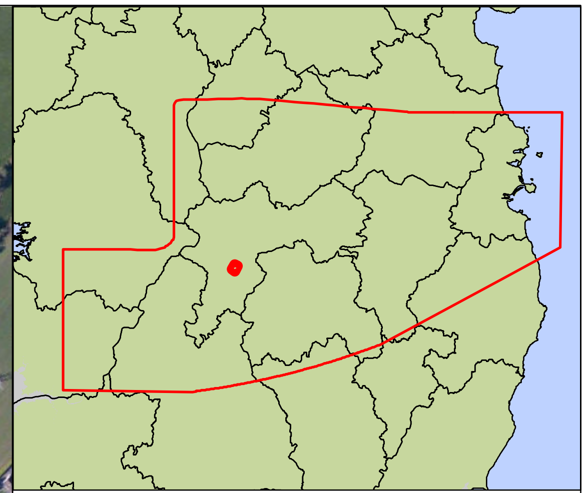
Client: UISCE ÉIREANN - IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status	**For Issue**		
Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\SI\32105801 - WSP-DIRGIS Tasks\5_Mxd\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-133



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

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Patrick J. Tobin & Co. Ltd.

Client
UISCE ÉIREANN : IRISH WATER

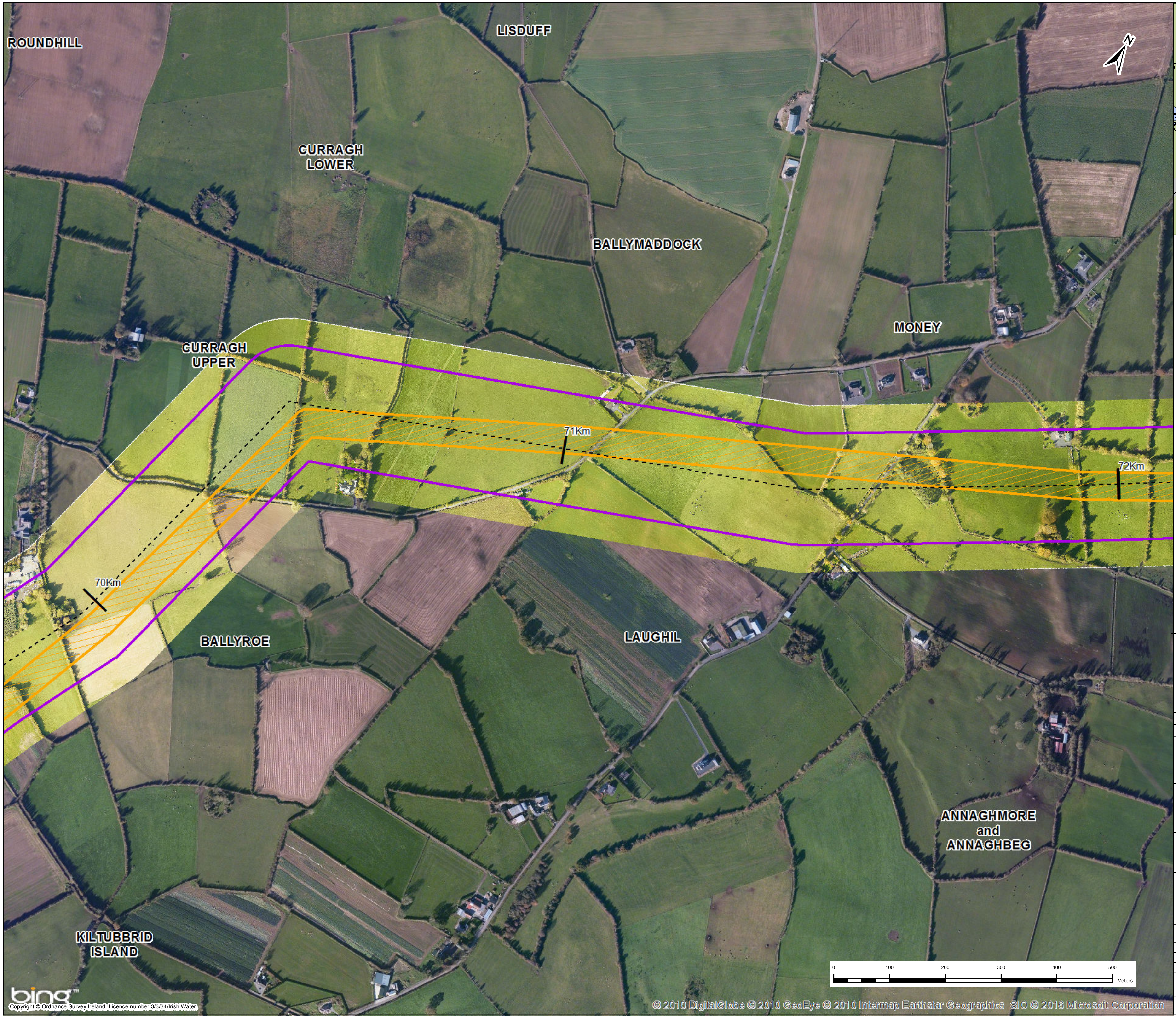
Project
Water Supply Project - Eastern and Midlands Region

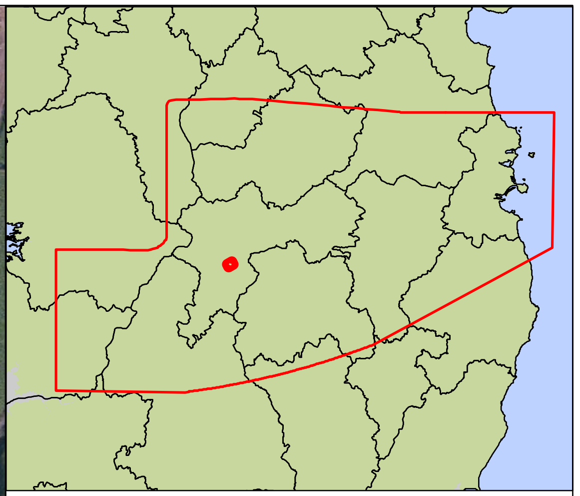
Drawing Title
Preferred 200m Pipeline Corridor
and Indicative 50m Pipeline Corridor

Drawing Status
For Issue

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JI\GIS\32105801 - WSP-DR\GIS Tasks\5_Mxds\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-134





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS® TOBIN Patrick J. Tobin & Co. Ltd.

Client: Uisce Éireann / Irish Water

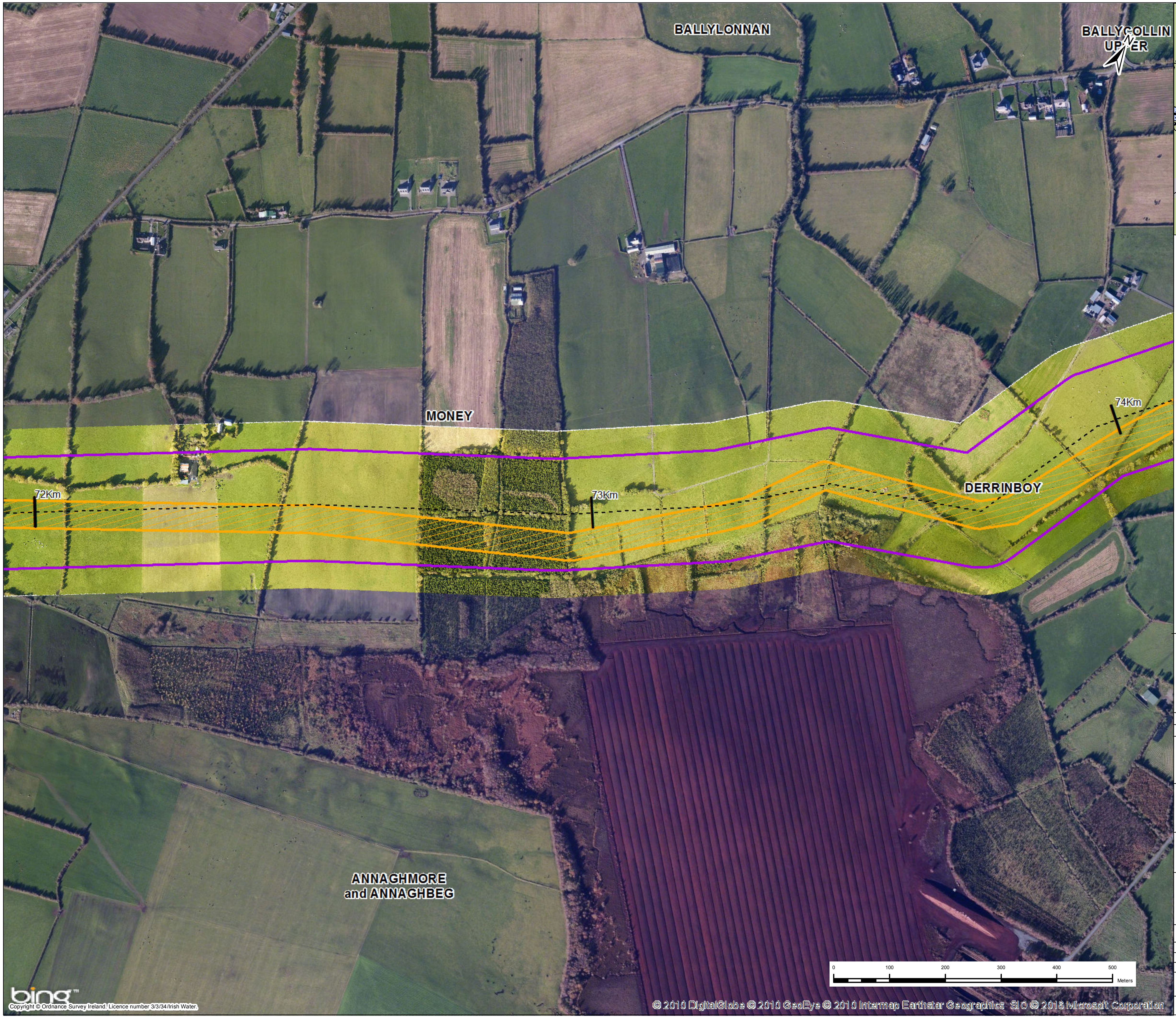
Project: Water Supply Project - Eastern and Midlands Region

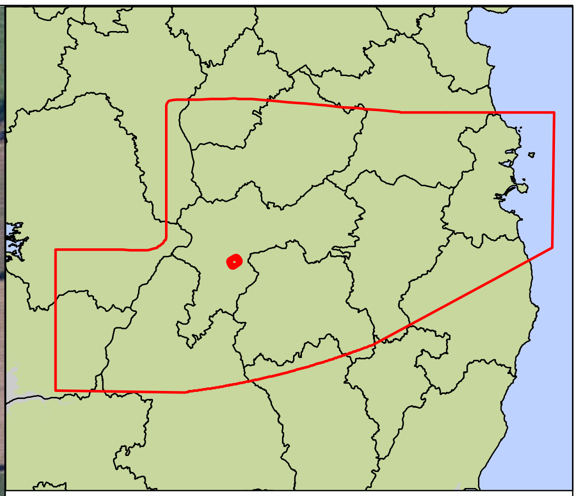
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JI\GIS\32105801 - WSP-DR\GIS Tasks\5_Mxds\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-135





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS® TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN : IRISH WATER

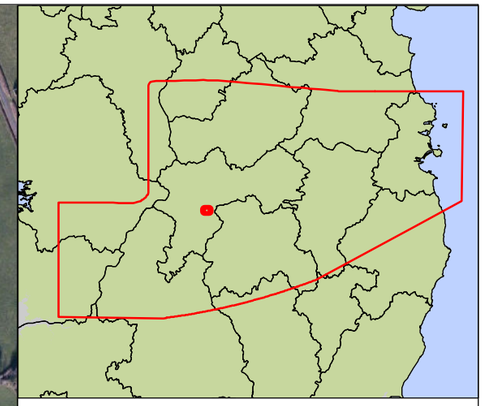
Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JI\GIS\32105801 - WSP-DR\GIS Tasks\5_Mxds\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-136



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

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TOBIN
Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

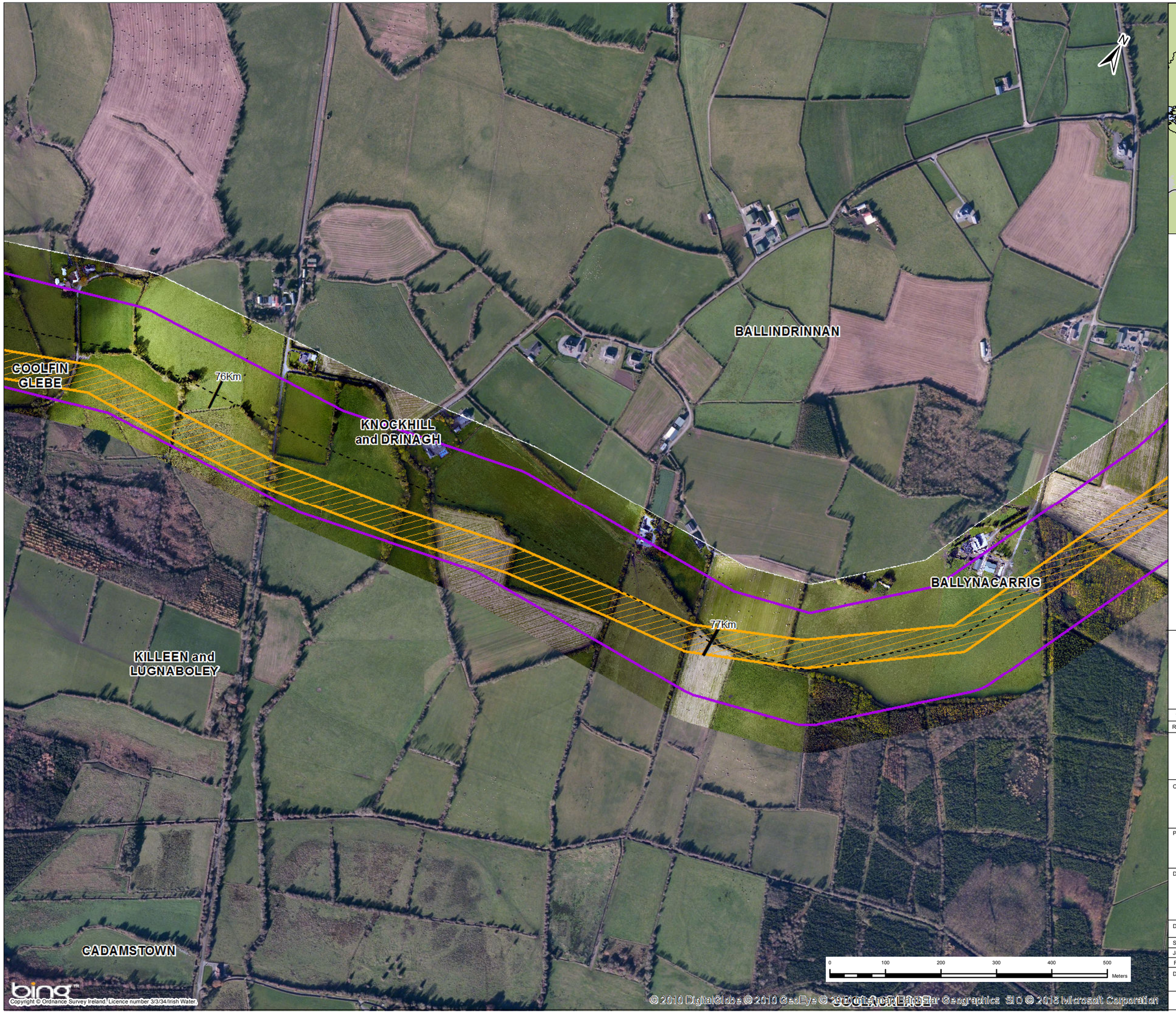
Project: Water Supply Project - Eastern and Midlands Region

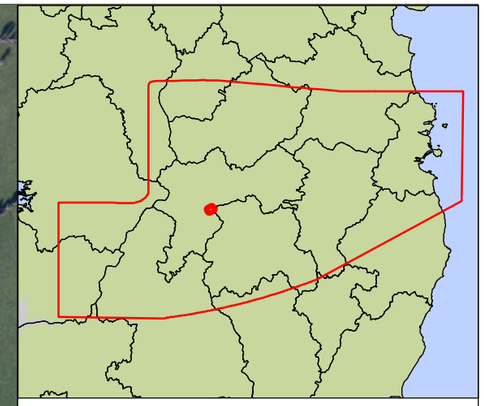
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\32105801 - WSP-DRG\5 Tasks\5_Mode\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-137





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN : IRISH WATER

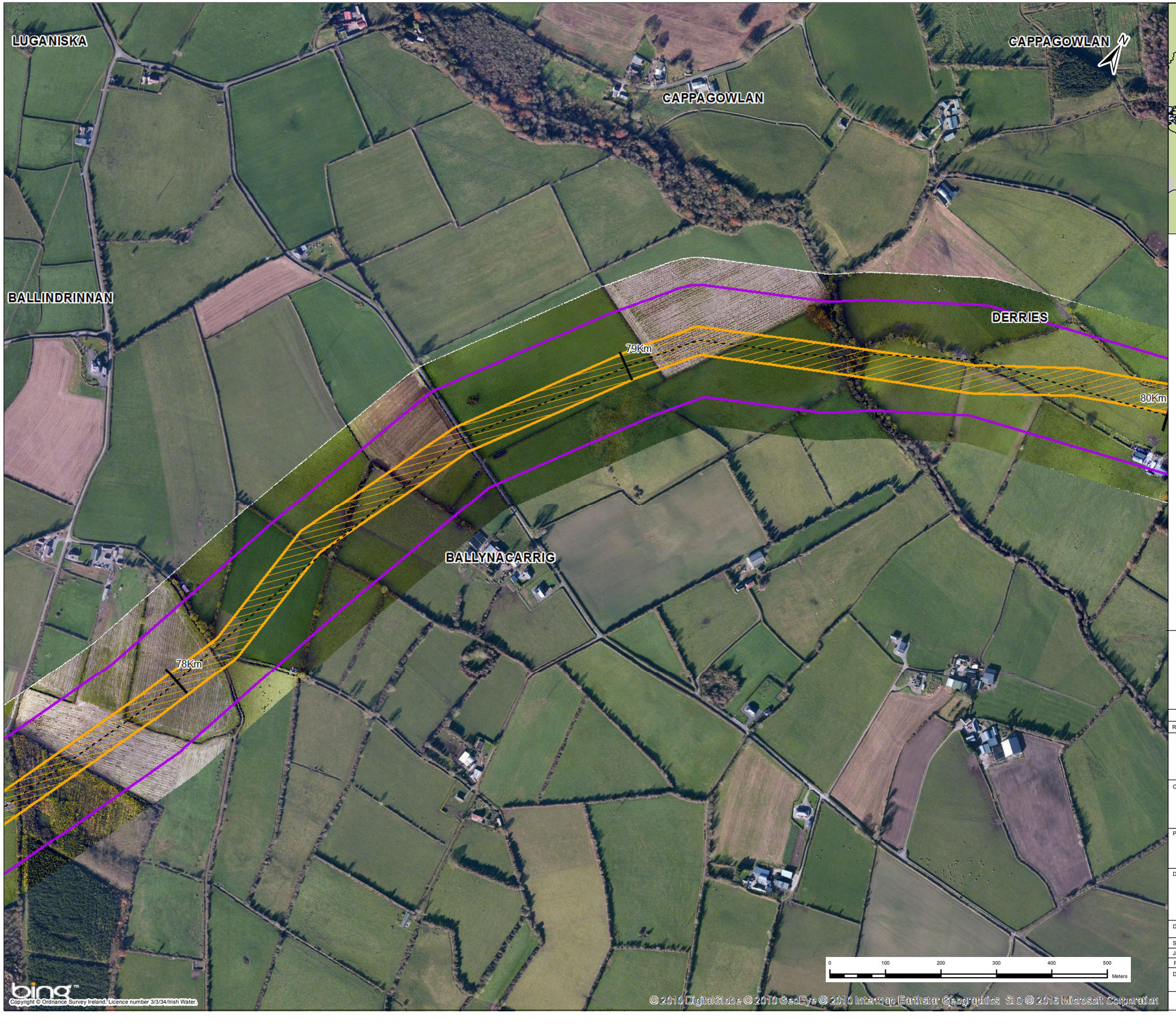
Project: Water Supply Project - Eastern and Midlands Region

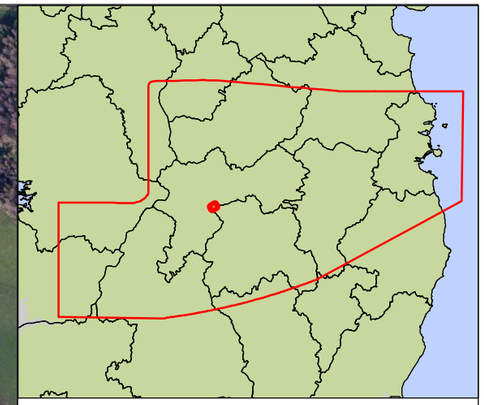
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 WSP-DAGS Tasks\5_Mxd\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-138





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN / IRISH WATER

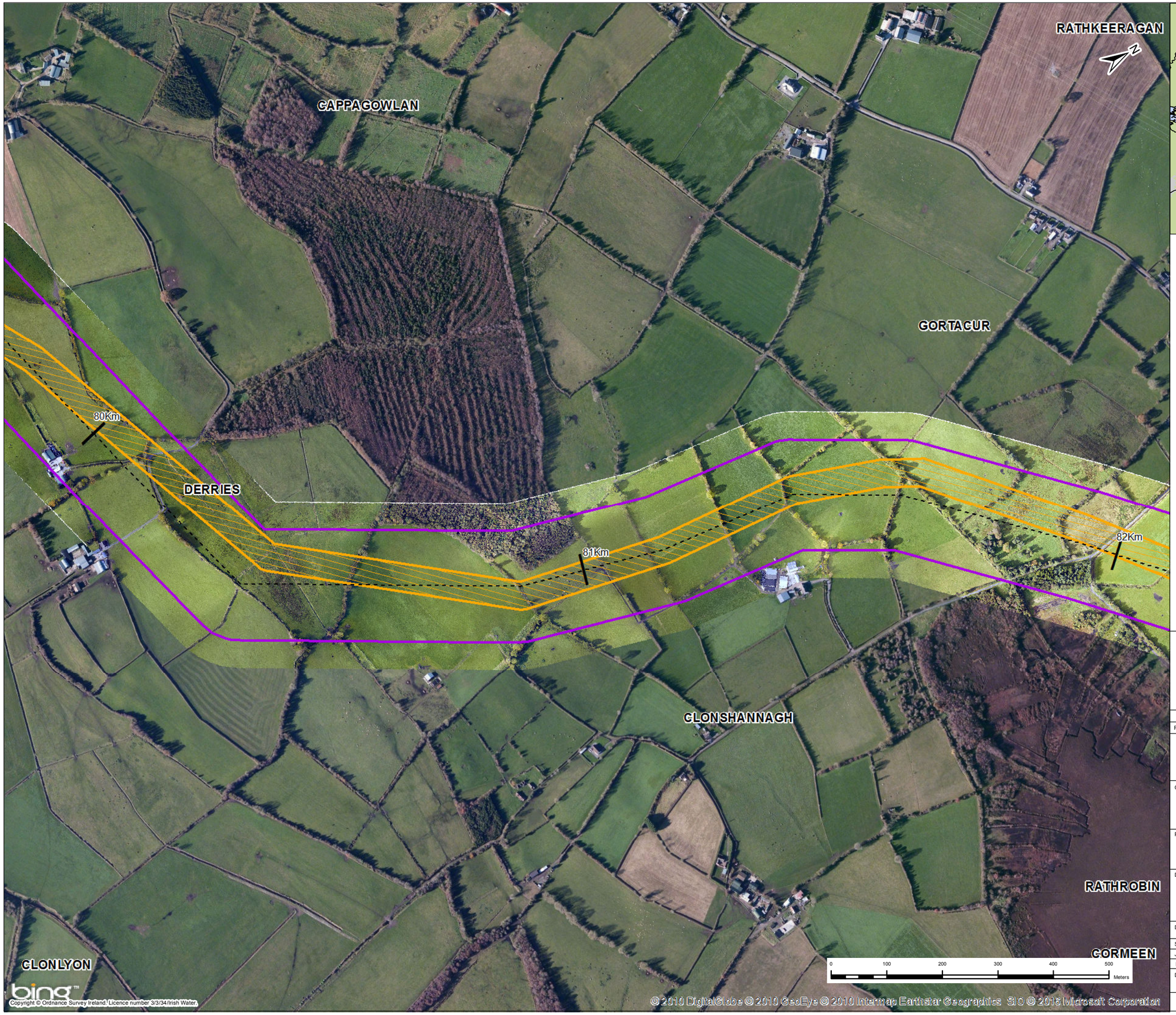
Project: Water Supply Project - Eastern and Midlands Region

