

**Planning & Development Act, 2000 - 2022,  
European Communities (Environmental Impact Assessment) Regulations 1989 (as  
amended), Planning & Development Regulations, 2001 (as amended)**

# **ENVIRONMENTAL IMPACT ASSESSMENT REPORT**

## **APPENDICES**

**Additional Information response (Planning Ref. SD22A/0333)**

**EdgeConneX Ireland Ltd.  
Data Centre (DUB06)  
Ballymakaily**

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**MARSTON**  

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**PLANNING CONSULTANCY**



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## Appendix 2.2 Schedule of mitigation measures

Project Phase	Mitigation Measures
<b>Construction phase- Habitats and Flora – Water Quality Non- native invasive species</b>	<b>Biodiversity</b>
	<p>The following mitigation measures will ensure there are no impacts on water quality in the immediate vicinity of the Proposed Development from release of hydrocarbons, polluting chemicals, sediment/silt and contaminated waters control during the construction stage of the Proposed Development and therefore no potential impacts on the downstream receiving water courses, <i>i.e.</i> the Griffeen River:</p> <ul style="list-style-type: none"> <li>• Specific measures to prevent the release of sediment over baseline conditions to the existing surface water drainage network, during the construction work, which will be implemented as the need arises. These measures include, but are not limited to, the use of silt fences, silt curtains, settlement lagoons and filter materials.</li> <li>• Provision of exclusion zones and barriers (e.g. silt fences) between earthworks, stockpiles and temporary surfaces to prevent sediment washing into the existing drainage systems and hence the downstream receiving water environment.</li> <li>• Provision of temporary construction surface drainage and sediment control measures to be in place before earthworks commence.</li> <li>• Weather conditions will be taken into account when planning construction activities to minimise risk of run-off from the site.</li> <li>• Prevailing weather and environmental conditions will be taken into account prior to the pouring of cementitious materials for the works adjacent to any surface water drainage features, or drainage features connected to same. Pumped concrete will be monitored to ensure no accidental discharge. Mixer washings and excess concrete will not be discharged to existing surface water drainage systems. Concrete washout areas will be located remote any surface water drainage features, where feasible, to avoid accidental discharge to watercourses. Washing out of any concrete trucks on site will be avoided (dry brush shoots will be used instead).</li> <li>• Any fuels of chemicals (including hydrocarbons or any polluting chemicals) will be stored in a designated, secure bunded area(s) to prevent any seepage of potential pollutants into the local surface water network. These designated areas will be clearly sign-posted and all personnel on site will be made aware of their locations and associated risks.</li> <li>• All mobile fuel bowsers shall carry a spill kit and operatives must have spill response training. All fuel containing equipment such as portable generators shall be placed on drip trays. All fuels and chemicals required to be stored on-site will be clearly marked. Care and attention should be taken during refuelling and maintenance operations. Particular attention should be paid to gradient and ground conditions, which could increase risk of discharge to waters.</li> <li>• A register of all hazardous substances, which will either be used on site or expected to be present (in the form of soil and/or groundwater contamination) will be established and maintained. This register will be available at all times and shall include as a minimum: <ul style="list-style-type: none"> <li>- Valid Safety Data Sheets;</li> <li>- Health &amp; Safety, Environmental controls to be implemented when storing, handling, using and in the event of spillage of materials;</li> <li>- Emergency response procedures/precautions for each material; and,</li> <li>- The Personal Protective Equipment (PPE) required when using the material.</li> <li>- Implementation of response measures to potential pollution incidents.</li> </ul> </li> <li>• Robust and appropriate Spill Response Plan and Environmental Emergency Plan will be prepared prior to works commencing and they will be communicated, resourced and implemented for the duration of the works. Emergency procedures/precautions and spillage kits will be available and construction staff will be trained and experienced in emergency procedures in the event of accidental fuel spillages.</li> <li>• All trucks will have a built-on tarpaulin that will cover excavated material as it is being hauled off-site and wheel wash facilities will be provided at all site egress points.</li> <li>• Water supplies shall be recycled for use in the wheel wash. All waters shall be drained through appropriate filter material prior to discharge from the construction sites.</li> <li>• The removal of any made ground material, which may be contaminated, from the construction site and transportation to an appropriate licenced facility shall be carried out in accordance with the Waste Management Act, best practice and guidelines for same.</li> <li>• A discovery procedure for contaminated material will be prepared and adopted by the</li> </ul>

	<p>appointed contractor prior to excavation works commencing on site. These documents will detail how potentially contaminated material will be dealt with during the excavation phase.</p> <ul style="list-style-type: none"> <li>• Implementation of measures to minimise waste and ensure correct handling, storage and disposal of waste (most notably wet concrete, pile arisings and asphalt).</li> <li>• All of the above measures implemented on site will be monitored throughout the duration of construction to ensure that they are working effectively, to implement maintenance measures if required and applicable, and to address any potential issues that may arise.</li> </ul>
<b>Construction phase – Vegetation clearance</b>	<p>The landscape plans prepared for the EdgeConneX masterplan site (refer to Chapter 11 of Marston Planning Consultancy, 2021) which includes the current Proposed Development site will implement appropriate measures such as using plants of native origin in planting/meadows and by leaving unmanaged and/or enhanced areas for biodiversity in the wider area of the plan. To offset the loss of habitats within the masterplan area, the proposed landscape plans include the planting of native treelines and woody hedgerow species to fill in gaps in existing hedgerows/treelines in the northern buffer area (i.e. along the Grand Canal) of the masterplan site, as well as the construction of a new pond wetland habitat in the north-eastern corner of the masterplan site with wetland planting (c. 1.7ha). The planted hedgerow species will mainly consist of <i>Corylus avellana</i>, <i>Crataegus monogyna</i> and <i>Prunus avium</i>, whilst the treelines will mainly consist of <i>Alnus glutinosa</i>, <i>Betula pendula</i>, <i>Pinus sylvestris</i> and <i>Quercus petraea</i>. The pond will be planted with <i>Phragmites australis</i>, <i>Sparganium erectum</i> and <i>Typha latifolia</i>, amongst other species. Any remaining hedgerows will be preserved, retained and protected in accordance with the arborist's report for the masterplan site and where feasible. Landscaping will also include extensive areas of wildflower hay meadow throughout the EdgeConnex masterplan site.</p>
<b>Construction phase – Badgers, habitat loss</b>	<p>Although no badger setts or signs of badger activity were recorded within the proposed development site, badger could potentially establish new setts within the Zol of the proposed development. Therefore, a confirmatory pre-construction check of all suitable badger habitat will be completed within 12 months prior to any construction works commencing by a suitably experienced and qualified ecologist.</p> <p>The presence of any new setts or significant badger activity will be treated and/or protected in accordance with the <i>Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes</i> (NRA, 2005).</p> <p>If required, a licence permitting their filming to assess locations of activity and their subsequent removal should be applied for from the NPWS. Any active badger setts located within the development or 30m from the development must be safely closed with the use of one-way badger gates and (infra-red camera) monitoring to ensure that all badgers have left the sett(s) and that it is no longer occupied, prior to sett removal. Any sett closing works shall be undertaken between the months of July to November inclusive (to avoid peak breeding season for this species and therefore avoid risk of disturbance to or mortality of cubs), in advance of site clearance and construction works commencing.</p>
<b>Construction phase – Otter, Water quality</b>	<p>Mitigation measures outlined above in "Mitigation Measures – Habitats and Flora" for the protection of water quality in the downstream receiving water courses, i.e. Griffeen River, and its immediate environs will mitigate against impacts of water pollution on the prey availability of otter during Construction Phase.</p>
<b>Construction phase – bats, lighting</b>	<p>During construction, any external lighting to be installed, including facilitating night-time working or security lighting, on the site shall be sensitive to the presence of bats in the area, downlighting, and time limited where possible. Lighting of sensitive wildlife areas and primary ecological corridors (e.g. Grand Canal and retained hedgerows in the immediate vicinity to the Proposed Development) and light pollution in general should be avoided. Lighting of the site during construction is designed in accordance with the following guidance:</p> <ul style="list-style-type: none"> <li>• Guidance Notes for the Reduction of Obtrusive Light GN01 (Institute of Lighting Professionals, 2020)</li> <li>• Bats &amp; Lighting - Guidance Notes for Planners, Engineers, Architects and Developers (Bat Conservation Ireland, December 2010)</li> <li>• Bats and Lighting in the UK – Bats and the Built Environment Series (Bat Conservation Trust UK, January 2018).</li> </ul> <p>It will be ensured in liaison with the suitably experienced and qualified ecologist that lighting at</p>

	<p>the construction compound, and active work areas within and adjacent to the proposed development, will be designed to minimise light spill outside the footprint of the proposed development, and be cognisant of light-spill into previously unlit areas. Any light spill to commuting/foraging habitats of bats may exclude them from using these areas and therefore have a negative impact on them through reduced food resources and/or longer flight routes as they try to avoid flying through the lit-up area by flying around it.</p> <p>Mitigation measures to reduce light spill during construction will include the following:</p> <ul style="list-style-type: none"> <li>• the use of sensor/timer triggered lighting;</li> <li>• LED luminaires to be used where possible due to their sharp cut-off, lower intensity, good colour rendition and dimming capability;</li> <li>• column heights to be considered to minimise light spill;</li> <li>• accessories such as baffles, hoods or louvres can be used to reduce light spill and direct it only where needed; and,</li> <li>• Where night-time works are required the suitably experienced and qualified ecologist will be liaised with to implement measures to mitigate the impact of such works.</li> </ul>
<b>Construction phase – Birds</b>	<p>The following mitigation measures are proposed to comply with the legal protection afforded to breeding birds and their nests under the Wildlife Acts:</p> <ul style="list-style-type: none"> <li>• In order to avoid disturbance or harm to breeding birds, their nests, eggs and/or their unflown young, all works involving the removal of trees, hedgerows or grasslands will be undertaken outside of the nesting season (i.e. 1 March to 31 August inclusive);</li> </ul> <p>or where this seasonal restriction cannot be observed then:</p> <ul style="list-style-type: none"> <li>• A breeding bird survey will be undertaken by a suitably experienced ecologist in order to assess whether birds are nesting within suitable habitat affected by or immediately adjacent to the proposed works. Should nesting birds be encountered during surveys, it may be necessary to delay the removal of trees, hedgerows or grasslands until after the nesting season (i.e. 1 March to 31 August inclusive), or until the chicks have fully fledged.</li> </ul>
<b>Construction phase – common frogs and lizards</b>	<p>No significant effects on common frogs or lizards are predicted during the Construction Stage of the proposed development, therefore no mitigation is required.</p>
<b>Construction phase – fish, fresh water white clawed crayfish and other aquatic species - water quality</b>	<p>Mitigation measures outlined above in “Mitigation Measures – Habitats and Flora” for the protection of water quality in the downstream receiving water courses, <i>i.e.</i> Griffeen River, and its immediate environs will mitigate against impacts of water pollution on fish and freshwater white-clawed crayfish and other aquatic species during Construction Phase.</p>
<b>Operational phase – surface water</b>	<p>The proposed drainage system for the site has been designed in accordance with Greater Dublin Strategic Design System (GDSDS) specifications. The drainage system will include a Stormtech attenuation system or similar. Roof water will be directed into an onsite reticulation system which will drain, along with road run-off, into the attenuation ponds which are to be located to the north of the site. A Hydrobrake will also be installed at the outflow to reduce the ultimate discharge.</p> <p>Pinnacle have identified that the above storm water drainage systems will accommodate a 1:2 year storm frequency. The attenuation system is also designed to accommodate a 1:100 year storm event accounting for a 20% increase with climate change.</p> <p>Due to a variety of measures such as the design of the attenuation system with hydrocarbon interceptors, the speed restrictions in place and the fact that no refuelling will be carried out on site (when practicable), the likelihood of any spills entering the water environment from vehicles on site is negligible.</p> <p>Run-off from the car park areas and access roads/delivery areas will be drained following these options:</p> <ul style="list-style-type: none"> <li>• A series of on-site gullies and channels draining into a separate system of below ground gravity storm water sewers; and,</li> </ul>

	<ul style="list-style-type: none"> <li>• A Duraflow (or similar approved), porous asphalt product.</li> </ul> <p>To minimise any impact from material spillages, all oils, solvents, paints and fuels to be stored onsite will be stored within permanently bunded areas and each of these areas will be bunded to a volume of 110% of the capacity of the largest tank/container within it (plus an allowance of 30 mm for rainwater ingress). Drainage from the bunded area(s) will be diverted for collection and safe disposal.</p>
<b>Operational phase – foul water</b>	In their Engineering Planning Report Pinnacle have proposed to discharge foul water from the proposed development, via a 225mm diameter gravity foul sewer outfall and discharge into the existing 450mm diameter connection. The increase in flow to the existing public foul sewer is not expected to have a negative effect on the foul drainage system in the area.
<b>Operational phase – bats, lighting</b>	<p>The Lighting design for the site during operation is designed in accordance with the following guidance:</p> <ul style="list-style-type: none"> <li>• Guidance Notes for the Reduction of Obtrusive Light GN01 (Institute of Lighting Professionals, 2020)</li> <li>• Bats &amp; Lighting - Guidance Notes for Planners, Engineers, Architects and Developers (Bat Conservation Ireland, December 2010)</li> <li>• Bats and Lighting in the UK – Bats and the Built Environment Series (Bat Conservation Trust UK, January 2018).</li> </ul> <p>Adhering with these guidelines ensures sensitive siting and design of the lighting elements and will include careful consideration of light placement on buildings, column heights and luminaire design.</p> <p>The following recommendations based on the above guidance have been considered in relation to the detailed construction and operational lighting design, and have been reviewed by a suitably qualified and experienced ecologist:</p> <ul style="list-style-type: none"> <li>• All pole mounted columns will be 5m high – located facing away from boundaries to minimise any light spill beyond the area to be illuminated;</li> <li>• The fittings have a sharp cut off with no upward light spill to minimise any resultant sky glow; and</li> <li>• All fittings selected will be LED selected with a lighting output spectrum which is appropriate for bat sensitive areas.</li> </ul> <p>These are in adherence with the guidance presented in relation to bats and lighting previously in this Chapter.</p>
<b>Operational phase – birds</b>	No significant effects on breeding birds and/or wintering non-SCI birds are predicted during the Operational Phase of the proposed development, therefore no mitigation is required.
<b>Operational phase - common frogs and lizards</b>	No significant effects on common frog or lizards are predicted during the Operational Phase of the proposed development, therefore no mitigation is required.
<b>Operational phase – fish, fresh water white clawed crayfish and other aquatic species - water quality</b>	No significant effects on fish, fresh water white clawed crayfish terrestrial invertebrates are predicted during the Operational Stage of the proposed development, therefore no mitigation is required.
<b><i>Land, soil, geology and hydrogeology</i></b>	
<b>Construction phase – Soil removal and compaction</b>	Reuse of excavated soil on site and capping with hardstand will minimise any increase in aquifer vulnerability. Construction works will require local removal of soil cover where levelling of the site is required and its use for re-instatement elsewhere on site. According to the GSI database the bedrock vulnerability is already extreme due to the thin cover of overburden on the site, removal of soil cover will increase the vulnerability of the underlying bedrock. However

	<p>due to levelling works imported fill will need to be deposited over a sizable proportion of the proposed development area. Overall vulnerability would not alter across the site. It is envisaged that any soil excavated will be retained on site and reused as fill material or landscaping.</p> <p>Temporary storage of soil will be carefully managed in such a way as to prevent any potential negative impact on the receiving environment and the material will be stored away from any open surface water drains. Movement of material will be minimised in order to reduce degradation of soil structure and generation of dust.</p> <p>Although there is no evidence of historical contamination in the proposed development area, all excavated materials will be visually assessed for signs of possible contamination such as staining or strong odours. Should any unusual staining or odour be noticed, samples of this soil will be analysed for the presence of possible contaminants in order to ensure that historical pollution of the soil has not occurred. Should it be determined that any of the soil excavated is contaminated, this will be disposed of by a licensed waste disposal contractor.</p>
<p><b>Construction phase – Fuel and chemical handling</b></p>	<p>To minimise any impact on the underlying subsurface strata from material spillages, all oils, solvents and paints used during construction will be stored within temporary bunded areas. Oil and fuel storage tanks shall be stored in designated areas, and these areas shall be bunded to a volume of 110% of the capacity of the largest tank/container within the bunded area(s) (plus an allowance of 30 mm for rainwater ingress). Drainage from the bunded area(s) shall be diverted for collection and safe disposal.</p> <p>Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles will take place in a designated area (or where possible off the site) which will be away from surface water gulleys or drains. In the event of a machine requiring refuelling outside of this area, fuel will be transported in a mobile double skinned tank. An adequate supply of spill kits and hydrocarbon adsorbent packs will be stored in this area. All relevant personnel will be fully trained in the use of this equipment. Guidelines such as “Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors” (CIRIA 532, 2001) will be complied with.</p> <p>Where feasible all ready-mixed concrete will be brought to site by truck. A suitable risk assessment for wet concreting will be completed prior to works being carried out which will include measures to prevent discharge of alkaline wastewaters or contaminated storm water to the underlying subsoil. Wash down and washout of concrete transporting vehicles will take place at an appropriate facility offsite.</p> <p>In the case of drummed fuel or other chemical which may be used during construction, containers should be stored in a dedicated internally bunded chemical storage cabinet and labelled clearly to allow appropriate remedial action in the event of a spillage.</p>
<p><b>Construction phase – CEMP</b></p>	<p>A Construction Environmental Management Plan (CEMP) has been developed by Winthrop Engineering and Contracting Limited and included with the application documentation. This will be refined by the Applicant and the construction contractor prior to commencement of construction. The CEMP will incorporate the mitigation measures outlined above as they relate to the construction phase. The CEMP will include emergency response procedures in the event of a spill, leak, fire or other environmental incident related to construction. This is an active document which is continuously updated to manage risk during the construction programme. All relevant personnel working on the site will be trained in the implementation of the procedures.</p> <p>As a minimum, the CEMP will be formulated in accordance with best international practice including but not limited to:</p> <ul style="list-style-type: none"> <li>• CIRIA, (2001), Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors;</li> <li>• Construction Industry Research and Information Association (CIRIA) Environmental Good Practice on Site (C650), 2005;</li> <li>• BPGCS005, Oil Storage Guidelines;</li> <li>• Eastern Regional Fisheries Board, (2006), Fisheries Protection Guidelines: Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites;</li> <li>• CIRIA 697, The SUDS Manual, 2007; and</li> <li>• UK Pollution Prevention Guidelines (PPG) UK Environment Agency, 2004.</li> </ul>

<p><b>Operational phase – Fuel and chemical handling</b></p>	<p>In order to minimise any impact on the underlying subsurface strata from material spillages, each generator will be installed in an externally rated container with a self-contained belly tank (steel double wall type for leak containment and inner tank leak alarm system) with 48 hours diesel fuel storage capacity at full load.</p> <p>Any chemicals, oils, herbicides required for site maintenance will be stored in suitable contained areas. As the site will be paved any accidental emissions from fuel spills or contaminated runoff will be directed through the surface water drainage system through oil interceptors prior to discharge to the proposed attenuation tank onsite rather than infiltrate directly to ground.</p>
<p><b>Operational phase – Environmental Plan</b></p>	<p>An environmental management plan will be prepared and followed during the operational phase incorporating mitigation measures and emergency response measures.</p>
<p><b>Hydrology</b></p>	
<p><b>Construction phase - CEMP</b></p>	<p>The design of the proposed development has taken account of the potential impacts of the development and the risks to the water environment local to the area where construction is taking place. Measures have been developed to mitigate the potential effects on the local water environment. These measures seek to avoid or minimise potential effects in the main through the implementation of best practice construction methods and adherence to all relevant legislation.</p> <p>These measures are part of the requirements under the Greater Dublin Strategic Drainage Study and South Dublin County Council. They are not intended to avoid or reduce any potential harmful effects to any European sites, since there is no potential impact on Dublin Bay, given the potential contaminant load chemical and the distance from source to the bay (c. 20 km).</p> <p>A Construction Environmental Management Plan (CEMP) has been developed by Winthrop Engineering and Contracting Limited and included with the application documentation. This will be refined by the Applicant and the construction contractor prior to commencement of construction. The CEMP will incorporate the mitigation measures outlined above as they relate to the construction phase. The CEMP will include emergency response procedures in the event of a spill, leak, fire or other environmental incident related to construction. This is an active document which is continuously updated to manage risk during the construction programme. All relevant personnel working on the site will be trained in the implementation of the procedures.</p> <p>As a minimum, the CEMP will be formulated in accordance with best international practice including but not limited to:</p> <ul style="list-style-type: none"> <li>• CIRIA, (2001), Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors;</li> <li>• Construction Industry Research and Information Association (CIRIA) Environmental Good Practice on Site (C650), 2005;</li> <li>• BPGCS005, Oil Storage Guidelines;</li> <li>• Eastern Regional Fisheries Board, (2006), Fisheries Protection Guidelines: Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites;</li> <li>• CIRIA 697, The SUDS Manual, 2007; and</li> <li>• UK Pollution Prevention Guidelines (PPG) UK Environment Agency, 2004.</li> </ul> <p>Pinnacle Consulting Engineers have outlined mitigation measures for the site in their Engineering Planning Report. The following mitigation measures include, but are not limited to, those provided in that report and are designed to address the impacts associated with the construction and operational phase of the project. Due to the inter-relationship between this section and Chapter 7 (Land, Soils, Geology and Hydrogeology) the following mitigation measures discussed will be considered applicable to both.</p>
<p><b>Construction phase - Increased run-off and sediment loading</b></p>	<p>During the construction phase any drains carrying a high sediment load will be diverted through the settlement ponds. The settlement ponds will be located between the area of construction and the nearest field drain. Surface water runoff will not be discharged directly to local watercourses. The following mitigation measures will be adopted:</p> <ul style="list-style-type: none"> <li>• the drainage system and settlement ponds will be constructed as a first step;</li> <li>• any excavations required will remain open for as little time as possible before the placement of fill. This will help to minimise potential for groundwater ingress into excavations;</li> <li>• silt traps will be placed in the existing drainage network around the site to minimise silt loss. These should be inspected and cleaned regularly.</li> </ul>

	<ul style="list-style-type: none"> <li>weather conditions will be considered when planning construction activities to minimise risk of run off from the site; and</li> <li>distance between topsoil piles etc. and streams will be maintained – to protect from dampening operations.</li> </ul>
<b>Construction phase – Contamination of local water courses</b>	<p>To minimise any impact on the underlying subsurface strata from material spillages, all oils, solvents, paints and fuels used during construction will be stored within temporary bunded areas and each of these areas will be bunded to a volume of 110% of the capacity of the largest tank/container within it (plus an allowance of 30 mm for rainwater ingress). Filling and draw-off points will be located entirely within the bunded area(s). Drainage from the bunded area(s) will be diverted for collection and safe disposal.</p> <p>Wet concrete operations adjacent to watercourses will be avoided where possible. A suitable risk assessment for wet concreting will be completed prior to works being carried out which will include measures to prevent discharge of alkaline wastewaters or contaminated storm water to groundwater.</p> <p>The contractor will be required to make provision for removal of any concrete wash waters, most likely by means of tankering off-site and no such wash waters will be discharged to groundwater. Any effluent generated by temporary onsite sanitary facilities will be taken off-site for appropriate treatment.</p> <p>Re-fuelling of construction equipment and the addition of hydraulic oil or lubricants to vehicles/equipment will take place in designated bunded areas where possible. Re-fuelling will be avoided in so far as possible at the other work sites but where necessary will take place within appropriately bunded areas.</p> <p>If it is not possible to bring a machine to the refuelling point, fuel will be delivered in a double-skinned mobile fuel bowser. A drip tray will be used beneath the fill point during refuelling operations in order to contain any spillages that may occur. The vehicles and equipment will not be left unattended during refuelling. Spill kits and hydrocarbon absorbent packs will be stored in the cab of each vehicle and operators will be fully trained in the use of this equipment.</p> <p>The generation of runoff from stockpiles of soils, excavated during construction, will be prevented from entering watercourses by diverting runoff to the settlement ponds on site, and removing the material off-site as soon as possible to designated storage areas.</p>
<b>Operational phase – Increased surface water run-off</b>	<p>The proposed drainage system for the site is outlined in Pinnacle’s Engineering Planning Report and has been designed in accordance with Greater Dublin Strategic Design System (GDSDS) specifications. Roof water will be directed into an onsite reticulation system which will drain, along with road run-off, into the attenuation ponds which are to be located to the north of the proposed data centres. A hydrobrake will also be installed at the outflow to reduce the ultimate discharge. The attenuation system is designed to accommodate a 1:100 year storm event accounting for a 20% increase with climate change.</p>
<b>Operational phase – Contamination of surface water</b>	<p>Due to a variety of measures such as the design of the attenuation system with hydrocarbon interceptors, the speed restrictions in place and the fact that no refuelling will be carried out on site (when practicable), the likelihood of any spills entering the water environment from vehicles on site is negligible.</p> <p>Run-off from the car park areas and access roads / delivery areas will be drained following these options:</p> <ul style="list-style-type: none"> <li>A series of on-site gullies and channels draining into a separate system of below ground gravity storm water sewers;</li> <li>A Duraflow (or similar approved), porous asphalt product.</li> </ul> <p>To minimise any impact from material spillages, all oils, solvents, paints and fuels to be stored onsite will be stored within permanently bunded areas and each of these areas will be bunded to a volume of 110% of the capacity of the largest tank/container within it (plus an allowance of 30 mm for rainwater ingress). Drainage from the bunded area(s) will be diverted for collection and safe disposal.</p>
<b>Operational phase – Foul water</b>	<p>In their Engineering Planning Report Pinnacle have proposed to discharge foul water from the proposed development, via a 225mm diameter gravity foul sewer outfall and discharge into the existing 450mm diameter connection. The increase in flow to the existing public foul sewer is not expected to have a negative effect on the foul drainage system in the area.</p>
<b>Operational phase – Water supply</b>	<p>The water system will be metered to facilitate detection of leakage and the prevention of water loss. Dual &amp; low flush toilets and water economy outlets and water saving measures will also</p>

	be proposed.
	<b>Noise and vibration</b>
<b>Construction – Noise and vibration</b>	<p>With regard to construction activities, reference will be made to BS5228 Parts 1 and 2, which offer detailed guidance on the control of noise and vibration from demolition and construction activities.</p> <p>Various mitigation measures will be considered and applied during the construction of the proposed development. Specific examples of such measures are:</p> <ul style="list-style-type: none"> <li>• limiting the hours during which site activities likely to create high levels of noise or vibration are permitted;</li> <li>• establishing channels of communication between the contractor/developer, Local Authority and residents;</li> <li>• appointing a site representative responsible for matters relating to noise and vibration;</li> <li>• monitoring levels of noise and/or vibration during critical periods and at sensitive locations; and</li> <li>• all site access roads will be kept even so as to mitigate the potential for vibration from lorries.</li> </ul> <p>Furthermore, it is envisaged that a variety of practicable noise control measures will be employed. These may include:</p> <ul style="list-style-type: none"> <li>• selection of plant with low inherent potential for generation of noise and/or vibration;</li> <li>• erection of barriers as necessary around items such as generators or high-duty compressors;</li> <li>• situate any noisy plant as far away from sensitive properties as permitted by site constraints and the use of vibration-isolated support structures where necessary.</li> </ul> <p>It is recommended that vibration from construction activities to off-site residences be limited to the values set out in Table 9.6. It should be noted that these limits are not absolute, but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage these limits may need to be reduced by up to 50%.</p>
<b>Operational phase - Building services noise / emergency site operation</b>	Noise from external plant will be minimised by purchasing low noise generating equipment and incorporating appropriately specified in line attenuators for stacks and exhausts where necessary. With due consideration as part of the detailed design process, this approach will result in the site operating well within the constraints of the best practice guidance noise limits that have been adopted as part of this detailed assessment.
<b>Operational phase - Additional vehicular traffic on public roads</b>	The noise impact assessment outlined previously has demonstrated that mitigation measures are not required.
<b>Operational phase – Noise and human health</b>	<i>Guidelines for construction and operational phase:</i> Noise criteria are provided by relevant bodies with consideration of the likely impact of noise on human health. The construction phase is short-term and therefore any elevated levels of noise will be of limited duration and, as a result, are not expected to pose any risk to human health. In terms of the noise exposure of construction workers and potential hearing damage that may be caused due to exposure to high levels of noise, the Safety, Health and Welfare at Work (General Application) Regulations 2007 (Statutory Instrument No. 299 of 2007) provides guidance in terms of allowable workplace noise exposure levels for employees. The Regulations specify two noise Action Levels at which the employer is legally obliged to reduce the risk of exposure to noise. The appointed contractor will be required to comply with the Regulations and provide appropriate noise exposure mitigation measures where necessary. No significant noise impacts are expected from the operational phase of the proposed development. As such, there is no anticipated risk of long-term exposure to noise on human health resulting from the proposed development.
	<b>Air quality and climate</b>
<b>Construction phase –Climate</b>	Construction vehicles, generators etc., may give rise to some CO <sub>2</sub> and N <sub>2</sub> O emissions. However, due to short-term and temporary nature of these works the impact on climate will <b>not be significant</b> .

<p><b>Construction phase – Air Quality</b></p>	<p>The objective of dust control at the site is to ensure that no significant nuisance occurs at nearby sensitive receptors. In order to develop a workable and transparent dust control strategy, the following management plan has been formulated by drawing on best practice guidance from Ireland and the UK (IAQM (2014), The Scottish Office (1996), UK Office of Deputy Prime Minister (2002) and BRE (2003)) and the USA (USEPA (1997)).</p>
<p><b>Construction phase – site management</b></p>	<p>The aim is to ensure good site management by avoiding dust becoming airborne at source. This will be done through good design and effective control strategies.</p> <p>At the construction planning stage, the siting of activities and storage piles will take note of the location of sensitive receptors and prevailing wind directions in order to minimise the potential for significant dust nuisance (see Figure 10.1 for the windrose for Casement Aerodrome). As the prevailing wind is predominantly south-westerly, locating construction compounds and storage piles downwind (to the north-east) of sensitive receptors will minimise the potential for dust nuisance to occur at sensitive receptors.</p> <p>Good site management will include the ability to respond to adverse weather conditions by either restricting operations on-site or quickly implementing effective control measures before the potential for nuisance occurs. When rainfall is greater than 0.2 mm/day, dust generation is generally suppressed (UK Office of Deputy Prime Minister (2002), BRE (2003)). The potential for significant dust generation is also reliant on threshold wind speeds of greater than 10 m/s (19.4 knots) (at 7m above ground) to release loose material from storage piles and other exposed materials (USEPA, 1986). Particular care should be taken during periods of high winds (gales) as these are periods where the potential for significant dust emissions are highest. The prevailing meteorological conditions in the vicinity of the site are favourable in general for the suppression of dust for a significant period of the year. Nevertheless, there will be infrequent periods where care will be needed to ensure that dust nuisance does not occur. The following measures should be taken in order to avoid dust nuisance occurring under unfavourable meteorological conditions:</p> <ul style="list-style-type: none"> <li>• The Principal Contractor or equivalent must monitor the contractors' performance to ensure that the proposed mitigation measures are implemented and that dust impacts and nuisance are minimised;</li> <li>• During working hours, dust control methods will be monitored as appropriate, depending on the prevailing meteorological conditions;</li> <li>• The name and contact details of a person to contact regarding air quality and dust issues shall be displayed on the site boundary, this notice board should also include head/regional office contact details;</li> <li>• It is recommended that community engagement be undertaken before works commence on site explaining the nature and duration of the works to local residents and businesses;</li> <li>• A complaints register will be kept on site detailing all telephone calls and letters of complaint received in connection with dust nuisance or air quality concerns, together with details of any remedial actions carried out;</li> <li>• It is the responsibility of the contractor at all times to demonstrate full compliance with the dust control conditions herein; and</li> <li>• At all times, the procedures put in place will be strictly monitored and assessed.</li> </ul> <p>The dust minimisation measures shall be reviewed at regular intervals during the works to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures. In the event of dust nuisance occurring outside the site boundary, site activities will be reviewed and satisfactory procedures implemented to rectify the problem. Specific dust control measures to be employed are described below.</p>
<p><b>Construction – site roads / haulage routes</b></p>	<p>Movement of construction trucks along site roads (particularly unpaved roads) can be a significant source of fugitive dust if control measures are not in place. The most effective means of suppressing dust emissions from unpaved roads is to apply speed restrictions. Studies show that these measures can have a control efficiency ranging from 25 to 80% (UK Office of Deputy Prime Minister, 2002).</p> <ul style="list-style-type: none"> <li>• A speed restriction of 20 km/hr will be applied as an effective control measure for dust for on-site vehicles using unpaved site roads;</li> <li>• Access gates to the site shall be located at least 10m from sensitive receptors where possible;</li> <li>• Bowsers or suitable watering equipment will be available during periods of dry weather</li> </ul>

	<p>throughout the construction period. Research has found that watering can reduce dust emissions by 50% (USEPA, 1997). Watering shall be conducted during sustained dry periods to ensure that unpaved areas are kept moist. The required application frequency will vary according to soil type, weather conditions and vehicular use; and</p> <ul style="list-style-type: none"> <li>Any hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads shall be restricted to essential site traffic only.</li> </ul>
<b>Construction phase – Land clearing / earth moving</b>	<p>Land clearing / earth-moving works during periods of high winds and dry weather conditions can be a significant source of dust.</p> <ul style="list-style-type: none"> <li>During dry and windy periods, and when there is a likelihood of dust nuisance, watering shall be conducted to ensure moisture content of materials being moved is high enough to increase the stability of the soil and thus suppress dust; and</li> <li>During periods of very high winds (gales), activities likely to generate significant dust emissions should be postponed until the gale has subsided.</li> </ul>
<b>Construction phase – storage piles</b>	<p>The location and moisture content of storage piles are important factors which determine their potential for dust emissions.</p> <ul style="list-style-type: none"> <li>Overburden material will be protected from exposure to wind by storing the material in sheltered regions of the site. Where possible storage piles should be located downwind of sensitive receptors;</li> <li>Regular watering will take place to ensure the moisture content is high enough to increase the stability of the soil and thus suppress dust. The regular watering of stockpiles has been found to have an 80% control efficiency (UK Office of Deputy Prime Minister, 2002); and</li> <li>Where feasible, hoarding will be erected around site boundaries to reduce visual impact. This will also have an added benefit of preventing larger particles from impacting on nearby sensitive receptors.</li> </ul>
<b>Construction phase – Site traffic on public roads</b>	<p>Spillage and blow-off of debris, aggregates and fine material onto public roads should be reduced to a minimum by employing the following measures:</p> <ul style="list-style-type: none"> <li>Vehicles delivering or collecting material with potential for dust emissions shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust; and</li> <li>In addition, public roads outside the site shall be regularly inspected for cleanliness, as a minimum on a daily basis, and cleaned as necessary.</li> </ul>
<b>Construction phase – Dust mitigation</b>	<p>The pro-active control of fugitive dust will ensure that the prevention of significant emissions, rather than an inefficient attempt to control them once they have been released, will contribute towards the satisfactory performance of the contractor. The key features with respect to control of dust will be:</p> <ul style="list-style-type: none"> <li>The specification of a site policy on dust and the identification of the site management responsibilities for dust issues;</li> <li>The development of a documented system for managing site practices with regard to dust control;</li> <li>The development of a means by which the performance of the dust minimisation plan can be regularly monitored and assessed;</li> <li>The specification of effective measures to deal with any complaints received.</li> </ul>
<b>Operational phase – Air Quality</b>	<p>The standby diesel generators have been designed in an iterative fashion to ensure that an adequate height was selected to aid dispersion of the plume. Provided each standby diesel generator flue stack is built to a height of 25m above local ground level and based on the site layout modelled and hours of operation, the air impact assessment has demonstrated that <b>mitigation measures are not required</b>.</p> <p>Under the previous permission similarly the stack heights of the gas generators were designed in an iterative fashion to ensure that an adequate height was selected to aid dispersion of the plume. Provided each gas generator flue stack is built to a height of 25m above local ground level, as per its permission, and based on the site layout modelled, the air impact assessment has demonstrated that mitigation measures are not required.</p>
<b>Operational phase - Climate</b>	<p>On-site emissions of greenhouse gases will mainly derive from the permitted gas generators with infrequent standby emissions due to the diesel generators. However, the emissions from the gas generators will form part of the EU-wide Emission Trading Scheme (ETS) and thus</p>

	greenhouse gas emission from onsite electricity generation are not included when determining compliance with the targeted 42% reduction in the non-ETS sector. In addition, gas generators have the lowest greenhouse gas emission rate of any fossil fuel.
	<b>Landscape and visual assessment</b>
<b>Operational – visual impact</b>	<p>The mitigation of potential negative landscape and visual impacts has influenced the design and layout of the scheme from the beginning of the design process (refer to Landscape Mitigation Drawing). As a result, the following landscape design mitigation measures have been made:</p> <ul style="list-style-type: none"> <li>• earth modelling and large tree planting reinforced with woodland whip planting in belts is proposed to provide a high level of visual screening of the most sensitive views of the development;</li> <li>• the creation of a wetland and woodland habitat in a buffer zone between the canal and the built development and provision of public access to some of these habitats;</li> <li>• the colour palette chosen for the building aims to further reduce any visual impact of the building; and</li> <li>• Green walls are proposed to the south and east that will enclose the water tower and pump house compound.</li> </ul>
	<b>Traffic and transportation</b>
<b>Construction – CMP</b>	<p>The Construction Management Plan prepared by Winthrop incorporates a range of integrated control measures and associated management initiatives with the objective of mitigating the impact of the proposed developments on-site construction activities. To minimise disruption to the surrounding environment, the following mitigation measures will be implemented:</p> <ul style="list-style-type: none"> <li>• During the pre-construction phase, the site will be securely fenced off from adjacent properties, public footpaths and roads.</li> <li>• All road works will be adequately signposted and enclosed to ensure the safety of all road users and construction personnel.</li> <li>• A dedicated 'construction' site access / egress junction will be provided during all construction phases. This will coincide with the overall site access/</li> <li>• Provision of sufficient on-site parking and compounding to ensure no potential overflow of construction generated traffic onto the local network.</li> <li>• Site offices and compound will be located within the site boundary. The site will be able to accommodate employee and visitor parking throughout the construction period through the construction of temporary hardstanding areas.</li> <li>• A material storage zone will also be provided in the compound area. This storage zone will include material recycling areas and facilities.</li> <li>• A series of 'way finding' signage will be provided to route staff / deliveries into the site and to designated compound / construction areas.</li> <li>• Dedicated construction haul routes will be identified and agreed with the local authority prior to the commencement of constructions activities on-site.</li> <li>• Truck wheel washes will be installed at construction entrances if deemed necessary and any specific recommendations with regard to construction traffic management made by the Local Authority will be adhered to.</li> <li>• On completion of the works all construction materials, debris, temporary hardstands etc. from the site compound will be removed off site and the site compound area reinstated in full on completion of the works.</li> </ul> <p>All construction related parking will be provided on site. Construction traffic will consist of the following two principal categories:</p> <ul style="list-style-type: none"> <li>• Private vehicles owned and driven by site construction staff and by full time supervisory staff;</li> <li>• Excavation plant and dumper trucks involved in site development works and material delivery vehicles for the following: granular fill materials, concrete pipes, manholes, reinforcement steel, ready mix concrete and mortar, concrete blocks, miscellaneous building materials, etc.</li> </ul> <p>It is anticipated that the generation of HGV's during the construction period will be evenly spread throughout the day and as such will not impact significantly during the peak traffic periods.</p>
<b>Operational – traffic</b>	The Adamstown Road (R120) and Nangor Road (R134) Improvement Scheme provides

<b>and transportation</b>	<p>suitable infrastructure and transport services for travel by sustainable modes. A key barrier to modal shift towards sustainable modes of travel is often a lack of information about potential alternatives to the car. As such, it is proposed that staff at the data centre are made aware of potential alternatives including information on walking, cycle routes and public transport.</p> <p>The local area provides suitable infrastructure and transport services for travel by sustainable modes. A key barrier to modal shift towards sustainable modes of travel is often a lack of information about potential alternatives to the car. As such, it is proposed that staff and visitors of the proposed development are made aware of potential alternatives including information on walking, cycle routes and public transport.</p> <p>A number of walking and cycling connection points are proposed within the development. These connection points will provide access for pedestrians and cyclists onto the R120. These facilities will provide attractive, convenient and safe routes for staff &amp; visitors. Therefore, there are good links proposed for staff to travel by more sustainable modes.</p> <p>It is proposed to provide car parking that will meet the expected-on site demand. The marketing of new pedestrian &amp; cyclists routes along with public transport information will further reinforce the efforts been made towards a modal shift away from car-based trips.</p> <p>The local area provides suitable infrastructure and transport services for travel by sustainable modes. A key barrier to modal shift towards sustainable modes of travel is often a lack of information about potential alternatives to the car. As such, it is proposed that staff and visitors of the proposed development are made aware of potential alternatives including information on walking, cycle routes and public transport. A Mobility Management Plan will be developed and implemented within six months of the commencement of the operation of the proposed development. This should be undertaken collaboratively with the permitted data centres already granted on this site. It is anticipated that this measure may help to reduce the level of traffic at the proposed development, thus providing mitigation against the already minimal traffic and transport effects of the development.</p>
<b>Cultural heritage</b>	
<b>Construction phase - Archaeology</b>	<p>A programme of licensed archaeological monitoring will be agreed with the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht, for areas not previously subjected to archaeological testing.</p> <p>A report outlining the results of the programme of archaeological monitoring will be prepared and will include a detailed method statement for any archaeological excavation of features identified, agreed in advance with the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht. The report will include a schedule of works detailing timeframes, personnel and logistical requirements.</p> <p>Any areas that require archaeological excavation will be cordoned off to facilitate the archaeological team to carry out the excavations. A buffer zone will be agreed with National Monuments Service and no construction works will be undertaken in these areas until archaeological excavations have been completed.</p> <p>Provision has been made for all costs associated with archaeological testing, any required excavations and reporting of the results to the standards required by the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht. The remedial or reductive mitigation measures outlined here are subject to the approval of the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht.</p>
<b>Operational phase – cultural heritage</b>	<p>No remedial or reductive measures are considered necessary during the operational phase of the proposed development, as the operational phase will not give rise to any adverse impacts.</p>
<b>Waste management</b>	
<b>Construction – C&amp;D WMP</b>	<p>As previously stated, a project specific RWMP has been prepared in line with the requirements of the requirements of the EPA, <i>Best Practice Guidelines for the Preparation of Resource and Waste Management Plans for Construction &amp; Demolition Projects</i> (2021) and is included as Appendix 14.1. The mitigation measures outlined in the RWMP will be implemented in full and form part of mitigation strategy for the site. The mitigation measures presented in this RWMP will ensure effective waste management and minimisation, reuse, recycling, recovery and disposal of waste material generated during the excavation and construction phases of the Proposed Development. Prior to commencement, the appointed Contractor(s) will be required to refine / update the RWMP (Appendix 14.1) in agreement with SDCC and in compliance with any planning conditions, or submit an addendum to the RWMP to SDCC, detailing specific measures to minimise waste generation and resource consumption, and provide details of the proposed waste contractors and destinations of each waste stream. The Contractor will implement the RWMP throughout the duration of the proposed excavation and construction</p>

	<p>phases.</p> <p>The project engineers (Pinnacle) estimated that c. 11,300m<sup>3</sup> of topsoil and 18,800m<sup>3</sup> of subsoil will be excavated. It is currently proposed that all of this excavated material will be reused on site, wherever possible, for berms and other landscaping purposes. Surplus material that is not required for reuse onsite, will be reused or recovered off-site insofar as is reasonably practicable. Where there is no suitable reuse or recovery option available, it will be disposed of at an authorised facility.</p> <p>In addition, the following mitigation measures will be implemented:</p> <ul style="list-style-type: none"> <li>• Building materials will be chosen with an aim to ‘design out waste’;</li> <li>• On-site segregation of waste materials will be carried out to increase opportunities for off-site reuse, recycling and recovery – it is anticipated that the following waste types, at a minimum, will be segregated: <ul style="list-style-type: none"> <li>- Concrete rubble (including ceramics, tiles and bricks);</li> <li>- Plasterboard;</li> <li>- Metals;</li> <li>- Glass; and</li> <li>- Timber.</li> </ul> </li> <li>• Left over materials (e.g. timber off-cuts, broken concrete blocks/bricks) and any suitable construction materials shall be re-used on-site, where possible;</li> <li>• All waste materials will be temporarily stored in skips or other suitable receptacles in designated areas of the site;</li> <li>• Any hazardous wastes generated (such as chemicals, solvents, glues, fuels, oils) will also be segregated and will be stored in appropriate receptacles (in suitably bunded areas, where required);</li> <li>• A person responsible for waste management will be appointed by the main contractor(s) to ensure effective management of waste during the excavation and construction works;</li> <li>• All construction staff will be provided with training regarding the waste management procedures;</li> <li>• All waste leaving site will be reused, recycled or recovered where possible to avoid material designated for disposal;</li> <li>• All waste leaving the site will be transported by suitable permitted contractors and taken to suitably registered, permitted or licensed facilities; and</li> <li>• All waste leaving the site will be recorded and copies of relevant documentation maintained.</li> </ul> <p>Nearby sites requiring clean fill material will be contacted to investigate reuse opportunities for clean and inert material, if required. If any of the material is to be reused on another site as by-product (and not as a waste), this will be done in accordance with regulation 15 (previously Article 27) of S.I. No. 323/2020 - European Union (Waste Directive) Regulations 2020. EPA approval will be obtained prior to moving material as a by-product.</p> <p>These mitigation measures will ensure that the waste arising from the construction phase of the Proposed Development is dealt with in compliance with the provisions of the Waste Management Act 1996, as amended, associated Regulations and the Litter Pollution Act 1997, and the EMR Waste Management Plan 2015 – 2021. It will also ensure optimum levels of waste reduction, reuse, recycling and recovery are achieved and will promote more sustainable consumption of resources.</p>
<p><b>Operational - Waste</b></p>	<p>All waste materials will be segregated into appropriate categories and will be temporarily stored in appropriate bins or other suitable receptacles in a designated, easily accessible areas on the site. In addition, the following mitigation measures will be implemented:</p> <ul style="list-style-type: none"> <li>• On-site segregation of all waste materials into appropriate categories including (but not limited to): <ul style="list-style-type: none"> <li>- Dry Mixed Recyclables;</li> <li>- Organic food/green waste;</li> <li>- Mixed Non-Recyclable Waste;</li> <li>- Batteries (non-hazardous and hazardous);</li> <li>- Waste electrical and electronic equipment (WEEE) including computers, printers and other ICT equipment; and</li> <li>- Cleaning chemicals (solvents, pesticides, paints, adhesives, resins, detergents, etc.).</li> </ul> </li> <li>• All waste materials will be stored in colour coded bins or other suitable receptacles in designated, easily accessible locations. Bins will be clearly labelled with the approved waste type to ensure there is no cross contamination of waste materials;</li> <li>• All waste collected from the development will be reused, recycled or recovered where possible, with the exception of those waste streams where appropriate facilities are</li> </ul>

	<p>currently not available;</p> <ul style="list-style-type: none"> <li>All waste leaving the site will be transported by suitable permitted contractors and taken to suitably registered, permitted or licensed facilities; and</li> <li>All waste leaving the site will be recorded and copies of relevant documentation maintained.</li> </ul> <p>These mitigation measures will ensure the waste arising from the development is dealt with in compliance with the provisions of the <i>Waste Management Act 1996</i>, as amended, associated Regulations, the <i>Litter Pollution Act 1997</i> and the <i>EMR Waste Management Plan (2015 - 2021)</i>. It will also ensure optimum levels of waste reduction, reuse, recycling and recovery are achieved.</p>
	<b>Material assets</b>
<b>Construction – Service providers</b>	Construction of the Proposed Development will require connections to water supply and drainage infrastructure, power and telecommunications. Ongoing consultation with SDCC, Irish Water, Eirgrid, ESB and other relevant service providers within the locality and compliance with any requirements or guidelines they may have will ensure a smooth construction schedule without disruption to local and business community.
<b>Construction – Power and Electricity supply</b>	The power demand for the construction phase will be relatively minor and the temporary connection works are entirely within the Proposed Development site, so that this would not have any potential offsite impact. The excavation of trenches within the vicinity of existing electrical services will be carried out in consultation with ESB Networks to ensure there is no impact on existing users. Once completed, ESB Networks will be mobilised to complete the commissioning in accordance with the ESB Network requirements. No remedial or mitigation measures are required in relation to power supply for the construction phase.
<b>Construction phase - Telecommunications</b>	A fibre optic cable distribution network will be installed within the site for the Proposed Development. The connection into the wider telecommunications network will be undertaken by a statutory telecommunications operator. No remedial or mitigation measures are required in relation to telecommunications.
<b>Construction phase – Water supply, surface water and foul water infrastructure</b>	<p>Run-off water containing silt will be contained on site and treated to ensure adequate silt removal. The works contractor will be obliged to put best practice measures in place to ensure that there are no interruptions to service in existing surface water drainage network. There will not be any interruptions to service in existing surface water sewers. Should interruptions to surface water infrastructure be anticipated, they will be agreed in advance. Strict quality control measures as outlined under the CEMP of the contractor will be undertaken while laying pipes to minimise or eradicate infiltration (where existing water in the ground enters the surface water infrastructure) and ex-filtration (where water in the surface water infrastructure escapes into the ground).</p> <p><i>Foul drainage infrastructure</i></p> <p>A temporary connection to the foul water drainage network will be made and is required for the welfare facilities for the construction staff. The foul water drainage network has sufficient available capacity for the wastewater discharges from the welfare facilities for the short term construction phase.</p> <p>The works contractor will be obliged to put a number of measures as outlined in Chapter 2 of this EIA Report and will be detailed within the CEMP in place to ensure that there is no impact on the existing foul drainage network during the construction works.</p> <p>Foul drainage construction for the Proposed Development will be in accordance with the relevant standards for design and construction, including the Irish Water Code of Practice for Wastewater Infrastructure, The Building Regulations Technical Guidance Document 'Part H' &amp; the Regional Code of Practice for Drainage Works. Strict quality control measures that will be outlined within the CEMP will be undertaken while laying pipes to minimise or eradicate infiltration and ex-filtration.</p> <p>Portable toilets will be provided for construction staff. The existing sewer will be extended into the site to facilitate the Proposed Development. As the construction works are entirely within the site boundary and business park, this would not have any offsite impact. The works contractor will be obliged to put a number of measures in place as outlined under the CEMP to ensure that there is no impact on the foul drainage network of the business park. Strict quality control measures as outlined under the CEMP will be undertaken while laying pipes to</p>

	<p>minimise or eradicate infiltration and ex-filtration.</p> <p><i>Water supply</i> Welfare facilities (canteens, toilets etc.) will be required for the construction staff. A temporary connection will be put in place for the construction phase. As the connection works are entirely within the Proposed Development site, and would therefore not have any potential offsite impact. The works contractor will be obliged to put best practice measures in place as outlined within the CEMP and elsewhere to ensure that there are no interruptions to service from the existing watermain. There will not be any interruptions to service from the existing water main, but should interruptions be required, they will be agreed in advance. Strict quality control measures as set out as best practice and as outlined under the CEMP will be undertaken while laying pipes to minimise or eradicate infiltration and ex-filtration.</p>
<p><b>Operational – Power and electricity supply</b></p>	<p>The applicants is already in receipt of a Connection Agreement from EirGrid to connect their permitted substation (known as Kishoge) into the national grid. This offer was made by EirGrid on the 21<sup>st</sup> August 2020 in the full knowledge of the constraints within the Greater Dublin area. Given this was made following both the EirGrid ‘Data Centre Connection Offer Process and Policy’ (“DCCOPP”) published initially in July 2019 and updated in July 2020 and the National Climate Action Plan 2019; it is only reasonable to conclude that the locational requirements and other criteria in place at the time, were considered to have been met. The nature of this offer is that it will facilitate the gas plants permitted under SDCC Planning Ref. SD21A/0042 to supply and reinforce the national grid.</p> <p>The policies and long term aims of Climate Action Plan 2021 are based on continuing to facilitate data centre development, subject to certain criteria, and future reviews, up to 2030. The Plan recognises, and takes account of the changes in demand for electricity over the next 10 years; and that this will alter the profile for demand and recognises that the forecast growth in data centres will represent a challenge to Ireland’s emissions targets.</p> <p>Government policy set out under the Climate Action Plan 2021, states that the strategy on data centres will be reviewed (section 11.1) to ensure that growth of such users can only happen in alignment with sectoral emission ceilings and renewable energy targets. Whilst the 2021 Plan identifies the potential for further regulatory measures to manage demand from data centres, in the context of climate targets and future network needs; these do not currently exist. We respectfully submit that the adopted Plan should reflect this and should require individual data centre applications to be considered on their merits having regard to Eirgrid and CRU policy.</p> <p>The CRU published on the 23<sup>rd</sup> November 2021 the “CRU Direction to the System Operators related to Data Centre grid connection processing” (CRU/21/124). This decision allows the data centre industry to continue to connect to the electricity grid, subject to certain conditions. New data centre connections are required to have on-site generation (and/or battery storage) that is sufficient to meet their own demand and, to assist in full decarbonisation of the power system, this generation should also be capable of running on renewably sourced fuels (such as renewable gas or hydrogen) when supplies become more readily available.</p> <p>The recently published ‘Government Statement on the Role of Data Centres in Ireland’s Enterprise Strategy’ (July 2022) seeks to enable the decarbonisation and digitalisation of the Irish economy and society.</p> <p>The Flexible Demand offer from Eirgrid requires an onsite energy generation solution for the site in the case where there are capacity issues on the National Grid. The permitted Power Plants, as well as providing short term permanent power will also provide mitigation back-up power supply in line with the Eirgrid offer for the site.</p> <p>The <i>Energy Statement</i> that accompanies this planning application also describes how waste heat associated with the facility has the capacity to connect with a future district heating scheme developed by others.</p>
<p><b>Operational - Telecommunications</b></p>	<p>There is sufficient capacity available in the area network for the Proposed Development. Therefore, no remedial or mitigation measures are required in relation to telecommunications.</p>
<p><b>Operational - water supply, surface water and foul water infrastructure</b></p>	<p><i>Surface water infrastructure</i> The surface water drainage system for the Proposed Development incorporates runoff control in the form of attenuation, which will restrict discharge from the Proposed Development to the allowable greenfield runoff rate. The attenuation storage and interceptors allows for any detritus material to be removed from the water and aids in particulate removal, increasing overall storm water quality prior to disposal.</p>

	<p>To limit the discharges from the attenuation zones to pre-development levels flow control devices are required. It is proposed to use 'Hydrobrake' flow control systems to achieve the required discharge rates. SuDS measures will prevent an increase in the rate of surface water runoff offsite. The allowable greenfield runoff rate has been established by the project engineers, Pinnacle, Consulting Engineers, using the methodology set out in the Water Services Report. A Class 1 Bypass Oil Separator will be used to treat runoff prior to discharging from site.</p> <p><i>Foul drainage infrastructure</i></p> <p>Foul drainage for the Proposed Development will be in accordance with the Building Regulations Technical Guidance Document H for design and construction and Irish Waters Code of Practice for Wastewater Infrastructure. The foul drainage network will be maintained by maintenance staff to ensure system is fit for purpose and to address any operational issues should they arise over the life time of the Proposed Development.</p> <p>No additional remedial or mitigation measures are required in relation to foul drainage infrastructure.</p> <p><i>Water supply</i></p> <p>Cold water storage tanks will be provided as part of the Proposed Development; pumps will supply water to the Proposed Development from the storage tanks. The storage tanks will act as break tanks and buffer demand on the public watermain infrastructure. Further discussions are ongoing with Irish Water. No remedial or mitigation measures are required in relation to water supply.</p>
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## CHAPTER 6 - BIODIVERSITY

### Appendix 6.1 Protected sites for Nature Conservation in the Vicinity of the Proposed Development

European sites in the vicinity of the Proposed Development are listed below in Table 1, along with their Qualifying/Special Conservation Interests, reference to the most recent conservation objectives document, and their location relative to the Proposed Development site.

Other nationally protected sites for nature conservation in the vicinity of the Proposed Development are listed below in Table 2 along with the nature conservation interests for which they are designated, and their location relative to the Proposed Development site.

European Site Name [Code] and its Qualifying Interest(s) / Special Conservation Interest(s) (*Priority Annex I Habitats)	Location Relative to the Proposed Development Site
<b>Special Area of Conservation (SAC)</b>	
<p><b>Rye Water Valley/Carnton SAC [001398]</b>            7220 Petrifying springs with tufa formation (Cratoneurion)*            1014 Narrow-mouthed Whorl Snail <i>Vertigo angustior</i>            1016 Desmoulin's Whorl Snail <i>Vertigo moulinsiana</i></p> <p><i>S.I. No. 494/2018 - European Union Habitats (Rye Water Valley/Carnton Special Area of Conservation 001398) Regulations 2018</i>            NPWS (2021) <i>Conservation Objectives: Rye Water Valley/Carnton SAC 001398</i>.            Version 1. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage.</p>	<p>c. 4.1km north-west of the Proposed Development</p>
<p><b>Glenasmole Valley SAC [001209]</b>            6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites)            6410 <i>Molinia</i> meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)            7220 Petrifying springs with tufa formation (Cratoneurion)*</p> <p><i>S.I. No. 345/22021 - European Union Habitats (Glenasmole valley special area of conservation 001209) regulations 2021</i>            NPWS (2021) <i>Conservation Objectives: Glenasmole Valley SAC 001209</i>.            Version 1. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage.</p>	<p>c. 9.8km south-east of the Proposed Development</p>
<p><b>Wicklow Mountains SAC [002122]</b>            3110 Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae)            3160 Natural dystrophic lakes and ponds            4010 Northern Atlantic wet heaths with <i>Erica tetralix</i>            4030 European dry heaths            4060 Alpine and Boreal heaths            6130 Calaminarian grasslands of the Violetalia calaminariae            6230 Species-rich <i>Nardus</i> grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)*            7130 Blanket bogs (* if active bog)            8110 Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani)            8210 Calcareous rocky slopes with chasmophytic vegetation            8220 Siliceous rocky slopes with chasmophytic vegetation            91A0 Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles            1355 <i>Lutra lutra</i> (Otter)</p> <p>NPWS (2017) <i>Conservation Objectives: Wicklow Mountains SAC 002122</i>.            Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.</p>	<p>c. 11.4km south of the Proposed Development</p>

European Site Name [Code] and its Qualifying Interest(s) / Special Conservation Interest(s) (*Priority Annex I Habitats)	Location Relative to the Proposed Development Site
<p><b>Red Bog, Kildare SAC [000397]</b> 7140 Transition mires and quaking bogs</p> <p><i>S.I. No. 76/2018 - European Union Habitats (Red Bog, Kildare Special Area of Conservation 000397) Regulations 2018</i> NPWS (2019) <i>Conservation Objectives: Red Bog, Kildare SAC 000397</i>. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.</p>	c. 15km south of the Proposed Development
<p><b>South Dublin Bay SAC [000210]</b> 1140 Mudflats and sandflats not covered by seawater at low tide 1210 Annual vegetation of drift lines 1310 <i>Salicornia</i> and other annuals colonising mud and sand 2110 Embryonic shifting dunes</p> <p><i>S.I. No. 525/2019 - European Union Habitats (South Dublin Bay Special Area of Conservation 000210) Regulations 2019</i> NPWS (2013) <i>Conservation Objectives: South Dublin Bay SAC 000210</i>. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.</p>	c. 16.4km east of the Proposed Development
<p><b>North Dublin Bay SAC [000206]</b> 1140 Mudflats and sandflats not covered by seawater at low tide 1210 Annual vegetation of drift lines 1310 <i>Salicornia</i> and other annuals colonising mud and sand 1330 Atlantic salt meadows (<i>Glauco-Puccinellietalia maritima</i>) 1395 Petalwort <i>Petalophyllum ralfsii</i> 1410 Mediterranean salt meadows (<i>Juncetalia maritimi</i>) 2110 Embryonic shifting dunes 2120 Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes) 2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)* 2190 Humid dune slacks</p> <p><i>S.I. No. 524/2019 - European Union Habitats (North Dublin Bay Special Area of Conservation 000206) Regulations 2019</i> NPWS (2013) <i>Conservation Objectives: North Dublin Bay SAC 000206</i>. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.</p>	c. 18.8km east of the Proposed Development
<b>Special Protection Area (SPA)</b>	
<p><b>North Bull Island SPA [004006]</b> A046 Light-bellied Brent Goose <i>Branta bernicla hrota</i> A048 Shelduck <i>Tadorna tadorna</i> A052 Teal <i>Anas crecca</i> A054 Pintail <i>Anas acuta</i> A056 Shoveler <i>Anas clypeata</i> A130 Oystercatcher <i>Haematopus ostralegus</i> A140 Golden Plover <i>Pluvialis apricaria</i> A141 Grey Plover <i>Pluvialis squatarola</i> A143 Knot <i>Calidris canutus</i> A144 Sanderling <i>Calidris alba</i> A149 Dunlin <i>Calidris alpina</i> A156 Black-tailed Godwit <i>Limosa limosa</i> A157 Bar-tailed Godwit <i>Limosa lapponica</i> A160 Curlew <i>Numenius arquata</i> A162 Redshank <i>Tringa totanus</i> A169 Turnstone <i>Arenaria interpres</i> A179 Black-headed Gull <i>Chroicocephalus ridibundus</i> A999 Wetlands &amp; Waterbirds</p>	c. 15.7km east of the Proposed Development

European Site Name [Code] and its Qualifying Interest(s) / Special Conservation Interest(s) (*Priority Annex I Habitats)	Location Relative to the Proposed Development Site
<p>S.I. No. 211/2010 - European Communities (Conservation of Wild Birds (North Bull Island Special Protection Area 004006)) Regulations 2010. NPWS (2015) Conservation Objectives: North Bull Island SPA 004006. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.</p>	
<p><b>Wicklow Mountains SPA [004040]</b> A098 Merlin <i>Falco columbarius</i> A103 Peregrine <i>Falco peregrinus</i></p> <p>S.I. No. 586/2012 - European Communities (Conservation of Wild Birds (Wicklow Mountains Special Protection Area 004040)) Regulations 2012. NPWS (2022) Conservation objectives for Wicklow Mountains SPA [004040]. Generic Version 9.0. Department of Housing, Local Government and Heritage.</p>	c. 12.3km south-east of the Proposed Development
<p><b>South Dublin Bay and River Tolka Estuary SPA [004024]</b> A046 Light-bellied Brent Goose <i>Branta bernicla hrota</i> A130 Oystercatcher <i>Haematopus ostralegus</i> A137 Ringed Plover <i>Charadrius hiaticula</i> A141 Grey Plover <i>Pluvialis squatarola</i> A143 Knot <i>Calidris canutus</i> A144 Sanderling <i>Calidris alba</i> A149 Dunlin <i>Calidris alpina</i> A157 Bar-tailed Godwit <i>Limosa lapponica</i> A162 Redshank <i>Tringa totanus</i> A179 Black-headed Gull <i>Chroicocephalus ridibundus</i> A192 Roseate Tern <i>Sterna dougallii</i> A193 Common Tern <i>Sterna hirundo</i> A194 Arctic Tern <i>Sterna paradisaea</i> A999 Wetland and Waterbirds</p> <p>S.I. No. 212/2010 - European Communities (Conservation of Wild Birds (South Dublin Bay and River Tolka Estuary Special Protection Area 004024)) Regulations 2010 NPWS (2015) Conservation Objectives: South Dublin Bay and River Tolka Estuary SPA 004024. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.</p>	c. 16.4km east of the Proposed Development

**Table 1:** European sites in the vicinity of the Proposed Development.

Designated Site Name [Code] and its nature conservation features	Location Relative to the Proposed Development Site
<b>proposed Natural Heritage Area (pNHA)</b>	
<p><b>Grand Canal pNHA [002104]</b></p> <p>Diversity of flora species the canal ecosystem supports and the presence of legally protected plant species, opposite-leaved pondweed <i>Groenlandia densa</i>.</p>	c. 46m north of the Proposed Development
<p><b>Liffey Valley pNHA [000128]</b></p> <p>The site is important for its diversity of habitats within, ranging from terrestrial to aquatic. A number of rare and threatened plant species, such as <i>Scrophularia umbrosa</i>, <i>Hypericum hirsutum</i> and <i>Lamiastrum caleobdolon</i> have been recorded from the site.</p>	c. 2.8km north of the Proposed Development
<p><b>Rye Water Valley/Cartron pNHA [001398]</b></p> <p>Diversity of flora and fauna species the river ecosystem supports – see also Rye Water Valley/Cartron SAC in Table 1 above.</p>	c. 4.2km north-west of the Proposed Development
<p><b>Royal Canal pNHA [002103]</b></p>	c. 4.5km north of the Proposed Development

Designated Site Name [Code] and its nature conservation features	Location Relative to the Proposed Development Site
Diversity of flora species the canal ecosystem supports and the presence of legally protected plant species, opposite-leaved pondweed <i>Groenlandia densa</i> .	
<p><b>Lugmore Glen pNHA [001212]</b></p> <p>The site is important as it is a fine example of wooded glen with a good representation of woodland flora. This type of habitat is scarce in Co. Dublin. The site also holds a Red Data Book species <i>Lamiastrum galeobdolon</i>.</p>	c. 7km south of the Proposed Development
<p><b>Dodder Valley pNHA [000991]</b></p> <p>The site represents the last remaining stretch of natural riverbank vegetation on the River Dodder in the built-up Greater Dublin Area. Includes a diversity of flora and bird species as well.</p>	c. 8.8km south-east of the Proposed Development
<p><b>Slade of Saggart and Crooksling Glen pNHA [000211]</b></p> <p>The site includes a good example of a wooded river valley and a small wetland system. The presence of a rare plant, a rare invertebrate and a variety of wildfowl species adds to the interest of the site.</p>	c. 6.7km south of the Proposed Development
<p><b>Glenasmole Valley pNHA [001209]</b></p> <p>Listed under similar conservation objectives as its SAC designation.</p>	c. 9.5km south-east of the Proposed Development
<p><b>Kilteel Wood pNHA [001394]</b></p> <p>The site is a fine example of a largely deciduous wood. Its elevated position gives it scenic value.</p>	c. 10.8km south-west of the Proposed Development
<p><b>Red Bog, Kildare pNHA [000397]</b></p> <p>Listed under similar conservation objectives as its SAC and SPA designations.</p>	c. 15km south of the Proposed Development
<p><b>South Dublin Bay pNHA [000210]</b></p> <p>Listed under similar conservation objectives as its SAC and SPA designations.</p>	c. 16km east of the Proposed Development
<p><b>North Dublin Bay pNHA [000210]</b></p> <p>Listed under similar conservation objectives as its SAC and SPA designations.</p>	c. 15km east of the Proposed Development
<p><b>Boosterstown Marsh pNHA [001205]</b></p> <p>The site is designated for its tidal habitats, rare flora and wintering bird populations.</p>	c. 17.1km east of the Proposed Development
<p><b>Dolphins, Dublin Docks pNHA [000201]</b></p> <p>Listed for breeding tern colonies.</p>	c. 17.2km east of the Proposed Development

**Table 2:** Nationally protected sites in the vicinity of the Proposed Development.

## Appendix 6.2 Desk study Flora and Fauna records

Desktop records of protected, rare, or other notable plant species, from the NPWS within the same 10km grid square, O03, in which the Proposed Development is located in, are listed below in Table 1. These are plant species which are legally protected under the Flora (Protection) Order, 2022 and/or are listed as Critically Endangered, Endangered or Vulnerable on the relevant national Red Data list for Ireland<sup>1</sup>. The NBDC database search did not return any rare and/or protected flora for within c. 2km of the Proposed Development.

Common Name/ Scientific name	Legal Status <sup>2</sup>	Red List Status	Source
Betony <i>Betonica officinalis</i>	FPO, 2022	None	NPWS database record
Hairy St John's-wort <i>Hypericum hirsutum</i>	FPO, 2022	None	NPWS database record
Hairy Violet <i>Viola hirta</i>	FPO, 2022	Vulnerable	NPWS database record
Meadow barley <i>Hordeum secalinum</i>	FPO, 2022	Vulnerable	NPWS database record
Opposite-leaved Pondweed <i>Groenlandia densa</i>	FPO, 2022	None	NPWS database record
Red Hemp-nettle <i>Galeopsis angustifolia</i>	FPO, 2022	Vulnerable	NPWS database record

**Table 1:** Records of protected, red-listed or notable flora recorded from the desk study in the vicinity of the study area.

Desktop records of protected, rare, or other notable fauna species are listed below in Table 2. In relation to amphibian, reptile and mammal species those which are protected under the Wildlife Acts, the Habitats Directive and/or are listed as threatened (Vulnerable to Critically Endangered) on the relevant national Red Lists are included. In the case of bird species, only those species listed in Annex I of the *Birds Directive* or on the *Birds of Conservation Concern in Ireland* (BoCCI) Red List are included in the table below. For invertebrate species, those which are listed as threatened (Vulnerable to Critically Endangered) on the relevant national Red List are included.

<sup>1</sup> Vascular flora from Wyse Jackson, M., FitzPatrick, Ú., Cole, E., Jebb, M., McFerran, D., Sheehy Skeffington, M. & Wright, M. (2016) *Ireland Red List No. 10: Vascular Plants*. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, Dublin, Ireland.