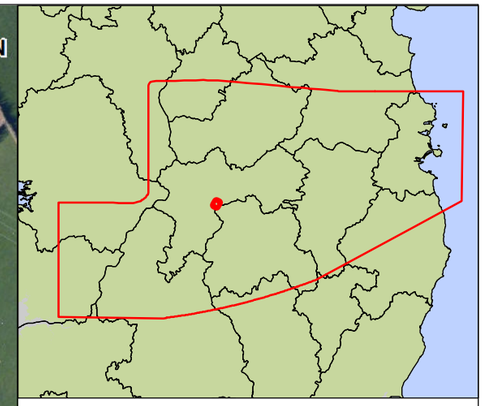
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 WSP-DAGS Tasks\5_Mxd\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-139





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS® TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN / IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status	For Issue		
Scale @A3	1:6,500		DO NOT SCALE
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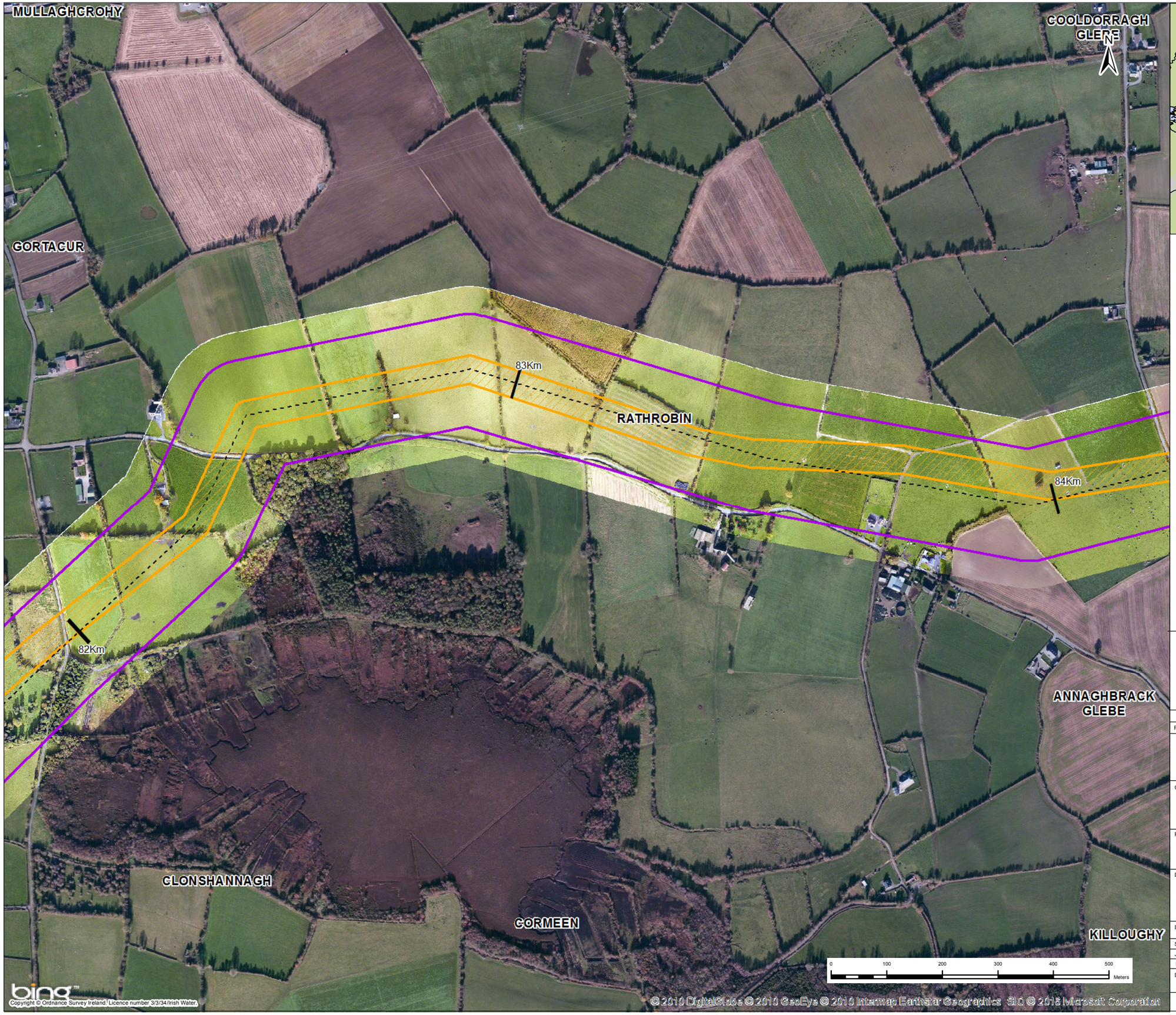
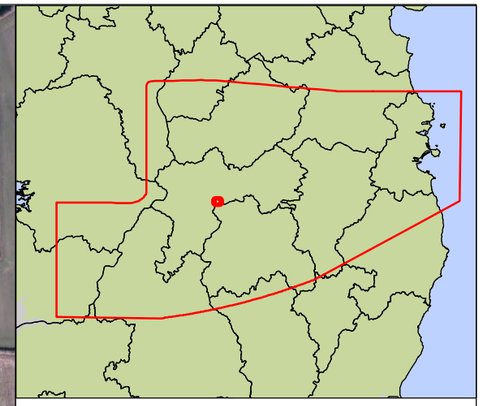
Drawing No. 32105801-FOAR-140





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

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TOBIN
Patrick J. Tobin & Co. Ltd.

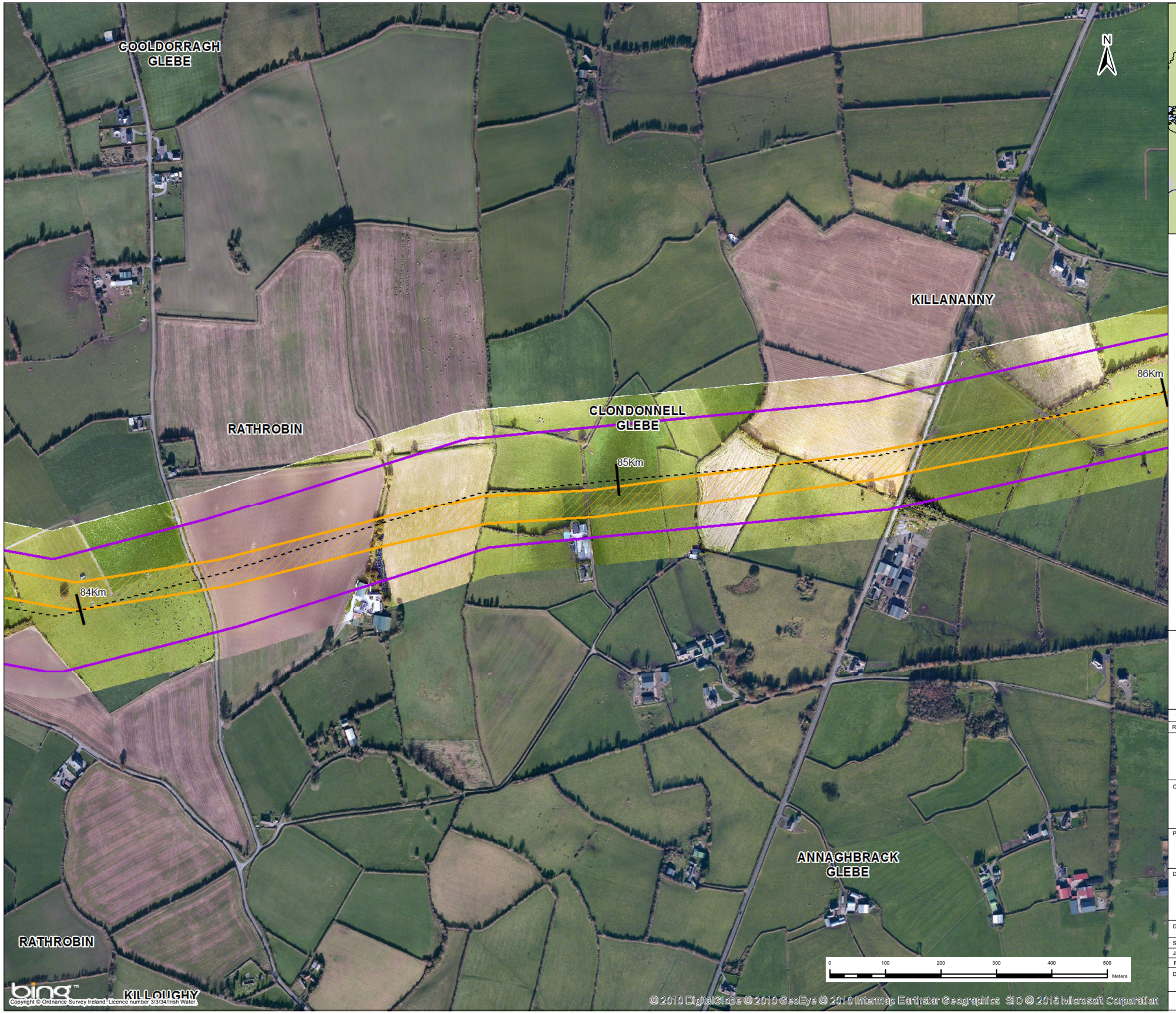
Client: UISCE ÉIREANN - IRISH WATER

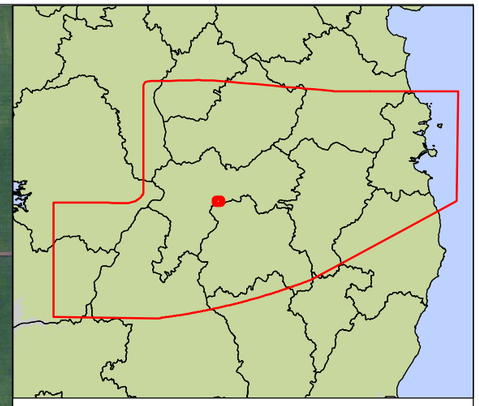
Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status	**For Issue**		
Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\SG32105801 - WSP-DRG\5 Tasks\5_Mode\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-141





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

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TOBIN
Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN : IRISH WATER

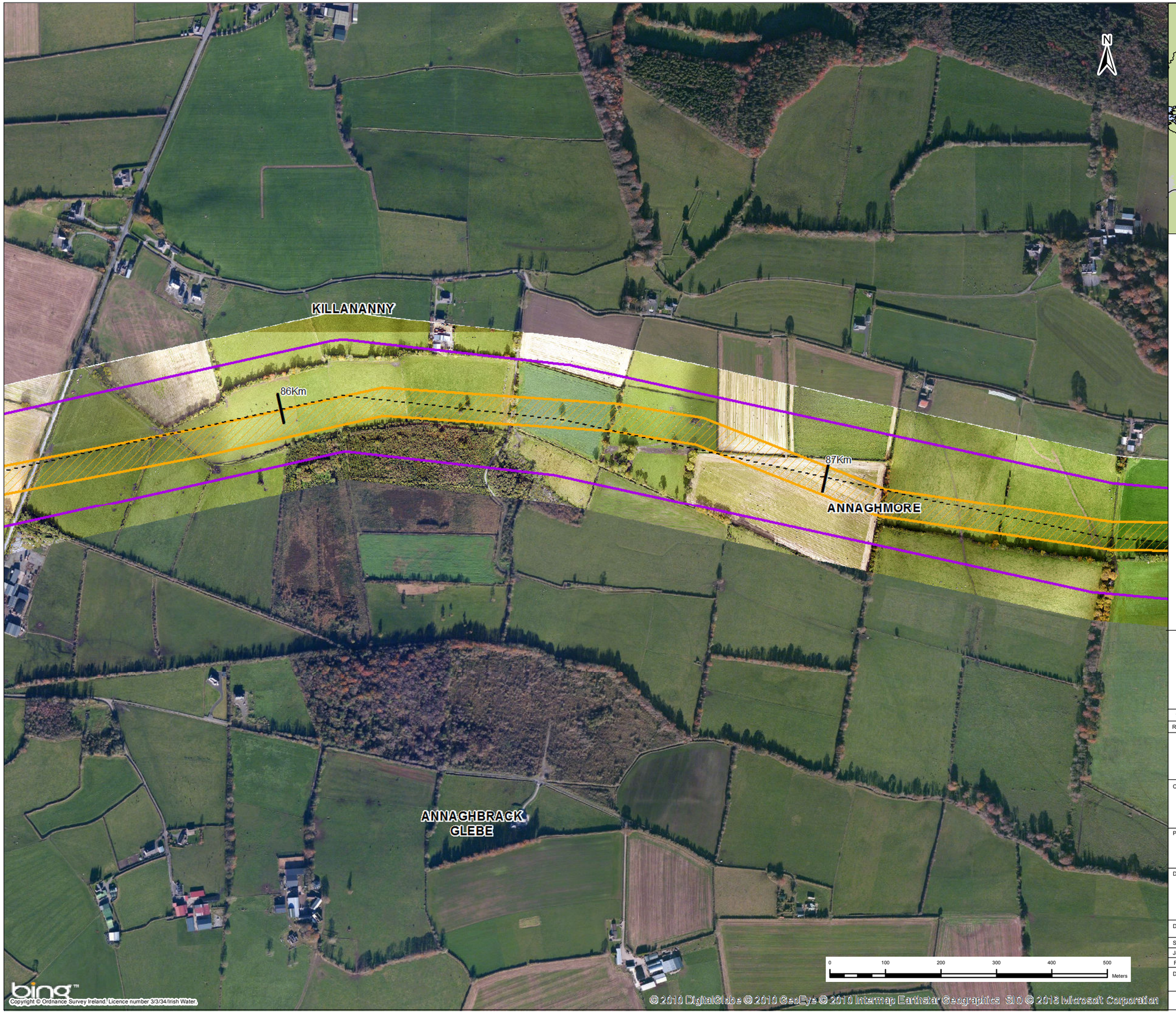
Project: Water Supply Project - Eastern and Midlands Region

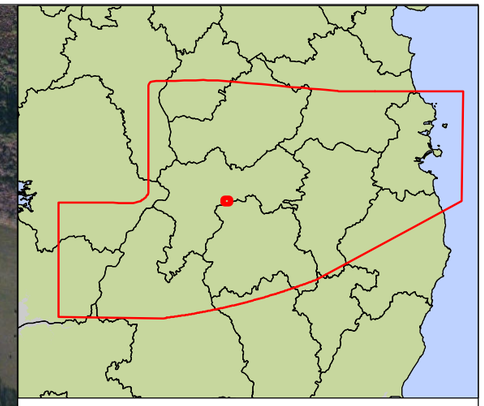
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\S\32105801 - WSP-DIR\GIS Tasks\5_Mxd\Route Mapping\50m Corridor Maps.mxd		

Drawing No.: 32105801-FOAR-142





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS

TOBIN
Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN : IRISH WATER

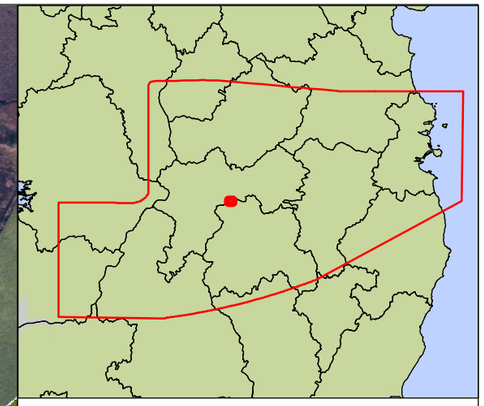
Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\S32105801 - WSP-DRGS Tasks\5_Mx-tb\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-143



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS

TOBIN
Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

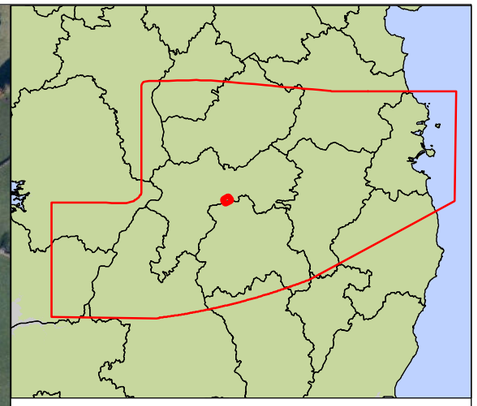
Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JN\32\105801 - WSP-DRGS\ Tasks\5_Mode\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-144



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

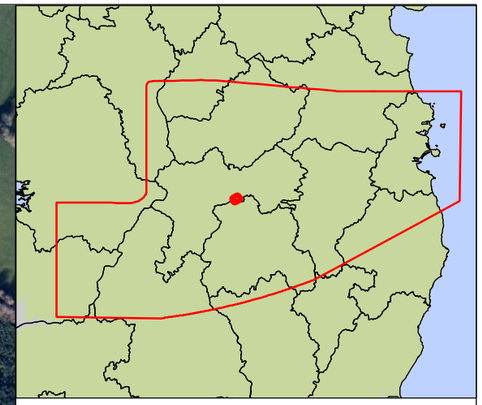
Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\32105801 - WSP-DRG\5 Tasks\5_Mode\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-145



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN · IRISH WATER

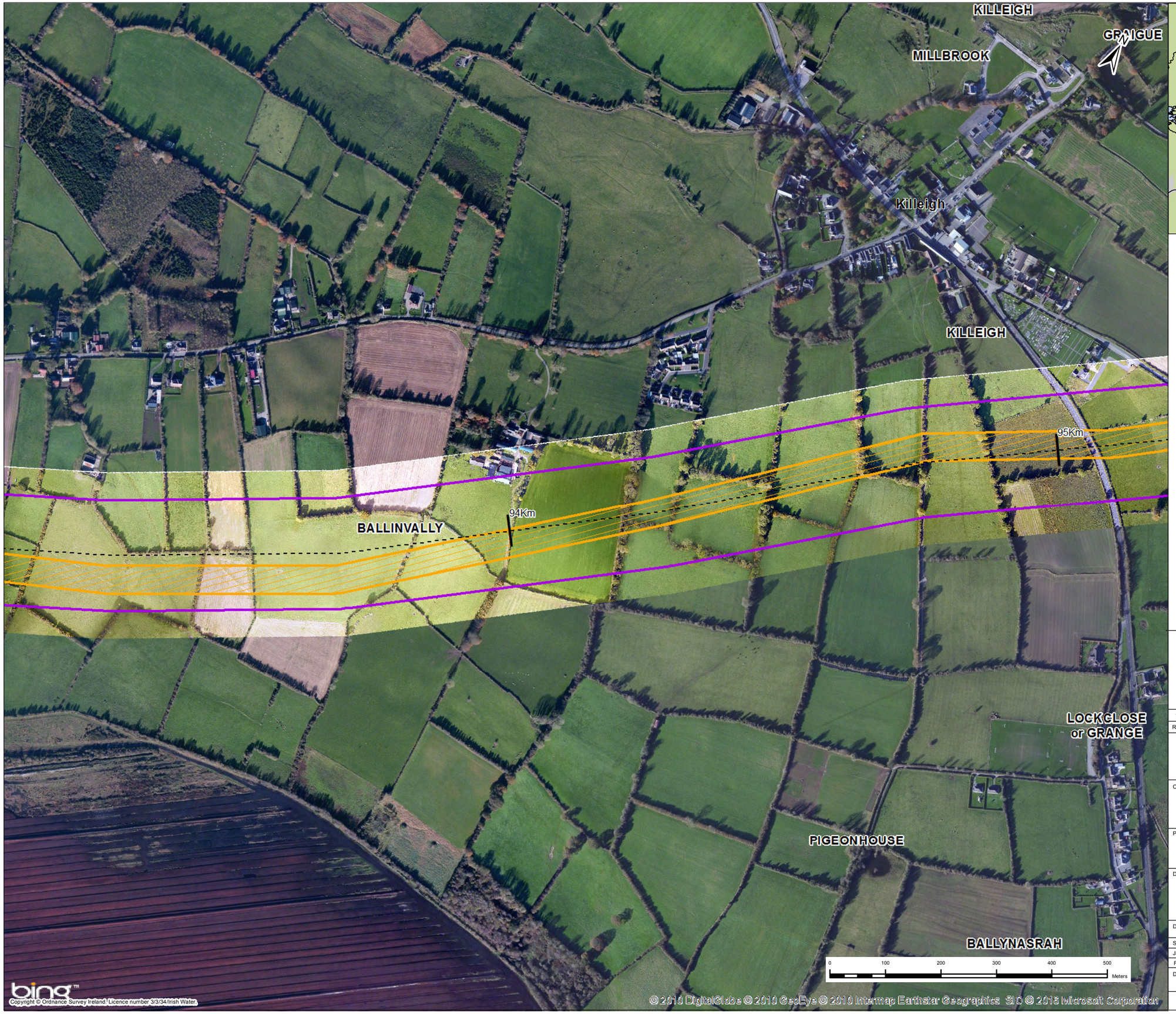
Project: Water Supply Project - Eastern and Midlands Region

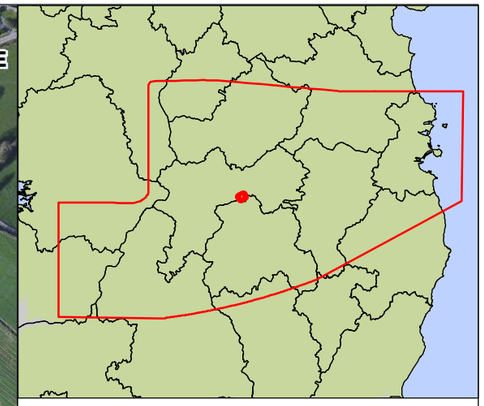
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\S\32105801 - WSP-DRG\S Tasks\S_Mxd\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-146





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

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Patrick J. Tobin & Co. Ltd.