<sup>2</sup> HDII/IV/V = Habitats Directive Annexes II/IV/V; FPO = Flora (Protection) Order, 2015; WA = Wildlife Acts

Common Name/ Scientific Name	Legal Status <sup>3</sup>	Red List Status <sup>4</sup>	Source
<b>Amphibians and Reptiles</b>			
Common frog <i>Rana temporaria</i>	HD_V, WA	Least concern	NPWS database record
Common lizard <i>Zootoca vivipara</i>	WA	Least concern	NPWS database record
Smooth newt <i>Lissotriton vulgaris</i>	WA	Least concern	NBDC online database record NPWS database record
<b>Mammals (Terrestrial)</b>			
Brown Long-eared Bat <i>Plecotus auritus</i>	HD_IV, WA	Least concern	NBDC online database record
Common pipistrelle <i>Pipistrellus pipistrellus</i>	HD_IV, WA	Least concern	NBDC online database record
Daubenton's Bat <i>Myotis daubentonii</i>	WA	Least concern	NBDC online database record
Leisler's bat <i>Nyctalus leisleri</i>	HD_IV, WA	Least concern	NBDC online database record NBDC online database record
Otter <i>Lutra lutra</i>	HD_II & IV, WA	Least concern	NBDC online database record NPWS database record
Pine Marten <i>Martes martes</i>	HD_V, WA	Least concern	NBDC online database record
Pygmy shrew <i>Sorex minutus</i>	WA	Least concern	NBDC online database record
<b>Birds</b>			
Barn swallow <i>Hirundo rustica</i>	WA	Amber	NBDC online database record
Black-headed gull <i>Chroicocephalus ridibundus</i>	WA	Amber	Scott Cawley Ltd. (2021) record <sup>5</sup>
Common coot <i>Fulica atra</i>	WA	Amber	NBDC online database record
Common gull <i>Larus canus</i>	WA	Amber	Scott Cawley Ltd. (2021) record
Cormorant <i>Phalacrocorax carbo</i>	WA	Amber	Scott Cawley Ltd. (2021) record
Common starling <i>Sturnus vulgaris</i>	WA	Amber	NBDC online database record
Common woodpigeon <i>Columba palumbus</i>	WA, BD_II (I), III (I)	Green	NBDC online database record
Herring gull <i>Larus argentatus</i>	WA	Amber	Scott Cawley Ltd. (2021) record
House martin <i>Delichon urbicum</i>	WA	Amber	NBDC online database record
Grey heron <i>Ardea cinerea</i>	WA	Green	Scott Cawley Ltd. (2021) record
Northern Lapwing <i>Vanellus vanellus</i>	WA, BD Annex II (II)	Red	Scott Cawley Ltd. (2021) record
Lesser black-backed gull <i>Larus fuscus</i>	WA	Amber	Scott Cawley Ltd. (2021) record

<sup>3</sup> HD\_II/IV/V = Habitats Directive Annexes II/IV/V; WA = Wildlife Acts; BD\_I/II/III = Birds Directive Annex I/II/III; OSPAR = Convention for the protection of the marine environment of the North-east Atlantic 1992

<sup>4</sup> Mammals from Marnell, F., Looney, D. & Lawton, C. (2019) *Ireland Red List No. 12: Terrestrial Mammals*. National Parks and Wildlife Service, Department of the Culture, Heritage and the Gaeltacht, Dublin, Ireland.

Birds from Gilbert, G., Stanbury, A. & Lewis, L. (2021) *Birds of Conservation Concern in Ireland 4: 2020-2026*. Irish Birds 43: 1-22 (2021).

Amphibians, reptiles and fish from King, J.L., Marnell, F., Kingston, N., Rosell, R., Boylan, P., Caffrey, J.M., Fitzpatrick, Ú., Gargan, P.G., Kelly, F.L., O'Grady, M.F., Poole, R., Roche, W.K. & Cassidy, D. (2011) *Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish*.

Non-Marine Molluscs from Byrne, A., Moorkens, E.A., Anderson, R., Killeen, I.J. & Regan, E.C. (2009) *Ireland Red List No. 2: Non-Marine Molluscs*.

<sup>5</sup> Scott Cawley Ltd. (2021) *Wintering Bird Survey Report for Clonburris Strategic Development Zone at Clonburris, Co. Dublin*.

Common Name/ Scientific Name	Legal Status <sup>3</sup>	Red List Status <sup>4</sup>	Source
Little grebe <i>Tachybaptus ruficollis</i>	WA	Green	Scott Cawley Ltd. (2021) record
Mallard <i>Anas platyrhynchos</i>	WA, BD Annex II (I), III (I)	Amber	Scott Cawley Ltd. (2021) record
Tufted duck <i>Aythya fuligula</i>	WA, BD Annex II (II)	Amber	Scott Cawley Ltd. (2021) record
<b>Invertebrates</b>			
Globular Pea Mussel <i>Pisidium hibernicum</i>	none	Near threatened	NBDC online database record
Iridescent pea mussel <i>Pisidium pulchellum</i>	none	Endangered	NBDC online database record

### Appendix 6.3 Examples of valuing important ecological features

#### International Importance:

'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation.

Proposed Special Protection Area (pSPA).

Site that fulfils the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended).

Features essential to maintaining the coherence of the Natura 2000 Network.<sup>6</sup>

Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive.

Resident or regularly occurring populations (assessed to be important at the national level)<sup>7</sup> of the following:

Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or

Species of animal and plants listed in Annex II and/or IV of the Habitats Directive.

Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971).

World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972).

Biosphere Reserve (UNESCO Man & The Biosphere Programme).

Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979).

Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979).

Biogenetic Reserve under the Council of Europe.

European Diploma Site under the Council of Europe.

Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 1988).<sup>8</sup>

#### National Importance:

Site designated or proposed as a Natural Heritage Area (NHA).

Statutory Nature Reserve.

Refuge for Fauna and Flora protected under the Wildlife Acts.

National Park.

Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park.

Resident or regularly occurring populations (assessed to be important at the national level)<sup>9</sup> of the following:

Species protected under the Wildlife Acts; and/or

Species listed on the relevant Red Data list.

Site containing 'viable areas'<sup>10</sup> of the habitat types listed in Annex I of the Habitats Directive

#### County Importance:

Area of Special Amenity.<sup>11</sup>

Area subject to a Tree Preservation Order.

Area of High Amenity, or equivalent, designated under the County Development Plan.

Resident or regularly occurring populations (assessed to be important at the County level)<sup>12</sup> of the following:

Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;

Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;

Species protected under the Wildlife Acts; and/or

<sup>6</sup> See Articles 3 and 10 of the Habitats Directive

<sup>7</sup> It is suggested that, in general, 1% of the national population of such species qualifies as an internationally important population. However, a smaller population may qualify as internationally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

<sup>8</sup> Note that such waters are designated based on these waters' capabilities of supporting salmon (*Salmo salar*), trout (*Salmo trutta*), char (*Salvelinus*) and whitefish (*Coregonus*)

<sup>9</sup> It is suggested that, in general, 1% of the national population of such species qualifies as a nationally important population. However, a smaller population may qualify as nationally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

<sup>10</sup> A 'viable area' is defined as an area of a habitat that, given the particular characteristics of that habitat, was of a sufficient size and shape, such that its integrity (in terms of species composition, and ecological processes and function) would be maintained in the face of stochastic change (for example, as a result of climatic variation).

<sup>11</sup> It should be noted that whilst areas such as Areas of Special Amenity, areas subject to a Tree Preservation Order and Areas of High Amenity are often designated on the basis of their ecological value, they may also be designated for other reasons, such as their amenity or recreational value. Therefore, it should not be automatically assumed that such sites are of County importance from an ecological perspective.

<sup>12</sup> It is suggested that, in general, 1% of the County population of such species qualifies as a County important population. However, a smaller population may qualify as County important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

Species listed on the relevant Red Data list.

Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance.

County important populations of species, or viable areas of semi-natural habitats or natural heritage features identified in the National or Local Biodiversity Action Plan, if this has been prepared.

Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county.

Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.

**Local Importance (higher value):**

Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared;

Resident or regularly occurring populations (assessed to be important at the Local level)<sup>13</sup> of the following:

Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;

Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;

Species protected under the Wildlife Acts; and/or

Species listed on the relevant Red Data list.

Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality;

Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.

**Local Importance (lower value):**

Sites containing small areas of semi-natural habitat that are of some local importance for wildlife;

Sites or features containing non-native species that are of some importance in maintaining habitat links.

<sup>13</sup> It is suggested that, in general, 1% of the local population of such species qualifies as a locally important population. However, a smaller population may qualify as locally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

## Appendix 6.4 Flora Species List by Habitat

Dry meadows and grassy verges (GS2)	Hedgerows (WL1)	Recolonising bare ground (ED3)
Barren Brome <i>Anisantha sterilis</i>	Ash <i>Fraxinus excelsior</i>	Barren Brome <i>Anisantha sterilis</i>
Broad-leaved Dock <i>Rumex obtusifolius</i>	Barren Brome <i>Anisantha sterilis</i>	Cut-leaved Crane's-bill <i>Geranium dissectum</i>
Bush Vetch <i>Vicia sepium</i>	Bittersweet <i>Solanum dulcamara</i>	Fleabane species <i>Erigeron</i> sp
Cock's-foot <i>Dactylis glomerata</i>	Blackthorn <i>Prunus spinosa</i>	Hedge Mustard <i>Sisymbrium officinale</i>
Common Nettle <i>Urtica dioica</i>	Bramble <i>Rubus fruticosus</i> agg.	Lesser Trefoil <i>Trifolium dubium</i>
Cowslip <i>Primula veris</i>	Bush vetch <i>Vicia sativa</i>	Perennial Sow-thistle <i>Sonchus arvensis</i>
Creeping Bent <i>Agrostis stolonifera</i>	Cleavers <i>Galium aparine</i>	Procumbent Pearlwort <i>Sagina procumbens</i>
Creeping Buttercup <i>Ranunculus repens</i>	Common Field-speedwell <i>Veronica persica</i>	Red Clover <i>Trifolium pratense</i>
Creeping Thistle <i>Cirsium arvense</i>	Common Ivy <i>Hedera helix</i>	White Clover <i>Trifolium repens</i>
Curled Dock <i>Rumex crispus</i>	Common Nettle <i>Urtica dioica</i>	Yorkshire-fog <i>Holcus lanatus</i>
Cut-leaved Crane's-bill <i>Geranium dissectum</i>	Cowslip <i>Primula veris</i>	
Elder <i>Sambucus nigra</i>	Cut-leaved Crane's-bill <i>Geranium dissectum</i>	
False Oat-Grass <i>Arrhenatherum elatius</i>	Dog-rose <i>Rosa canina</i> agg.	
False-brome <i>Brachypodium sylvaticum</i>	Elder <i>Sambucus nigra</i>	
Hoary Willowherb <i>Epilobium parviflorum</i>	False-brome <i>Brachypodium sylvaticum</i>	
Hogweed <i>Heracleum sphondylium</i>	Ground-ivy <i>Glechoma hederacea</i>	
Perennial Rye-grass <i>Lolium perenne</i>	Hawthorn <i>Crataegus monogyna</i>	
Perennial Sow-thistle <i>Sonchus arvensis</i>	Hedge Bindweed <i>Calystegia sepium</i>	
Prickly Sow-thistle <i>Sonchus asper</i>	Hogweed <i>Heracleum sphondylium</i>	
Red Fescue <i>Festuca rubra</i> agg.	Lesser Burdock <i>Arctium minus</i>	
Ribwort Plantain <i>Plantago lanceolata</i>	Oak species <i>Quercus</i> sp	
Rosebay Willowherb <i>Chamaenerion angustifolium</i>	Wood Avens <i>Geum urbanum</i>	
Silverweed <i>Argentina anserina</i>		
Soft-brome <i>Bromus hordeaceus</i>		
Spear Thistle <i>Cirsium vulgare</i>		
White Clover <i>Trifolium repens</i>		
Yorkshire-fog <i>Holcus lanatus</i>		

## Appendix 6.5 Relevant Policies and objectives

Policies and objectives relevant to the Proposed Development and referenced in the chapter are presented in the following tables. Table 1 covers relevant policies and objectives found in the South Dublin County Development Plan 2022-2028, and includes those covering designated sites, water quality and biodiversity. Table 2 covers additional land use plan policies and objectives that are relevant in the wider area, together with the Development Plan, on European sites and water quality within Dublin Bay.

South Dublin County Development Plan 2022-2028
<p><b>Policy NCBH3 Natura 2000 Sites</b> Conserve and protect Natura 2000 sites and achieve and maintain favourable conservation status for habitats and species that are considered to be at risk through the protection of the Natura 2000 network from any plans or projects that are likely to have a significant effect on their coherence or integrity</p> <p><b>NCBH3 Objective 1</b> To prevent development and activities that would adversely affect the integrity of any Natura 2000 site located within or adjacent to the County and promote the favourable conservation status of the habitats and species integral to these sites.</p> <p><b>NCBH3 Objective 2</b> To ensure that plans, including land use plans, will only be adopted, if they either individually or in combination with existing and / or proposed plans or projects, will not have a significant adverse effect on a European Site, or where such a plan is likely or might have such a significant adverse effect (either alone or in combination), South Dublin County Council will, as required by law, carry out an appropriate assessment as per requirements of Article 6(3) of the Habitats Directive 92 / 43 / EEC of the 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, as transposed into Irish legislation. Only after having ascertained that the plan will not adversely affect the integrity of any European site, will South Dublin County Council adopt the plan, incorporating any necessary mitigation measures. A plan which could adversely affect the integrity of a European site may only be adopted in exceptional circumstances, as provided for in Article 6(4) of the Habitats Directive as transposed into Irish legislation.</p> <p><b>NCBH3 Objective 3</b> To ensure that planning permission will only be granted for a development proposal that, either individually or in combination with existing and / or proposed plans or projects, will not have a significant adverse effect on a European Site, or where such a development proposal is likely or might have such a significant adverse effect (either alone or in combination), the planning authority will, as required by law, carry out an appropriate assessment as per requirements of Article 6(3) of the Habitats Directive 92 / 43 / EEC of the 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, as transposed into Irish legislation. Only after having ascertained that the development proposal will not adversely affect the integrity of any European site, will the planning authority agree to the development and impose appropriate mitigation measures in the form of planning conditions. A development proposal which could adversely affect the integrity of a European site may only be permitted in exceptional circumstances, as provided for in Article 6(4) of the Habitats Directive as transposed into Irish legislation.</p> <p><b>G11 Objective 3</b> To facilitate the development and enhancement of sensitive access to and connectivity between areas of interest for residents, wildlife and biodiversity, and other distinctive landscapes as focal features for linkages between natural, semi natural and formalised green spaces where feasible and ensuring that there is no adverse impact (directly, indirectly or cumulatively) on the conservation objectives of Natura 2000 sites and protected habitats outside of Natura 2000 sites</p> <p><b>IE2 Objective 1</b> To work in conjunction with Irish Water to protect existing water and drainage infrastructure and to promote the ongoing upgrade and expansion of water supply and wastewater services to meet the future needs of the County and the Region.</p> <p><b>Policy IE3 Surface Water and Groundwater</b> Manage surface water and protect and enhance ground and surface water quality to meet the requirements of the EU Water Framework Directive.</p> <p><b>IE3 Objective 1</b> To maintain, improve and enhance the environmental and ecological quality of our surface waters and groundwater by implementing the relevant programme of measures set out in the River Basin Management Plans.</p> <p><b>IE3 Objective 2</b> To maintain and enhance existing surface water drainage systems in the County and to require Sustainable Drainage Systems (SuDS) in new development in accordance with objectives set out in section 4.2.2 of this Plan including, where feasible, integrated constructed wetlands, at a local, district and County level, to control surface water outfall and protect water quality.</p>

**Table 1:** Relevant land use plan policies/objectives within South Dublin County Development Plan 2022-2028 relating to the protection of designated sites, water quality and biodiversity.

**Dún Laoghaire-Rathdown County Development Plan 2022-2028****Policy Objective GIB18: Protection of Natural Heritage and the Environment**

It is a Policy Objective to protect and conserve the environment including, in particular, the natural heritage of the County and to conserve and manage Nationally and Internationally important and EU designated sites - such as Special Protection Areas (SPAs), Special Areas of Conservations (SACs), proposed Natural Heritage Areas (pNHAs) and Ramsar sites (wetlands) - as well as non-designated areas of high nature conservation value known as locally important areas which also serve as 'Stepping Stones' for the purposes of Article 10 of the Habitats Directive

**Policy Objective GIB19: Habitats Directive**

It is a Policy Objective to ensure the protection of natural heritage and biodiversity, including European Sites that form part of the Natura 2000 network, in accordance with relevant EU Environmental Directives and applicable National Legislation, Policies, Plans and Guidelines.

**Policy Objective GIB21: Designated Sites**

It is a Policy Objective to protect and preserve areas designated as proposed Natural Heritage Areas, Special Areas of Conservation, and Special Protection Areas. It is Council policy to promote the maintenance and as appropriate, delivery of 'favourable' conservation status of habitats and species within these areas.

**Policy Objective GIB22: Non-Designated Areas of Biodiversity Importance**

It is a Policy Objective to protect and promote the conservation of biodiversity in areas of natural heritage importance outside Designated Areas and to ensure that notable sites, habitats and features of biodiversity importance - including species protected under the Wildlife Acts 1976 and 2000, the Birds Directive 1979, the Habitats Directive 1992, Flora (Protection) Order, 2015, Annex I habitats, local important areas, wildlife corridors and rare species - are adequately protected. Ecological assessments will be carried out for all developments in areas that support, or have potential to support, features of biodiversity importance or rare and protected species and appropriate mitigation/ avoidance measures will be implemented. In implementing this policy, regard shall be had to the Ecological Network, including the forthcoming DLR Wildlife Corridor Plan, and the recommendations and objectives of the Green City Guidelines (2008) and 'Ecological Guidance Notes for Local Authorities and Developers' (Dún Laoghaire-Rathdown Version 2014)

**Policy Objective GIB23: County-Wide Ecological Network**

It is a Policy Objective to protect the Ecological Network which will be integrated into the updated Green Infrastructure Strategy and will align with the DLR County Biodiversity Action Plan. Creating this network throughout the County will also improve the ecological coherence of the Natura 2000 network in accordance with Article 10 of the Habitats Directive. The network will also include non-designated sites.

**Policy Objective EI7: Water Supply and Wastewater treatment and Appropriate Assessment**

It is a Policy Objective to require that all developments relating to water supply and wastewater treatment are subject to screening for Appropriate Assessment to ensure there are no likely significant effects on the integrity, defined by the structure and function, of any European sites and that the requirements of Article 6 of the EU Habitats Directive are met. (Consistent with RPO 10.7 of the RSES).

**Policy Objective EI8: Groundwater Protection and Appropriate Assessment**

It is a Policy Objective to ensure the protection of the groundwater resources in and around the County and associated habitats and species in accordance with the Groundwater Directive 2006/118/EC and the European Communities Environmental Objectives (Groundwater) Regulations, 2010. In this regard, the Council will support the implementation of Irish Water's Water Safety Plans to protect sources of public water supply and their contributing catchment.

**Policy Objective EI2: Irish Water Enabling Policies Irish Water's Plans and Programmes**

It is a Policy Objective - in conjunction with the Eastern and Midland Regional Authority, where appropriate - to work with and support Irish Water in the delivery of the strategic objectives and strategic water and wastewater projects and infrastructure as set out in the 'Water Services Strategic Plan' (2015), any subsequent plan, Irish Water's Capital Investment Plan 2020 – 2024, any subsequent Capital Investment Plans and the forthcoming National Water Resources Plan, so as to ensure provision of infrastructure to service settlements in accordance with the Core Strategy of this Plan, and the settlement strategy of the RSES. (Consistent with RPO 10.2, 10.3, 10.11, 10.16 of the RSES).

**Policy Objective EI5: River Basin Management Plans (RMBPs)**

It is a Policy Objective: To ensure the delivery of the relevant policies and objectives of the River Basin Management Plan for Ireland 2018 – 2021 and any subsequent plan, including those relating to protection of water status, improvement of water status, prevention of deterioration and meeting objectives for designated protected sites. To support Irish Water in its implementation of Water Quality Management Plans for ground, surface, coastal and estuarine waters as part of the implementation of the EU Water Framework Directive. To support Irish Water in the development of Drinking Water Protection Plans.

**Policy Objective EI6: Sustainable Drainage Systems**

It is a Policy Objective to ensure that all development proposals incorporate Sustainable Drainage Systems (SuDS).

<p><b>Policy Objective EI17: Water Pollution</b></p> <p>It is a Policy Objective to implement the provisions of water pollution abatement measures in accordance with national and EU Directives and other legislative requirements in conjunction with other agencies as appropriate.</p>
<p><b>Fingal Development Plan 2017-2023</b></p> <p><b>Objective NH10</b></p> <p>Ensure that the Council takes full account of the requirements of the Habitats and Birds Directives, as they apply both within and without European Sites in the performance of its functions.</p> <p><b>Objective NH11</b></p> <p>Ensure that the Council, in the performance of its functions, takes full account of the objectives and management practices proposed in any management or related plans for European Sites in and adjacent to Fingal published by the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.</p> <p><b>Objective NH15</b></p> <p>Strictly protect areas designated or proposed to be designated as Natura 2000 sites (i.e. Special Areas of Conservation (SACs) and Special Protection Areas (SPAs); also known as European sites) including any areas that may be proposed for designation or designated during the period of this Plan.</p> <p><b>Objective SW04</b></p> <p>Require the use of sustainable drainage systems (SuDS) to minimise and limit the extent of hard surfacing and paving and require the use of sustainable drainage techniques where appropriate, for new development or for extensions to existing developments, in order to reduce the potential impact of existing and predicted flooding risks.</p> <p><b>Objective WQ01</b></p> <p>Strive to achieve ‘good status’ in all waterbodies in compliance with the Water Framework Directive, the Eastern River Basin District Management Plan 2009-2015 and the associated Programme of Measures (first cycle) and to cooperate with the development and implementation of the second cycle national River Basin Management Plan 2017-2021.</p> <p><b>Objective WQ04</b></p> <p>Protect existing riverine wetland and coastal habitats and where possible create new habitats to maintain naturally functioning ecosystems whilst ensuring they do not impact negatively on the conservation objectives of any European Sites.</p> <p><b>Objective WT01</b></p> <p>Liaise with and work in conjunction with Irish Water during the lifetime of the plan for the provision, extension and upgrading of waste water collection and treatment systems in all towns and villages of the County to serve existing populations and facilitate sustainable development of the County, in accordance with the requirements of the Settlement Strategy and associated Core Strategy.</p> <p><b>Objective WT02</b></p> <p>Liaise with Irish Water to ensure the provision of wastewater treatment systems in order to ensure compliance with existing licences, EU Water Framework Directive, River Basin Management Plans, the Urban Wastewater Directive and the EU Habitats Directive.</p>
<p><b>Wicklow County Development Plan 2016-2022</b></p> <p><b>NH2</b></p> <p>No projects giving rise to significant cumulative, direct, indirect or secondary impacts on Natura 2000 sites arising from their size or scale, land take, proximity, resource requirements, emissions (disposal to land, water or air), transportation requirements, duration of construction, operation, decommissioning or from any other effects shall be permitted on the basis of this plan (either individually or in combination with other plans or projects). Except as provided for in Section 6(4) of the Habitats Directive, viz. There must be a) no alternative solution available, b) imperative reasons of overriding public interest for the project to proceed; and c) Adequate compensatory measures in place.</p> <p><b>NH3</b></p> <p>To contribute, as appropriate, towards the protection of designated ecological sites including candidate Special Areas of Conservation (cSACs) and Special Protection Areas (SPAs); Wildlife Sites (including proposed Natural Heritage Areas); Salmonid Waters; Flora Protection Order sites; Wildfowl Sanctuaries (see S.I. 192 of 1979); Freshwater Pearl Mussel catchments; and Tree Preservation Orders (TPOs). To contribute towards compliance with relevant EU Environmental Directives and applicable National Legislation, Policies, Plans and Guidelines, including the following and any updated/superseding documents:</p> <ul style="list-style-type: none"> <li>- EU Directives, including the Habitats Directive (92/43/EEC, as amended)<sup>7</sup>, the Birds Directive (2009/147/EC)<sup>8</sup>, the Environmental Liability Directive (2004/35/EC)<sup>9</sup>, the Environmental Impact Assessment Directive (85/337/EEC, as amended), the Water Framework Directive (2000/60/EC) and the Strategic Environmental Assessment Directive (2001/42/EC).</li> <li>- National legislation, including the Wildlife Act 1976<sup>10</sup>, the European Communities (Environmental Impact Assessment) Regulations 1989 (SI No. 349 of 1989) (as amended), the Wildlife (Amendment) Act 2000, the European Union (Water Policy) Regulations 2003 (as amended), the Planning and Development Act 2000 (as amended), the European Communities (Birds and Natural Habitats) Regulations 2011 (SI No. 477 of 2011) and</li> </ul>

the European Communities (Environmental Liability) Regulations 200811.

- National policy guidelines (including any clarifying Circulars or superseding versions of same), including the Landscape and Landscape Assessment Draft Guidelines 2000, the Environmental Impact Assessment Sub-Threshold Development Guidelines 2003, Strategic Environmental Assessment Guidelines 2004 and the Appropriate Assessment Guidance 2010.
- Catchment and water resource management Plans, including Eastern and South Eastern River Basin Management Plan 2009-2015 (including any superseding versions of same).
- Biodiversity Plans and guidelines, including Actions for Biodiversity 2011-2016: Ireland's 2nd National Biodiversity Plan (including any superseding version of same).
- Ireland's Environment 2014 (EPA, 2014, including any superseding versions of same), and to make provision where appropriate to address the report's goals and challenges.

#### **NH4**

All projects and plans arising from this plan<sup>12</sup> (including any associated improvement works or associated infrastructure) will be screened for the need to undertake Appropriate Assessment under Article 6 of the Habitats Directive. A plan or project will only be authorised after the competent authority has ascertained, based on scientific evidence, Screening for Appropriate Assessment, and a Stage 2 Appropriate Assessment where necessary, that:

- 1) The Plan or project will not give rise to significant adverse direct, indirect or secondary effects on the integrity of any European site (either individually or in combination with other plans or projects); or
- 2) The Plan or project will have significant adverse effects on the integrity of any European site (that does not host a priority natural habitat type and / or a priority species) but there are no alternative solutions and the plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature. In this case, it will be a requirement to follow procedures set out in legislation and agree and undertake all compensatory measures necessary to ensure the protection of the overall coherence of Natura 2000; or
- 3) The Plan or project will have a significant adverse effect on the integrity of any European site (that hosts a natural habitat type and/or a priority species) but there are no alternative solutions and the plan or project must nevertheless be carried out for imperative reasons for overriding public interest, restricted to reasons of human health or public safety, to beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest. In this case, it will be a requirement to follow procedures set out in legislation and agree and undertake all compensatory measures necessary to ensure the protection of the overall coherence of Natura 2000.

#### **NH5**

To maintain the conservation value of all proposed and future Natural Heritage Areas (NHAs) and to protect other designated ecological sites in Wicklow.

Along with cSACs, SPAs and pNHA these include Salmonid Waters; Flora Protection Order sites; Wildfowl Sanctuaries (see S.I. 192 of 1979); Freshwater Pearl Mussel catchments; and Tree Preservation Orders (TPOs).

#### **WI2**

To protect existing and potential water resources of the County, in accordance with the EU Water Framework Directive, the River Basin Management Plans, the Groundwater Protection Scheme and source protection plans for public water supplies.

#### **WI12**

Ensure the implementation of Sustainable Urban Drainage Systems (SUDS) and in particular, to ensure that all surface water generated in a new development is disposed of on-site or is attenuated and treated prior to discharge to an approved surface water system.

#### **WI6**

In order to fulfil the objectives of the Core Strategy, Wicklow County Council will work alongside and facilitate the delivery of Irish Water's Water Services Investment Programme, to ensure that all lands zoned for development are serviced by an adequate wastewater collection and treatment system and in particular, to endeavour to secure the delivery of regional and strategic wastewater schemes. In particular, to support and facilitate the development of a WWTP in Arklow, at an optimal location following detailed technical and environmental assessment and public consultation.

#### **WI7**

Permission will be considered for private wastewater treatment plants for single rural houses where: · the specific ground conditions have been shown to be suitable for the construction of a treatment plant and any associated percolation area;

- the system will not give rise to unacceptable adverse impacts on ground waters / aquifers and the type of treatment proposed has been drawn up in accordance with the appropriate groundwater protection response set out in the Wicklow Groundwater Protection Scheme (2003);
- the proposed method of treatment and disposal complies with Wicklow County Council's Policy for Wastewater Treatment & Disposal Systems for Single Houses (PE ≤ 10) and the Environmental Protection Agency "Wastewater Treatment Manuals"; and
- in all cases the protection of ground and surface water quality shall remain the overriding priority and proposals must definitively demonstrate that the Proposed Development will not have an adverse impact on water quality

standards and requirements set out in EU and national legislation and guidance documents.

**WI9**

Private wastewater treatment plants for commercial / employment generating development will only be considered where:

- Irish Water has confirmed the site is due to be connected to a future public system in the area or Irish Water have confirmed there are no plans for a public system in the area;
- it can clearly demonstrated that the proposed system can meet all EPA / Local Authority environmental criteria; and
- an annually renewed contract for the management and maintenance of the system is contracted with a reputable company / person, details of which shall be provided to the Local Authority.

**Kildare County Development Plan 2017-2023****NH 4**

Support the conservation and enhancement of Natura 2000 Sites including any additional sites that may be proposed for designation during the period of this Plan and to protect the Natura 2000 network from any plans and projects that are likely to have a significant effect on the coherence or integrity of a Natura 2000 Site.

**NH 5**

Prevent development that would adversely affect the integrity of any Natura 2000 site located within and immediately adjacent to the county and promote favourable conservation status of habitats and protected species including those listed under the Birds Directive, the Wildlife Acts and the Habitats Directive.

**NH 6**

Ensure an Appropriate Assessment, in accordance with Article 6(3) and Article 6(4) of the Habitats Directive and with DEHLG guidance (2009), is carried out in respect of any plan or project not directly connected with or necessary to the management of a Natura 2000 site to determine the likelihood of the plan or project having a significant effect on a Natura 2000 site, either individually or in combination with other plans or projects and to ensure that projects which may give rise to significant cumulative, direct, indirect or secondary impacts on Natura 2000 sites will not be permitted (either individually or in combination with other plans or projects) unless for reasons of overriding public interest.

**WQ 1**

Co-operate with the EPA and other authorities in the continued implementation of the EU Water Framework Directive and assist and co-operate with the lead authority for the River Basin Management Plan(s).

**WQ 2**

Ensure, through the implementation of the River Basin Management Plan(s) and the associated Programmes of Measures and any other associated legislation, the protection and improvement of all drinking water, surface water and ground waters throughout the county.

**WQ 6**

Protect recognised salmonid water courses in conjunction with Inland Fisheries Ireland such as the Liffey catchment, which are recognised to be exceptional in supporting salmonid fish species.

**WW 4**

Ensure that adequate wastewater services will be available to service development prior to the granting of planning permission. Applicants who are proposing to connect to the public wastewater network should consult with Irish Water regarding available capacity prior to applying for planning permission.

**WW 12**

Ensure that existing and permitted private wastewater treatment plants are operated in compliance with their wastewater discharge license, in order to protect water quality.

**Meath County Development Plan 2021-2027****HER POL 28**

To integrate in the development management process the protection and enhancement of biodiversity and landscape features wherever possible, by minimising adverse impacts on existing habitats (whether designated or not) and by including mitigation and/or compensation measures, as appropriate.

**HER POL 31**

To ensure that the ecological impact of all development proposals on habitats and species are appropriately assessed by suitably qualified professional(s) in accordance with best practice guidelines – e.g. the preparation of an Ecological Impact Assessment (EclA), Screening Statement for Appropriate Assessment, Environmental Impact Assessment, Natura Impact Statement (NIS), species surveys etc. (as appropriate).

**HER POL 32**

To permit development on or adjacent to designated Special Areas of Conservation, Special Protection Areas, Natural Heritage Areas, Statutory Nature Reserves or those proposed to be designated over the period of the Plan, only where the development has been subject to the outcome of the Appropriate Assessment process and has been carried out to the satisfaction of the Planning Authority, in consultation with National Parks and Wildlife.

**HER POL 33**

To have regard to the views and guidance of the National Parks and Wildlife Service in respect of Proposed Development where there is a possibility that such development may have an impact on a designated European or National site or a site proposed for such designation.

**HER POL 34**

To undertake appropriate surveys and collect data to provide an evidence-base to assist the Council in meeting its obligations under Article 6 of the Habitats Directives (92/43/EEC) as transposed into Irish Law, subject to available resources.

**HER OBL 33**

To ensure an Appropriate Assessment in accordance with Article 6(3) and Article 6(4) of the Habitats Directives (92/43/EEC) and in accordance with the Department of Environment, Heritage and Local Government Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities, 2009 and relevant EPA and European Commission guidance documents, is carried out in respect of any plan or project not directly connected with or necessary for the management of the site but likely to have a significant effect on a Natura 2000 site(s), either individually or in-combination with other plans or projects, in view of the site's conservation objectives.

**HER OBL 34**

To protect and conserve the conservation value of candidate Special Areas of Conservation, Special Protection Areas, Natural Heritage Areas and proposed Natural Heritage Areas as identified by the Minister for the Department of Culture, Heritage and the Gaeltacht and any other sites that may be proposed for designation during the lifetime of this Plan in accordance with the provisions of the Habitats and Birds Directives and to permit development in or affecting same only in accordance with the provisions of those Directives as transposed into Irish Law.

**HER POL 35**

To ensure, where appropriate, the protection and conservation of areas, sites, species and ecological/networks of biodiversity value outside designated sites and to require an appropriate level of ecological assessment by suitably qualified professional(s) to accompany development proposals likely to impact on such areas or species.

**HER POL 36**

To consult with the National Parks and Wildlife Service and take account of their views and any licensing requirements, when undertaking, approving or authorising development which is likely to affect plant, animal or bird species protected by law.

**HER OBJ 35**

To ensure that development does not have a significant adverse impact, incapable of satisfactory avoidance or mitigation, on plant, animal or bird species protected by law.

**HER POL 45**

To ensure that peatland areas which are designated (or proposed for designation) as NHAs, SACs or SPAs are conserved for their ecological, climate regulation, archaeological, cultural and educational significance.

**HER OBJ 39**

To work in partnership with relevant stakeholders on a suitable peatland site(s) to demonstrate best practice in sustainable peatland conservation, management and restoration techniques and to promote their heritage and educational value subject to Ecological Impact Assessment and Appropriate Assessment Screening, as appropriate, having regard to local and residential amenities.

**HER POL 47**

To protect the ecological, recreational, educational, amenity and flood alleviation potential of navigational and non-navigational waterways within the County, towpaths and adjacent wetlands.

**HER OBJ 42**

To undertake conservation works in accordance with best practice on the coastal dune systems subject to ecological impact assessment and Appropriate Assessment, as appropriate.

**HER OBJ 60**

To encourage, pursuant to Article 10 of the Habitats Directive (92/43/EEC), the management of features of the landscape, such as traditional field boundaries, important for the ecological coherence of the Natura 2000 network and essential for the migration, dispersal and genetic exchange of wild species

**INF POL 9**

To consider the potential for the provision of temporary water treatment facilities for new developments but only where a permanent solution has already been identified and committed to by Irish Water but has not yet been implemented. The provision of such temporary facilities shall only be considered where the solution is environmentally sustainable and would not affect the quality status of water sources. Adequate provision shall be made by the developer for the operation and maintenance of the proposed temporary facility for the duration of its required existence and thereafter for its decommissioning and removal from site.

**INF OBJ 6**

To liaise and work in conjunction with Irish Water in their implementation of water conservation measures.

**INF OBJ 7**

To promote the sustainable use of water and water conservation in existing and new development within the County and encourage demand management measures among all water users

**INF OBJ 8**

To protect both ground and surface water resources and work with Irish Water to develop and implement Water Safety Plans to protect sources of public water supply and their contributing catchment

**INF POL 11**

To liaise and work in conjunction with Irish Water during the lifetime of the Plan in the provision, upgrading or extension of wastewater collection and treatment systems in the County to serve existing and planned future populations and enterprise in accordance with the requirements of the Core and Settlement Strategies.

**INF OBJ 12**

The Planning Authority shall consider the provision of temporary wastewater treatment facilities for new developments only in circumstances where a permanent solution is identified and committed to by Irish Water. The temporary solution shall only be considered where it is deemed to be environmentally sustainable and would not affect the water quality status of receiving waters. Adequate provision shall be made by the developer for the operation and maintenance of the temporary facility for the duration of the operation of the required infrastructure.

**INF POL 16**

To ensure that all planning applications for new development have regard to the surface water management policies provided for in the GDSDS.

**INF OBJ 14**

To require the use of SuDS within Local Authority Developments and other infrastructural projects in accordance with the Greater Dublin Regional Code of Practice for Drainage Works.

**INF OBJ 15**

To require the use of SuDS in accordance with the Greater Dublin Regional Code of Practice for Drainage Works for new developments (including extensions).

**INF OBJ 19**

To ensure that developments permitted by the Council which involve discharge of wastewater to surface waters or groundwaters comply with the requirements of the EU Environmental Objectives (Surface Waters) Regulations and EU Environmental Objectives (Groundwater) Regulations.

**INF POL 29**

To facilitate the provision of new, or the reinforcement of existing flood defences and protection measures where necessary and in particular to support the implementation of flood schemes being progressed through the planning process during the lifetime of the Plan. The provision of flood defences will be subject to the outcome of the Appropriate Assessment process.

**INF OBJ 22**

To ensure flood relief measures are suitably designed to protect the conservation objectives of Natura 2000 sites, and to avoid direct or indirect impacts upon qualifying interests or Natura 2000 sites.

**INF OBJ 25**

To require the use of Sustainable Urban Drainage Systems (SuDS) to minimise and limit the extent of hard surfacing and paving and require the use of sustainable drainage techniques where appropriate, for new development or for extensions to existing developments, in order to reduce the potential impact of existing and predicted flooding risks.

**INF POL 33**

To protect recognised salmonid water courses (in conjunction with Inland Fisheries Ireland) such as the Boyne and Blackwater catchments, which are recognised to be exceptional in supporting salmonid fish species.

**INF OBJ 30**

To ensure the County's natural coastal defences, such as beaches, sand dunes, salt marshes and estuary lands, are protected and are not compromised by inappropriate works or forms of development.

**INF OBJ 36**

To protect and develop, in a sustainable manner, the existing groundwater sources and aquifers in the County and manage development in a manner consistent with the sustainable management of these resources in conformity with the EU Environmental Objectives (Groundwater) Regulations 2010 and the second cycle National River Basin Management Plan 2018-2021, and any subsequent plan and the Groundwater Protection Scheme.

**Table 2:** Relevant land use plan policies/objectives relating to the protection of European sites and water quality in Dublin Bay.

**CHAPTER 7 - LAND, SOIL, GEOLOGY AND HYDROGEOLOGY****Appendix 7.1 Criteria for Rating Site Attributes – Estimation of Importance of Hydrogeological Attributes (National Roads Authority (NRA, 2009))****Table 1 Criteria for rating site importance of Geological Features (NRA)**

<b>Importance</b>	<b>Criteria</b>	<b>Typical Example</b>
Very High	Attribute has a high quality, significance or value on a regional or national scale Degree or extent of soil contamination is significant on a national or regional scale Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale.	Geological feature rare on a regional or national scale (NHA) Large existing quarry or pit Proven economically extractable mineral resource
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale. Volume of peat and/or soft organic soil underlying route is significant on a local scale.	Contaminated soil on site with previous heavy industrial usage Large recent landfill site for mixed wastes Geological feature of high value on a local scale (County Geological Site) Well drained and/or high fertility soils Moderately sized existing quarry or pit Marginally economic extractable mineral resource
Medium	Attribute has a medium quality, significance or value on a local scale Degree or extent of soil contamination is moderate on a local scale Volume of peat and/or soft organic soil underlying route is moderate on a local scale	Contaminated soil on site with previous light industrial usage Small recent landfill site for mixed wastes Moderately drained and/or moderate fertility soils Small existing quarry or pit Sub-economic extractable mineral resource
Low	Attribute has a low quality, significance or value on a local scale Degree or extent of soil contamination is minor on a local scale. Volume of peat and/or soft organic soil underlying route is small on a local scale	Large historical and/or recent site for construction and demolition wastes. Small historical and/or recent landfill site for construction and demolition wastes. Poorly drained and/or low fertility soils. Uneconomically extractable mineral resource.

**Table 2 Criteria for rating impact magnitude at EIS stage – Estimation of magnitude of impact on soil / geology attribute (NRA)**

Magnitude of Impact	Criteria	Typical Examples
<b>Large Adverse</b>	Results in loss of attribute	Loss of high proportion of future quarry or pit reserves
<b>Moderate Adverse</b>	Results in impact on integrity of attribute or loss of part of attribute	Loss of moderate proportion of future quarry or pit reserves
<b>Small Adverse</b>	Results in minor impact on integrity of attribute or loss of small part of attribute	Loss of small proportion of future quarry or pit reserves
<b>Negligible</b>	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	No measurable changes in attributes
<b>Minor Beneficial</b>	Results in minor improvement of attribute quality	Minor enhancement of geological heritage feature
<b>Moderate Beneficial</b>	Results in moderate improvement of attribute quality	Moderate enhancement of geological heritage feature
<b>Major Beneficial</b>	Results in major improvement of attribute quality	Major enhancement of geological heritage feature

The NRA criteria for estimation of the importance of hydrogeological attributes at the site during the EIA stage are summarised in [Table 4](#) below.

**Table 3 Criteria for rating Site Attributes - Estimation of Importance of Hydrogeology Attributes (NRA)**

Magnitude of Impact	Criteria	Typical Examples
<b>Extremely High</b>	Attribute has a high quality or value on an international scale	Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation e.g. SAC or SPA status
<b>Very High</b>	Attribute has a high quality or value on a regional or national scale	Regionally Important Aquifer with multiple well fields Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – NHA status Regionally important potable water source supplying >2500 homes Inner source protection area for regionally important water source
	Attribute has a high quality or value on a local scale	Regionally Important Aquifer Groundwater provides large proportion of baseflow to local rivers Locally important potable water source supplying >1000 homes Outer source protection area for regionally important water source Inner source protection area for locally important water source
<b>Medium</b>	Attribute has a medium quality or value on a local scale	Locally Important Aquifer Potable water source supplying >50 homes Outer source protection area for locally important water source
<b>Low</b>	Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer Potable water source supplying <50 homes

**Table 4 Criteria for Rating Impact Significance at EIS Stage – Estimation of Magnitude of Impact on Hydrogeology Attribute (NRA)**

Magnitude of Impact	Criteria	Typical Examples
<b>Large Adverse</b>	Results in loss of attribute and /or quality and integrity of attribute	Removal of large proportion of aquifer. Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems. Potential high risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >2% annually.
<b>Moderate Adverse</b>	Results in impact on integrity of attribute or loss of part of attribute	Removal of moderate proportion of aquifer. Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems. Potential medium risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >1% annually.
<b>Small Adverse</b>	Results in minor impact on integrity of attribute or loss of small part of attribute	Removal of small proportion of aquifer. Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems. Potential low risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >0.5% annually.
<b>Negligible</b>	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Calculated risk of serious pollution incident <0.5% annually.

**Table 5: Rating of Significant Environmental Impacts at EIS Stage (NRA)**

Importance of Attribute	Magnitude of Importance			
	Negligible	Small Adverse	Moderate Adverse	Large Adverse
<b>Extremely High</b>	Imperceptible	Significant	Profound	Profound
<b>Very High</b>	Imperceptible	Significant/moderate	Profound/Significant	Profound
<b>High</b>	Imperceptible	Moderate/Slight	Significant/moderate	Profound/Significant
<b>Medium</b>	Imperceptible	Slight	Moderate	Significant
<b>Low</b>	Imperceptible	Imperceptible	Slight	Slight/Moderate

Appendix 7.2 Lands at Ballymakaily - Ground Investigations



## Lands at Ballymakaily – Ground Investigation

Client: BCEI  
 Report No.: 18-0827  
 Date: August 2018  
 Status: Final for Issue

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Lands at Ballymakaily  
 Report No. 18-0827

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### APPENDICES

Appendix A	Site and exploratory hole location plans
Appendix B	Borehole logs
Appendix C	Trial pit logs
Appendix D	Trial pit photographs
Appendix E	Dynamic probe logs
Appendix F	Indirect in-situ CBR test results
Appendix G	Geotechnical laboratory test results
Appendix H	Environmental laboratory test results
Appendix I	SPT hammer energy measurement report

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### Document Control Sheet

Report No.:		18-0827			
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Prepared by:		Reviewed by:		Approved by:	
					
Sean Ross BSc MSc		Stephen Franey BSc (Hons) MSc		Darren O'Mahony BSc MSc MIEI	

The works were conducted in accordance with:

- UK Specification for Ground Investigation 2<sup>nd</sup> Edition, published by ICE Publishing (2012)
- British Standards Institute (2015) BS 5930:2015, Code of practice for site investigations.
- BS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing.
- Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland

Laboratory testing was conducted in accordance with:

- British Standards Institute BS 1377:1990 parts 2, 4, 5, 7 and 9

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**METHODS OF DESCRIBING SOILS AND ROCKS**

Soil and rock descriptions are based on the guidance in BS5930:2015, The Code of Practice for Site Investigation.

Abbreviations used on exploratory hole logs	
U	Nominal 100mm diameter undisturbed open tube sample (thick walled sampler)
UT	Nominal 100mm diameter undisturbed open tube sample (thin walled sampler)
P	Nominal 100mm diameter undisturbed piston sample
B	Bulk disturbed sample
LB	Large bulk disturbed sample
D	Small disturbed sample
C	Core sub-sample (displayed in the Field Records column on the logs)
L	Linear sample from dynamic sampled borehole
W	Water sample
ES / EW	Soil sample for environmental testing / Water sample for environmental testing
SPT (s)	Standard penetration test using a split spoon sampler (small disturbed sample obtained)
SPT (c)	Standard penetration test using 60 degree solid cone
xx/xxxx	Blows per increment during the standard penetration test. The initial two values relate to the seating drive (150mm) and the remaining four to the 75mm increments of the test length. The length achieved is stated (mm) for any test increment less than 75mm
N-X	SPT blow count 'N' given by the summation of the blows 'X' required to drive the full test length (300mm)
N-X/Z	Incomplete standard penetration test where the full test length was not achieved. The blows 'X' represent the total blows for the given test length 'Z' (mm)
V	Shear vane test (borehole)
VR	Hand vane test (trial pit)
dd/mm/yy: 1.0	Date & water level at the borehole depth at the end of shift
dd/mm/yy: dry	and the start of the following shift
Abbreviations relating to rock core – reference Clause 36.4.4 of BS 5930: 2015	
TCR (%)	Total Core Recovery: Ratio of rock/soil core recovered (both solid and non-intact) to the total length of core run
SCR (%)	Solid Core Recovery: Ratio of solid core to the total length of core run. Solid core has a full diameter, uninterrupted by natural discontinuities, but not necessarily a full circumference and is measured along the core axis between natural fractures.
RQD (%)	Rock Quality Designation: Ratio of total length of solid core pieces greater than 100mm to the total length of core run.
FI	Fracture Index: Number of natural discontinuities per metre over an indicated length of core of similar intensity of fracturing.
NI	Non Intact: Used where the rock material was recovered fragmented, for example as fine to coarse gravel size particles.
AZCL	Assessed zone of core loss: The estimated depth range where core was not recovered.
DIF	Drilling induced fracture: A fracture of non-geological origin brought about by the rock coring.



**Lands at Ballymakilly**

**1 AUTHORITY**

On the instructions of BCEI, ("the Client"), a ground investigation was undertaken at the above location to provide geotechnical and environmental information for input to the design and construction of a proposed data centre.

This report details the work carried out both on site and in the geotechnical and chemical testing laboratories; it contains a description of the site and the works undertaken, the exploratory hole logs and the laboratory test results. A discussion on the recommendations for construction is also provided.

All information given in this report is based upon the ground conditions encountered during the site investigation works, and on the results of the laboratory and field tests performed. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata, contaminant concentrations, and water conditions between or below exploratory holes. It should be noted that groundwater levels usually vary due to seasonal and/or other effects and may at times differ to those recorded during the investigation. No responsibility can be taken for conditions not encountered through the scope of work commissioned, for example between exploratory hole points, or beneath the termination depths achieved.

This report was prepared by Causeway Geotech Ltd for the use of the Client in response to a particular set of instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

**2 SCOPE**

The extent of the investigation, as instructed by the Client, included boreholes, trial pits, dynamic probing, soil and rock core sampling, environmental sampling, in-situ and laboratory testing, and the preparation of a report on the findings including recommendations for construction.

**3 DESCRIPTION OF SITE**

As shown on the site location plan in Appendix A, the works were conducted on the site of agricultural lands in west Dublin, just north of Baldonnell Aerodrome. The site is bounded to the north by the Grand Canal, to the east by the R120 and to the south and west by agricultural fields. The site generally slopes downwards towards the north east.



**4 SITE OPERATIONS**

**4.1 Summary of site works**

Site operations, which were conducted between 23<sup>rd</sup> July and 21<sup>st</sup> August 2018, comprised:

- fifteen boreholes by dynamic sampling methods;
- a standpipe installation in six boreholes;
- nineteen dynamic probes;
- nineteen machine dug trial pits;
- indirect CBR tests at eighteen locations.

The exploratory holes and in-situ tests were located as instructed by the Client's Representative, as shown on the exploratory hole location plan in Appendix A.

**4.2 Boreholes**

Fifteen boreholes (BH01-BH15) were put down to completion by light percussion boring techniques using a Dando Terrier dynamic sampling rig. The boreholes were put down initially in 150mm diameter, reducing in diameter with depth as required, down to 50mm by use of the smallest sampler.

The boreholes were taken to depths ranging between 0.5m and 3.4m where they were terminated on encountering virtual refusal on obstructions above their scheduled depth.

Standard penetration tests were carried out in accordance with BS EN 22476-3: 2005 at standard depth intervals using the split spoon sampler (SPT<sub>0</sub>) or solid cone attachment (SPT<sub>c</sub>). The penetrations are stated for those tests for which the full 150mm seating drive or 300mm test drive was not possible. The N-values provided on the borehole logs are uncorrected and no allowance has been made for energy ratio corrections. The SPT hammer energy measurement report is provided in Appendix I.

Disturbed (bulk and small bag) samples were taken within the encountered strata. Environmental samples were taken at standard intervals.

Any water strikes encountered during boring were recorded along with any changes in their levels as the borehole proceeded. Details of the water strikes are presented on the individual borehole logs.

Appendix B presents the borehole logs.



**4.3 Standpipe installations**

A groundwater monitoring standpipe was installed in boreholes BH05, BH09, BH10, BH11, BH14 and BH15.

Details of the installations, including the depth range of the response zone, are provided in Appendix B on the individual borehole logs.

**4.4 Trial Pits**

Nineteen trial pits (TP01-TP19) were excavated using an 8t tracked excavator fitted with a 600mm wide bucket, to depths ranging between 0.40m and 2.8m where they were terminated on obstructions.

Disturbed (small jar and bulk bag) samples were taken at standard depth intervals and at change of strata.

Environmental samples were taken at depths of 0.5m and 1.5m in each trial pit.

Any water strikes encountered during excavation were recorded along with any changes in their levels as the excavation proceeded. The stability of the trial pit walls was noted on completion.

Appendix C presents the trial pit logs with photographs of the pits and arising provided in Appendix D.

**4.5 Dynamic Probes**

Nineteen dynamic probes were conducted adjacent to trial pits using the DPSHB method as described in BS EN ISO 22476-2: 2005. The method entails a 63.5kg hammer falling 0.75m onto a 50.5mm diameter cone with an apex angle of 90°.

Appendix E provides the dynamic probe logs on the sheet following the relevant borehole log in the form of plots, against depth, of the number of blows per 100mm penetration.

**4.6 Indirect CBR tests**

An indirect CBR test was conducted at eighteen locations (TP02-TP19) adjacent to the trial pits using a Dynamic Cone Penetrometer (DCP). The equipment was developed in conjunction with the UK Transport Research Laboratory, is used widely throughout the world, and is referred to in the UK Highway Agency Interim Advice Note 73/06. A DCP test was not undertaken at TP01 due to the presence of made ground.

The test results are presented in Appendix F in the form of plots of the variation with depth of the penetration per blow. Straight lines have been fitted to the plots and the CBR for each depth range estimated using the following relationship, as proposed by Kleyn & Van Heerden (1983):

$$\text{Log CBR} = 2.632 - 1.28 \text{ Log (mm/blow)}$$





The frequently elevated CBR values are a consequence of the coarse-grained content of the penetrated soils and are often not representative of the soil matrix.

4.7 Surveying

The as-built exploratory hole positions were surveyed following completion of site operations by a Site Engineer from Causeway Geotech. Surveying was carried out using a Trimble R6 GPS system employing VRS and real time kinetic (RTK) techniques.

The plan coordinates (Irish National Grid) and ground elevation (mOD Malin) at each location are recorded on the individual exploratory hole logs. The exploratory hole plan presented in Appendix A shows these as-built positions.

5 LABORATORY WORK

Upon their receipt in the laboratory, all disturbed samples were carefully examined and accurately described, and their descriptions incorporated into the borehole logs.

5.1 Geotechnical laboratory testing of soils

Laboratory testing of soils comprised:

- **soil classification:** moisture content measurement, Atterberg Limit tests and particle size distribution analysis.
- **soil chemistry:** pH and water-soluble sulphate content

Laboratory testing of soils samples was carried out in accordance with British Standards Institute: BS 1377, Methods of test for soils for civil engineering purposes; Part 1 (2016), and Parts 2-9 (1990).

The test results are presented in Appendix G.

5.2 Environmental laboratory testing of soils

Environmental testing was conducted on selected environmental soil samples by Chemtest at its laboratory in Newmarket, Suffolk.

Testing was carried out for a range of determinants, including:

- Metals
- Speciated total petroleum hydrocarbons (TPH)



- Speciated polycyclic aromatic hydrocarbons (PAH)
- Cyanides
- Asbestos screen
- pH.

Results of environmental laboratory testing are presented in Appendix H.

6 GROUND CONDITIONS

6.1 General geology of the area

Published geological mapping indicate the superficial deposits underlying the site comprise Glacial Till. These deposits are underlain by limestones and shales of the Lucan Formation.

6.2 Ground types encountered during investigation of the site

A summary of the ground types encountered in the exploratory holes is listed below, in approximate stratigraphic order:

- **Topsoil:** encountered typically in 200-400mm thickness across the site.
- **Made Ground (fill):** reworked clay fill with fragments of red brick, plastic, steel, fabric and concrete. Encountered only in TP01 to a depth of 1.8m, close to the canal.
- **Glacial Till:** sandy gravelly clay, frequently with low cobble content, typically firm or stiff in upper horizons, becoming very stiff with increasing depth. Contains localised pockets of granular material, consisting of sandy clayey gravel.

6.3 Groundwater

Groundwater was encountered during percussion boring through soil and in trial pits as water strikes as shown in Table 1 below.

Table 1 Groundwater strikes encountered during ground investigation

GI Ref	Water strike (mbgl)	Comments
TP12	2.2	Seepage
TP14	2.1	Seepage
TP15	2.6	Seepage
TP16	1.9	Seepage



Details of the individual groundwater strikes, along with any relative changes in levels as works proceeded, are presented on the exploratory hole logs for each location.

Groundwater was not noted during drilling at any of the borehole locations. However, it should be noted that the casing used in supporting the borehole walls during drilling may have sealed out any groundwater strikes encountered and the possibility of encountering groundwater during excavation works should not be ruled out. Seasonal variation in groundwater levels should also be factored into design considerations.

Continued monitoring of the six installed standpipes will give an indication of the seasonal variation in groundwater level.

7 DISCUSSION

7.1 Proposed construction

It is proposed to construct a new data centre on the site.

No further details were available to Causeway Geotech at the time of preparing this report and any designs based on the recommendations or conclusions within this report should be completed in accordance with the current design codes, taking into account the variation and the specific details contained within the exploratory holes. Causeway Geotech were commissioned to provide a geotechnical report, and it is outwith our remit to advise on structure design.

7.2 Recommendations for construction

7.2.1 Summary

Based on the presence of stiff glacial till and possible bedrock at relatively shallow depths across the footprint of the proposed building, the implementation of traditional shallow (spread) foundations (strip/pad) are considered suitable.

7.2.2 Soil strength parameters

When estimating the shear strength of fine soils (silt/clay), reference is made to the results of Standard Penetration Tests (SPT's) carried out within the boreholes. The undrained shear strength of fine soils can be estimated using the correlation developed by Stroud & Butler:

$$C_u = f_s \times N$$

where  $f_s$  is typically in the range 4 to 6. A median  $f_s$  value of 5 is adopted for this report.



For granular soils (sand/gravel), a graphical relationship between SPT "N" value and angle of shearing resistance,  $\phi$ , has been developed by Peck, Hanson and Thorburn. This is published in *Foundation Design and Construction* (Tomlinson, 2001) and is referenced in this report when deriving angles of shearing resistance for the gravel soils.

7.2.3 Bearing resistance

The ultimate bearing resistance for conventional strip or pad foundations can be obtained from Brinch Hansen's general equation:

$$q_n = cN_c s_c d_c l_c b_c + p_o N_q s_q d_q l_q b_q + \frac{1}{2} \gamma B N_\gamma s_\gamma d_\gamma l_\gamma b_\gamma$$

where:

- $q_n$  = ultimate bearing resistance
- $c$  = undrained cohesion of soil
- $B$  = foundation width
- $p_o$  = effective overburden pressure at foundation level
- $N_c, N_q, N_\gamma$  = bearing capacity factors
- $s_c, s_q, s_\gamma$  = shape factors
- $d_c, d_q, d_\gamma$  = depth factors
- $l_c, l_q, l_\gamma$  = load inclination factors
- $b_c, b_q, b_\gamma$  = base inclination factors

For conventional strip and pad foundations constructed on fine soils, the general equation has been simplified by Terzaghi to:

$$\text{Net ultimate bearing resistance} = cN_c$$

where:

- $c$  = undrained cohesion
- $N_c$  = bearing capacity factor

For cohesionless soils (sand/gravel,  $c=0$ ), the calculation of ultimate bearing resistance is generally required only for loose sands. This is because coarser gravel soils would not be expected to suffer a bearing capacity failure. However, limits are placed on the allowable bearing resistance in order to control settlement. For shallow conventional pad foundations on granular soils, Terzaghi's simplified equation can be used as follows:

$$q_n = p_u(N_c - 1) + 0.4BN + p$$



where:  
 $p$  = total overburden pressure

It is obvious from the equations 1 to 3 that some knowledge of the foundation width and depth is required before the ultimate bearing resistance can be calculated.

Table 1 provides an indication of minimum founding depth at each borehole location. Also shown are approximate soil strengths based on the Stroud and Butler (1975) correlations with SPT N-values and visual examination of recovered samples of the clay deposits.

The table also suggests allowable bearing resistance using Equations 2 and 3 for cohesive and cohesionless soils respectively.

This table does not take into account the variations in soil composition, and the effects of differential movement within a particular structure. Calculation of the design bearing resistance over the entire structure will entail a knowledge of the magnitude and distribution of the structural actions.

**7.2.4 Foundations and ground floor construction**

Foundations should transfer loading to below any Made Ground or subsoil. The recommended foundation construction and allowable bearing pressure (ABP) at the borehole locations are presented in Table 1

**Table 1: Construction recommendations**

Borehole	Depth below EGL* to suitable bearing stratum	Estimated ABP (kPa)	Strata description	Foundation type	Ground floor construction	Groundwater
BH01	1.0m	>250	Stiff Glacial Till/Possible bedrock	Strip & pad	Ground bearing	Not encountered
BH02	1.20m	>250	Stiff Glacial Till	Strip & pad	Ground bearing	Not encountered
BH03	1.20m	>250	Stiff Glacial Till	Strip & pad	Ground bearing	Not encountered
BH04	1.20m	230	Stiff Glacial Till	Strip & pad	Ground bearing	Not encountered
BH05	1.20m	160	Stiff Glacial Till	Strip & pad	Ground bearing	Not encountered
BH06	0.50m	>250	Possible bedrock	Strip & pad	Ground bearing	Not encountered

Borehole	Depth below EGL* to suitable bearing stratum	Estimated ABP (kPa)	Strata description	Foundation type	Ground floor construction	Groundwater
BH07	2.0m	>250	Stiff Glacial Till	Strip & pad	Ground bearing	Not encountered
BH08	1.20m	220	Stiff Glacial Till	Strip & pad	Ground bearing	Not encountered
BH09	1.20m	>250	Stiff Glacial Till	Strip & pad	Ground bearing	Not encountered
BH10	1.20m	200	Stiff Glacial Till	Strip & pad	Ground bearing	Not encountered
BH11	1.20m	>250	Stiff Glacial Till	Strip & pad	Ground bearing	Not encountered
BH12	1.20m	>250	Stiff Glacial Till	Strip & pad	Ground bearing	Not encountered
BH13	1.20m	>250	Stiff Glacial Till	Strip & pad	Ground bearing	Not encountered
BH14	1.20m	130	Firm Glacial Till	Strip & pad	Ground bearing	Not encountered
	2.0m	>250	Stiff Glacial Till			
BH15	1.20m	200	Stiff Glacial Till	Strip & pad	Ground bearing	Not encountered

\*Existing Ground Level

Based on the findings of the site investigation, spread foundations (strip/pad) are considered suitable with estimated allowable bearing pressures between 130kPa and >250kPa at depths between 0.5m and 1.5m on stiff glacial till or possible bedrock. If foundations are designed to be constructed on bedrock, it is recommended that rotary drilling is undertaken determine rock strength across the site, as this will aid in design.

The base of foundation excavations should be thoroughly inspected; any soft soils should be removed with the resultant void backfilled with ST1 concrete. A consistent bearing stratum should be provided for any building unit to limit differential settlements.

Given the generally fine grained/cohesive nature of the soils throughout the proposed formation levels, excavations for foundations are likely to be relatively stable. However, any instability can be minimised by battering the side slopes at 2 vertical to 1 horizontal and by limiting the duration that the excavation is open. Groundwater control, where required, will be possible by pumping from sumps formed in the base of excavations.



**7.2.5 Floor slabs**

Floor slabs should not bear directly onto Made Ground or soft soils. The use of ground bearing floor slabs is only appropriate following the removal of any surface Made Ground and soft clay layers and their replacement using well-graded well-compacted granular fill. However, a suspended floor slab should be adopted where the difference in levels of the proposed floor and the base of Made Ground/soft soils is greater than 600mm.

**7.2.6 Excavations for services**

For the installation of services ducts/trenches, it is suggested that open trenching will be the most practicable construction method. Generally speaking, the ground conditions should render the use of open trenching by backhoe excavator possible. Localised rock breaking may be required depending on the invert level of services in the west of the site. This may be possible using a hydraulic rock breaker depending on the strength of the rock.

Where working in open trenches, it is thought that trench support systems, by way of a trench box may be required to maintain trench stability and safe working conditions. Groundwater control at these locations should be possible by means of sump pumping.

To preclude the eventuality of differential settlements in pipes, they should be laid on a consistent stratum of appropriate allowable bearing capacity and protected with appropriate fill cover.

Where ducts and chambers must be installed in areas where localised soft spots are encountered, the use of geogrid reinforcement along the base of the very soft/soft soil (e.g. peat) below the trench base is recommended. This will stiffen the base of the trench and help control longitudinal differential settlement.

Backfilling of trenches may be completed by using compacted CI 804 granular fill and reinstated as appropriate.

**7.2.7 Soil aggressivity**

An assessment of the Aggressive Chemical Environment for Concrete (ACEC) was undertaken through reference to the Building Research Establishment (BRE) Special Digest 1 (2017).

As noted by BRE Special Digest 1, sulphates in the soil and groundwater are the chemical agents most likely to attack concrete. The extent to which sulphates affect concrete is linked to their concentrations, the type of ground, the presence of groundwater, the type of concrete and the form of construction in which concrete is used.

BRE Special Digest 1 identifies four different categories of site which require specific procedures for investigation for aggressive ground conditions:

- Sites not subjected to previous industrial development and not perceived as containing pyrite;
- Sites not subjected to previous industrial development and perceived as containing pyrite;
- Brownfield sites not perceived as containing pyrite;
- Brownfield sites perceived as containing pyrite.

For the purposes of this report the site was classified as not having been subject to previous industrial development and perceived as potentially containing pyrite.

The results of chemical tests (pH and water-soluble sulphate contents) on soil samples indicate Design Sulphate Class DS-1 and ACEC Class AC-1 – reference Table C1 of BRE Special Digest 1 (Building Research Establishment, 2005). The Special Digest does not require any measures to protect underground concrete elements greater than 140mm thick.

**7.2.8 Access roads, car parks and hard standing**

Based on the strata descriptions and the results of in-situ indirect CBR tests (DCP), the following design CBR values are appropriate.

- less than 2% at locations where the sub-grade is formed in Made Ground, requiring a 600mm thick capping
- A value of 4% at depth of 1m, is appropriate where stiff Glacial Till is encountered at sub-formation level.

Although the CBR value increases with depth, with a value of above 5% below a depth of 300mm, the required construction thickness should be determined by the minimum long-term equilibrium CBR value of the Glacial Till. The value of 4% stated for a depth of 300mm is based on the soil plasticity, as per Table 2.1 of volume 7 section2 of the Design Manual for Roads and Bridges, assuming average construction conditions. A CBR of 4% requires a 300mm thick capping layer.

The use of geosynthetics in the construction of paved areas, will be beneficial, particularly in areas of Made Ground. These could include a geosynthetic (e.g. a geogrid) at subgrade level with further benefit gained by incorporating further layer(s) within the capping/sub-base layer.

**7.3 Site contamination and waste disposal**

Selected soil samples were analysed for a range of potential contaminants including:

- Metals;
- Speciated total petroleum hydrocarbons (TPH);
- Speciated polycyclic aromatic hydrocarbons (PAH);
- Cyanides;



- Sulphates and sulphide;
- Phenols; and
- Asbestos screening

Samples were also tested for a Waste Acceptance Criteria (WAC) suite to assess the potential categorisation of waste from the site.

In the initial examination of the potential risk of site contamination, the laboratory results have been compared to the following available assessment criteria relevant to the proposed land use:

- the Environment Agency Soil Guideline Values (SGVs) published, in 2009. These relate to arsenic, mercury, selenium, cadmium, benzene, toluene, ethylbenzene, xylenes, and phenol.

The results from theselected samples do not identify significantly elevated concentrations above the SGVs where criteria are available.

It should be noted that the above assessment is based on the results, of the tested soil samples against publicly available criteria. No further assessment has been undertaken where criteria are not available. Any potential contamination identified during site development by visual or olfactory means should be investigated, including further laboratory testing, and appropriate health & safety, waste disposal and remediation measures adopted.

In assessment of the disposal of waste, the test results have been compared with the European Union Directive limits for Inert waste landfill, Stable, Non-reactive hazardous waste in non-hazardous landfill and hazardous waste landfill criteria.

From the thirty samples tested for WAC analysis, material from the site may potentially be classified as inert/non-hazardous. It is noted however that any material excavated for off-site disposal would a Waste Classification following the guidance in the National Hazardous Waste Management Plan (EPA, 2014)

8 REFERENCES

Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland

IS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing.

BS 1377: 1990: Methods of test for soils for civil engineering purposes. British Standards Institution.

BS 5930: 2015: Code of practice for ground investigations. British Standards Institution.

BS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing. British Standards Institution.

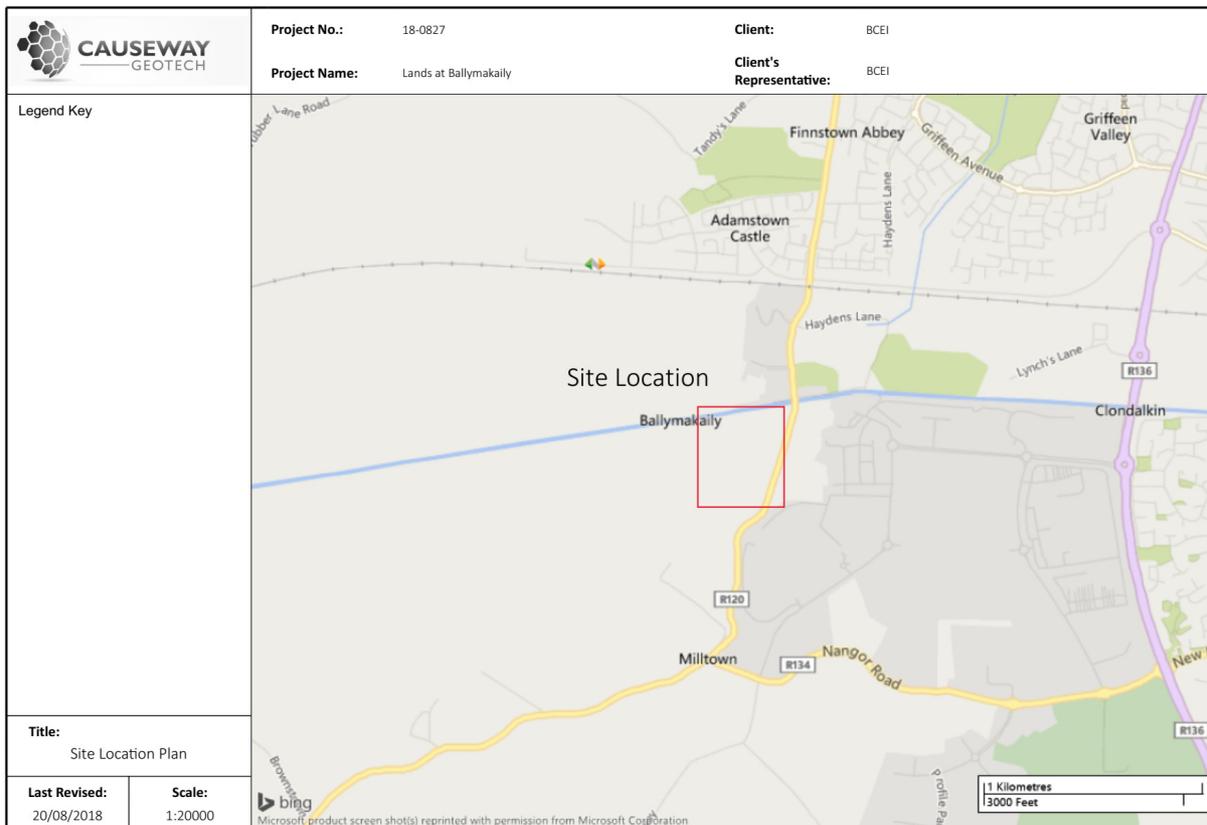
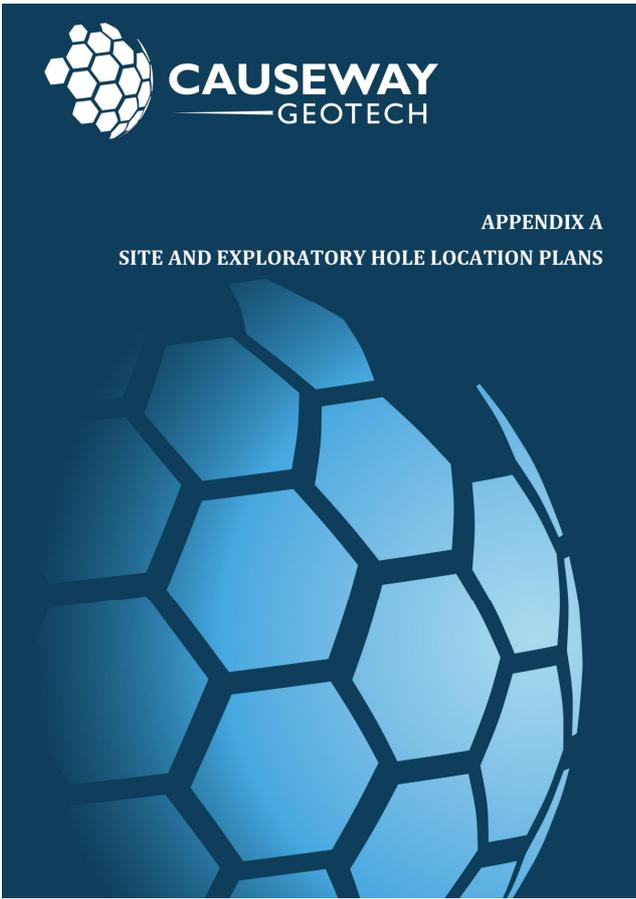
BS EN ISO 14688-1:2018: Geotechnical investigation and testing. Identification and classification of soil. Part 1 Identification and description. British Standards Institution.

BS EN ISO 14688-2:2004+A1:2013: Geotechnical investigation and testing. Identification and classification of soil. Part 2 Principles for a classification.

BS EN ISO 22476-3:2005+A1:2011: Geotechnical investigation and testing. Field testing. Standard penetration test.

Building Research Establishment (2005) BRE Special Digest 1, Concrete in aggressive ground.

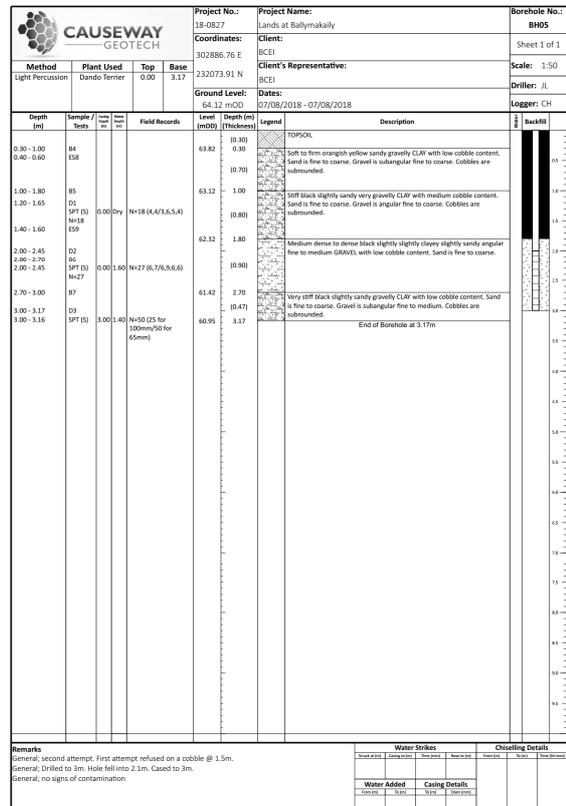
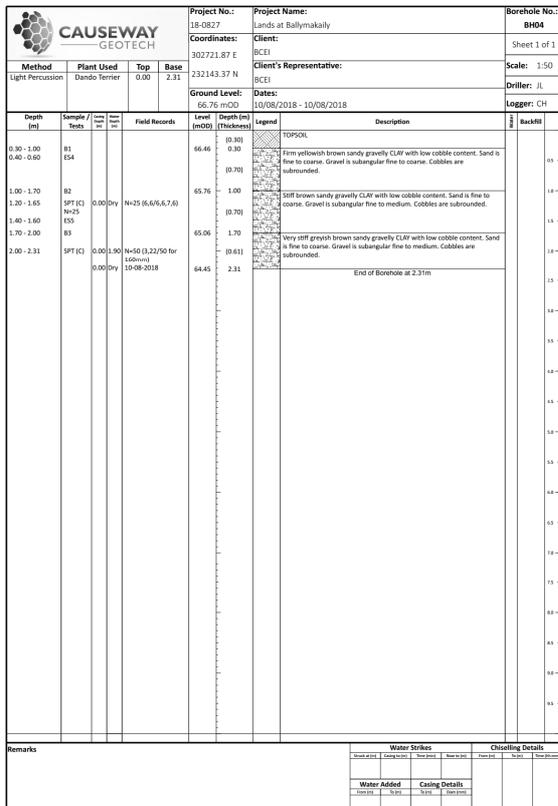
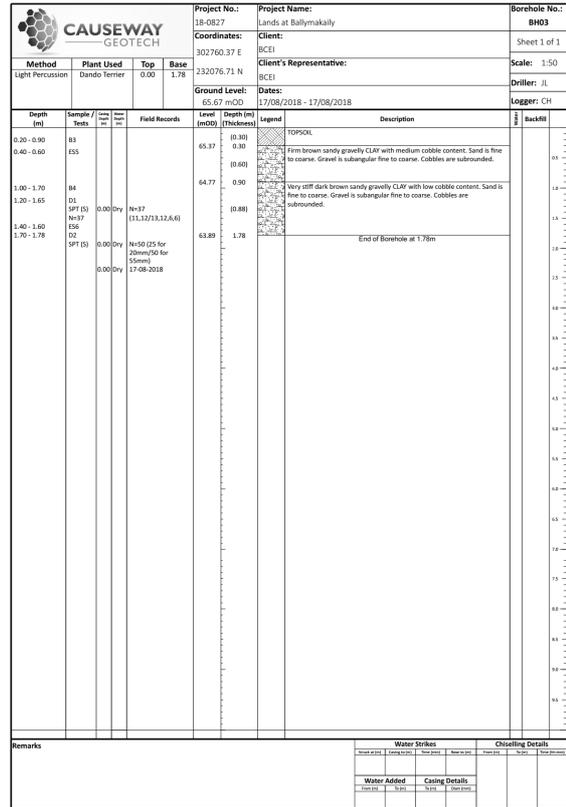
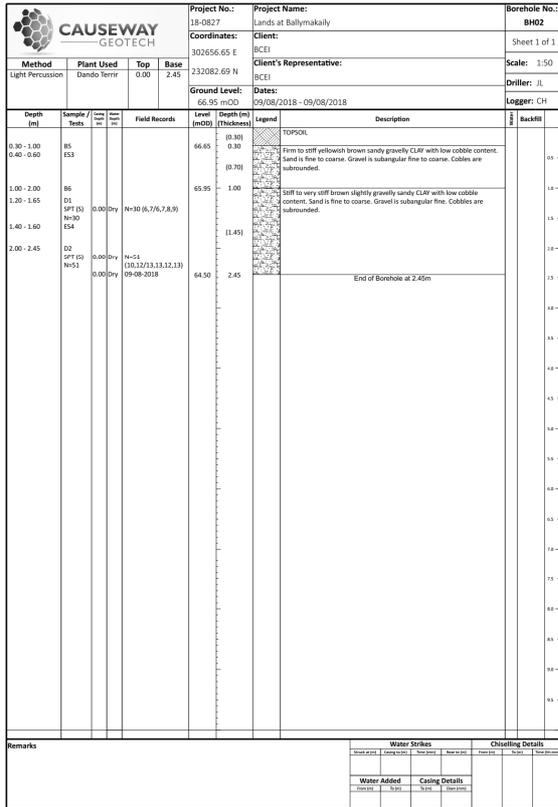
Contaminated Land Report (CLR) 11, (2009) Model Procedures for the Management of Land Contamination, The Department for Environment, Food and Rural Affairs (Defra) and the Environment Agency.

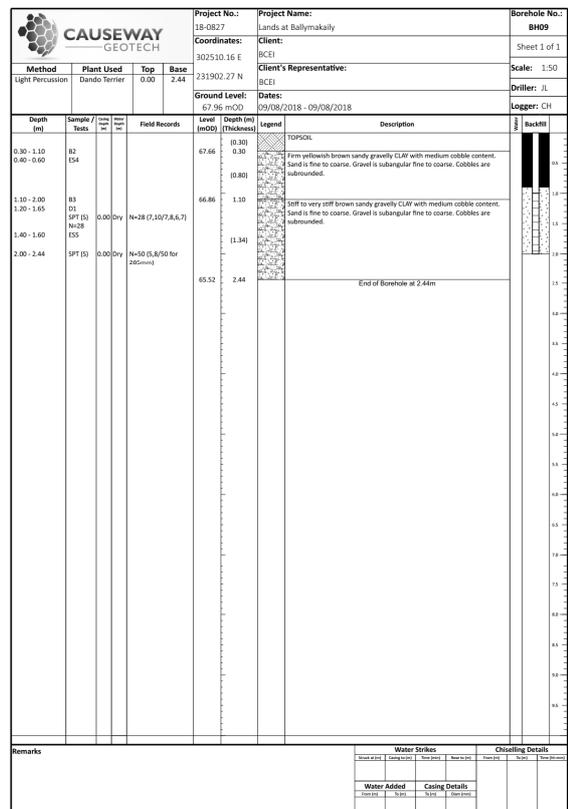
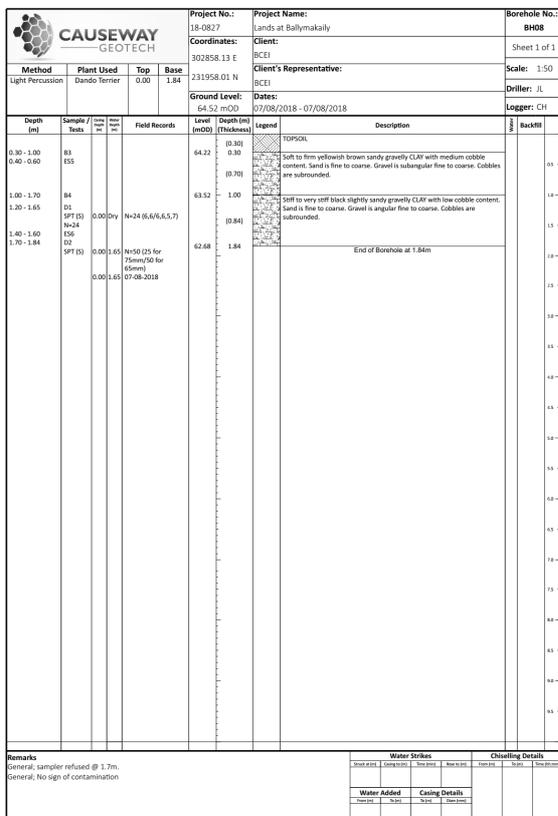
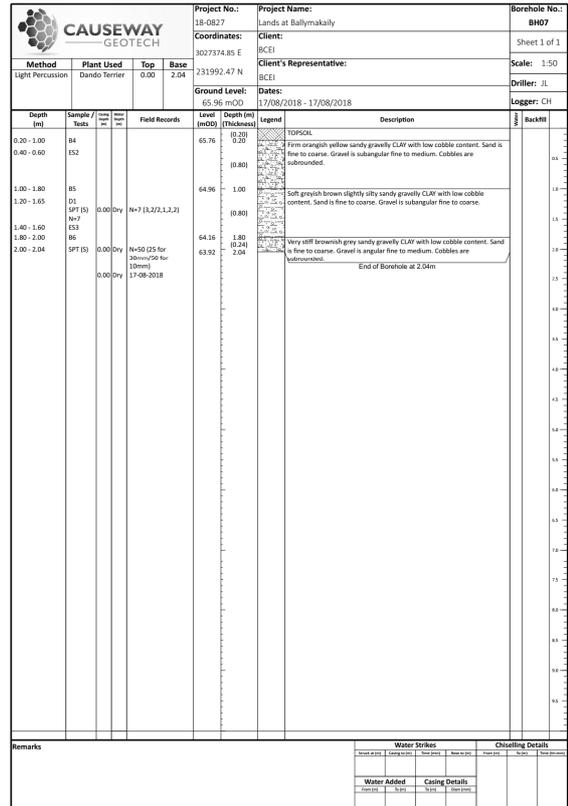
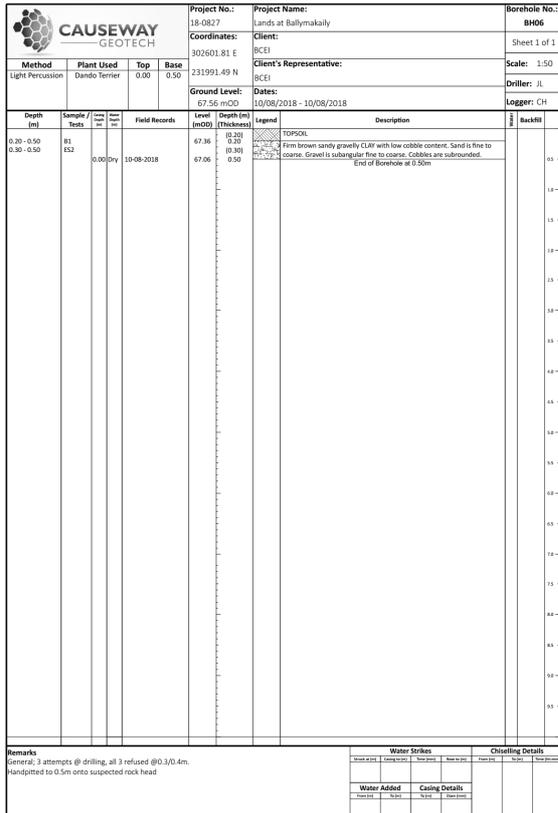


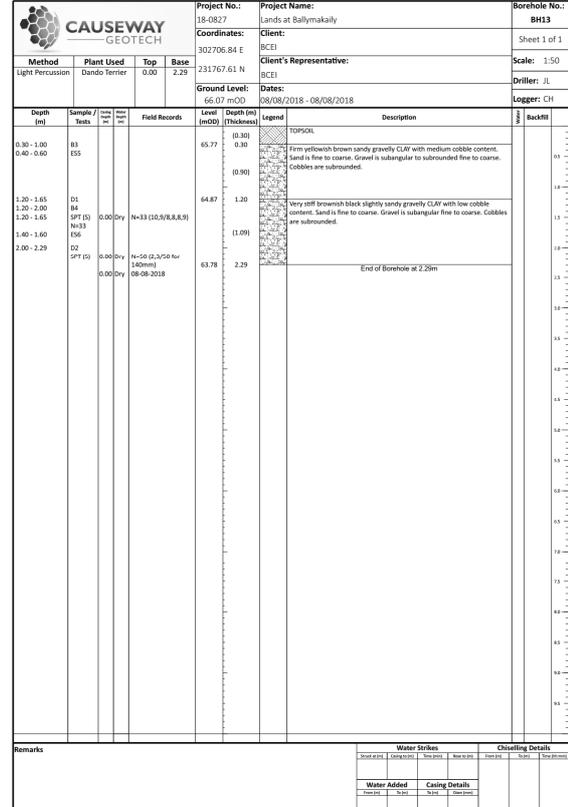
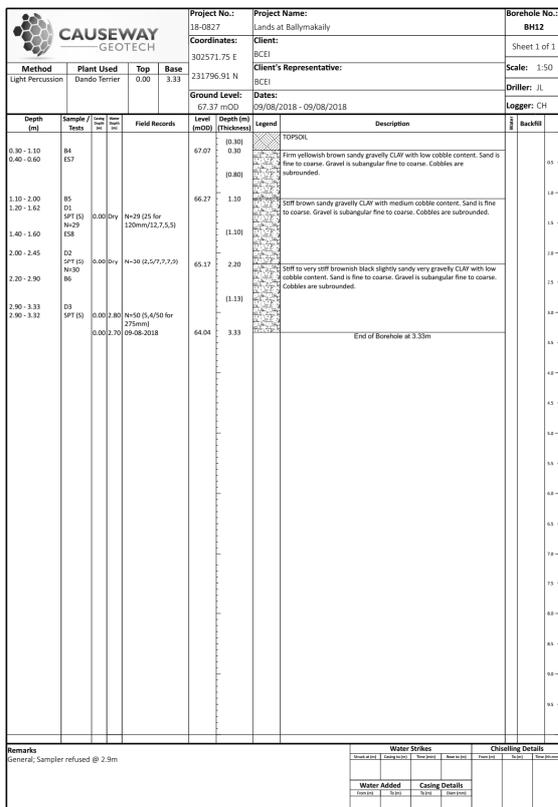
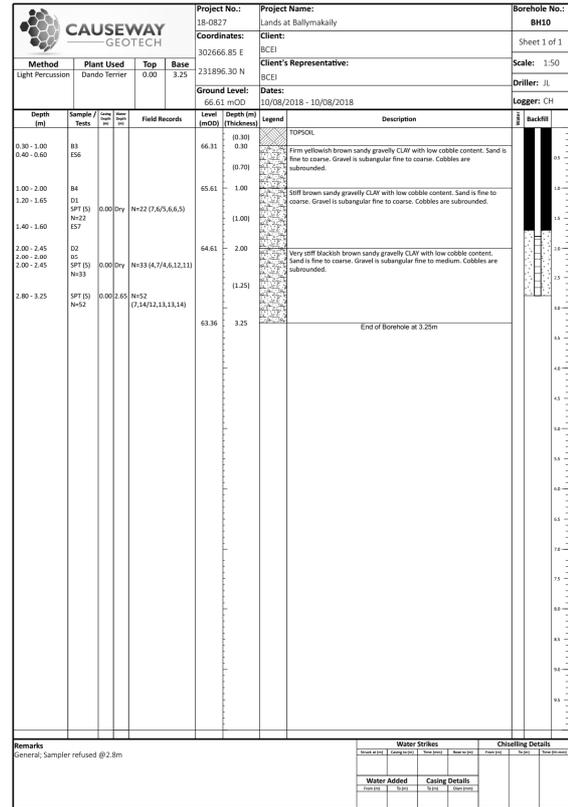
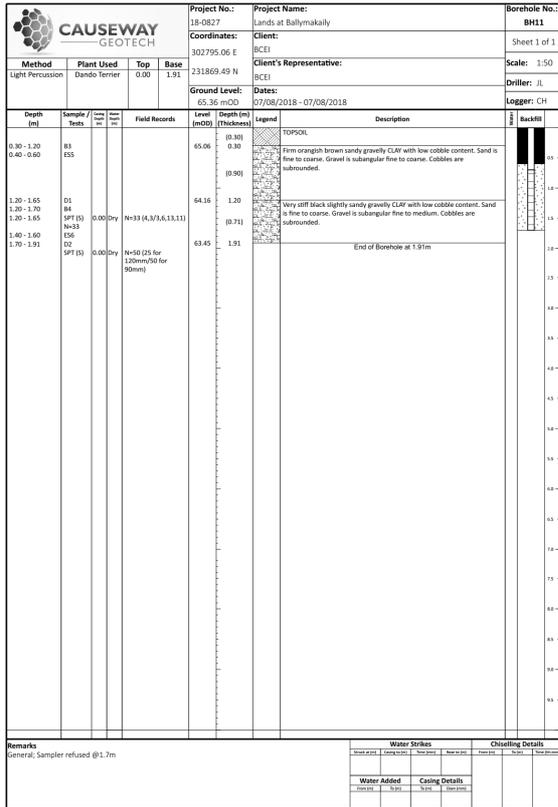


**APPENDIX B  
 BOREHOLE LOGS**

Method		Plant Used	Top	Base	Coordinates		Ground Level:		Dates:		Borehole No.:		
Light Percussion		Dando Turner	0.00	1.36	302543.55 E 232075.82 N		68.54 mCD		09/08/2018 - 09/08/2018		BH01		
Sample / Tests		Core No.	Test No.	Field Records	Level (mOD)	Depth (m)	Legend	Description	Backfill				
0.30 - 1.00	R2				68.64	0.30	TOPSOIL						
0.40 - 0.60	ES3					0.30		Very soft brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine. Cobbles are subrounded.					
1.00 - 1.36	D1		0.00	Dry	67.58	1.36							
1.00 - 1.16	SPT (N)		0.00	Dry									
N=50 (25 for 65mm/50 for 90mm) 09/08/2018 End of Borehole at 1.36m													
<b>Remarks</b> General: Second attempt. First attempt refused on a cobble @ 0.9m. General: Sampler refused @ 1m.										<b>Water Strikes</b> Shallow   Medium   Deep   No to BS   Other		<b>Challenging Details</b> Other	
<b>Water Added</b> Other										<b>Casing Details</b> Other		Other	

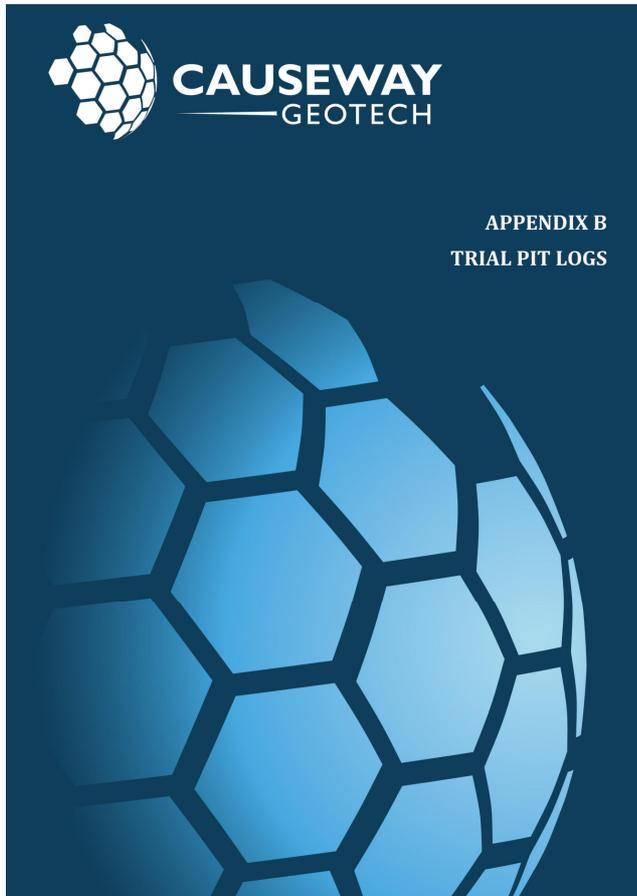






CAUSEWAY GEOTECH		Project No.: 18-0827	Project Name: Lands at Ballymakilly	Borehole No.: BH14		
Method: Light Percussion		Coordinates: 302512.17 E	Client: BCEI	Scale: 1:50		
Plant Used: Dando Terrier		Top: 0.00	Base: 3.38	Sheet 1 of 1		
Ground Level: 67.41 mOD		Dates: 08/08/2018 - 08/08/2018	Driller: JL	Logger: CH		
Depth (m)	Sample / Tests	Field Records	Level (mOD) / Depth (Thickness)	Legend	Description	Backfill
0.30 - 0.80	B6 ES4		0.30	TOPSOIL	Firm yellowish brown sandy gravelly CLAY with low cobbles content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subrounded.	
1.30 - 2.00	B7 D1 SPT (S) N=15	N=15 (1,3/3,4,4)	1.10		Firm black slightly sandy gravelly CLAY with low cobbles content. Sand is fine to coarse. Gravel is subangular fine to coarse.	
2.00 - 2.45	D2 D6 SPT (S) N=30	N=30 (4,5/6,8,8)	2.00		Stiff to very stiff black slightly sandy gravelly CLAY with low cobbles content. Sand is fine to coarse. Gravel is subangular fine to medium.	
3.00 - 3.38	D3 SPT (S)	N=50 (4,6/50 for 225mm)	3.38		End of Borehole at 3.38m	

CAUSEWAY GEOTECH		Project No.: 18-0827	Project Name: Lands at Ballymakilly	Borehole No.: BH15		
Method: Light Percussion		Coordinates: 302633.53 E	Client: BCEI	Scale: 1:50		
Plant Used: Dando Terrier		Top: 0.00	Base: 3.38	Sheet 1 of 1		
Ground Level: 66.55 mOD		Dates: 08/08/2018 - 08/08/2018	Driller: JL	Logger: CH		
Depth (m)	Sample / Tests	Field Records	Level (mOD) / Depth (Thickness)	Legend	Description	Backfill
0.30 - 0.80	B8 ES7		0.30	TOPSOIL	Firm orangish brown sandy gravelly CLAY with low cobbles content. Sand is fine to coarse. Gravel is subangular fine to coarse. Cobbles are subrounded.	
1.00 - 2.00	B4 SPT (S) N=24	N=24 (4,6/6,6,6)	1.00		Stiff black sandy gravelly CLAY with low cobbles content. Sand is fine to coarse. Gravel is subangular fine to coarse. Cobbles are subrounded.	
2.00 - 2.45	D1 D6 SPT (S) N=13	N=13 (3,4/5,3,2,3)	2.00		Firm black slightly sandy gravelly CLAY with low cobbles content. Sand is fine to coarse. Gravel is subangular fine to medium. Cobbles are subrounded.	
2.70 - 3.00	B6 D2 SPT (S)	N=50 (4,4/50 for 35mm)	3.00		Very stiff black slightly sandy gravelly CLAY with low cobbles content. Sand is fine to coarse. Gravel is subangular fine to medium. Cobbles are subrounded.	
3.00 - 3.19	D3 SPT (S)	N=50 (4,4/50 for 35mm)	3.19		End of Borehole at 3.19m	



CAUSEWAY GEOTECH		Project No.: 18-0827	Project Name: Lands at Ballymakilly	Trial Pit No.: TP01		
Method: Trial Pitting		Coordinates: 302596.12 E	Client: BCEI	Sheet 1 of 1		
Plant: BT Tracked Excavator		Top: 232139.99 N	Base: 69.16 mOD	Scale: 1:25		
Ground Level: 69.16 mOD		Dates: 25/07/2018	Driller: MMC	Logger: MMC		
Depth (m)	Sample / Tests	Field Records	Level (mOD) / Depth (Thickness)	Legend	Description	Backfill
0.50	ES1		0.20	TOPSOIL	Firm light greyish brown slightly sandy CLAY with rootlets.	
			0.20	MADE GROUND	Firm light greyish brown slightly sandy gravelly CLAY with low cobbles content, fragments of plastic, steel, fabric, concrete and red brick. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Cobbles are subangular to angular of mixed lithologies.	
1.50	ES2		1.80		Firm brown peaty CLAY.	
			2.20		End of trial pit at 2.20m	

CAUSEWAY GEOTECH		Project No.: 18-0827	Project Name: Lands at Ballymakilly	Trial Pit No.: TP02			
Method: Trial Pitting		Co-ordinates: 302686.63 E 232135.26 N	Client: BCEI Client's Representative: BCEI	Scale: 1:25 Sheet 1 of 1			
Plant: BT Tracked Excavator		Ground Level: 67.33 mOD	Date: 25/07/2018	Logger: MMC			
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Depth (m)
0.30	E51		66.92	0.40	(0.40)	TOPSOIL: Firm light greyish brown slightly sandy CLAY with rootlets. Sand is fine to coarse.	0.30
						End of trial pit at 0.40m	0.30
Remarks: No groundwater encountered		Water Strikes:		Stability: Stable		Width: 1.00	
Terminated on possible bedrock		Struck at (m):		Remarks:		Length: 3.00	

CAUSEWAY GEOTECH		Project No.: 18-0827	Project Name: Lands at Ballymakilly	Trial Pit No.: TP03			
Method: Trial Pitting		Co-ordinates: 302811.23 E 232087.26 N	Client: BCEI Client's Representative: BCEI	Scale: 1:25 Sheet 1 of 1			
Plant: ST Tracked Excavator		Ground Level: 65.10 mOD	Date: 23/07/2018	Logger: MMC			
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Depth (m)
0.50	B1		64.90	0.20	(0.20)	TOPSOIL: Firm light greyish brown slightly sandy CLAY with rootlets.	0.50
0.50	D2		64.50	0.60	(0.40)	Stiff light brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to angular fine to coarse of limestone.	0.50
1.00	B3		64.10	1.00	(0.40)	Stiff dark grey slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to angular of limestone. Possible weathered rock.	1.00
1.00	D4		64.00	1.00	(1.00)	Dark angular COBBLES of limestone with dark clayey subangular to angular fine to coarse GRAVEL of limestone.	1.00
1.00	E55		64.00	1.00	(1.00)	End of trial pit at 1.00m	1.00
Remarks: No groundwater encountered		Water Strikes:		Stability: Stable		Width: 0.50	
Terminated on possible bedrock		Struck at (m):		Remarks:		Length: 3.00	

CAUSEWAY GEOTECH		Project No.: 18-0827	Project Name: Lands at Ballymakilly	Trial Pit No.: TP04			
Method: Trial Pitting		Co-ordinates: 302908.22 E 232126.02 N	Client: BCEI Client's Representative: BCEI	Scale: 1:25 Sheet 1 of 1			
Plant: BT Tracked Excavator		Ground Level: 64.16 mOD	Date: 24/07/2018	Logger: MMC			
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Depth (m)
0.50	B1		63.86	0.30	(0.30)	TOPSOIL	0.50
0.50	D2		63.56	0.50	(0.50)	Brownish grey slightly sandy slightly gravelly SILT with low cobble content. Sand is fine to coarse. Gravel is subangular to angular of limestone. Cobbles are subangular to subrounded of limestone.	0.50
0.50	E53		63.36	0.80	(0.50)	Grey sandy clayey angular fine to coarse GRAVEL of limestone. Sand is fine to coarse (Possible Weathered Bedrock)	0.50
1.00	B4		62.86	1.30	(0.50)	End of trial pit at 1.30m	1.00
Remarks: No groundwater encountered		Water Strikes:		Stability: Stable		Width: 0.80	
Terminated on possible bedrock		Struck at (m):		Remarks:		Length: 3.00	

CAUSEWAY GEOTECH		Project No.: 18-0827	Project Name: Lands at Ballymakilly	Trial Pit No.: TP05			
Method: Trial Pitting		Co-ordinates: 302951.53 E 232053.03 N	Client: BCEI Client's Representative: BCEI	Scale: 1:25 Sheet 1 of 1			
Plant: BT Tracked Excavator		Ground Level: 68.74 mOD	Date: 25/07/2018	Logger: MMC			
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Depth (m)
0.50	B1		68.54	0.20	(0.20)	TOPSOIL: Firm brown slightly sandy CLAY with rootlets.	0.50
0.50	D2		68.34	0.40	(0.20)	Light grey sandy tabular fine to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Cobbles are tabular of limestone.	0.50
0.50	E53		68.34	0.40	(0.40)	End of trial pit at 0.40m	0.50
Remarks: No groundwater encountered		Water Strikes:		Stability: Stable		Width: 1.00	
Terminated on possible boulder		Struck at (m):		Remarks:		Length: 3.00	

CAUSEWAY GEOTECH		Project No.: 18-0827	Project Name: Lands at Ballymakally	Trial Pit No.: TP06				
Method: Trial Pitting		Co-ordinates: 302687.48 E 232061.61 N	Client: BCEI Client's Representative: BCEI	Sheet 1 of 1 Scale: 1:25				
Plant: ST Tracked Excavator		Ground Level: 66.77 mOD	Date: 23/07/2018	Logger: MMC				
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Notes	
0.50	B1		66.57	0.20		TOPSOIL: Firm light brown sandy CLAY with rootlets.		
0.50	D2		66.57	0.20		Grey slightly sandy slightly clayey fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Gravel is angular fine to coarse of limestone. Cobbles are angular of limestone.		
0.50	E3		66.17	0.60		Firm to stiff dark brownish grey slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to angular. Cobbles are subangular of limestone.		
1.50	B4		64.47	2.30		Stiff dark grey slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of limestone. Cobbles are subangular of limestone.		
1.50	D5		64.07	0.40				
1.50	E6		64.07	2.70		End of trial pit at 2.70m		
2.50	B7							
2.50	D8							
Remarks					Water Strikes:		Stability:	
No groundwater encountered					Struck at (m):		Stable	
Terminated on possible bedrock					Remarks:		Width: 0.50	
							Length: 3.00	

CAUSEWAY GEOTECH		Project No.: 18-0827	Project Name: Lands at Ballymakally	Trial Pit No.: TP07				
Method: Trial Pitting		Co-ordinates: 302787.78 E 232026.39 N	Client: BCEI Client's Representative: BCEI	Sheet 1 of 1 Scale: 1:25				
Plant: ST Tracked Excavator		Ground Level: 65.63 mOD	Date: 23/07/2018	Logger: MMC				
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Notes	
0.50	B1		65.43	0.20		TOPSOIL: Firm greyish brown slightly sandy CLAY with rootlets. Sand is fine to coarse.		
0.50	D2		65.43	0.20		Stiff light greyish brown slightly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded of limestone. Cobbles are subangular to sub rounded of limestone.		
0.50	E3		64.93	0.70		Stiff dark grey slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to angular fine to coarse of limestone. Cobbles are subangular of limestone.		
1.10	B4		64.43	1.20		End of trial pit at 1.20m		
1.10	D5							
Remarks					Water Strikes:		Stability:	
No groundwater encountered					Struck at (m):		Stable	
Terminated on possible bedrock					Remarks:		Width: 0.50	
							Length: 3.50	

CAUSEWAY GEOTECH		Project No.: 18-0827	Project Name: Lands at Ballymakally	Trial Pit No.: TP08				
Method: Trial Pitting		Co-ordinates: 302879.48 E 232010.68 N	Client: BCEI Client's Representative: BCEI	Sheet 1 of 1 Scale: 1:25				
Plant: ST Tracked Excavator		Ground Level: 64.27 mOD	Date: 23/07/2018	Logger: MMC				
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Notes	
0.50	B1		63.97	0.30		TOPSOIL: Firm light greyish brown slightly sandy CLAY with rootlets.		
0.50	D2		63.97	0.30		Stiff light brown sandy slightly gravelly CLAY. Sand is fine to coarse.		
0.50	E3		63.67	0.60		End of trial pit at 0.60m		
Remarks					Water Strikes:		Stability:	
No groundwater encountered					Struck at (m):		Stable	
Terminated on possible large boulder/bedrock					Remarks:		Width: 0.50	
							Length: 3.50	

CAUSEWAY GEOTECH		Project No.: 18-0827	Project Name: Lands at Ballymakally	Trial Pit No.: TP09				
Method: Trial Pitting		Co-ordinates: 302522.08 E 231967.03 N	Client: BCEI Client's Representative: BCEI	Sheet 1 of 1 Scale: 1:25				
Plant: ST Tracked Excavator		Ground Level: 68.92 mOD	Date: 25/07/2018	Logger: MMC				
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Notes	
0.50	B1		68.72	0.20		TOPSOIL: Firm light greyish brown slightly sandy CLAY with rootlets.		
0.50	D2		68.72	0.20		Light brownish sandy clayey angular fine to coarse GRAVEL of limestone with medium cobble content. Sand is fine to coarse (Possible Weathered Bedrock).		
0.50	E3		68.02	0.90		End of trial pit at 0.90m		
Remarks					Water Strikes:		Stability:	
No groundwater encountered					Struck at (m):		Stable	
Terminated on possible bedrock					Remarks:		Width: 3.00	
							Length: 3.00	

CAUSEWAY GEOTECH		Project No.: 18-0827	Project Name: Lands at Ballymakally	Trial Pit No.: TP10			
Method: Trial Pitting		Co-ordinates: 302622.64 E 231938.93 N	Client: BCEI	Scale: 1:25			
Plant: ST Tracked Excavator		Ground Level: 67.25 mOD	Date: 23/07/2018	Logger: MMC			
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Notes
0.50	B1		67.25	0.20	TOPSOIL	Firm light brown slightly sandy CLAY with rootlets.	
0.50	D2			0.20		Stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of limestone. Cobbles are subangular of limestone.	
0.50	E3			0.80			
1.50	B4		66.25	1.00		Grey subangular to subrounded COBBLES with a fill of sandy clay.	
1.50	D5			0.40			
1.50	E6			1.40		Dark greyish brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Cobbles are subangular to subrounded of limestone.	
				1.30			
			64.55	2.70		End of trial pit at 2.70m	

Remarks: No groundwater encountered		Water Strikes:		Stability: Stable
		Struck at (m):	Remarks:	
				Width: 0.50
				Length: 3.50

Terminated on very stiff clay

CAUSEWAY GEOTECH		Project No.: 18-0827	Project Name: Lands at Ballymakally	Trial Pit No.: TP11			
Method: Trial Pitting		Co-ordinates: 302736.08 E 231938.58 N	Client: BCEI	Scale: 1:25			
Plant: ST Tracked Excavator		Ground Level: 65.85 mOD	Date: 23/07/2018	Logger: MMC			
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Notes
0.50	B1		65.85	0.20	TOPSOIL	Firm greyish brown slightly sandy CLAY with rootlets.	
0.50	D2			0.20		Stiff light yellowish brown sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to angular fine to coarse of limestone.	
0.50	E3			0.40			
0.80	B4		65.25	0.60		Stiff dark grey very sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to angular of limestone. Possible weathered rock.	
0.80	D5			0.40			
			64.85	1.00		End of trial pit at 1.00m	

Remarks: No groundwater encountered		Water Strikes:		Stability: Stable
		Struck at (m):	Remarks:	
				Width: 0.60
				Length: 4.00

Terminated on possible bedrock

CAUSEWAY GEOTECH		Project No.: 18-0827	Project Name: Lands at Ballymakally	Trial Pit No.: TP12			
Method: Trial Pitting		Co-ordinates: 302853.34 E 231875.36 N	Client: BCEI	Scale: 1:25			
Plant: BT Tracked Excavator		Ground Level: 64.93 mOD	Date: 20/08/2018	Logger: MMC			
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Notes
0.50	B1		64.93	0.30	TOPSOIL	Brownish grey sandy CLAY with rootlets.	
0.50	D2			0.30		Firm to stiff light brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular and tabular of limestone. Cobbles are tabular of limestone.	
0.50	E3			0.80			
1.50	B4		63.83	1.10		Stiff dark grey slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is tabular of limestone. Cobbles are tabular of limestone.	
1.50	D5			0.50			
1.50	E6			1.60		Soft to firm dark grey slightly sandy very gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular of limestone. Cobbles are tabular of limestone. Possible weathered bedrock.	
2.00	B7		62.73	2.00		End of trial pit at 2.20m	
2.00	D8	Groundwater encountered at 2.20m					

Remarks: No groundwater encountered		Water Strikes:		Stability: Stable
		Struck at (m):	Remarks:	
		2.20	Groundwater encountered at 2.20m	Width: 0.80
				Length: 3.50

Terminated on possible bedrock

CAUSEWAY GEOTECH		Project No.: 18-0827	Project Name: Lands at Ballymakally	Trial Pit No.: TP13			
Method: Trial Pitting		Co-ordinates: 302498.69 E 231859.71 N	Client: BCEI	Scale: 1:25			
Plant: BT Tracked Excavator		Ground Level: 67.45 mOD	Date: 24/07/2018	Logger: MMC			
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Notes
0.50	B1		67.45	0.30	TOPSOIL		
0.50	D2			0.30		Stiff light greyish brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to angular of limestone.	
0.50	E3			0.40			
1.50	B4		66.75	0.70		Stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to angular of limestone. Cobbles are subangular to angular of limestone.	
1.50	D5			0.50			
1.50	E6			1.40			
2.40	B7		65.35	2.10		Very stiff dark grey slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subrounded.	
2.40	D8			0.70			
			64.65	2.80		End of trial pit at 2.80m	

Remarks: No groundwater encountered		Water Strikes:		Stability: Stable
		Struck at (m):	Remarks:	
				Width: 0.80
				Length: 3.50

Terminated on very stiff clay

CAUSEWAY GEOTECH		Project No.: 18-0827	Project Name: Lands at Ballymakally	Trial Pit No.: TP15																		
Method: Trial Pitting		Co-ordinates: 302690.86 E 231794.82 N	Client: BCEI	Sheet 1 of 1																		
Plant: BT Tracked Excavator		Ground Level: 66.11 mOD	Client's Representative: BCEI	Scale: 1:25																		
Date: 24/07/2018		Logger: MMC																				
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Remarks															
0.50	B1 D2 E53		65.81	0.30	(0.30)	TOPSOIL: Light brown sandy CLAY with some rootlets.																
0.50			65.81	0.30	(0.30)	Firm to stiff light brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to angular of limestone. Cobbles are subrounded of limestone.																
1.50	B4 D5 E56		64.81	1.30	(1.00)	Firm dark grey slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to angular of limestone.																
1.50			64.81	1.30	(1.20)	Firm dark grey slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to angular of limestone.																
2.40	B7 D8	Seepage at 2.60m	63.61	2.50	(0.30)	Very dark grey angular to tabular COBBLES of limestone with sandy very gravelly infill. Sand is fine to coarse. Gravel is subangular to angular of limestone. Cobbles are angular and tabular of limestone. (Possible Weathered bedrock)																
2.40			63.31	2.80		End of trial pit at 2.80m																
<table border="1"> <tr> <th colspan="2">Water Strikes:</th> <th>Stability:</th> </tr> <tr> <td>Struck at (m):</td> <td>Remarks:</td> <td>Stable</td> </tr> <tr> <td>2.60</td> <td>Seepage at 2.60m</td> <td></td> </tr> <tr> <td colspan="2">Width: 0.80</td> <td></td> </tr> <tr> <td colspan="2">Length: 3.50</td> <td></td> </tr> </table>								Water Strikes:		Stability:	Struck at (m):	Remarks:	Stable	2.60	Seepage at 2.60m		Width: 0.80			Length: 3.50		
Water Strikes:		Stability:																				
Struck at (m):	Remarks:	Stable																				
2.60	Seepage at 2.60m																					
Width: 0.80																						
Length: 3.50																						
Remarks: Terminated on possible bedrock																						

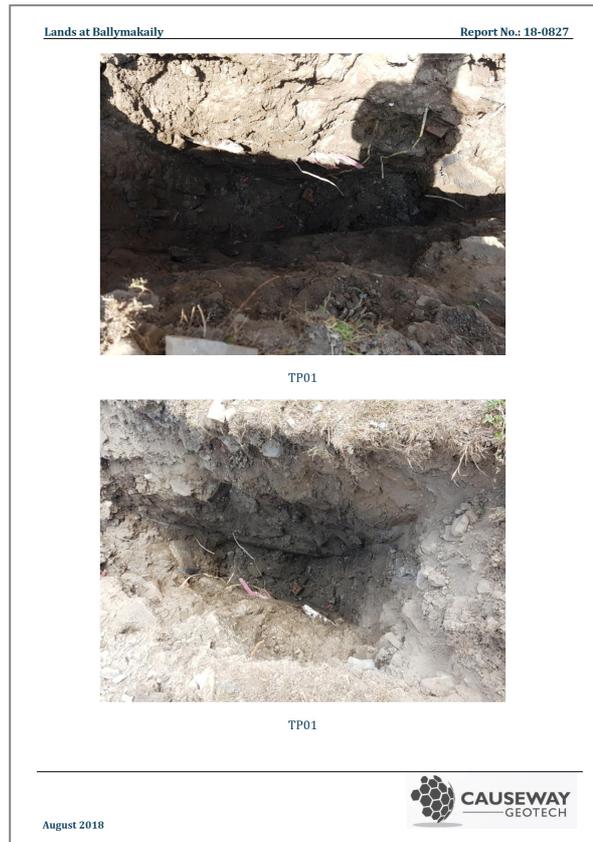
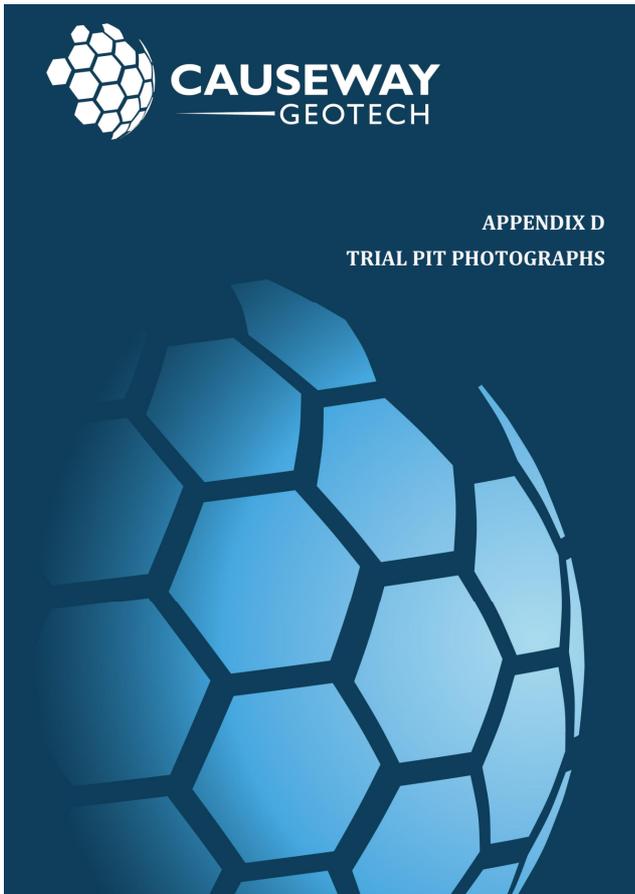
CAUSEWAY GEOTECH		Project No.: 18-0827	Project Name: Lands at Ballymakally	Trial Pit No.: TP14																		
Method: Trial Pitting		Co-ordinates: 302603.77 E 231860.37 N	Client: BCEI	Sheet 1 of 1																		
Plant: BT Tracked Excavator		Ground Level: 66.92 mOD	Client's Representative: BCEI	Scale: 1:25																		
Date: 23/07/2018		Logger: MMC																				
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Remarks															
0.50	B1 D2		66.72	0.20	(0.20)	Firm light greyish brown slightly sandy CLAY with rootlets.																
0.50			66.72	0.20	(0.20)	Light brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to angular of limestone. Cobbles are subangular of limestone.																
1.50	B3 D4		66.02	0.90	(0.30)	Grey slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to angular of limestone. Cobbles are subangular of limestone.																
1.50			65.33	1.20	(0.60)	Firm dark grey slightly sandy slightly gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of limestone. Cobbles are subangular to subrounded of limestone.																
2.00	B6 D6	Seepage at 2.10	65.32	1.80	(0.40)	Soft to firm dark grey slightly sandy slightly gravelly CLAY with low cobble content and high boulder content. Sand is fine to coarse. Gravel is subangular to angular of limestone. Cobbles and boulders are subangular of limestone.																
2.00			64.72	2.20		End of trial pit at 2.20m																
<table border="1"> <tr> <th colspan="2">Water Strikes:</th> <th>Stability:</th> </tr> <tr> <td>Struck at (m):</td> <td>Remarks:</td> <td>Stable</td> </tr> <tr> <td>2.10</td> <td>Seepage at 2.10</td> <td></td> </tr> <tr> <td colspan="2">Width: 0.50</td> <td></td> </tr> <tr> <td colspan="2">Length: 3.50</td> <td></td> </tr> </table>								Water Strikes:		Stability:	Struck at (m):	Remarks:	Stable	2.10	Seepage at 2.10		Width: 0.50			Length: 3.50		
Water Strikes:		Stability:																				
Struck at (m):	Remarks:	Stable																				
2.10	Seepage at 2.10																					
Width: 0.50																						
Length: 3.50																						
Remarks: Terminated on possible bedrock																						

CAUSEWAY GEOTECH		Project No.: 18-0827	Project Name: Lands at Ballymakally	Trial Pit No.: TP16																		
Method: Trial Pitting		Co-ordinates: 302809.71 E 231763.22 N	Client: BCEI	Sheet 1 of 1																		
Plant: BT Tracked Excavator		Ground Level: 65.56 mOD	Client's Representative: BCEI	Scale: 1:25																		
Date: 24/07/2018		Logger: MMC																				
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Remarks															
0.50	B1 D2 E53		65.26	0.30	(0.30)	TOPSOIL: Light greyish brown sandy CLAY with rootlets. Sand is fine to coarse.																
0.50			65.26	0.30	(0.30)	Firm to stiff light brown slightly sandy slightly gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular to angular of limestone. Cobbles are angular and tabular of limestone.																
1.50	B4 D5 E56		64.36	1.20	(0.70)	Soft dark grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to tabular fine to coarse of limestone. Cobbles are angular and tabular of limestone.																
1.50		Groundwater encountered at 1.90m	63.66	1.90		End of trial pit at 1.90m																
<table border="1"> <tr> <th colspan="2">Water Strikes:</th> <th>Stability:</th> </tr> <tr> <td>Struck at (m):</td> <td>Remarks:</td> <td>Stable</td> </tr> <tr> <td>1.90</td> <td>Groundwater encountered at 1.90m</td> <td></td> </tr> <tr> <td colspan="2">Width: 0.80</td> <td></td> </tr> <tr> <td colspan="2">Length: 3.00</td> <td></td> </tr> </table>								Water Strikes:		Stability:	Struck at (m):	Remarks:	Stable	1.90	Groundwater encountered at 1.90m		Width: 0.80			Length: 3.00		
Water Strikes:		Stability:																				
Struck at (m):	Remarks:	Stable																				
1.90	Groundwater encountered at 1.90m																					
Width: 0.80																						
Length: 3.00																						
Remarks: Terminated on possible bedrock																						

CAUSEWAY GEOTECH		Project No.: 18-0827	Project Name: Lands at Ballymakally	Trial Pit No.: TP17																		
Method: Trial Pitting		Co-ordinates: 302475.99 E 231721.45 N	Client: BCEI	Sheet 1 of 1																		
Plant: BT Tracked Excavator		Ground Level: 67.75 mOD	Client's Representative: BCEI	Scale: 1:25																		
Date: 24/07/2018		Logger: MMC																				
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Remarks															
0.50	B1 D2 E53		67.45	0.30	(0.30)	TOPSOIL: Firm light greyish brown sandy CLAY with some rootlets. Sand is fine to coarse.																
0.50			67.45	0.30	(0.30)	Firm to stiff light brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to angular fine to coarse of limestone.																
0.50			67.05	0.70	(0.40)	Light grey gravelly angular COBBLES of limestone. Gravel is subangular to angular fine to coarse of limestone.																
1.50	B4 D5 E56		66.65	1.10	(1.10)	Firm to stiff greyish brown slightly sandy slightly gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular fine to coarse of limestone. Cobbles are subangular to angular of limestone.																
1.50			65.55	2.20	(0.50)	Firm dark grey slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to angular of limestone. Cobbles are angular of limestone.																
2.50	B7 D8		65.05	2.70		End of trial pit at 2.70m																
<table border="1"> <tr> <th colspan="2">Water Strikes:</th> <th>Stability:</th> </tr> <tr> <td>Struck at (m):</td> <td>Remarks:</td> <td>Stable</td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="2">Width: 0.30</td> <td></td> </tr> <tr> <td colspan="2">Length: 3.50</td> <td></td> </tr> </table>								Water Strikes:		Stability:	Struck at (m):	Remarks:	Stable				Width: 0.30			Length: 3.50		
Water Strikes:		Stability:																				
Struck at (m):	Remarks:	Stable																				
Width: 0.30																						
Length: 3.50																						
Remarks: No groundwater encountered																						
Remarks: Terminated on possible bedrock																						

CAUSEWAY GEOTECH		Project No.: 18-0827	Project Name: Lands at Ballymakilly	Trial Pit No.: TP18			
Method: Trial Pitting		Co-ordinates: 302575.82 E 231703.10 N	Client: BCEI Client's Representative: BCEI	Sheet 1 of 1 Scale: 1:25			
Plant: BT Tracked Excavator		Ground Level: 67.00 mOD	Date: 24/07/2018	Logger: MMC			
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Notes
0.50	B1		66.70	0.30	(0.30)	TOPSOIL: Light greyish brown slightly sandy CLAY with some rootlets.	
0.50	D2		66.00	1.00	(0.70)	Light greyish brown slightly sandy slightly gravelly CLAY. Sand is finer to coarse. Gravel is angular fine to coarse of limestone.	
1.50	B3		65.30	1.70	(0.70)	Stiff dark brown slightly sandy slightly gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular fine to coarse of limestone. Cobbles are angular of limestone.	
1.50	D4		64.90	2.10	(0.40)	Stiff dark grey slightly sandy CLAY with high boulder content. Sand is fine to coarse. Boulder are angular of limestone. Possible weathered rock.	
End of trial pit at 2.10m							
Remarks: No groundwater encountered		Water Strikes:		Stability: Stable			
Terminated on possible bedrock		Struck at (m):		Remarks:		Width: 2.10 Length: 2.10	

CAUSEWAY GEOTECH		Project No.: 18-0827	Project Name: Lands at Ballymakilly	Trial Pit No.: TP19			
Method: Trial Pitting		Co-ordinates: 302717.93 E 231651.79 N	Client: BCEI Client's Representative: BCEI	Sheet 1 of 1 Scale: 1:25			
Plant: BT Tracked Excavator		Ground Level: 66.55 mOD	Date: 24/07/2018	Logger: MMC			
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Notes
0.50	B1		66.25	0.30	(0.30)	TOPSOIL: Firm light brown sandy CLAY with rootlets.	
0.50	D2		65.55	1.00	(0.70)	Light greyish brown slightly sandy very gravelly CLAY. Sand is fine to coarse. Gravel is subangular to angular fine to coarse of limestone.	
1.10	ES3		64.85	1.70	(0.20)	Stiff grey slightly sandy very gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular fine to coarse of limestone. Cobbles and boulders are angular of limestone.	
1.50	B4		64.65	1.90	(0.20)	Grey angular COBBLES and BOULDERS of limestone with sandy gravelly clay infill. Sand is fine to coarse. Gravel is angular fine to coarse of limestone. Possible weathered rock.	
1.50	D5						
1.50	ES6						
End of trial pit at 1.90m							
Remarks: No groundwater encountered		Water Strikes:		Stability: Stable			
Terminated on possible bedrock		Struck at (m):		Remarks:		Width: 0.80 Length: 3.00	



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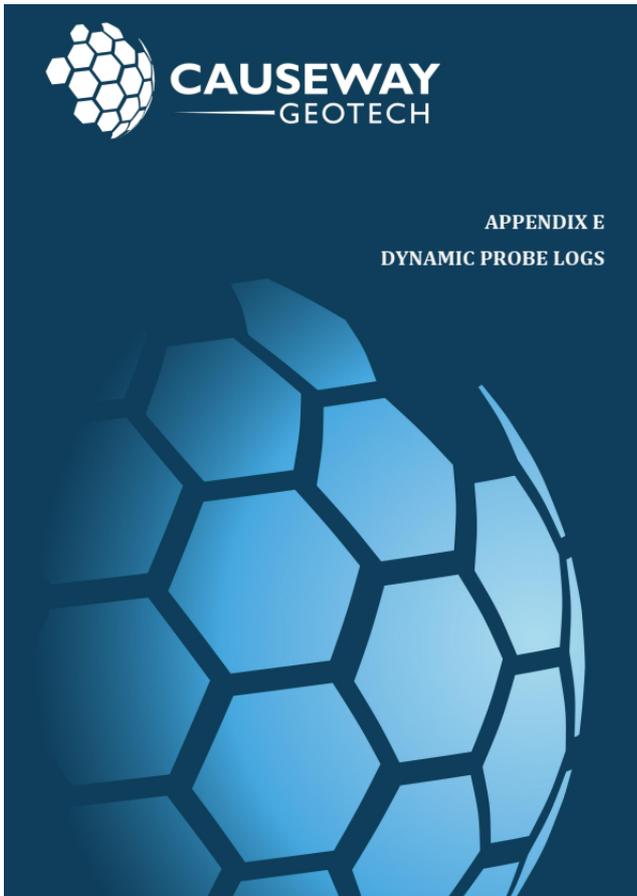
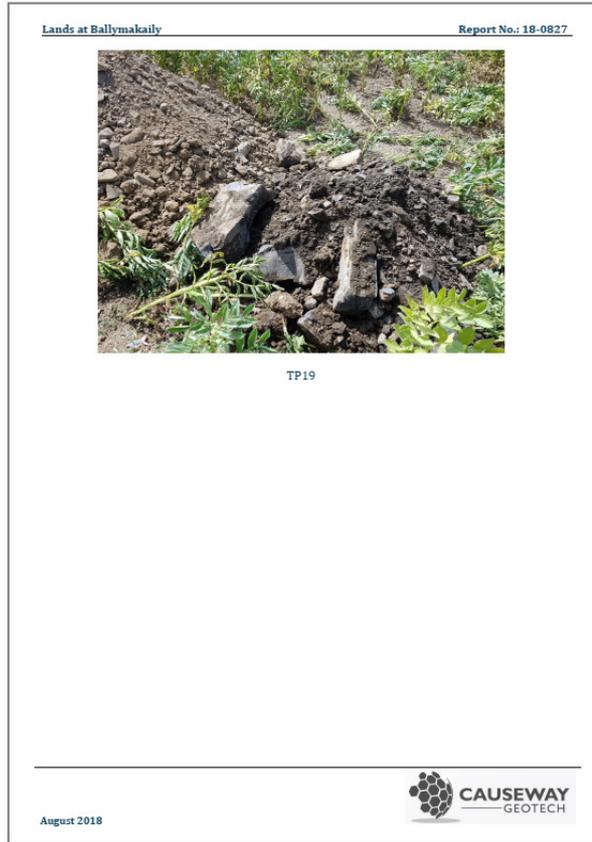


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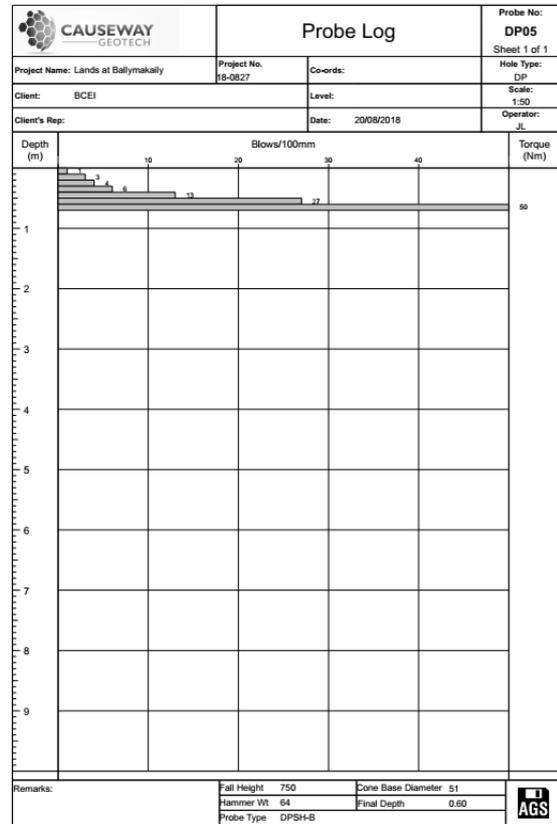
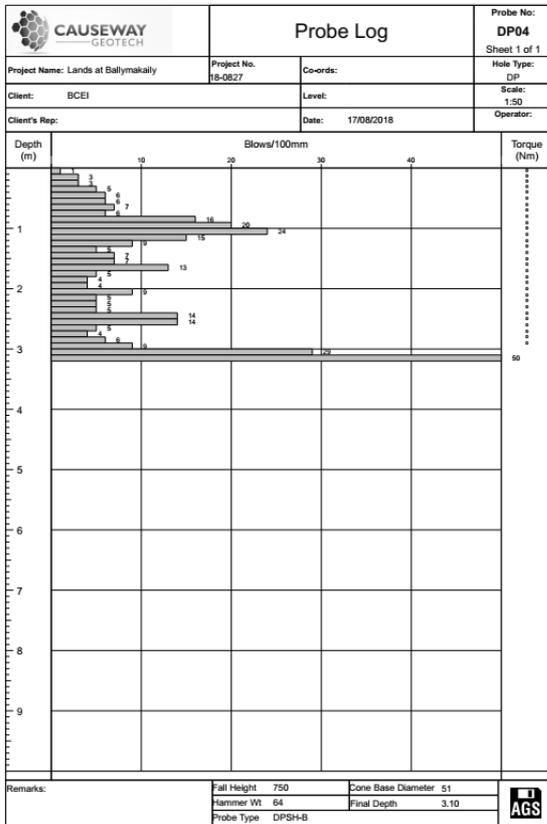
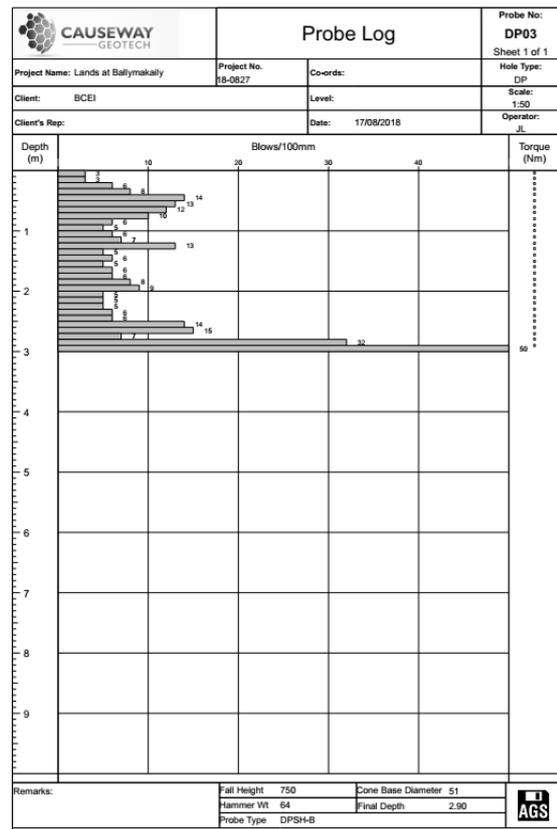
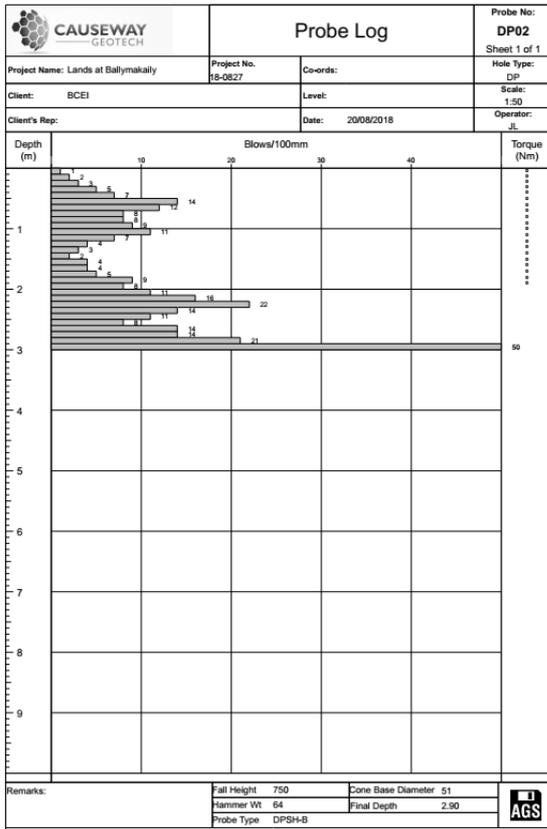
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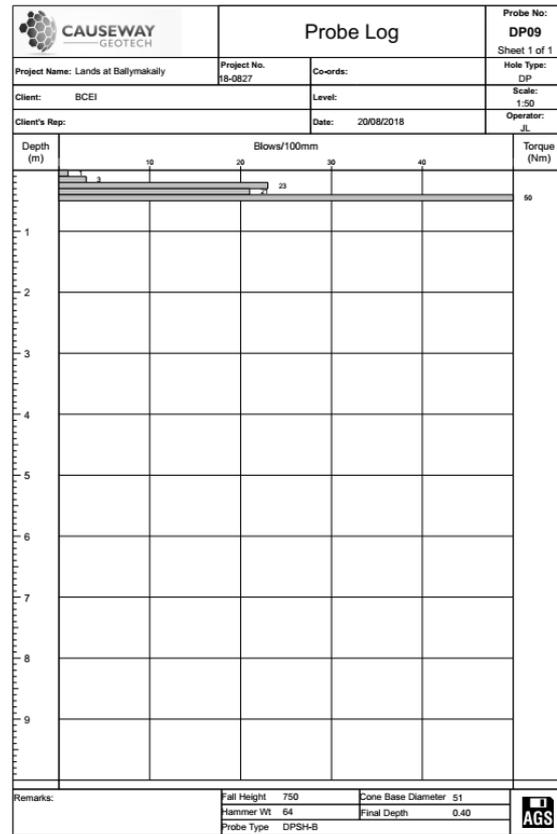
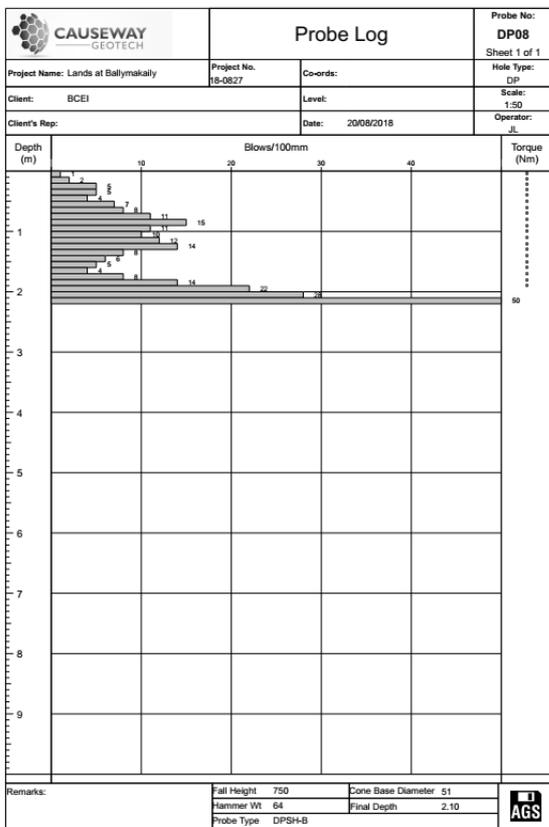
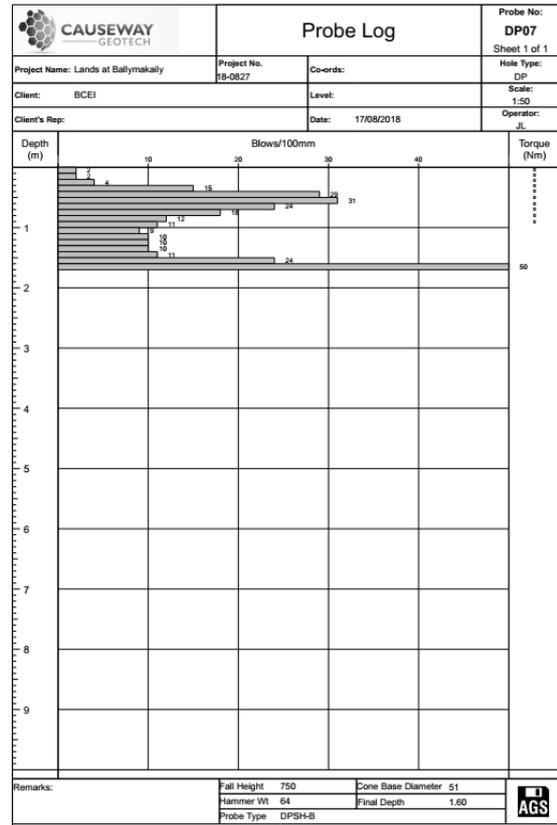
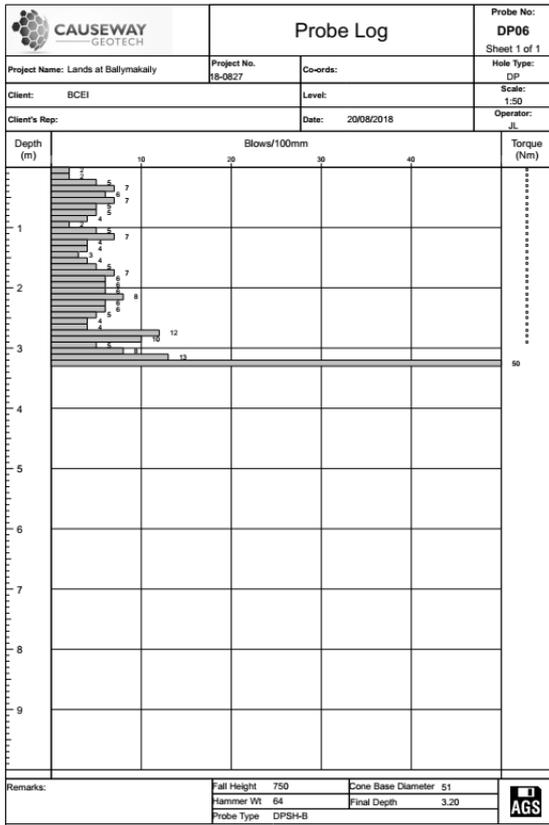
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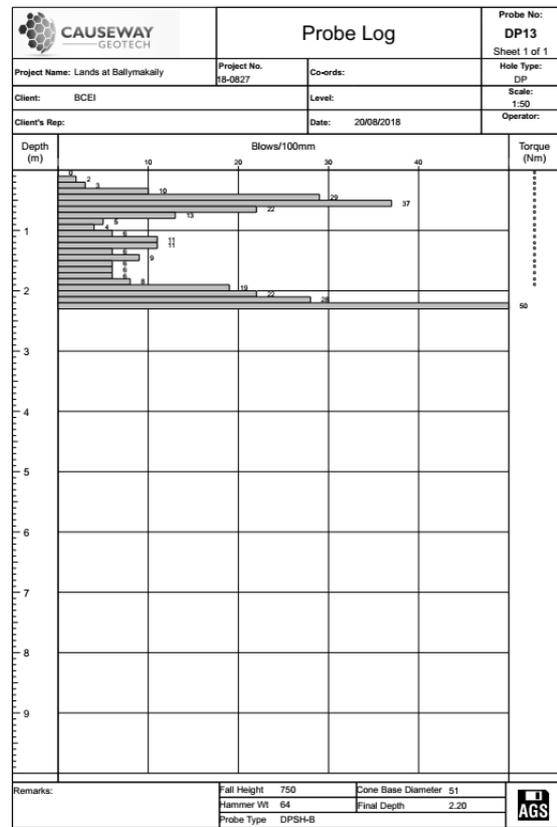
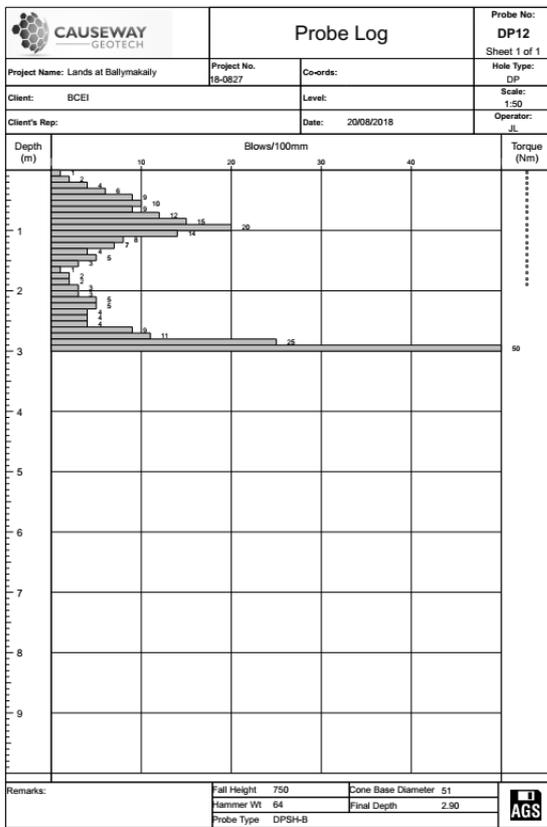
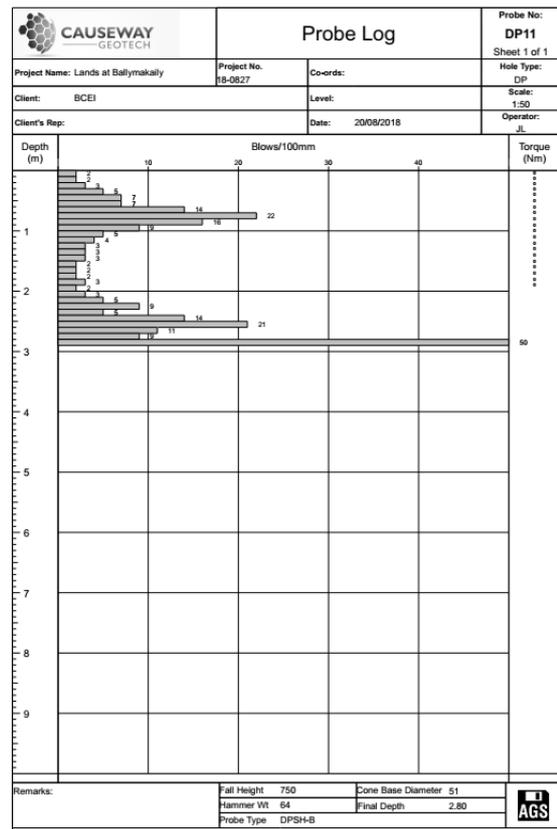
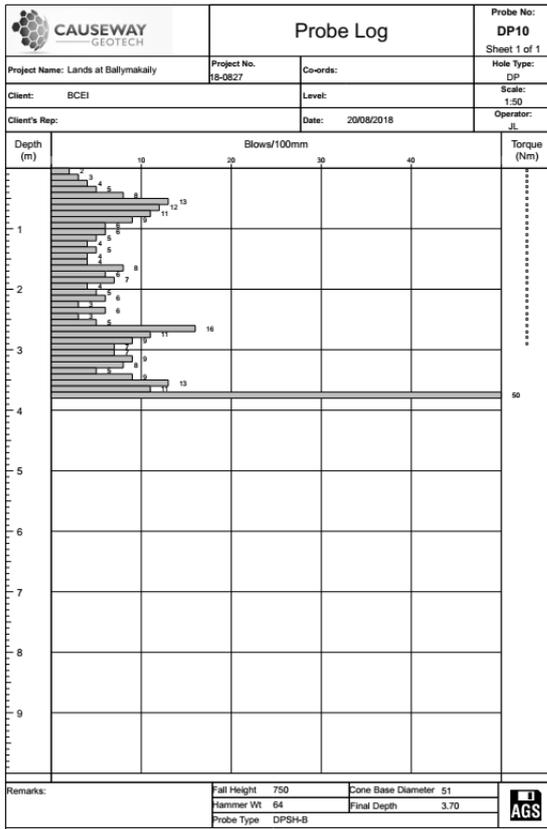
August 2018