Client

UISCE ÉIREANN IRISH WATER

Project

Water Supply Project - Eastern and Midlands Region

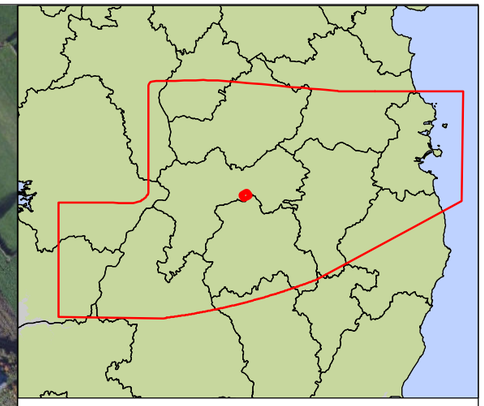
Drawing Title

Preferred 200m Pipeline Corridor
and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 - WSP-DRGB Tarrett_Model\Route Mapping\50m Corridor Mask.mxd		

Drawing No.
32105801-FOAR-147



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS
TOBIN
Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN IRISH WATER

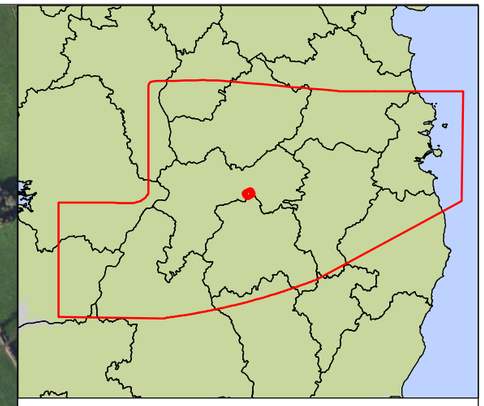
Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 - WSP-DRGS Tasks\5_Mxd\Route Mapping\50m Corridor Maps.mxd		

Drawing No.: 32105801-FOAR-148



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS
TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

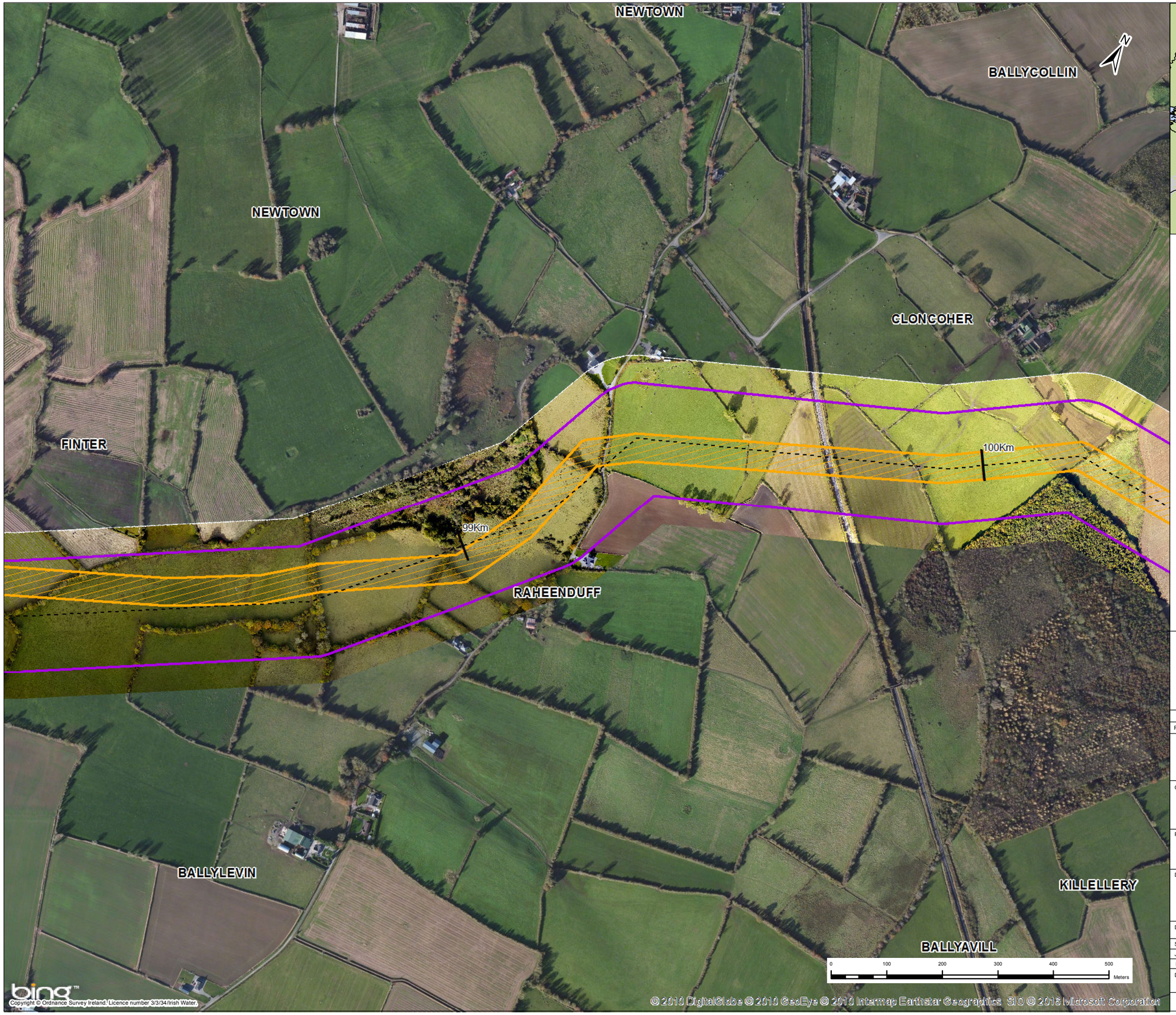
Project: Water Supply Project - Eastern and Midlands Region

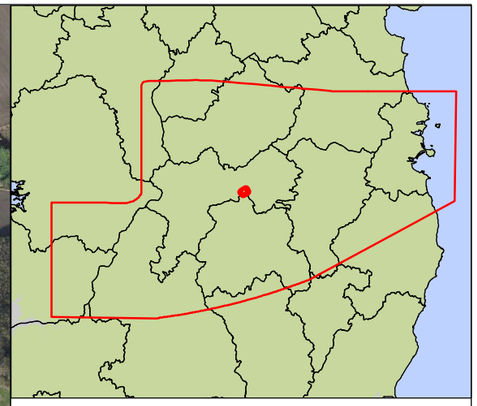
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\32105801 - WSP-DRG\5 Tasks\5_Mode Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-149





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN : IRISH WATER

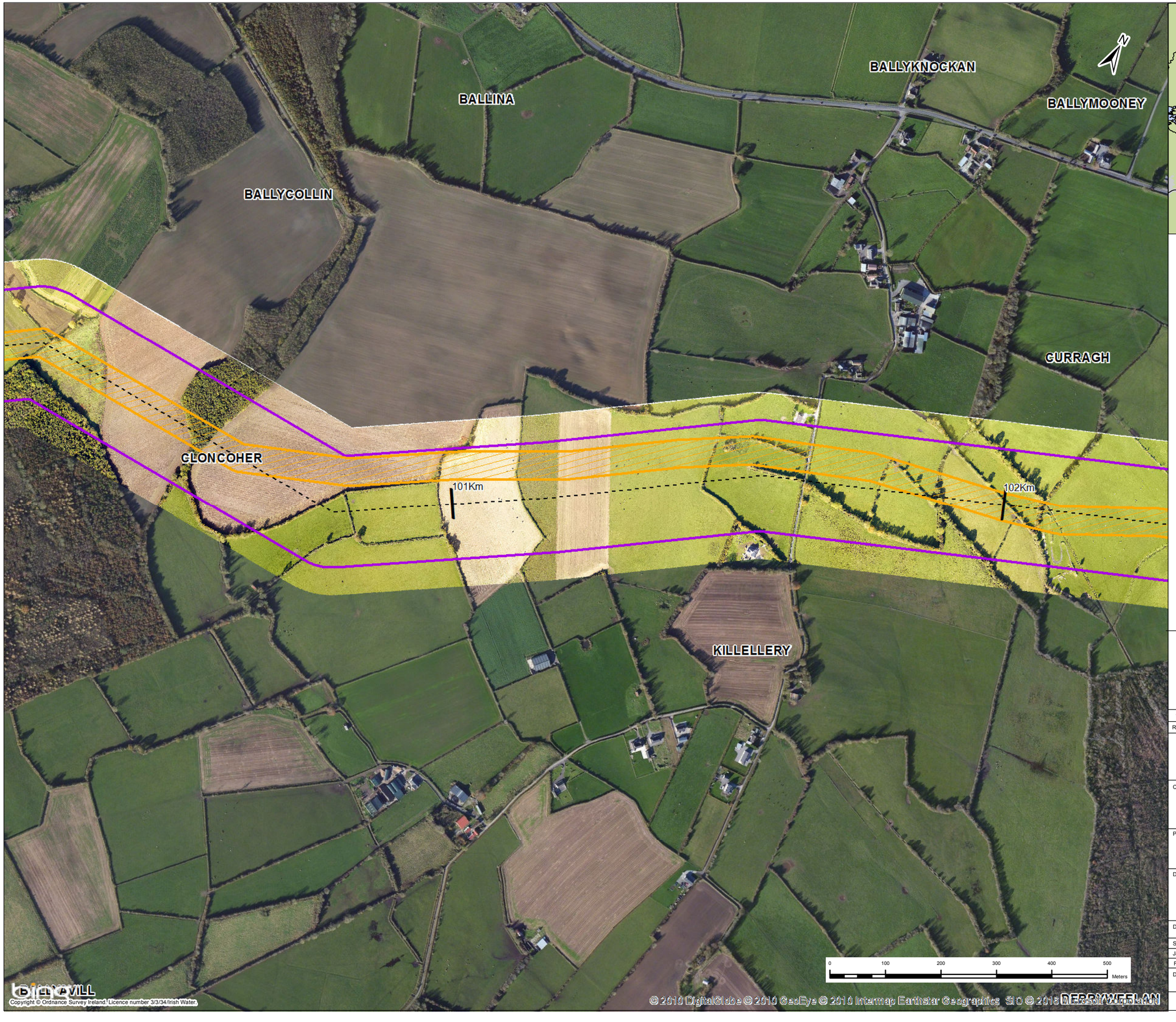
Project: Water Supply Project - Eastern and Midlands Region

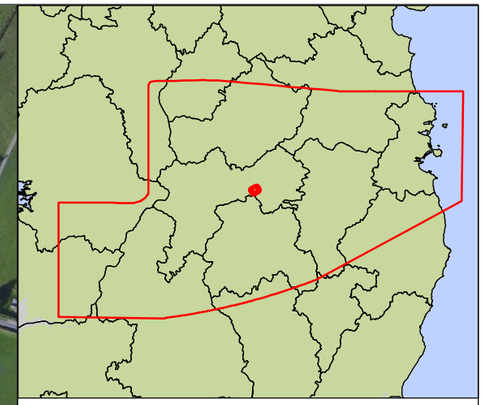
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\S\32105801 - WSP-DIR\GIS Tasks\5_Mxd\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-150





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN : IRISH WATER

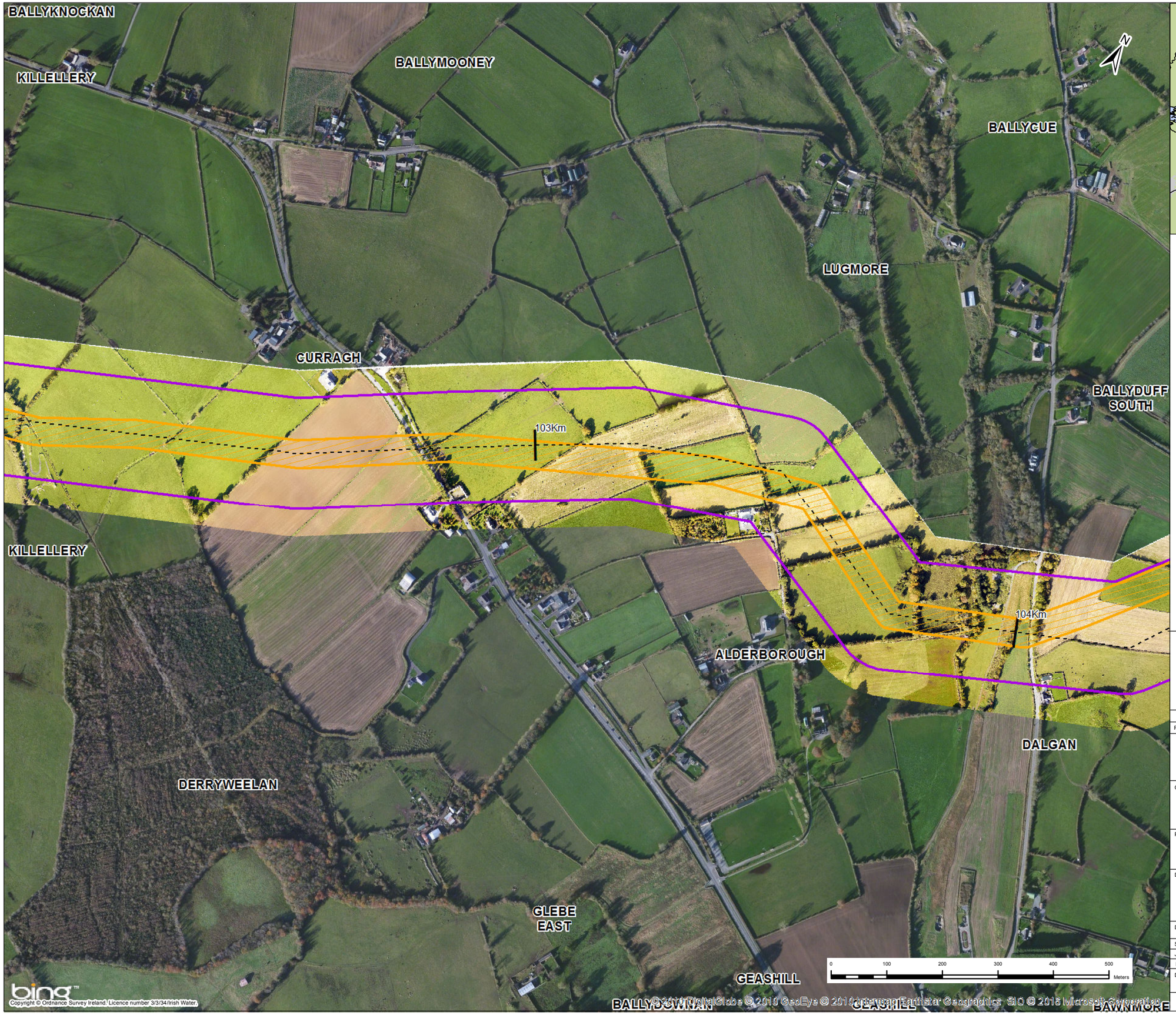
Project: Water Supply Project - Eastern and Midlands Region

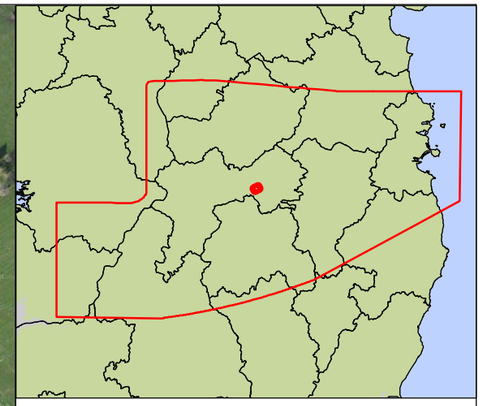
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 WSP-DRGS Tasks\5_Iss.de\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-151





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

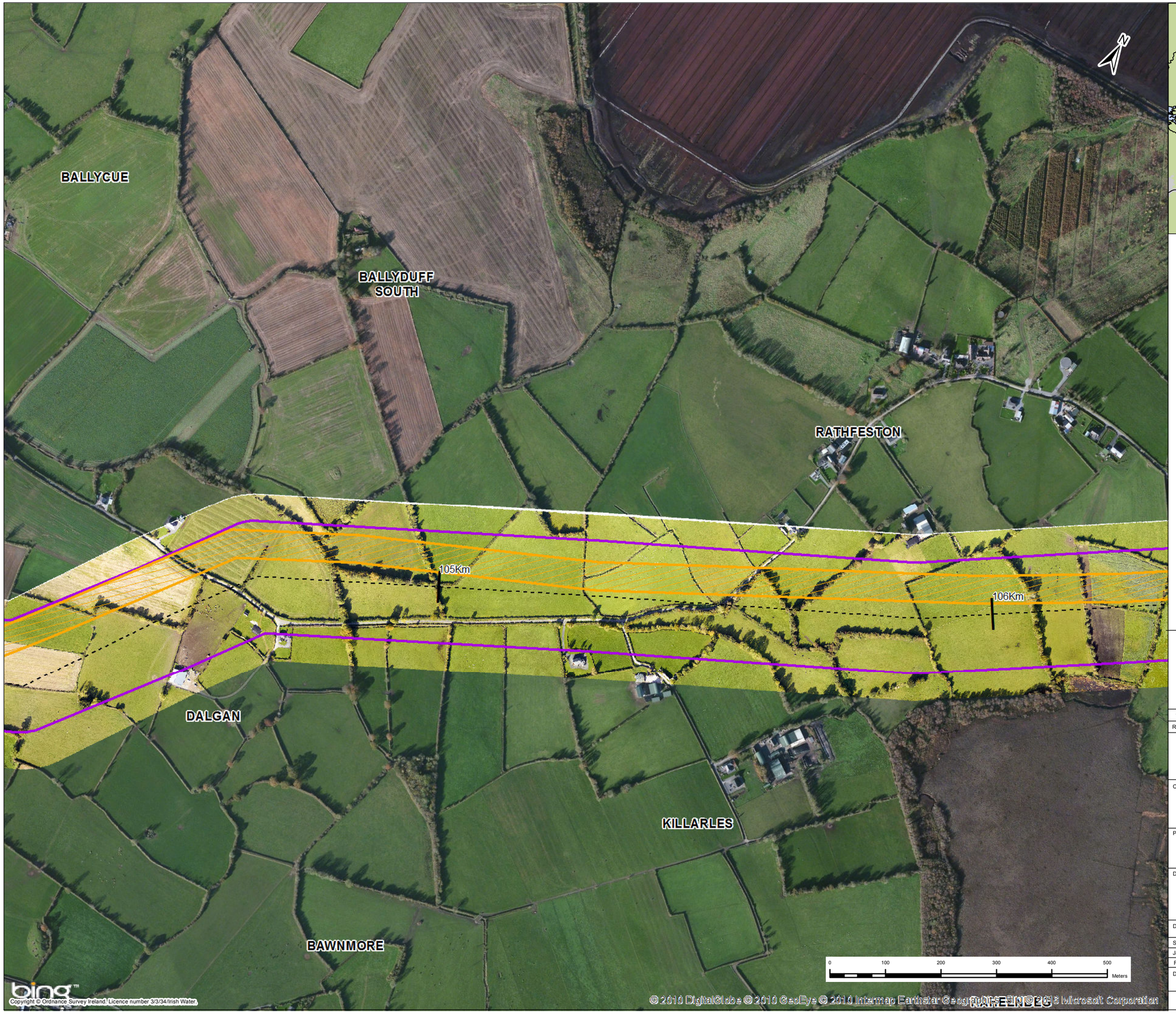
JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

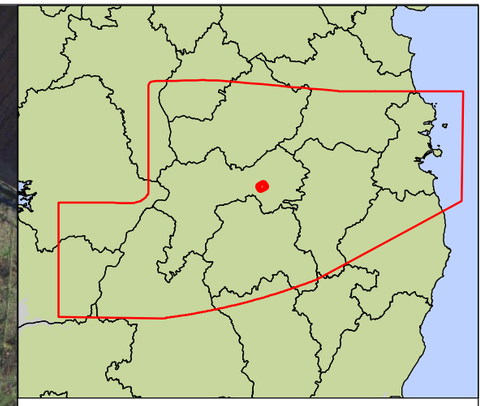
Client: UISCE ÉIREANN : IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status	**For Issue**		
Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\IS\32105801 - WSP-DRGS Tasks\5_Mxd\Route Mapping\50m Corridor Maps.mxd		
Drawing No.	32105801-FOAR-152		





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN · IRISH WATER

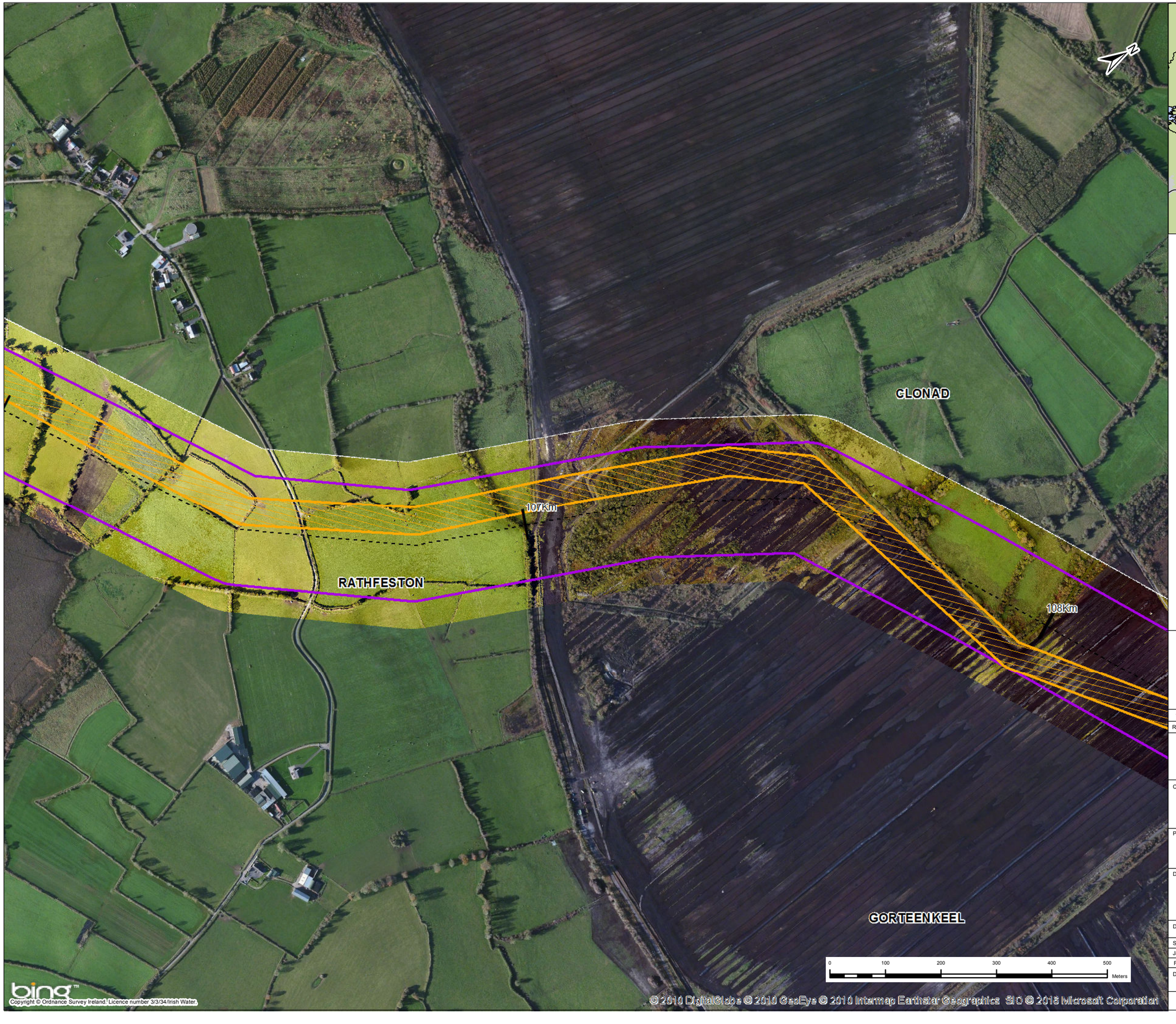
Project: Water Supply Project - Eastern and Midlands Region

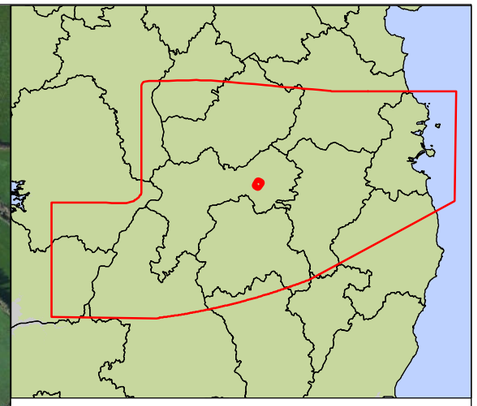
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 WSP-DAGS Tasks\5_Models\Route Mapping\Dtm Corridor Maps.mxd		

Drawing No. 32105801-FOAR-153





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS

TOBIN
Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN : IRISH WATER

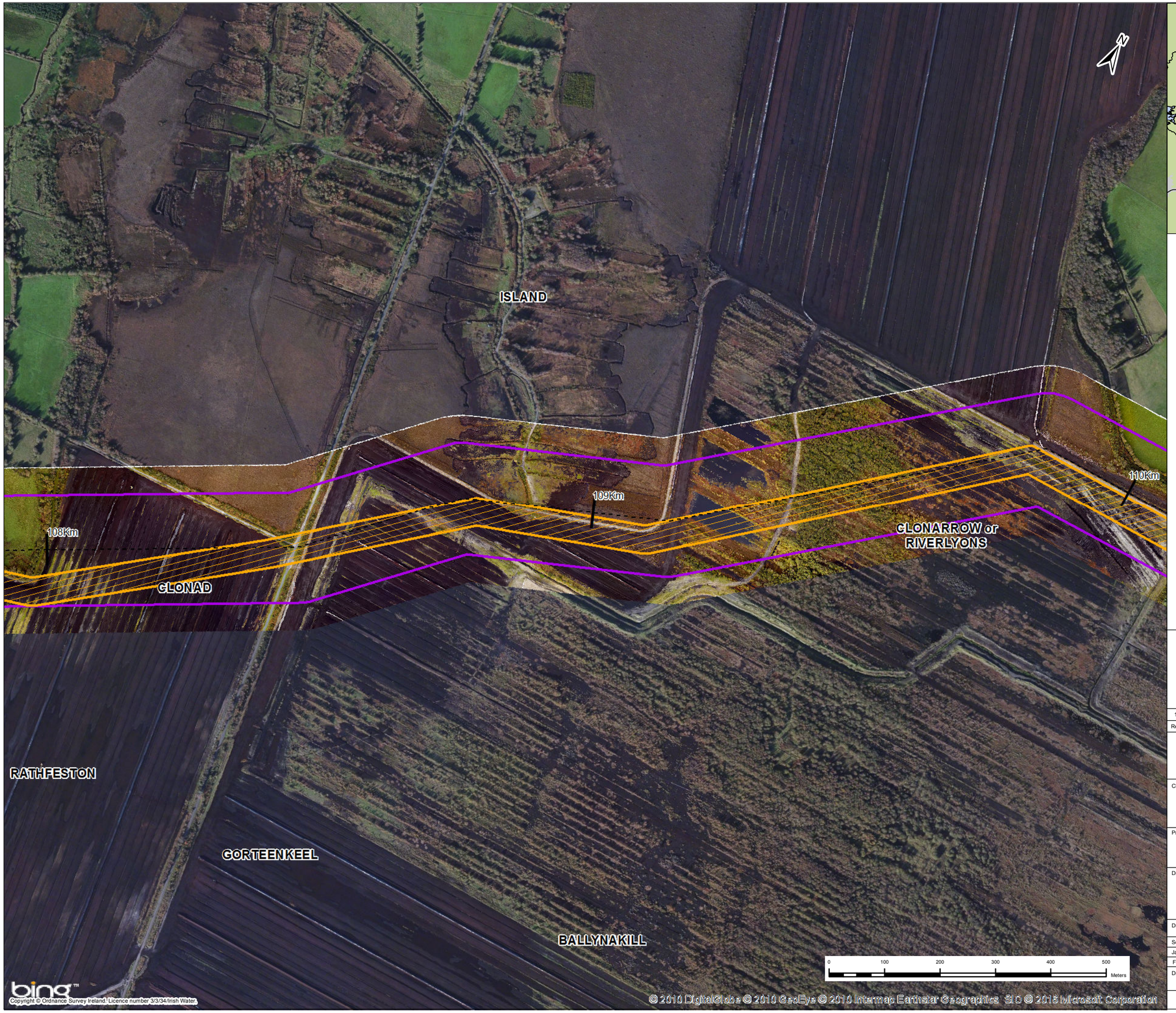
Project: Water Supply Project - Eastern and Midlands Region

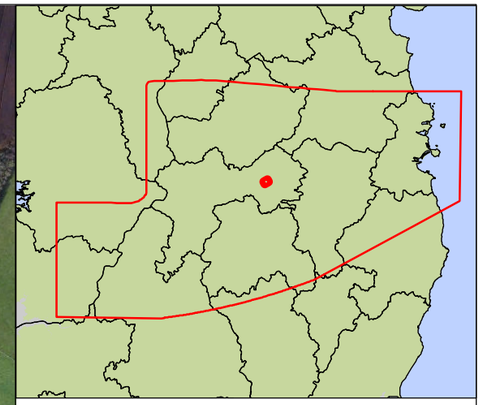
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\32105801 - WSP-DRGS Tasks\5_Mxd\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-154





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS

TOBIN
Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN IRISH WATER

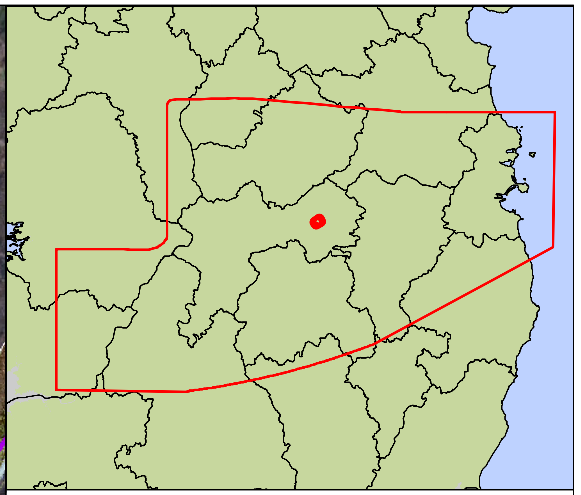
Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRE\GIS\32105801 - WSP-EMGS Tasks\5_Mxd\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-155



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

1	03/11/2016	For Issue	PW	CK	DS	MG
Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd

JACOBS
TOBIN Patrick J. Tobin & Co. Ltd.

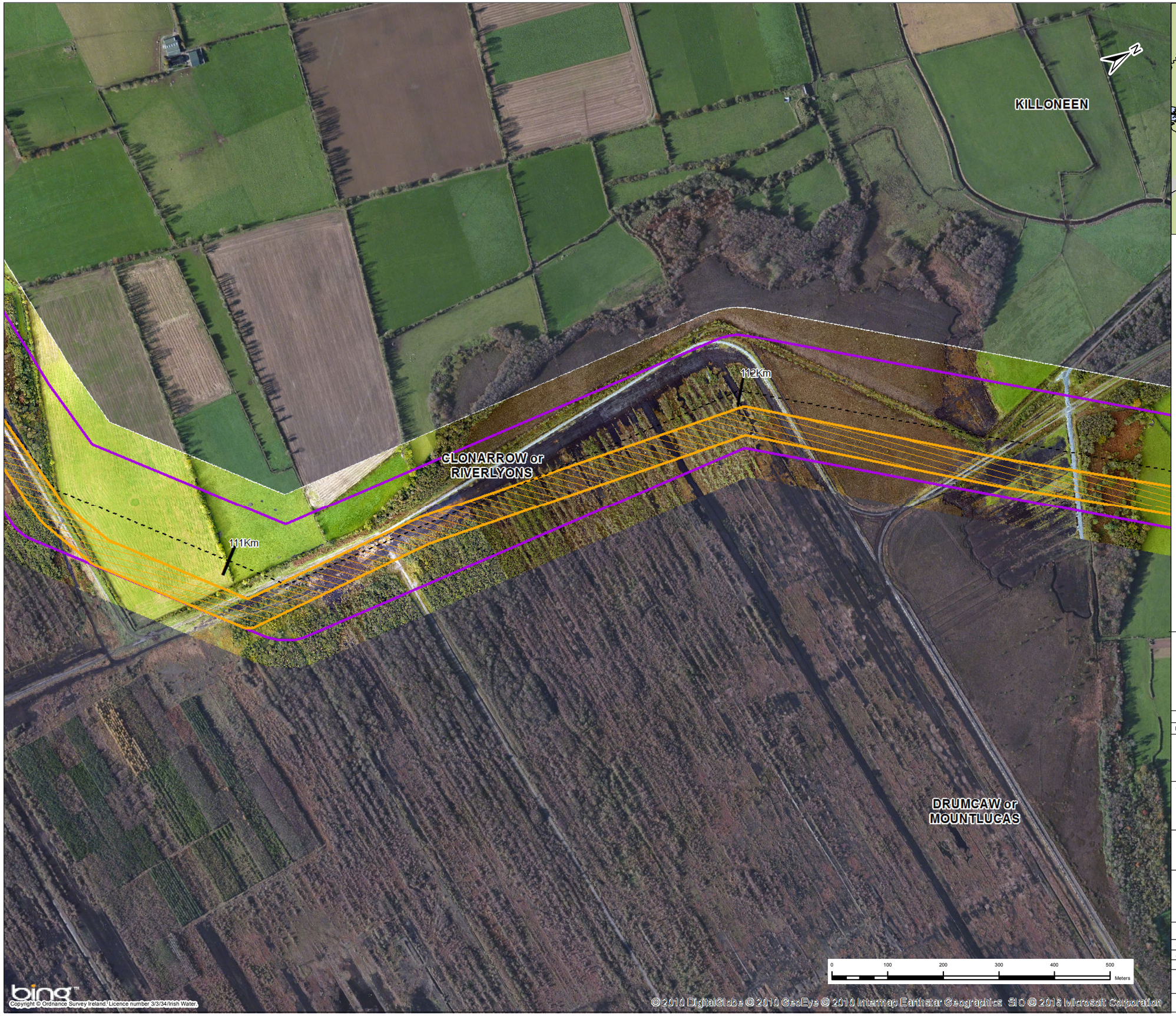
Client
UISCE ÉIREANN : IRISH WATER

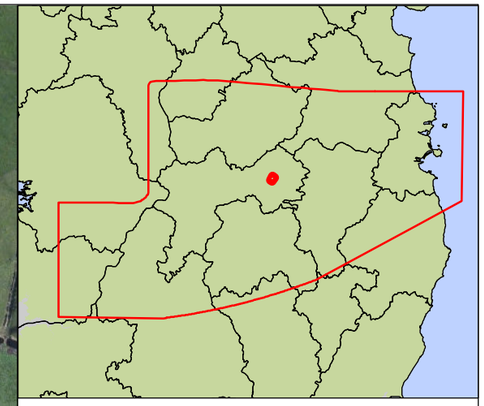
Project
Water Supply Project - Eastern and Midlands Region

Drawing Title
Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status
For Issue

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath			
Drawing No.	32105801-FOAR-156		





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS

TOBIN
Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN : IRISH WATER

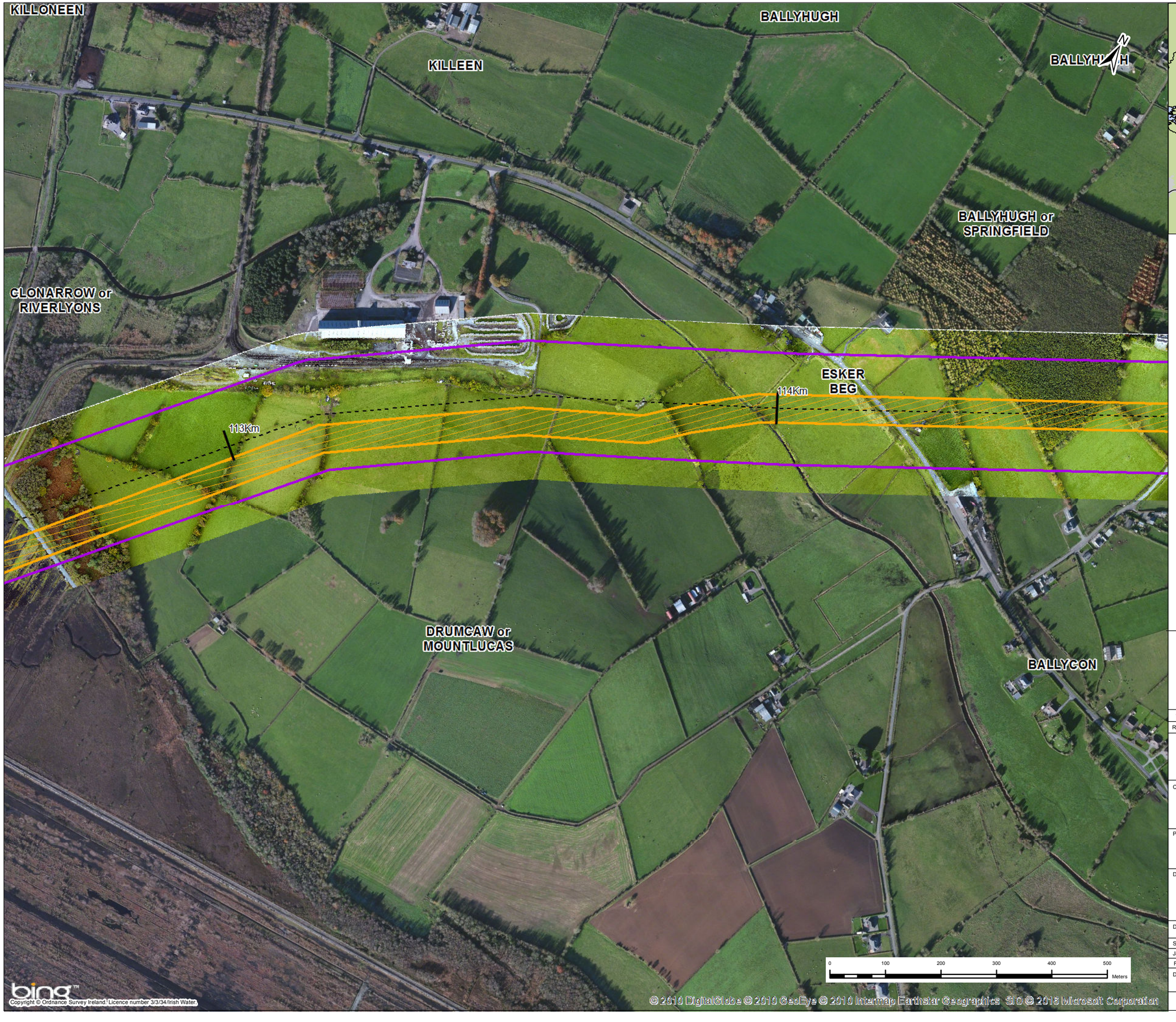
Project: Water Supply Project - Eastern and Midlands Region

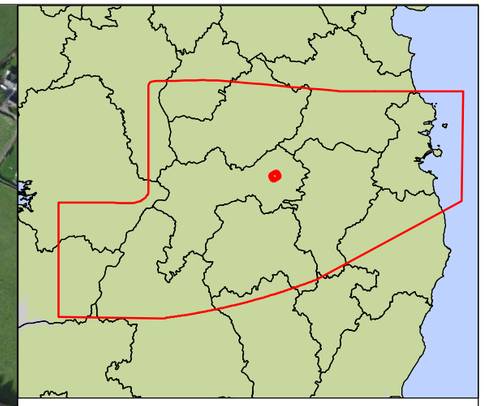
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\32105801 - WSP-DIRG\6 Tasks\5_Mxd\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-157





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS

TOBIN
Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN : IRISH WATER

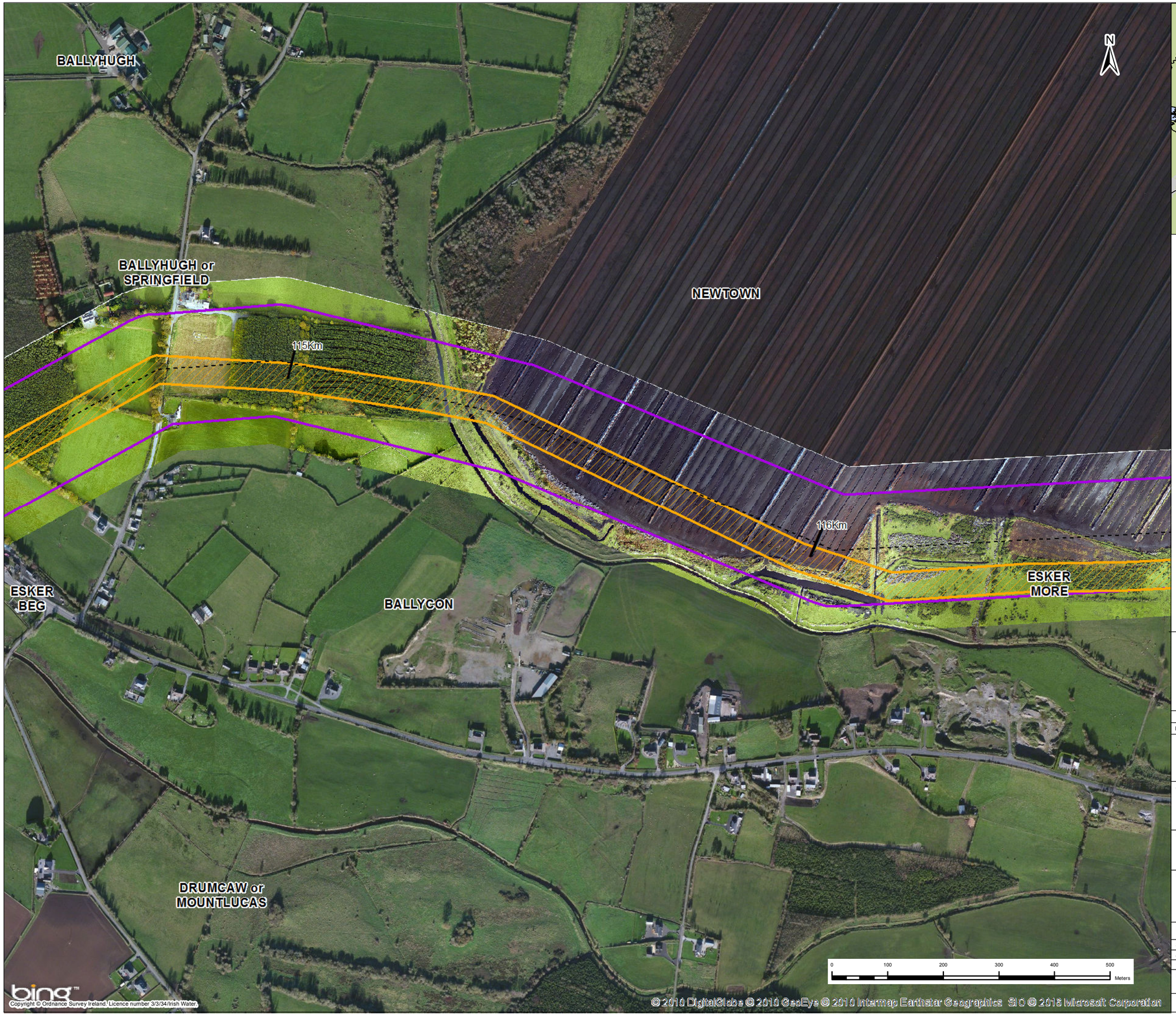
Project: Water Supply Project - Eastern and Midlands Region

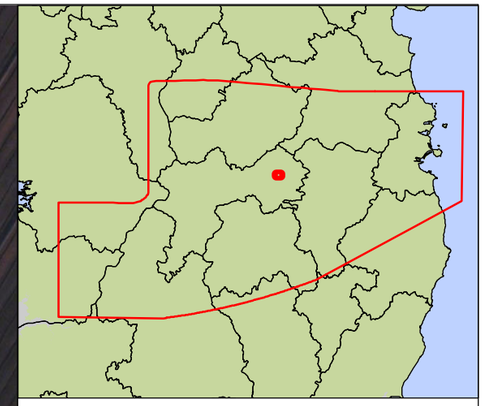
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 WSP-DRGS Tasks\5_Iss.de\Raw Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-158





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS® TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

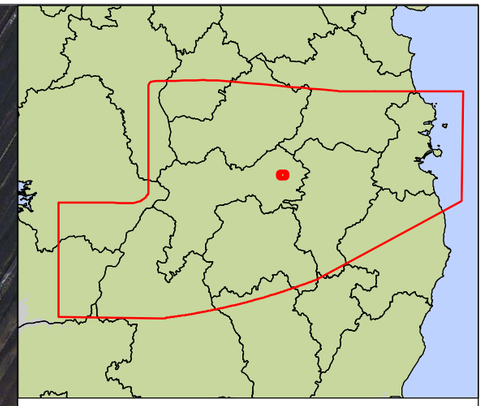
Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 - WSP-ORGS Tender\5_Mxd+Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-159



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

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Client

UISCE ÉIREANN IRISH WATER

Project

Water Supply Project - Eastern and Midlands Region

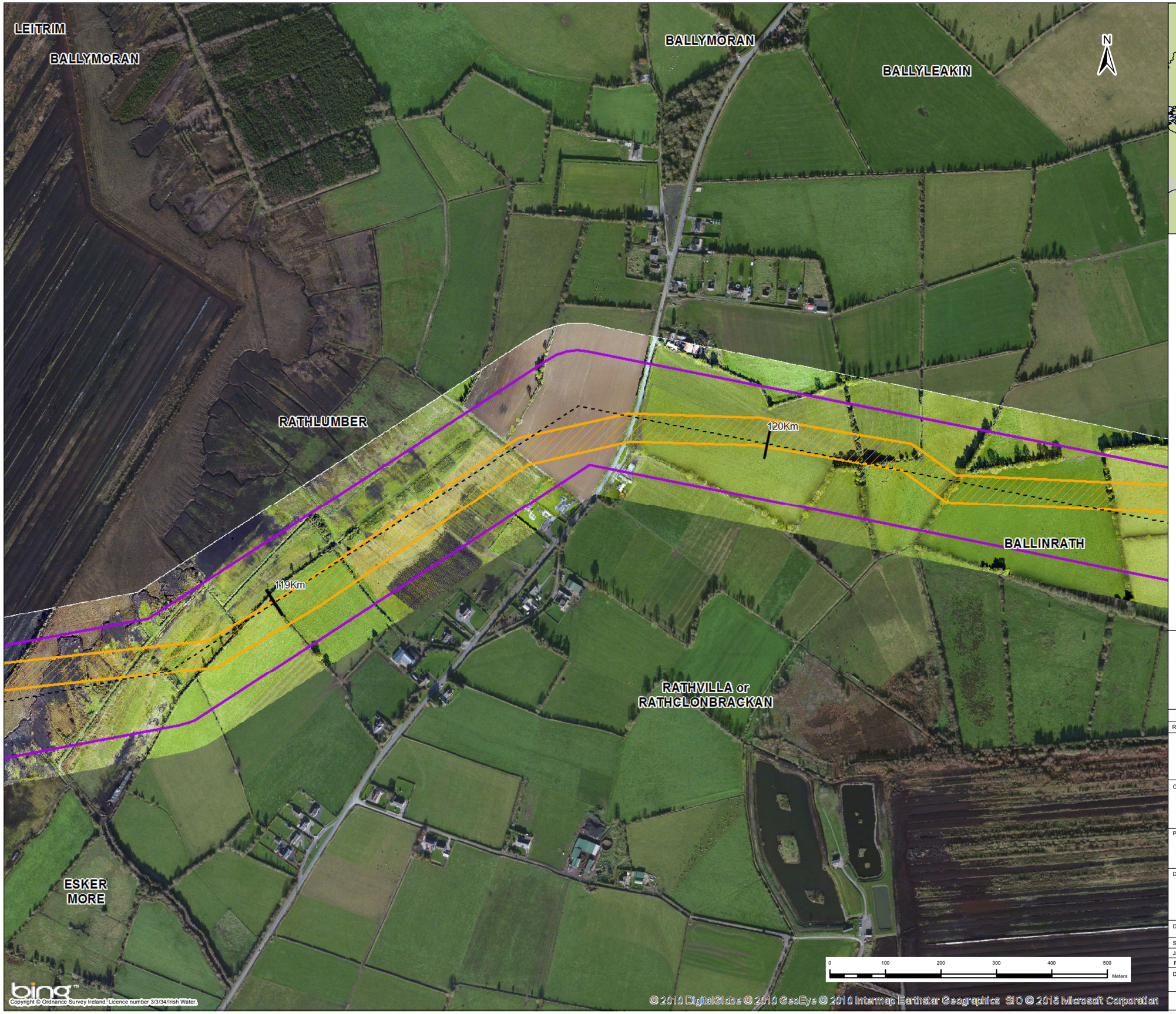
Drawing Title

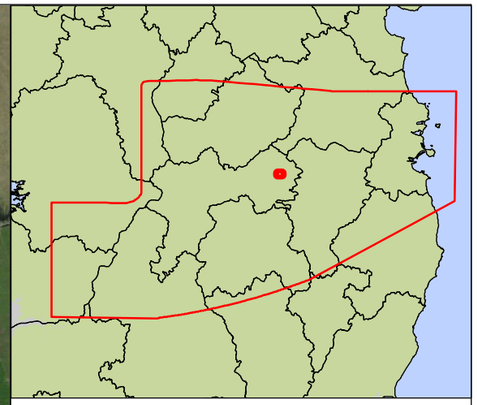
Preferred 200m Pipeline Corridor
and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 - WSP-DRGB Tarbert_Mullingar\Route Mapping\50m Corridor Maps.mxd		

Drawing No.
32105801-FOAR-160





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

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Client

UISCE ÉIREANN : IRISH WATER

Project

Water Supply Project - Eastern and Midlands Region

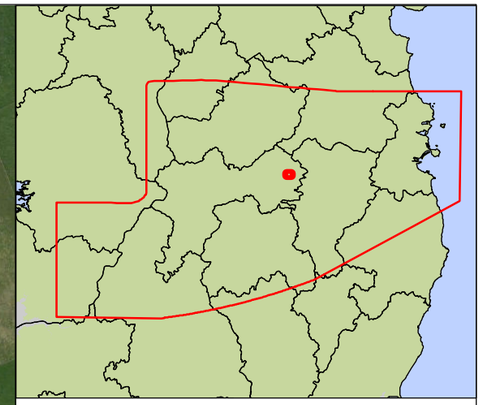
Drawing Title

Preferred 200m Pipeline Corridor
and Indicative 50m Pipeline Corridor

Drawing Status **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\32105801 - WSP-DIRG\6 Tasks\5_Mode\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-161



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

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TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN : IRISH WATER

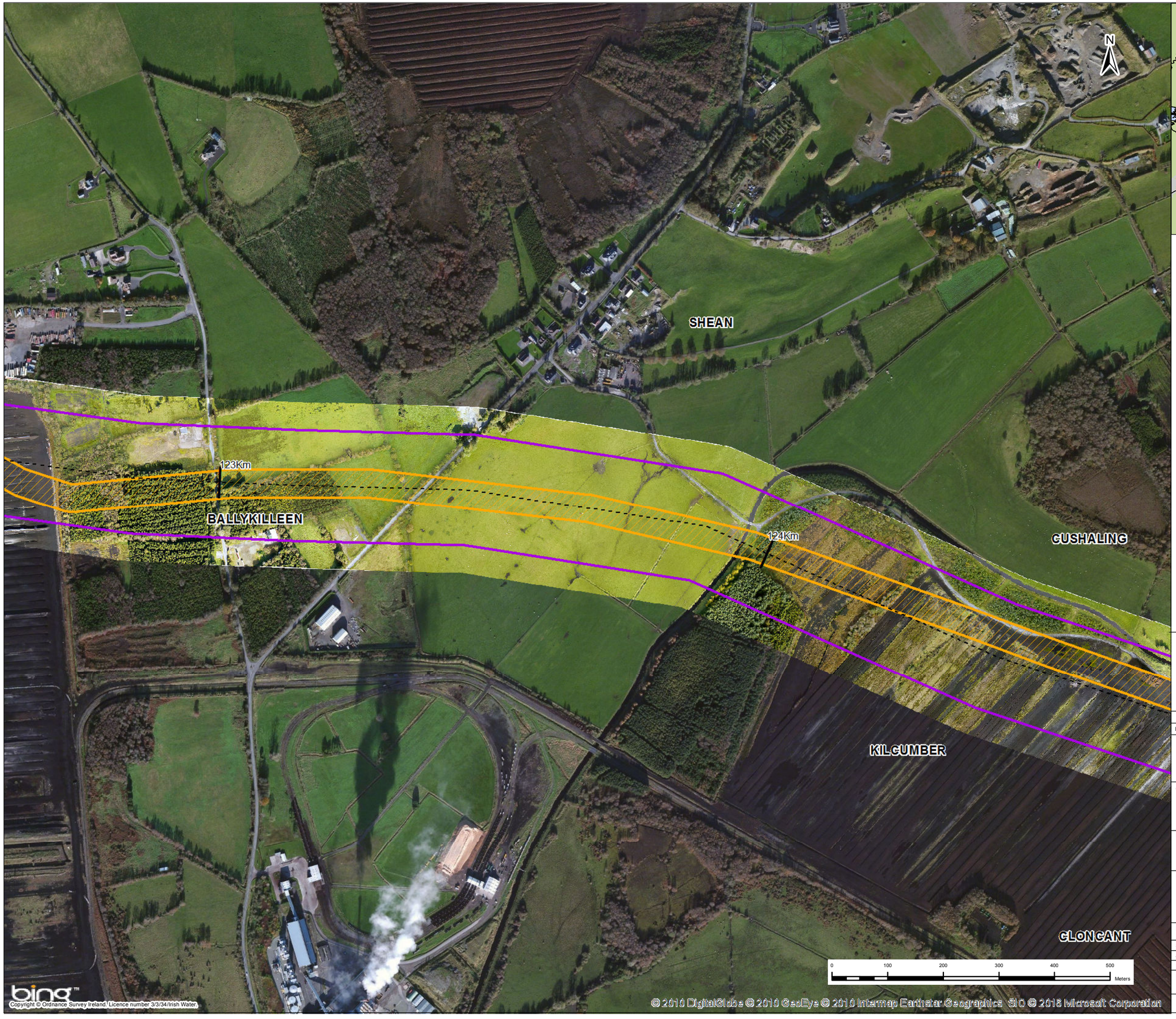
Project: Water Supply Project - Eastern and Midlands Region