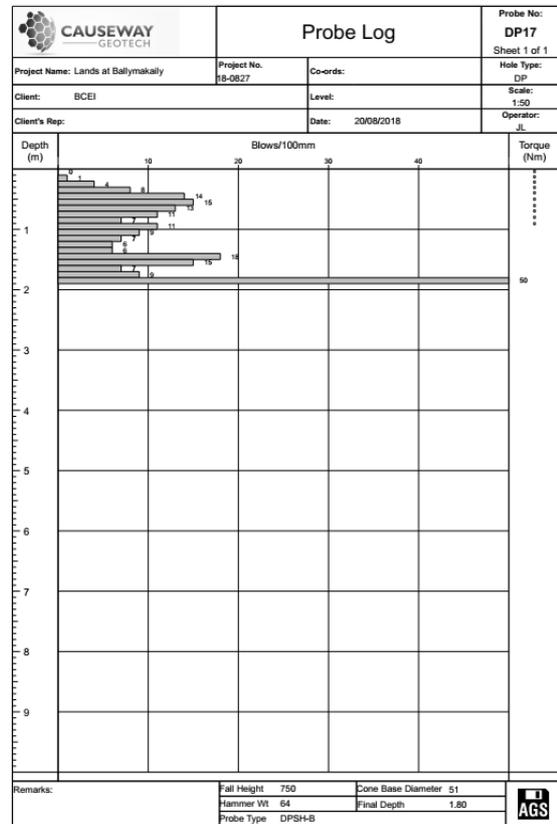
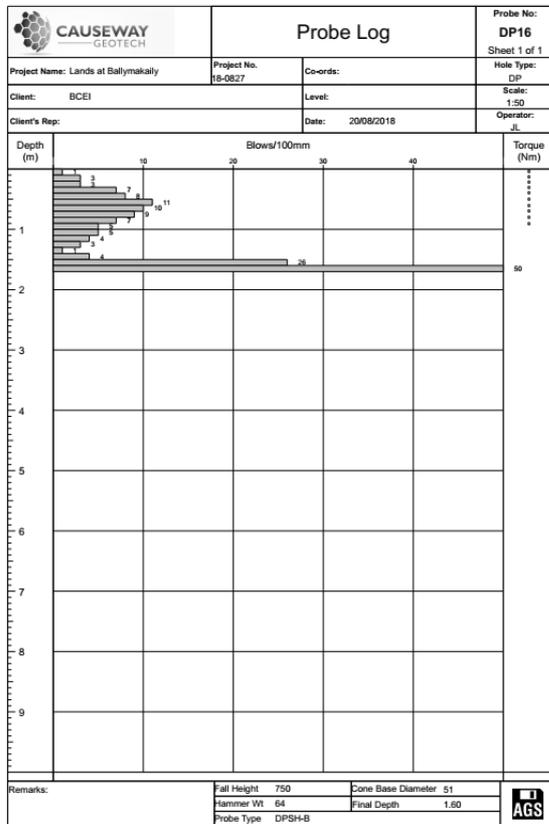
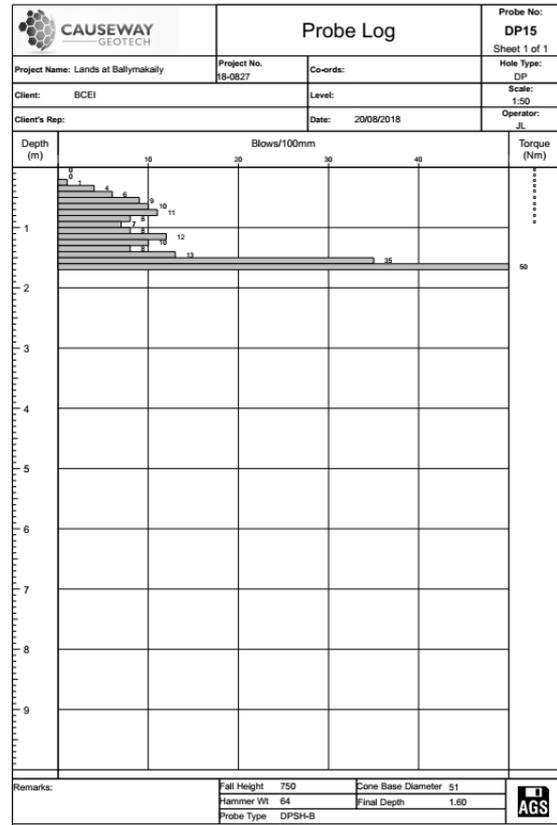
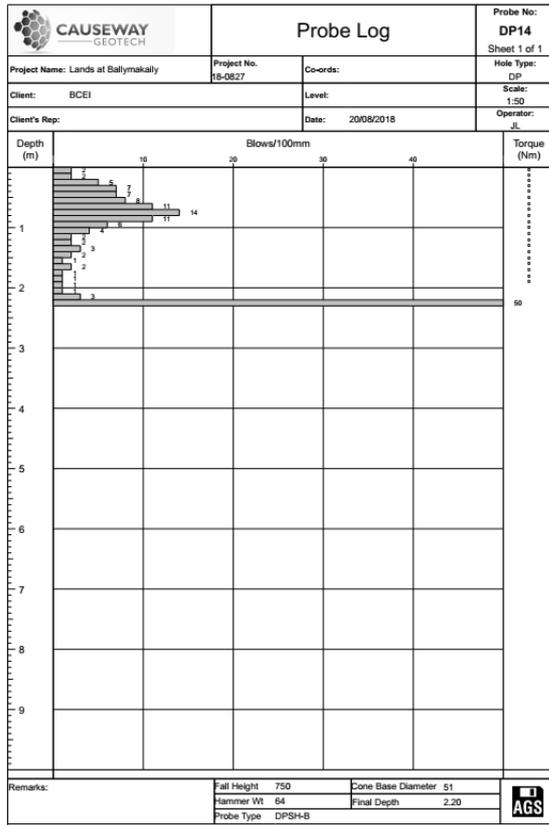


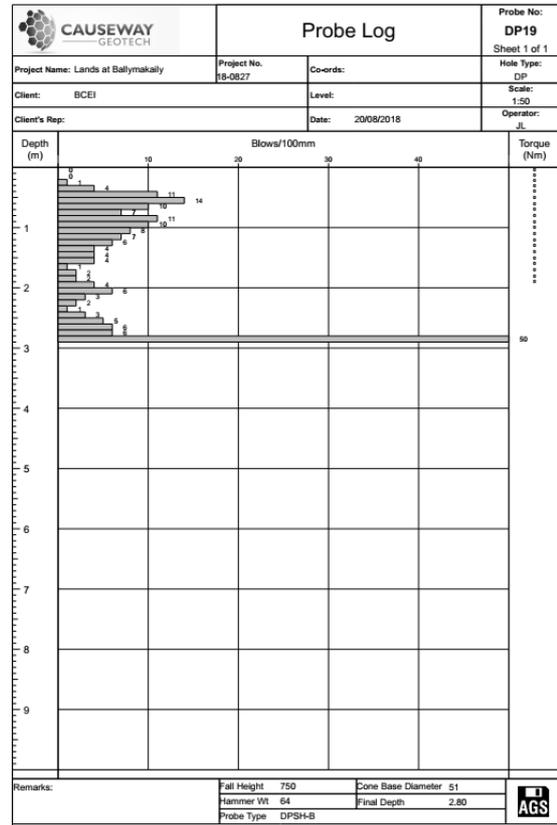
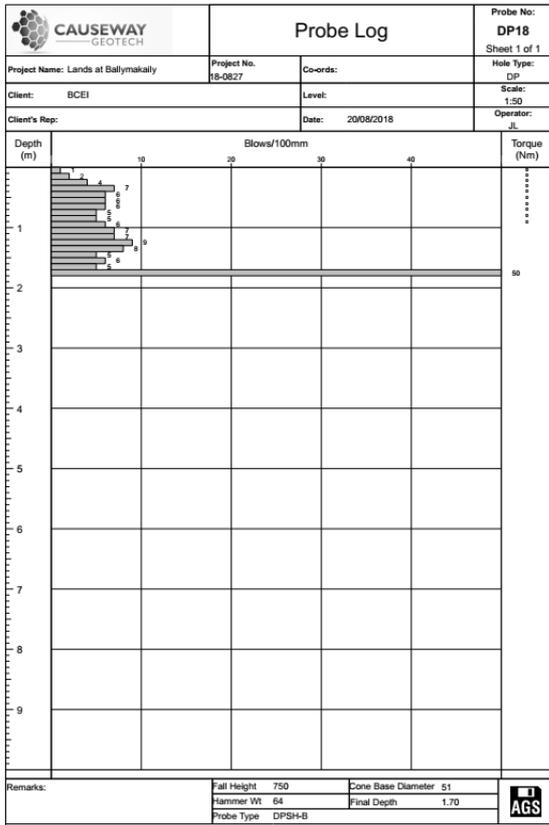
CAUSEWAY GEOTECH		Probe Log		Probe No: DP01
Project Name: Lands at Ballymakailly		Project No: 18-0827	Co-ords:	Sheet 1 of 1
Client: BCEI		Level:		Hole Type: DP
Client's Rep:		Date: 20/08/2018		Scale: 1:50
				Operator: JL
Depth (m)	Blows/100mm			Torque (Nm)
0	4	13	14	
1	16			
2	13	23		
3				50
4				
5				
6				
7				
8				
9				
Remarks:		Fall Height 750	Cone Base Diameter 51	AGS
		Hammer Wt 64	Final Depth 2.70	
		Probe Type DP5H-B		







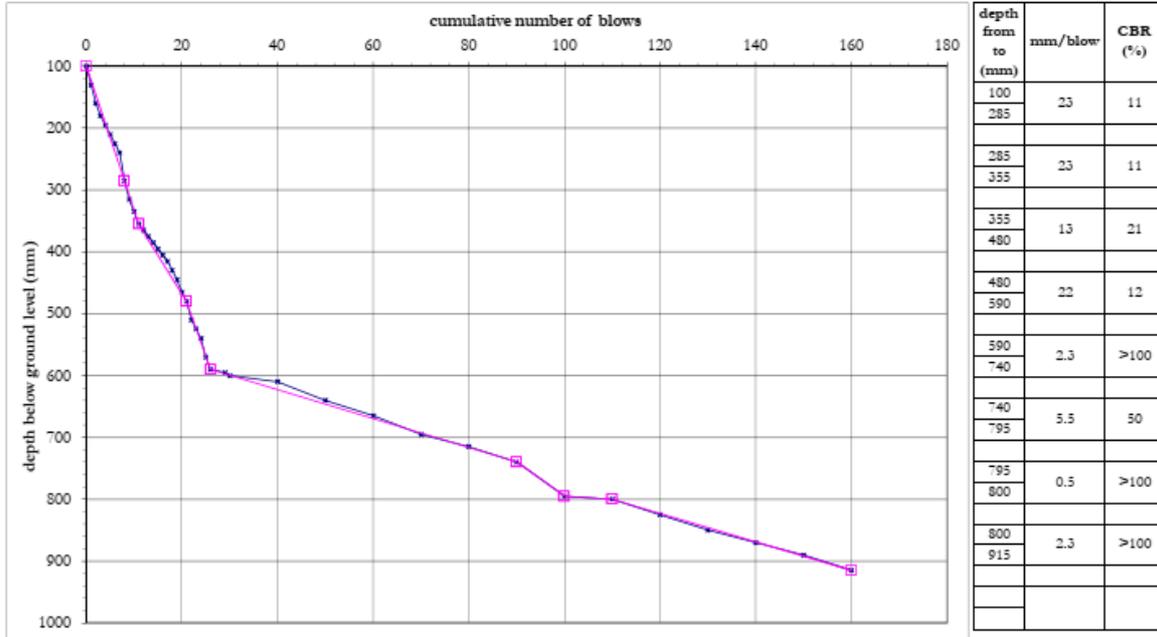






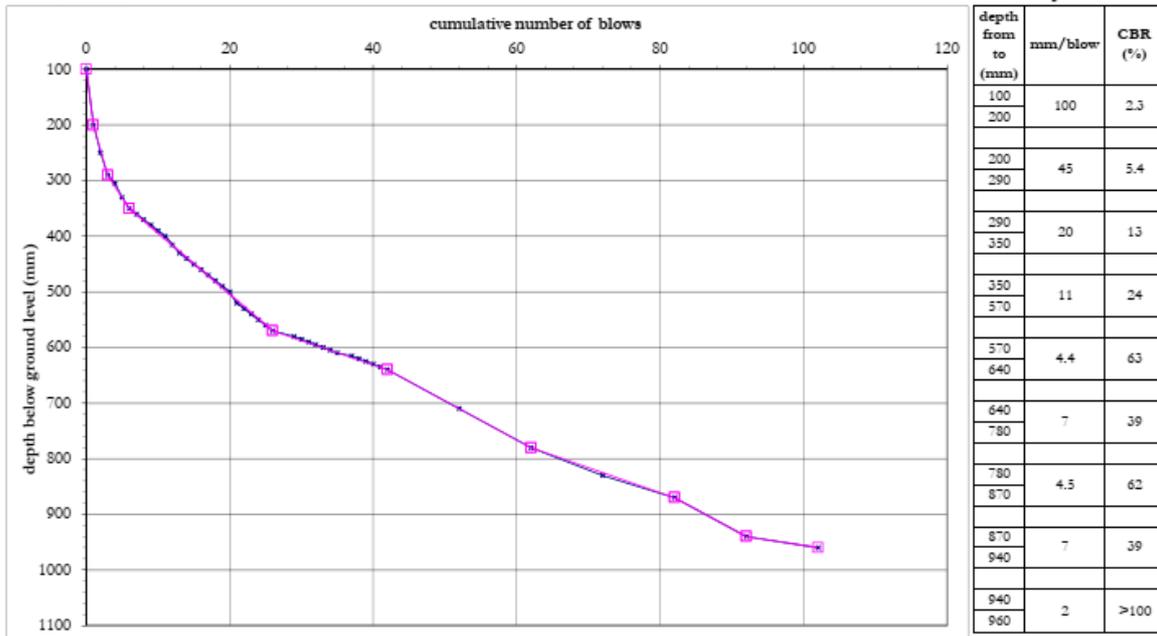
Causeway Geotech Ltd  
 Dynamic Cone Penetrometer (DCP) test results and estimated CBR  
 Project: Lands at Ballymakailly  
 Test Number: TP03

CBR estimated using TRL Road Note 8:  
 $\text{Log CBR} = 2.48 - 1.057 \text{ Log (mm/blow)}$   
 Project No: 18-0827  
 Date: 25-Jul-18



Causeway Geotech Ltd  
 Dynamic Cone Penetrometer (DCP) test results and estimated CBR  
 Project: Lands at Ballymakailly  
 Test Number: TP04

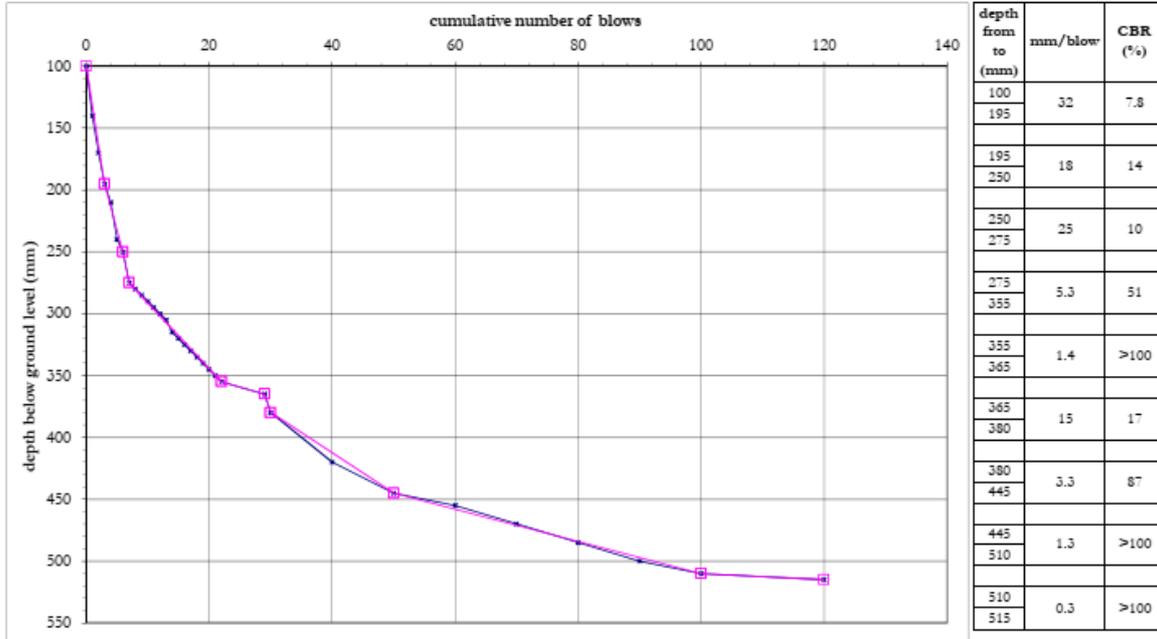
CBR estimated using TRL Road Note 8:  
 $\text{Log CBR} = 2.48 - 1.057 \text{ Log (mm/blow)}$   
 Project No: 18-0827  
 Date: 25-Jul-18





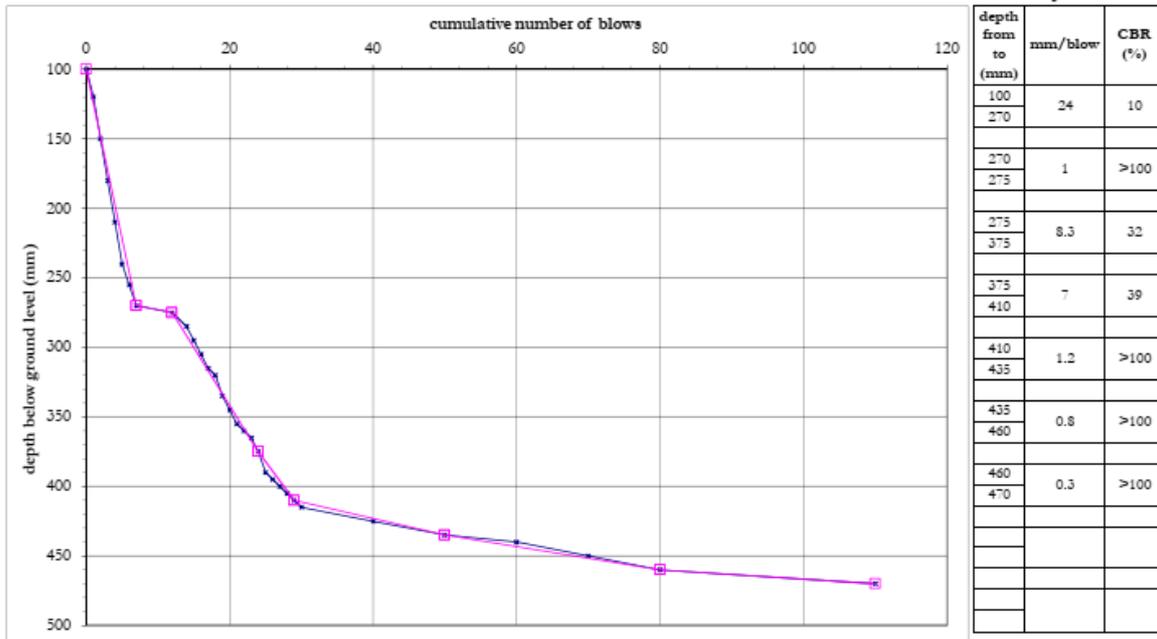
Causeway Geotech Ltd  
 Dynamic Cone Penetrometer (DCP) test results and estimated CBR  
 Project: Lands at Ballymakailly  
 Test Number: TP07

CBR estimated using TRL Road Note 8:  
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 Project No: 18-0827  
 Date: 25-Jul-18



Causeway Geotech Ltd  
 Dynamic Cone Penetrometer (DCP) test results and estimated CBR  
 Project: Lands at Ballymakailly  
 Test Number: TP08

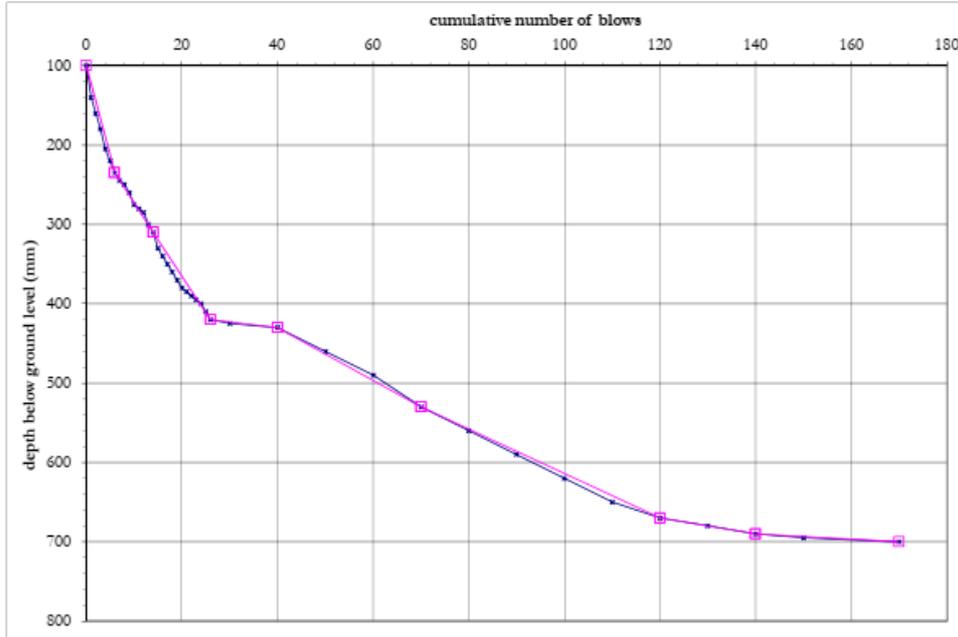
CBR estimated using TRL Road Note 8:  
 $\text{Log CBR} = 2.48 - 1.057 \text{ Log (mm/blow)}$   
 Project No: 18-0827  
 Date: 25-Jul-18





Causeway Geotech Ltd  
 Dynamic Cone Penetrometer (DCP) test results and estimated CBR  
 Project: Lands at Ballymakailly  
 Test Number: TP11

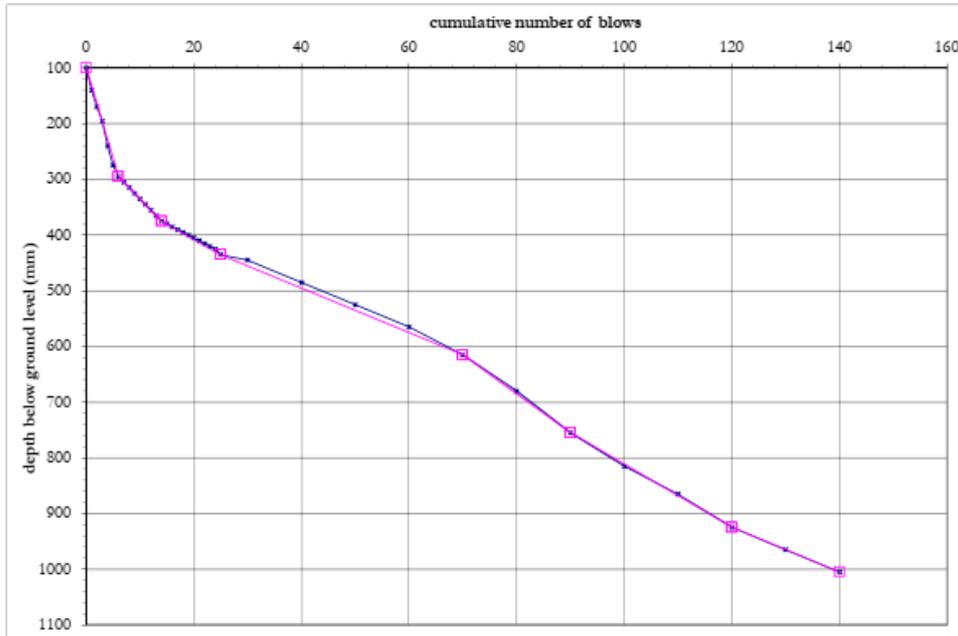
CBR estimated using TRL Road Note 8:  
 $\text{Log CBR} = 2.48 - 1.057 \text{ Log (mm/blow)}$   
 Project No: 18-0827  
 Date: 25-Jul-18



depth from to (mm)	mm/blow	CBR (%)
100	23	11
235		
235	9.4	28
310		
310	9.2	29
420		
420	0.7	>100
430		
430	3.3	85
530		
530	2.8	>100
670		
670	1	>100
690		
690	0.3	>100
700		

Causeway Geotech Ltd  
 Dynamic Cone Penetrometer (DCP) test results and estimated CBR  
 Project: Lands at Ballymakailly  
 Test Number: TP12

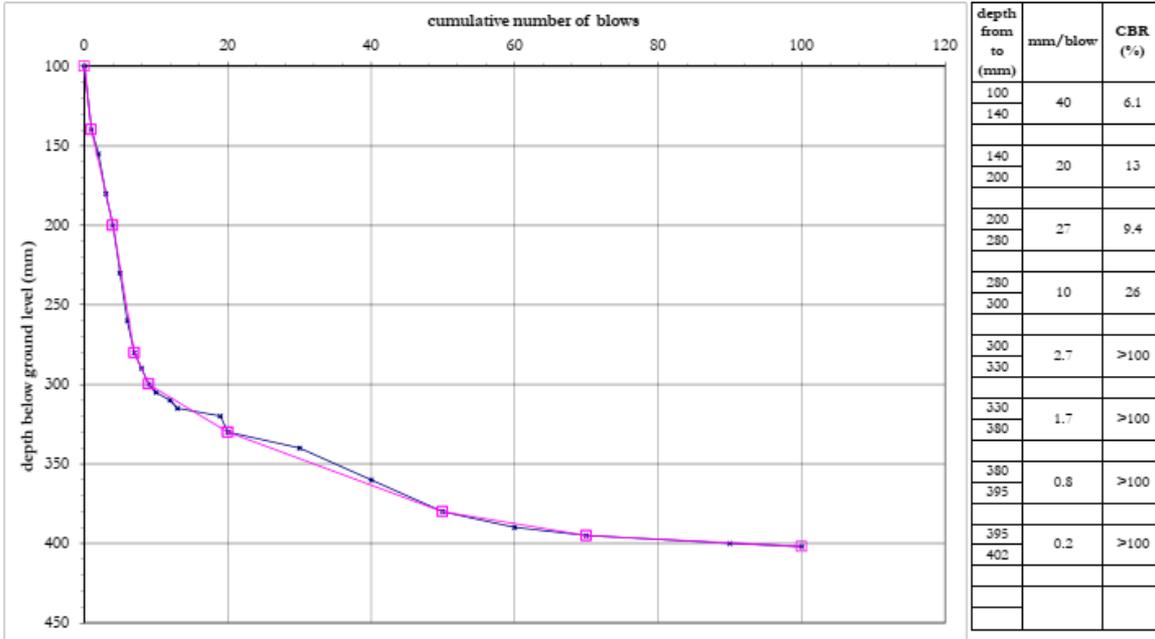
CBR estimated using TRL Road Note 8:  
 $\text{Log CBR} = 2.48 - 1.057 \text{ Log (mm/blow)}$   
 Project No: 18-0827  
 Date: 25-Jul-18



depth from to (mm)	mm/blow	CBR (%)
100	33	7.6
295		
295	10	26
375		
375	5.5	50
435		
435	4	70
615		
615	7	39
755		
755	5.7	48
925		
925	4	70
1005		

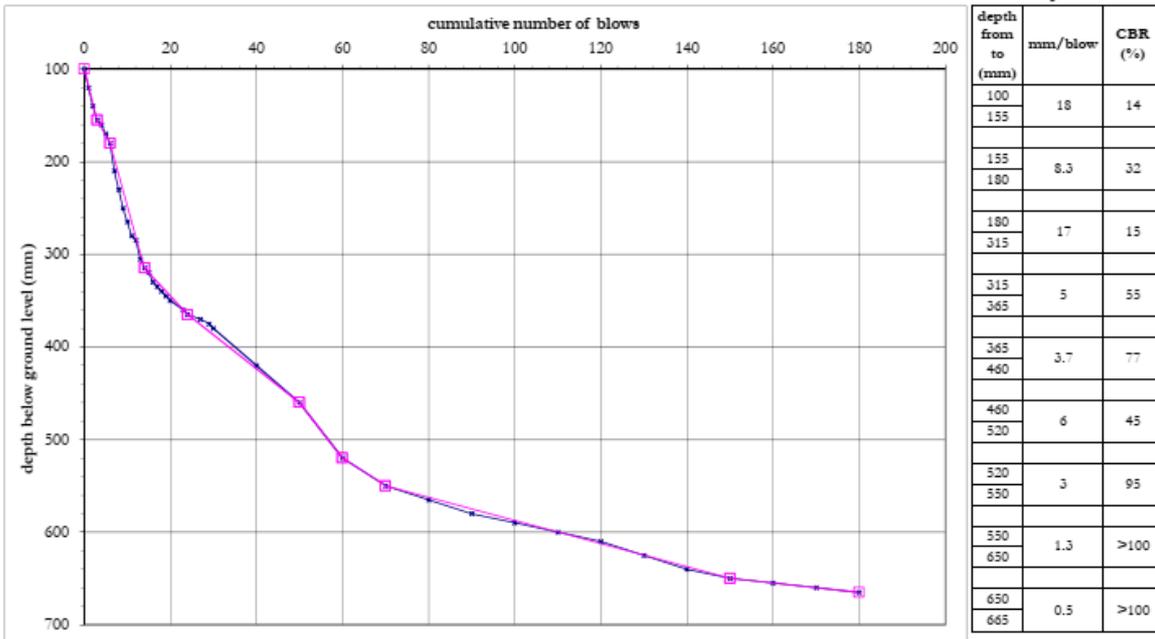
Causeway Geotech Ltd  
 Dynamic Cone Penetrometer (DCP) test results and estimated CBR  
 Project: Lands at Ballymakailly  
 Test Number: TP13

CBR estimated using TRL Road Note 8:  
 $\text{Log CBR} = 2.48 - 1.057 \text{ Log (mm/blow)}$   
 Project No: 18-0827  
 Date: 25-Jul-18



Causeway Geotech Ltd  
 Dynamic Cone Penetrometer (DCP) test results and estimated CBR  
 Project: Lands at Ballymakailly  
 Test Number: TP14

CBR estimated using TRL Road Note 8:  
 $\text{Log CBR} = 2.48 - 1.057 \text{ Log (mm/blow)}$   
 Project No: 18-0827  
 Date: 25-Jul-18







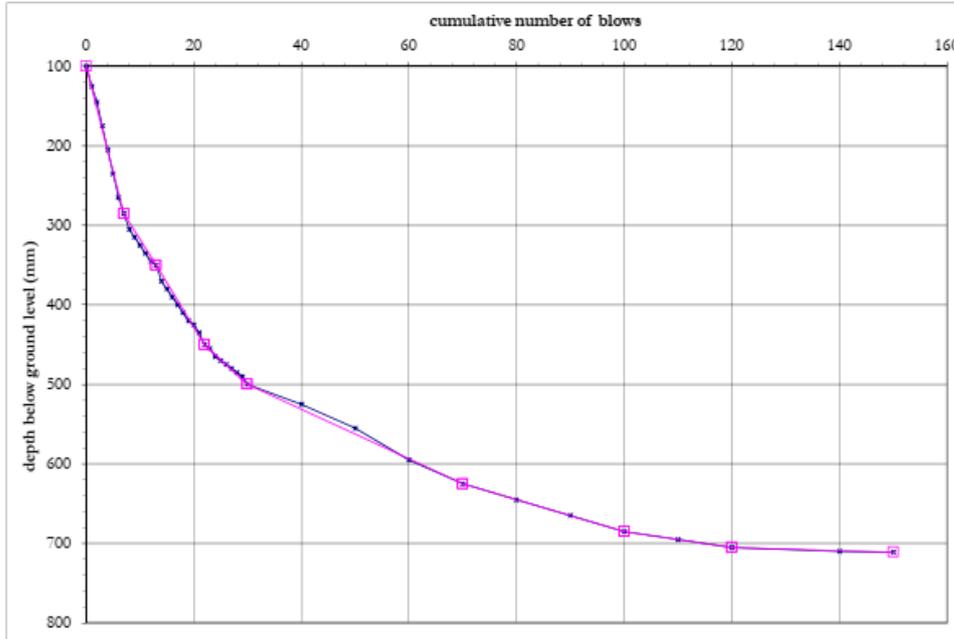
**Causeway Geotech Ltd**  
**Dynamic Cone Penetrometer (DCP) test results and estimated CBR**

**Project:** Lands at Ballymakailly  
**Test Number:** TP19

CBR estimated using TRL Road Note 8:  
 $\text{Log CBR} = 2.48 - 1.057 \text{ Log (mm/blow)}$

**Project No:** 18-0827

**Date:** 25-Jul-18



depth from to (mm)	mm/blow	CBR (%)
100	26	9.5
285		
285	11	24
350		
350	11	24
450		
450	6.3	44
500		
500	3.1	91
625		
625	2	>100
685		
685	1	>100
705		
705	0.2	>100
711		



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 info@causewaygeotech.com  
 www.causewaygeotech.com

**SOIL AND ROCK SAMPLE ANALYSIS**  
**LABORATORY TEST REPORT**

<b>Project Name:</b>	Lands at Ballymakailly
<b>Project No.:</b>	18-0827
<b>Client:</b>	BCEI
<b>Engineer:</b>	BCEI
<b>Date:</b>	15/08/18

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the Contents page(s).

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.

Approved Signatory

Stephen Watson  
 Laboratory Manager

Signed for and on behalf of Causeway Geotech Ltd

Causeway Geotech Ltd  
 8 Drumahiskey Road, Ballymoney  
 Co. Antrim, N. Ireland, BT53 7QL  
 Registered in Northern Ireland. Company Number: NI520766





+44 (0)28 2766 6640  
info@causewaygeotech.com  
www.causewaygeotech.com

Project Name: Lands at Ballymakilly

Report Reference: 18-0827 – Soils Schedule 1

The table below details the tests carried out, the specifications used, and the number of tests included in this report.

Tests marked with \* in this report are not United Kingdom Accreditation Service (UKAS) accredited and are not included in Causeway Geotech Limited's scope of UKAS Accreditation Schedule of Tests. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL	Moisture Content of Soil	BS 1377-2: 1990: CI 3.2	16
SOIL	Liquid and Plastic Limits of soil-1 point cone penetrometer method	BS 1377-2: 1990: CI 4.4, 5.3 & 5.4	16
SOIL	Particle size distribution - wet sieving	BS 1377-2: 1990: CI 9.2	16
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: CI 9.5	16

**SUB-CONTRACTED TESTS**

In agreement with Client, the following tests were conducted by an approved sub-contractor. All sub-contracting laboratories used are UKAS accredited.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL - Subcontracted to Chemtest Ltd (UKAS 2183)	pH Value of Soil		16
SOIL - Subcontracted to Chemtest Ltd (UKAS 2183)	Sulphate Content water extract		16

Causeway Geotech Ltd  
8 Drumahiskey Road, Ballymoney  
Co. Antrim, N. Ireland, BT53 7GL  
Registered in Northern Ireland, Company Number: NI602766



Summary of Classification Test Results												
Project No.		Project Name										
18-0827		Lands at Ballymakilly										
Hole No.	Sample			Soil Description	Density bulk dry Mg/m <sup>3</sup>	w %	w <sub>p</sub> %	LL %	PL %	PI %	Particle density Mg/m <sup>3</sup>	Casagrande Classification
	Ref	Top	Base									
TP03	1	0.50		B		9.8	60	38-tp	26	12		MI
TP04	1	0.50		B		13	68	38-tp	26	12		MI
TP06	4	1.50		B		11	67	29-tp	19	10		CL
TP07	1	0.50		B		5.5	49	29-tp	19	10		CL
TP10	1	0.50		B		10	72	41-tp	21	20		CI
TP10	4	1.50		B		11	60	41-tp	21	20		CI
TP11	1	0.50		B		8.4	65	38-tp	25	13		MCI
TP12	1	0.50		B		11	68	28-tp	19	9		CL
TP13	1	0.50		B		7.2	64	35-tp	19	16		CLCI
TP14	1	0.50		B		11	70	35-tp	19	16		CLCI
TP15	1	0.50		B		12	82	35-tp	18	17		CLCI
TP15	4	1.50		B		11	58	27-tp	17	10		CL

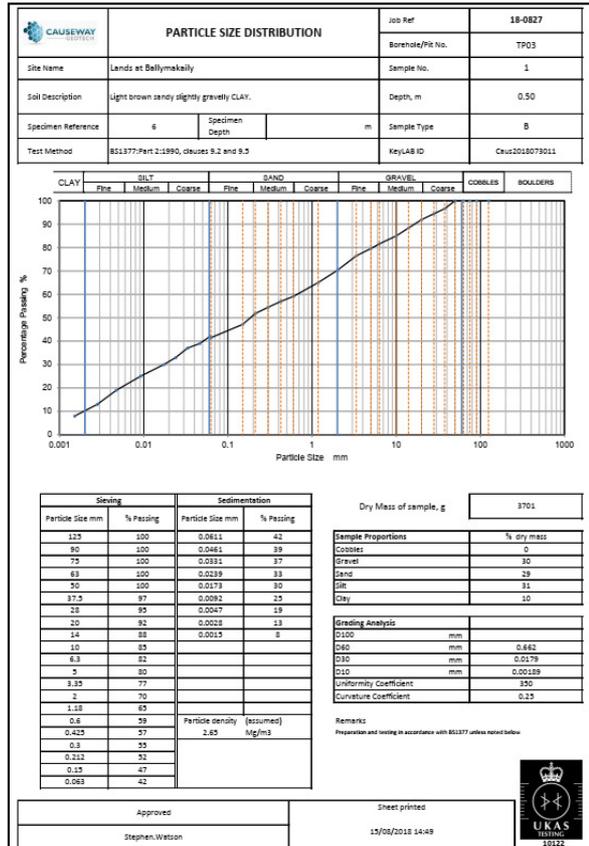
All tests performed in accordance with BS1377:1990 unless specified otherwise

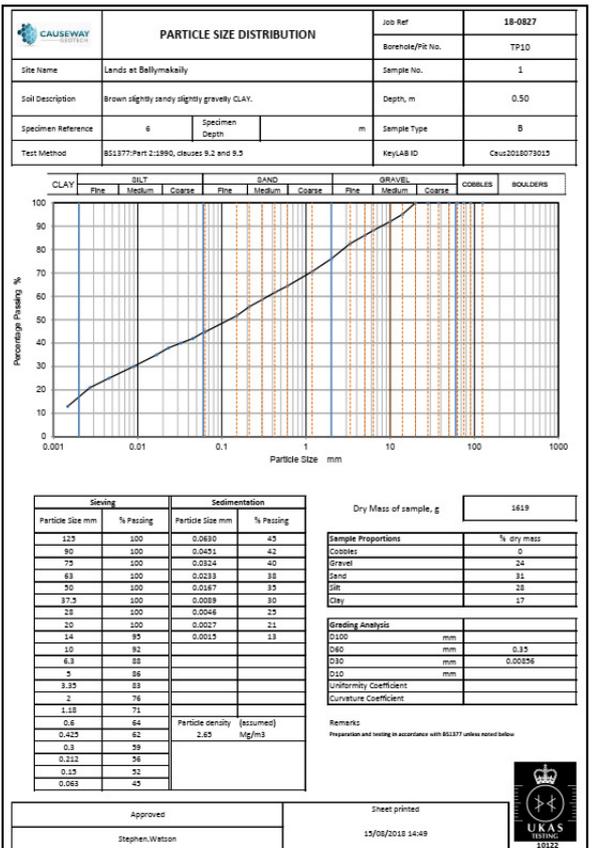
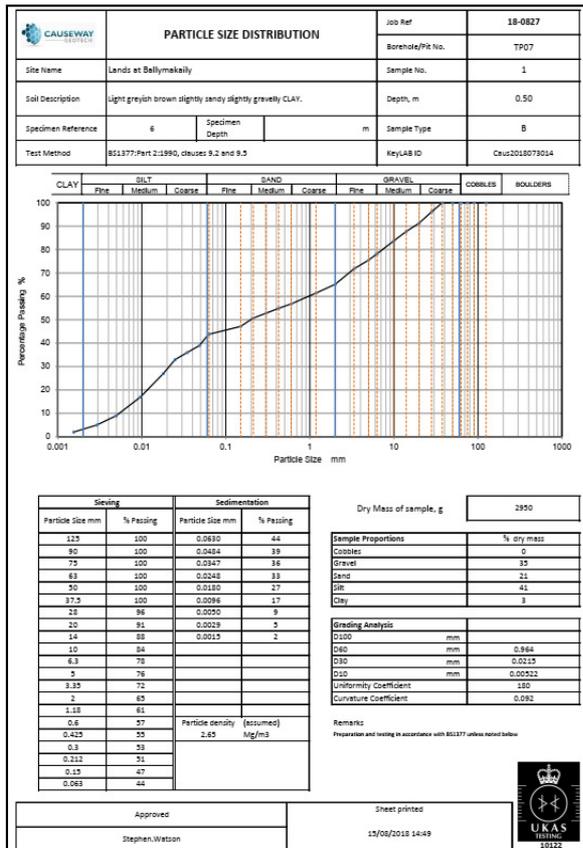
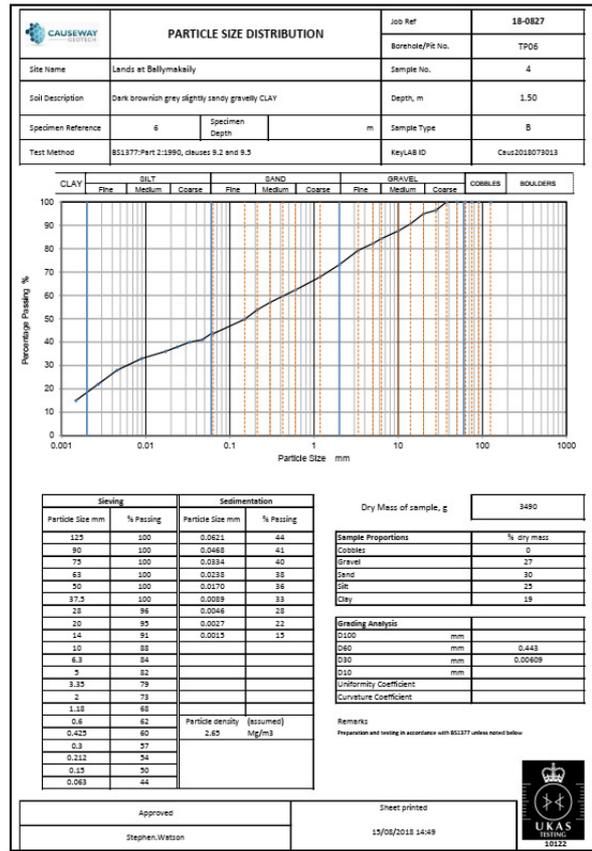
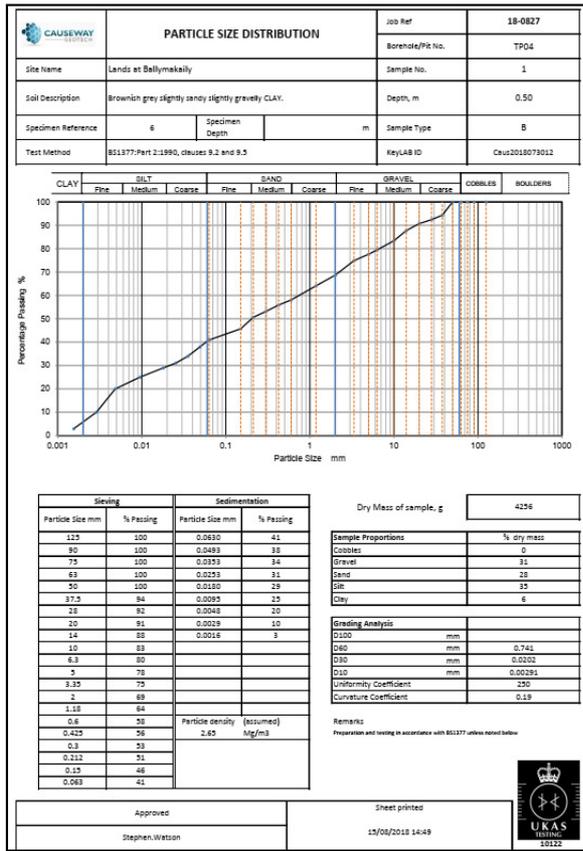
Key	Density test	Liquid Limit	Particle density	Date Printed	Approved By
	Linear measurement unless:	4pt cone unless:	sp - small pycnometer	15/08/2018	Stephen Watson
	wf - water displacement	cas - Casagrande method	gl - gas jar		
	wf - immersion in water	tp - single point test			

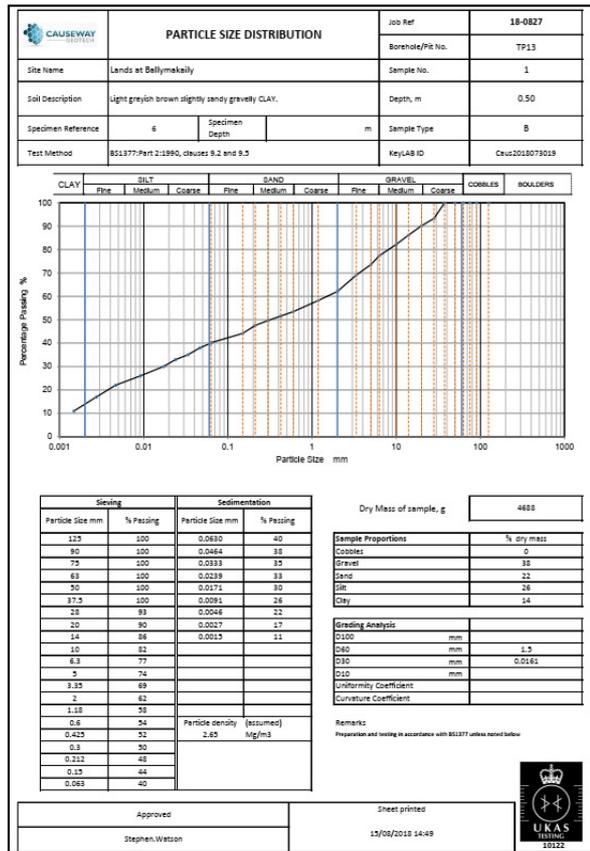
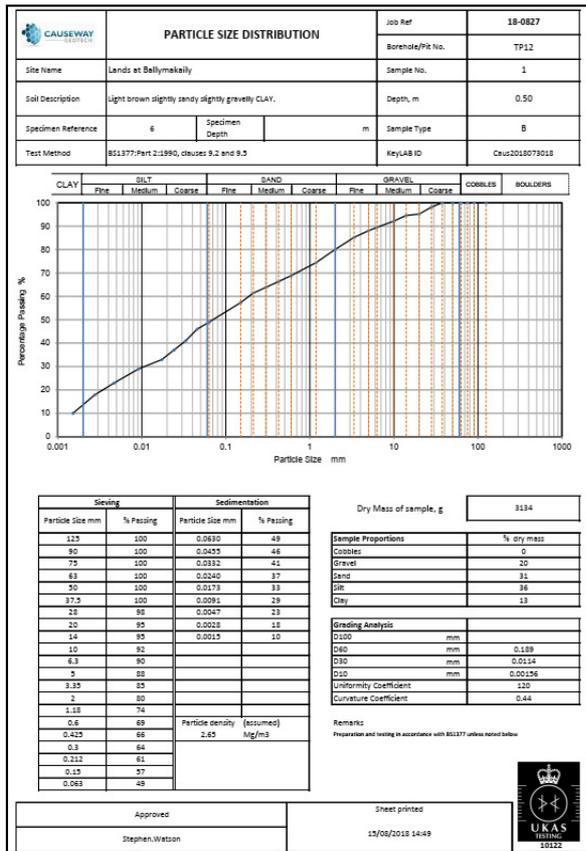
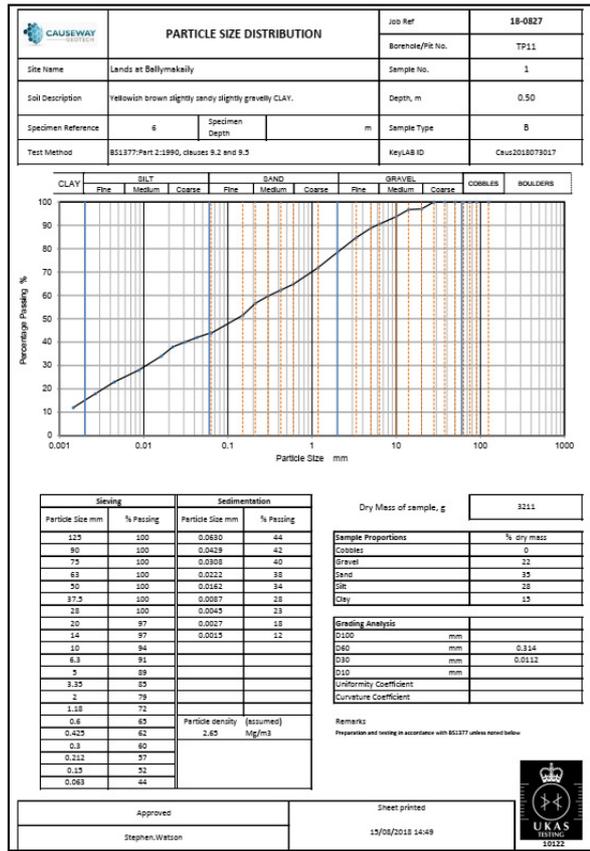
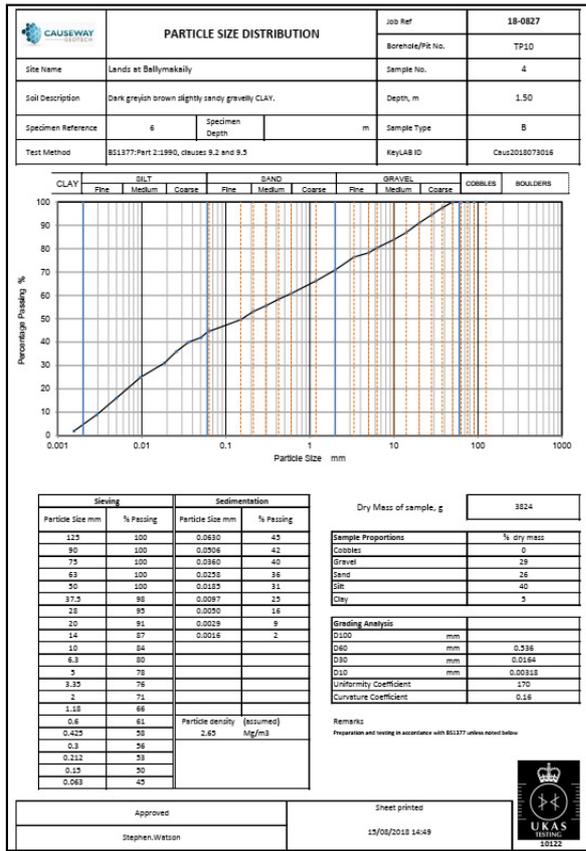
Summary of Classification Test Results												
Project No.		Project Name										
18-0827		Lands at Ballymakilly										
Hole No.	Sample			Soil Description	Density bulk dry Mg/m <sup>3</sup>	w %	w <sub>p</sub> %	LL %	PL %	PI %	Particle density Mg/m <sup>3</sup>	Casagrande Classification
	Ref	Top	Base									
TP16	1	0.50		B		12	78	42-tp	28	14		MI
TP17	4	1.50		B		7.0	47	24-tp	14	10		CL
TP18	3	1.50		B		10	68	24-tp	16	8		CL
TP19	4	1.50		B		7.3	44	23-tp	15	8		CL

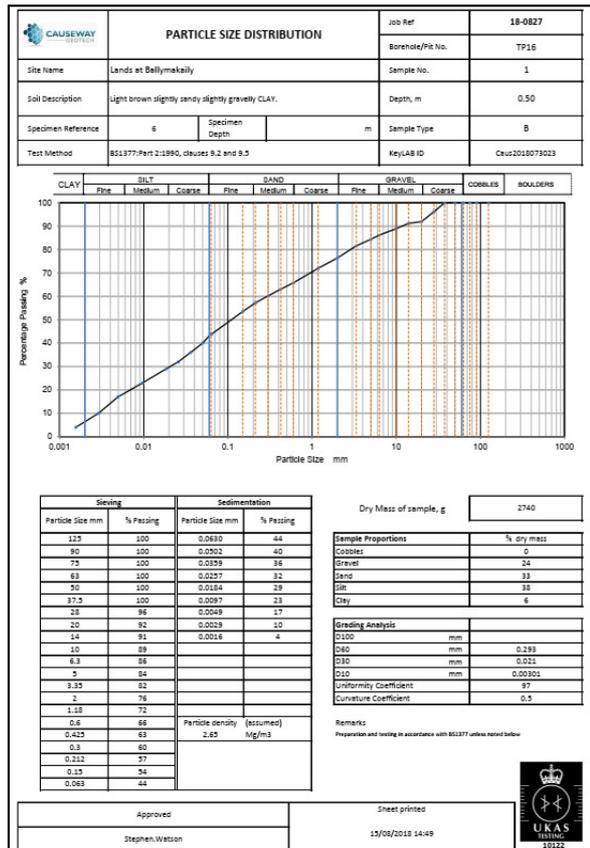
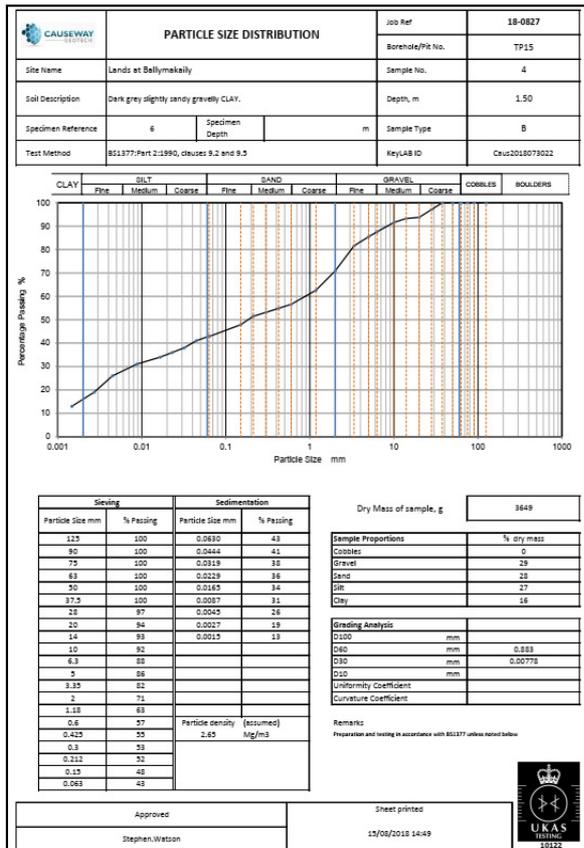
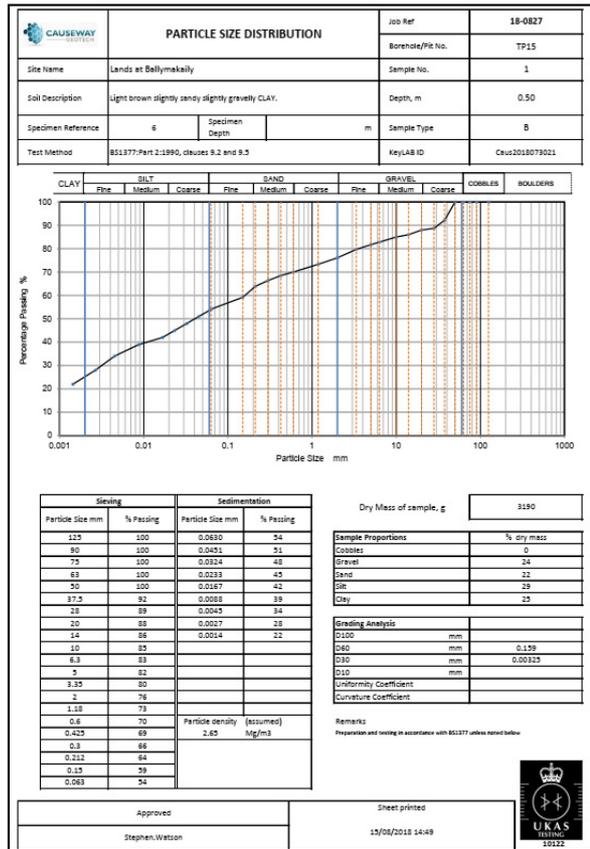
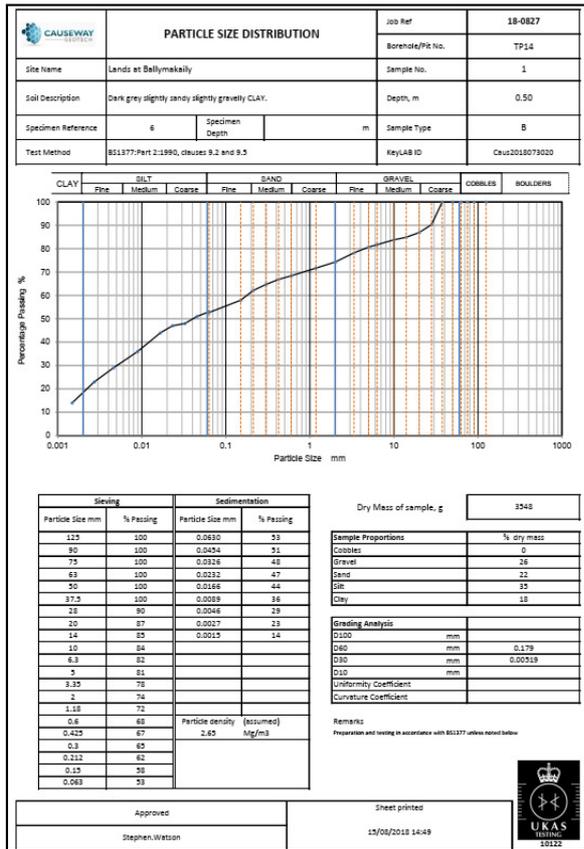
All tests performed in accordance with BS1377:1990 unless specified otherwise

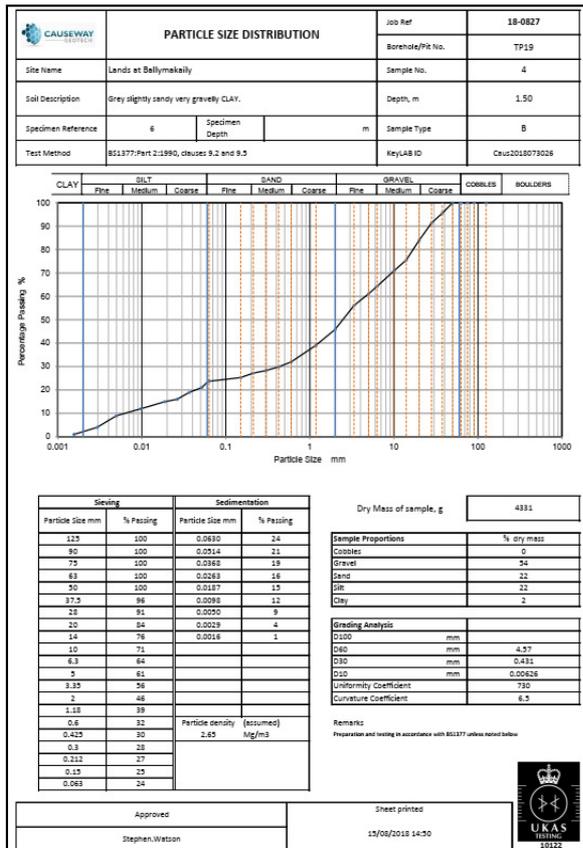
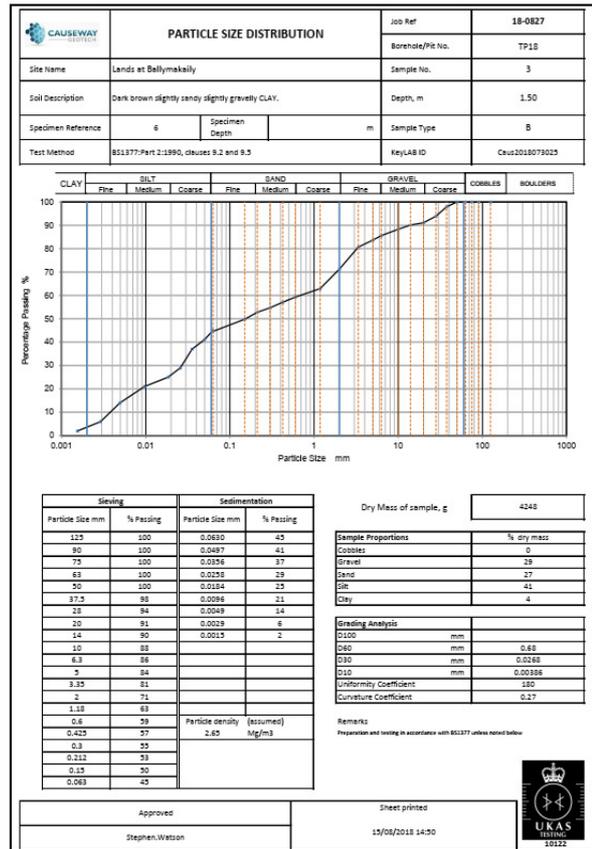
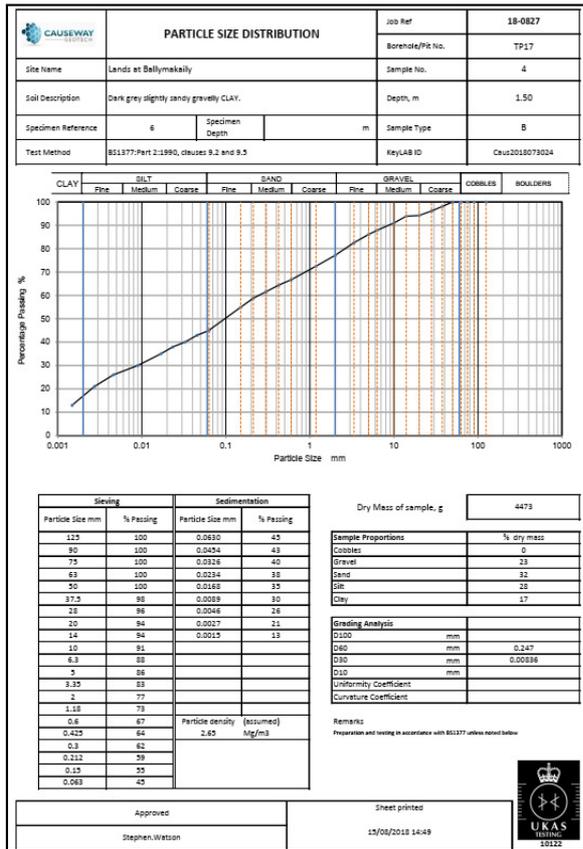
Key	Density test	Liquid Limit	Particle density	Date Printed	Approved By
	Linear measurement unless:	4pt cone unless:	sp - small pycnometer	15/08/2018	Stephen Watson
	wf - water displacement	cas - Casagrande method	gl - gas jar		
	wf - immersion in water	tp - single point test			













**Final Report**

**Report No.:** 18-23652-1  
**Initial Date of Issue:** 10-Aug-2018  
**Client:** Causeway Geotech Ltd  
**Client Address:** 8 Drumahiskey Road, Balnamore, Ballymoney, County Antrim, BT53 7QL  
**Contact(s):** Carin Cornwall, Colm Hurley, Darren O'Mahony, Gabriella Horan, John Cameron, Lucy Newland, Matthew Gilbert, Neil Haggan, Paul Dunlop, Paul McNamara, Sean Ross, Stephen Franey, Stephen Watson, Stuart Abraham  
**Project:** 18-0827 Lands at Ballymakelly  
**Quotation No.:** **Date Received:** 08-Aug-2018  
**Order No.:** **Date Instructed:** 08-Aug-2018  
**No. of Samples:** 16  
**Turnaround (Wkdays):** 3 **Results Due:** 10-Aug-2018  
**Date Approved:** 10-Aug-2018  
**Approved By:**   
**Details:** Martin Dyer, Laboratory Manager



**Results - Soil**

**Project: 18-0827 Lands at Ballymakelly**

Client: Causeway Geotech Ltd	Chemtest Job No.:	18-23652	18-23652	18-23652	18-23652	18-23652	18-23652	18-23652	18-23652	18-23652		
Quotation No.:	Chemtest Sample ID.:	667901	667902	667903	667904	667905	667906	667907	667908	667908		
Order No.:	Client Location ID.:	TP03	TP04	TP06	TP07	TP10	TP10	TP11	TP12			
	Client Sample Ref.:	2	2	5	2	2	5	2	2			
	Sample Type:	SOIL										
	Top Depth (m):	0.50	0.50	1.50	0.50	0.50	1.50	0.50	0.50	0.50		
	Date Sampled:	07-Aug-2018										
Determinand	Accred.	SOP	Units	LOD								
Moisture	N	2030	%	0.020	7.8	11	9.2	4.4	7.8	9.6	7.7	8.3
pH	U	2010		N/A	8.4	8.6	8.5	8.5	8.5	8.6	8.3	8.4
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010