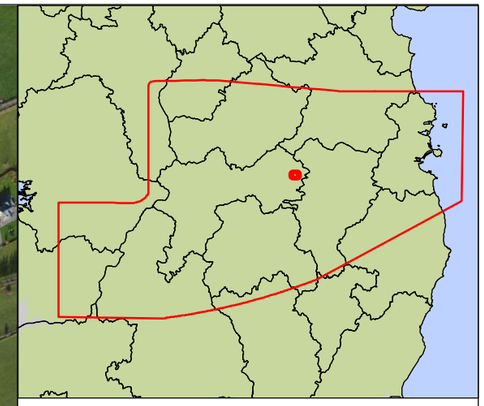
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 - WSP-DRGS Tasks\5_Mxd\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-162





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

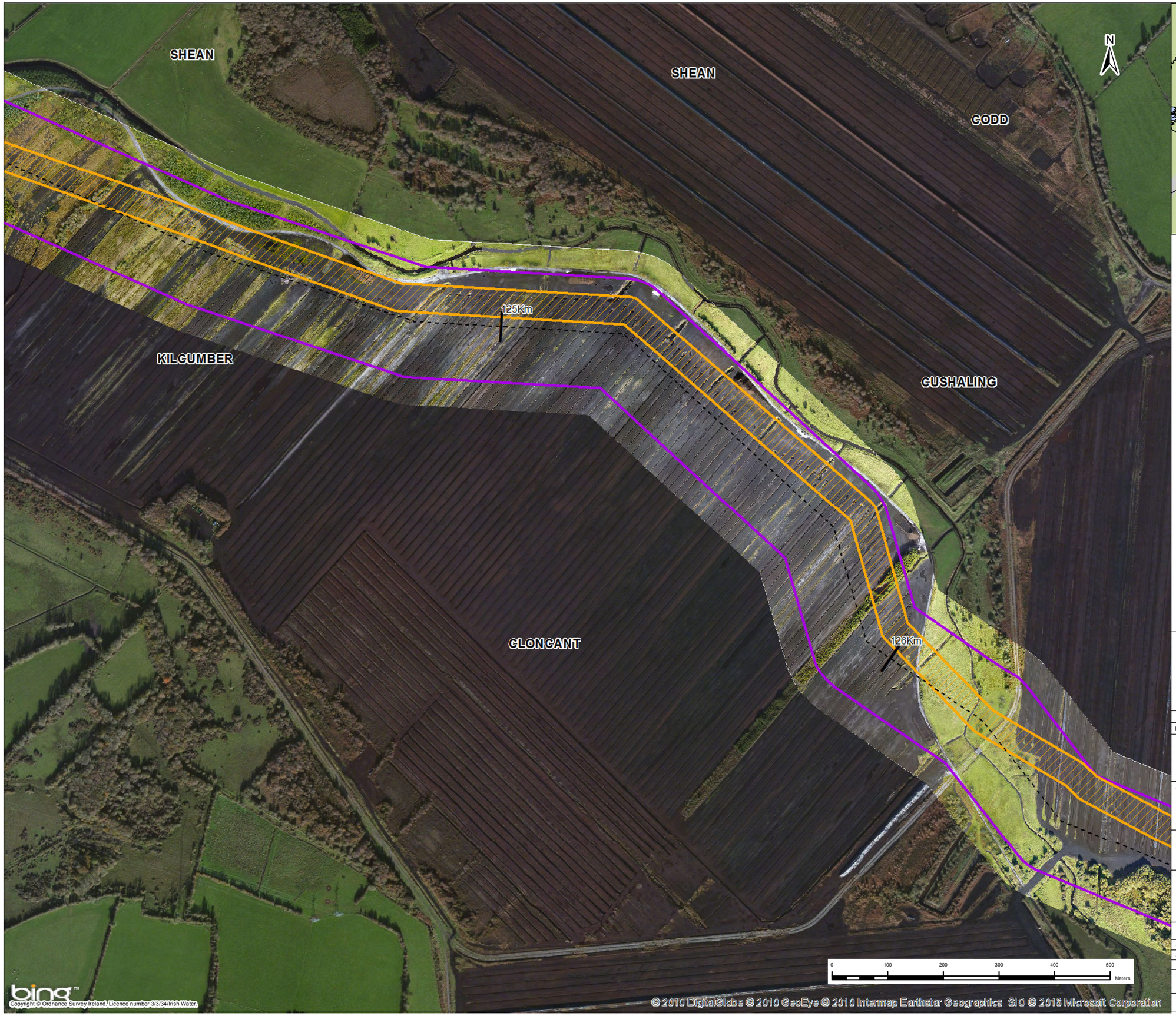
Project: Water Supply Project - Eastern and Midlands Region

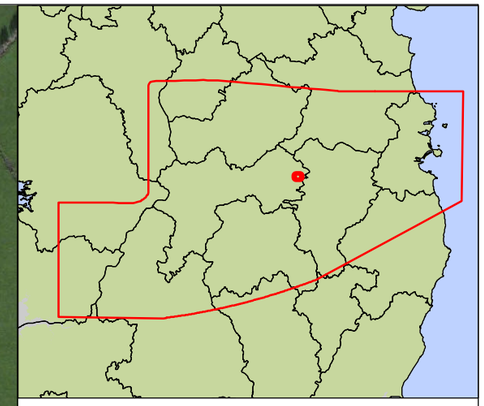
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\S\32105801 - WSP-DIRGIS Tasks\5_Mxd\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-163





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

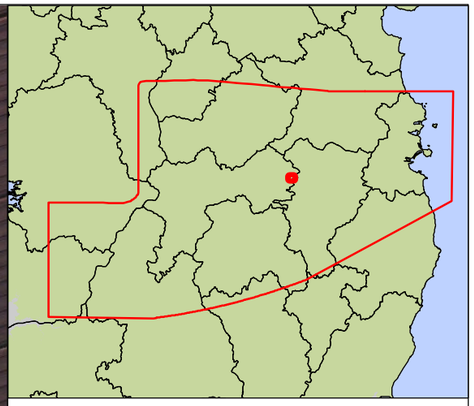
Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\S\32105801 - WSP-DRGS Tasks\5_Mode\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-164



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

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Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

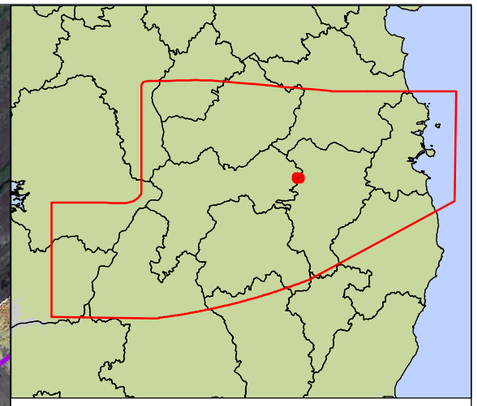
Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\32105801 - WSP-DRGS Tasks\5_Mode\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-165



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS

TOBIN
Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

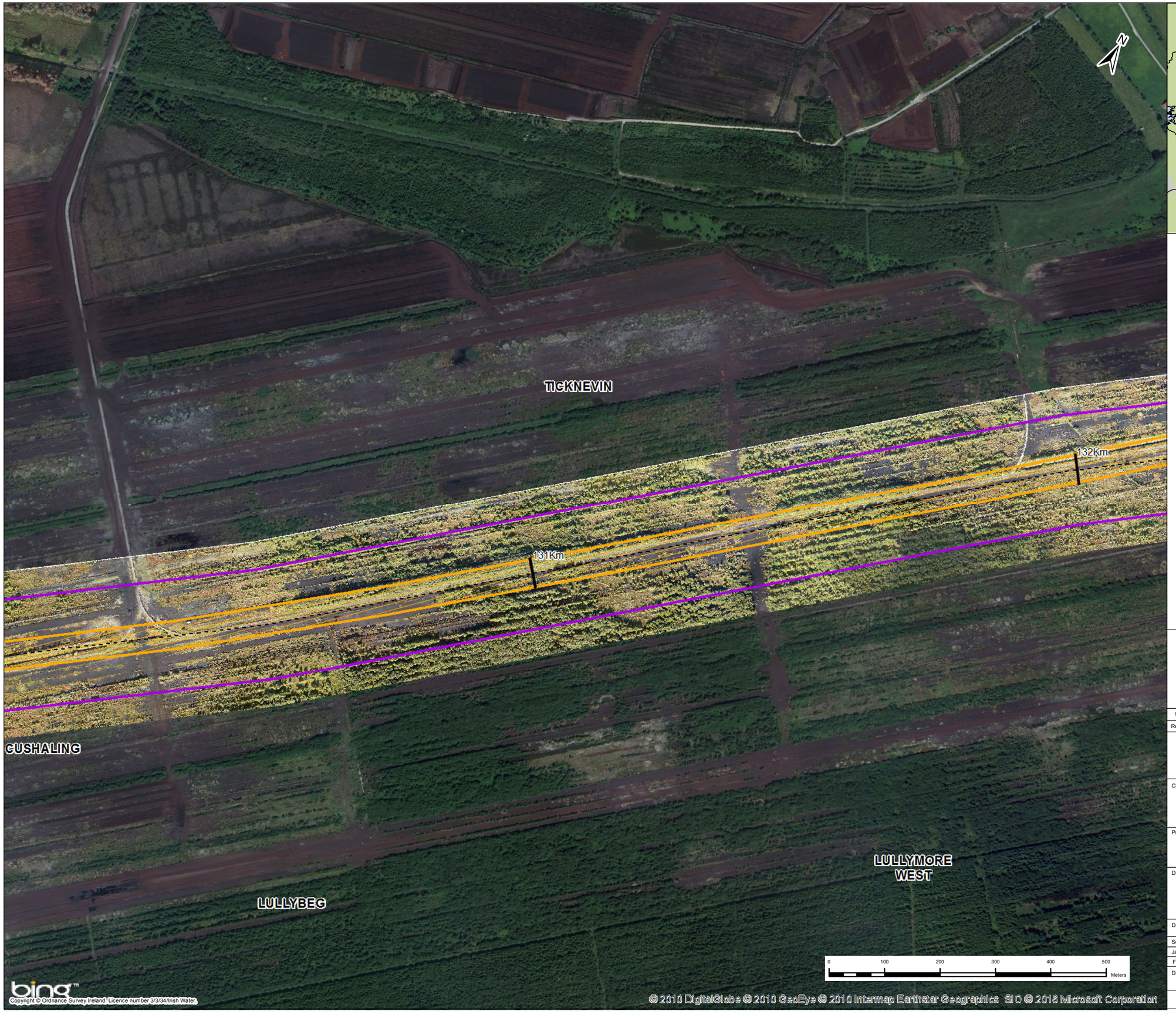
Project: Water Supply Project - Eastern and Midlands Region

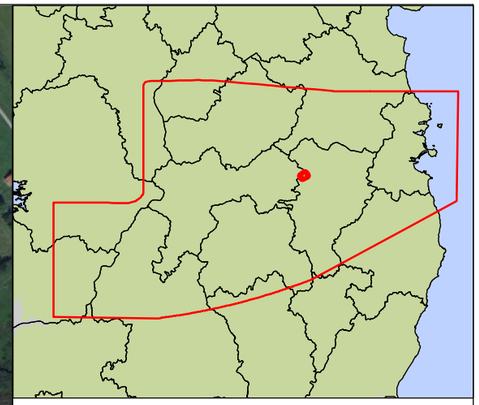
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\32105801 - WSP-DRGS Tasks\5_Model\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-166





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE EIREANN : IRISH WATER

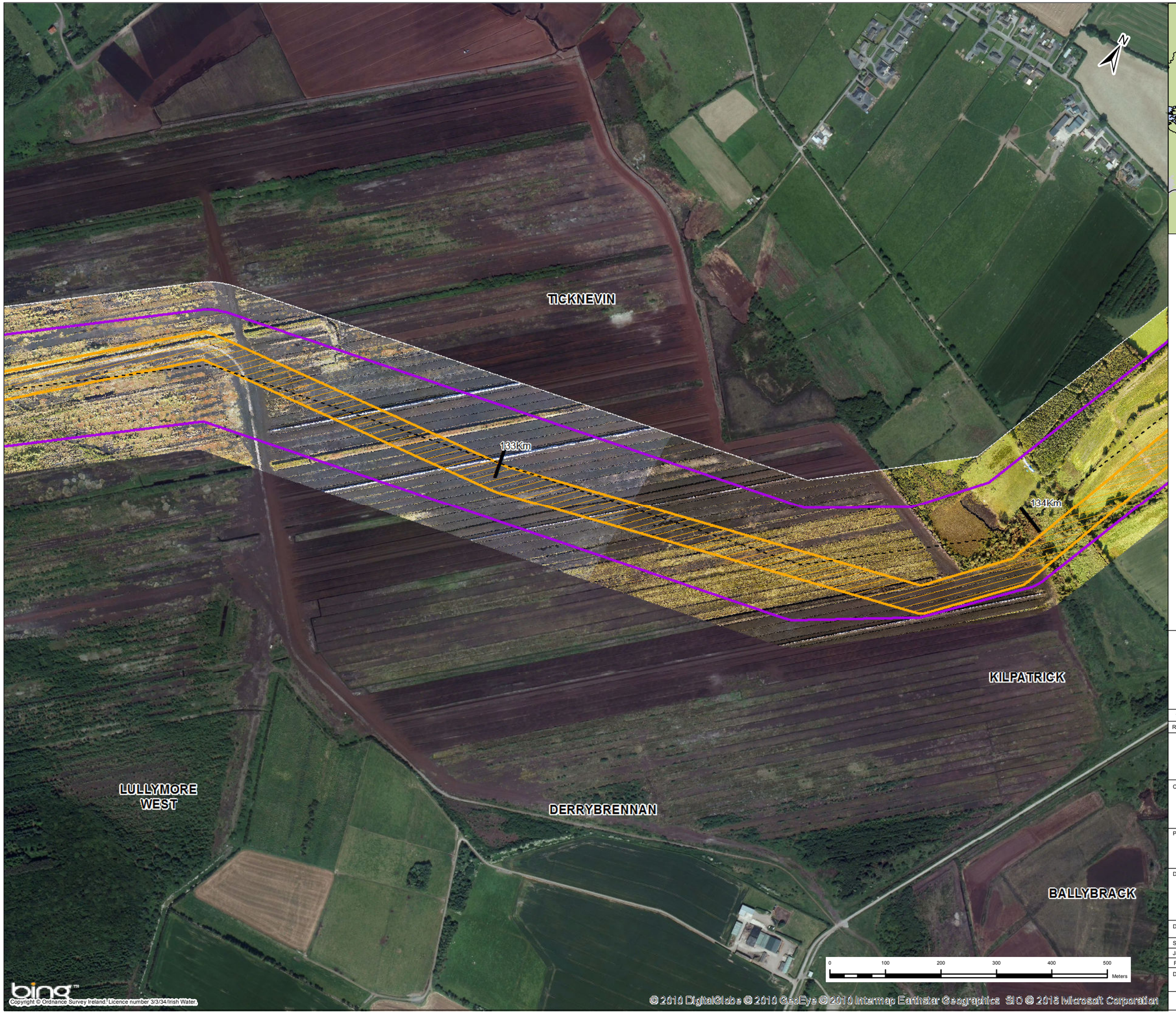
Project: Water Supply Project - Eastern and Midlands Region

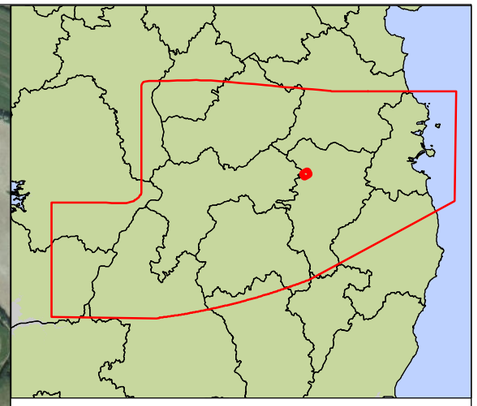
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 WSP-DRGS Tasks\5_Iss.de\Raw Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-167





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

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Patrick J. Tobin & Co. Ltd.

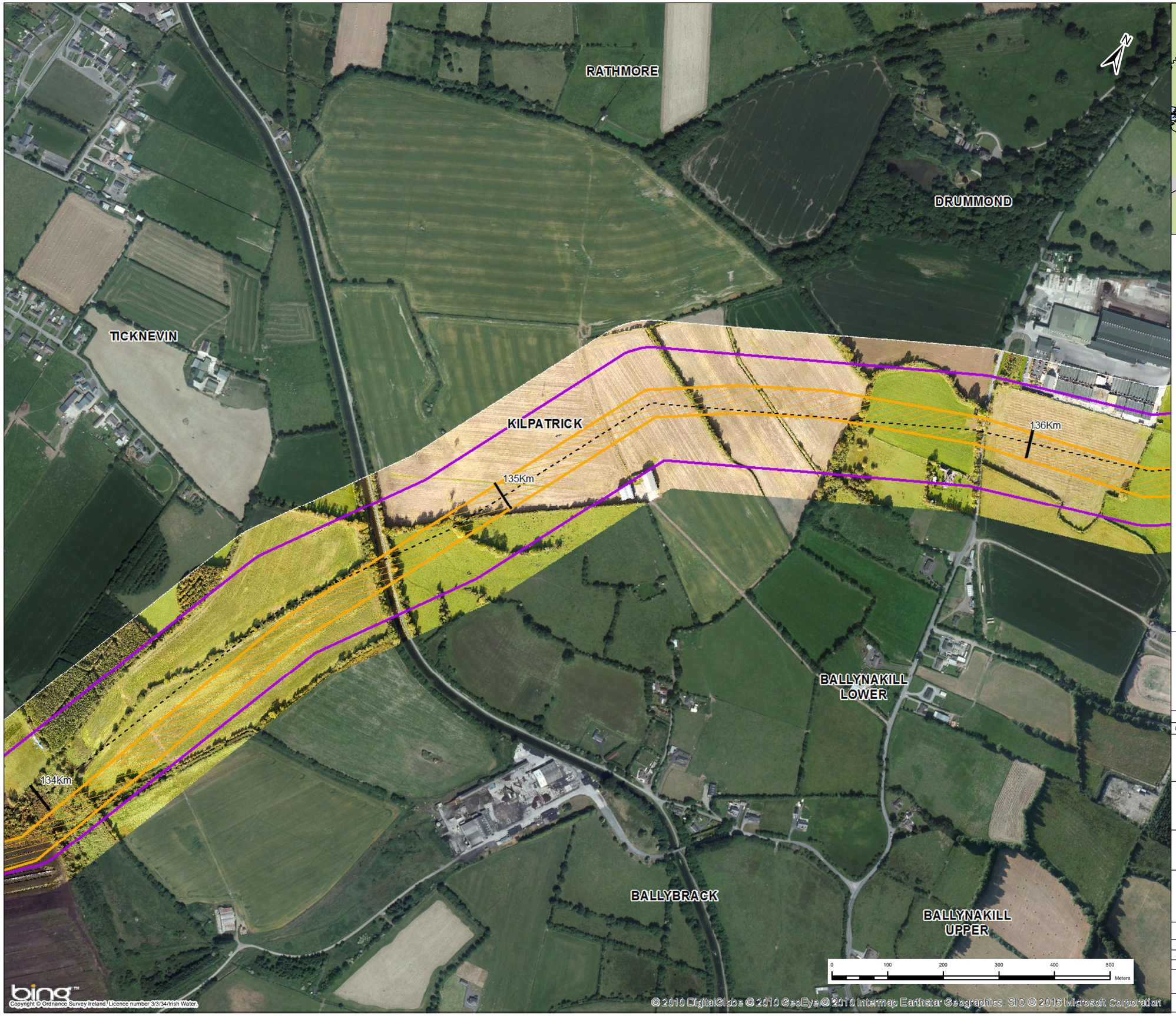
Client: UISCE ÉIREANN - IRISH WATER

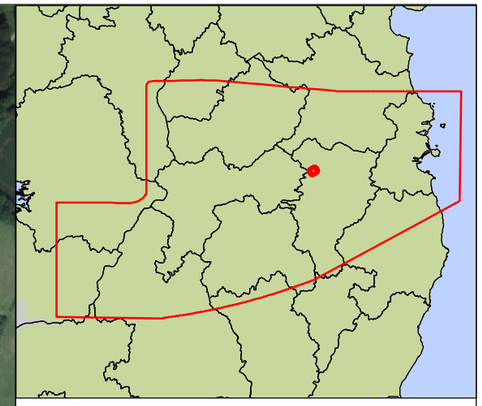
Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status	**For Issue**		
Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\IRG32105801 - WSP-DIR\GIS Tasks\5_Mxds\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-168





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS® TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

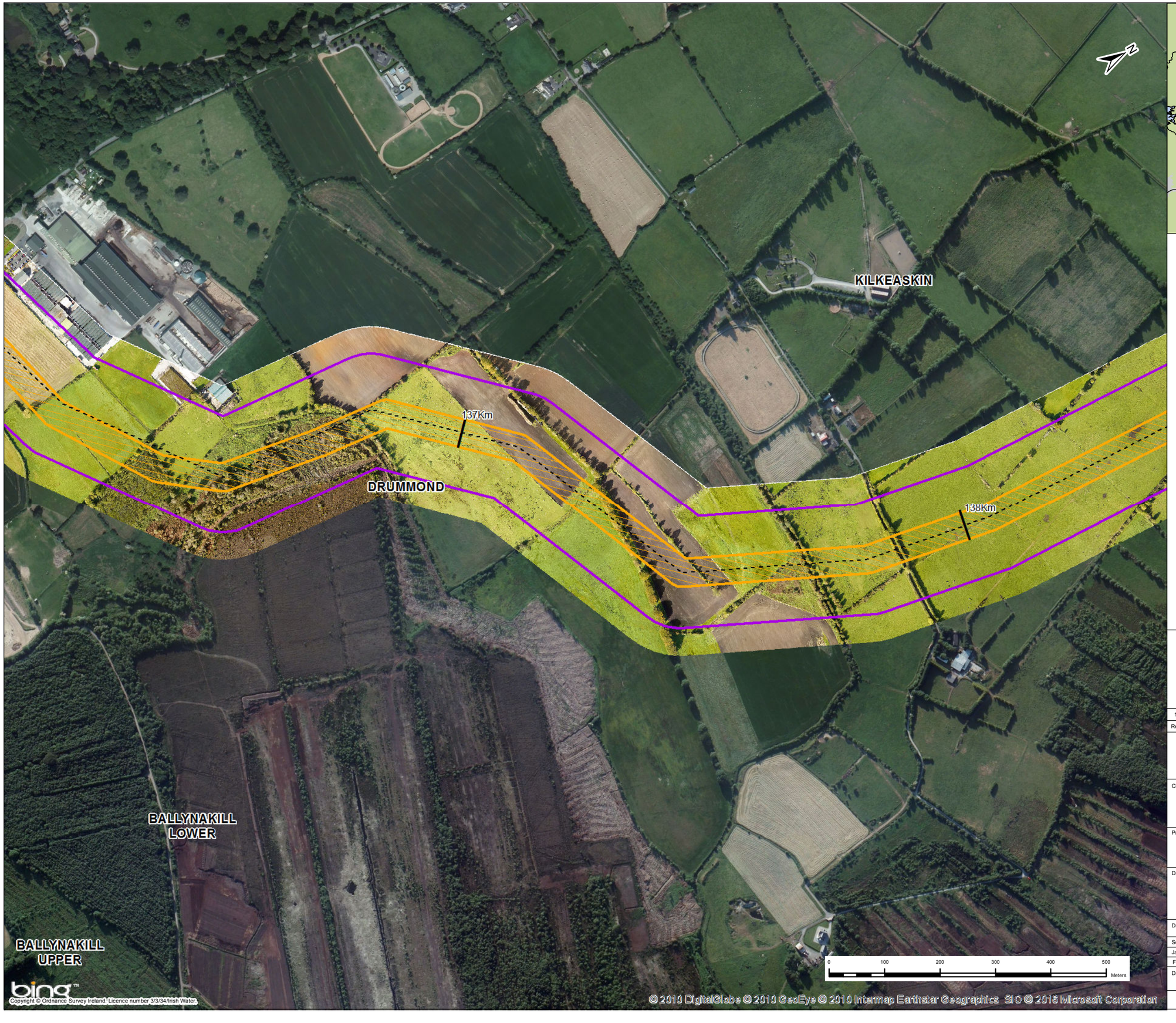
Project: Water Supply Project - Eastern and Midlands Region