## Results - Soil

Project: 18-0927 Lands at Ballymakelly

Client: Causeway Geotech Ltd	Chemtest Job No.:	18-23652	18-23652	18-23652	18-23652	18-23652	18-23652	18-23652	18-23652	18-23652		
Quotation No.:	Chemtest Sample ID.:	667909	667910	667911	667912	667913	667914	667915	667916	667916		
Order No.:	Client Location ID.:	TP13	TP14	TP15	TP15	TP16	TP17	TP18	TP19	TP19		
	Client Sample Ref.:	2	2	2	4	2	5	4	5	5		
	Sample Type:	SOIL										
	Top Depth (m):	0.50	0.50	0.50	1.50	0.50	1.50	1.50	1.50	1.50		
	Date Sampled:	07-Aug-2018										
Determinand	Accred.	SOP	Units	LOD								
Moisture	N	2030	%	0.020	5.7	6.7	8.0	11	10	8.5	10	5.9
pH	U	2010		N/A	8.5	8.5	8.4	8.7	8.2	8.8	8.5	8.7
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Page 3 of 4



## Report Information

## Key

- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
- T This analysis has been subcontracted to an unaccredited laboratory
- I/S Insufficient Sample
- U/S Unsuitable Sample
- N/E not evaluated
- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation  
 The results relate only to the items tested  
 Uncertainty of measurement for the determinands tested are available upon request  
 None of the results in this report have been recovery corrected  
 All results are expressed on a dry weight basis  
 The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols  
 For all other tests the samples were dried at < 37°C prior to analysis  
 All Asbestos testing is performed at the indicated laboratory  
 Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

## Sample Deviation Codes

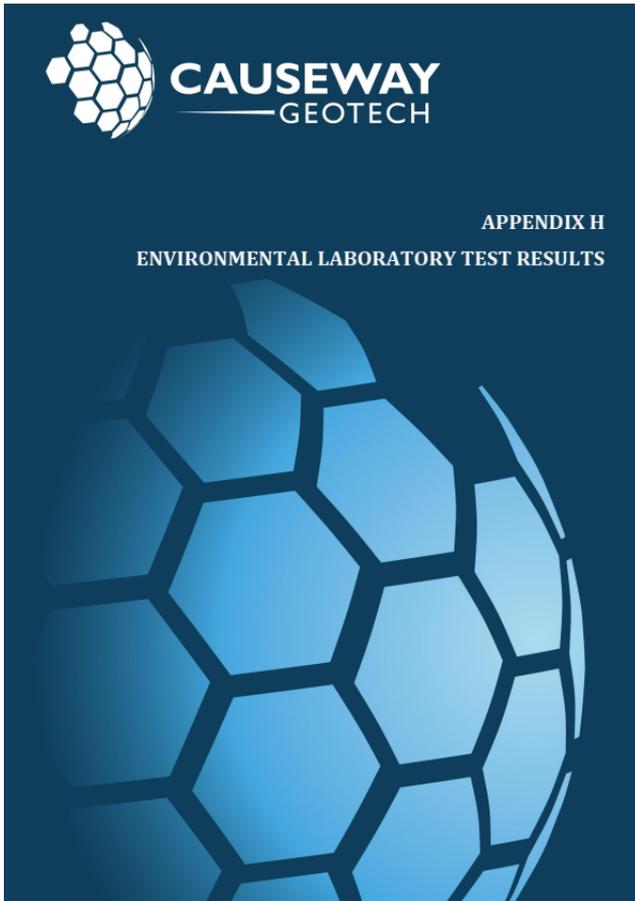
- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

## Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt  
 All water samples will be retained for 14 days from the date of receipt  
 Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:  
[customerservices@chemtest.co.uk](mailto:customerservices@chemtest.co.uk)

Page 4 of 4



**APPENDIX H**  
**ENVIRONMENTAL LABORATORY TEST RESULTS**



**Final Report**

**Report No.:** 18-22446-1  
**Initial Date of Issue:** 03-Aug-2018  
**Client:** Causeway Geotech Ltd  
**Client Address:** 8 Drumahiskey Road  
 Balnamore  
 Ballymoney  
 County Antrim  
 BT53 7QL  
**Contact(s):** Aisling O'Kane  
 Calm Hurley  
 Darren O'Mahony  
 Gabriella Horan  
 John Cameron  
 Lucy Newland  
 Matthew Gilbert  
 Neil Haggan  
 Paul Dunlop  
 Paul McNamara  
 Stephen Franey  
 Stephen Watson  
 Sean Ross  
**Project:** 18-0827 Ballymakally  
**Quotation No.:** **Date Received:** 30-Jul-2018  
**Order No.:** **Date Instructed:** 30-Jul-2018  
**No. of Samples:** 14  
**Turnaround (Wkdays):** 3 **Results Due:** 01-Aug-2018  
**Date Approved:** 03-Aug-2018  
**Approved By:**   
**Details:** Robert Monk, Technical Manager



**Results - Soil**

Client: Causeway Geotech Ltd	Chemtest Job No.:	18-22446	18-22446	18-22446	18-22446	18-22446	18-22446	18-22446	18-22446	18-22446
Quotation No.:	Chemtest Sample ID.:	661593	661595	661597	661599	661601	661602	661603	661604	661606
Order No.:	Client Location ID.:	TP03	TP06	TP10	TP11	TP01	TP02	TP04	TP09	TP12
	Client Sample Ref.:	1	2	1	1	2	1	1	1	2
	Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):	1.00	1.50	0.50	0.50	1.50	0.30	0.50	0.50	1.50
	Date Sampled:	23-Jul-2018	23-Jul-2018	23-Jul-2018	23-Jul-2018	25-Jul-2018	25-Jul-2018	25-Jul-2018	25-Jul-2018	25-Jul-2018
	Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD						
ACM Type	U	2192	N/A	-	-	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected					
Moisture	N	2030	%	0.020	12	9.2	6.2	5.7	14	5.7
pH	U	2010	N/A	8.4	8.4	8.4	8.4	8.5	9.0	8.5
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	< 0.40	< 0.40	< 0.40	< 0.40	0.74	< 0.40
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/t	0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.095	< 0.010
Cyanide (Free)	U	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Cyanide (Total)	U	2300	mg/kg	0.50	0.80	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Thiocyanate	U	2300	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	15	35	6.3	12	12	6.2
Sulphate (Total)	U	2430	%	0.010	0.098	0.094	0.043	0.029	0.16	0.23
Arsenic	U	2450	mg/kg	1.0	28	29	33	26	31	21
Cadmium	U	2450	mg/kg	0.10	1.5	1.5	2.7	0.83	0.74	1.6
Chromium	U	2450	mg/kg	1.0	19	12	16	21	14	16
Copper	U	2450	mg/kg	0.50	25	22	32	17	30	38
Mercury	U	2450	mg/kg	0.10	0.11	< 0.10	< 0.10	< 0.10	0.11	< 0.10
Nickel	U	2450	mg/kg	0.50	49	48	53	37	55	41
Lead	U	2450	mg/kg	0.50	26	14	20	16	38	42
Selenium	U	2450	mg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20	0.31	0.43
Zinc	U	2450	mg/kg	0.50	80	58	74	56	73	110
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40	1.5	0.52	3.8	0.84	1.9	5.2
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0



Results - Soil

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 Project: 18-0827 Ballymakally

Client: Causeway Geotech Ltd	Chemtest Job No.:	18-22446	18-22446	18-22446	18-22446	18-22446	18-22446	18-22446	18-22446	18-22446	18-22446
Quotation No.:	Chemtest Sample ID.:	661593	661595	661597	661599	661601	661602	661603	661604	661606	661606
Order No.:	Client Location ID.:	TP03	TP06	TP11	TP11	TP02	TP02	TP04	TP09	TP12	TP12
	Client Sample Ref.:	1	2	1	2	1	1	1	1	2	2
	Sample Type:	SOIL									
	Top Depth (m):	1.00	1.50	0.50	0.50	1.50	0.30	0.50	0.50	1.50	1.50
	Date Sampled:	23-Jul-2018	23-Jul-2018	23-Jul-2018	23-Jul-2018	25-Jul-2018	25-Jul-2018	25-Jul-2018	25-Jul-2018	25-Jul-2018	25-Jul-2018
	Asbestos Lab:	COVENTRY									
Determinand	Accred.	SOP	Units	LOD							
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Naphthalene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno[1,2,3-c,d]Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz[a,h]Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Benzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Resorcinol	U	2920	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Phenol	U	2920	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Cresols	U	2920	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Xylenols	U	2920	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
1-Naphthol	N	2920	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Trimehylphenols	U	2920	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30



Results - Soil

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 Project: 18-0827 Ballymakally

Client: Causeway Geotech Ltd	Chemtest Job No.:	18-22446	18-22446	18-22446	18-22446	18-22446
Quotation No.:	Chemtest Sample ID.:	661608	661609	661611	661614	661616
Order No.:	Client Location ID.:	TP13	TP15	TP16	TP17	TP19
	Client Sample Ref.:	2	1	1	2	2
	Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):	1.50	0.50	0.50	1.50	1.50
	Date Sampled:	25-Jul-2018	25-Jul-2018	25-Jul-2018	25-Jul-2018	25-Jul-2018
	Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD		
ACM Type	U	2192	N/A	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	11	9.4
pH	U	2010	N/A	8.5	8.2	8.5
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	< 0.40	0.54
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	< 0.010
Cyanide (Free)	U	2300	mg/kg	0.50	< 0.50	< 0.50
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	0.60
Thiocyanate	U	2300	mg/kg	5.0	< 5.0	< 5.0
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	12	6.3
Sulphate (Total)	U	2430	%	0.010	0.063	0.083
Arsenic	U	2450	mg/kg	1.0	28	26
Cadmium	U	2450	mg/kg	0.10	1.7	1.4
Chromium	U	2450	mg/kg	1.0	14	24
Copper	U	2450	mg/kg	0.50	34	24
Mercury	U	2450	mg/kg	0.10	< 0.10	0.11
Nickel	U	2450	mg/kg	0.50	49	44
Lead	U	2450	mg/kg	0.50	20	27
Selenium	U	2450	mg/kg	0.20	0.73	0.48
Zinc	U	2450	mg/kg	0.50	87	83
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40	0.79	2.1
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C7-C9	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C9-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0



Results - Soil

The right chemistry to deliver results  
Project: 18-0827 Ballymakelly

Client: Causeway Geotech Ltd	Chemtest Job No.:	18-22446	18-22446	18-22446	18-22446	18-22446
Quotation No.:	Chemtest Sample ID.:	661603	661609	661611	661614	661616
Order No.:	Client Location ID.:	TP13	TP15	TP16	TP17	TP19
	Client Sample Ref.:	2	1	1	2	2
	Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):	1.50	0.50	0.50	1.50	1.50
	Date Sampled:	25-Jul-2018	25-Jul-2018	25-Jul-2018	25-Jul-2018	25-Jul-2018
	Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD		
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10
Naphthalene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Chrysene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Indeno[1,2,3-c,d]Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Dibenz[a,h]Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[ghi]perylene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	< 2.0	< 2.0
Benzene	U	2760	µg/kg	1.0	< 1.0	< 1.0
Toluene	U	2760	µg/kg	1.0	< 1.0	< 1.0
Ethylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0
m & p-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0
o-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0
Resorcinol	U	2920	mg/kg	0.050	< 0.050	< 0.050
Phenol	U	2920	mg/kg	0.050	< 0.050	< 0.050
Cresols	U	2920	mg/kg	0.050	< 0.050	< 0.050
Xylenols	U	2920	mg/kg	0.050	< 0.050	< 0.050
1-Naphthol	N	2920	mg/kg	0.050	< 0.050	< 0.050
Trimeitylphenols	U	2920	mg/kg	0.050	< 0.050	< 0.050
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30



Report Information

Key

- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
- T This analysis has been subcontracted to an unaccredited laboratory
- I/S Insufficient Sample
- U/S Unsuitable Sample
- NE not evaluated
- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt  
All water samples will be retained for 14 days from the date of receipt  
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:  
customerservices@chemtest.co.uk



Final Report

Report No.: 18-24061-1  
Initial Date of Issue: 16-Aug-2018  
Client: Causeway Geotech Ltd  
Client Address: 8 Drumahiskey Road  
Bainamore  
County Antrim  
BT53 7QL  
Contact(s): Carin Cornwall  
Colm Hurley  
Darren O'Mahony  
Gabriella Horan  
John Cameron  
Lucy Newland  
Matthew Gilbert  
Neil Haggan  
Paul Dunlop  
Paul McNamara  
Sean Ross  
Stephen Franey  
Stephen Watson  
Stuart Abraham

Project: 18-0827 Lands at Ballymakelly

Quotation No.: Date Received: 10-Aug-2018

Order No.: Date Instructed: 13-Aug-2018

No. of Samples: 10

Turnaround (Wkdays): 3 Results Due: 15-Aug-2018

Date Approved: 16-Aug-2018

Approved By:

Details: Robert Monk, Technical Manager



**Results - Soil**

Project: 18-0827 Lands at Ballymakelly

Client: Causeway Geotech Ltd	Chemtest Job No.:	18-24061	18-24061	18-24061	18-24061	18-24061	18-24061	18-24061	18-24061	18-24061
Quotation No.:	Chemtest Sample ID.:	669833	669834	669835	669836	669837	669838	669839	669840	
Order No.:	Client Location ID.:	BH08	BH08	BH11	BH11	BH13	BH13	BH14	BH14	
	Client Sample Ref.:	ES1	ES2	ES2	ES1	ES1	ES2	ES1	ES2	
	Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	
	Top Depth (m):	0.5	1.5	1.50	0.50	0.5	1.5	0.5	1.5	
	Date Sampled:	09-Aug-2018	09-Aug-2018	09-Aug-2018	09-Aug-2018	09-Aug-2018	09-Aug-2018	09-Aug-2018	09-Aug-2018	
	Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	
Determinand	Accred.	SOP	Units	LOD						
ACM Type	U	2192	%	N/A	-	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected					
Moisture	N	2030	%	0.020	7.6	8.8	13	12	6.9	7.8
pH	U	2010		N/A	8.6	8.6	8.4	8.4	8.6	8.2
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	< 0.40	< 0.40	0.61	< 0.40	< 0.40	< 0.40
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Cyanide (Free)	U	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Thiocyanate	U	2300	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	7.9	24	17	5.1	4.3	21
Sulphate (Total)	U	2430	%	0.010	0.077	0.10	0.17	0.031	0.041	0.83
Arsenic	U	2450	mg/kg	1.0	17	22	20	19	22	28
Cadmium	U	2450	mg/kg	0.10	0.76	1.6	1.3	0.81	2.0	1.4
Chromium	U	2450	mg/kg	1.0	18	12	18	24	14	12
Copper	U	2450	mg/kg	0.50	11	25	25	13	24	20
Mercury	U	2450	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Nickel	U	2450	mg/kg	0.50	30	45	41	48	51	48
Lead	U	2450	mg/kg	0.50	14	11	31	18	15	11
Selenium	U	2450	mg/kg	0.20	< 0.20	0.83	2.0	0.30	< 0.20	0.60
Zinc	U	2450	mg/kg	0.50	49	53	69	73	54	96
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40	1.1	1.2	2.9	0.72	0.76	1.5
Alliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Alliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Alliphatic TPH >C8-C10	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Alliphatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Alliphatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Alliphatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Alliphatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	16	65	< 1.0	< 1.0	< 1.0
Alliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Alliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	16	65	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0



**Results - Soil**

Project: 18-0827 Lands at Ballymakelly

Client: Causeway Geotech Ltd	Chemtest Job No.:	18-24061	18-24061	18-24061	18-24061	18-24061	18-24061	18-24061	18-24061	18-24061
Quotation No.:	Chemtest Sample ID.:	669833	669834	669835	669836	669837	669838	669839	669840	
Order No.:	Client Location ID.:	BH08	BH08	BH11	BH11	BH13	BH13	BH14	BH14	
	Client Sample Ref.:	ES1	ES2	ES2	ES1	ES1	ES2	ES1	ES2	
	Sample Type:	SOIL								
	Top Depth (m):	0.5	1.5	1.50	0.50	0.5	1.5	0.5	1.5	
	Date Sampled:	09-Aug-2018								
	Asbestos Lab:	COVENTRY								
Determinand	Accred.	SOP	Units	LOD						
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	25	97	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	25	97	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	41	160	< 10	< 10	< 10
Naphthalene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.32
Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.66
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno[1,2,3-c,d]Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz[a,h]Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[ghi]perylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Benzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Resorcinol	U	2920	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Phenol	U	2920	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Cresols	U	2920	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Xylenols	U	2920	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
1-Naphthol	N	2920	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Trimethylphenols	U	2920	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30



**Results - Soil**

Project: 18-0827 Lands at Ballymakelly

Client: Causeway Geotech Ltd		Chemtest Job No.:		18-24061	18-24061
Quotation No.:		Chemtest Sample ID.:		669841	669842
Order No.:		Client Location ID.:		BH15	BH15
		Client Sample Ref.:		ES1	ES2
		Sample Type:		SOIL	SOIL
		Top Depth (m):		0.5	1.5
		Date Sampled:		09-Aug-2018	09-Aug-2018
		Asbestos Lab:		COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD	
ACM Type	U	2192		N/A	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected
Moisture	N	2030	%	0.020	9.8
pH	U	2010		N/A	8.4
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	< 0.40
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010
Cyanide (Free)	U	2300	mg/kg	0.50	< 0.50
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50
Thiocyanate	U	2300	mg/kg	5.0	< 5.0
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	2.1
Sulphate (Total)	U	2430	%	0.010	0.024
Arsenic	U	2450	mg/kg	1.0	44
Cadmium	U	2450	mg/kg	0.10	1.2
Chromium	U	2450	mg/kg	1.0	20
Copper	U	2450	mg/kg	0.50	23
Mercury	U	2450	mg/kg	0.10	< 0.10
Nickel	U	2450	mg/kg	0.50	54
Lead	U	2450	mg/kg	0.50	16
Selenium	U	2450	mg/kg	0.20	0.73
Zinc	U	2450	mg/kg	0.50	58
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50
Organic Matter	U	2625	%	0.40	0.86
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0



**Results - Soil**

Project: 18-0827 Lands at Ballymakelly

Client: Causeway Geotech Ltd		Chemtest Job No.:		18-24061	18-24061
Quotation No.:		Chemtest Sample ID.:		669841	669842
Order No.:		Client Location ID.:		BH15	BH15
		Client Sample Ref.:		ES1	ES2
		Sample Type:		SOIL	SOIL
		Top Depth (m):		0.5	1.5
		Date Sampled:		09-Aug-2018	09-Aug-2018
		Asbestos Lab:		COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD	
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10
Naphthalene	U	2700	mg/kg	0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	< 0.10
Anthracene	U	2700	mg/kg	0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	< 0.10
Pyrene	U	2700	mg/kg	0.10	< 0.10
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10
Chrysene	U	2700	mg/kg	0.10	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10
Benzo(g,h)perylene	U	2700	mg/kg	0.10	< 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	< 2.0
Benzene	U	2760	µg/kg	1.0	< 1.0
Toluene	U	2760	µg/kg	1.0	< 1.0
Ethylbenzene	U	2760	µg/kg	1.0	< 1.0
m & p-Xylene	U	2760	µg/kg	1.0	< 1.0
o-Xylene	U	2760	µg/kg	1.0	< 1.0
Resorcinol	U	2920	mg/kg	0.050	< 0.050
Phenol	U	2920	mg/kg	0.050	< 0.050
Cresols	U	2920	mg/kg	0.050	< 0.050
Xylenols	U	2920	mg/kg	0.050	< 0.050
1-Naphthol	N	2920	mg/kg	0.050	< 0.050
Trimethylphenols	U	2920	mg/kg	0.050	< 0.050
Total Phenols	U	2920	mg/kg	0.30	< 0.30



**Report Information**

**Key**

- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
- T This analysis has been subcontracted to an unaccredited laboratory
- IS Insufficient Sample
- UIS Unsuitable Sample
- N/E not evaluated
- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation  
 The results relate only to the items tested  
 Uncertainty of measurement for the determinands tested are available upon request  
 None of the results in this report have been recovery corrected  
 All results are expressed on a dry weight basis  
 The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols  
 For all other tests the samples were dried at < 37°C prior to analysis  
 All Asbestos testing is performed at the indicated laboratory  
 Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

**Sample Deviation Codes**

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

**Sample Retention and Disposal**

All soil samples will be retained for a period of 45 days from the date of receipt  
 All water samples will be retained for 14 days from the date of receipt  
 Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:  
[customerservices@chemtest.co.uk](mailto:customerservices@chemtest.co.uk)

**APPENDIX H**  
**SPT HAMMER ENERGY MEASUREMENT REPORT**



**SPT Hammer Energy Test Report**  
 in accordance with BS EN ISO 22476-3:2005

**Nell Burrows**  
 Southern Testing Laboratories  
 Unit 11  
 Charlwoods Road  
 East Grinstead  
 RH19 2HU

SPT Hammer Ref: T10267  
 Test Date: 14/04/2018  
 Report Date: 15/04/2018  
 File Name: T10267.spt  
 Test Operator: CAUSEWAY

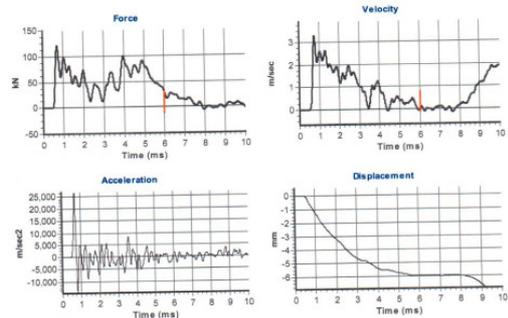
**Instrumented Rod Data**

Diameter  $d_r$  (mm): 54  
 Wall Thickness  $t_r$  (mm): 5.0  
 Assumed Modulus  $E_a$  (GPa): 200  
 Accelerometer No.1: 6458  
 Accelerometer No.2: 9607

**SPT Hammer Information**

Hammer Mass  $m$  (kg): 63.5  
 Falling Height  $h$  (mm): 760  
 SPT String Length  $L$  (m): 10.5

**Comments / Location**  
 Causeway Yard



**Calculations**

Area of Rod A (mm<sup>2</sup>): 905  
 Theoretical Energy  $E_{theor}$  (J): 473  
 Measured Energy  $E_{meas}$  (J): 351

**Energy Ratio  $E_r$  (%)**: 74

*N.P. Burrows*  
 Signed: N.P. Burrows  
 Title: Field Operations Manager

The recommended calibration interval is 12 months

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## Appendix 7.3 Soil chemical test analysis results



Element Materials Technology

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F: +44 (0) 1244 833781

Zone 3

Deeside Industrial Park

W: www.element.com

Deeside

CH5 2UA

AWN Consulting  
 Tecpro Building  
 Clonshaugh Business & Technology Park  
 Dublin  
 Dublin 17  
 Ireland



**Attention :** Colm Driver  
**Date :** 4th December, 2020  
**Your reference :**  
**Our reference :** Test Report 20/16584 Batch 1  
**Location :** Edgeconnex, Grangecastle  
**Date samples received :** 26th November, 2020  
**Status :** Final report  
**Issue :** 1

Four samples were received for analysis on 26th November, 2020 of which four were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.  
 All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

**Authorised By:**

**Phil Sommerton BSc**  
 Senior Project Manager

Please include all sections of this report if it is reproduced











**NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS**

EMT Job No.: 20/16584

**SOILS**

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overestimate when other sulphides such as Barite (Barium Sulphate) are present.

**WATERS**

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

**DEVIATING SAMPLES**

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

**SURROGATES**

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

**DILUTIONS**

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

**BLANKS**

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

**NOTE**

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

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All solid results are expressed on a dry weight basis unless stated otherwise.

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EMT Job No.: 20/16584

**REPORTS FROM THE SOUTH AFRICA LABORATORY**

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

**Measurement Uncertainty**

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

**ABBREVIATIONS and ACRONYMS USED**

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

Element Materials Technology

Method Code Appendix

EMT Job No: 20/16584

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/IS ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM4	Modified USEPA 8270D v5.2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM4	Modified USEPA 8270D v5.2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM5	Modified 8015B v2.1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GC/FID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16/PM30	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE/Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TMS/TM56	please refer to TMS and TM56 for method details	PM12/PM16/PM30	please refer to PM16/PM30 and PM12 for method details	Yes			
TM15	Modified USEPA 8260B v2.1996. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021A v2.2014. Preparation of solid and liquid samples for GC headspace analysis.				
TM15	Modified USEPA 8260B v2.1996. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021A v2.2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes			
TM16	Modified USEPA 8270D v5.2014. Quantitative determination of Semi-Volatile Organic compounds (SVOCs) by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM16	Modified USEPA 8270D v5.2014. Quantitative determination of Semi-Volatile Organic compounds (SVOCs) by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM17	Modified US EPA method 8270D v5.2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry). WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec. 1996; Modified BS EN ISO 11885:2009. SOILS by Modified USEP	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified				

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Element Materials Technology

Method Code Appendix

EMT Job No: 20/16584

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/IS ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry). WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec. 1996; Modified BS EN ISO 11885:2009. SOILS by Modified USEP	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified	Yes			
TM36	Modified US EPA method 8015B v2.1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GC/FID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2.2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes			
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrate 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM0	No preparation is required.	Yes			
TM38/TM125	Total Nitrogen/Organic Nitrogen by calculation	PM0	No preparation is required.				
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.	Yes			
TM76	Modified US EPA method 120.1 (1982). Determination of Specific Conductance by Metrohm automated probe analyser.	PM0	No preparation is required.	Yes			

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**CHAPTER 8 - HYDROLOGY****Appendix 8.1 Criteria for rating Site Attributes - Estimation of Importance of Hydrology Attributes (NRA)**

<b>Importance</b>	<b>Criteria</b>	<b>Typical Examples</b>
Extremely High	Attribute has a high quality or value on an international scale	River, wetland or surface water body ecosystem protected by EU legislation e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	Attribute has a high quality or value on a regional or national scale	River, wetland or surface water body ecosystem protected by national legislation – NHA status Regionally important potable water source supplying >2500 homes Quality Class A (Biotic Index Q4, Q5) Flood plain protecting more than 50 residential or commercial properties from flooding Nationally important amenity site for wide range of leisure activities
High	Attribute has a high quality or value on a local scale	Salmon fishery Locally important potable water source supplying >1000 homes Quality Class B (Biotic Index Q3-4) Flood plain protecting between 5 and 50 residential or commercial properties from flooding Locally important amenity site for wide range of leisure activities
Medium	Attribute has a medium quality or value on a local scale	Coarse fishery Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2- 3) Flood plain protecting between 1 and 5 residential or commercial properties from flooding
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure activities Local potable water source supplying <50 homes Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding Amenity site used by small numbers of local people

**Estimation of magnitude of impact on hydrology attribute (NRA)**

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute	Loss or extensive change to a waterbody or water dependent habitat. Increase in predicted peak flood level >100mm. Extensive loss of fishery. Calculated risk of serious pollution incident >2% annually. Extensive reduction in amenity value.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Increase in predicted peak flood level >50mm. Partial loss of fishery. Calculated risk of serious pollution incident >1% annually. Partial reduction in amenity value.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Increase in predicted peak flood level >10mm. Minor loss of fishery. Calculated risk of serious pollution incident >0.5% annually. Slight reduction in amenity value.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Negligible change in predicted peak flood level. Calculated risk of serious pollution incident <0.5% annually.
Minor Beneficial	Results in minor improvement of attribute quality	Reduction in predicted peak flood level >10mm. Calculated reduction in pollution risk of 50% or more where existing risk is <1% annually.
Moderate Beneficial	Results in moderate improvement of attribute quality	Reduction in predicted peak flood level >50mm. Calculated reduction in pollution risk of 50% or more where existing risk is >1% annually.
Major Beneficial	Results in major improvement of attribute quality	Reduction in predicted peak flood level >100mm

**Rating of Significant Environmental Impacts at EIS Stage (NRA)**

Importance of Attribute	Magnitude of Importance			
	Negligible	Small Adverse	Moderate Adverse	Large Adverse
<b>Extremely High</b>	Imperceptible	Significant	Profound	Profound
<b>Very High</b>	Imperceptible	Significant/moderate	Profound/Significant	Profound
<b>High</b>	Imperceptible	Moderate/Slight	Significant/moderate	Profound/Significant
<b>Medium</b>	Imperceptible	Slight	Moderate	Significant
<b>Low</b>	Imperceptible	Imperceptible	Slight	Slight/Moderate

## CHAPTER 9 - NOISE AND VIBRATION

### Appendix 9.1 Glossary of acoustic terminology (prepared by AWN Consulting Ltd.)

<b>ambient noise</b>	The totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, near and far.
<b>background noise</b>	The steady existing noise level present without contribution from any intermittent sources. The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 per cent of a given time interval, T ( $L_{AF90,T}$ ).
<b>broadband</b>	Sounds that contain energy distributed across a wide range of frequencies.
<b>dB</b>	Decibel - The scale in which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 $\mu$ Pa).
<b>dB <math>L_{pA}</math></b>	An 'A-weighted decibel' - a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. 'A'-weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
<b>Hertz (Hz)</b>	The unit of sound frequency in cycles per second.
<b>impulsive noise</b>	A noise that is of short duration (typically less than one second), the sound pressure level of which is significantly higher than the background.
<b><math>L_{Aeq,T}</math></b>	This is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T). The closer the $L_{Aeq}$ value is to either the $L_{AF10}$ or $L_{AF90}$ value indicates the relative impact of the intermittent sources and their contribution. The relative spread between the values determines the impact of intermittent sources such as traffic on the background.
<b><math>L_{AFN}</math></b>	The A-weighted noise level exceeded for N% of the sampling interval. Measured using the "Fast" time weighting.
<b><math>L_{AFmax}</math></b>	is the instantaneous slow time weighted maximum sound level measured during the sample period (usually referred to in relation to construction noise levels).
<b><math>L_{Ar,T}</math></b>	The Rated Noise Level, equal to the $L_{Aeq}$ during a specified time interval (T), plus specified adjustments for tonal character and impulsiveness of the sound.
<b><math>L_{AF90}</math></b>	Refers to those A-weighted noise levels in the lower 90 percentile of the sampling interval; it is the level which is exceeded for 90% of the measurement period. It will therefore exclude the intermittent features of traffic and is used to estimate a background level. Measured using the "Fast" time weighting.
<b><math>L_{AT}(DW)</math></b>	equivalent continuous downwind sound pressure level.
<b><math>L_{rT}(DW)</math></b>	equivalent continuous downwind octave-band sound pressure level.
<b><math>L_{day}</math></b>	$L_{day}$ is the average noise level during the daytime period of 07:00hrs to 19:00hrs
<b><math>L_{night}</math></b>	$L_{night}$ is the average noise level during the night-time period of 23:00hrs to 07:00hrs.
<b>low frequency noise</b>	LFN - noise which is dominated by frequency components towards the lower end of the frequency spectrum.
<b>noise</b>	Any sound, that has the potential to cause disturbance, discomfort or psychological stress to a person exposed to it, or any sound that could cause

actual physiological harm to a person exposed to it, or physical damage to any structure exposed to it, is known as noise.

**noise sensitive location** NSL – Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.

**octave band** A frequency interval, the upper limit of which is twice that of the lower limit. For example, the 1,000Hz octave band contains acoustical energy between 707Hz and 1,414Hz. The centre frequencies used for the designation of octave bands are defined in ISO and ANSI standards.

**rating level** See  $L_{Ar,T}$ .

**sound power level** The logarithmic measure of sound power in comparison to a referenced sound intensity level of one picowatt (1pW) per m<sup>2</sup> where:

$$L_w = 10 \log \frac{P}{P_0} \text{ dB}$$

Where:  $p$  is the rms value of sound power in pascals; and  $P_0$  is 1 pW.

**sound pressure level** The sound pressure level at a point is defined as:

$$L_p = 20 \log \frac{P}{P_0} \text{ dB}$$

**specific noise level** A component of the ambient noise which can be specifically identified by acoustical means and may be associated with a specific source. In BS 4142, there is a more precise definition as follows: 'the equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval ( $L_{Aeq,T}$ )'.

**tonal** Sounds which cover a range of only a few Hz which contains a clearly audible tone i.e. distinguishable, discrete or continuous noise (whine, hiss, screech, or hum etc.) are referred to as being 'tonal'.

**1/3 octave analysis** Frequency analysis of sound such that the frequency spectrum is subdivided into bands of one-third of an octave each.

## Appendix 9.2 Noise monitoring details (AWN Consulting Ltd.)

A series of environmental noise surveys were conducted in order to quantify the existing noise environment. The survey was conducted in accordance with *ISO/DIS 1996-2 Acoustics - Description, measurement and assessment of environmental noise -- Part 2: Determination of sound pressure levels (2015)*. Specific details are set out below.

### Choice of noise monitoring locations

Noise measurements were conducted at three positions on the site boundary that are reflective of noise levels at the nearest noise sensitive locations and the common boundary with the Cuisine de France facility to the west. Details for the particular locations are outlined below:

- Location S01** Located in the north western corner of the site in line with the common boundary of the nearest noise sensitive locations at the junction of the R102 and the Grand Canal.
- Location S02** Located on the south western corner of the site along with the common boundary of a nearby noise sensitive location. The location is representative of the row of noise sensitive locations that along the R102 beyond the western boundary of the proposed development.
- Location S03** Located in the vicinity of the nearest residential location to the north east of the proposed development site. The property is located on the boundary of the Grangecastle Business Park and is immediately adjacent a number of commercial activities.
- Location S04** Located in the north eastern concern of the development lands. This location is considered to be representative of noise levels currently experienced in the vicinity of the residential properties on the Royal Canal to the north.
- Location S05** Located in the south western concern of the development lands. The location is considered to be representative of noise levels currently experienced in the vicinity of the halting site located to the south west at some 200 m distance.



**Figure A** Noise monitoring locations (Source: Bing Maps)

## Survey periods

Measurements were conducted over the course of the following survey periods:

Table A Noise monitoring periods

Locations	Period	Start Time/Date	End Time/Date
S01, S02, S03	Day	09:50hrs 9 April 2016	12:40hrs 9 April 2016
	Evening	21:40hrs 9 April 2016	22:50hrs 9 April 2016
	Night	23:00hrs 9 April 2016	01:40hrs 10 April 2016
S04, S05	Unattended	15:00hrs 4 November 2020	11:45hrs 10 November 2020

## Personnel & Instrumentation

AWN conducted the noise level measurements during the various survey periods. The measurements were performed using Brüel & Kjær Type 2260 Modular Precision Sound Analysers. Before and after the survey the measurement apparatus was check calibrated using a Brüel & Kjær Type 4231 Sound Level Calibrator. Donogh Casey installed and removed the noise meters on site in the 2020 unattended survey.

Table B Instrumentation details

Meter	Serial Number
Brüel & Kjær 2260	2248262
Rion NL-42	575802
Rion NL-52	186670

## Procedure

During each of the daytime, evening and night-time periods, measurements were conducted on a continuous basis over the stated time periods. Sample periods were 15 minutes during all surveys. The results were saved to the instrument memory for later analysis where appropriate. Survey personnel noted all primary noise sources contributing to noise build-up. In terms of the various locations the following significant noise sources (in subjective order of influence) were noted:

Table C Significant noise sources

Location	
S01	S02
<ul style="list-style-type: none"> <li>R120 road traffic noise.</li> <li>Water running in a nearby canal in absence of traffic.</li> <li>Site work and plant noise associated with existing sites.</li> <li>During evening period noise dominated by traffic and water noise associated with the canal.</li> <li>During night time plant noise from existing facilities (to the East and South) is the dominant background source.</li> </ul>	<ul style="list-style-type: none"> <li>Plant noise from facility to the south.</li> <li>Noise from existing site including impulsive noise (bangs) and reverse alarms.</li> <li>Dogs barking and birdsong.</li> <li>During the evening distant traffic noise and plant noise noted.</li> <li>During night time existing plant noise from southern existing facilities is the dominant source. Distant traffic also noted.</li> </ul>
Location	
S03	S04
<ul style="list-style-type: none"> <li>Noise dominated by existing plant noise from adjacent facility.</li> <li>Occasional bus passing by.</li> <li>Water flow from nearby watercourse.</li> <li>Reverse alarms and construction noise from nearby site.</li> <li>As above for evening period with the exception of construction noise.</li> <li>During night time plant noise from the adjacent facility and water flow from nearby watercourse.</li> </ul>	<ul style="list-style-type: none"> <li>R120 road traffic noise.</li> <li>Water flow from nearby watercourse.</li> <li>During night time plant noise from the adjacent facility and water flow from nearby watercourse noted.</li> </ul>
Location	
S05	
<ul style="list-style-type: none"> <li>R120 road traffic noise.</li> <li>Water flow from nearby watercourse.</li> <li>During night time plant noise from the adjacent facility and water flow from nearby watercourse noted.</li> </ul>	

**Noise Monitoring Results**

The noise data collated during the current noise survey is extensive in nature. It is not produced in full here however is available on request.

Table D presents average daytime and night time noise levels measured at the monitoring location over the period of the noise monitoring programme.

Table D Noise monitoring results

Location	Date	Period	Start Time	Measured Noise Levels (dB re. 2x10 <sup>-5</sup> Pa)		
				L <sub>Aeq,15min</sub>	L <sub>AFMax</sub>	L <sub>A90,15min</sub>
S01	9 April	Day	09:51	58	71	44
	9 April	Day	11:15	61	76	47
	9 April	Evening	21:46	53	63	45
	10 April	Night	00:01	48	61	42
	10 April	Night	00:58	49	67	43
S02	9 April	Day	10:23	48	65	42
	9 April	Day	11:37	48	73	41
	9 April	Day	12:47	49	65	43
	9 April	Evening	22:04	44	61	41
	9 April	Night	23:38	41	63	39
	10 April	Night	01:20	40	61	38
S03	9 April	Day	10:50	53	76	47
	9 April	Day	12:05	53	73	48
	9 April	Day	12:21	52	72	48
	9 April	Evening	22:35	51	68	49
	9 April	Night	23:00	51	70	48
	9 April	Night	23:16	49	54	48

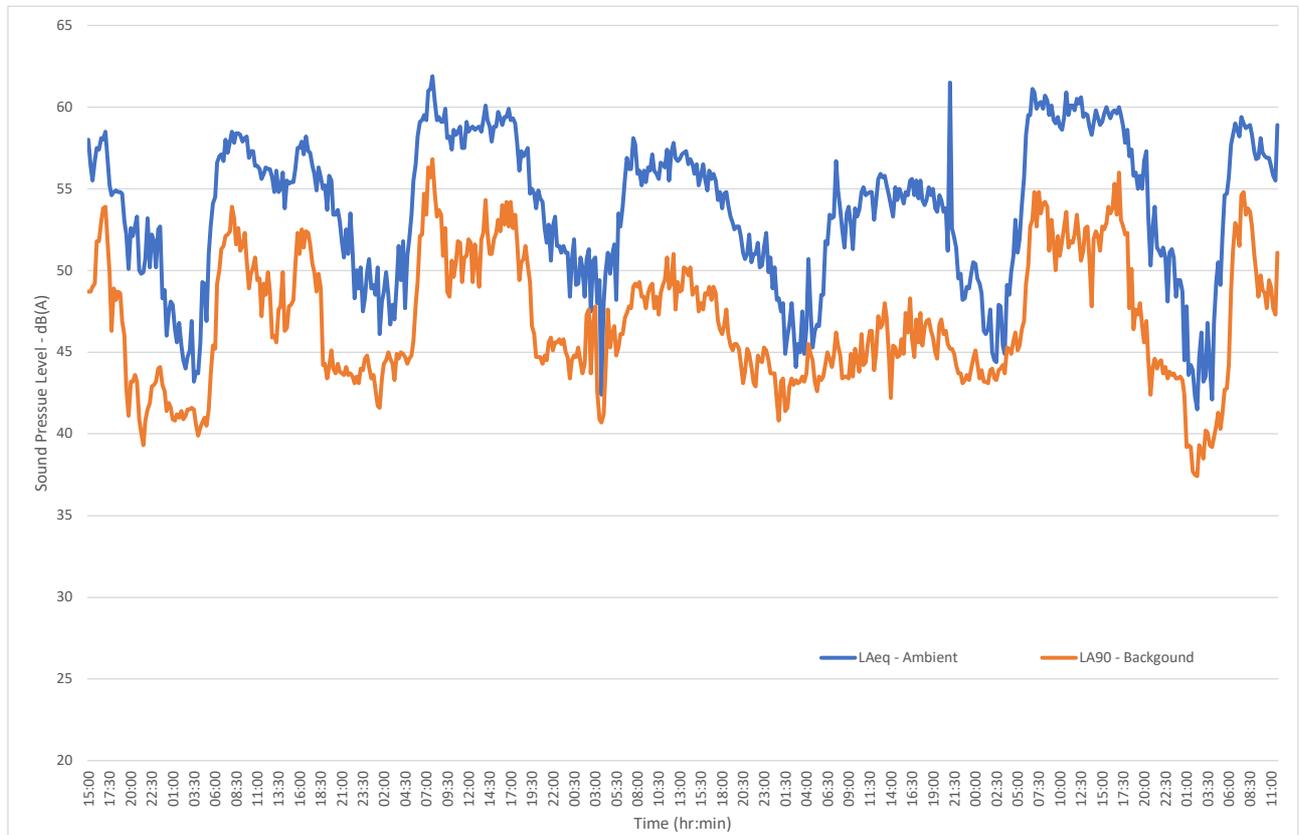


Figure B Unattended Noise Monitoring – Location S04

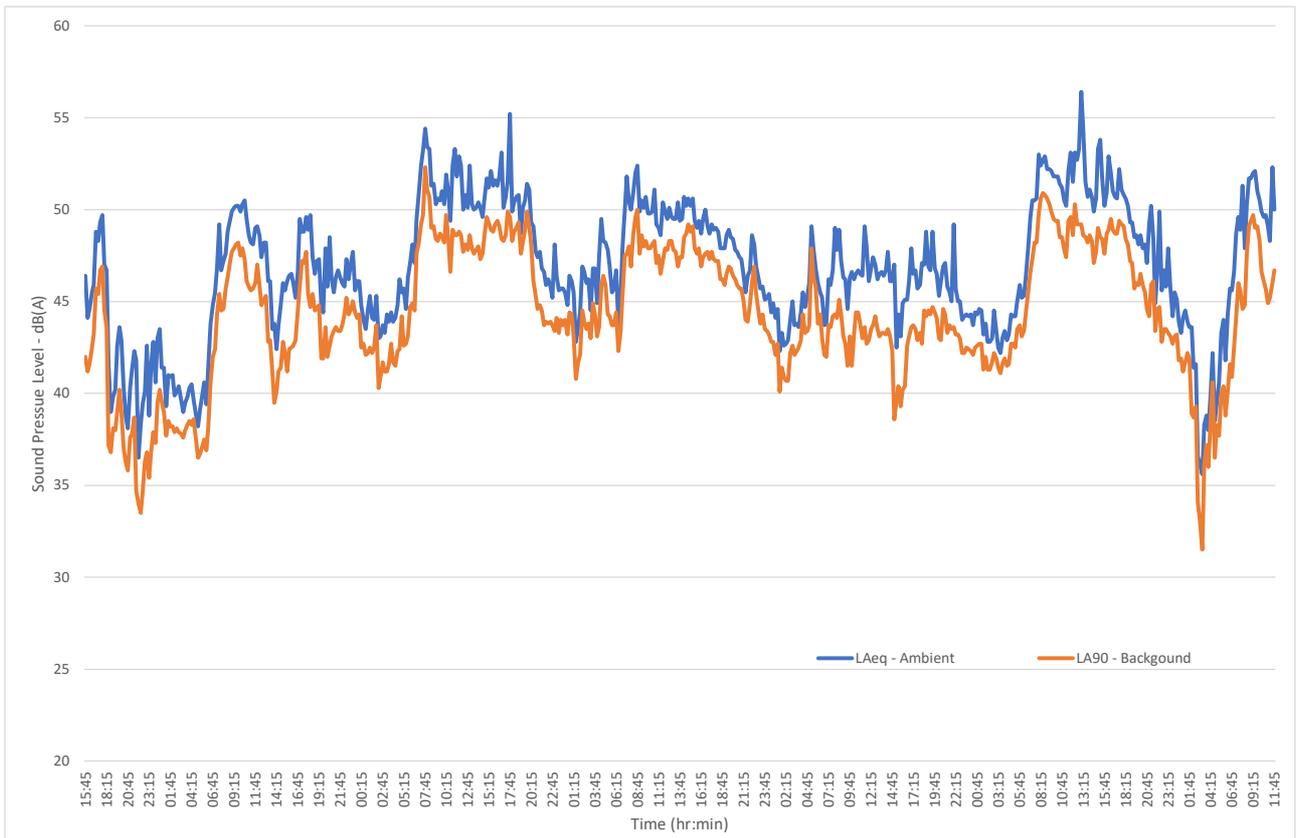


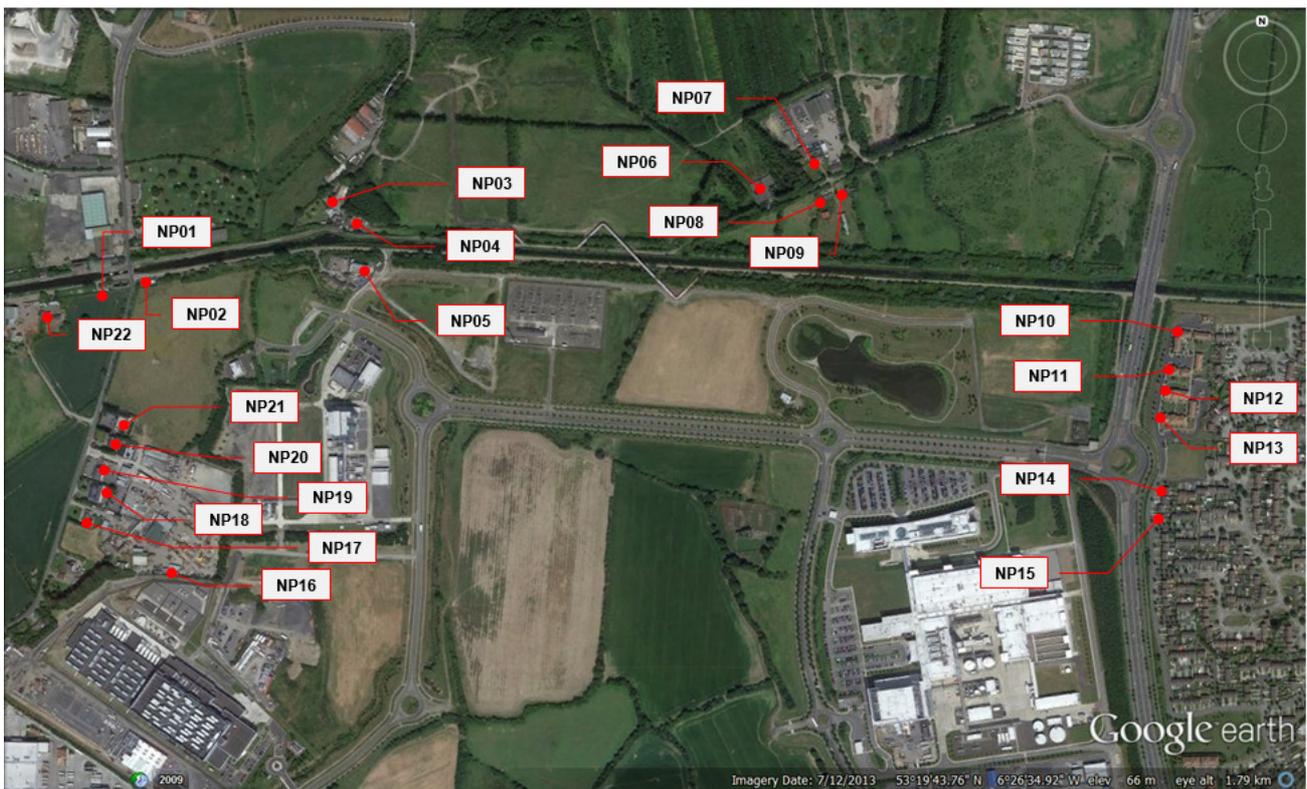
Figure C Unattended Noise Monitoring – Location S05

**Appendix 9.3 Indicative construction noise & vibration management plan**

This Noise and Vibration Management Plan (NVMP) details a 'Best Practice' approach to dealing with potential noise and vibration emissions during the construction phase of the development. The Plan should be adopted by all contractors and sub-contractors involved in construction activities on the site. The Site Manager should ensure that adequate instruction is provided to contractors regarding the noise and vibration control measures contained within this document.

The environmental impact assessment report conducted for the construction activity has highlighted that the construction noise and vibration levels can be controlled to within the adopted criteria. However, mitigation measures should be implemented, where necessary, in order to control impacts to nearby sensitive areas within acceptable levels.

Nearby sensitive properties in the vicinity of the proposed development are summarised in Figure A below:



**Figure A** Sensitive receptors

Construction Noise Criteria

As referenced in the EIS prepared for the site, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the National Roads Authority (NRA) publication *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*<sup>14</sup> which indicates the following criteria and hours of operation.

Table A Construction noise limit values

Days and Times	Noise Levels (dB re. 2x10 <sup>-5</sup> Pa)	
	L <sub>Aeq</sub> (1hr)	L <sub>Amax</sub>
Monday to Friday 07:00hrs to 19:00hrs	70	80
Monday to Friday 19:00 to 22:00hrs	60*	65*
Saturdays 08:00hrs to 14:00hrs	65	75

Note \* Construction activity at these times, other than that required for emergency works, will normally require the explicit permission of the relevant local authority.

<sup>14</sup> *Guidelines for the Treatment of Noise and Vibration in National Road Schemes, Revision 1, 25 October 2004*, National Roads Authority.

### Construction Vibration Criteria

It is recommended in the EIS that vibration from construction activities to off-site residences be limited to the values set out in Table B. It should be noted that these limits are not absolute, but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage these limits may need to be reduced by up to 50%.

Table B Construction vibration limit values

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of		
Less than 10 Hz	10 to 50 Hz	50 to 100 Hz (and above)
8 mm/s	12.5 mm/s	20 mm/s

### Hours of Work

The proposed general construction hours are 07:00 to 19:00hrs, Monday to Friday and 08:00 to 13:00 on Saturdays. However, there are also weekday evening works proposed (19:00 to 23:00hrs).

Weekday evening activities should be significantly reduced and generally only involve internal activities and concrete pouring which will be required during certain phases of the development. As a result, noise emissions from evening activities are expected to be significantly lower than for other general daytime activities.

### Best Practice Guidelines for the Control of Noise & Vibration

BS5228 includes guidance on several aspects of construction site mitigation measures, including, but not limited to:

- selection of quiet plant;
- control of noise sources;
- screening;
- hours of work;
- liaison with the public, and;
- monitoring.

Detailed comment is offered on these items in the following paragraphs. Noise and vibration control measures that will be considered include the selection of suitable plant, enclosures and screens around noise sources, limiting the hours of work and monitoring.

### ***Selection of Quiet Plant***

This practice is recommended in relation to sites with static plant such as compressors and generators. It is recommended that these units be supplied with manufacturers' proprietary acoustic enclosures where possible. The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item should be selected wherever possible. Should a particular item of plant already on the site be found to generate high noise levels, the first action should be to identify whether or not said item can be replaced with a quieter alternative.

### ***General Comments on Noise Control at Source***

If replacing a noisy item of plant is not a viable or practical option, consideration should be given to noise control "at source". This refers to the modification of an item of plant or the application of improved sound reduction methods in consultation with the supplier. For example, resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can often be controlled by fixing resilient materials in between the surfaces in contact.

BS5228 states that "*as far as reasonably practicable sources of significant noise should be enclosed*". In applying this guidance, constraints such as mobility, ventilation, access and safety must be taken into account. Items suitable for enclosure include pumps and generators. Demountable enclosures will also be used to screen operatives using hand tools and will be moved around site as necessary.

In practice, a balance may need to be struck between the use of all available techniques and the resulting costs of doing so. As with Ireland's Environmental Protection Act legislation, we propose that the concept of

*“best available techniques not entailing excessive cost” (BATNEEC) be adopted. Furthermore, proposed noise control techniques should be evaluated in light of their potential effect on occupational safety etc. BS5228 makes a number of recommendations in relation to “use and siting of equipment”. These are all directly relevant and hence are reproduced in full. These recommendations will be adopted on site.*

*“Plant should always be used in accordance with manufacturers’ instructions. Care should be taken to site equipment away from noise-sensitive areas. Where possible, loading and unloading should also be carried out away from such areas. Special care will be necessary when work has to be carried out at night.*

*Circumstances can arise when night-time working is unavoidable. Bearing in mind the special constraints under which such work has to be carried out, steps should be taken to minimise disturbance to occupants of nearby premises.*

*Machines such as cranes that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum. Machines should not be left running unnecessarily, as this can be noisy and waste energy.*

*Plant known to emit noise strongly in one direction should, when possible, be orientated so that the noise is directed away from noise-sensitive areas. Attendant operators of the plant can also benefit from this acoustical phenomenon by sheltering, when possible, in the area with reduced noise levels.*

*Acoustic covers to engines should be kept closed when the engines are in use and idling. The use of compressors that have effective acoustic enclosures and are designed to operate when their access panels are closed is recommended.*

*Materials should be lowered whenever practicable and should not be dropped. The surfaces on to which the materials are being moved could be covered by resilient material.”*

All items of plant should be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.

### **Screening**

Typically screening is an effective method of reducing the noise level at a receiver location and can be used successfully as an additional measure to all other forms of noise control. The effectiveness of a noise screen will depend on the height and length of the screen and its position relative to both the source and receiver.

The length of the screen should in practice be at least five times the height, however, if shorter sections are necessary then the ends of the screen should be bent around the source. The height of any screen should be such that there is no direct line of sight between the source and the receiver.

BS5228 states that on level sites the screen should be placed as close as possible to either the source or the receiver. The construction of the barrier should be such that there are no gaps or openings at joints in the screen material. In most practical situations the effectiveness of the screen is limited by the sound transmission over the top of the barrier rather than the transmission through the barrier itself. In practice screens constructed of materials with a mass per unit of surface area greater than 7 kg/m<sup>2</sup> will give adequate sound insulation performance.

In addition, careful planning of the site layout should also be considered. The placement of site buildings such as offices and stores and in some instances materials such as topsoil or aggregate can provide a degree of noise screening if placed between the source and the receiver.

### **Vibration**

The vibration from construction activities will be limited to the values set out in Table 2. It should be noted that these limits are not absolute, but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage, these limits may need to be reduced by up to 50%.

***Liaison with the Public***

The Contractor will provide proactive community relations and will notify the public and sensitive premises before the commencement of any works forecast to generate appreciable levels of noise or vibration, explaining the nature and duration of the works. The Contractor will distribute information circulars informing people of the progress of works and any likely periods of significant noise and vibration.

A designated noise liaison should be appointed to site during construction works. Any complaints should be logged and followed up in a prompt fashion. In addition, prior to particularly noisy construction activity, e.g. rock breaking, piling, etc., the site contact should inform the nearest noise sensitive locations of the time and expected duration of the works.

***Noise Monitoring***

During the construction phase consideration should be given to noise monitoring at the nearest sensitive locations.

Noise monitoring should be conducted in accordance with the International Standard ISO 1996: 2007: *Acoustics – Description, measurement and assessment of environmental noise* and be located a distance of greater than 3.5m away from any reflective surfaces, e.g. walls, in order to ensure a free-field measurement without any influence from reflected noise sources.

***Vibration Monitoring***

During the construction phase consideration should be given to vibration monitoring at the nearest sensitive locations.

Vibration monitoring should be conducted in accordance with BS7385-1 (1990) *Evaluation and measurement for vibration in buildings — Part 1: Guide for measurement of vibrations and evaluation of their effects on buildings* or BS6841 (1987) *Guide to measurement and evaluation of human exposure to whole-body mechanical vibration and repeated shock*.

The mounting of the transducer to the vibrating structure should comply with BS ISO 5348:1998 *Mechanical vibration and shock – Mechanical mounting of accelerometers*. In summary, the following ideal mounting conditions apply:

- the transducer and its mountings are as rigid as possible;
- the mounting surfaces should be as clean and flat as possible;
- simple symmetric mountings are best, and;
- the mass of the mounting should be small in comparison to that of the structure under test.

In general the transducer will be fixed to the floor of a building or concrete base on the ground using expansion bolts. In instances where the vibration monitor will be placed outside of a building a flat and level concrete base with dimensions of approximately 1m x 1m x 0.1m will be required.

## Appendix 9.4 Noise modelling details

### Noise model

A 3D computer-based prediction model has been prepared in order to quantify the noise level associated with the operation of the proposed building. This section discusses the methodology behind the noise modelling process.

### DGMR iNoise

Proprietary noise calculation software has been used for the purposes of this modelling exercise. The selected software, DGMR iNoise, calculates noise levels in accordance with *ISO 9613: Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation, 1996*.

DGMR iNoise is a proprietary noise calculation package for computing noise levels in the vicinity of noise sources. Predictor calculates noise levels in different ways depending on the selected prediction standard. In general, however, the resultant noise level is calculated taking into account a range of factors affecting the propagation of sound, including:

- the magnitude of the noise source in terms of A weighted sound power levels ( $L_{WA}$ );
- the distance between the source and receiver;
- the presence of obstacles such as screens or barriers in the propagation path;
- the presence of reflecting surfaces;
- the hardness of the ground between the source and receiver;
- Attenuation due to atmospheric absorption; and
- Meteorological effects such as wind gradient, temperature gradient and humidity (these have significant impact at distances greater than approximately 400m).

### Brief description of ISO9613-2: 1996

ISO9613-2:1996 calculates the noise level based on each of the factors discussed previously. However, the effect of meteorological conditions is significantly simplified by calculating the average downwind sound pressure level,  $L_{AT}(DW)$ , for the following conditions:

- wind direction at an angle of  $\pm 45^\circ$  to the direction connecting the centre of the dominant sound source and the centre of the specified receiver region with the wind blowing from source to receiver, and;
- wind speed between approximately  $1 \text{ ms}^{-1}$  and  $5 \text{ ms}^{-1}$ , measured at a height of 3 m to 11 m above the ground.

The equations and calculations also hold for average propagation under a well-developed moderate ground based temperature inversion, such as commonly occurs on clear calm nights.

The basic formula for calculating  $L_{AT}(DW)$  from any point source at any receiver location is given by:

$$L_{AT}(DW) = L_W + D_c - A \quad \text{Eqn. A}$$

Where:

$L_{AT}(DW)$  is an octave band centre frequency component of  $L_{AT}(DW)$  in dB relative to  $2 \times 10^{-5} \text{ Pa}$ ;

$L_W$  is the octave band sound power of the point source;

$D_c$  is the directivity correction for the point source;

$A$  is the octave band attenuation that occurs during propagation, namely attenuation due to geometric divergence, atmospheric absorption, ground effect, barriers and miscellaneous other effects.

The estimated accuracy associated with this methodology is shown in Table A below:

Table A Estimated accuracy for broadband noise of  $L_{AT}(DW)$ 

Height, $h^*$	Distance, $d^\dagger$	
	$0 < d < 100$ m	$100 \text{ m} < d < 1,000$ m
$0 < h < 5$ m	$\pm 3$ dB	$\pm 3$ dB
$5 \text{m} < h < 30$ m	$\pm 1$ dB	$\pm 3$ dB

\*  $h$  is the mean height of the source and receiver.  $^\dagger d$  is the mean distance between the source and receiver.

N.B. These estimates have been made from situations where there are no effects due to reflections or attenuation due to screening.

### Input data and assumptions

The noise model has been constructed using data from various source as follows:

<i>Site Layout</i>	The general site layout has been obtained from the drawings forwarded by Henry J Lyons Architects.
<i>Local Area</i>	The location of noise sensitive locations has been obtained from a combination of site drawings provided by Henry J Lyons Architects and others obtained from Ordinance Survey Ireland (OSI).
<i>Heights</i>	The heights of buildings on site have been obtained from site drawings forwarded by Henry J Lyons Architects. Off-site buildings have been assumed to be 6m high with the exception of industrial buildings where a default height of 15 m has been assumed.
<i>Contours</i>	Site ground contours/heights have been obtained from site drawings forwarded by Henry J Lyons Architects where available.

The final critical aspect of the noise model development is the inclusion of the various plant noise sources. Details are presented in the following section.

### Source sound power data

BCEI Engineering has provided noise emission data for the significant external mechanical plant and emergency generators. The information provided is review in Table B below.

Table B Source noise data assumed for assessment (DUB06)

Item	Sound Power Levels dB								dB(A)
	63	125	250	500	1000	2000	4000	8000	
Condenser Left Side	86	83	74	70	64	62	61	55	73
Condenser Right Side	86	83	74	70	64	62	61	55	73
Condenser Front (Evaporator)	84	81	72	68	62	60	59	53	71
Condenser Rear (Condenser)	86	83	74	70	65	62	61	55	73
Condenser Top	90	87	78	74	69	66	65	59	77
Gen. Front <sup>Note B</sup>	100.8	108.7	92.4	90.2	78.9	73	73.7	67.8	64
Gen. Rear <sup>Note B</sup>	99	107	90.7	88.5	77.2	71.3	72	66.1	62.3
Gen. Sides <sup>Note B</sup>	102.5	105.3	89	86.8	75.5	69.6	70.3	64.4	60.6
Gen. Exhaust <sup>Note B</sup>	86	103	86.7	84.5	73.2	67.3	68	62.1	58.3
Transformer <sup>Note C</sup>	72	40	70	63	66	50	39	36	36

Note A Maximum permissible Sound Power Level Per unit.

Note B Dub 05 generators are assumed to be attenuated to achieve max. 75dB(A) at 1m.

Note C Transformer noise level advised by Ethos Engineering and typical transformer spectrum from AWN database has been assumed for assessment purposes.

It has been advised that significant noise emissions are not associated with the proposed substations related to the development.

Figure A presents a 3D render of the developed site noise model.

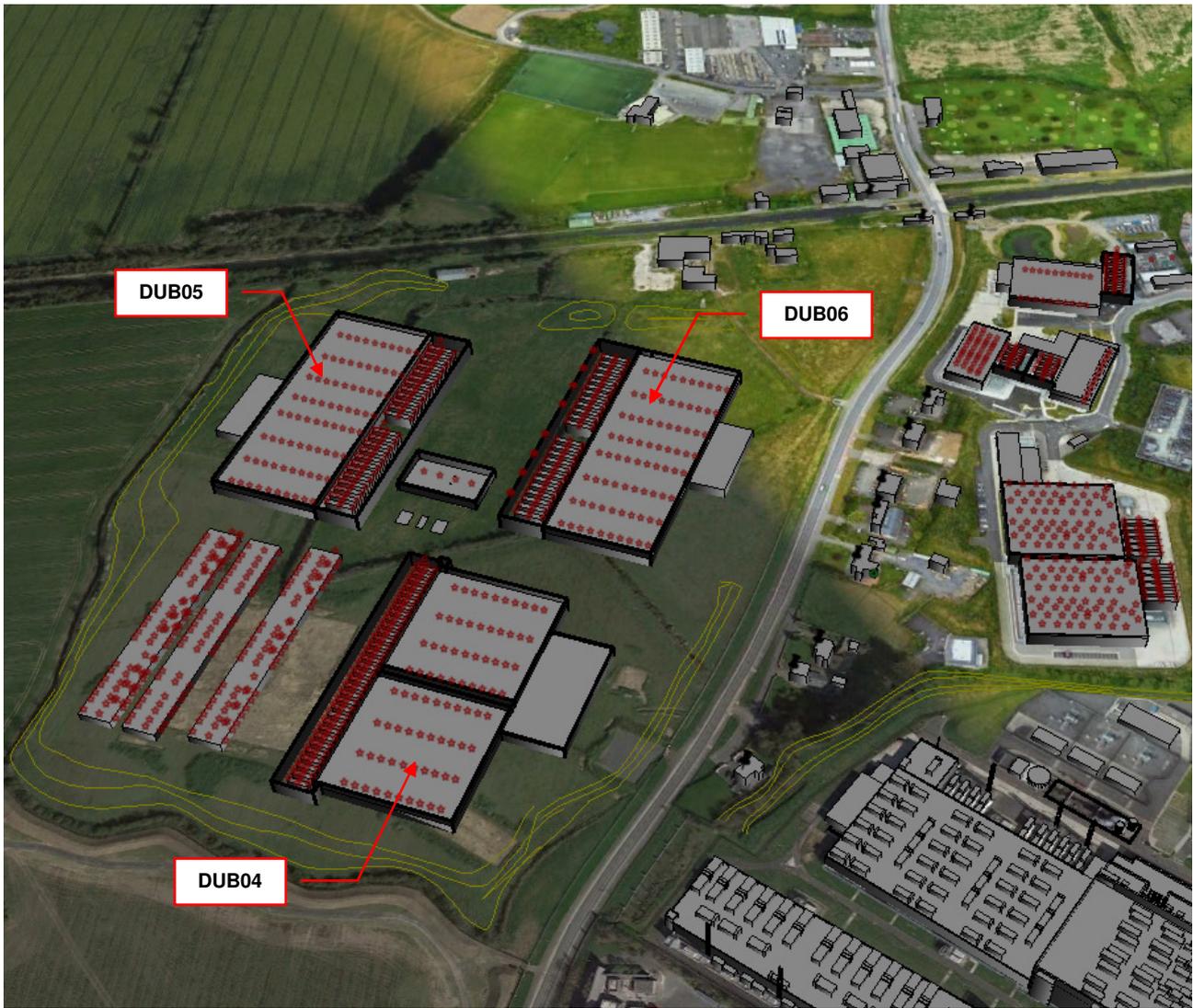


Figure A Images of Developed Noise Model

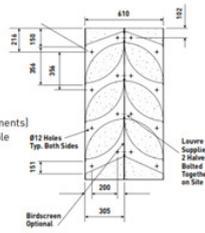
Note in relation to the emergency diesel generators screening to these elements of plant are to be formed from an acoustic louvre which offers the following sound insertion loss. The height of the screen is at least 0.5m above the top of the generator installations to be located to their north, west and south.



**Weight**  
70kg/m<sup>2</sup>

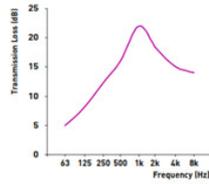
**Module Width**  
300 - 1800mm

**Standard Module Height**  
356 - 3560mm (in 356mm increments)  
Intermediate heights are available



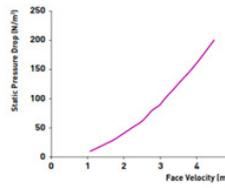
**Acoustic Performance**

Octave Band Centre Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Transmission Loss (dB)	5	8	12	16	22	18	15	14
Acoustic Rating	R <sub>19</sub> dB / D <sub>25</sub> dB							
For noise reduction, add 6dB to the above values								



**Aerodynamic Performance**

Static Pressure Drop (N/m <sup>2</sup> )	10	20	30	40	50	60	70	80	90	100
Face Velocity (m/s)	1.07	1.41	1.73	1.98	2.21	2.46	2.62	2.77	2.99	3.12
Nominal Free Area	52%* * Average over louvre depth									
Cd	0.242									



Pressure Drop =  $\rho h / Cd$   
 $\rho h$  = mass flow  
 $Cd$  = Discharge Coefficient

Figure B Diesel Generators Screen

It has been advised that intake and exhaust louvres to the building will be some 3.5 m wide and 5 m high (i.e. some 15 m<sup>2</sup>). Based on this knowledge and the extent of the buildings shown on masterplan drawings developed to date the following maximum sound power levels for the louvres opes have been estimated:

Table C Assumed Louvre Sound Power Level

Source	L <sub>WA</sub> - Octave Band Centre Frequency								dB (A)
	63	125	250	500	1k	2k	4k	8k	
Intake / Exhaust per Louvre	71	76	66	58	59	60	64	65	78

The above noise level equates to a sound pressure level of some **50dB(A) at a distance of 10m.**

In terms of the walls and roof of the generator halls, is assumed that detailed design will result in sound power levels per m<sup>2</sup> of the element as detailed in Table D.

Table D Assumed Louvre Sound Power Level – Walls & Roof per m<sup>2</sup>

Source	L <sub>WA</sub> - Octave Band Centre Frequency								dB (A)
	63	125	250	500	1k	2k	4k	8k	
Wall / Roof per m <sup>2</sup>	52	50	50	40	30	20	20	20	45

A radiator is located 1.5 m above the roof of the building with the following noise rating associated with it as extracted from the supplied data sheet<sup>15</sup>:

Table E Assumed Radiator L<sub>WA</sub> Level – Gas Generation (Cummings Data)

Source	L <sub>pA</sub> - Octave Band Centre Frequency								dB (A)
	63	125	250	500	1k	2k	4k	8k	
Radiators	62	69	72	78	80	76	70	61	83

It is advised generator exhaust stacks will need to be attenuated to achieve a sound pressure level of no more than 65 dB(A) at 1 m. Based on this we have assumed a sound power level of some 76 dB(A) in relation to these sources.

<sup>15</sup> Radiator Technical Information – Finning/CAT – 25°C ambient level

## Appendix 9.5 – Modelling calculation parameters

Prediction calculations for noise emissions have been conducted in accordance with *ISO 9613: Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation, 1996*. The following are the main aspects that have been considered in terms of the noise predictions presented in this instance.

### *Directivity Factor:*

The directivity factor (D) allows for an adjustment to be made where the sound radiated in the direction of interest is higher than that for which the sound power level is specified. In this case the sound power level is measured in a down wind direction, corresponding to the worst case propagation conditions and needs no further adjustment.

### *Ground Effect:*

Ground effect is the result of sound reflected by the ground interfering with the sound propagating directly from source to receiver. The prediction of ground effects is inherently complex and depend on source height receiver height propagation height between the source and receiver and the ground conditions. The ground conditions are described according to a variable defined as G, which varies between 0.0 for hard ground (including paving, ice concrete) and 1.0 for soft ground (includes ground covered by grass trees or other vegetation) Our predictions have been carried out using various source height specific to each plant item, a receiver heights of 1.6m for single storey properties and 4m for double. An assumed ground factor of  $G = 0.8$  has been applied off site. Noise contours presented in the assessment have been predicted to a height of 4m in all instances.