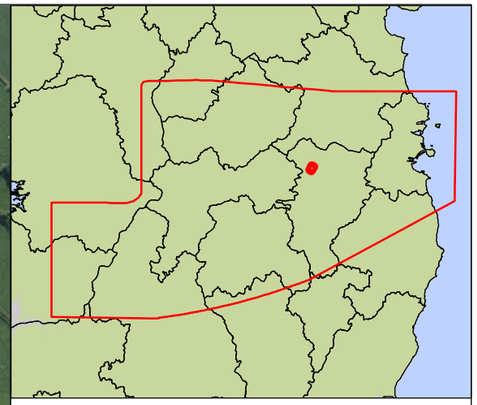
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 - WSP-DRGS Tasks\5_Media\Route Mapping\50m Corridor Maps.mxd		

Drawing No.: 32105801-FOAR-169





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN · IRISH WATER

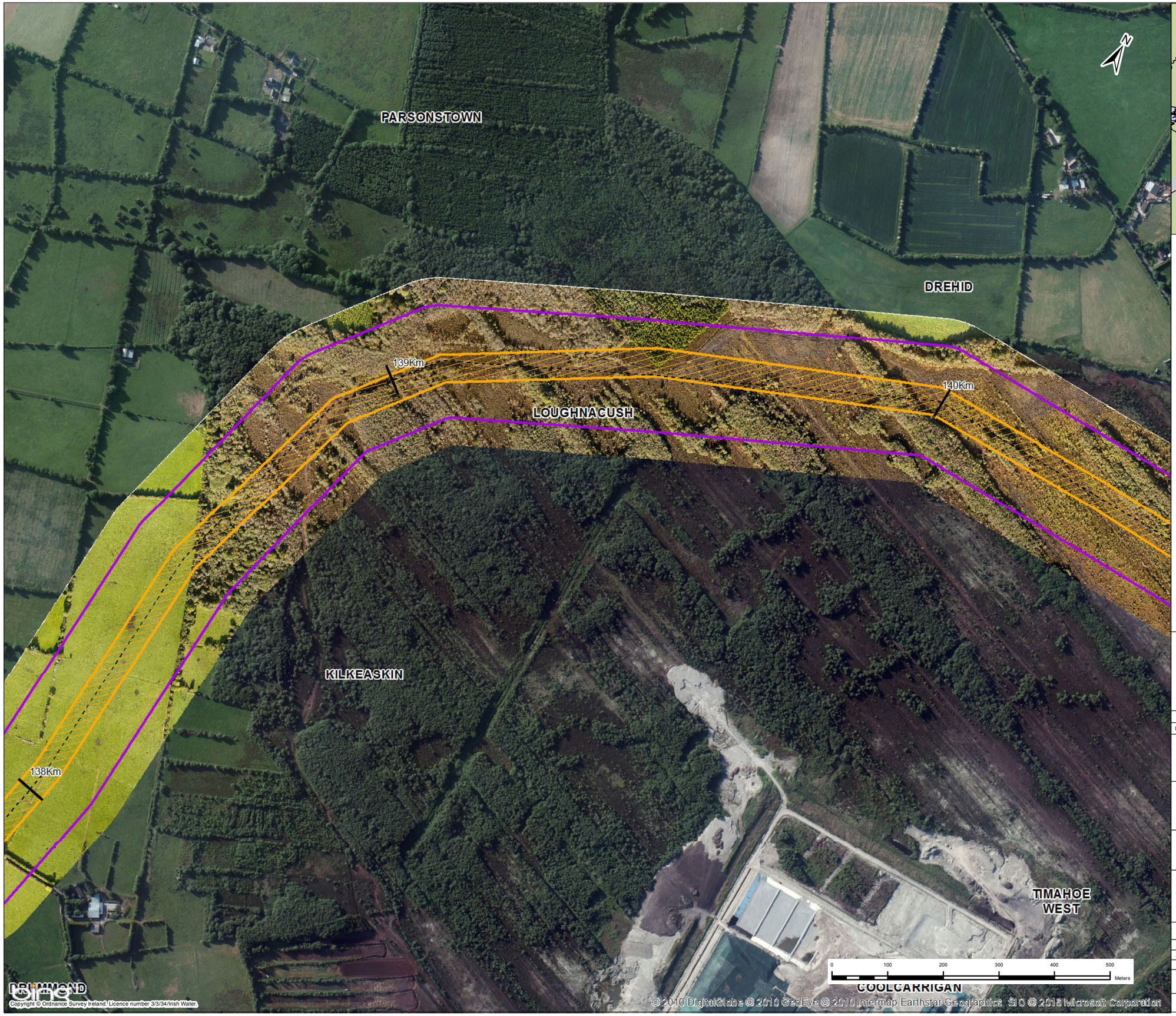
Project: Water Supply Project - Eastern and Midlands Region

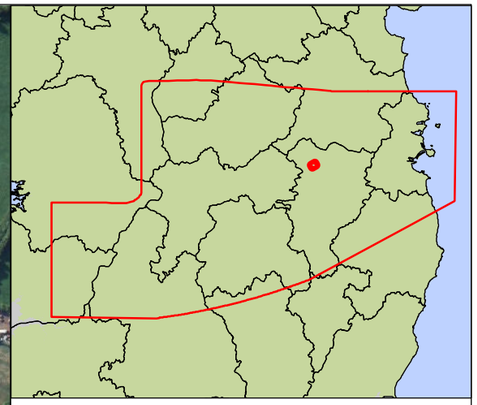
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 WSP-DAGS Tasks\5_Issue\Raw Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-170





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN · IRISH WATER

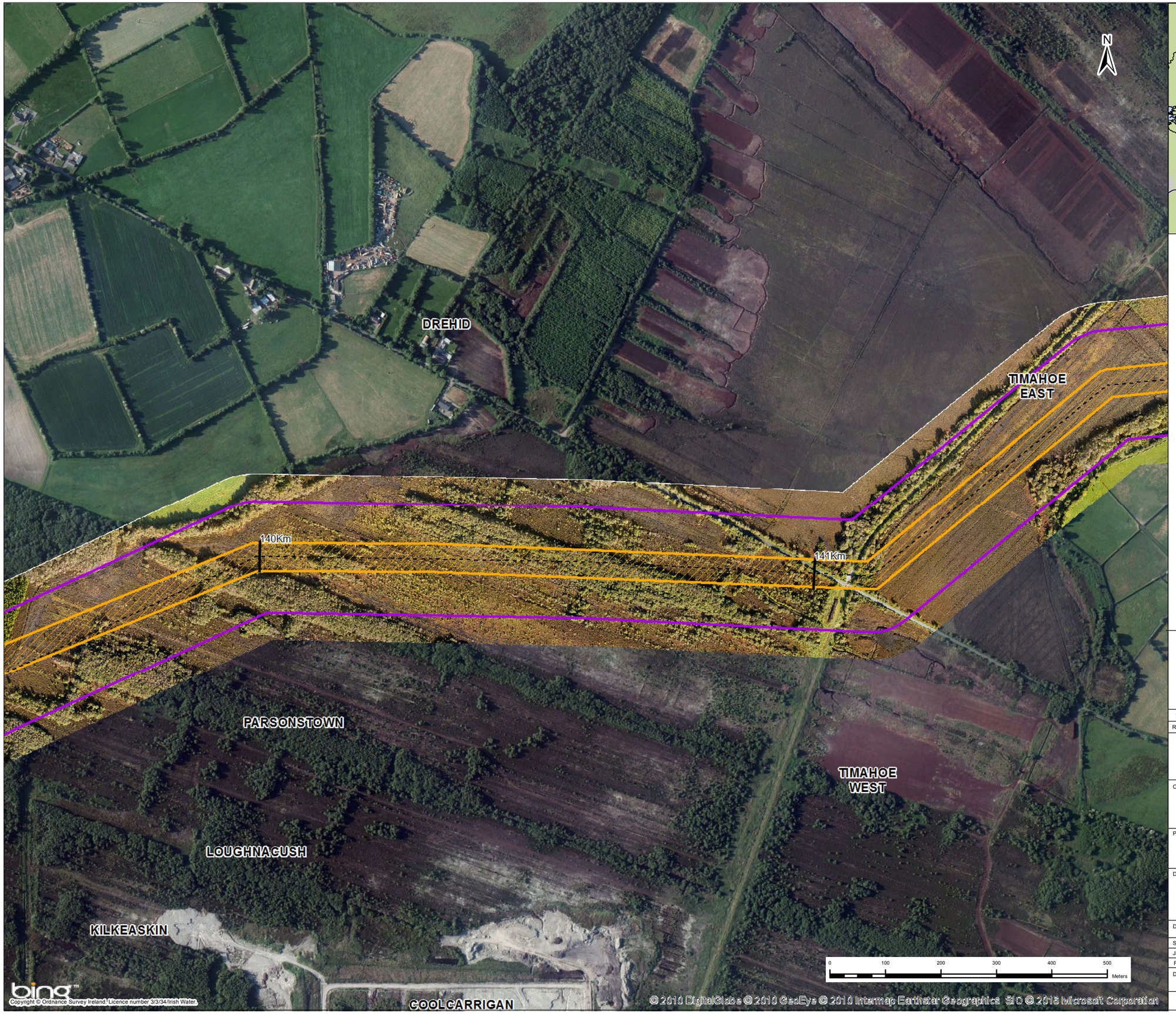
Project: Water Supply Project - Eastern and Midlands Region

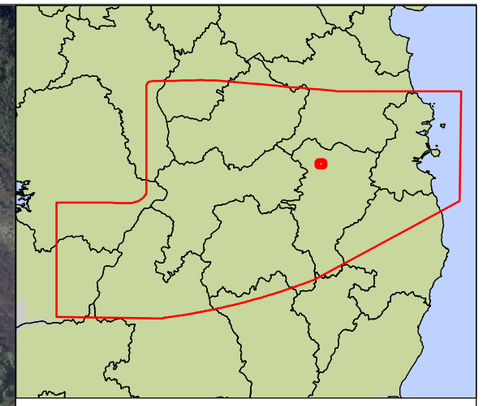
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRGIS\32105801 - WSP-DIRGIS Tasks\5_Mxds\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-171





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

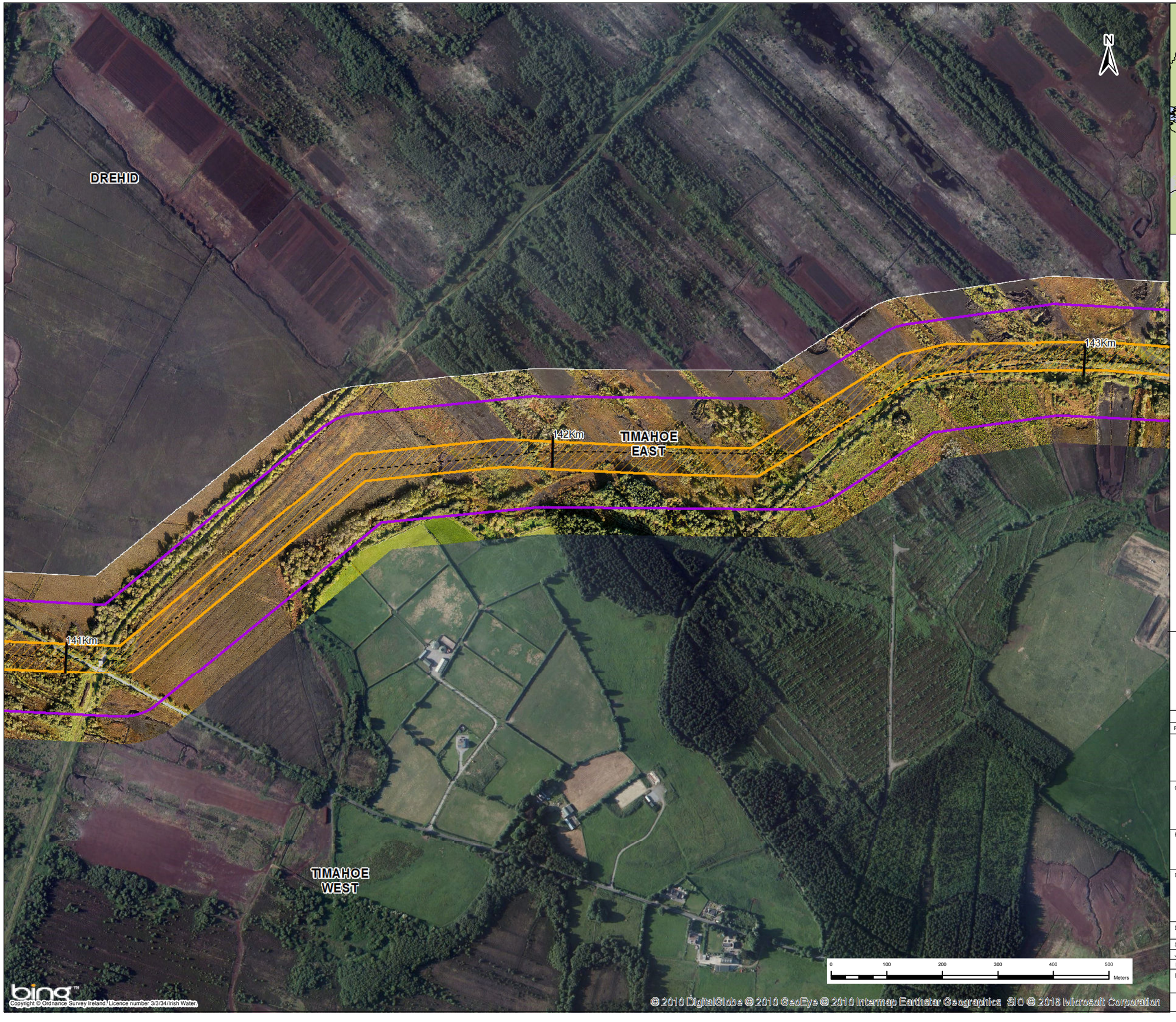
Project: Water Supply Project - Eastern and Midlands Region

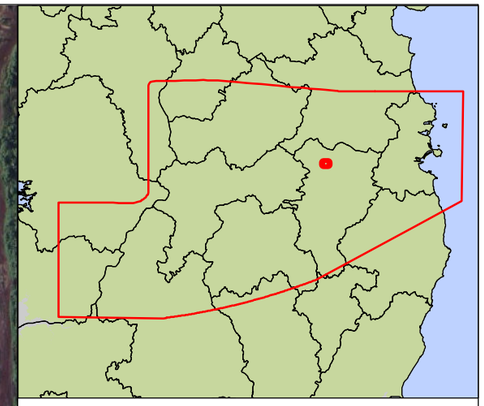
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\32105801 - WSP-DIRGS Tasks\5_Mode\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-172





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS

TOBIN
Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

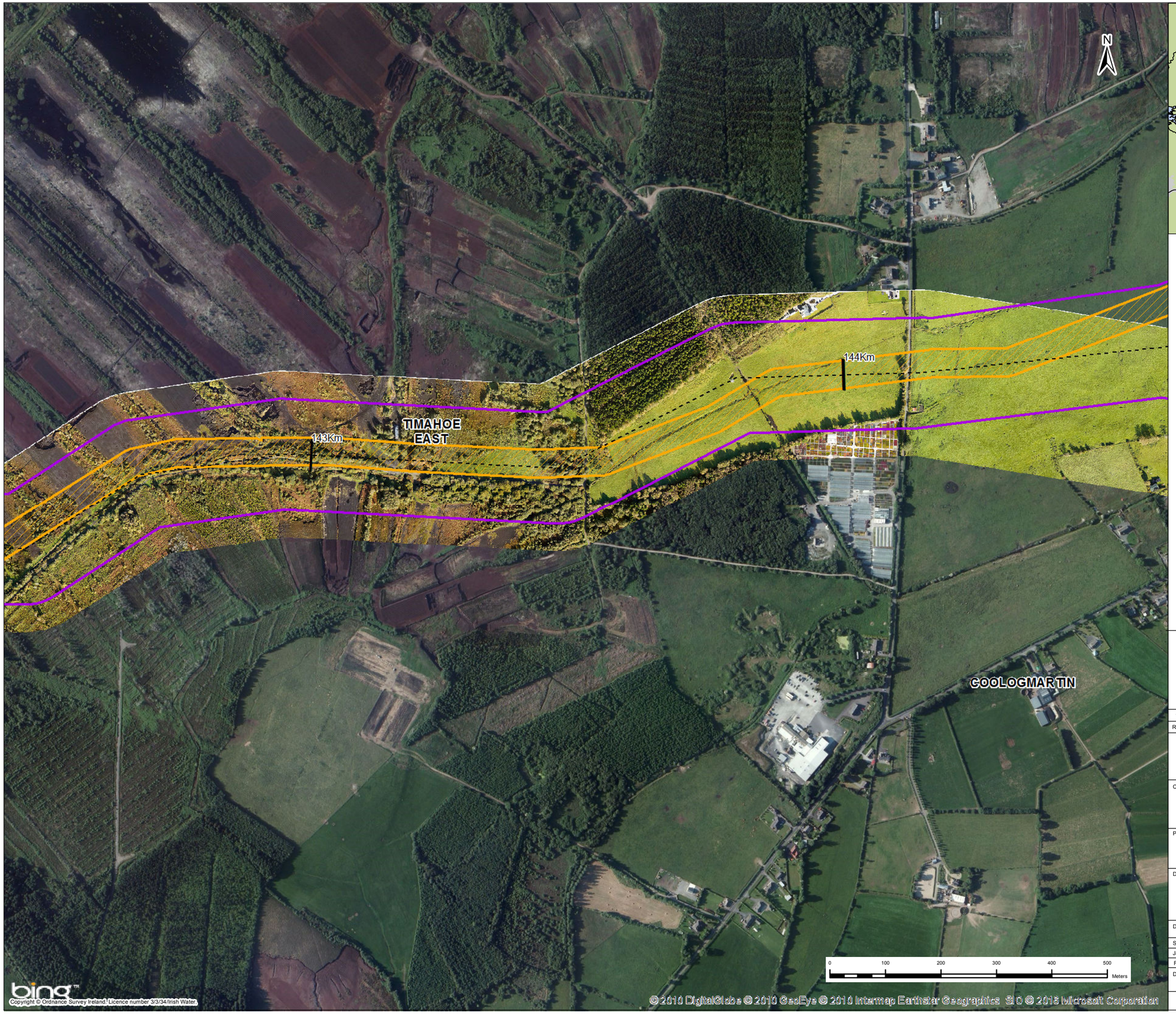
Project: Water Supply Project - Eastern and Midlands Region

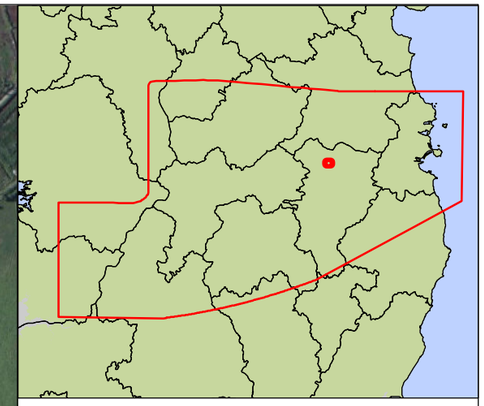
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\IS\32105801 - WSP-DRGS Tasks\5_Mxds\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-173





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS

TOBIN
Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

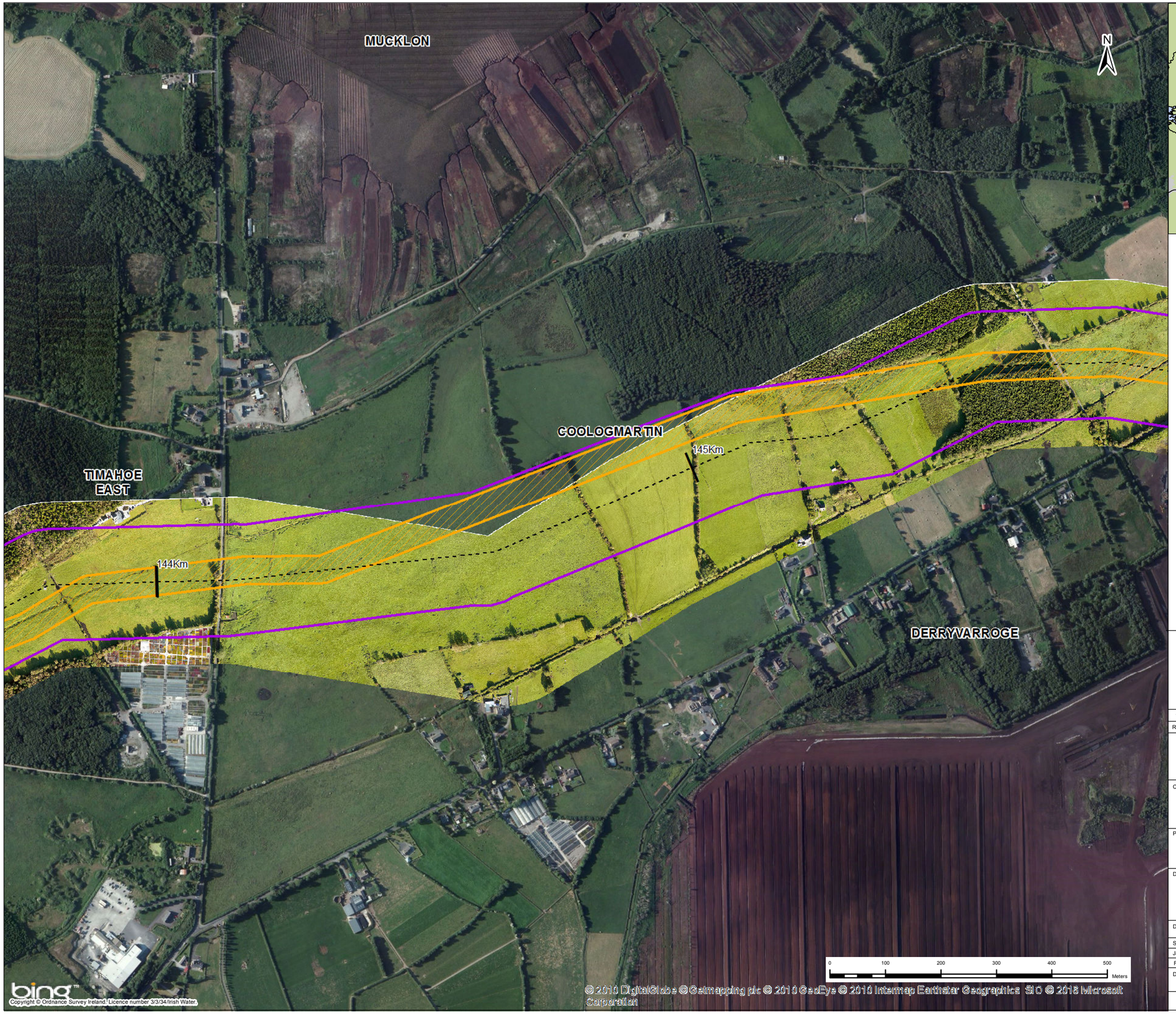
Project: Water Supply Project - Eastern and Midlands Region

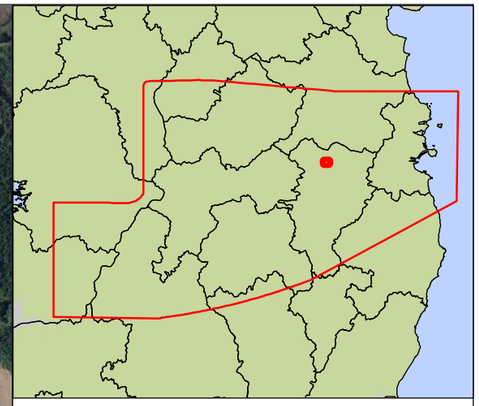
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\32105801 - WSP-DRG\5 Tasks\5_Mode\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-174