### *Geometrical Divergence*

This term relates to the spherical spreading in the free-field from a point sound source resulting in attenuation depending on distance according to the following equation:

$$A_{geo} = 20 \times \log(\text{distance from source in meters}) + 11$$

### *Atmospheric Absorption*

Sound propagation through the atmosphere is attenuated by the conversion of the sound energy into heat. This attenuation is dependent on the temperature and relative humidity of the air through which the sound is travelling and is frequency dependent with increasing attenuation towards higher frequencies. In these predictions a temperature of 10°C and a relative humidity of 70% have been used, which give relatively low levels of atmosphere attenuation and corresponding worst case noise predictions.

Table A Atmospheric Attenuation Assumed for Noise Calculations (dB per km)

Temp (°C)	% Humidity	Octave Band Centre Frequencies (Hz)							
		63	125	250	500	1k	2k	4k	8k
10	70	0.12	0.41	1.04	1.92	3.66	9.70	33.06	118.4

### *Barrier Attenuation*

The effect of any barrier between the noise source and the receiver position is that noise will be reduced according to the relative heights of the source, receiver and barrier and the frequency spectrum of the noise.

## CHAPTER 10 – AIR QUALITY

### Appendix 10.1 Description of the AERMOD model

The AERMOD dispersion model has been developed in part by the U.S. Environmental Protection Agency (USEPA, 2021). The model is a steady-state Gaussian model used to assess pollutant concentrations associated with industrial sources. The model is an enhancement on the Industrial Source Complex-Short Term 3 (ISCST3) model which has been widely used for emissions from industrial sources.

Improvements over the ISCST3 model include the treatment of the vertical distribution of concentration within the plume. ISCST3 assumes a Gaussian distribution in both the horizontal and vertical direction under all weather conditions. AERMOD with PRIME, however, treats the vertical distribution as non-Gaussian under convective (unstable) conditions while maintaining a Gaussian distribution in both the horizontal and vertical direction during stable conditions. This treatment reflects the fact that the plume is skewed upwards under convective conditions due to the greater intensity of turbulence above the plume than below. The result is a more accurate portrayal of actual conditions using the AERMOD model. AERMOD also enhances the turbulence of night-time urban boundary layers thus simulating the influence of the urban heat island.

In contrast to ISCST3, AERMOD is widely applicable in all types of terrain. Differentiation of the simple versus complex terrain is unnecessary with AERMOD. In complex terrain, AERMOD employs the dividing-streamline concept in a simplified simulation of the effects of plume-terrain interactions. In the dividing-streamline concept, flow below this height remains horizontal, and flow above this height tends to rise up and over terrain. Extensive validation studies have found that AERMOD (precursor to AERMOD with PRIME) performs better than ISCST3 for many applications and as well or better than CTDMPPLUS for several complex terrain data sets (USEPA, 1999).

Due to the proximity to surrounding buildings, the PRIME (Plume Rise Model Enhancements) building downwash algorithm has been incorporated into the model to determine the influence (wake effects) of these buildings on dispersion in each direction considered. The PRIME algorithm takes into account the position of the stack relative to the building in calculating building downwash. In the absence of the building, the plume from the stack will rise due to momentum and/or buoyancy forces. Wind streamlines act on the plume leads to the bending over of the plume as it disperses. However, due to the presence of the building, wind streamlines are disrupted leading to a lowering of the plume centreline.

When there are multiple buildings, the building tier leading to the largest cavity height is used to determine building downwash. The cavity height calculation is an empirical formula based on building height, the length scale (which is a factor of building height & width) and the cavity length (which is based on building width, length and height). As the direction of the wind will lead to the identification of differing dominant tiers, calculations are carried out in intervals of 10 degrees.

In PRIME, the nature of the wind streamline disruption as it passes over the dominant building tier is a function of the exact dimensions of the building and the angle at which the wind approaches the building. Once the streamline encounters the zone of influence of the building, two forces act on the plume. Firstly, the disruption caused by the building leads to increased turbulence and enhances horizontal and vertical dispersion. Secondly, the streamline descends in the lee of the building due to the reduced pressure and drags the plume (or part of) nearer to the ground, leading to higher ground level concentrations. The model calculates the descent of the plume as a function of the building shape and, using a numerical plume rise model, calculates the change in the plume centreline location with distance downwind.

The immediate zone in the lee of the building is termed the cavity or near wake and is characterised by high intensity turbulence and an area of uniform low pressure. Plume mass captured by the cavity region is re-emitted to the far wake as a ground-level volume source. The volume source is located at the base of the lee wall of the building, but is only evaluated near the end of the near wake and beyond. In this region, the disruption caused by the building downwash gradually fades with distance to ambient values downwind of the building.

AERMOD has made substantial improvements in the area of plume growth rates in comparison to ISCST3 (USEPA, 2004a, 2009). ISCST3 approximates turbulence using six Pasquill-Gifford-Turner Stability Classes and bases the resulting dispersion curves upon surface release experiments. This treatment, however, cannot explicitly account for turbulence in the formulation. AERMOD is based on the more realistic modern planetary boundary layer (PBL) theory which allows turbulence to vary with height. This use of turbulence-based plume growth with height leads to a substantial advancement over the ISCST3 treatment.

Improvements have also been made in relation to mixing height (USEPA, 2004a, 2009). The treatment of mixing height by ISCST3 is based on a single morning upper air sounding each day. AERMOD, however, calculates mixing height on an hourly basis based on the morning upper air sounding and the surface energy balance, accounting for the solar radiation, cloud cover, reflectivity of the ground and the latent heat due to evaporation from the ground cover. This more advanced formulation provides a more realistic sequence of the diurnal mixing height changes.

AERMOD also has the capability of modelling both unstable (convective) conditions and stable (inversion) conditions. The stability of the atmosphere is defined by the sign of the sensible heat flux. Where the sensible heat flux is positive, the atmosphere is unstable whereas when the sensible heat flux is negative the atmosphere is defined as stable. The sensible heat flux is dependent on the net radiation and the available surface moisture (Bowen Ratio). Under stable (inversion) conditions, AERMOD has specific algorithms to account for plume rise under stable conditions, mechanical mixing heights under stable conditions and vertical and lateral dispersion in the stable boundary layer.

AERMOD also contains improved algorithms for dealing with low wind speed (near calm) conditions. As a result, AERMOD can produce model estimates for conditions when the wind speed may be less than 1 m/s, but still greater than the instrument threshold.

## Appendix 10.2 Description of AERMET

AERMOD incorporates a meteorological pre-processor AERMET PRO (USEPA 2021). AERMET PRO allows AERMOD to account for changes in the plume behaviour with height. AERMET PRO calculates hourly boundary layer parameters for use by AERMOD, including friction velocity, Monin-Obukhov length, convective velocity scale, convective (CBL) and stable boundary layer (SBL) height and surface heat flux. AERMOD uses this information to calculate concentrations in a manner that accounts for changes in dispersion rate with height, allows for a non-Gaussian plume in convective conditions, and accounts for a dispersion rate that is a continuous function of meteorology.

The AERMET PRO meteorological pre-processor requires the input of surface characteristics, including surface roughness ( $z_0$ ), Bowen Ratio and albedo by sector and season, as well as hourly observations of wind speed, wind direction, cloud cover, and temperature. A morning sounding from a representative upper air station, latitude, longitude, time zone, and wind speed threshold are also required.

Two files are produced by AERMET PRO for input to the AERMOD dispersion model. The surface file contains observed and calculated surface variables, one record per hour. The profile file contains the observations made at each level of a meteorological tower, if available, or the one-level observations taken from other representative data, one record level per hour.

From the surface characteristics (i.e. surface roughness, albedo and amount of moisture available (Bowen Ratio)) AERMET PRO calculates several boundary layer parameters that are important in the evolution of the boundary layer, which, in turn, influences the dispersion of pollutants. These parameters include the surface friction velocity, which is a measure of the vertical transport of horizontal momentum; the sensible heat flux, which is the vertical transport of heat to/from the surface; the Monin-Obukhov length which is a stability parameter relating the surface friction velocity to the sensible heat flux; the daytime mixed layer height; the nocturnal surface layer height and the convective velocity scale which combines the daytime mixed layer height and the sensible heat flux. These parameters all depend on the underlying surface.

The values of albedo, Bowen Ratio and surface roughness depend on land-use type (e.g., urban, water, cultivated land etc) and vary with seasons and wind direction. The assessment of appropriate land-use type was carried out to a distance of 10km from the location of the meteorological station in line with USEPA recommendations (USEPA 2005) for albedo and Bowen ratio with a 1km geometric determination undertaken for the surface roughness. In relation to wind direction, a minimum sector arc of 30 degrees is recommended.

### *Surface roughness*

Surface roughness length is the height above the ground at which the wind speed goes to zero. Surface roughness length is defined by the individual elements on the landscape such as trees and buildings. In order to determine surface roughness length, the USEPA recommends that a representative length be defined for each sector, based on geometric mean of the inverse distance area-weighted land use within the sector, by using the eight land use categories outlined by the USEPA. The area-weighted surface roughness length derived from the land use classification within a radius of 1km from Casement Aerodrome is shown in Table A10.1.

**Table A10.1** Surface Roughness based on an inverse distance area-weighted average of the land use within a 1km radius of Casement Aerodrome.

Sector	Area Weighted Land Use Classification	Spring	Summer	Autumn	Winter <sup>Note 1</sup>
0-360	100% Grassland	0.050	0.100	0.010	0.010

**Note 1:** Winter defined as periods when surfaces covered permanently by snow whereas autumn is defined as periods when freezing conditions are common, deciduous trees are leafless and no snow is present (Iqbal (1983)). Thus for the current location autumn more accurately defines “winter” conditions at the proposed facility.

### *Albedo*

Noon-time Albedo is the fraction of the incoming solar radiation that is reflected from the ground when the sun is directly overhead. Albedo is used in calculating the hourly net heat balance at the surface for calculating hourly values of Monin-Obuklov length. The area-weighted arithmetic mean albedo derived from the land use classification over a 10km x 10km area centred on Casement Aerodrome is shown in Table A10.2.

**Table A10.2** Albedo based on an area-weighted arithmetic mean of the land use over a 10km x 10km area centred on Casement Aerodrome.

Area Weighted Land Use Classification	Spring	Summer	Autumn	Winter <sup>Note1</sup>
0.5% Water, 30% Urban, 0.5% Coniferous Forest 38% Grassland, 19% Cultivated Land	0.155	0.180	0.187	0.187

**Note 1:** For the current location autumn more accurately defines “winter” conditions at the proposed facility.

#### *Bowen Ratio*

The Bowen ratio is a measure of the amount of moisture at the surface of the earth. The presence of moisture affects the heat balance resulting from evaporative cooling which, in turn, affects the Monin-Obukhov length which is used in the formulation of the boundary layer. The area-weighted geometric mean Bowen ratio derived from the land use classification over a 10km x 10km area centered on Casement Aerodrome is shown in Table A10.3

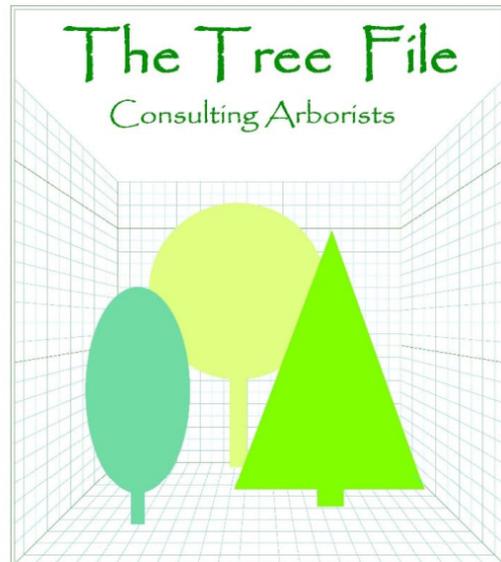
**Table A10.3** Bowen ratio based on an area-weighted geometric mean of the land use over a 10km x 10km area centred on Casement Aerodrome.

Area Weighted Land Use Classification	Spring	Summer	Autumn	Winter <sup>Note1</sup>
0.5% Water, 30% Urban, 0.5% Coniferous Forest 38% Grassland, 19% Cultivated Land	0.549	1.06	1.202	1.202

**Note 1:** For the current location autumn more accurately defines “winter” conditions at the proposed facility.



**Appendix 12.2 Tree survey**



**Arboricultural Report**  
**Trees at Proposed Site**  
**EdgeConneX**  
**within the townland of Ballymakailly,**  
**West of Newcastle Road (R120),**  
**Lucan**  
**Co. Dublin**  
**May 2023**

**The Tree File Ltd**  
**Consulting Arborists**  
**4 Mulberry Court**  
**Castleknock**  
**Dublin 15**  
**D15 F2V4**  
**086-3819011**



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A2	<u>Appendix A2 - Tree Survey</u> Table 1 – Tree Survey Data

### Associated Drawings

This report is for reading in conjunction with the drawings noted below

<u>Drawing Title</u>	<u>Drawing Subject</u>
1) EdgeConneX Tree Constraints Plan	<b>Tree Constraints Plan</b> A plan depicting the predevelopment location, size, calculated constraints, and simplified tree quality category system
2) EdgeConneX Tree Impacts Plan	<b>Tree Impacts Plan</b> This plan represents the effects of the proposed development works on the above tree population and depicts trees to be retained and removed.
3) EdgeConneX Tree Protection Plan	<b>Tree Protection Plan</b> This plan depicts the nature, location and extent of tree protection measures required for sustainable tree retention.



## **1 Report Summary**

- 1.1 This report comprises an update of previous Arboricultural reports for the site and relates to minor design amendments, and to the broader development already granted under SDCC Planning Ref. SD19A/0042 / ABP Ref. PL06S.305948 and Ref. SD21A/0042.
- 1.2 This report appreciates that much of the site, as described in previous reports remains unchanged, other than the commencement of previously permitted works within the southernmost portion of the site. At the time this report was compiled, no vegetation had been removed from site.
- 1.3 The site supports little vegetation of Arboricultural interest, other than an agricultural field hedge system. The “red line” area supports only three trees, each of which is of poor quality and not intended for retention. The site is adjoined, to the north, by a number of trees, but these are positioned outside of the site red line and thus are beyond the site’s jurisdiction.
- 1.4 Though variable, many of the agricultural field boundary hedges are in reasonable condition and a majority offer good sustainability, should they be managed over time.
- 1.5 The proposed development phase will unavoidably consume or otherwise modify a large proportion “red line” area. In addition to the tree and vegetation losses related to previously granted works, this phase will see the loss of;- Hedge 3, the northern portion of Hedge 4, Hedge 5, the southern portion of Hedge 6 and Hedge 8.
- 1.6 Within the Red Line area, the only vegetation being retained includes Hedge 1 and the northern portion of Hedge 6. The retention of this vegetation will be achieved by using tree protection measures. This will comprise “construction exclusion fencing”, erected prior to the commencement of site works and maintained in situ until the completion of all construction related works.

## **2 Introduction**

- 2.1 This report was commissioned by-  
**EdgeConneX Ireland Limited.**

This report was prepared by-  
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### **Report Brief**

- 2.2 An Arboricultural report has been requested in respect of the proposed development. As "BS5837: 2012 Trees in Relation to Design, Demolition and Construction – Recommendations" is the accepted framework for such reports, the composition of this report, its inclusions and recommendations are followed as a general basis for this report.

### **Report Context**

- 2.3 This report includes an Arboricultural review of the proposed development project. The report includes an assessment of the sites existing tree population within its current context. The report assesses their potential for sustainable retention in the post-development scenario. The report also describes the likely effects and repercussions of the development and construction process upon those trees. It also provides information regarding the necessary tree protection and the avoidance of damage to trees during the construction process, necessary to achieve sustainable tree retention.
- 2.4 This assessment summarises the Arborists findings and recommendations. These findings were developed after reviewing the proposed project details as provided by the design team, and after an evaluation of trees as defined and described in the tree survey at "Appendix 2". This report also includes a preliminary "Arboricultural Method Statement" at "Appendix 1" as well as a Tree Protection Plan. This plan illustrates the requisite conservation and protection methodologies necessary to maintain tree sustainability. This report is not intended as a critique of the proposed development but is an impartial assessment of the development implications relating to the sustainable retention of trees, whether that be any, some, or all trees. This report is for planning purposes only and may be deficient for construction phase use.

### **Report Limitations**

- 2.5 This report relates the Arborists interpretation of information provided to him before the report compilation and gained by him during the undertaking of the site review and tree survey. The site review data is subject to the limitations set out under "Inspection and Evaluation Limitations and Disclaimers" in "Appendix 2" of this report. The findings and recommendations made within this report are compiled based upon the knowledge and expertise of the inspecting Arborist.
- 2.6 The "Implication Assessment" element of the report builds on assumptions and estimates, particularly in respect of how construction works might proceed on a day to day basis and appreciates the "design" stage of the project, as opposed to "detail design" or "construction" detail.
- 2.7 In line with the "design" stage of the development details, many elements of the "Arboricultural Method Statement" are deliberately broad and generic. They will require review, amendment and consolidation at the construction stage, for example, in respect of the size and nature of the equipment, plant and machinery that might be utilised by any potential building contractor and any details as may change at "detail design" or "construction detail" stages.
- 2.8 Accordingly, this assessment is premised on all its elements/recommendations, and the omission or alteration of any part of it, particularly the application of tree protection methodologies, can radically alter outcomes regarding sustainable tree retention.

### **3 Site Description**

- 3.1 The subject site comprises a small proportion of the broader site area. The broader site is located south of Lucan, Co Dublin and to the south of the Grand Canal, with the sites eastern boundary being adjoined by the Lucan to Newcastle road. The site appears broadly level and comprises agricultural land divided into various fields. Towards the north of the site area and adjoining the canal towpath there are several derelict buildings and farm yards.
- 3.2 In comparison to the current context, the 18<sup>th</sup> century historical mapping notes a single building group referred to as The Grange accessed from the Newcastle Road and within the townland of Ballymakailly. To the west of the house, there appears to have been areas of quarrying.
- 3.3 Much of the vegetation associated with the site is associated with field or paddock demarcations with the site supporting a larger number of hedges and alignments than it does individual trees. All of the hedges remaining to date are noted on historical mapping, though it appears that some hedges have been removed during the 20<sup>th</sup> century. The 1837-42 mapping suggests most field demarcations supported vegetation, most likely hedges. If trees had existed, there is nothing remaining still on the site that would date from this period.
- 3.4 During the review, the bulk of the central and southern portion of the site exhibited evidence of recent agricultural use however, the northern area, south of the towpath and associated with the derelict buildings and outbuildings appears to have undergone varying degrees of disturbance and modification in the recent past.

### **4 Pre-Development Arboricultural Scenario**

- 4.1 This survey builds upon an earlier review of site vegetation, from which no substantive changes have been recorded. However, the northern site has become increasingly overgrown. Additionally, a greater proportion of the young emergent Elm population has now been affected by Dutch Elm Disease. Additionally, some concern now relates to the likelihood of site Ash trees becoming affected by Ash Dieback Disease.
- 1.2 Much of the material associated with the broader site relates to its original agricultural usage. All described hedge lines being represented on both the 1837-42 and the 1888-13, though the historical mapping shows that some hedges, particularly to the south of the site have been lost. Current field demarcation is dominated by hedges, that appear to be associated with topographical features including ditches and embankments. In some instances, the features are large however, in other instances, for example towards the north of the site, such features tended to be of a smaller scale and in some instances have been partially eroded out. Nonetheless and in respect of any intent to retain such material, it must be appreciated that the retention of hedges is intrinsically linked with the retention and preservation of the ditches or embankments that support them.

- 1.3 Many of the hedges appear to have originated as Hawthorn alignments. While many of these Hawthorns remain, many hedges are now becoming invaded by other species, most notably Blackthorn, Elder, Bramble, Ash and Wych Elm. Many of the hedges retain reasonable continuity however, such continuity is not always provided by the original Hawthorn.
- 1.4 Regarding the southernmost areas of the site, note is made of the numbers of emergent Elms arising from hedgerows. Since the survey undertaken in 2018, it is noted that many more trees have died because of ongoing Dutch Elm disease attack. It is likely that many is not all remaining Elm on the site will be lost to the disease in the near future.
- 1.5 Similar concerns are developing in respect of Ash. Ash Dieback disease (*Hymenoscyphus fraxineus*) is developing widely in Ireland, with many specimens already affected or dead. Therefore Ash should not be relied upon as part of sustainable tree retention strategy as the Ash on the site at present may be lost in the near future.
- 1.6 Within the region of the outbuildings and farm yards towards the north of the site, note is made of substantial, apparently recent environmental change and vandalism that has seen substantial ground works and ground disturbance as well as fire damage. Many such hedges are beyond any reasonable suitability for retention.
- 1.7 It is about the north of the site that we see most individual tree specimens. Unfortunately, very few specimens can be regarded as being suitable for retention and indeed some are recommended for immediate removal.
- 1.8 With regard to the western end of the site's northern boundary, note is made that though located outside of the site confines, the embankment descending towards the Grand Canal supports a developing tree population typically including Sycamore, Alder and Ash. Many such trees would be suitable for retention and have immense potential for ongoing growth over time. Note should however be made that there is evidence to suggest substantial fill and disturbance along the boundary line that may have disturbed both trees directly adjoining and some metres outside of the site. Note is also made that some trees in this area and particularly a Crack Willow, are in particularly poor condition. As noted within the survey, an Ash and Sycamore have been harshly cut back because of their position beneath high tension cables and the Crack Willow has collapsed affecting another described Ash. These poorly condition trees are located substantially outside of the site confines but potentially close enough to influence them as result of ongoing growth over time.
- 1.9 In conclusion it is worthy of note that the site supports little material of Arboricultural interest though it is appreciated that some elements may have ecological and heritage value. Regarding the tree population very few specimens would be regarded as valuable though it is appreciated that some of the hedges, dependent upon the context within which they might be retained, do offer some degree of sustainability.

## **5 Planning Scenario in Respect of Tree**

- 5.1 In respect of trees as they relate to planning within the **South Dublin County Council** area, note is made of two areas of guidance including - **The South Dublin County**

**Council Development Plan 2022-2028 and South Dublin County Council’s Tree Management Policy ‘Living with Trees’ (2021-2026).**

- 5.2 In their development plan, **South Dublin County Council** have made numerous references to trees in respect of planting, retention and protection.
- 5.3 Within Section 3 “**Natural, Cultural and Built Heritage**”, trees gain specific mention in section 3.3.6 “Protection of Trees and Hedgerows”. Specifically, note is made of Policy NCBH11: Tree Preservation Orders and Other Tree / Hedgerow Protections, and NCBH11 Objectives 1 to 5 inclusive that deal with tree preservation orders, the value of trees and hedges within the landscape as well as the general objective to retain, preserve and protect trees, woodlands and hedges.
- 5.4 Note is made of the importance of trees in the landscape and for their environmental values (e.g. carbon sequestration). Note is made of an intent to incorporate new plantings within Section 4 “Green Infrastructure” and as incorporated in objective GI1 Objective 1, which emphasises the use of trees (including street trees) and woodlands as a core element of the Green Infrastructure” policy. Objective GI2.2, further enshrines the importance of trees and tree groups in new developments, with requirements for new planting being noted in Objective GI2.7. In respect of Policy GI5: Climate Resilience, note is made of policies GI5 3 and 6 that specifically deal with an intent to increase tree cover across the county.
- 5.5 Particular note is made of the South Dublin County Council “Tree Management Policy 2021 – 2026”, “Living With Trees”. This document outlines and enshrines the broader development plan objectives, but provides more detail in respect of ecological, environmental and amenity background. Particular note is made of Section 7 “Tree and Development”. This section includes and overriding policy objective of “The Council will use its powers to ensure that where it is conducive with the objectives of the County Development Plan, and other planning objectives, there is maximum retention of trees on new development sites”. It is also this section that stipulated the use of “British Standard 5837 (2012): Trees in Relation to Design, Demolition and Construction – Recommendations” in respect of trees on construction sites. In this respect and in line with Section 7.2, particular note is made of the Policy: “Where there are trees within a proposed planning application site or on land adjacent to it that could influence or be affected by proposed development, including street trees in the ownership or management of the Council, the planning application must include a detailed submission prepared by a suitably qualified Arboriculturist in accordance with British Standard 5837: 2012 ‘Trees in Relation to Design, Demolition and Construction – Recommendations”
- 5.6 Other than the specific objectives noted throughout the development plan, it is noted that the subject site supports no specific tree-related objectives or “Tree Preservation Orders”.

## **6 Other Legislative and Legal Constraints**

- 6.1 Under the Forestry Act 2014, the felling of a tree standing in a county area requires a felling license unless the trees are exempted under Section 19 of the Act. An exemption applies where trees are being felled in line with a specific detail of a grant of planning permission.
- 6.2 Some "Section 19" exemptions are not applicable to the development scenario, for example, those applying to fire control, forest survey or gene pool protection relating to horticultural use or Christmas tree production.
- 6.3 Some exemptions are pertinent to the development scenario, particularly Section 19(1)(M)(ii), where "the removal of which is specified in a grant of planning permission".
- 6.4 Other non-specific exemptions may also be applicable, including-
- Trees standing in an urban area.
  - Trees within 30 metres of a building (other than a wall or temporary structure), but excluding any building built after the trees were planted.
  - Trees removed by a public authority in the performance of its statutory functions.
  - A tree that is, in the opinion of the planning authority, dangerous on account of its age, condition or location.
  - A tree within 10 metres of a public road and which, in the opinion of the owner (being an opinion formed on reasonable grounds), is dangerous to persons using the public road on account of its age or condition.
- 6.5 The above derogations do not apply where-
- The tree is within the curtilage or attendant grounds of a protected structure under Chapter 1 of Part IV of the Act of 2000.
  - The tree is within an area subject to a special amenity area order
  - The tree is within a landscape conservation area under section 204 of the Act of 2000.
  - The tree is within a monument or place recorded under section 12 of the National Monuments (Amendment) Act 1994, a historic monument or archaeological area entered in the Register of Historic Monuments under section 5 of the National Monuments (Amendment) Act 1987, or a national monument in the ownership or guardianship of the Minister for the Arts, Heritage and the Gaeltacht under the National Monuments Acts 1930 to 1994 or is within a European Site or a natural heritage area within the meaning of Regulation 2(1) of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011)
- 6.6 For further clarification, contact should be made with Forest Service (Department of Agriculture, Fisheries and Food). The Felling Section of the Forest Service is based in Johnstown Castle, Co. Wexford

- 6.7 Other legislation may affect tree cutting and felling. Particular note should be made of the "Wildlife Act 1976 (as amended), as well as the EU Habitats Directive. These offer protection to animals, including Bats that often roost or even breed in trees. The protection afforded by the above legislation means that particular care must be taken in the pruning or felling of trees that may contain Bats. For this reason, specific specialist advice should be sought.

## **7 Construction Activities and their Effect on Trees**

- 7.1 Retaining trees takes up space. There is a big difference between physically preserving a tree and ensuring its future survival. Sustainable tree retention often depends on the extent and nature of construction protection.
- 7.2 Like all living things, trees are highly dependent on their environment in which they exist. A tree's continuity in supplies of water and nutrients from the soil. Any long-term change in ground conditions can easily affect a tree's metabolism, health, and sustainability.
- 7.3 Particularly, development and construction activities can easily damage the soil environment. Removing, disturbing or denaturing soil can irreparably damage tree roots and can render the soil incapable of supporting plant root function. Most modern construction requires large plants, equipment, and vehicles. Such machinery causes soil profile destruction and compaction that denatures the soil.
- 7.4 Where the above issues occur within the minimum "root protection area" as defined by "BS5837-2012", the tree's sustainability and safety may be compromised.
- 7.5 Sustainable tree retention must accept changing contexts and increased management in the future. Where rates of occupation and use increase, then any retained trees have a potential to cause harm or damage. This issue may be exacerbated where shelter-loss and exposure occur regarding the retention of individual trees.
- 7.6 Retained trees should be considered in respect of shadow-cast, light admission, and view-blocking. Wind patterns can affect leaf shedding, causing drifts and accumulations creating management issues around drains and gullies, or the creation of slippery surfaces.

## **8 Nature of Project Works**

- 8.1 The proposed development is described as below:
- 8.1.1 We, EdgeConneX Ireland Limited are applying for permission for development at this site of 5.14 hectares that is located within the townland of Ballymakailly to the west of the Newcastle Road (R120), Lucan, Co. Dublin.

The development will consist of the construction of two no. adjoined single storey data centres with associated office and service areas with an overall gross floor area of 15,274sqm that will comprise of the following:

- Construction of 2 no. adjoined single storey data centres with a gross floor area of 12,859sqm that will include a single storey goods receiving area / store and single storey office area (2,415sqm) with PV panels above, located to the east of the data centres as well as associated water tower, sprinkler tank, pump house and other services;
- The data centres will also include plant at roof level; with 24 no. standby diesel generators with associated flues (each 25m high) that will be located within a generator yard to the west of the data centres;
- New internal access road and security gates to serve the proposed development that will provide access to 36 no. new car parking spaces (including 4 no. electric and 2 no. disabled spaces) and sheltered bicycle parking to serve the new data centres;
- New attenuation ponds to the north of the proposed data centres; and
- Green walls are proposed to the south and east that will enclose the water tower and pump house compound.

The development will also include ancillary site works, connections to existing infrastructural services as well as fencing and signage. The development will include minor modifications to the permitted landscaping to the west of the site as granted under SDCC Planning Ref. SD19A/0042 / ABP Ref. PL06S.305948 and Ref. SD21A/0042. The site will remain enclosed by landscaping to all boundaries. The development will be accessed off the R120 via the permitted access granted under SDCC Planning Ref. SD19A/0042 / ABP Ref. PL06S.305948 and SD21A/0042.

A new hedgerow corridor is proposed along the western and southern edge of the application site in response to the Additional Information request.

An Environmental Impact Assessment Report (EIAR) has been submitted with this application.

- 8.2 Considering the scope and scale of the proposed development, then many of the issues dealt with at "Construction Works and Trees" above could apply if trees are not protected during construction works, including-
- a) Direct conflict with proposed structures, thus requiring tree removal.
  - b) A partial conflict where the "Root Protection Area" is encroached upon by works or ground amendments and cannot be preserved/protected in full.
  - c) Environmental damage e.g. compaction, capping, sealing – changing the existing ground environment to one that can no longer support tree root function.
  - d) Construction activity and the use of large plant and machinery that can denature the ground.
  - e) A change in site context or a change in occupation or use which makes a tree unsuitable for retention.

## **9 Development Related Issues and Arboricultural Concerns**

- 9.1 The greatest issues affecting trees has been the consumption of site space and encroachment on trees ostensibly retainable trees and hedges.
- 9.2 This means that successful tree retention will be subject to the limitation of construction related disturbance and the provision of suitable tree protection during the construction phase.

## **10 Design Iterations and Arboricultural Considerations**

- 10.1 This report relates to clause 4.4.2.1 of BS5837-2012 in that its finding relate to a predefined concept that was issued for review. Accordingly, the report assesses Arboricultural implications and impacts of the proposals, making recommendations in respect of tree protection relating to those trees that might be retained and as outlined below.

## **11 Identification of Development Impacts to Trees**

- 11.1 The expected tree impacts have been represented graphically on the tree impacts drawing "**EdgeConneX Tree Impacts Plan**" and within the narrative of this report. This drawing combines the tree constraints plan information with the current stage development details, including the architectural and services layouts below, thereby allowing for simple direct comparisons between the existing site context and the development proposals regarding new structures.
- 11.2 In this drawing, trees denoted with "Broken Pink" crown outlines are to be removed, and those denoted with "Continuous Green" crown outlines are to be retained.
- 11.3 Detail of the development proposals where gained from drawings provided by-
- Kevin Fitzpatrick Landscape Architecture
- 11.4 The evaluation is primarily based on minimum protection ranges as defined in paragraphs 4.6.1, 4.6.2 and 4.6.3 of BS5837:2012. Any structure, action or apparent need to enter or otherwise disturb/convert the "root protection area" of a site tree has been considered likely to have a negative impact, with the potential to render a tree wholly unsuitable for retention, unsafe or unsustainable.
- 11.5 Where applicable, this assessment attempts to consider both direct and indirect implications. The assessment is based on perceived construction requirements and how a tree will likely interact with the development. The assessment appreciates issues including growth, hazard development, light blockage and other social concerns regarding the changing context, including its effect on tree amenity value.

## **12 Tree Retention and Loss**

- 12.1 The drawing "EdgeConneX Tree Impacts Plan" comprises the tree survey drawings overlaid by the development drawings, thus providing a graphic representation of the relationship between tree constraints and the development elements. In this drawing, the trees that will be removed, are highlighted in "pink dashed" outlines.
- 12.2 While it is noted that [prior p]ermissions involve the loss of trees and vegetation, the works proposed within the current "red line" will result in the loss of:-
- Hedge 3,
  - The northern portion of Hedge 4,
  - Hedge 5,
  - The southern portion of Hedge 6
  - Hedge 8.

## **13 Tree Protection within the Scope of a Development**

- 13.1 The design and management recommendations as set out in "BS5837:2012" are considered as "best practice" regarding the selection, retention, protection, and management of tree within the scope of new developments.
- 13.2 In respect of tree protection, whether vertical or horizontal, all must conform or equate to the recommendations of Section 6, BS5837: 2012, must be fit for purpose and commensurate with the nature of development and the expected day-to-day activities of the site works.
- 13.3 This report provides a "Preliminary Arboricultural Method Statement" at "Appendix 1" to this report, as well as the associated "Tree Protection Plan" drawing "EdgeConneX Tree Protection Plan".
- 13.4 In the drawing, the "Construction Exclusion Zone" is defined by an orange hatching with bold "Orange" lines representing the proposed location of the primary protective "Construction Exclusion Fencing".
- 13.5 The above drawing provides only a representation of the protection locations and extents that must be located, positioned and erected under the guidance of the project Arborist. This drawing may require referral to a figured and dimensioned, "construction stage" version of the "Tree Protection Plan" drawing. All recommended protection measures will be installed before the commencement of any site works and must remain in situ (unless under the guidance of the site Arborist) until the completion of all site works.
- 13.6 In respect of the provision of tree protection for site hedges, this will comprise the erecting of construction exclusion fencing at a range no less than 2.50 metres from the root of the hedge being retained.

## **14 Preliminary Management Recommendations**

- 14.1 In respect of the broader site, and as provided in the tree survey table (Table 1) are "Preliminary Management Recommendations". These recommendations relate to the trees as they existed at the time of the tree review. Therefore and in line with the changing context of the site, such recommendations may no longer apply. Examples include where the felling of trees or other specific works are necessary to facilitate development requirements.
- 14.2 Many of the concerns raised in the tree survey relate to evidence suggesting mechanical failure to trees, ill-health or contextual issues. These may continue to a point where the suitability of a tree for retention may change over time.
- 14.3 Additionally, any development related loss of trees can result in exposure and shelter loss issues. Therefore all retained trees must be reviewed immediately after the primary site clearance works. A review will allow for the updating and amending of the "preliminary management recommendations" of the primary survey. Such amendments would address such issues as may arise and may include additional structural pruning works. Regular reviews of all retained trees must be maintained, so that early and prompt intervention and action can be applied as required.

## **15 Bibliography**

- 15.1 British Standards Institution (2010) BS 3998:2010: Tree Work - Recommendations. London: British Standards Institution.
- 15.2 British Standards Institution (2012) BS 5837:2012: Trees in Relation to Design, Demolition and Construction - Recommendations. London: British Standards Institution.
- 15.3 Jackson, R.B et al (1996) A Global Analysis for Root Distribution in Terrestrial Biomes *Oecologia*, 108 (1996) pp389-411, Springer Verlag
- 15.4 Lonsdale, D. (2005) *Principals of Tree Hazard Assessment and Management*, London, TSO
- 15.5 Mattheck, C. and Breloer, H. (1994) *The Body Language of Trees*, London, TSO
- 15.6 Roberts, J. and Jackson, N. and Smith, M. (2006) *Tree Roots in the Built Environment*, London, TSO
- 15.7 Strouts, R.G. and Winter, T.G. (1994) *Diagnosis of Ill-Health in Trees*, London, HMSO
- 15.8 Teagasc (2021) Development of ash tree genetic resources, <https://www.teagasc.ie/crops/forestry/research/ash-resistance-to-ash-dieback/>
- 15.9 Woodland Trust (2021) Ash Dieback, <https://www.woodlandtrust.org.uk/trees-woods-and-wildlife/tree-pests-and-diseases/key-tree-pests-and-diseases/ash-dieback/>

## **A1 Appendix 1 - Arboricultural Method Statement (and Tree Protection Plan)**

### **Method Statement Outline**

- A1.1 This method statement intends to provide guidance in respect of tree protection on a development site. This is a broad and prescriptive method statement, intended to provide general advice and guidance in respect of trees and tree protection on a typical development site, dealing with issues known at planning stage.
- A1.2 Any inability to conform to the recommendations of this method statement or the associated tree protection plan could readily change the sustainability of trees and/or their suitability for retention.
- A1.3 This method statement addresses, amongst others, two primary issues, those being –
- a) The avoidance/prevention of physical damage to a tree to be retained.
  - b) The avoidance/prevention of physical damage or disturbance to the ground/earth upon which a tree is reliant.

### **Drawings**

- A1.4 This Arboricultural Method Statement must be read with the associated "Tree Protection Plan" drawing, "EdgeConneX Tree Protection Plan". The "planning stage" drawing must be updated for "Construction" stage purposes, to include tree protection ranges/dimensions as defined for that tree within the tree survey table or unless otherwise defined by the project Arborist.

### **Method Statement Use**

- A1.5 This Method Statement should be used under the direct guidance of the project Arborist. As limited "construction stage" detail was available at planning stage, it may require amendment and adjustment to address construction stage issues.

### **Amendments and Modifications to Tree Protection Plan**

- A1.6 Any amendment to the tree protection plan must be agreed with the project Arborist, including the adoption of specific methodologies and/or procedures and structures for access into/use of certain parts of the above defined "Construction Exclusion Zones". Such procedures, including the provision of suitable ground protection may allow for the relocation of the "Construction Exclusion Fencing" to provide access to and across the previously protected areas.

### **Works Related Impacts**

- A1.7 In respect of any necessary and unavoidable structures/works required within or entry into the "RPA" zone, all efforts must be made to minimise impacts. Aerial issues may

require "access facilitation pruning" or clearance pruning. Subterranean works that require excavation must, by design, location, and action, minimise impacts to trees.

### **Tree Works Specification Updates**

- A1.8 Many of the tree management recommendations stipulated within the "Preliminary Management Recommendation" section of the primary tree survey, relate to the "as was" site scenario. Because of changing site contexts, these may no longer apply and may require modification to account for the changes that the built project will cause.

### **General Method Statement**

#### **1.0) Overview and Implementation**

- 1.1 **Prior to any site works or construction/demolition related works or access, this method statement will be addressed and discussed by all member of the construction team management.**
- 1.2 The project Arborist or another suitably qualified person will oversee the application of all tree protection measures and any necessary modifications to this Method Statement (any issues as may have arisen in respect of planning conditions or details as may have changed between the design stage) to provide a basis upon which tree protection will be managed on the construction site.
- 1.3 Any situation that requires entry into the "root protection zones" of a tree intended for retention must be brought to the attention of the Project Arborist regarding the adoption/amendment of suitable tree protection measures.
- 1.4 As unforeseen tree losses may compromise project planning permissions, it is imperative that issues relating to tree protection and/or tree damage be brought to the immediate attention of the project Arborist for review and possible discussion with the relevant planning authority.

#### **2.0) Works Sequence**

- 2.1 No construction related works or mechanised site access will occur until the agreed level of tree protection, in accordance with the "Tree Protection Plan", is completed.
- 2.2 The only exception to the above will relate to the undertaking of tree works and felling as defined in the Arboricultural report and/or grant of permission.
- 2.3 On completion of tree felling/site clearance works, the tree management plan will be reviewed, accounting for (if necessary) the updating of the "preliminary Management Recommendations" stipulated in the original Tree Survey.

- 2.4 Any revised pruning/cutting works will be agreed with the local authority and applied at the earliest possible opportunity.
- 2.5 After the completion of primary tree clearance, but prior to the commencement of construction works, all "Construction Exclusion" and "Protective" fencing must be erected and "signed-off" as complete, by the Project Arborist.
- 2.6 Only on completion of all construction works will any/all tree protective measures be removed, and only then in a manner, that does not compromise the "Protection Zones". Such works must be agreed and overseen by Project Arborist.
- 2.7 At construction works completion stage, all retained trees will be reviewed regarding their condition and longer-term management recommendations and regarding site hand-over,

### **3.0) Tree Protection**

- 3.1 All tree protection measures and locations must be agreed, overseen, and verified by the Project Arborist prior to works commencement.
- 3.2 All construction, works or access areas must be enclosed and defined by protective fencing, this comprising the "Construction Exclusion Zone" based upon drawings "EdgeConneX Tree Protection Plan" (Construction Stage version).
- 3.3 Unless specifically stipulated by the project Arborist, the default minimum range of the protective fencing from a tree is the range stipulated for that tree within the "RPA" (root protection area) column of the original survey.
- 3.4 Such a fence must be fit for purpose and commensurate with the nature of activity expected upon the site and should comply with "Section 6.2" of BS5837: 2012.
- 3.5 The fence should be affixed with notification signs such as "TREE PROTECTION AREA - KEEP OUT"
- 3.6 Structures such as "lock-ups", offices or other temporary site building, not requiring excavation or underground ducting, might be positioned such as to comprise part of the "Construction Exclusion Zone" fencing. All remaining fencing must be continuous with such features and effectively prevents access to protected ground.
- 3.7 If entry into the "RPA" (Root Protection Area) zones becomes unavoidable, ground protection systems agreed with the project Arborist, will be utilised.
- 3.8 No amendment, alteration, relocation, or removal of the tree protection fencing shall occur without prior liaison and approval from the Project Arborist.

#### **4.0) Provision of Ground Protection (If Required)**

- 4.1 No vehicular/mechanised access whatsoever will be allowed onto unprotected "Construction Exclusion Area" ground.
- 4.2 Ground protection can comprise the use of proprietary materials/structures (installed to manufacturer's specifications and recommendations) or procedures that avoid ground damage/disturbance/compaction, or the use of procedures that avoid such effects e.g. manual/pedestrian installation procedures.
- 4.3 Any system utilised must effectively spread load-weight, avoid compaction, maintain drainage/percolation/aeration, and be installed in a manner that avoids these issues.
- 4.4 Newly provided access will be strictly limited to the area of the new protection structure.
- 4.6 Protection installation will require a progressive laying down of ground protection, with previously laid material providing vehicular access to the next zone will be accepted as an approved methodology.

#### **5.0) Works within "RPA" Zone**

- 5.1 Only works and construction practices, agreed with the Project Arborist prior to commencement, will be allowed in the "RPA" area.
- 5.2 All works will be undertaken under the supervision and guidance of the Project Arborist who will have the authority to stop works if activities are considered such as to have the potential to damage trees.
- 5.3 Preference must be given to manual labour and techniques within the fenced "RPA" zone.
- 5.4 On completion of the required works, the area will be inspected by the Project Arborist regarding the reinstatement of the original protection and the relocation of the protective fencing to a position relating to the original "RPA" area.

#### **6.0) Service Installation**

- 6.1 The "Project Arborist" must be consulted for advice and procedural recommendations, in respect of any installation of services within or requiring entry into the "Root Protection Area" of any tree intended for retention.
- 6.2 Any such works found to be unavoidable, must be undertaken with special care, incorporating the recommendations of both "BS5837: 2012 and the National joint utility groups, guidelines for the planning, installation and maintenance of utility services in proximity to trees (NJUG 10)

- 6.3 Preference must be given to trench-less techniques including Mole-piping, Directional-drilling manual hydro-trenching (high-pressure water), "Air-Spade" or broken-trench techniques.

### **7.0) Tree Management and Works**

- 7.1 All tree works should be undertaken under the guidance of the project Arborist
- 7.2 The primary site clearance and felling should be undertaken at the earliest stage of the overall development works, to enable the re-assessment of all ostensibly retainable trees and the updating of the "Preliminary Management Recommendations" to account for context changes and construction access and/or other issues coming to light.
- 7.3 All Tree Works must adopt safe work procedures and must be undertaken by staff suitably trained for the purpose at hand and compliant with all legislative, safety and insurance requirements.
- 7.5 All additional works will be agreed with the local authority and/or other stakeholders and applied at the earliest possible opportunity.
- 7.6 On completion of site works, the retained tree population will be reviewed and re-evaluated regarding its ongoing condition and the likely requirements of any ongoing or future monitoring or management needs.

### **8.0) Demolition**

- 8.1 All demolition procedures must be agreed and overseen by the Project Arborist or other suitably skilled staff to monitor for damage and to protect exposed roots/cut-trim exposed roots/oversee backfilling of exposed roots.
- 8.2 Where access into unprotected "RPA" zone becomes unavoidable then suitable ground protection, provided in accordance with an engineer's direction and agreed with the Project Arborist will be installed.
- 8.3 Care will be taken to avoid damage to soil volumes beneath and adjoining demolished structures that may contain tree root material.
- 8.4 Whilst existing foundations/structures may provide temporary protected access to areas within the "RPA" zone, preference must be given to the location of demolition plant outside of the "RPA" zone.
- 8.5 Where tree(s) exist near a structure to be demolished then the demolition should be undertaken inwards within the footprint of the existing building (top down, pull back).
- 8.6 Underground structures (services etc.) within the "RPA" zone should be reviewed with regards to decommissioning and retention in situ in the interest of avoiding tree damage.

- 8.7 Preference should be given to the retention existing sub-bases where hard surfaces are removed, particularly if the hard surface is to be replaced.

### **9.0) Ancillary Precautions**

- 9.1 The methodologies as set out in this document apply to all undertakers of work upon or adjoining the site as may require access to the "Construction Exclusion Zone" or the "RPA" area of any tree.
- 9.2 This document will be disseminated to all persons requiring access to the work site, with all persons undertaking works either before or after the principal development (site investigation works, Landscape Contractors) are subject to the above requirements
- 9.3 Works outside the "Construction Exclusion Zone" must be controlled to create no potential secondary hazard to tree health.
- 9.4 Large loads accessing the site must be reviewed regarding clearance and potential tree damage.
- 9.5 Care must be taken regarding materials that may contaminate the ground. No concrete mixings, diesel or fuel, washings or any other liquid material may be discharged within 10 metres of a tree.
- 9.6 No fires can be lit within 5 metres of any tree canopy extent.
- 9.7 No tree will be used for support regarding cables, signs etc.
- 9.8 The trees should be reviewed on a regular basis throughout the development process and on completion. At that time, additional recommendations regarding tree management may be required.
- 9.9 Any issue that has the potential to affect site trees must be brought to the attention of the Project Arborist for review and comment.
- 9.10 Any circumstances that become known whilst the development project is ongoing that either involves trees or access to/works within the construction exclusion zone must be brought to the attention of the Project Arborist for evaluation and advice regarding approach and methodology.
- 9.11 It is possible that liaison/agreement will be required with the Local Planning Authority regarding compliance with, as well as the verification of the required tree protection measures.

## **A2 Appendix 2 - Tree Survey**

### **Nature of Survey**

- A2.1 The criteria put forward in "BS5837:2012 – Trees in Relation to Design, Demolition and Construction – Recommendations" have provided a basis for this report.
- A2.2 The data collected has been represented in table form as "Table 1" within "Appendix 1" to this report. This appendix includes a Survey Methodology, Survey Key, Survey Abbreviations, Condition Category Definitions and a brief resume of the typical application of Tree Protection measures as defined within the above standard and as relates to the "RPA" zones defined both within the survey table and on the "TCP" drawing.
- A2.3 The survey, its findings and management recommendations relate to the site and the conditions thereon at the time of the survey. It relates to a "do nothing" or "as is" scenario and intends to provide an impartial representation of the site's tree population, regardless of any possible development works. It is likely that changes in site usage, development or other environmental changes will require an amendment of any tree's potential retention status and its preliminary management recommendations, and in some instances, may require the re-classification of a tree's suitability for retention.

### **Drawing References**

- A2.4 The survey must be read with the "Tree Constraints Plan" drawing "EdgeConneX Tree Constraints Plan" regarding the representation of tree positions, crown forms, "RPA" extents and colour reference to category systems. Trees omitted from the supplied drawing may be "sketched in" to "EdgeConneX Tree Constraints Plan". Any such trees should be located and plotted by professional means to identify the constraints such trees have upon the site.
- A2.5 A green coloured outline represents each tree crown. It is scaled to represent the north, east, south, and west crown radii as denoted in the survey table. Each tree (categories A-green, B-blue, and C-grey only) have been apportioned a "Root Protection Area" (RPA see below) denoted as a dashed orange circle.
- A2.6 The development of a Tree Constraints Plan (TCP) provides a design tool regarding tree retention. Such a plan combines the topographical land survey drawing with additional information as provided by the tree survey. The aspects of the tree's existence recorded on the "TCP" are, firstly, the tree canopies, represented by the four cardinal compass point radii (Sp: R in survey Table 1). Secondly, and following paragraphs 4.6.1, 4.6.2 and 4.6.3 of BS5837: 2012, we represent each tree's "Root Protection Area" (RPA). For design purposes, it approximates the position of the tree protection fencing to be erected before the commencement of any site works, thus excluding all site

activities other than those dealt with by way of the "Arboricultural Implication Assessment" and "Arboricultural Method Statement".

- A2.7 The "Tree Constraints Plan" (TCP) depicts the extent and location of constraints, placed upon the site by the trees. The "TCP" represents both the true canopy form (north, east, south, and west radii) but also the "RPA" as defined above. These constraints are provided to advise regarding the design and layout of a proposed development.

### **Survey Intent and Context**

- A2.8 This document intends to highlight the extent and nature of the material of Arboricultural interest on the site in question.

### **Survey Data Collection and Methodology**

#### **The Survey**

- A2.9 An earlier survey was updated in March 2021. This survey portion of the overall report is not an Implication Assessment though but provided some of the basic information regarding its compilation. The compilation of this survey was guided by the recommendations of BS 5837: 2012. This survey typically includes trees of stem diameters exceeding 150mm at approximately 1.50 metres from ground level. The survey relates to current site conditions, setting and context.
- A2.10 Each tree in the survey has a consecutive number that relates directly to the survey text. Measurements are metric and defined in metres and millimetres. All trees referred to in the survey text have been measured to provide information regarding canopy height and canopy spread (north, east, south, and west radii), level of canopy base and stem diameter at 1.50 meters from ground level. The dimensions provided are intended to provide a reasonable representation of a tree's size and form. While efforts are made to maintain accuracy, visual obstruction, especially regarding trees in groups, requires that some tree dimensions be estimated only.

#### **Inspection and Evaluation Limitations and Disclaimers**

- A2.11 The information set out in this report relates to the review of a tree population on the site in question. As such, the information provided is based on a general review of trees and does not constitute a detailed review of any one of the individual specimens. Such an evaluation (tree report) would require the gathering of substantially more information than that dealt with in this survey.
- A2.12 The survey is not a safety assessment and the parameters reviewed within this survey context would be substantially deficient in extent to provide for a reliable safety assessment. The survey is intended to provide a general and qualitative review to assist

in gauging the suitability of an individual tree for retention within a development context. All trees are subject to impromptu failure and damage. The assessment of risk as may be presented by a tree requires the review of numerous factors more than those noted herein and as such, remains outside the scope of this document and any attempt to use the information herein for such purposes will render the information invalid.

- A2.13 A competent and experienced Arborist has completed all inspection and tree assessment. The inspection involves visual tree assessment (Mattheck and Breloer 1994) only, which has been carried out from ground level. No below ground, internal, invasive, or aerial (climbing) inspection has been carried out.
- A2.14 Trees are living organisms whose health, condition and safety can change rapidly. All trees should be re-evaluated regarding their condition on an annual basis or after substantial trauma such a storm event, other damage, or injury. The results and recommendations of this survey will require review and reassessment after one year from the date of execution. This survey does not constitute a review of tree or site safety. Attempts to use the contents herein for such purposes will render the contents invalid.
- A2.15 Throughout the undertaking of the survey, several factors acted against the inspectors, contriving to reduce the accuracy of the survey.

### **Seasonality**

- A2.16 Various surveys have been completed during different seasons. Some of the signs, typically symptomatic of ill-health or defect within a tree, may not have been available to view at the time of the survey or may have been obscured by seasonality related factors. Some of the fruiting bodies of various fungi, parasitic upon or causing decay or disease in trees, may have been out of season and unavailable to view. This survey can only comment upon symptoms of ill-health or defects visible at the time of the inspection.

### **Survey Key**

<b>Species</b>	Refers to the specific tree species
<b>Age</b>	Referred to in generalised categories including: -
Y - Young	A young and typically small tree specimen.
S/M - Semi-Mature	A young tree, having attained dimensions that allow it to be regarded independently of its neighbours but typically, would be less than 50% of its ultimate size.
E/M - Early-Mature	A specimen, typically 50% - 100% of ultimate dimensions but with substantial capacity for mass and dimensional increase remaining.
M - Mature	A specimen of dimensions typical of a full-grown specimen of its species. Future growth would tend to be extremely slow with little if any dimensional increase.

O/M - Over-Mature	An old specimen of a species having already attained or exceeded its naturally expected longevity.
V - Veteran	An extremely old, veteran specimen of a species, usually of low vigour and typically subject to rapid decline and deterioration or of very limited future longevity.
<b>Tree Dimensions</b>	All dimensions are in meters. See notes regarding limitation of accuracy.
<b>Ht.</b>	Tree Height
<b>CH</b>	Lowest canopy height
<b>N, E, S, W</b>	Tree Canopy Spread measured by radii at north, east, south, and west
<b>Dia.</b>	Stem diameter at approx. 1.50m from ground level.
<b>RPA</b>	Root Protection Area, as a radius measured from the tree's stem centre.
<b>Con</b>	Physical Condition
G Good	A specimen of generally good form and health
G/F Good/Fair	
F Fair	A specimen with defects or ill health that can be either rectified or managed typically allowing for retention
F/P Fair/Poor	
P Poor	A specimen whom through defect, disease attack or reduced vigour has limited longevity or maybe un-safe
D Dead	A dead tree
<b>Structural Condition</b>	Information on structural form, defects, damage, injury, or disease supported by the tree
<b>PMR – Preliminary Management Recommendations</b>	Recommendation for Arboricultural actions or works considered necessary at the time of the inspection and relating to the existing site context and tree condition. Works considered as urgent will be noted.
<b>Retention Period</b>	
S – Short	Typically, 0 -10 years
M – Medium	Typically, 10 -20 years
L – Long	Typically, 20 – 40 years
L+	Typically, more than 40 years
<b>Category System</b>	The Category System is intended to quantify a tree regarding its Arboricultural value as well as a combination of its structural and physical health.
Category U	Particularly poor quality, dangerous or diseased trees that offer no realistic sustainability
Category A	A typically a good quality specimen, which is considered to make a substantial Arboricultural contribution
Category B	Typically including trees regarded as being of moderate quality
Category C	Typically including generally poor-quality trees that may be of only limited value. The above categories are further subdivided regarding the nature of their values or qualities.

Sub-Category 1	Values such as species interest, species context, landscape design or prominent aspect.
Sub-Category 2	Mainly cumulative landscape values such as woods, groups, avenues, lines.
Sub-Category 3	Mainly cultural values such as conservation, commemorative or historical links.

Table 1 – Tree Data Table

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural Condition	PMR	Yrs	Cat
12	Ash ( <i>Fraxinus excelsior</i> )	M	P	12.00	3.00	5.00	3.50	3.50	2.00	1	471	5.65	A poor-quality specimen in a state of ongoing decline and exhibiting evidence of Polyporus infection. Is wholly unsuitable for retention in roadside position.	Remove immediately.	N/A	U
13	Sycamore ( <i>Acer pseudoplatanus</i> )	M	F	10.00	2.00	5.00	5.50	4.50	4.50	1	681	8.17	Is of variable vigour and vitality, arising from what appears to be disturbed ground. Note is made of buttress root damage and localised bark loss about buttress zone.	Review regarding retention context.	M	C2
14	Horse Chestnut ( <i>Aesculus hippocastanum</i> )	M	P	8.00	2.00	5.00	5.00	5.00	5.00	1	993	11.92	Crudely decapitated and affected by chronic limb loss and decay. Is unsuitable for retention.		N/A	U
15	Sycamore ( <i>Acer pseudoplatanus</i> )	M	D	11.00	2.00	4.00	4.00	4.00	4.00	1	780	9.36	Completely dead and in a state of ongoing collapse.	Remove immediately.	N/A	U
16	Ash ( <i>Fraxinus excelsior</i> )	E/M	F	12.00	2.25	4.00	4.00	3.00	4.00	1	376	4.51	Relatively young and still vigorous. Arises from disturbed bank and area of dumped spoil between Canal towpath and area of hardstanding. Vigour and vitality appear reasonable however much of tree is obscured by dense Ivy cover.	Cut Ivy and rereview.	M	C2
17	Ash Group ( <i>Fraxinus excelsior</i> )	E/M	F/P	12.00	3.00	5.00	5.00	4.00	4.50	4	462	5.54	Close-knit group of multiple stems arising from disturbed spoil between Canal towpath and area of hardstanding. Eastern and south-eastern stems have sustained notable mechanical damage. Broader crown appears to be maintaining reasonable vigour and vitality.	Review regarding retention context.	M	C2

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No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural Condition	PMR	Yrs	Cat
18	Crack Willow ( <i>Salix fragilis</i> )	E/M	F/P	10.00	1.00	3.00	5.00	5.00	5.00	3	493	5.92	Distorted and apparently naturally arising comprises part of a broader multi-stemmed thicket development to north and north-east. Tree vigour and vitality remains good though tree has been subject to prior mechanical damage and has sustained notable bark wounding to south of lower stems.	Review regarding retention context.	M	C2
19	Ash Group ( <i>Fraxinus excelsior</i> )	E/M	F	9.00	2.50	0.00	4.50	4.00	4.00	1	290	3.48	One-sided and typically unbalanced to south as a result of being part of a broader group that extends down embankment to north and towards Canal. Tree appears broadly vigorous though has been affected by substantial dumping and creation of embankment to south of stem.		M	C2
20	Ash ( <i>Fraxinus excelsior</i> )	S/M	F	6.00	1.00	1.00	2.00	2.00	1.50	1	207	2.48	Suppressed distorted and affected by failure of Willow from Canal embankment.	Review regarding retention context.	M	C2
21	Ash Group ( <i>Fraxinus excelsior</i> )	E/M	P	12.00	0.00	5.00	4.00	3.00	2.00	5	592	7.10	A broader multi-stemmed group arising from lower embankment above Canal. Has been crudely decapitated in past presumably in respect of position adjoining and beneath high-tension power cables. Is of poor quality and ill-suited to retention.	consider early removal.	S	C2
22	Sycamore ( <i>Acer pseudoplatanus</i> )	M	P	13.00	0.00	6.00	4.00	2.00	5.00	1	579	6.95	Crudely decapitated with much of southern upper crown removed to facilitate clearance of overhead power cables. Is of dubious sustainability.		S	C2

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**Tree Lines, Groups and Hedges**

Tree Lines and Hedges												
H1	Hedge 1 Hawthorn ( <i>Crataegus monogyna</i> ) Blackthorn ( <i>Prunus spinosa</i> ) Wych Elm ( <i>Ulmus glabra</i> ) Ash ( <i>Fraxinus excelsior</i> ) Bramble ( <i>Rubus fruticosus</i> ) Ivy ( <i>Hedera helix</i> ) Privet ( <i>Ligustrum ovalifolium</i> ) Spindle ( <i>Euonymus europaeus</i> ) Dog Rose ( <i>Rosa canina</i> )	M	F	3.00-6.00	0.00	Spread 4.00-6.00m	m/s	207	2.48	A broadly can tenuous but highly variable hedge arising from the descending slope of a shallow embankment that descends to a ditch circa 1.50 m below field levels to the South, the original Thorn is of variable continuity with notable gaps, particularly where suppression has occurred as a result of ash, elder and Bramble infestations. There are multiple sections where hedge continuity is provided solely by low level Bramble thicket. suitability for retention will be context dependent and dependent upon management needs/potential. The alignment supports a notable, emergent tree population, typically dominated by ash and which Elm. All trees are present can be readily regarded as semimature most not exceeding 5 – 6.00 m. Note is made of the proportion of elms that have died, presumably as result of Dutch Elm disease. Those remaining alive are not expected to last beyond imaging short-term.	M	C2

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H2	Hedge 2 Hawthorn ( <i>Crataegus monogyna</i> ) Blackthorn ( <i>Prunus spinosa</i> ) Wych Elm ( <i>Ulmus glabra</i> ) Ash ( <i>Fraxinus excelsior</i> ) Bramble ( <i>Rubus fruticosus</i> ) Ivy ( <i>Hedera helix</i> ) Privet ( <i>Ligustrum ovalifolium</i> )	M	F	1.25-7.00	0.00	Spread 1.50-4.00m	m/s	207	2.48	This hedge is associated with a shallow but nonetheless raised embankment located on the western side of a substantial ditch. A large proportion of the material associated with this alignment arises from the eastern bank of the ditch and appears to include a distinct hedge format at the upper edge of the ditch embankment that has been added to by natural thicket development extending to the east by circa 3 – 4.00 m. Elements of this hedge exhibit evidence of mechanical cutting to circa 1.25 m though other areas are substantially outgrown. Continuity is again a result of plant combinations with substantial elements comprising Bramble thicket only. This alignment supports a more significant emergent tree population, this time dominated by ash though all specimens remain young with most being between a semi maturity and early maturity. Suitability for retention will again be context and management potential dependent.	M	C2
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H3	Hedge 3 Hawthorn ( <i>Crataegus monogyna</i> ) Blackthorn ( <i>Prunus spinosa</i> ) Wych Elm ( <i>Ulmus glabra</i> ) Ash ( <i>Fraxinus excelsior</i> ) Bramble ( <i>Rubus fruticosus</i> ) Ivy ( <i>Hedera helix</i> ) Elder ( <i>Sambucus nigra</i> )	M	F	4.00-6.00	0.00	Spread 5.00-7.00m	m/s	207	2.48	The hedge alignment arises predominantly to the north of a substantial ditch and in association with a raised embankment. The original hedge thicket has been substantially contributed to by extensive thicket development, typically dominated by Blackthorn and Bramble. Note is made of a substantial number of emergent trees that at this time would be regarded as semimature including both ash and which Elm. Already, numerous specimens of the Wych Elm exhibit evidence of Dutch Elm disease suggesting limited sustainability and an unlikelihood of survival beyond the immediate short-term.	M	C2
H4	Hedge 4 Hawthorn ( <i>Crataegus monogyna</i> ) Blackthorn ( <i>Prunus spinosa</i> ) Wych Elm ( <i>Ulmus glabra</i> ) Ash ( <i>Fraxinus excelsior</i> ) Bramble ( <i>Rubus fruticosus</i> ) Ivy ( <i>Hedera helix</i> )	M	F	1.50-3.50	0.00	Spread 5.00m	m/s	207	2.48	A broadly continuous alignment arising from the ascending embankment to a notable ditch to the west with the embankment to the east. Small elements of this alignment have been destroyed through fire damage though elsewhere the alignment tends to be broadly continuous however, continuity tends to be as a result of vegetation combinations as opposed to the original Thorn hedge. In this respect, note is made of the substantial proportion of the hedge continuity is provided by Bramble.	M	C2

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H5	Hedge 5 Hawthorn ( <i>Crataegus monogyna</i> ) Blackthorn ( <i>Prunus spinosa</i> ) Wych Elm ( <i>Ulmus glabra</i> ) Ash ( <i>Fraxinus excelsior</i> ) Bramble ( <i>Rubus fruticosus</i> ) Ivy ( <i>Hedera helix</i> ) Holly ( <i>Ilex aquifolium</i> )	M	F	2.50-6.00	0.00	Spread 4.00-6.00m	m/s	207	2.48	Continuity within this hedge remains good notwithstanding the proportion provided by Bramble at lower levels. The hedge supports only a small number of emergent Ash that could readily be regarded as semimature only with singular poor-quality poplar at its northernmost end. Once again, this hedge exists in association with a ditch and embankment feature with the more significant material arising from the north-western embankment of the ditch.	M	C2
H6	Hedge 6 Hawthorn ( <i>Crataegus monogyna</i> ) Blackthorn ( <i>Prunus spinosa</i> ) Wych Elm ( <i>Ulmus glabra</i> ) Ash ( <i>Fraxinus excelsior</i> ) Bramble ( <i>Rubus fruticosus</i> ) Ivy ( <i>Hedera helix</i> )	M	F	1.00-2.50	0.00	Spread 3.00m	m/s	207	2.48	Substantially smaller than previously reviewed hedges with an apparent reduced degree of maturity. Continuity within the line is substantially contributed to by Bramble thicket at lower levels. In keeping with other hedges, the materials associated with a substantial ditch and embankment feature with most of the significant material arising from the northern bank of the ditch feature.	M	C2

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H7	Hedge 7 Hawthorn ( <i>Crataegus monogyna</i> ) Blackthorn ( <i>Prunus spinosa</i> ) Wych Elm ( <i>Ulmus glabra</i> ) Ash ( <i>Fraxinus excelsior</i> ) Bramble ( <i>Rubus fruticosus</i> ) Ivy ( <i>Hedera helix</i> )	M	F	5.00-7.00	0.00	Spread 5.00-7.00m	m/s	207	2.48	A mature hedge, originally dominated by Hawthorn but where broader continuity is now provided by a combination of plants, most notably elder and emergent ash. Eradication of invasive species would leave a particularly fragmented alignment. Note is made that many of the emergent trees tend to be of poor quality, namely being distorted as result of prior decapitation presumed to be associated with original hedge management works.		M	C2
H8	Hedge 8 Hawthorn ( <i>Crataegus monogyna</i> ) Blackthorn ( <i>Prunus spinosa</i> ) Wych Elm ( <i>Ulmus glabra</i> ) Bramble ( <i>Rubus fruticosus</i> ) Ivy ( <i>Hedera helix</i> ) Elder ( <i>Sambucus nigra</i> )	M	F	2.50-5.50	0.00	Spread 3.00-4.00m	m/s	207	2.48	A broadly mature hedge alignment of reasonable continuity associated with the eastern ascending embankment from a ditch feature. General continuity amongst the thorns tends to be broadly good though suppression is developing as result of more invasive plants such as Elder and ash. The hedge alignment is affected by only a small number of gaps where continuity is provided for only by lower level Privet and Bramble Scrub.		M	C2

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H9	Hedge 9 Hawthorn ( <i>Crataegus monogyna</i> ) Elder ( <i>Sambucus nigra</i> ) Ivy ( <i>Hedera helix</i> ) Bramble ( <i>Rubus fruticosus</i> ) Ash ( <i>Fraxinus excelsior</i> )	M	F	2.50-5.50	0.00	Spread 3.00-4.00m	m/s	207	2.48	A broadly continuous hedge associated with a raised embankment on the eastern side of a drainage ditch. Some continuity tends to be reasonable though imperfect with the small number of gaps being filled by invasive species such as Elder and Bramble. The alignment supports only a small number of emergent trees typically not exceeding 6.00 m and regarded as being of poor quality being distorted as a result of prior hedge management related decapitation.		M	C2
H10	Hedge 10 Hawthorn ( <i>Crataegus monogyna</i> ) Elder ( <i>Sambucus nigra</i> ) Bramble ( <i>Rubus fruticosus</i> ) Ivy ( <i>Hedera helix</i> ) Blackthorn ( <i>Prunus spinosa</i> )	M	F/P	5.00-6.00	0.00	Spread 5.00-6.00m	m/s	207	2.48	A remnant of an original Thorn based hedge however, at this time for you of the thorns remain with the broader alignment continuity being provided for by emergent elder. In individual terms, most plants are reasonable but overall the hedge alignment is of broadly poor quality. Substantially eroded, the hedge appears to be associated with a shallow ditch and embankment feature.		M	C2

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H11	Hedge 11 Hawthorn ( <i>Crataegus monogyna</i> ) Elder ( <i>Sambucus nigra</i> ) Bramble ( <i>Rubus fruticosus</i> ) Ivy ( <i>Hedera helix</i> ) Blackthorn ( <i>Prunus spinosa</i> ) Dog Rose ( <i>Rosa canina</i> )	M	P	0.00-4.00	0.00	Spread 3.00m	m/s	207	2.48	A particularly overgrown and effectively defunct hedge comprising a broad corridor of material loosely based around an original Hawthorn alignment. The original alignment appears to be associated with a raised and embankment though this is substantially dilapidated and broadly eroded, particularly considering earthworks having occurred at its northernmost end. Additionally, note is also made at circa 30 m of the hedge at its northernmost end has been destroyed by what appears to be recent fire damage.		N/A	U
H12	Hedge 12 Hawthorn ( <i>Crataegus monogyna</i> ) Elder ( <i>Sambucus nigra</i> ) Bramble ( <i>Rubus fruticosus</i> ) Ivy ( <i>Hedera helix</i> ) Blackthorn ( <i>Prunus spinosa</i> )	M	P	7.00	0.00	Spread 6.00-7.00m	m/s	207	2.48	A dilapidated section of hedging originally comprising a Thorn hedge but now supporting only an intermittent alignment of plants, some of which have been affected by either ground disturbance or by fire damage. The few remaining Hawthorne's are substantially affected by chronic Ivy cover to the point where there are effectively defunct and unworthy of retention.	Consider early removal.	N/A	U
H13	Hedge 13 Elder ( <i>Sambucus nigra</i> ) Bramble ( <i>Rubus fruticosus</i> ) Ivy ( <i>Hedera helix</i> ) Sycamore ( <i>Acer pseudoplatanus</i> )	M	P	3.00-4.00	0.00	Spread 5.00	m/s	207	2.48	Effectively comprises a thicket development only with no evidence remaining of any original Thorn based hedge. The material arises from both sides of an apparent field drainage ditch.		M	C2