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN / IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status	**For Issue**		
Scale @A3	1:6,500		DO NOT SCALE
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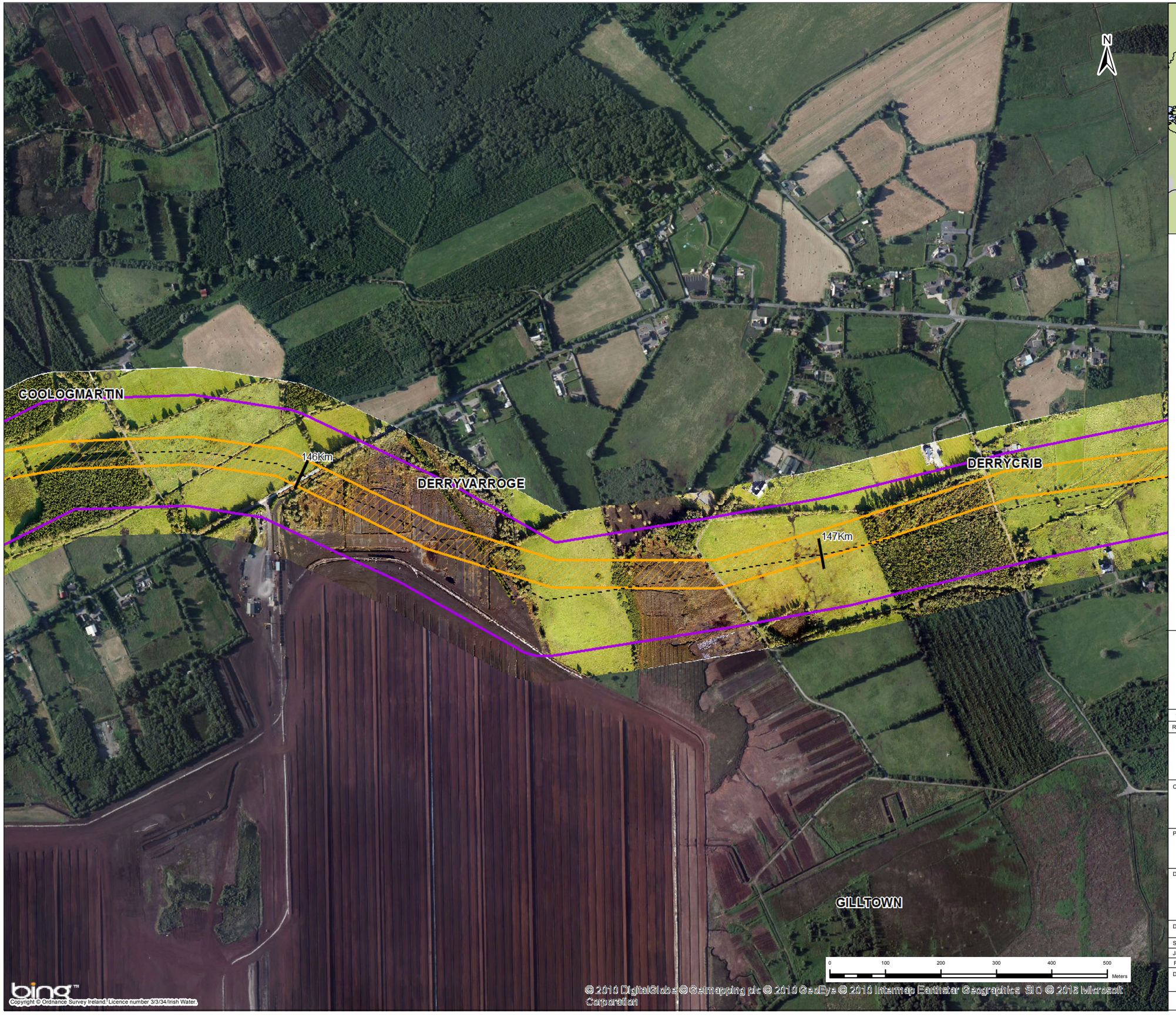
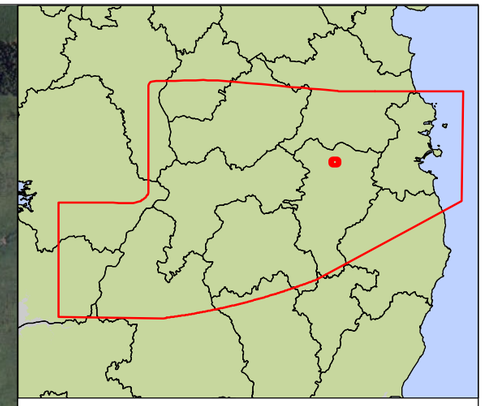
Drawing No.	32105801-FOAR-175		





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

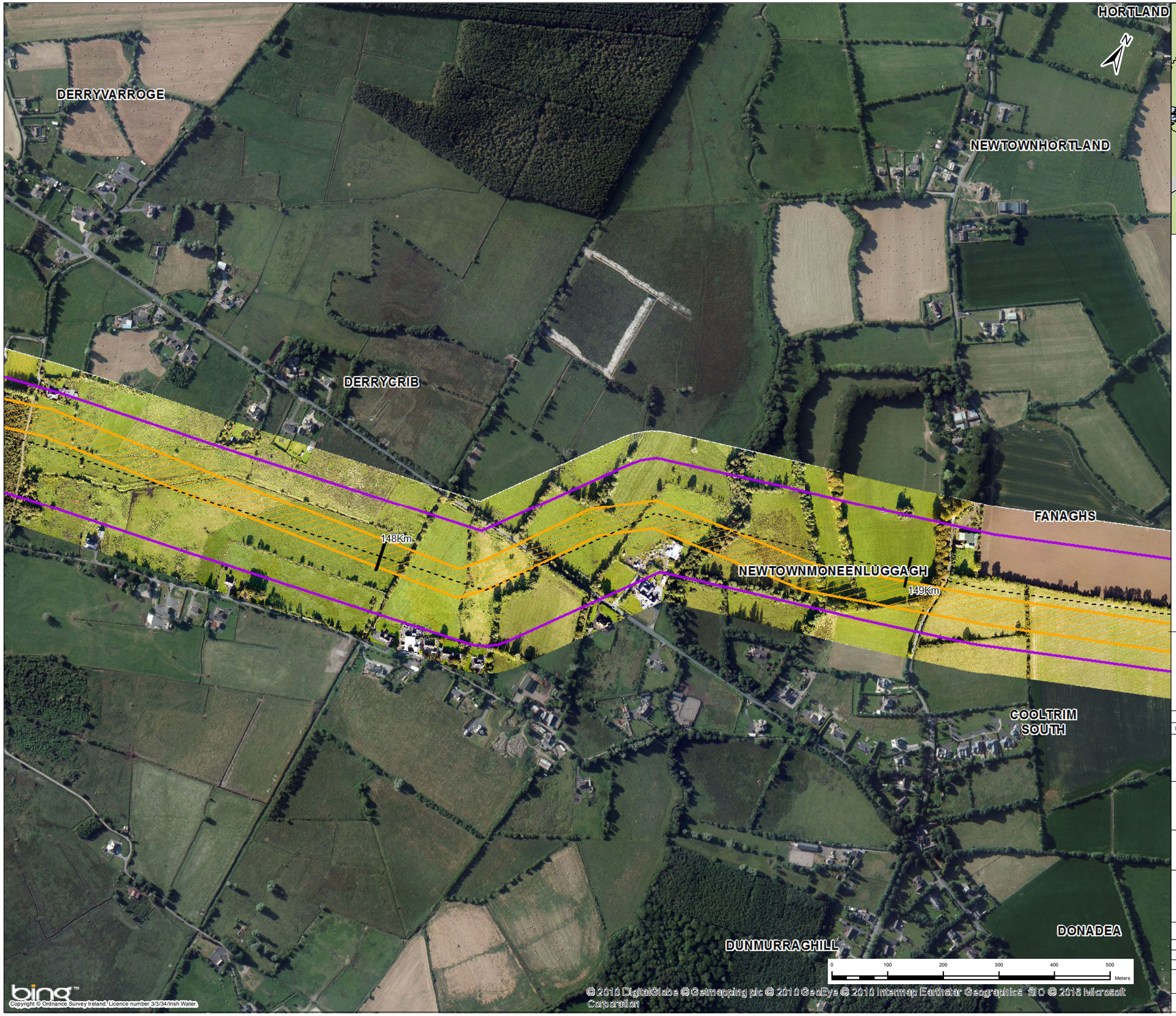
JACOBS® TOBIN Patrick J. Tobin & Co. Ltd.

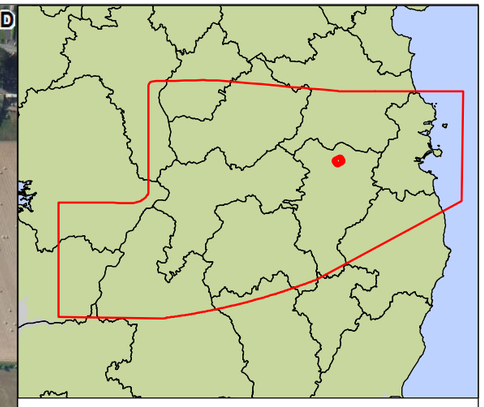
Client: UISCE ÉIREANN / IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status	For Issue		
Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRE\32105801 - WSP-DRIGB Tasks\5_Mxd\Route Mapping\50m Corridor Maps.mxd		
Drawing No.	32105801-FOAR-176		





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS | TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN / IRISH WATER

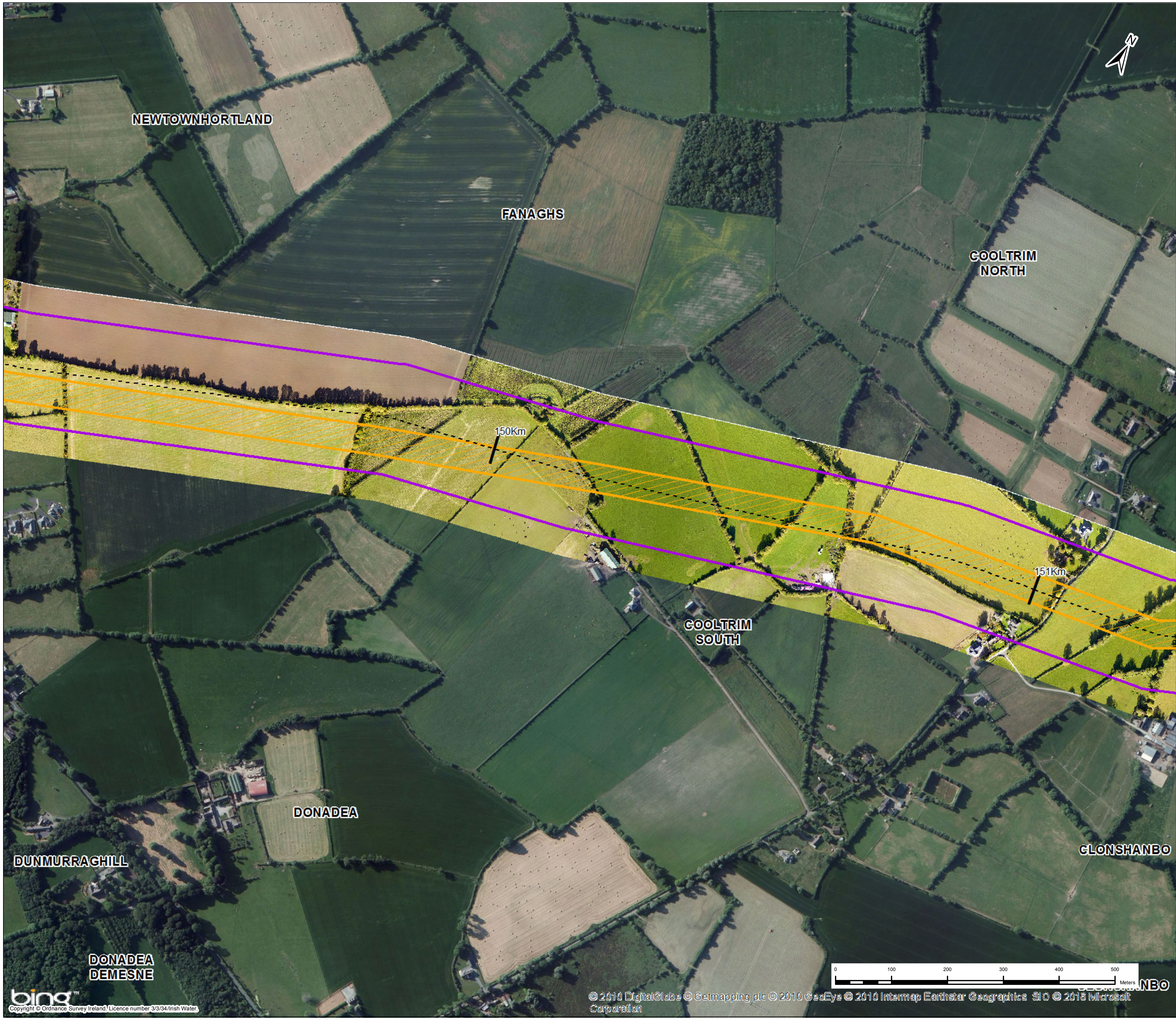
Project: Water Supply Project - Eastern and Midlands Region

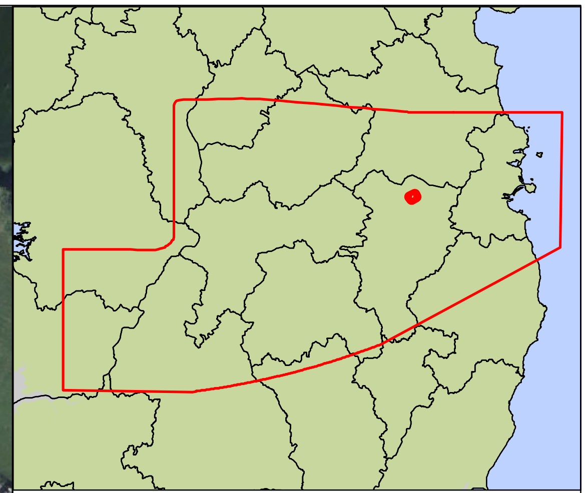
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRE\32105801 - WSP-DIRGIS Tasks\5_Mxds\Route Mapping\Rte Corridor Maps.mxd		

Drawing No. 32105801-FOAR-177





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN

Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN : IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath			
Drawing No.	32105801-FOAR-178		

KILMAGORROGE

BELGARD

BALLYBRACK

BALLYLOUGHAN

N

152Km

AGHAFULLIM

153Km

COOLTRIM NORTH

FARRANADUM

BALTRACEY

COOLTRIM SOUTH

CLONSHANBO

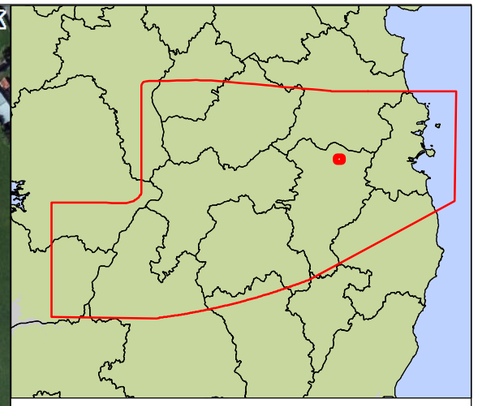
DONADEA

PART OF FARRANADUM

BALTRACEY

0 100 200 300 400 500 Meters

bing™



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS

TOBIN
Patrick J. Tobin & Co. Ltd.

Client

UISCE ÉIREANN IRISH WATER

Project

Water Supply Project - Eastern and Midlands Region

Drawing Title

Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
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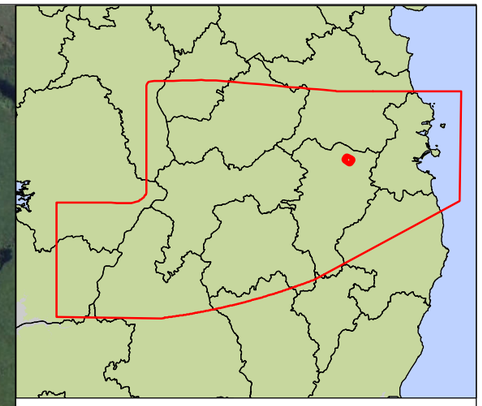
Drawing No.

32105801-FOAR-179



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

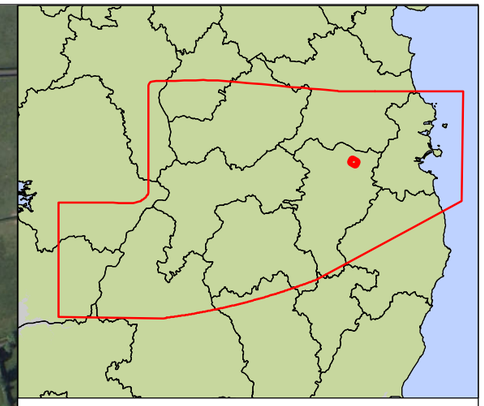
Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 WSP-DAGS Tasks\5_Iss.de\Rave Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-180



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN · IRISH WATER

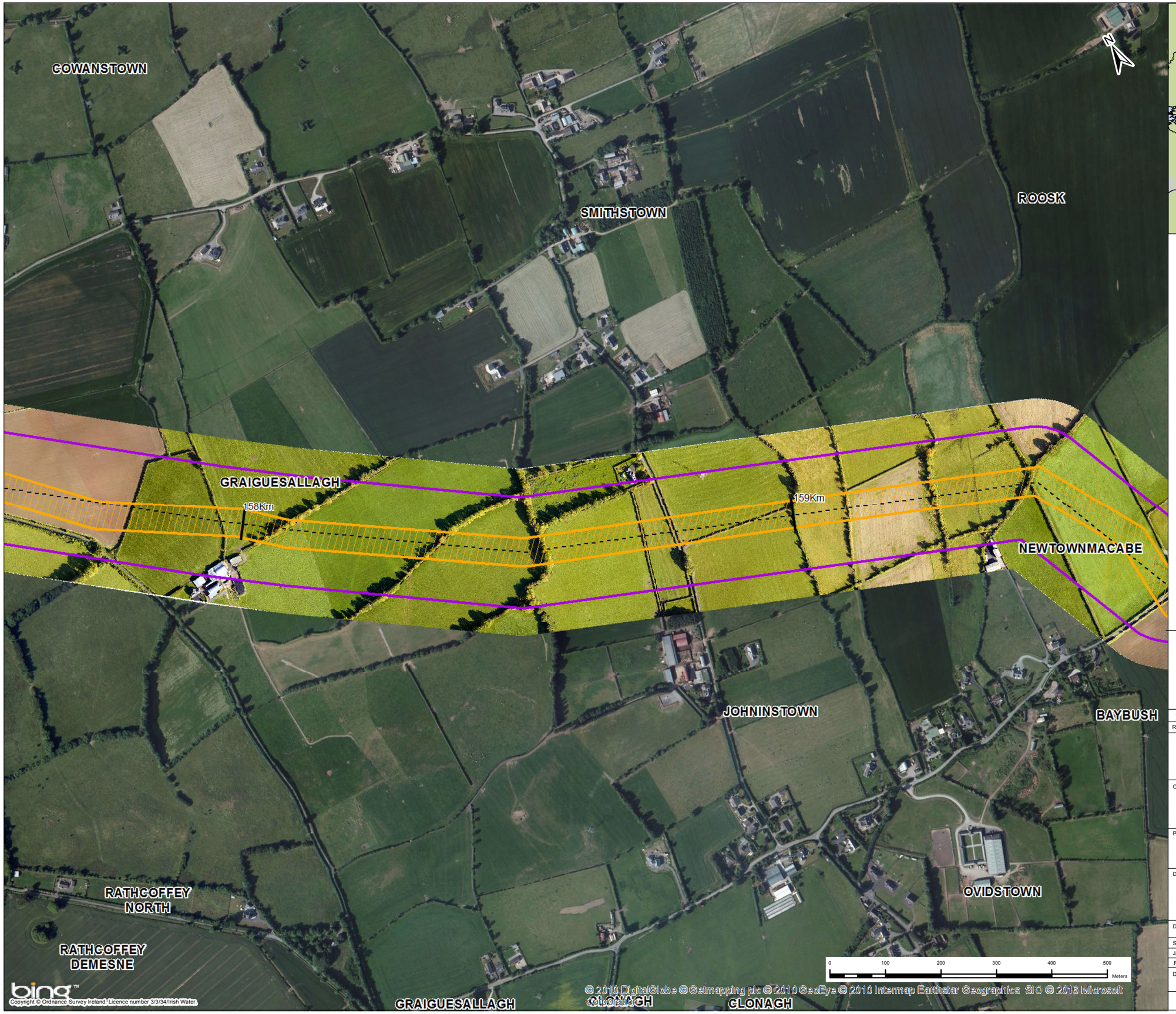
Project: Water Supply Project - Eastern and Midlands Region

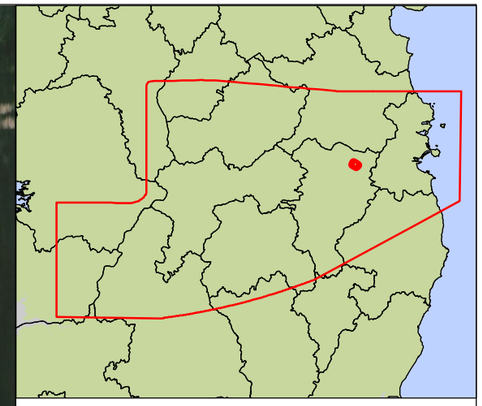
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\32105801 - WSP-DIRG\6 Tasks\5_Mode\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-181





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

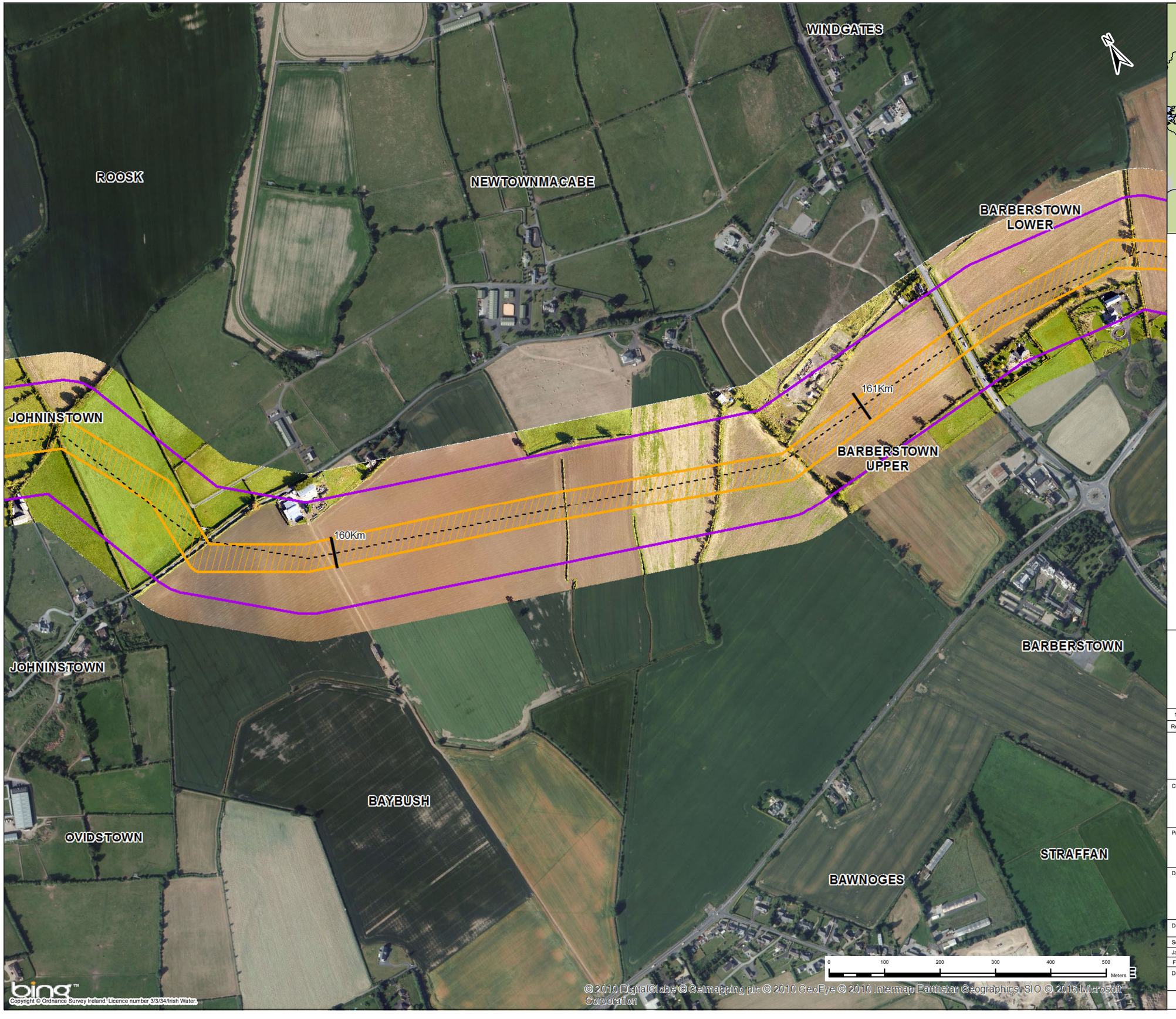
Project: Water Supply Project - Eastern and Midlands Region

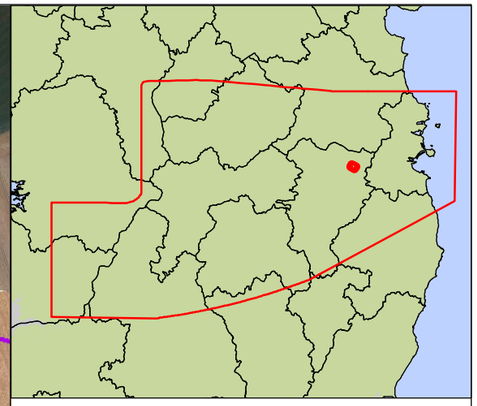
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 - WSP-DRGS Tender\5_Mxd\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-182





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN IRISH WATER

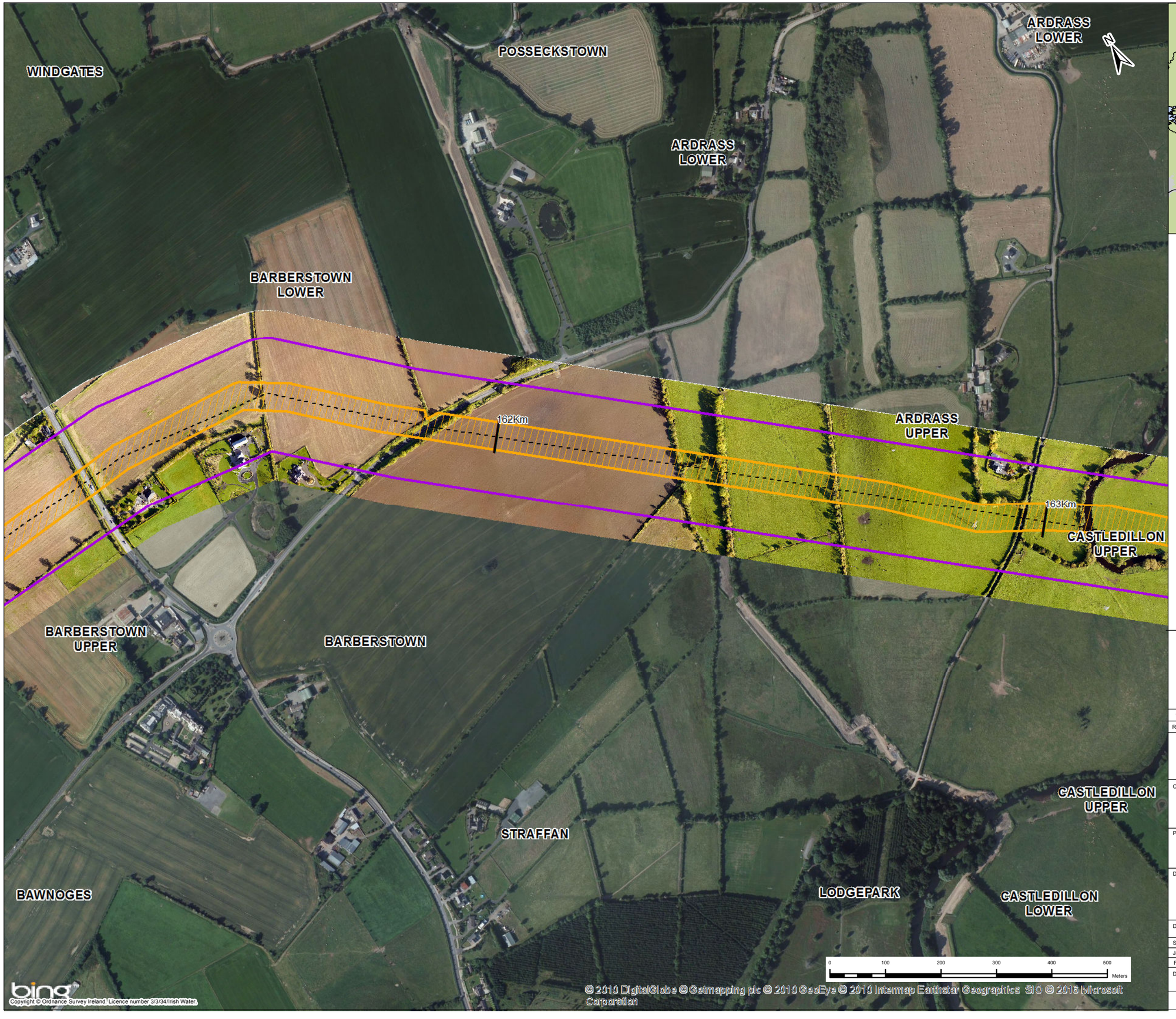
Project: Water Supply Project - Eastern and Midlands Region

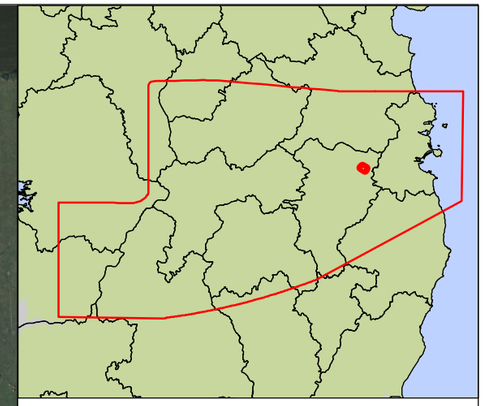
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 - WSP-DRGB Tankill_Ikerdrin\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-183





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN : IRISH WATER

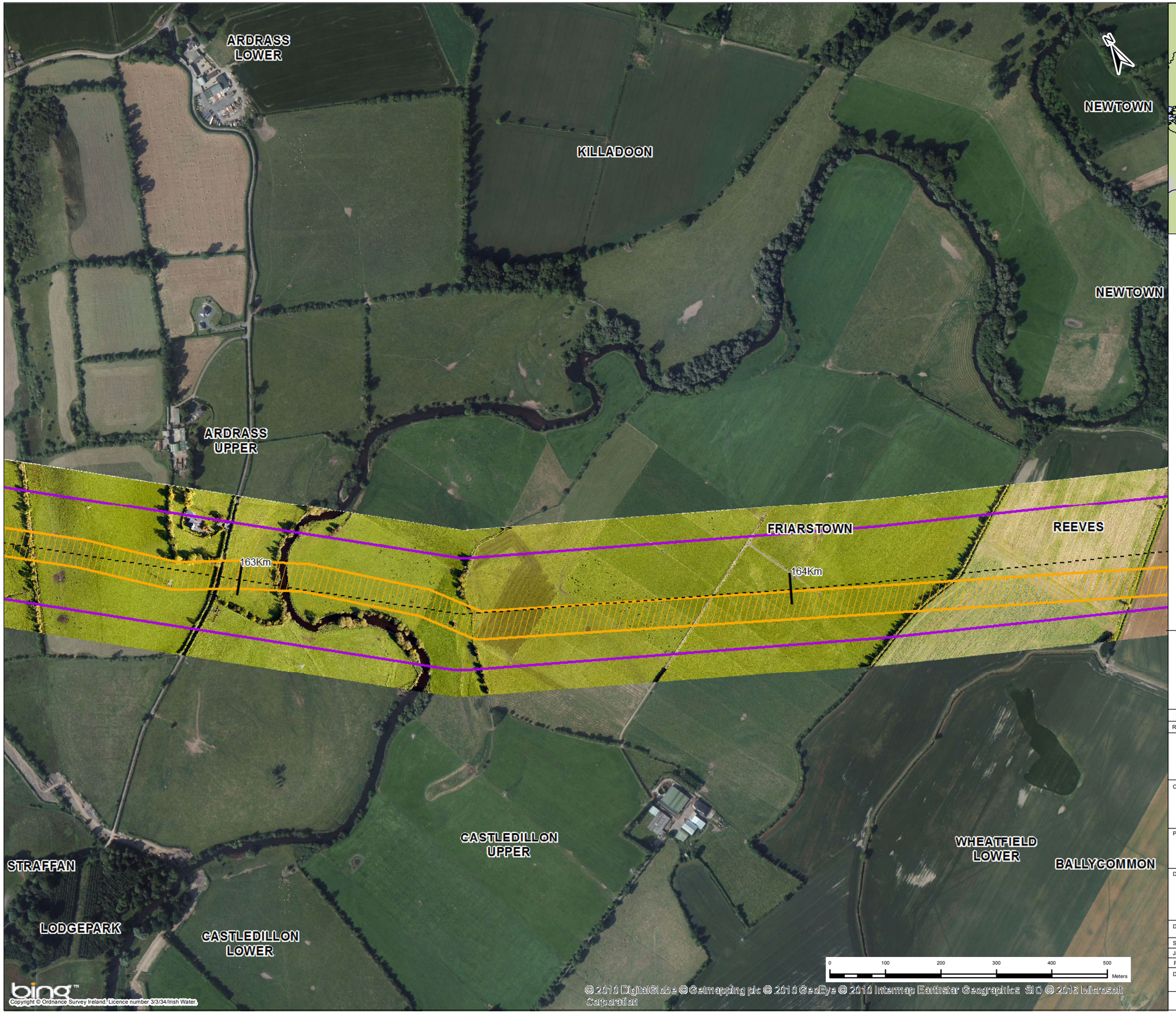
Project: Water Supply Project - Eastern and Midlands Region

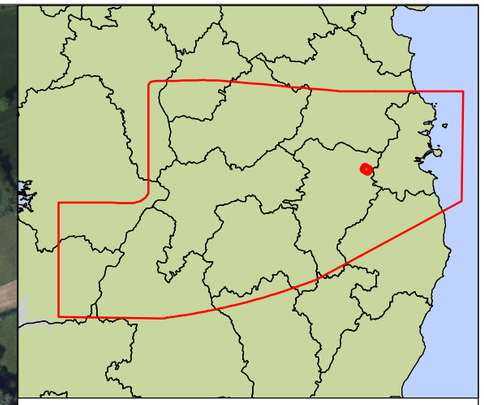
Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\JOBS\32105801 WSP-DAGS Tasks\5_Models\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-184





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN - IRISH WATER

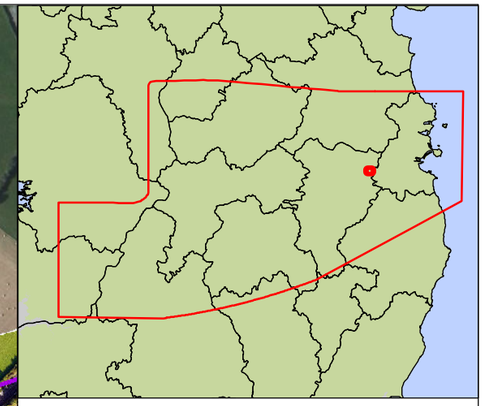
Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\IRG\S32105801 - WSP-DIRGS Tasks\S_Mxd\Route Mapping\50m Corridor Maps.mxd		

Drawing No. 32105801-FOAR-185



Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS

TOBIN
Patrick J. Tobin & Co. Ltd.

Client
UISCE ÉIREANN - IRISH WATER

Project
Water Supply Project - Eastern and Midlands Region

Drawing Title
Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
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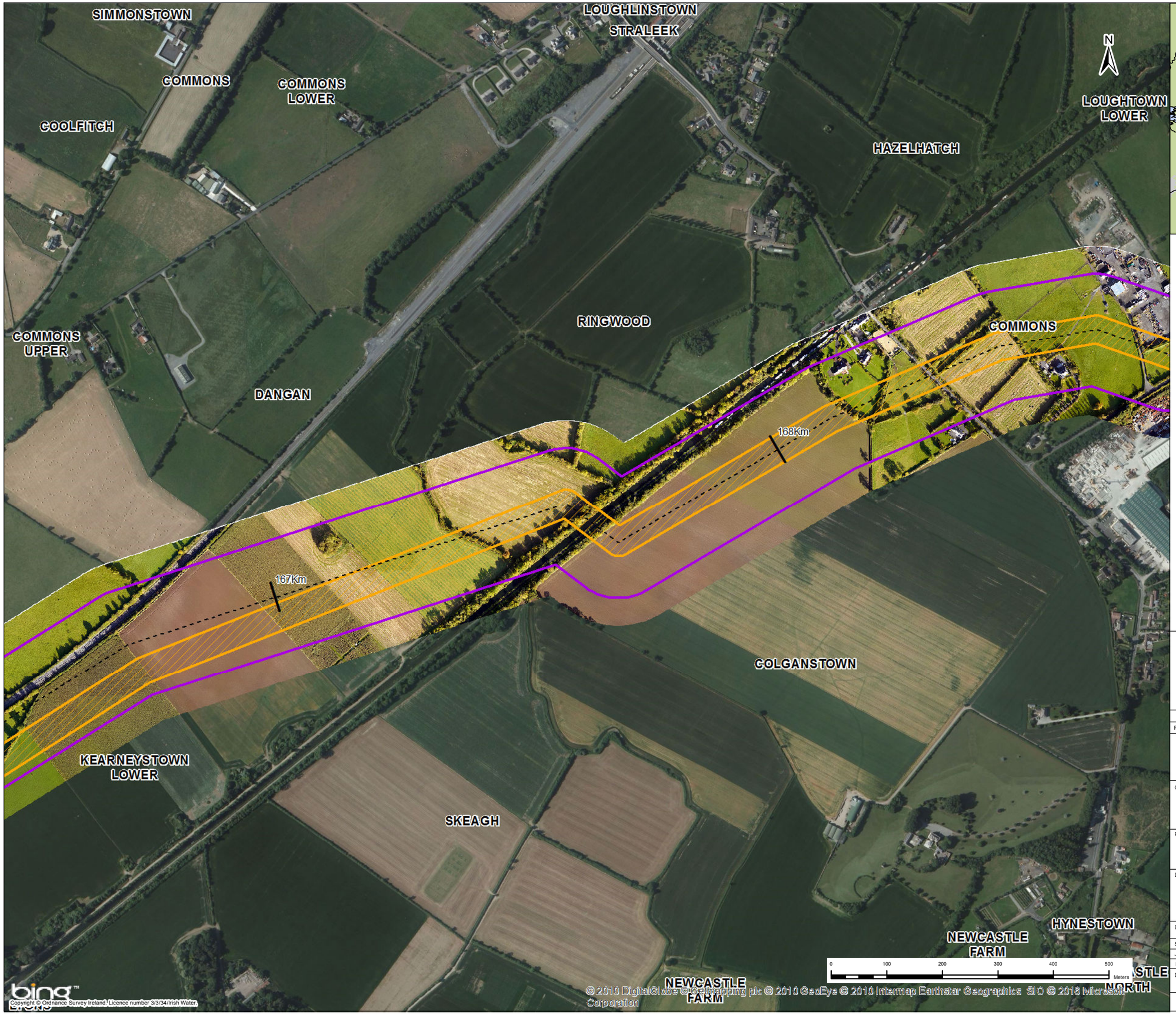
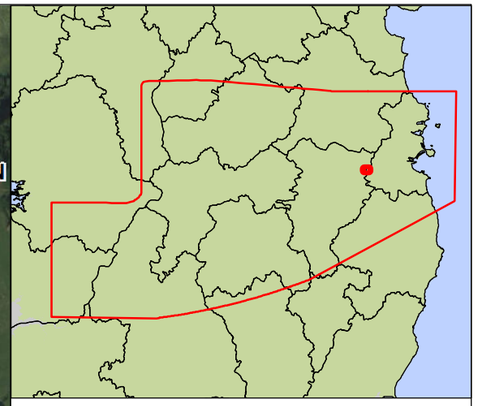
Drawing No.
32105801-FOAR-186





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN : IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status	**For Issue**		
Scale @A3	1:6,500		DO NOT SCALE
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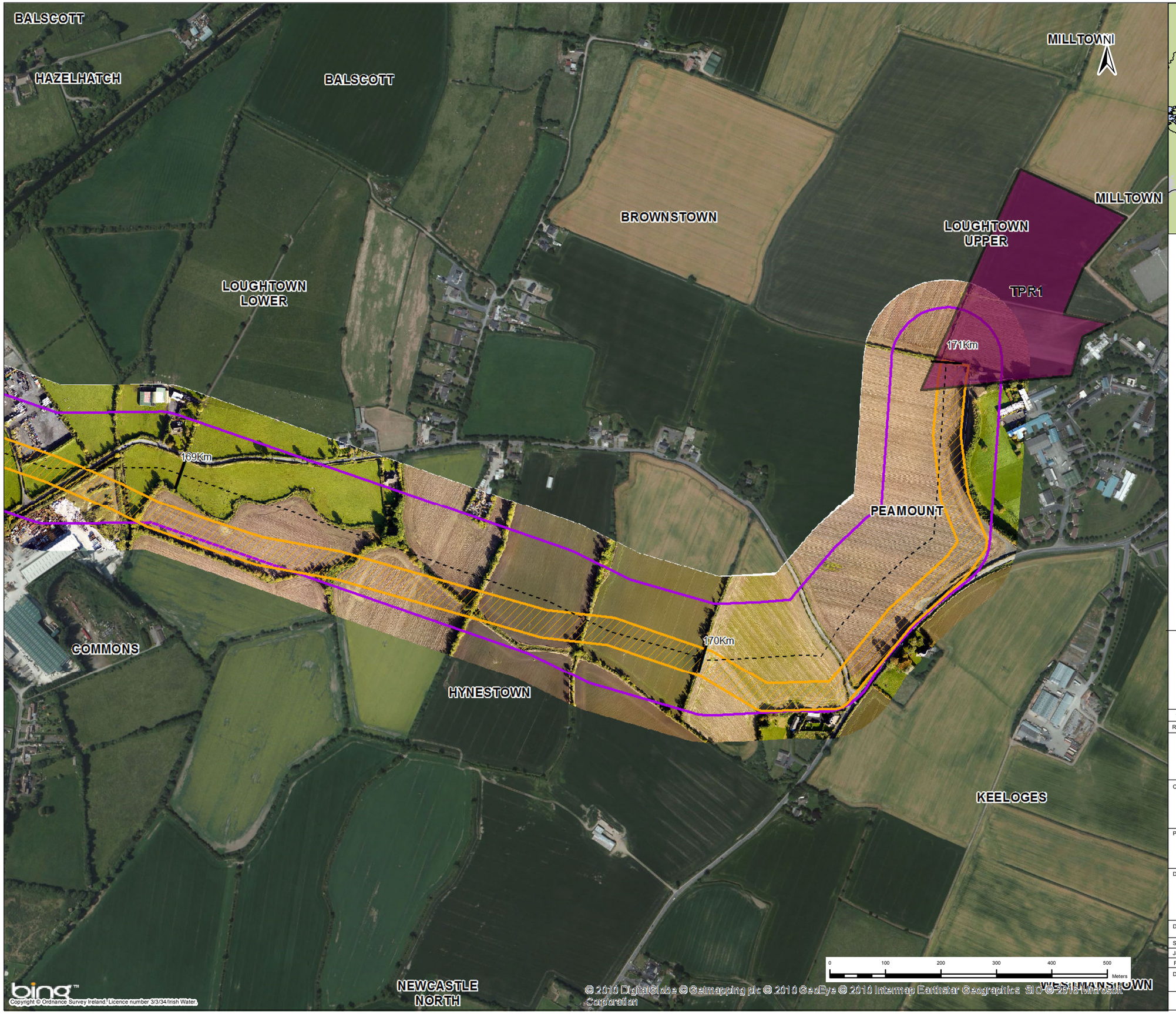
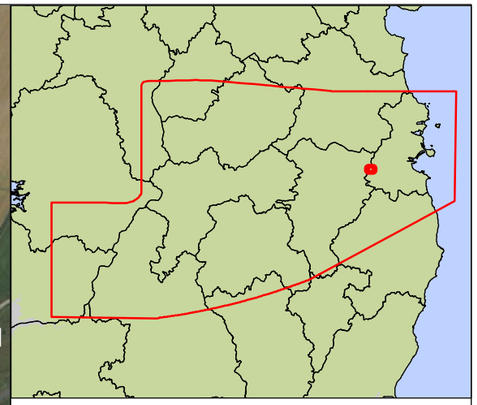
Drawing No. 32105801-FOAR-187





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN · IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
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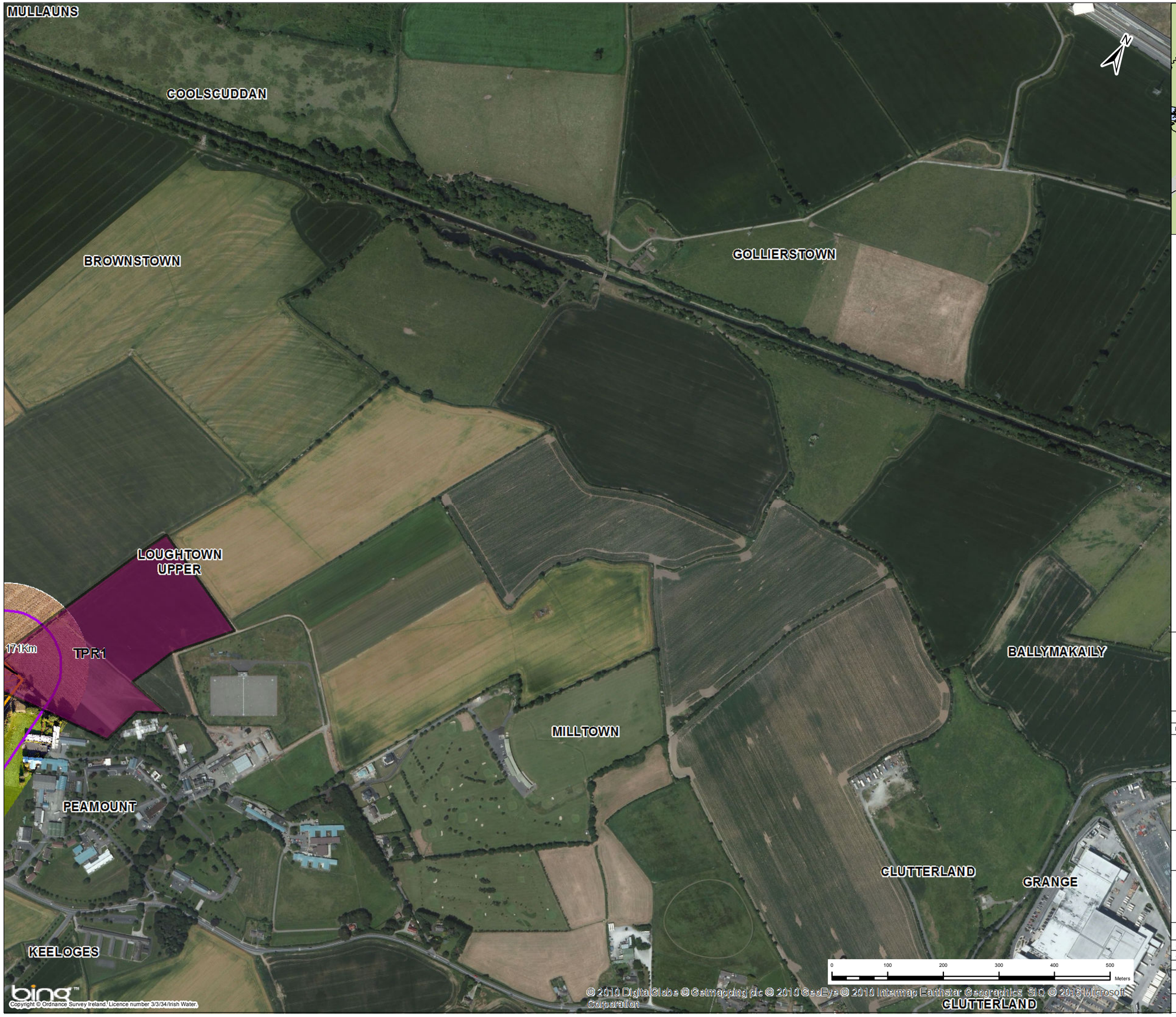
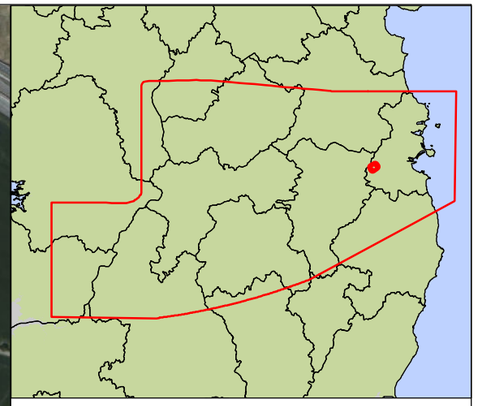
Drawing No. 32105801-FOAR-188





Key

- Centreline of Preferred 200m Pipeline Corridor
- Indicative 50m Pipeline Corridor
- Preferred 200m Pipeline Corridor
- Least Constrained Termination Point Reservoir Site
- Least Constrained Raw Water Abstraction Site
- Least Constrained Water Treatment Plant Site
- Least Constrained Break Pressure Tank Site

Note :-
The Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor Have Been Determined Following an Iterative Process to Define the Least Constrained Pipe Alignment : Refer to Appendix I

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	03/11/2016	For Issue	PW	CK	DS	MG

JACOBS® TOBIN Patrick J. Tobin & Co. Ltd.

Client: UISCE ÉIREANN IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Preferred 200m Pipeline Corridor and Indicative 50m Pipeline Corridor

Drawing Status: **For Issue**

Scale @A3	1:6,500		DO NOT SCALE
Jacobs No.	32105801	Client No.	WSP1
Filepath	G:\AG\01\32105801 - WSP DRIGB Tender_Work\Report Maps\FOAR\Rtn Corridor Maps.mxd		

Drawing No.: 32105801-FOAR-189


UISCE
ÉIREANN : IRISH
WATER