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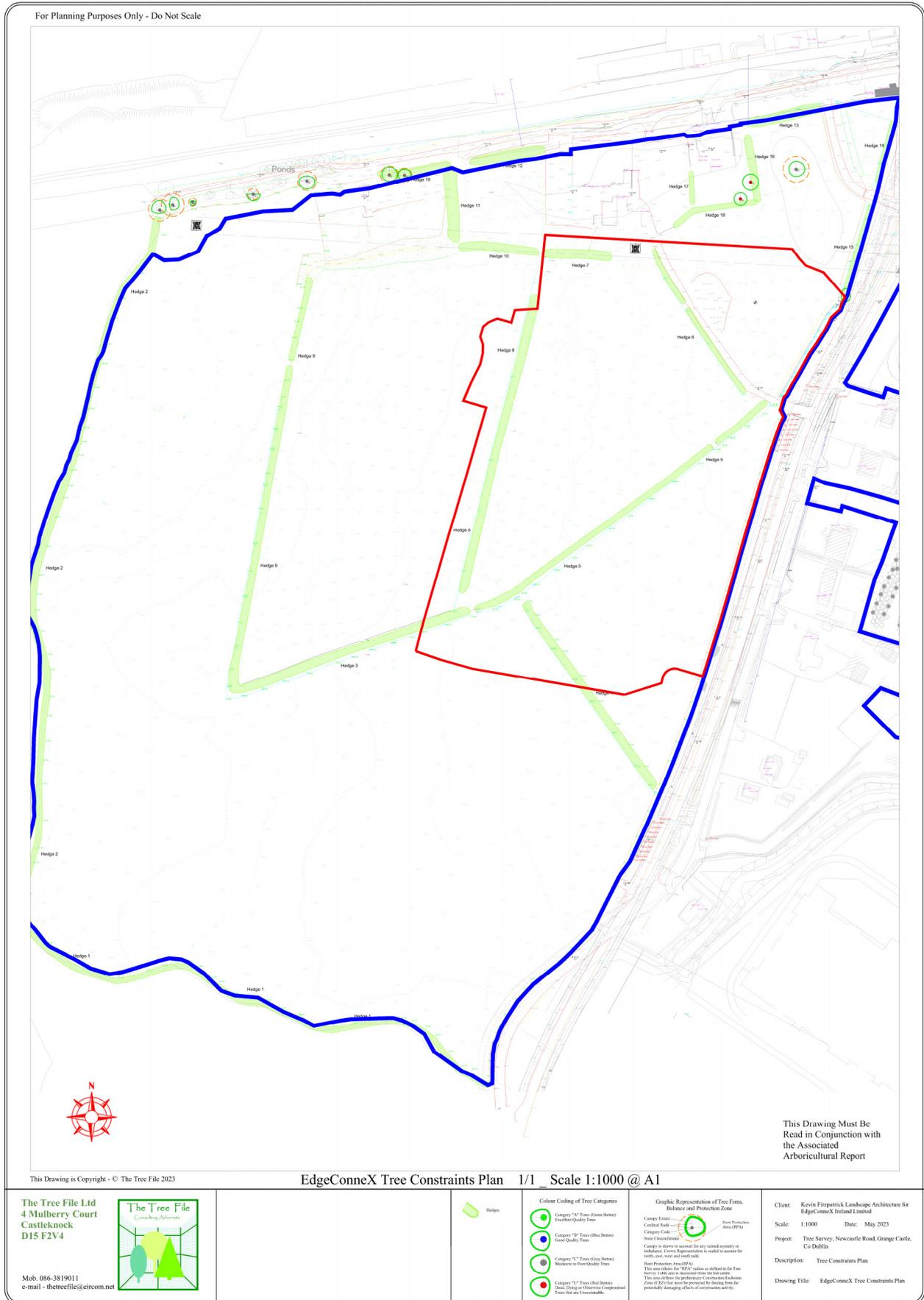
H14	Hedge 14 Sycamore ( <i>Acer pseudoplatanus</i> ) Ash ( <i>Fraxinus excelsior</i> ) Hawthorn ( <i>Crataegus monogyna</i> ) Bramble ( <i>Rubus fruticosus</i> ) Elder ( <i>Sambucus nigra</i> ) Ivy ( <i>Hedera helix</i> )	M	P	1.50-5.00	0.00	Spread 3.00m	m/s	207	2.48	A relic old hedge now substantially disturbed by ongoing earthworks. Original ground contours in vicinity of this hedge have effectively been lost and the few remaining plants are considered unsuitable for retention.	Remove.	N/A	U
H15	Hedge 15 Hawthorn ( <i>Crataegus monogyna</i> ) Blackthorn ( <i>Prunus spinosa</i> ) Bramble ( <i>Rubus fruticosus</i> ) Elder ( <i>Sambucus nigra</i> ) Ivy ( <i>Hedera helix</i> ) Dog Rose ( <i>Rosa canina</i> )	M	F	2.50-3.00	0.00	Spread 3.00m	m/s	207	2.48	A short remnant section of hedging disturbed to its eastern side as result of ongoing roadworks. The hedge appears to be broadly young and in general terms remains continuous however, a notable proportion of the hedge alignment continuity is provided by spurious invasive plants such as Bramble.	Review regard retention context.	M	C2

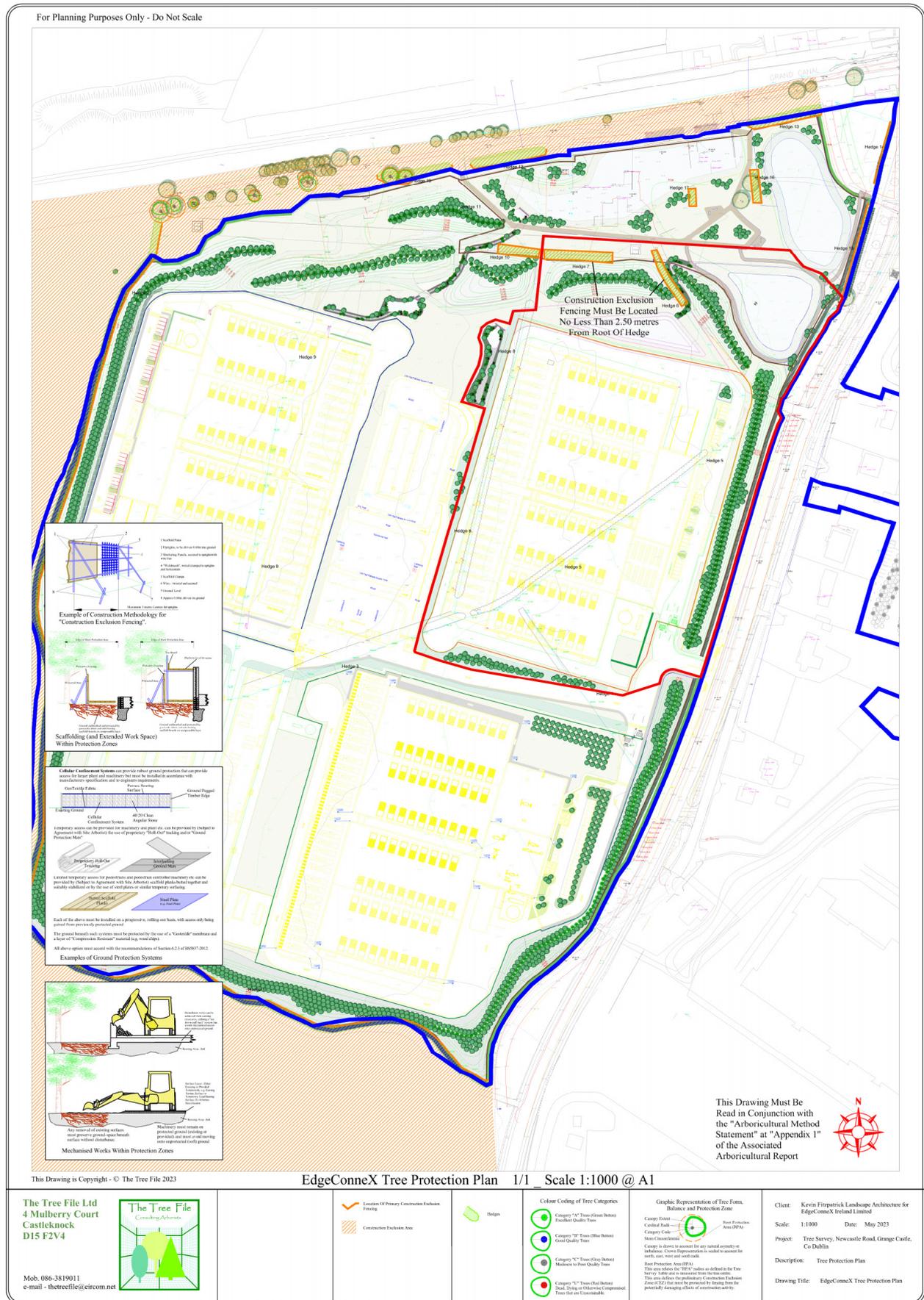
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H16	Hedge 16 Hawthorn ( <i>Crataegus monogyna</i> ) Elder ( <i>Sambucus nigra</i> ) Bramble ( <i>Rubus fruticosus</i> ) Ivy ( <i>Hedera helix</i> ) Snowberry ( <i>Symphoricarpos Sp.</i> ) Cherry Laurel ( <i>Prunus laurocerasus</i> )	M	P	4.50-5.00	0.00	Spread 3.00-4.00m	m/s	207	2.48	A dilapidated and effectively defunct remnant of an original hedge now best defined by low level thicket development. Is considered Unsuitable for retention.	Remove.	N/A	U
H17	Hedge 17 Elder ( <i>Sambucus nigra</i> ) Cherry Laurel ( <i>Prunus laurocerasus</i> ) Lawson Cypress ( <i>Chamaecyparis lawsoniana</i> )	M	D	4.50-5.00	0.00	Spread 4.00-6.00m	m/s	207	2.48	Effectively defunct and much material is now dead as a result of fire damage.	Remove.	N/A	U
H18	Hedge 18 Sycamore ( <i>Acer pseudoplatanus</i> ) Elder ( <i>Sambucus nigra</i> ) Bramble ( <i>Rubus fruticosus</i> ) Hawthorn ( <i>Crataegus monogyna</i> ) Ivy ( <i>Hedera helix</i> )	M	P	2.00-4.00	0.00	Spread 5.00m	m/s	207	2.48	A defunct thicket now dominated by Bramble. Unsuitable for retention.	Remove.	N/A	U

H19	Hedge 19 Hawthorn ( <i>Crataegus monogyna</i> ) Elder ( <i>Sambucus nigra</i> ) Bramble ( <i>Rubus fruticosus</i> ) Ivy ( <i>Hedera helix</i> )	M	F/P	4.00-6.00	0.00	Spread 4.00-5.00m	m/s	207	2.48	A dilapidated and disturbed remnant of an original hedge now affected by spoil dumping. Ground conditions in vicinity of hedge are substantially disturbed. Very few of the original Hawthorn is remain suggesting limited sustainability.	Consider early removal.	N/A	U
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**CHAPTER 14 CULTURAL HERITAGE****Appendix 14.1 Record of Monuments and Places**

The recorded archaeological sites within c. 1km of the development are listed below, all noted in the Record of Monuments and Places for Co. Dublin.

<b>RMP No.</b>	<b>DU017-029----</b>
Townland	Adamstown (Newcastle By.)
Site Type	Castle - tower house
NGR	702836, 732705
Description	Located on flat ground between the canal and the railway. A three-storey tower house, which was oblong in plan with a projecting turret and stepped crenellations. Demolished in the 1960s. No visible at ground level (Compiled by: Geraldine Stout, Date of upload: 26 August 2011, Date of last visit: 23 July 1993.
Sources	RMP Healy, P. 1974 Report on Monuments and Sites of Archaeological Interest in County Dublin, p. 22 Ball, F. E. 1906 Parish of Arderrig Part 4, 58-60; Dix, E. R. 1897 The lesser castles of Co. Dublin, in Irish Builder, p. 12.

<b>RMP No.</b>	<b>DU017-034----</b>
Townland	Grange (Newcastle By.)
Site Type	Castle - tower house
NGR	703857, 731879
Description	Attached to a farmhouse in flat, low-lying ground. Shown as a castle on the Down Survey (1655-6) map. This is a rectangular tower house with a square tower that's projects to the N in the NE corner. The tower house is three storeys high. The walls are plastered but where stonework is visible it is coursed limestone with roughly dressed quoins. The windows are all later insertions. Entrance is in the N wall through a round-headed doorway. There is a murder hole over the entrance lobby which leads into a vaulted ground floor (int. dims. L 7.08m; Wth.5.2m). Access to stair turret is off the lobby through a round-headed doorway. First floor not accessible. Second floor is accessed through a two-centred arched doorway. There is a garderobe chute in the SE corner which is supported by corbels and entered through a narrow round-headed door to a small circular chamber lit by a single ope. The jambs are hammer-dressed. There is a square stair tower or cap house which rises above parapet level (Healy 1974, 22; Mc Dix 1897, XXXIX, 22). A drawing by Beranger in 1773 shows stepped crenellations at parapet level (Harbison 1998, 168-9). In 1997 monitoring and excavation were undertaken in the vicinity of the castle, in advance of the construction of an access road and the excavation of foul sewers for a Business Park at Grange Castle. A curving ditch was identified orientated north-east/south-west. It was 30m in length, 0.8-0.9m deep, and 1.2-2.4m wide. The upper fills contained charcoal, mortar, flint and animal bones, and were aceramic. A decorated bone comb, stick-pin and knife gave the later ditch phase a terminus ante quem of from the 12th to the 13th century AD. A stone causeway, 0.5-0.6m wide and 0.06-0.1m deep, crossed the ditch. The evidence suggests that extensive early medieval and post-medieval activity survives in this area; the ditches can be interpreted as medieval field boundaries (O'Brien, R. 1998, 26-7). (Compiled by: Geraldine Stout, Date of upload: 26 August 2011, Date of last visit: 03 October 1986)
Sources	RMP Healy, P. 1974 Report on Monuments and Sites of Archaeological Interest in County Dublin, p. 22. Ball, F. E. 1906 Parish of Arderrig Part 4, 65 Dix, E. R. 1897 The lesser castles of Co. Dublin, in Irish Builder, p. 22 Cooper, A. 1780 Down Survey.

<b>RMP No.</b>	<b>DU017-093</b>
Townland	GOLLIERSTOWN
Site Type	Enclosure
NGR	701891, 732600
Description	A rectilinear enclosure visible as crop marks on an aerial photograph (SMR file; pers. comm. Tom Condit, 11 March 2015).
Sources	RMP Google Maps.
Images	

<b>RMP No.</b>	<b>DU021-108</b>
Townland	BALLYBANE
Site Type	Concentric enclosure
NGR	703060, 730985
Description	Not indicated on any OS map a large concentric enclosure is visible as a crop-mark on an aerial photo. A second enclosure (DU021-109----) is visible to the SW. The area of AH1 contains a recorded concentric enclosure (DU021-108). This site contains subsurface remains of a large double ditched enclosure and the morphology of this monument and its associated ditches suggest it is of possible early medieval date. However, 12 <sup>th</sup> to 13 <sup>th</sup> century pottery finds associated with the upper fills of both the internal and external ditch appear to suggest multiple periods of activity. Internal features and deposits within the enclosure are suggestive of settlement evidence. This monument has a diameter of approximately 60m (Stirland 2016, 10).
Sources	RMP Google Maps. Stirland, J. (ACS) 2016 Archaeological testing at Grange Castle South Business Park Ballybane, Clondalkin, Dublin 22 (16E0531).
Images	

<b>RMP No.</b>	<b>DU021-109</b>
Townland	BALLYBANE
Site Type	Enclosure
NGR	702937, 730716
Description	Not indicated on any OS map this enclosure is as a crop-mark on an aerial photo. A second larger enclosure (DU021-108----) is visible to the NE. AH5 – the archaeological test trenching confirmed the presence of a single-ditched circular enclosure (DU021-109), 44m in diameter with the ditch measuring 3m wide and 1.6m deep. The general appearance of this features is suggestive of a possible

	ringfort type enclosure. No internal features were recorded (Stirland 2016, 10).	
Sources	RMP Google Maps. Stirland, J. (ACS) 2016 Archaeological testing at Grange Castle South Business Park Ballybane, Clondalkin, Dublin 22 (16E0531).	
Images		

### Appendix 14.2 Archaeological Finds

The recorded archaeological finds in the vicinity of the proposed development, are listed below, all noted in the National Museum of Ireland files, Kildare Street, Dublin 2, or in other published catalogues of prehistoric material: Raftery (1983 - iron age antiquities), Eogan (1965; 1993; 1994 - bronze swords, Bronze Age hoards and goldwork), Harbison (1968; 1969a; 1969b - bronze axes, halberds and daggers) and the Irish Stone Axe Project Database. The following townlands were assessed Adamstown, Aungierstown & Ballybane, Ballybane, Ballymakailly, Clutterland, Finnstown, Gollierstown, Grange, Kilmactalway, Kilmahuddrick, Kishoge, Milltown and Nangor.

<b>NMI 1994:20 IA/28/1994</b>	<b>Kishoge</b>
<b>Bronze Flat Axe</b>	
Possible Derryniggin type bronze flat axe. Bronze disease covering both surfaces. Found with metal detector.	

In addition to the above, a large number of archaeological artefacts have been recorded from excavations in the study area (see Appendix 14.3).

Finally, in the course of archaeological testing and excavations at the site in 2019 (License No. 19E0038), a 115 archaeological finds were discovered. These predominantly comprised pottery, stone, iron and glass dating to the medieval period, but also included a stone axehead of Neolithic date.

**Appendix 14.3 Previous excavations**

Previously published archaeological excavations in the area from 1969 to 2022 ([www.excavations.ie](http://www.excavations.ie)) are summarised below. The following townlands were assessed Adamstown, Aungierstown & Ballybane, Ballybane, Ballymakailly, Clutterland, Finnstown, Gollierstown, Grange, Kilmactalway, Kilmahuddrick, Kishoge, Milltown and Nangor.

**Dublin****1996:068****Nangor Castle, Clondalkin**

Medieval

**O045312****96E273**

Trial-trenching in the vicinity of the now-demolished castle and eighteenth-century house produced evidence for a substantial ditch and an associated shallower linear feature. Neither feature produced any datable artefacts but had silted up with a series of organic-rich clays with animal bone, shell and matted grass-possibly bedding material.

Trial-trenching continued in the field bounding the castle site to its south, after an extensive geophysical survey had been carried out. Results from these cuttings suggest widespread archaeology surviving below the ploughsoil. Several lignite cores and slivers, early medieval pottery and metal slag were all retrieved both from the trenches and from field-walking, suggesting a date in at least the early medieval period-twelfth/thirteenth century. Several trenches cut through a large ditch located on both the east and west of the field, which apparently substantiated the impression, given from the overall lie of the land, that the field had contained a ploughed-out rath or ring-ditch. Human skeletal remains were also uncovered, as were numerous charcoal-flecked irregular features. Other than some cutting into the ditch, the trench went no deeper once in situ archaeology was reached.

**Cia McConway, Archaeological Development Services Ltd. Power House, Pigeon House Harbour, Dublin 4.**

**Dublin****1997:086****NANGOR CASTLE/GRANGE CASTLE, KILMAHUDDRICK, CLONDALKIN**

Medieval?

**O045312****SMR 17:34 and 17:37****97E0116**

Test-trenching was carried out along the line of a proposed road leading northwards from the vicinity of the now-demolished Nangor Castle to Grange Castle, within the area of a proposed industrial park. This was the second phase of testing, the first phase having concentrated on the field to the immediate south of Nangor Castle and its general vicinity.

An intensive geophysical survey had been carried out along the line of the proposed road and several anomalies were identified. This testing specifically examined the areas of anomalies, as agreed on with the relevant authorities within the National Monuments Service. Trenching was carried out by machine, and halted once in situ archaeological deposits were encountered. However, as experienced before, only subsoil-cut features survived-years of ploughing the fairly shallow ploughsoil had completely removed any potential archaeological stratigraphy.

Seven trenches were opened. Of these, only three, all located in Grange Field 3, to the east of Grange Castle, produced any significant archaeology. Two linear features 0.5-0.8m wide, of unknown date and function, ran in a north-south direction. However, their proximity both to the 15th-century castle and to one another could suggest substantial archaeological potential. Some spreads of brown soil had 20th-century pottery inclusions in their upper surface, while other areas, a mix of brown soil and broken slate subsoil, were probably the result of the dragging action of the plough.

This licence was taken over by Richard O'Brien to carry out monitoring and excavation along the line of the road (No. 87 below).

**Cia Mc Conway, Archaeological Development Services Ltd, Windsor House, 11 Fairview Strand, Fairview, Dublin 3.**

**Dublin****1997:087****GRANGE CASTLE BUSINESS PARK, KILMAHUDDRICK, CLONDALKIN**

Medieval

**O045312****SMR 17:34 and 17:37****97E0116ext.**

Monitoring and excavation were undertaken in advance of the construction of an access road and the excavation of foul sewers for a Business Park at Grange Castle. The excavation work continued until February 1998. Documentary evidence is scarce for Nangor Castle, but it is known that a castle stood on the site in the 16th century. Grange Castle is an upstanding 15th-century tower-house. It is proposed to develop an industrial park in this area.

Previous archaeological assessment by Cia Mc Conway (Excavations 1996, 17, 96E273, and above, No. 86) and geophysical survey by A. Mc Cleary, ADS Ltd, in February 1997 established that the area was archaeologically sensitive.

In advance of construction of a site access road topsoil was stripped from a 24m-wide area by mechanical excavator, under archaeological supervision, for a distance of 480m northwards from the Nangor Road. A further strip, 6m wide and 1300m long, was excavated for the sewers. The full 24m-wide strip was excavated in the field adjacent to Grange Castle.

All archaeological features uncovered had been truncated by deep ploughing, resulting in the removal of all but subsurface features cut into natural boulder clay.

A curving ditch was identified in Field 1; it terminated at Nangor Road, and was orientated north-east/south-west. It was 30m in length, 0.8-0.9m deep, and 1.2-2.4m wide. The eastern terminus continued beyond the limits of the excavation. The upper fills contained charcoal, mortar, flint and animal bones, and were aceramic. A decorated bone comb, stick-pin and knife gave the later ditch phase a terminus ante quem of from the 12th to the 13th century AD.

A stone causeway, 0.5-0.6m wide and 0.06-0.1m deep, crossed the ditch. The existence of this ditch had been shown in Mc Conway's assessment.

Field 7 is located between Grange Castle and the Kilmahuddrick Housing Estate. Two curving ditches were identified in this field. One was found under a post-medieval stone and brick trackway. It was 51m in length and varied in width from 1.1m to 1.4m, and in depth from 0.3m to 0.4m. A stone causeway, 0.6-0.84m wide, crossed it towards the western side of Field 7. No datable finds came from the primary fills of the ditch, but the secondary fills consisted of charcoal-rich clays with animal bones. It continued beyond the limits of the excavation at its western end.

A second ditch was found 1.6m east of the eastern terminus of the first. No archaeological features or deposits were found in this gap. The second ditch closely resembled the first; it was 22m long, 2m wide and 0.5-0.6m deep. The primary fills were sterile apart from some animal bone. The secondary fills consisted of charcoal-rich clays in which were found animal bones, mortar, two metal knives, and a fragment of worked lignite. An incomplete one-sided decorated bone comb and fragments of another in the upper fills gave a terminus ante quem of the 12th to 13th century AD. This ditch continued beyond the limits of excavation at its eastern end. The evidence from Field 7 suggests that extensive early medieval and post-medieval activity survives in this area; the ditches can be interpreted as medieval field boundaries.

A pit that contained a deposit of iron slag was found in Field 2, north of the site of Nangor Castle; it was associated with post-holes and stake-holes, though no structural pattern could be discerned.

Elsewhere various pits, hearths, furrows and field drains were recorded; some of the hearths may be prehistoric in date.

**Richard N. O'Brien, Archaeological Development Services Ltd, Windsor House, 11 Fairview Strand, Fairview, Dublin 3.**

**Dublin****1998:129****KILCABBERRY DISTRIBUTION PARK, NANGOR, CLONDALKIN**

Monitoring

**98E0572**

The development is for the provision of infrastructural works to serve an industrial distribution park. Monitoring was requested as a condition to any planning permission. Reference to the SMR reveals the presence of a number of recorded monuments within the general landscape, although there are no known sites within the proposed development area.

Monitoring, ongoing at time of writing, has failed to note any archaeological features on the site, with the exception of one 1m-wide north-south modern field drain. Finds have been restricted to the north-west corner of the site but include only sherds of post-medieval pottery along with several sherds of modern pottery, all recovered from the topsoil.

Removal of topsoil has revealed limestone bedrock across the site, with occasionally a natural layer of friable, mid-grey, fine, silty clay with moderate stone inclusions sealing the bedrock layer and sealed by topsoil.

**Dermot Nelis, Irish Archaeological Consultancy Ltd, 8 Dungar Terrace, Dun Laoghaire, Co. Dublin.**

#### **Dublin**

**1999:170**

#### **KILCARRBERRY DISTRIBUTION PARK, NANGOR, CLONDALKIN**

Adjacent to monuments

**SMR 17:37 (vicinity of)**

**98E0572**

Archaeological monitoring at this site was ongoing when the summaries published in Excavations 1998 (42) were written. A further three days' monitoring was required in January 1999 to bring this project to completion.

The development is for the provision of roads, sewers, water mains and other ancillary infrastructural works to serve an Industrial Distribution Park. Because of the presence of recorded archaeological remains within the general landscape, Dúchas The Heritage Service recommended that archaeological monitoring be requested as a condition to any planning permission. Reference to the Sites and Monuments Record reveals the presence of a number of monuments within the general landscape, although there are no known archaeological sites within the proposed development area. A 15th-century tower-house (SMR 17:34), recorded on the Down Survey of c. 1655, is 600m north of the development site. Nangor Castle (SMR 17:37), a castle incorporated into a 19th-century mansion, is 500m east of the development area. All buildings on the site have now been demolished, however, leaving no surface trace of the earlier building. The site of Kilbride Castle (SMR 21:4) is 600m south of the proposed development, although again no visible surface remains are present. An unplastered wall is extant, but it does not contain any cut stone, although it was probably constructed using material from the castle. Slightly to the south-east of this are a church and graveyard (SMR 21:00501), a ringfort (21:00502) and earthworks (21:00503). The church is in ruins and stands in a circular raised graveyard at the edge of a broad-bottomed valley. It is possible that this is the site of an early ecclesiastical enclosure.

Monitoring has failed to reveal any archaeological features on the site, with the exception of one 1m-wide north-south modern field drain. Finds have been restricted to the north-west corner of the site, but these include only several small sherds of post-medieval pottery, along with several sherds of modern pottery, all recovered from the topsoil.

Removal of topsoil has revealed naturally deposited limestone bedrock across the site, with occasionally a c. 0.5m-thick natural layer of friable, mid-grey, fine, silty clay with moderate stone inclusions, 30-70mm, evenly distributed, sealing the bedrock layer and sealed by topsoil.

**Dermot Nelis, IAC Ltd, 8 Dungar Terrace, Dun Laoghaire, Co. Dublin.**

#### **Dublin**

**2000:0223**

#### **GRANGE/KILMAHUDDRICK/NANGOR (GRANGE CASTLE INTERNATIONAL BUSINESS PARK), CLONDALKIN**

Various

**0043318**

**00E0263**

The Grange Castle International Business Park is located to the west of Clondalkin village and incorporates part of the townlands of Grange, Kilmahuddrick, and Nangor. Wyeth Medica Ireland intends to construct a biotechnology campus on this site. The area, of c. 100 acres (40ha), was used for agricultural purposes until recently. The site is bounded to the north by the Grand Canal, to the south by the New Nangor Road, to the east by a new housing estate and land reservation for the proposed Dublin Outer Ring Road (linking the N4 and N7 roads), and to the west by the Grange Castle International Business Park access road.

Two medieval occupation sites are adjacent to the boundary of the Business Park. Grange Castle (SMR 17:34) is a fine late medieval tower-house, while Nangor Castle (SMR 17:37), to the south of the development site, appears to have been demolished during the 1970s. Geophysical survey and excavation were previously carried out by Cia McConway and Richard N. O'Brien (Excavations 1996, 17, 96E0273; Excavations 1997, 26–7, 97E0116). This work revealed that plough-truncated medieval and prehistoric features do survive within the confines of the Business Park.

Archaeological assessment by the writer consisted of the excavation of test-trenches during April and May 2000 in Fields 105, 106, 109, 110 (EIS field reference numbers) and in the northern part of Field 111. This was followed by the test-trenching of anomalies detected through geophysical survey carried out by

Geophysical Surveys Bradford (GSB) in Fields 104, 107, 108, 111 (southern part), 112, 113 and 114. This assessment took place during June and July 2000.

A ring-barrow was detected through geophysical survey and follow-up test-trenching in Kilmahuddrick townland (Field 108). The remains of field boundaries were revealed close to this ring-barrow. Approximately 50m to the east of the ring-barrow two cobbled surfaces, a charcoal spread and a series of linear features were revealed (see below No. 225).

Other truncated archaeological features were detected in Field 110 to the south of the Grange Castle tower-house. In the other areas that were tested a number of features were detected, the majority of which can be explained by ploughing or by the presence of spreads of dumped redbrick debris. Much of this redbrick debris appears to have been over-fired and reduced to a vitreous slag. There was no evidence for in situ burning or oxidation of the natural subsoil adjacent to these features. These redbrick features were only detected in Field 112.

To the south of Kilmahuddrick townland, in Nangor townland, several features of archaeological potential were detected. In Field 111 a small, undated, charcoal-rich pit was revealed. This contained a small quantity of cremated bone. In the central part of Field 111 a cluster of small, undated pits and charcoal stains was detected. A trench in the south-eastern corner of the field revealed a large cut into natural, containing 19th/20th-century cultural material. This cut corresponds with the location of an 'Old Gravel Pit' marked on the 1864 1:2500 OS map.

Field 112 is located to the north of Nangor Castle and is adjacent to the Business Park access road. In the south-eastern corner of this field a cluster of cobbled surfaces, pits and gullies, associated with medieval pottery, was revealed. Some 60m to the west of this complex a narrow ditch on a south-east/north-west axis was detected. No cultural material that could date this feature was retrieved (see below No. 226).

Further medieval material was uncovered in Field 113. Here, a trench contained a series of linear ditches directly associated with medieval ceramics (see below No. 226). A short stretch of ditch was also revealed in the north of Field 113. This length of ditch was undated but contained frequent inclusions of charcoal at the base. The ditch proved difficult to trace, but the location and orientation correspond with an anomaly detected in the geophysical survey carried out by GSB. Trenches excavated in the south-eastern portion of this field revealed a series of concrete yard surfaces and modern buildings associated with recent occupation of Nangor Castle. These remains had been covered over by spoil derived from nearby construction activity in the recent past.

Test-trenching in Field 114, a narrow field immediately north of Nangor Castle, revealed modern ground disturbance to a depth of 1.4m below the ground level. This field appears to have been associated with the Nangor Castle gardens.

None of the areas of archaeological potential have any visible, above-ground, expression. Archaeological features, where detected, were present in a truncated form, cut into subsoil and were only apparent when ploughsoil was removed.

Excavation of the ring-barrow and adjacent features commenced under licence 00E0448, while the medieval remains in Nangor townland were excavated under licence 00E0754. Topsoil-stripping during construction was monitored under licence 00E0718.

**Ian W. Doyle, Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.**

## **Dublin**

**2000:0224**

### **GRANGE/KILMAHUDDRICK/NANGOR (GRANGE CASTLE INTERNATIONAL BUSINESS PARK), CLONDALKIN**

Monitoring

**0043318**

**00E0718**

Monitoring of topsoil-stripping commenced in early September 2000. In Nangor townland, in the northern part of Field 111, the remains of a small fulacht fiadh were revealed. This consisted of a small pit or trough, a spread of heat-cracked stone and a linear feature to the south-west of the trough.

The pit/trough consisted of a subcircular cut into natural, 0.56m by 1.25m. The cut was steep-sided, leading to a flat base. It was filled with a mix of silt and compact, stony clays.

A spread of heat-shattered sandstone was located some 0.9m to the west of the trough. This spread consisted of a moderately compact, dark grey, sandy clay with frequent inclusions of heat-shattered sandstone fragments, pieces of burnt clay and charcoal. This spread measured 1.92m north-south x 1.18m with a maximum depth of 0.05m.

Approximately 6m to the west of the spread a linear gully feature was revealed. This gully consisted of a cut into natural boulder clay measuring 2.57m north-south x 0.28–0.54m. This had a depth of 0.16m with sharply sloping sides and a flat base. The cut was filled with a moderately compact, mid-brown clay containing frequent pieces of oxidised clay and occasional flecks of charcoal. Infrequent fragments of burnt bone were noted in the fill. Some 4m to the south of the heat-shattered sandstone spread, a small linear gully feature was excavated. This measured c. 1m north-east/south-west x 0.12m with a depth of 0.14m. The

fill of this comprised a mid-brown, sandy clay with frequent charcoal flecking. No archaeological objects were recovered.

To the south of the fulacht fiadh, a backfilled field boundary was revealed by topsoil-stripping. The alignment of this boundary possibly corresponds with a similar ditch encountered in Field 113 (see above No. 223). Topsoil-stripping is set to continue in 2001.

**Ian W. Doyle, Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.**

## **Dublin**

**2000:0225**

### **KILMAHUDDRICK (GRANGE CASTLE INTERNATIONAL BUSINESS PARK), CLONDALKIN**

Ring barrow

**304420 231665**

**00E0448**

The initial detection of this ring-barrow by geophysical survey was confirmed by archaeological assessment under licence 00E0263 (See above No. 223). Excavation commenced in July for a period of eight weeks, during which time the ring-barrow and several adjacent features were excavated.

The ring-barrow was located in Field 108, a large field at the centre of the area designated for the biotechnology campus buildings. The topography is generally level at c. 68m OD. However, the south-eastern corner of the field contains a natural raised area measuring c. 60m east–west x 150m. This area is generally 2m higher than the surrounding topography. The ring-barrow was sited in this slightly elevated position.

The ring-barrow was not visible prior to the geophysical survey or archaeological testing. Following stripping, a dark, circular band of charcoal-rich, black, ditch fill was visible, with a spread of cremated bone in the interior. A series of linear features skirted the eastern side of the ditch. Excavation of the ditch fills revealed a well-stratified sequence of deposits in a ditch 2.5m wide at the top and 0.25–0.3m wide at the base. The ditch cut had a depth of 1.6m below the level of natural subsoil and measured c. 13m in external diameter.

The uppermost fills of the ditch, F4 and F5, contained occasional fragments of burnt bone, charcoal and mollusc shells. Although occasional fragments of burnt bone were recovered from these ditch fills, no coherent or discrete cremation deposits were detected. Fragments of a human skull were recovered from the upper fill. A central fill of mid-brown, silty clay in the ditch sealed a series of stone features. F15 and F16, in the western quadrant, were large limestone blocks resting in the base of the ditch. Charcoal deposits were present on the flat upper surfaces of these stones. Oxidised clay patches against the sides of the ditch, adjacent to these stones, indicate that fires had been lit on these boulders in the ditch.

In the northern quadrant of the ditch, at the base, a stone 'cist-like' structure with a capstone was revealed. This was composed of medium-to-large angular stones leaning inwards at an angle of c. 45°. A large, angular capstone was positioned at the apex of the inward-leaning stones. Several of the stones comprising this small structure were fire-reddened, though there were no indications of in situ burning. When excavated, this structure was empty. Some 2m to the east of this structure, at the base of the ditch, a limestone pillar was revealed. This stood upright to a height of 0.62m and had a width of 0.44m.

Within the circular area enclosed by the barrow ditch, several deposits of cremated bone were visible. A small spread of cremated bone was initially apparent, and this may indicate disturbance. Upon excavation this was found to seal a shallow depression filled with frequent inclusions of powdered cremated bone fragments. To the north-west of this, a pit measuring some 2.1m north–south x 0.6m was revealed. This pit contained occasional fragments of cremated bone and appeared to cut an irregularly shaped cremation pit (F87), which measured 1.3m east–west x 0.5m and had a depth of 0.8–0.9m. The upper fill of this was a hard, compact, grey clay with occasional stones. This fill sealed a layer of cremated bone and charcoal. A sherd of pottery was recovered from this material, the characteristics of which all point to an Early Bronze Age date for its manufacture, specifically a Beaker or Food Vessel background (Anna Brindley, pers. comm.). What appears to be a small black bead was retrieved, during sieving, from this deposit.

Two undated pits were excavated adjacent to the barrow. A series of linear features was also revealed in the area surrounding the ring-barrow. These are interpreted as the remains of field boundaries and were found to enclose the ring-barrow in a subrectangular field system. These remain undated. A geological seam was traced running from the north side of the barrow.

Some 50m to the east of the ring-barrow a trench was reopened in Field 109 to examine features originally detected during assessment 00E0263 (see above No. 223). A northern return of the field system found to enclose the ring-barrow was revealed. This places the ring-barrow in a rectangular enclosure measuring c. 50m east–west x 100m (minimum). A metallised surface was found to seal the field boundary in this trench. While the field boundary system remains undated at the time of writing, it is likely to post-date the ring-barrow. A hearth was also excavated.

Analysis of the soil samples from the ring-barrow has recovered evidence of cereal production. Charred remains of barley, wheat and oats were identified in the ditch fills and cremation deposits. Traces of hazel,

haw and sloe were also found. Post-excavation analysis of the human remains, the faunal remains and the charcoal samples is ongoing.

A cluster of ring-barrows is located on the upland area of Saggart Hill and Verschoyles Hill, approximately 6km to the south of the Kilmahuddrick site. Within this group, the Lugg monument complex, which contained a ring-barrow, was excavated by Kilbride-Jones in the late 1930s. The Kilmahuddrick barrow may be a northern element of this distributional cluster, or, alternatively, its presence in a heavily ploughed lowland area may indicate a greater survival rate and higher level of visibility in the upland areas.

**Ian W. Doyle, Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.**

## **Dublin**

**2000:0226**

### **NANGOR (GRANGE CASTLE INTERNATIONAL BUSINESS PARK), CLONDALKIN**

Medieval field complex

**30440 23117**

**00E0754**

Excavations commenced in this area of the Grange Castle International Business Park in October 2000 and are continuing at the time of writing (January 2001). The site of Nangor Castle (SMR 17:37) is located immediately outside the southern boundary of the Wyeth Medica Ireland biotechnology campus. There are no upstanding remains of Nangor Castle—demolition appears to have happened in the 1970s. Cartographic evidence and test-trenching carried out close to this area (see above No. 223) indicate that a complex of agricultural buildings and concrete surfaces existed in the area. To the west of the Nangor Castle site, mid-19th-century OS maps depict a well-designed garden. The unkempt remains of this garden exist today to the south of the biotechnology campus.

The place name Nangor appears to be of old French origin. In 1307 there is a reference to the tenements of 'Kilbryde and the Naungre', which were held by Walter de Kenley from William, son of John de Galbarry, for a rent of 20 pounds (Mills 1914, 356). Test-trenching carried out by Cia McConway in 1996 at Nangor Castle revealed at least one substantial ditch and a shallow linear feature to the west of the castle site (Excavations 1996, 17, 96E0273).

The present phase of excavation was designed to resolve any archaeological material in Fields 112 and 113 within the southern boundary of the biotechnology campus. In addition to this, excavation is ongoing to the south of the boundary in a corridor through the Nangor Castle gardens (South Dublin County Council land) to enable a gas pipeline and access road to serve the Wyeth Medica Ireland site.

To date, a complex of intercutting medieval ditches and gullies has been excavated. Some 1500 sherds of locally manufactured medieval pottery (Dublin-type wares, Leinster cooking ware) have been recovered. A complete iron sickle was found in a ditch associated with sherds of medieval pottery. Further details will be provided for Excavations 2001.

#### *Reference*

Mills, J. (ed.) 1914 Calendar of the Justiciary Rolls or Proceedings in the Court of the Justiciar of Ireland, Edward I. Part 2. Dublin.

**Ian W. Doyle, Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.**

## **Dublin**

**2001:427**

### **Grange Castle International Business Park, Grange and Kishoge**

Various

**204230 232120**

**00E0061**

Test-trenching was carried out at Grange Castle International Business Park, Clondalkin, Dublin 22, on a site owned by South Dublin County Council, during February 2001. The greater part of this site is currently under development as a business park by Wyeth Medica Ireland.

The assessment was concerned with the area immediately south of the Grand Canal in Grange and Kishoge townlands. It is intended to construct an attenuation lake in this area, which will aid drainage. The lake structure will measure approximately 250m north-west/south-east by 90m. An underground 110kV electricity cable will run through this area and towards the west for a length of approximately 1.5km. The terrain in the areas to be affected is relatively low-lying and the land has been used for agricultural purposes. The centre of the area intended for the attenuation lake was subjected to ground disturbance in the recent past. This disturbance appears to have been associated with the diversion of a stream and ground was stripped to bedrock in places.

Sixteen trenches were opened by mechanical excavator. These were placed in the areas which would be subjected to disturbance by the attenuation lake and the electricity cable way-leave.

Trench 1 was located at the western end of the lake and associated roadway. It revealed a long linear feature cutting natural subsoil. Where sectioned, the cut for this feature, which measured 2.6m east-west by

16.5m with a depth of 0.35m, comprised a sloping-sided flat-bottomed gully. The upper fill consisted of a moderately compact light brown clay silt with occasional inclusions of mollusc shells and small pebbles. The lower fill comprised a moderately compact grey clay with occasional mollusc shell inclusions. A small undated hearth was revealed in Trench 4, which was also located to the west of the lake.

Trench 13 was opened on the line of the electricity cable way-leave, at a point where a mound and masonry wall were observed in the extreme north-eastern corner of the field. What is likely to be a modern agricultural feature was revealed, comprised of a mound, a stone wall and a metalled surface. This is likely to represent a watering-hole for livestock formed by excavating a depression, placing the upcast to the west into a mound, which was then revetted with a low masonry wall. A metalled surface was then placed at the point of animal access.

Monitoring of topsoil-stripping was recommended and was later carried out (see below, No. 428).

**Ian W. Doyle for Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.**

**Dublin**

**2001:428**

**Grange Castle International Business Park, Grange/Nangor/Kilmahuddrick**

Monitoring

**304420 231665**

**01E0718**

Monitoring continued in the townlands of Grange, Nangor and Kilmahuddrick. Wyeth Medica Ireland commenced construction of a biotechnology campus in this area in September 2000.

The campus area is located west of Clondalkin village and incorporates parts of the townlands of Grange, Kishoge, Kilmahuddrick and Nangor. It is bounded to the north by the Grand Canal, to the south by New Nangor Road, to the east by a new housing estate and reservation for the South Dublin Outer Ring Road and, finally, to the west by the Grange Castle International Business Park access road. The Wyeth Medica Ireland site is approximately 90 acres in extent.

Previously, during 2000, excavation in Kilmahuddrick townland concentrated on a prehistoric ring-barrow, which was resolved in advance of construction (Excavations 2000, No. 225, 00E0448). Monitoring of topsoil-stripping in October 2000 led to the identification and excavation of a small fulacht fiadh in Nangor townland. The monitoring of topsoil-stripping within these townlands continued during January 2001. No additional archaeological material was detected.

**Ian W. Doyle for Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.**

**Dublin**

**2001:429**

**Grange Castle International Business Park, Grange and Kishoge**

Post-medieval

**20423 23212**

**01E0718 ext.**

The archaeological assessment carried out in this area during February 2001 (see below, No. 438) recommended that an archaeologist be present to monitor the stripping of topsoil.

The initial recognition of archaeological features was compromised somewhat by the contractor stripping a quantity of topsoil before informing the archaeologist. However, several metalled surfaces, field drains, pits and gullies of post-medieval and modern date were recognised during the stripping when an archaeological presence was maintained.

In Kishoge townland, to the south-west of the area intended for the attenuation lake, the remains of a subrectangular structure, which appears to have burnt down, were detected. This consisted of what appeared to be the remains of slot-trenches cut into natural boulder clay with a fill of oxidised clay and charcoal. The feature measured 5.8m east-west by 4.6m and appeared to have been truncated through intensive ploughing. Access to this area was not available at the time of the assessment owing to dumping and storage of building materials. This area was later excavated by Edmond O'Donovan (see below, No. 438).

**Ian W. Doyle for Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.**

**Dublin****2001:438****Kishoge**

Prehistoric house

**30423 23212****01E0061**

The remains of a truncated burnt Neolithic wooden house were identified in Kishoge, Dublin 22, halfway between Clondalkin and Newcastle. Ploughing in antiquity had led to the truncation of the structure, and no occupation surfaces survived. However, cut features, such as post-holes, pits and foundation trenches, were identified at the site.

The house was originally roughly rectangular in shape, although the walls were slightly curved at the south-western end. The structure measured 6.05m (north-east/south-west) by 4.5m. The archaeological remains consisted of foundation trenches cut into the glacial boulder clay and bedrock. The house walls and the support for the building's superstructure were constructed from timber posts augmented by planking. All of the posts and planks identified in the house were of oak. The foundation trenches varied between 0.25m and 0.3m in width and were excavated to a depth of 0.08–0.21m. The foundation trenches at the north-eastern end of the house originally housed upright timber planks that formed the house walls. A break in one of these linear features (house wall) was visible in the north-eastern foundation trench; this was interpreted as an entrance. The south-western end of the house was predominantly post-built. The south-western house walls curved, with an open entrance at the southern end of the building.

Only two features were identified in the interior of the structure: the truncated remains of two internal timber roof supports, suggesting some kind of internal division within the house into two spaces at the north-east and south-west ends. The house appeared to have burnt down in antiquity, with little evidence for repair or reoccupation.

Pits and charcoal were identified both to the south and north-west of the house. These features are likely to represent contemporary domestic activity around the dwelling. A small number of artefacts were retrieved from these features, including a number of crude round scrapers, waste flint and a single poorly preserved fragment of prehistoric pottery.

Rough flint scraping tools and flint waste flakes were retrieved from the features excavated on the site, but none of these were obviously diagnostic. The complete absence of prehistoric pottery from the house is curious. The morphological comparison with other Neolithic houses excavated in Ireland suggests that the structure dates from this period. This was confirmed by the results of the radiocarbon dating programme. The Centrum voor Isotopen Onderzoek, Groningen, processed three samples to date the house (GrN-26770, 4880+40 BP; GrN-26771, 5020+40 BP; and GrN-26789, 4990+50 BP). The 2-sigma-calibrated results indicate that the house was built and occupied between 3941 and 3659 BC. A fourth Middle Bronze Age date (GrN-26772, 3120+75 BP) was obtained from a large pit to the south of the house (1595–1131 BC), suggesting that not all of the peripheral archaeological activity is contemporary with the structure.

**Edmond O'Donovan, Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.**

**Dublin****2001:455****Grange Castle International Business Park, Nangor**

Medieval field system

**304400 231170****01E0754**

Excavations were carried out in Nangor townland, west of Clondalkin, Dublin 22, during October 2000–January 2001. The excavations revealed a medieval ditch complex. The northern area of the site is presently under development as a biotechnology campus.

Construction of the campus commenced in September 2000. The area excavated in Nangor is south of the construction site and outside the immediate area of impact. No detailed development is presently intended for the greater part of this area. However, additional excavation was undertaken to mitigate the impact of a gas pipeline and associated access road in part of the area formerly occupied by the Nangor Castle gardens. Nangor Castle (RMP 17:37) is located immediately outside the southern boundary of the Wyeth Medica Ireland site. References to a castle at this site date from the 15th–16th centuries. All buildings on the site were demolished during the 1970s, but an area of archaeological potential surrounds the site.

Trench 1, which measured 60m north–south by 33m, was located some 90m to the north-west of the castle site. Geophysical survey and subsequent test-trenching had suggested that the area of Trench 1 held archaeological potential. Excavation in Trench 1 commenced in October 2000 and continued until December 2000. Activity assigned to Phase I in this trench consisted of a linear feature and a pit, both of which cut natural subsoil. These features did not produce pottery or finds. The pit consisted of a rectangular cut into natural subsoil, which contained a series of ash deposits. Areas of oxidised or fire-reddened soil present on

the north-east and south-west sides are indicative of in situ burning. This cut was filled with a series of sterile silty layers and dumps of ash.

The Phase I activity was succeeded by a medieval phase of activity which consisted of further linear features, pits and cobbled surfaces. These were assigned to a single general phase which is capable of further subdivision based on stratigraphic grounds. Finds retrieved from the fills of these features include approximately 1000 sherds of Leinster Cooking Ware and Dublin-type wares, and assorted iron finds including nails, an armour-piercing arrowhead, a buckle, a key and an intact iron sickle.

Trench 2, located to the east, detected a similar sequence of linear features, which contained sherds of medieval pottery in their fills. Trench 3, to the south of Trench 1, detected shallow linear features running on an east–west axis. These linear features were succeeded by a pit and a metalled surface, both of which were directly associated with medieval pottery.

Trench 4, located to the west, was excavated to examine a ditch encountered during an earlier assessment. A ditch orientated north-west/south-east with steep sloping sides and a rounded U-shaped base was revealed. It was 1.05m wide, narrowing to 0.3m at the base, with a maximum depth of 1.1m. Its fill contained occasional fragments of animal bone, from which a radiocarbon date of cal. AD 601–883 was obtained.

Trench 5, located to the south-east of Trench 4, uncovered further medieval linear features. A narrow ditch which ran across the trench on a south-east/north-west axis is likely to represent a continuation of a similar feature encountered in Trench A to the south. A series of post-medieval field boundaries was also detected in Trench 5.

Trench A was excavated to the south of Trench 5 on the line of the gas pipeline and associated roadway. Excavation in this area revealed an undated metalled surface and a series of ditches/gullies. Excavation of these commenced in January 2001. Although there were relatively few finds from these features, their stratigraphic relationship indicates that there were five phases of ditches and gullies in the trench dating from medieval to modern times.

The excavation of Trench B, an extension of Trench A, revealed one feature of interest, a substantial medieval ditch which cut into natural subsoil. This was found in the extreme eastern end of the trench. The ditch ran through Trench B, outside the northern and southern limits of excavation. The cut measured 10m north–south by 2.5m, with a depth of 1.1m as exposed, and had sloping sides and a rounded base. The ditch ran on a north–south axis with a slight curve towards the north-east. In overall plan the ditch appears to have been subcircular, enclosing an area to the east of Trench B. The fills of the ditch comprised black sticky silts with organic content. The lower and upper fills contained medieval pottery. No trace of an enclosing bank was detected in the area opened for examination; however, the depth of overburden, composed of cultivated soils, in this area may be in part composed of a levelled bank.

Trench C to the north-east of Trench B did not detect the ditch. No archaeological material was detected in Trench C, where it was found that modern disturbance had removed the old ground surface.

In total, some 1600 sherds of native medieval pottery were recovered from the Nangor excavations. It is of some interest that only two sherds of imported medieval pottery were recovered. The excavated linear features at Nangor may represent the remains of medieval field boundaries with associated water-management gullies. The presence of such linear features, which can be dated to the medieval period by the presence of Leinster Cooking Ware and Dublin-type wares, argues for land enclosure during the medieval period. That cereal production was the purpose of such enclosures may be suggested by evidence from pollen and macro-plant analysis. The examination of a wide range of medieval samples from the Nangor excavations has shown a predominance of wheat over other plant remains.

**Ian W. Doyle for Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.**

**Dublin**

**2002:0448**

**Adamstown**

**No archaeological significance**

**ITM E 702819m, N 732976m**

**Latitude, Longitude (decimal degrees): 53.337018, -6.456151**

**01E1147**

Test excavation before the construction of a housing development was carried out in the townland of Adamstown, adjacent to the Newcastle Road, west Dublin. The greenfield site measured c. 200m by 200m. Testing was required because of the proximity of the site to that of Adamstown Castle, SMR 17:29. Seven trenches, 30–50m long, were excavated by mechanical digger. In no trench were finds, features or structures of archaeological significance uncovered.

**Georgina Scally, 81 Upper Leeson Street, Dublin 4, for Margaret Gowen & Co. Ltd.**

**Dublin**  
**2002:0612**  
**Kishoge**  
Monitoring  
**0042325**  
**02E1808**

Monitoring before the construction of a temporary haul road associated with the construction of the South Dublin Outer Ring Road was undertaken in November and December 2002. The temporary haul road is in the vicinity of Lynches Lane, in the townland of Kishoge, west Dublin. All subsurface works associated with the construction of the road were monitored, and no finds, features or structures of archaeological significance were uncovered. The licence has since been extended to include monitoring of the full length of the roadway, which will extend c. 5.7km from Kingwood in Tallaght to Lynche's Lane. This work will continue in 2003.

**Georgina Scally, 81 Upper Leeson Street, Dublin 4, for Margaret Gowen & Co. Ltd.**

**Dublin**  
**2003:0604**  
**Grange**  
Mill  
**03E1210**

The site was excavated because it was directly threatened by the realignment of the Griffeen River within the precincts of the Grange Industrial Park. Surface evidence for the mill was in the form of the north wall, surviving as part of the boundary fence separating the Beattie farm from the Grand Canal towpath. Some 19th-century pottery was found on the surface and some fragments of floor tiles from an industrial drying kiln. Testing and subsequent excavation revealed the extent of the building as a single block, 13m west–east by 8.5m. Wall thickness was between 0.8 and 0.9m. The wall structure was of coursed rubble with opes defined by brick dressings. The dressings allowed for the identification of two window opes in the north-east corner of the building. Flanking the main block to the west was a wheel pit, 2.2m in width and 1.6–1.7m in depth. The wheel pit is delimited on the west by a wall 0.85m thick, widening to 1.1m where the axle bearing was mounted. The wheel pit was partially lined with red brick. The upper courses, forming the downslope of the wheel pit, are formed of brick with headers presented, while the lower part of the pit and its base are lined with brick, stretchers presented.

The flanking walls show evidence for wheel wear in the stonework, and this suggests that the wheel had a diameter in the region of 3m. The wheel was breast shot fed from a headrace to the south. The headrace either emanated from a penstock to the south or was linked back to the Griffeen further upstream. There was no evidence for a race in the field south of the mill site. The confluence of the headrace and the wheel pit is again lined with red brick in a rough English bond pattern.

Within the mill structure, the pit for the pit wheel was identified. No machinery was present on the site. Artefacts within the mill structure were largely of 19th-century date, although some sherds of post-medieval imported ware were found in the topsoil but do not appear to be contemporary with the mill. It is possible that the mill has its origin in the later 18th century and served as a gristmill for flour milling. The general water supply would make such a mill difficult to operate. With the inauguration of the Grand Canal, a constant head of water became available and so the mill relocated to the Lock area at Adamstown. It is likely that the machinery was taken from the old mill and tweaked to function within the new mill. The old mill may well have served a later function as a cereal-drying kiln, as suggested by the quantities of kiln tiles found on the northern part of the site.

**Red Tobin, Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.**

**Dublin**  
**2003:0607**  
**Grange Castle**  
Monitoring  
**030335 23200**  
**SMR 17:29; 17:34; 17:37**  
**03E0025**

Monitoring of topsoil-stripping for a pharmaceutical plant and associated services located at Grange Castle International Business Park was carried out from 8 January to 2 February 2003. The development consisted of a 20-acre greenfield site, of which c. twelve acres were stripped of topsoil by a mechanical excavator equipped with a toothless bucket. The only subsoil cut features uncovered dated to recent times. These consisted of refuse pits, field drains and areas of burning. The field boundary and watercourse that were

revealed had been backfilled in the 19th century. All the finds recovered were either post-medieval or modern in date.

**John O'Connor, 2 Walnut Rise, Courtlands, Dublin 9, for Archaeological Development Services Ltd.**

**Dublin**

**2003:1918**

**Grange International Business Park, Dublin**

No archaeological significance

**SMR DU017-034**

**03E1846**

Monitoring of works took place within the constraint area of Grange Castle, RMP 17:34, at Grange International Business Park, Clondalkin. South Dublin County Council required that the site be cleared of debris and secured with a fence and ground-beams. The site was being vandalised and used as a dumping ground. A method statement was agreed with the client and with the National Monuments Service. This involved a low-impact solution involving lightweight plant, with the majority of the work being carried out in dry weather to further reduce the surface damage.

The clearance work was carried out without disturbing any archaeological deposits and without the recovery of any artefacts. The fencing required the excavation of a series of holes for the fence posts. These excavations were monitored and no archaeological deposits were disturbed. The ground slab required some excavation but was secured within the depth of the topsoil and remaining debris field. The work has now been completed satisfactorily.

**Red Tobin for Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.**

**Dublin**

**2004:0602**

**GRANGE INTERNATIONAL BUSINESS PARK, GRANGE**

Burnt mounds

**04E0299**

Excavations were carried out during works on the Griffeen River realignment, part of ongoing infrastructure works within the precincts of the Grange International Business Park. The works are principally aesthetic in purpose, designed to enhance the appearance of the park and to highlight the river, which otherwise would have flowed behind the Takeda Pharmaceuticals complex. The area stripped will also accommodate the extended road network that will serve the business park when it is fully occupied.

Topsoil-stripping for this realignment commenced in early December 2003 and continued intermittently until May 2004. Topsoil-stripping revealed the locations of three burnt mounds. Of these three features, two were excavated, as the development was likely to have a total impact on them. The third mound was preserved in situ, as it was located outside the development area.

The first mound was excavated between 16 and 18 February 2004 and the second was excavated from 5 April 2004.

*Burnt Mound 1, 303279.542 231522.602*

During the monitoring of the topsoil removal this site was identified as an irregularly shaped deposit of firing material (heat-shattered stone and blackened soil). The burnt-mound material extended 28m east-west along the northern edge of the stripped corridor and extended to the south by 8m from the northern baulk. The feature lay c. 25m to the west of the Griffeen River on gently undulating pasture sloping to the south. The evidence from initial survey work and subsequent excavation suggests that the main spread of this site remains preserved in situ to the south of this location.

The nature and extent of the mound material was exaggerated by plough action, which had dragged it from its original focal point to extend over 28m in length. After the removal of topsoil, etc., the F2 mound of firing material extended little more than 0.5m from the limit of the excavation. From this southern extremity, the mound rose to the north to a maximum height of 0.65m at the northern limit of the excavation. No cut features were exposed during the excavation.

*Burnt Mound 2, 303104.7 231270.2*

The realigned Griffeen crosses the course of the old river at two locations. To allow for the excavation of the first of these crossings it was necessary to divert the Griffeen into a third channel. During stripping prior to this channel being dug the second burnt mound was found. During the topsoil removal this site was identified as an irregularly shaped deposit of firing material (heat-shattered stone and blackened soil).

The area of excavation measured 13m east-west by 17.5m. A silted-up streambed abutted the southern part of the mound. The stream appears originally to have flowed from east-north-east to south-west. It had a width of 3-5m, but the length could not be discerned as it extended beyond the limit of excavation. The

stream fill contained water-rolled stones, pebbles and a dark-grey silt with a minimum depth of 0.1m. Wood residue, possibly alder, was in evidence here and was probably indicative of remnants of fen woodland. This stream system is likely to have been the reason for siting the burnt mound at this location.

One of the earliest features on the site was a grouping of stake-holes cut into the clayey peat. These formed a semicircular band. All were comparable in shape and size and all contained the same fill. They ranged in depth from 5mm to 2mm with a diameter of 6-12mm. Small amounts of heat-affected pebbles and small stones around the sides of the stake-holes may be evidence for packing material. The function of the complex is not clear. Some stake-holes are vertical, while others have been driven into the ground at an angle. They follow a vague northeast to south-west pattern, but the angled stakes do not appear to offer support to each other or to any possible structure.

The burnt mound was situated on the northern bank of the silted up stream. The bank was steep-sided. The main concentration of firing material is in the west. No evidence for a trough was found and the only evidence of activity associated with the burnt mound appears to be the stake-hole complex. The mound measured 11m east-west by 4.5m. It is more likely that the original east-west dimensions were closer to being 6m, with a depth of 0.12-0.25m.

Covering and surrounding the burnt mound was a layer of peat measuring 4.64m from north to south by 14.7m, with a surviving depth of 0.2-0.45m. This was a moist dark-reddish-brown peat of moderate compaction that contained inclusions of sphagnum moss, plants and wood. It was most pronounced to the south of the burnt mound, sloping downwards to the stream. A third burnt mound was recorded during the course of the topsoil-strip. The site was not fully exposed but was identified by a number of concentrations of the characteristic firing material. This site was not impacted on by the development and it was possible to preserve it in situ. It was first sealed using a double layer of geotextile material and then covered by a soil bund forming the boundary between the business park and the pitch-and-putt course.

**Red Tobin, Margaret Gowen & Co. Ltd, 27 Merrion Square, Dublin 2.**

#### **Dublin**

**2004:0616**

**FINNSTOWN (Finnstown House, Newcastle Road, Lucan)**

**No archaeological significance**

**ITM: E**

**04E0522**

An assessment including testing was carried out at Finnstown House, Lucan, Co. Dublin. The development plans included the demolition of a single-storey building and the erection of a two-storey building, with a pedestrian link at ground level and stairs/lift enclosure abutting an existing two-storey building. The plans also include the renovation of existing two-storey outbuildings/coach houses. A medieval tower-house was noted within Finnstown House during the course of this assessment. This tower-house will not be impacted upon by the development.

Testing was carried out in the walled garden area and within the footprint of the proposed new building. The north-eastern end of the trench comprised 1m of infill material. This material was dumped during recent construction work and was then levelled out. It comprised wood, stone, plastic and modern ceramics. This material lay on the natural subsoil, which was light-brown to yellow clay. The south-western extent of the trench comprised c. 0.3m of topsoil, which consisted of stony light-brown clay with a grey hue. Some red brick and willow-pattern pottery was noted in this topsoil layer. The natural subsoil lay under the topsoil and appeared to be consistent throughout the site. No features or finds or archaeological significance were uncovered in this trench.

#### **Dublin**

**2005:379**

**ADAMSTOWN**

**Urban burial ground**

**ITM: E 703029m, N 732827m**

**Latitude, Longitude (decimal degrees): 53.335639, -6.453048**

-

**05E1295**

Human remains were located within the road-take of the Adamstown link road (ALR) at the rear of the old Lucan train station adjacent to the Ascon compound in Adamstown, Dublin. The investigations involved the excavation of human remains uncovered during the course of topsoil-stripping in advance of the construction of the ALR. The excavations entailed the lifting of 36 full or partial skeletons and eight disarticulated skeletons. Two linear features and two deposits were also excavated at the site.

The skeletal remains were primarily orientated in a west–east direction, with heads to the west, but a number were aligned slightly along a south-west/north-east axis and two along a north-west/south-east axis. All were

in simple graves, with no traces of any coffins or grave-markers. They appeared to represent 43 adults and one infant. A single find uncovered with a burial was a fragment of plastic rosary beads found in the pelvic region of Skeleton 10. This find may not suggest a modern date for the burials, as they were disturbed and truncated by the railway wall, which appears to date to the 1950s. It is possible that the rosary beads were interred when the burial was disturbed during the demolition of Lucan station or the construction of the wall that divided the site from the Dublin/Kildare railway line. Removal of the wall and build-up on its southern side revealed that skeletal remains did not extend over the northern side of the existing railway wall. It is hoped that further post-excavation and osteoarchaeological analysis of the remains will indicate a possible date for the site.

**Ellen O'Carroll, The Archaeology Company, 17 Castle Street, Dalkey, Co. Dublin.**

#### **Dublin**

**2006:581**

#### **New IAWS HQ, Grange Castle Business Park, Clondalkin**

No archaeological significance.

**30280 23110**

**06E1161**

The Grange Castle Business Park has witnessed several archaeological investigations since 2000 (O'Donovan 2004; Doyle 2005). These investigations resulted in the discovery and excavation of several prehistoric sites in the area of the Grange Castle Business Park. The Record of Monuments and Places records two castles located within the grounds of Grange Castle Business Park, namely Grange Castle DU(017–134) and Nangor Castle DU(017–037). The new IAWS HQ has an area of 9.3ha and is located at the south-west corner of Grange Castle Business Park, being bordered on the west by the R120 (Lucan road). The site was part of an extensive geophysical survey carried out by Margaret Gowen & Co. Ltd in October 2005, which revealed that the south-west corner of the site had a distinct magnetic disturbance indicative of a spread of material, possibly rubble.

All groundworks associated with the development were monitored during December 2006. The excavation of the site access road resulted in the discovery of a modern pit, a modern linear spread of angular stone, a small spread of red brick mixed with shells and several modern land drains. No features of archaeological significance were encountered during the stripping of topsoil. The programme for the monitored stripping of topsoil at the eastern portion of the site will resume in January 2007.

#### References

Doyle, I. 2005 Excavation of a prehistoric ring barrow at Kilmahuddrick, Clondalkin, Dublin 22. *The Journal of Irish Archaeology* 14, 43–75.

O'Donovan, E. 2004 A Neolithic house at Kishoge, Co. Dublin. *The Journal of Irish Archaeology* 12 and 13, 1–27.

**Eoin Sullivan, for Margaret Gowen & Co. Ltd, 27 Merrion Square, Dublin 2.**

#### **Dublin**

**2006:659**

#### **Grange Castle Business Park (Grange, Milltown and Clutterland)**

No archaeological significance

**06E0777**

Monitoring of ground-disturbance activities associated with the construction of a link road within Grange Castle Business Park was undertaken in July and August 2006. The link road was constructed in the west of the business park from the Takeda Factory to the Nangor Road; 1250m of single carriageway was constructed parallel to the course of the Griffeen River. The majority of the route of the link road was disturbed by the previous realignment of the Griffeen River (see Red Tobin in Excavations 2003, No. 604, 03E1210). No features or stratigraphy of an archaeological nature were identified.

**Emer Dennehy, Margaret Gowen & Co. Ltd, 27 Merrion Square, Dublin 2.**

#### **Dublin**

**2007:515**

#### **Gollierstown, Dublin**

No archaeological significance

**SMR N/A**

**07E0671**

Testing was carried out in compliance with a planning condition for enabling works to facilitate the construction of the district centre at Adamstown, Lucan, Co. Dublin. The proposed development lands were in use as a compound for the railway development and, as such, the topsoil had been stripped from some of

the area. A bridge has also been constructed across the lands at the western side. There are no known monuments in the development lands for the district centre and cartographic research indicates that the development site was always laid out in open fields. Eleven test-trenches were excavated across the development site with a 1.8m-wide toothless bucket. The stratigraphy consisted of c. 0.2m of topsoil underlying subsoil on to natural stony marly soils. Nothing of archaeological significance was recorded during the testing.

**Ellen O'Carroll, 8 Cumberland Street, Dún Laoghaire, Co. Dublin.**

## **Dublin**

**2007:530**

### **NANGOR**

Medieval, post-medieval

**30459 23122**

**DU017-037**

**07E0588**

Monitoring and testing took place between August and October 2007 within and adjacent to the Nangor Castle, Clondalkin, Co. Dublin.

The monitoring of a service trench, 400m in length, 1m in depth and 0.5–0.55m in width, revealed several archaeological features that have been tentatively identified as part of the landscaped gardens, located to the west of the RMP site and associated with the now demolished 18th-century Queen Anne house that was built on the site of the earlier Nangor Castle. The initial stage of the service trench, which was parallel to an existing access road to a gas pumping station, ran through heavily disturbed ground that contained redeposited topsoil, subsoil and road-making materials. As the monitoring trench approached the gas pumping station, a series of small stone walls, averaging 0.5m in width, separated in some instances by low banks of stone-free soil, were revealed. The walls, six in all, were located at a depth of 0.5m below the present ground surface. They consisted of stones, c. 0.2m by 0.15m or smaller, bonded together in some instances with creamy gritty mortar with fragments of red brick. One wall, F9, lay at a depth of 1m; it was 0.5m in width and appeared to be bordered by narrow pieces of wood on each side. All the walls ran in a north-west to south-east direction across the monitoring trench.

As the service trench ran to the south of the pumping station it cut through concrete floors, possibly associated with farm and cattle yards. The foundation for the floors consisted of loose stone, stone blocks and mortar and lay directly on the subsoil. Two further stone walls were revealed at the extreme eastern portion of the service trench in this area. Both ran north–south across the service trench. The walls were just under 1m in width and were revealed 0.6m beneath disturbed topsoil and fill.

As the service trench turned southwards and ran parallel with the site boundary for 120m, there was a marked difference in the ground conditions. The ground here was undisturbed. However, nothing of any significance was revealed in this area.

It should be noted that, while the monitoring did reveal landscape features possibly associated with the Queen Anne house, the rubble foundation that underlay the concrete floors in the northern portion of the site contained a considerable amount of stonework, which may be related to the 18th-century house and possibly to Nangor Castle itself. The incidence of red brick and large blocks of stone may indicate this to be the case. Areas with the constraint zone for Nangor Castle are strewn with large rough-hewn limestone blocks, possibly relating to the castle structure, although the dumping of construction waste and other waste within the area masks this to quite a degree. There was no evidence for in situ remains of the Queen Anne house or Nangor Castle revealed during monitoring.

Two phases of testing took place on the site. The initial phase took place within the RMP site and one test-trench was located across the possible remains of the Queen Anne house and the castle. It had been hoped to insert a series of test-trenches over possible subsurface remains of the Queen Anne house and castle site, but, due to a very large and unstable overburden and the desire not to impact unnecessarily on the RMP site, only one test-trench was completed.

This test-trench, located across possible structural remains in the western portion of the site, was cut through a very large deposit of construction debris, general dumping and waste, averaging between 3m and 4m in places. This overburden was extremely loose and unsound. Consequently a test-trench 6m in width was cut through this overburden and battered back for safety. Within this a slightly narrower test-trench revealed the remains of a modern concrete building at the western end of the test-trench, 3m below the original overburden. The modern structural remains were abutted by a portion of a large stone structure, over 1m in height and 1.75m in width, with a rubble core, suggesting it may be associated with or be part of Nangor Castle. The true depth of the wall was not ascertained. It appeared to run in a southwards direction from the test-trench. Further to the east, possible remains associated with the Queen Anne house were revealed. These consisted of stone walls plastered on one side, walls of red brick and painted walls. They were revealed to be up to 1m or more in depth. Red brick from this area was identified as being very early in date. No further work was done in the area due to the instability of the overburden.

A second phase of testing took place to the south, south-east and south-west of the RMP site. A series of three test-trenches were excavated. This testing took place within a possible Early Christian 90m diameter enclosure previously identified. An area to the south-east of the RMP site and the Early Christian enclosure was also tested. The two test-trenches to the south-east revealed a redeposit of disturbed modern fill, within which lay garden features such as low banks of stone-free soil, for trees or shrubs, which may have been associated with the avenue which led up to the Queen Anne house, which was located to the immediate west. The third test-trench, which was 150m in length, ran across the previously identified Early Christian enclosure to the south-west of the RMP.

This long test-trench cut across the entire width of the enclosure, at the northern extremity, and confirmed the previous investigations and geophysical survey. The presence of a large enclosure with ditches up to 2.7m in width and over 0.7m in depth, with the possible remains of a second ditch in the western portion of the enclosure, were revealed. Previous investigations had revealed a cemetery and possible structures within the enclosure. There was considerable evidence for occupation levels, areas of burning within the test-trench and features such as pits and linear features. Finds from the original investigations by Cia McConway (Excavations 1996, No. 68, 96E0273; Excavations 1997, No. 86, 97E0116) included lignite slivers and cores, metal slag, animal bone, medieval pottery and human remains. Additional medieval pottery, green-glazed, was recovered from this second phase of testing, together with large quantities of animal bone.

The monitoring of the service trench and the two phases of testing has confirmed that this is an area of considerable archaeological activity. The location of such a large enclosure, Early Christian in date, with evidence for a cemetery and interior occupation, may have given the site considerable importance, marking it out as a significant place in the landscape. The second phase of activity, to the north and north-east of the enclosure, that of the medieval Nangor Castle, also attests to the importance of this site, as does the erection of the later Queen Anne house. The layout of the Queen Anne gardens is still clearly visible on the ground, although heavily overgrown, and the testing has shown that subsurface features associated with the gardens still exist. Possible substantial remains of Nangor Castle itself and the Queen Anne house, under a deep overburden of unstable construction fill, were also revealed, although further investigations would be necessitated to confirm this.

**Sylvia Desmond, Margaret Gowen & Co. Ltd, 27 Merrion Square, Dublin 2.**

#### **Dublin**

**2008:363**

**Gollierstown, Adamstown**

**Urban**

**ITM: E 701516m, N 732303m**

**08E0197**

An assessment and associated testing were in compliance with a planning condition for the construction of a post-primary school and a community centre. The proposed development is to be located to the south of the SDZ lands and adjoins the railway line. Previous testing was carried out by the author at the adjoining site for the Adamstown District Centre. There are no known monuments in the development lands for the District Centre and cartographic research indicates that the development site was always laid out in open fields.

The proposed development site is located on a brownfield site at the western edges of the Adamstown development. The lands were in use as a compound for the railway development and other developments in the surrounding area and therefore topsoil had been stripped from most of the site. Two large holding tanks at the north-west of the site, a small access road at the south and housing developments to the north-east had already been constructed in the part of the areas proposed for development prior to the author arriving on-site.

Seven test-trenches were excavated across the site with a 1.8m wide toothless bucket. The stratigraphy consisted of c. 0.2–0.4m of topsoil intermixed with debris and overlying subsoil onto natural stony marl soils at the western portion of the site where the proposed community centre is to be located. There was very little topsoil remaining at the eastern end of the development site and the stratigraphy comprised of orange/brown subsoil overlying natural marl subsoil with veins of stone/slate running south-east/north-west across the development lands.

Nothing of archaeological significance was recorded during testing.

**Ellen O'Carroll, 8 Cumberland Street, Dun Laoghaire, Co. Dublin.**

**Dublin****2013:043****Grange/Ballybane/Nangor, Dublin****Furnace pit (monitoring)****ITM: E 703978. N 703391m****13E0435**

Monitoring of a proposed central carriageway at Grange Castle Business Park, Co. Dublin was carried out from 1-8 November 2013. Monitoring followed an archaeological appraisal carried out in September 2013 and geophysical survey was previously carried out throughout the entire area of Grange Castle Business Park.

Two features of archaeological interest were identified during monitoring of topsoil stripping in the east of the development area in Nangor townland. These features comprised a small bowl furnace (0.36m x 0.33m x 0.15m) filled with charcoal-rich soil and slag, and a shallow oval pit (0.97m x 0.69m x 0.1m) filled with charcoal, thought to be a charcoal clamp. These features were located approximately 35m apart and may have been associated with each other.

It is anticipated that specialist analyses in the form of charcoal analysis, radiocarbon dating and metallurgical analysis will be carried out on the material retrieved from the features excavated at the site

**Courtney Deery Heritage Consultancy, 65 Mountain View Drive, Boghall Road, Bray, Co. Wicklow**

**Dublin****2013:196****Grange, Dublin**

No archaeology found

**SMR N/A****13E0459**

Testing was carried out at the site of a proposed biopharmaceutical plant in Grange Castle Industrial Park, Co. Dublin. The entire development site is approximately 11ha in size however the proposed plant will be built on the southern 7.5ha of the site, leaving the northern portion available for future expansion. Only the southern 7.5ha was subject to testing. A total of 15 trenches, measuring 2,585 linear metres, were excavated across the area of proposed development over the course of four days from 9 December 2013. Nothing of archaeological significance was identified during this programme of testing.

**Fintan Walsh for IAC Ltd, Unit G1, Network Enterprise Park, Kilcoole, Co. Wicklow**

**Dublin****2013:521****Grange/Ballybade/Nangor, Co. Dublin****Iron Age smelting pit and early medieval charcoal clamp****ITM: E 703873m, N 731566m****13E0435**

Archaeological monitoring of a proposed central carriageway at Grange Castle Business Park, Co. Dublin was carried out from 1-8 November 2013 (east of Pfizer Ireland). Monitoring followed an archaeological appraisal carried out in September 2013 and geophysical survey was previously carried out throughout the entire area of Grange Castle Business Park.

Two features of archaeological interest were identified during monitoring of topsoil stripping in the east of the development area in Nangor townland. These features comprised a small bowl furnace (0.36m x 0.33m x 0.15m) filled with charcoal rich soil and slag, and a shallow oval charcoal clamp (0.97m x 0.69m x 0.1m). These features were located approximately 35m apart and it was initially thought that they could have been associated, however the dating evidence has indicated otherwise.

The furnace pit contained 1.26kg of metalworking residues and constituted the base of a typical slag-pit furnace. A sample of oak charcoal from fill C3 of the furnace pit returned a radiocarbon date of 2403+/-30 BP (UBA 25347), which was calibrated to 732-400 BC (2 Sigma) dating this feature to the early Iron Age. This radiocarbon date is one of the earliest to come from an Irish iron smelting context to date (Rondelez, 2014). (ITM 703873E 731566N).

A sample of oak charcoal from fill C7 in the charcoal clamp returned a radiocarbon date of 1256+/-32 BP (UBA 25348). The 2 Sigma calibrated result for this was 671-867 AD dating this deposit to the early medieval period. (ITM 703843E 731580N).

The features discovered at the site have been excavated and "preserved by record" and as such no further mitigation measures are necessary in relation to this development, however future development of the adjacent areas have the potential for further isolated small features to be discovered.

**Courtney Deery Heritage Consultancy, Lynwood House, Ballinteer Road, Dublin 16**

**Dublin****2015:268****Grange Castle Access Road, Grange Castle, Dublin**

No archaeology found

**SMR N/A****15E0392**

An archaeological assessment was undertaken for a site at Grange Castle Access Road, Grange, Dublin 22, on a 2.02 ha site. The site was a green field area within an industrial estate off the Nangor Road. The site of a tower-house (Grange Castle) lies 400m to the south. No archaeological features were recorded in the course of the assessment.

**Aidan O’Connell for Archer Heritage Planning Ltd, 8 Beat Centre, Stephenstown, Balbriggan, Co. Dublin**

**Dublin****2016:049****Gollierstown, Aungierstown, Ballybane, Dublin**

No archaeology found

**ITM: E 763222m, N 730681m****15E0551**

MOORE GROUP undertook a programme of archaeological testing at two sites in West Dublin as part of the development of a 220/110 kV Substation in a green field site at Ballybane/Aungierstown and the development of an interface compound at nearby Kishoge, South County Dublin. Earthsound Archaeological Geophysics carried out surveys of the proposed development works at both sites in October 2015 (detection Device no. 15R0116). At the interface site in Kishoge dipolar anomalies detected suggested that the land has been used for the deposition of debris or imported soils, causing the magnetic interference. This interference appeared to be truncated by a number of possible ditches which, it was suggested, relate to underlying features or may be an artefact of the deposition of the debris or imported soils. At Ballybane, the proposed sub-station site, a series of circular and sub-circular trends were detected across the northern survey area. These were interpreted as representing archaeological ditches or geological trends. Testing involving the mechanical excavation of twelve trenches was carried out from 22-24 February 2016 in bright and dry conditions.

**Ballybane Site**

The proposed substation site was accessed via a new business park access road south of the New Nangor Road (R134). The site consists of an improved tillage field to the north, cut by a ditch to the south. The field was originally subdivided into a smaller sub-triangular plot, the boundary of which has in recent years been cleared away. Due to regular ploughing the site was relatively even underfoot. The test trenches were excavated by a 15-tonne backhoe excavator using a 1.2m-wide ditching bucket. All the test trenches were deliberately sited to target sub-surface anomalies identified during the geo-physical survey. These anomalies were variously interpreted as possible pits, ditches or relict boundaries. Trench 1 was located in the north-west corner of the site in relatively even ground. The trench measured 24m in length and was dug to an average depth of 0.5m. The topsoil was a rich humic material and the subsoil contained a high inclusion of angular stones. The only notable feature was a drainage channel at the west of the trench and was orientated north to south.

**Kishoge Site**

The proposed interface compound at Kishoge is located to the south-east of a roundabout at the junction of the R136 and the Ninth Lock Road. The field contains a high voltage tower with power lines overhead; the ground is of rough pasture with evidence of previous infill. This infilling was confirmed by the geophysical results, frequent ‘iron spikes’ were interpreted as relating to the importation of soils/debris. Three trenches were excavated across this area. Groundworks exposed a disturbed stratigraphy of imported builders’ rubble and topsoil that had been dumped on the site. Subsoil, a boulder clay, was exposed at 1m in depth. There were no finds or features of archaeological potential.

**Moore Archaeological and Environmental Services Ltd. Corporate House, Ballybrit, Business Park, Ballybrit, Galway.**

**Dublin****2016:083****Dub06 Data Centre, Grange Castle Business Park, Ballybane, Dublin 22, Dublin**

Bronze Age - Early Medieval

**SMR N/A****13E0471**

The initial excavation comprised extensive test trenches over a large area within Grange Castle Business Park, County Dublin, on behalf of Microsoft Operations (Ireland) Ltd, in advance of a Data Centre complex. Test trenching began in January 2014, confirming the results of a geophysical survey carried out in 2004, identifying a circular enclosure in one portion of the site, known as Area 11, and two burnt mounds in another portion, known as Area 9. The excavation of Area 11 began in May 2014 and additional, associated, enclosures came to light leading to a prolonged excavation continuing on an intermittent basis until January 2016. The excavations in Area 9 took place in July 2014. Monitoring continued elsewhere in lands impacted by the construction works, with the subsequent recovery of more isolated features.

**Area 11**

The excavation of Area 11 revealed a series of associated enclosures aligned north-south. The earliest enclosure, Site 3, comprised a circular penannular ditch, with a maximum diameter of 48m, and maximum depth of 1m. Finds within the ditch included iron knives, a pair of mismatched quernstones, and a cluster of cow skulls. An upended cow skull, with human femur, provided an AMS date 656-727 and 737-768 CAL AD. The ditch was encircled by the penannular Site 4 ditch, maximum diameter 86m, which also contained cow skulls. Both Site 3 & 4 enclosures shared a south-western entrance way. The Site 4 ditch was preceded by a linear, and more shallow, east-west ditch running across the north end of the site for a distance of 86m. The large D-shaped Site 2 enclosure, 40m x 32m, attached itself to the southern arc of the Site 4 ditch. Much reworked and augmented, the ditch cut through the underlying limestone bedrock to a maximum of 0.9m.

A portion of the old ground surface was recovered within this enclosure as well as the burial of a male and female, within a shallow grave, aligned north-south. Other finds included an articulated sheep or goat within a shallow pit, and a complete horse pelvis and femur.

The smaller Site 1 enclosure comprises two concentric ditches, 14.7m diameter maximum. An occupation surface of redeposited clay set it apart from the larger ritual enclosures, as did the numerous stake-holes, post-holes, and kiln, within the interior. A wattle fence survived in what appears to be a later recut ditch within the enclosure. Much of the clay deposits were characterised by large amounts of charcoal, both in the fills of internal pits, and the ditches. Cremated bone was also recovered, raising the possibility of ritual feasting and / or a funeral pyre being situated here.

A significant feature of the enclosures is the deliberate linking of each ditch to one another. In the case of Sites 3 & 4, a shallow ditch provides the connection. Site 2 was then physically attached to the Site 4 ditch. In the case of Site 1, a ditch emanates from its outer enclosure almost to the lip of the Site 2 ditch.

The burial of two individuals within a shallow grave, the cluster of cow skulls, the deposition of a cow skull with human femur, as well as the insertion of mismatched quernstones, all indicate substantial ritual and ceremonial uses, probably including animal sacrifice. The continuation of pre-Christian rituals is not unprecedented but is stark in view of the nearby presence of Clondalkin monastic settlement.

Several post-1169 medieval ditches ran up to, aligned themselves to the enclosures.

**Area 9**

Two fulacht fiadh were situated in a waterlogged field. The remains to the west comprised a shallow unlined trough, a well and several pits, including a recut pit indicating a second phase of use, as well as a spread of heat-shattered stones. Finds included fragments of human bone in a deep pit.

Thirty metres to the east, another fulacht fiadh comprised troughs, pits, numerous stake-holes and an elongated gully. The stake-holes, and an associated deep trough, appear to belong to a second phase of use. The findings tend to support the hypothesis of intermittent communal feasting.

Other archaeological sites have since been excavated within the Data Centre complex, although none to the same scale as those described above. They include a Bronze Age structure, and a possible Neolithic structure. A summary will be submitted in due course.

Excavations were also carried out in an adjacent associated site under licence 14E0453 in the townland of Nangor revealing a corn-drying kiln, medieval field boundaries as well as two clusters of cremations pits.

**Neil O'Flanagan, Botanic Court, 30-32 Botanic Road, Glasnevin**

**Dublin****2016:084****DSF, Grange Castle Business Park, Dublin 22, Dublin**

Bronze Age cremation pits &amp; medieval corn-drying kiln

**SMR N/A****14E0453**

Excavations were carried out on behalf of Sisk & Sons Ltd during the course of 2015-16, yielding a corn-drying kiln, medieval field boundaries, and two clusters of cremation pits.

The kiln was dumbbell shaped, 6.06m in length, 1.4m wide across its flue, and cut to a depth of 0.48m. The fill included clays that appear to have originally formed part of the roofing of the kiln, indicating that the roof collapsed after its use, to be followed by a gradual natural accumulation.

The kiln lay adjacent to a pair of parallel ditches, one of which extended to 38m within the monitored area, with a depth of 0.25m maximum.

Some distance to the south, a cluster of 5 cremation pits came to light, with burnt bone within the pits evident from the surface. The pits were cut to a depth of 0.32m maximum, and a diameter of 0.37m maximum.

Further to the south, another cluster of 4 cremation pits, including a shallow oval-shaped pit, measuring 0.57m in length, and 0.07 in depth, and another circular pit 0.48m in diameter, and 0.14m in depth. Some of the pits appear to have been 'capped', or sealed.

**Neil O'Flanagan, Botanic Court, 30-32 Botanic Road, Glasnevin, Dublin 9**

**Dublin****2016:094****Ballybane and Aungierstown, Dublin (South County), Dublin**

No archaeology found

**SMR 250m from 'the zones of notification' for RMP's DU021-108 & DU021-109 a concentric enclosure and an enclosure**

**16E0030**

Archaeological testing at the site of a proposed substation site at Ballybane and an interface compound at Kishoge, Co. Dublin was undertaken between the 22nd and 24th of February 2016. The test trenches were purposely sited on both sites to provide coverage for the new development and to investigate geophysical anomalies identified in an earlier survey. The trenches exposed a number of modern drainage channels across the site and a natural sterile stratigraphy elsewhere. The anomalies can be accounted for by modern disturbance, drains and geology. There was no evidence for any features of archaeological potential.

Billy Quinn for Moore Archaeological and Environmental Services, 3 Gort na Ri, Athenry, Co. Galway

**Dublin****2016:147****Grange Castle Business Park, Clondalkin, Dublin****Early modern agricultural activity****ITM: E 703773m, N 732160m****15E0394**

Testing and monitoring were carried out at Grange Castle Business Park, Clondalkin, Dublin 22, on behalf of Interxion Ireland in advance of the construction of a new data centre. Testing (followed by monitoring as an extension to the existing licence in January 2016) was required as a condition to grant of planning (SD15A/0034: Condition 11 b) from South Dublin County Council.

The 7 test trenches (totaling 229m) were aligned to investigate a faint geophysical trend (c. 23m in diameter) that was identified during geophysical survey of the site in January 2015. The trenching did not reveal any features of considered archaeological significance but did identify a furrow, some oxidised soil, brick waste and evidence of modern ploughing.

The testing report recommended monitoring of the soil strip – due to the wider archaeological/historical significance of the surrounding landscape and the small percentage of the development's footprint that was assessed through the initial testing.

Monitoring was undertaken over two days in January 2016 and exposed evidence for agriculture (furrows) and land improvement (drains) on the site in the early modern to modern period; isolated spreads of burnt clay, brick and charcoal (which were also frequently contained in the backfill of the agricultural features) indicate contemporary light industrial in the vicinity of the site – the brick inferring such activity may have been associated with a brickfield/brick firing and/or the demolition of brick buildings. However, no features of considered archaeological significance were recorded. The site was fully reduced to the level of natural subsoil under archaeological supervision.

**Number 1, Brendan Street, Birr, County Offaly**

**Dublin****2016:340****Adamstown Road (R120) and Nangor Road (R134) Improvement Scheme, Ballybane, Ballymakailly, Clutterland, Grange and Milltown townlands**

Post-medieval structure

**16E0520****702670, 731650**

The development is intended to improve the standard of the existing carriageway on both the Adamstown Road and Nangor Road, and will provide footpaths, cycle tracks, pedestrian crossing facilities, public lighting and two new signalised junctions. The overall length of the scheme is 2.45km. The excavation of six test trenches located throughout the proposed development area failed to reveal any archaeological features or artefacts.

Test trenching in Milltown townland, immediately west of Adamstown Road, revealed two associated mortar-bonded stone walls. The walls appeared parallel, and were 25m apart, forming the gables of a structure that was orientated north-east/south-west. A concrete floor was continuous throughout the structure at a depth of 0.4m below the existing ground level. A structure is depicted in this location on the First Edition Ordnance Survey map.

**Dermot Nelis, 36 Fingal Street, Dublin 8****Dublin****2016:464****Grange Castle South Business Park, Ballybane, Clondalkin, Dublin 22.**

Early medieval/medieval enclosures

**DU021:108 & DU021:109****16E0531****703029, 730829**

The areas tested were identified initially from studies of aerial photography and geophysical survey results and a very close correlation between the test trenching results and the results of the geophysical survey was noted.

AH1 represented a recorded concentric enclosure (DU021-108) with an internal ditched enclosure measuring c.50m east to west and 60m north to south and an outer ditched enclosure measuring c.90m in diameter. The test trenching confirmed the presence of extensive and well preserved internal and external ditches measuring 4m wide and 1.80m in depth below the current ground level. Numerous internal features were identified which comprised a group of linear type features and pits all of which are suggestive of domestic activity within the enclosure. The enclosure is likely to represent an early medieval settlement site.

AH2 was located 100m to the south of AH1 and represented a probable circular enclosure measuring 25m in diameter. The test trenching clearly identified the presence of a single – ditched circular enclosure measuring between 20m to 25m in diameter, with the ditch averaging 3m in width. The ditch was present within three test trenches and probably represents a ringfort or similar enclosure.

AH3 was described in the geophysical survey as a negative band of data oriented southwest-northeast and extending into the adjacent field which may represent a former track-way. The test trenching of this feature recorded two linear parallel ditches both measuring 3m wide by 1.60m deep that appear to form an old abandoned road or track. Both ditches contained old terracotta land drainage pipes suggestive of a relatively modern date for these two features.

AH4 was located in the east of the northern most field and was identified in the geophysical survey as a cluster of isolated responses which may represent a spread of burnt material or cluster of small pits and larger, isolated pit-type features. Archaeological test trenching in this area failed to identify any features of an archaeological nature. The ground was quite disturbed in this part of the site and it would appear to have been subject to test trenching previously.

AH5 represented an enclosure (DU021-109) located in the southern field, measuring c.44m with a probable entranceway in the east. The archaeological test trenching confirmed the presence of a single-ditched circular enclosure, 44m in diameter with the ditch measuring 3m wide and 1.60m deep. The general appearance of this feature is suggestive of a possible ringfort type enclosure. No internal features were recorded.

AH6 represented a circular internal ditched enclosure measuring c. 37m in diameter encompassed by a larger oval-shaped enclosure measuring c.75m x 42m. The test trenching confirmed the presence of the large elongated oval enclosure measuring approximately 75m north-south by 42m east-west with a smaller associated internal enclosure c. 37m in width containing features suggestive of occupation. The external ditch of this enclosure measured on average 2.60m wide and 1.60m deep. The site is likely to represent a multi-phased early medieval settlement site.

AH7 was identified in the geophysical survey as a series of circular and sub-circular trends and five possible pits which may be archaeological or agricultural in origin. The test trenching failed to identify any features of

an archaeological nature. A field boundary was recorded containing old terracotta land drainage pipes suggestive of a relatively modern date.

AH8 was identified in the geophysical survey as a series of linear negative magnetic trends which were suggestive of archaeology. The test trenching of this area failed to identify any features of an archaeological nature. A field boundary was recorded containing old terracotta land drainage pipes suggestive of a relatively modern date.

Within Field 1, two sections of a possible linear double ditched type feature were recorded with curving u-shaped termini (AH 9-10). These two parallel ditches may form a linear boundary and one of the ditches was clearly identified by the geophysical survey. An archaeological section excavated through one of these ditches recorded its width as 2.5m and depth as 1.45m in depth. The deposits recorded within this section appear similar to that recorded within area AH1 and contain no modern materials suggestive of modern field boundaries.

The geophysical survey and the results of archaeological test trenching clearly indicate that the site contains significant archaeological remains including four separate enclosure sites, two of which are scheduled for inclusion in the next revision of the Record of Monuments & Places. Although preservation in situ of archaeological remains should always be the preferred option, where such can be accommodated within any proposed development, the present site is located with a partly developed business park and any future development here is likely to extend to the entirety of the two fields resulting in an inevitable impact on all identified archaeological features. Any proposed development of this site should take into account the surviving archaeological remains and where possible the development should be designed to avoid the archaeology.

Jon Stirland Will O'Siorain Robert Breen, Archaeological Consultancy Services Unit, Unit 21 Boyne Business Park, Greenhills, Drogheda, Co Louth

#### **Dublin**

**2016:495**

#### **Grifols Phase 2 site #B201, Grange Castle Business Park, Grange**

Testing, monitoring and excavation (Isolated pits)

**13E0459**

703500, 731930

Testing (Phase 2) was undertaken within the footprint of a proposed biopharmaceutical plant at Grange Castle Business Park, Nangor Road, Grange, Dublin 22 in 2016. This testing followed from a previous phase (Phase 1) of testing undertaken in the southern half of the development site (2013:196), under an extension to licence 13E0459. A total of 13 test trenches were excavated within the Phase 2 development area.

One archaeological feature (AA 1: a pit filled with charcoal-rich soils) was identified. Subsequent monitoring of the Phase 2 development area in late 2016 identified an additional six archaeological areas (AA 2–7) all of which are individual pits/spreads similar to AA1. These areas were excavated under an extension to 13E0459 in December 2016.

**Fintan Walsh, IAC Ltd, Unit G1, Network Enterprise Park, Kilcoole, Co. Wicklow**

#### **Dublin**

**2016:530**

#### **Grange Castle**

Tower-house

**DU017-034**

**16E0510**

**703859, 731879**

Site investigation works associated with a programme of conservation at Grange Castle, Clondalkin, Dublin 22 (OS Sheet 17) by South Dublin County Council took place in October 2016. IAC Ltd monitored these groundworks.

The original structure of Grange Castle (DU017-034) dates from c. 1580 and has an 18th-century, two-storey addition attached to its western elevation. The overall footprint is 6m x 16m. While the buildings were inhabited until the 1970s, they are now in a state of dilapidation. There is significant build-up of vegetation including tree and shrub growth to the external walls of the castle as well as to the internal floors at ground floor level and at first floor level over a deep arch to the original castle.

Monitoring was carried out in October 2016 and a total of eight pits were excavated. The pits revealed that both the Georgian house and the earlier tower-house possess shallow foundations. Nothing of archaeological significance was identified within the pits surrounding the house and tower-house.

**Paul Duffy, IAC Ltd, Unit G1, Network Enterprise Park, Kilcoole, Co. Wicklow**

**Dublin****2017:042****Adamstown Road (R120) and Nangor Road (R134) Improvement Scheme, Ballybane and Milltown townlands**

No archaeology found

**16E0520 Ext.****702620, 731140**

The development is intended to improve the standard of the existing carriageway on both the Adamstown Road and Nangor Road, and will provide footpaths, cycle tracks, pedestrian crossing facilities, public lighting and two new signalised junctions. The overall length of the scheme is 2.45km. Test trenching in Milltown townland, immediately west of Adamstown Road, in 2016 (Licence No. 16E0520) revealed two associated mortar-bonded stone walls. The walls appeared parallel and were 25m apart, forming the gables of a structure that was orientated north-east/south-west. A concrete floor was continuous throughout the structure at a depth of 0.4m below the existing ground level. A structure is depicted in this location on the First Edition Ordnance Survey map.

Additional test trenching in April 2017 confirmed the structure to be built directly on geologically deposited strata, and no associated or earlier phases of activity were noted. A test trench was also excavated in Ballybane townland in April 2017, and no archaeological features or artefacts were noted.

**Dermot Nelis, 36 Fingal Street, Dublin 8****Dublin****2017:411****Ballymakailly, Grange Castle Business Park**

Urban monitoring

**16E0471 ext****703002, 732209**

Testing and monitoring was conducted in advance of a proposed development of a new Data Centre, and associated works, in Ballymakailly Townland, Clondalkin, Dublin 22. The site is in close proximity (800m) to Grange Castle (DU017-034—) as well as a range of other upstanding remains and sub-surface archaeological sites. This archaeological work followed a previous phase of testing undertaken by Finola O'Carroll in 2016 in the southern portion of the site. The licence was extended and transferred in January 2017.

Testing and monitoring were required as a condition of planning (Planning Ref. No. SD16A/0345; South Dublin County Council – Condition 12). Testing of the site was completed by mechanical excavator in February 2017. Seven trenches were positioned to investigate anomalies identified during a previous geophysical survey. Monitoring was also undertaken, under the same licence, in April 2017 in advance of a soil strip associated with the construction works (specifically an attenuation pond). No features of archaeological significance were recorded in either phase of works. However, considering the discovery of archaeological remains in the wider region (including Neolithic Houses, Bronze Age Settlement, Ring-Barrows and an Early Medieval Complex) monitoring was recommended for any and all future works.

**Denis Shine, CRDS Ltd.****Dublin****2017:597****Grange**

No archaeology found

**17E0257****703293, 731784**

Archaeological monitoring and testing were undertaken as a condition of planning prior to the construction of an extension to the existing Takeda Ireland pharmaceutical plant within Grange Castle International Business Park in south Co Dublin. Previous archaeological investigation in the vicinity of the development site exposed a Neolithic house, a Bronze Age ring barrow and numerous fulachta fiadh. Earlier archaeological monitoring and excavation in the vicinity of Grange Castle identified a curving ditch orientated NE/SW with the contents suggesting a date phase of 12th/ 13th century.

The overall site area was approximately 17 hectares and the location of the new production facility as well as lands scheduled for the temporary construction compound and car park were tested in advance of the initial phase of the groundworks. A total of eight test trenches were mechanically excavated. Testing at the site compound and temporary car parking area at the western side of the development site revealed that the area had previously been stripped of topsoil and filled with modern inert material. Monitoring of topsoil removal on the footprint of the production building site exposed the partial remains of a nineteenth century building indicated in the 1st Edition OS map for the area. This survived as a localised spread (2m NS/1.7m EW) of

red brick and fragmented limestone. No other features or finds of archaeological or cultural heritage value were exposed during topsoil stripping at the development site.

**Margaret McCarthy, Rostellan, Midleton, Co. Cork**

**Dublin**

**2019:252**

**Ballymakailly**

Enclosures and other features

**19E0038E**

**702480, 731800**

Archaeological excavations were undertaken by Archaeological Management Solutions in collaboration with Cultural Resource Development Services at Ballymakailly townland, Grange Park Business Park, Co. Dublin, over a 16-week period, from May to August 2019. The excavation was conducted in advance of proposed industrial development and followed on from geophysical survey and test investigations at the site in early 2019. This work revealed the buried remains of a significant archaeological complex that was thought to comprise a long-running ditch suggested to form part of an ancient field system (Area 1); a small spread of burnt stones of potential prehistoric date (Area 2); and a large, circular enclosure, possibly defined by two, widely-spaced concentric ditches (Area 3).

Full excavation of these areas revealed an impressive array of features associated with multi-phase settlement and agricultural activity, possibly extending from prehistoric to modern times. The principal remains were identified in Area 3 and comprised two successive phases of enclosure. Potentially the earliest was a large, roughly circular enclosure seemingly defined by two widely-spaced ditches, set c.15–20m apart. It had an overall (north–south) diameter of about 70m, with the inner boundary reaching a maximum diameter of c.30m. The area between the enclosing elements was traversed by a number of possible radial ditches that may delineate the footprint of several small fields or paddocks. This phase of enclosure appears to have been followed by the construction at the same location of a large, sub-circular ditched enclosure, with maximum overall dimensions of 50m north–south by 52m. It overlapped with the Phase 1 inner enclosure ditch on the south and east, and the Phase 1 outer enclosure ditch on the north and west, thereby erasing all trace of the earlier cuts and deposits. Both phases of enclosures produced evidence for internal occupation in the form of several possible circular structures/buildings, as well as pits, post-holes, spreads, etc., while their defining ditches were likely originally accompanied by internal earthen banks. The enclosures are probably early medieval raths, though this interpretation is tentative pending the results of post-excavation analyses.

A number of possible ancillary features were identified immediately outside the main enclosures, on the north and north-west. This included a small sub-circular enclosure defined by ditch that measured approximately c.18m in diameter. The ditch, which splayed outwards on the north-east and produced tentative evidence to indicate the former presence of an external bank, was breached by three gaps on the north, north-west and south-east, one or more of which may represent an original entrance. A small pit containing a few fragments of burnt bone was the only feature discovered within the interior of the enclosure. A small, C-shaped ditch (length of chord c.16m) was also discovered a short distance to the north-east of the main enclosures and was found to contain three discrete deposits of charcoal-rich soil. These external features cannot readily be assigned to any particular phase in the site's history and further work is required to determine their precise dating and significance.

The investigations did, however, produce limited evidence for potential pre-enclosure (prehistoric?) activity in Areas 2 and 3, where a series of pits containing charcoal-rich soil and burnt stone were identified. These features may be indicative of cooking and/or other related activities. An array of linear and curvilinear ditches and drains were also identified across the site and appear to be associated with post-enclosure (medieval/post-medieval) agricultural practices. The long-running linear ditch identified in Area 3 may likewise relate to post-medieval agriculture.

**Ger Dowling, AMS Consultancy, Unit 1, Hector Street Mills, Kilrush, Co. Clare.**

**Dublin**

**2021:267**

**Ballymakailly and Grange**

Site type: N/A

**21E0147**

**702935, 732180**

The development site measured c.77,000m<sup>2</sup> (c.7.7 hectares). A number of archaeological investigations had been carried out on the site in 2016–17 in response to planning conditions informed by an Environmental Impact Statement (Marston Planning Consultancy 2016). The site was subject to a geophysical survey in 2016 (Licence No. 16R0070, Leigh 2016), and two phases of archaeological test-trenching (Licence No.

16E0471, O'Carroll 2016; and Licence No. 16E0471 ext., Shine 2017). Archaeological monitoring of a topsoil strip in advance of the excavation of an attenuation pond was also undertaken at this time. No features of archaeological significance were uncovered during the testing or monitoring works; however, due to the discovery of archaeological remains in the wider region, a recommendation for further monitoring of works within the northern portion of the site was made in the Test-Trenching and Monitoring Report (Shine 2017, p.13).

AMS was contacted (17 February 2021) to carry out any outstanding monitoring in advance of the latest phase of construction on-site. No finds or features of any archaeological significance were uncovered during this phase of archaeological works.

No further archaeological works were recommended for the site.

**Steve Hickey, AMS, Fahy's Road, Kilrush, Co. Clare**

### Appendix 14.4 National Inventory of Architectural Heritage

The recorded archaeological sites within c. 1km of the development are listed below, all noted in the National Inventory of Architectural Heritage (NIAH) for Co. Dublin ([www.archaeology.ie](http://www.archaeology.ie); [www.buildingsofireland.ie](http://www.buildingsofireland.ie)).

#### Milltown, South Dublin County



<b>Reg. No.</b>	<b>11208005</b>
Date	1850 - 1900
Previous Name	N/A
Townland	MILLTOWN (NE. BY.)
County	South Dublin County
Coordinates	302185, 230870
Categories of Special Interest	ARTISTIC SOCIAL TECHNICAL
Rating	Regional
Original Use	gates/railings/walls
In Use As	gates/railings/walls

#### **Description**

Pair of cylindrical rendered gate piers, c.1870, of squared limestone with conical cement capping. Five-bar wrought-iron gate with arched bar. Former entrance to farm house beyond, now demolished.

#### **Appraisal**

A fine intact example of a type of vernacular gateway peculiar to this area of County Dublin. Preserves the old road line and is now set back from the re-aligned section.

#### Milltown, South Dublin County



<b>Reg. No.</b>	<b>11208006</b>
Date	1840 - 1860
Previous Name	N/A
Townland	MILLTOWN (NE. BY.)
County	South Dublin County
Coordinates	302518, 230958
Categories of Special Interest	ARCHITECTURAL
Rating	Regional
Original Use	outbuilding
In Use As	outbuilding

#### **Description**

Detached two-storey farm outbuilding, c.1850, with two-bay gable ends. Rendered walls. Blind wall to street with chamfered corners. Timber sash and casement windows. Corrugated aluminium pitched roof. Adjoining rubble stone walls of demolished outbuildings to south-east and ruinous cottages to north-east.

#### **Appraisal**

The chamfered corners of this outbuilding indicate the volume of horse-drawn traffic originally passing into the farm complex. Such buildings following the road line sheltered the farm yard and were a characteristic feature of Irish agriculture. This farm was associated with the now-demolished Milltown House.

#### **Milltown, South Dublin County**



<b>Reg. No.</b>	<b>11208008</b>
Date	1840 - 1870
Previous Name	N/A
Townland	GRANGE (BA. W BY.)
County	South Dublin County
Coordinates	302752, 231546
Categories of Special Interest	ARCHITECTURAL
Rating	Regional
Original Use	farm house
In Use As	farm house

#### **Description**

Detached four-bay two-storey farm house, c.1850. Roughcast rendered walls. uPVC door and casement windows. Replacement pitched slate roof with terracotta ridge tiles and gable coping. Two central brick chimney stacks. Later drip moulding over northern front window. Lean-to extension to the rere, and shed to side.

#### **Appraisal**

A tidy detached farm house which retains its original form and an unusually formal front garden, still serving the farm to the rere.

#### **Grange Castle, GRANGE (BA. W BY.), Milltown, DUBLIN**



<b>Reg No</b>	<b>11208013</b>
Rating	Regional
Categories of Special Interest	Archaeological, Architectural, Historical
Original Use	Castle/fortified house
Date	1740 - 1760
Coordinates	303928, 231851

Date Recorded 12/06/2002

Date Updated --/--/--

**Description**

Ruinous remains of detached multiple-bay three-storey over vaulted basement former tower house, remodelled c. 1750 by addition of two-bay two-storey domestic wing attached to the west, with large supporting wall buttresses to the south. All openings blocked in roughcast walls leading to partially roofless wallheads. Earlier house, built c.1580, retains slender projecting square tower and garderobe. Large chimneybreast exposed where buildings have been demolished in the east.

**Appraisal**

Despite its ruinous state, many features of the two building phases can be clearly discerned, and the building remains a prominent landmark in the area.

**Gollierstown Bridge, GOLLIERSTOWN, Milltown, DUBLIN****Reg No****11208014**

Rating

Regional

Categories of Special Interest

Architectural, Social, Technical

Original Use

Bridge

In Use As

Bridge

Date

1770 - 1790

Coordinates

301517, 231971

Date Recorded

10/06/2002

Date Updated

--/--/--

**Description**

Single-arch road bridge over canal, c.1780. Coursed ashlar piers and dressed voussoirs to semi-circular arch. Rubble parapets with coping terminating in curves to canal banks. Deep rope grooves cut into north pier adjacent to walkway/towpath.

**Appraisal**

This noticeably elevated bridge is a fine example of the canal bridges to be found on the Grand Canal. It is all the more stunning due to its remote location and idyllic setting amongst the lush natural environment.

**Milltown, South Dublin County****Reg. No.****11208015**

Date

1750 - 1770

Previous Name

N/A

Townland

MILLTOWN (NE. BY.)

County	South Dublin County
Coordinates	302520, 231041
Categories of Special Interest	ARCHITECTURAL
Rating	Regional
Original Use	farm house
In Use As	farm house

**Description**

Detached four-bay two-storey farm house, c.1760, with attached outbuildings. Rendered rubble stone walls. Glazed timber door in gabled porch. Timber sash windows. Some openings blocked. Possible traces of carriage arch to central bay. Pitched slate roof with two rendered chimney stacks. House possibly originally single-storey. Adjoining outbuildings to north with hayloft, and enlarged openings inserted recently. Partial tubular iron sunburst gate. Original fir tree stand to south.

**Appraisal**

A fine example of an eighteenth-century farm cottage and barn, demonstrating a classic sequence of vernacular evolution. Retains many period features.

**Polly Hop's, Milltown, South Dublin County**

<b>Reg. No.</b>	<b>11208016</b>
Date	1780 - 1810
Previous Name	N/A
Townland	MILLTOWN (NE. BY.)
County	South Dublin County
Coordinates	302591, 231012
Categories of Special Interest	ARCHITECTURAL SOCIAL
Rating	Regional
Original Use	house
In Use As	public house

**Description**

Formerly detached four-bay two-storey former house, c.1790, in use as public house. Roughcast rendered walls with parallel render quoins. Timber casement windows. Timber door with iron fittings. Pitched slate roof with single rendered chimney stack. Series of nineteenth- and twentieth-century extensions to south and west.

**Appraisal**

This site has long been in use as a public house as shown by the extensions surrounding the original modest rural house. Its presence gives a focus to this important and formerly more developed junction.

**R120, ADAMSTOWN (NE. BY.), DUBLIN**

<b>Reg No</b>	<b>11204051</b>
Rating	Regional
Categories of Special Interest	Architectural, Technical
Original Use	Bridge
In Use As	Bridge
Date	1900 - 1930
Coordinates	303016, 232768
Date Recorded	16/05/2002
Date Updated	--/--/--

**Description**

Single-arch road bridge over railway, c.1915. Three-centred arch with dressed voussoir stones. Coursed limestone parapets with granite coping at road level. Coursed limestone retaining walls either side of bridge.

**Appraisal**

This handsome road bridge is an integral part of the railway network, built to a standard design with well-executed stonework and a graceful arch.

**12th Lock Bridge, R120, BALLYMAKAILY, DUBLIN**

<b>Reg No</b>	<b>11204052</b>
Rating	Regional
Categories of Special Interest	Architectural, Technical
Original Use	Bridge
In Use As	Bridge
Date	1760 - 1780
Coordinates	302981, 232234
Date Recorded	16/05/2002
Date Updated	--/--/--

**Description**

Single-arch road bridge over canal, c.1770. Segmental arch with painted dressed voussoir stones set into smooth rendered west elevation. Roughcast rendered parapet with semi-circular coping stones and roughcast rendered pier faced with dressed granite blocks to each end. Bridge widened and refurbished, 1932.

**Appraisal**

This bridge, though widened, retains much original fabric and remains a valuable element in this group of canal structures including the lock gates and mill buildings.

**12th Lock, R120, BALLYMAKAILY, DUBLIN**

<b>Reg No</b>	<b>1204053</b>
Rating	Regional
Categories of Special Interest	Architectural, Technical
Original Use	Lock
In Use As	Lock
Date	1760 - 1780
Coordinates	302957, 232232
Date Recorded	16/05/2002
Date Updated	--/--/--

**Description**

Single-stage canal lock, c.1770. Lock gates are of timber and iron construction with coursed granite inner walls. Painted timber mooring post at intervals between gates.

**Appraisal**

A good example of a standard-type eighteenth-century canal lock, enhanced by its setting among such a rich group of canal structures.

**BALLYMAKAILY, DUBLIN**

<b>Reg No</b>	<b>11204054</b>
Rating	Regional
Categories of Special Interest	Architectural, Technical
Original Use	Mill (water)
In Use As	Office
Date	1850 - 1870
Coordinates	302938, 232247
Date Recorded	16/05/2002
Date Updated	--/--/--

**Description**

Detached seven-bay two-storey over basement former mill building, c.1860, now in use as offices. Random coursed rubble stone walls with roughly dressed limestone quoins. Replacement timber windows. Ground floor windows have a modern concrete surround with the original red brick relieving arches still visible. Seven large oval cast-iron building ties are located on the south front. Segmental profile corrugated iron roof.

**Appraisal**

Despite alteration and conversion, this former mill building associated with the Flour Mill still retains its elegance and dominance over the Twelfth Lock and bridge, and is a valuable reminder of the former variety of functions associated with the canal network.

### BALLYMAKAILY, DUBLIN



<b>Reg No</b>	<b>11204055</b>
Rating	Regional
Categories of Special Interest	Architectural, Technical
Original Use	Mill (water)
Date	1850 - 1870
Coordinates	302907, 232242
Date Recorded	16/05/2002
Date Updated	--/--/--

#### **Description**

Detached multiple-bay three-storey over basement former mill building, c.1860, now derelict. Roughcast rendered walls. Smooth render to the centre bays on the ground floor showing outline of former extension, now removed. A mix of boarded-up and steel-framed windows. Large door openings to ground floor of front elevation and west gable. Pitched corrugated asbestos roof.

#### **Appraisal**

This substantial former mill building fronting onto the canal, though in poor condition, retains its imposing volume and some materials, and is a valuable document of the diversity of building functions and types associated with the canal network.

### Lock Keeper's Cottage, BALLYMAKAILY, DUBLIN



<b>Reg No</b>	<b>11204056</b>
Rating	Regional
Categories of Special Interest	Architectural, Social, Technical
Original Use	Lock keeper's house
In Use As	House
Date	1750 - 1780
Coordinates	302847, 232228
Date Recorded	16/05/2002
Date Updated	--/--/--

**Description**

Detached three-bay two-storey gable-fronted classical style former lock keeper's house, c.1765, now in use as a detached house. Timber sash windows. Roughcast rendered walls with cut stone architrave and string courses, with a round-arched blind recess to the gable front. Pitched slate roof with red brick chimney stacks to each gable. Annexe to east has a hipped slate roof, timber sash windows and timber panelled door with overlight.

**Appraisal**

This attractive former lock-keeper's house of a standard design retains much of its original architectural impact and style. The plain string courses and classical detail contrast with the roughcast walls to a very pleasing effect. Possibly designed by Thomas Omer, it is a fine addition to the varied group surrounding the twelfth lock.

**Grange Cottage, GRANGE (BA. W BY.), DUBLIN**

<b>Reg No</b>	<b>11204057</b>
Rating	Regional
Categories of Special Interest	Architectural
Original Use	Farm house
In Use As	Farm house
Date	1800 - 1830
Coordinates	303291, 232228
Date Recorded	16/05/2002
Date Updated	-/--/--

**Description**

Detached six-bay single-storey farm house, c.1810. Roughcast rendered walls with smooth rendered base course. Timber sash windows. Two projecting canted bays with hipped roofs to the front elevation flanking an enclosed glazed porch with a lean-to roof of corrugated iron. Pitched slate roof with four brick chimney stacks. Corrugated iron shed with a lean-to roof and another small modern flat-roofed extension attached to rear.

**Appraisal**

This house, though appearing initially quite modest, possesses an elegant and balanced design which lends it a grander air than is usual for houses of this size. It is beautifully sited along the canal towpath and retains many original materials.

**GRANGE (BA. W BY.), DUBLIN**

<b>Reg No</b>	<b>11204058</b>
Rating	Regional
Categories of Special Interest	Architectural
Original Use	Outbuilding
In Use As	Outbuilding
Date	1800 - 1830
Coordinates	303302, 232257
Date Recorded	16/05/2002
Date Updated	--/--/--

**Description**

Detached multiple-bay single-storey farm buildings set around a courtyard, c.1820, now in a dilapidated site. Random coursed stone rubble construction with large corrugated iron doors. Pitched roof of corrugated iron and slate. Breeze-block wall to south.

**Appraisal**

A simple range of farm outbuildings which enhances the setting and history of the nearby house, and adds further variety of type to this stretch of canal.

**Hayden's Lane, ADAMSTOWN (NE. BY.), DUBLIN**

<b>Reg No</b>	<b>11204059</b>
Rating	Regional
Categories of Special Interest	Architectural, Technical
Original Use	Bridge
In Use As	Bridge
Date	1900 - 1930
Coordinates	303406, 232767
Date Recorded	16/05/2002
Date Updated	--/--/--

**Description**

Single-arch road bridge over railway, c.1915. Three-centred arch with dressed voussoir stones. Coursed limestone parapets with granite coping at road level. Coursed limestone retaining walls either side of bridge. Long embankments to each approach to bridge with walls of limestone rubble having vertically set stone coping.

**Appraisal**

This handsome road bridge is an integral part of the railway network, built to a standard design with well-executed stonework and a graceful arch. The embankment approaches necessitated by the level ground in the vicinity make this a very prominent feature in the landscape.



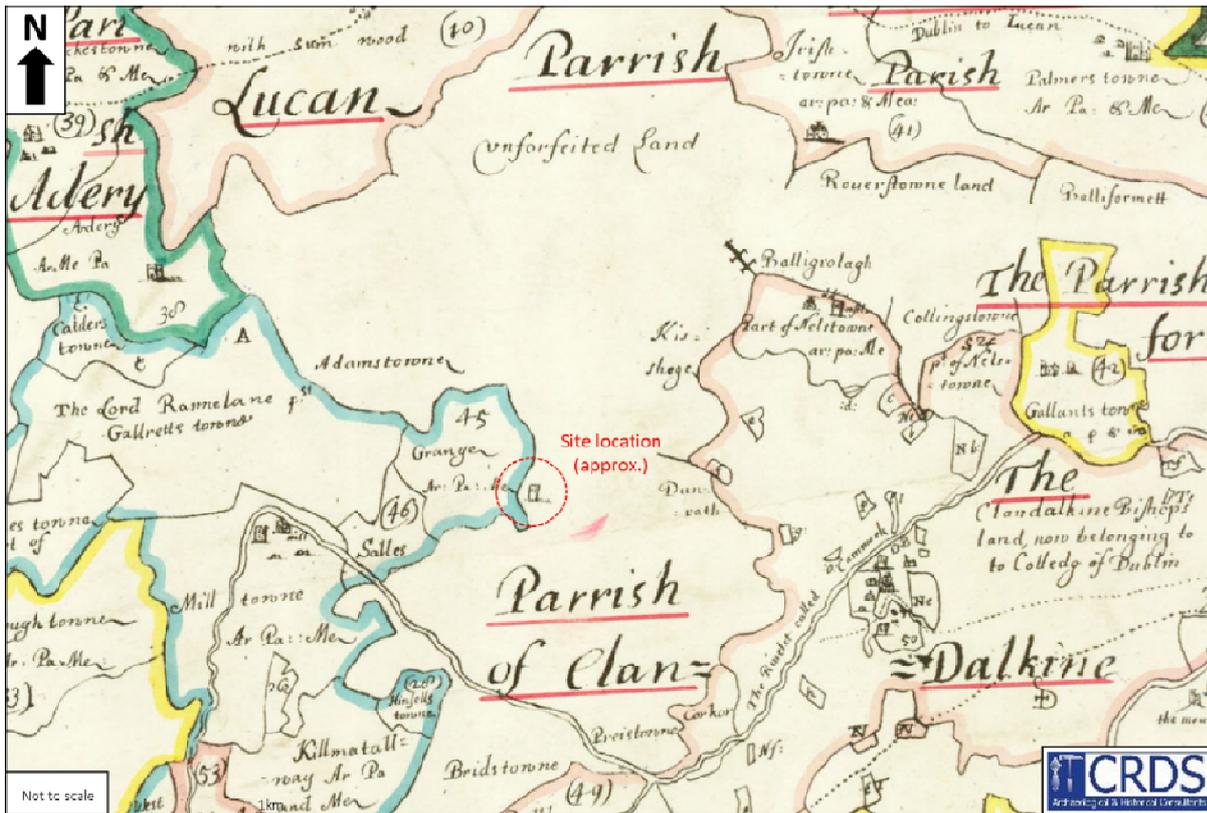


Figure 2 Down Survey Barony map showing Grange Castle, 1656 (<http://downsurvey.tcd.ie/down-survey-maps.php>).

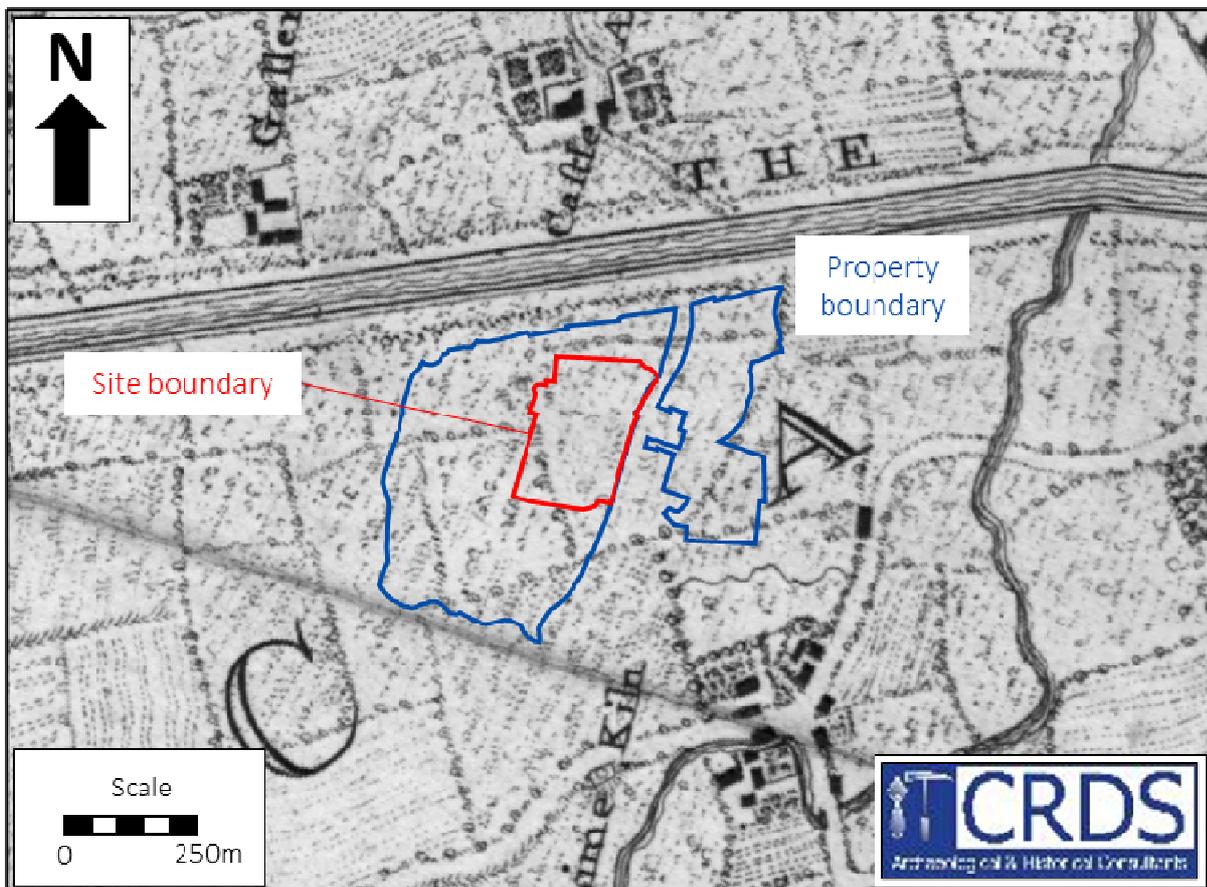


Figure 3 Extract from Roque's map of Dublin County Southwest, 1760 (<http://www.dublinhistoricmaps.ie/maps/1600-1799/index.html>).

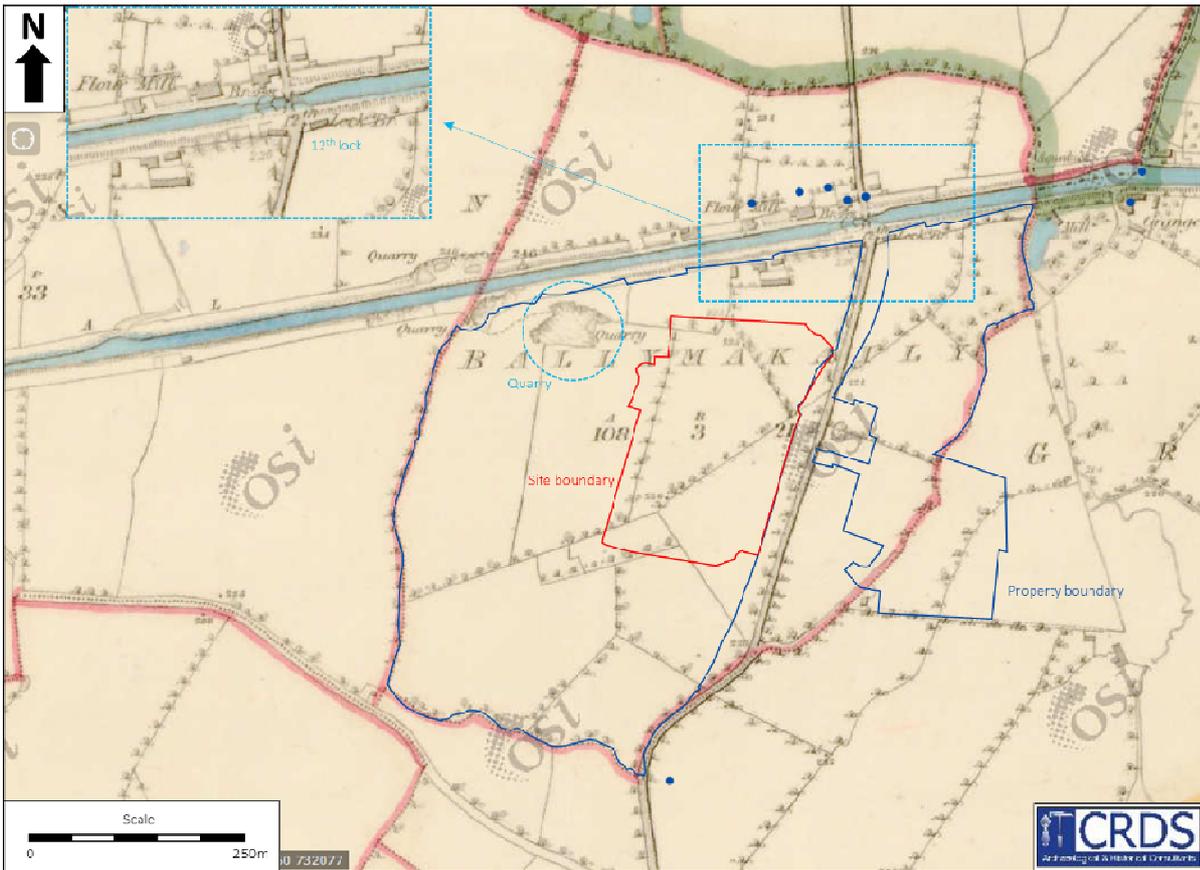


Figure 4 OS First Edition showing 12<sup>th</sup> Lock and quarry site (source <http://archaeology.ie>)

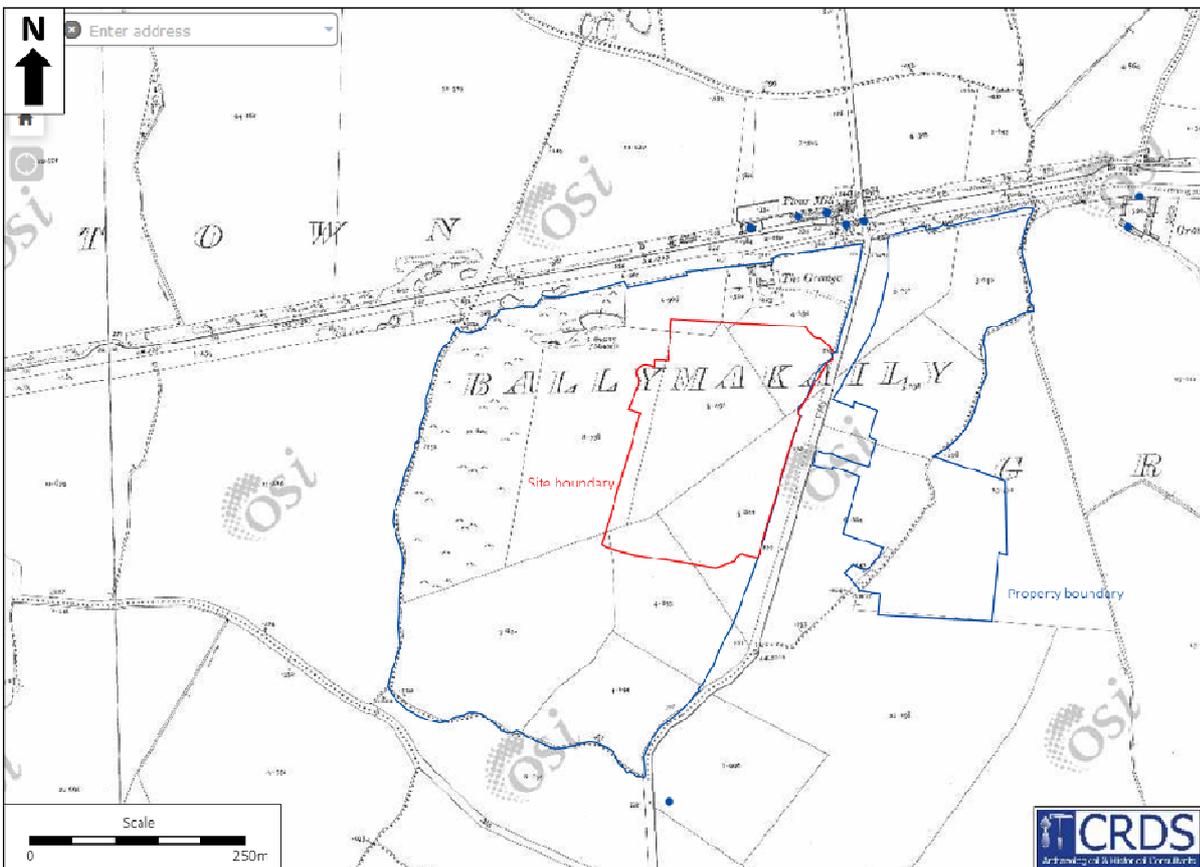


Figure 5 OS Second Edition (source <http://archaeology.ie>)



Figure 6 Aerial Photographic extract showing site and field numbers noted in field survey (source: Google Maps 2022).

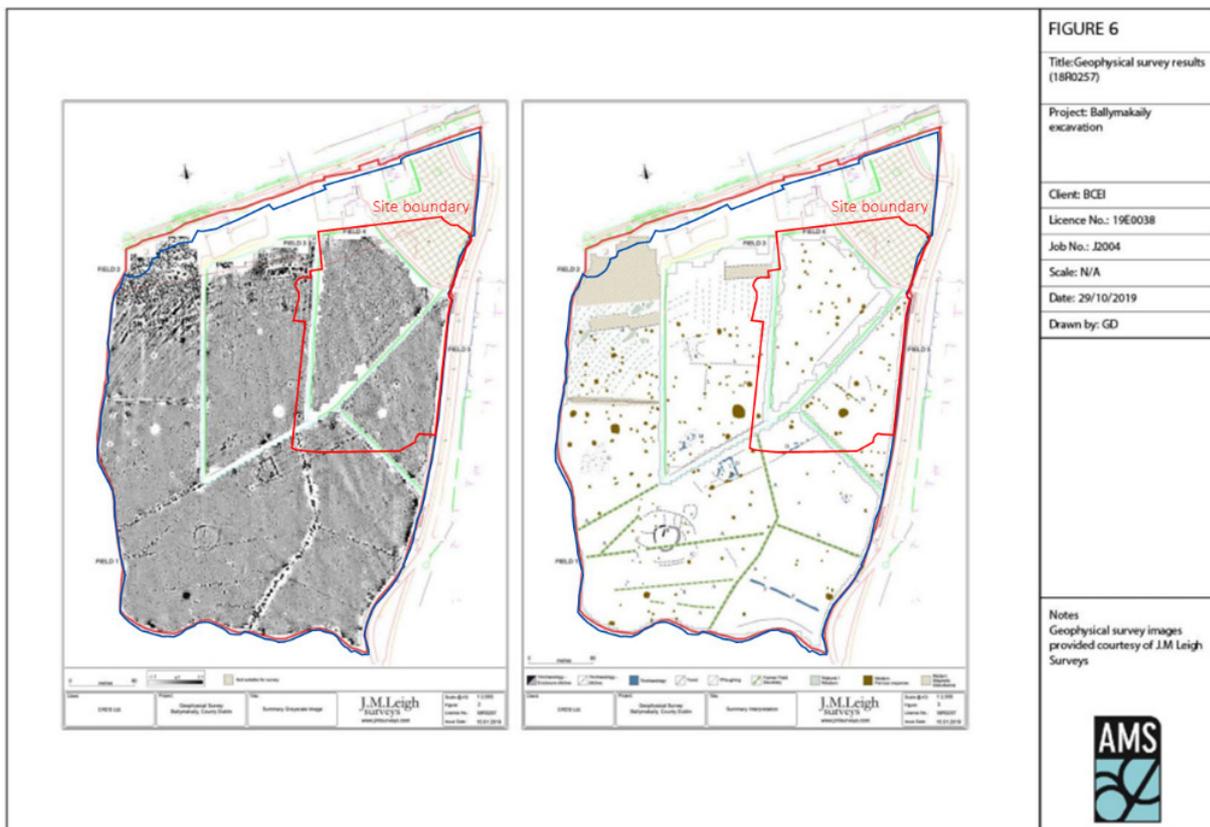


Figure 7 Results of Geophysical Survey of the site (undertaken by JM Leigh Surveys; license no 18R0257)

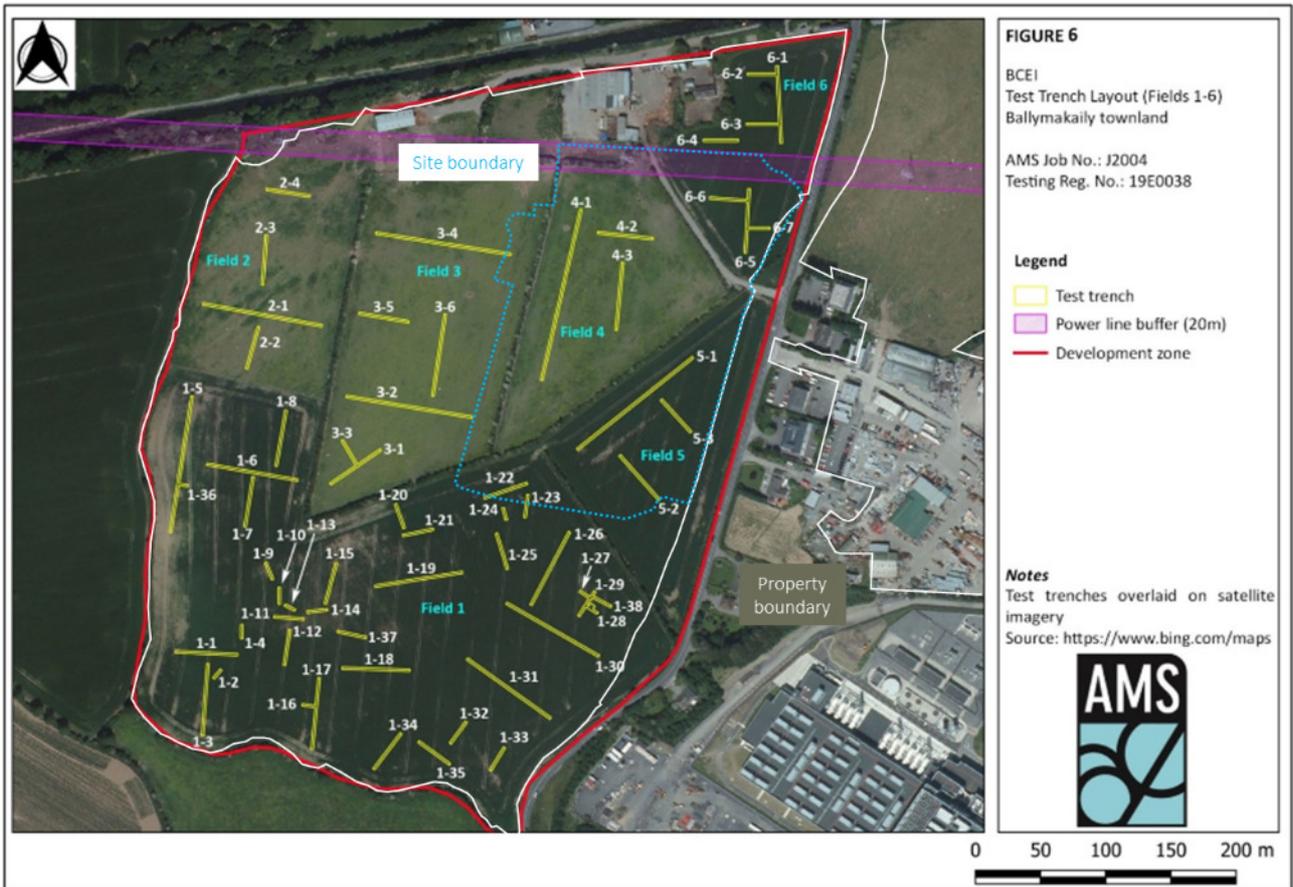


Figure 8 Archaeological testing of the site (undertaken by AMS Ltd; license no 19E0038)

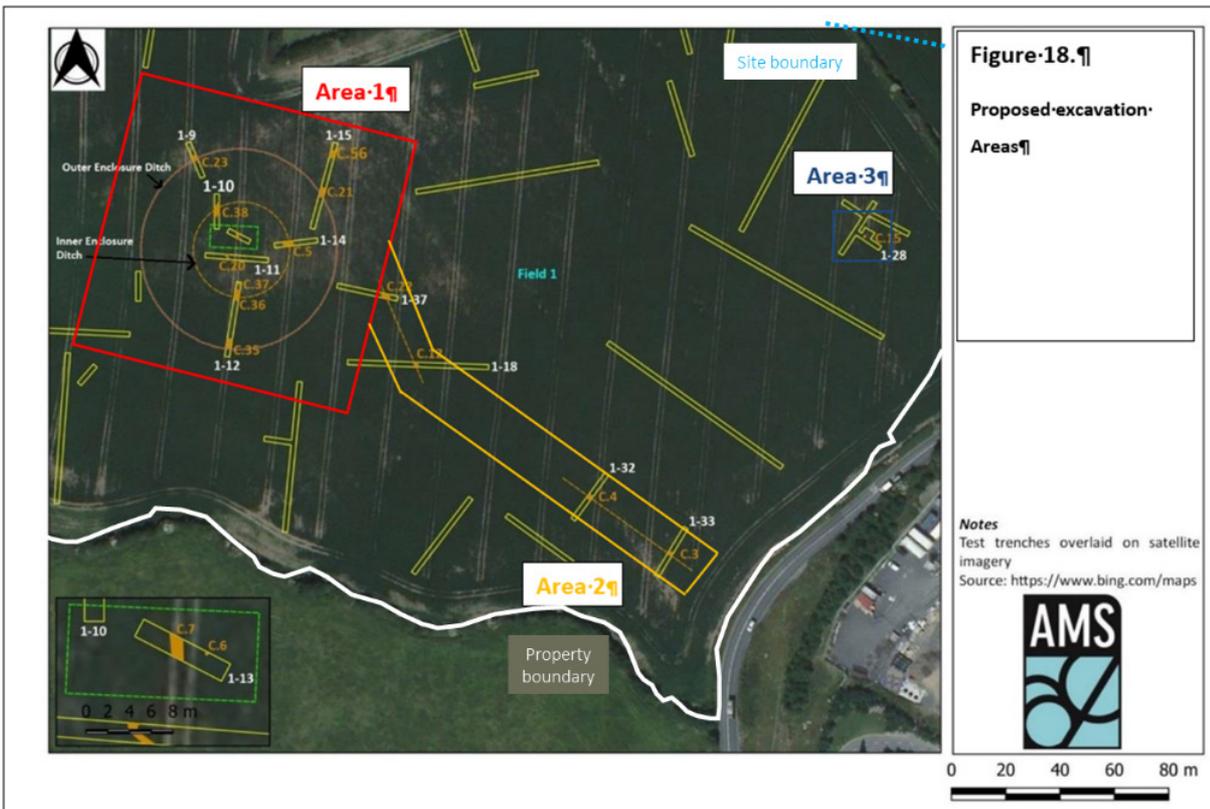


Figure 9 Archaeological areas identified during testing (undertaken by AMS Ltd; license no 19E0038)



Figure 10 Area photograph of archaeological features identified in Areas 1-3 under excavation (undertaken by AMS Ltd; license no 19E0038)

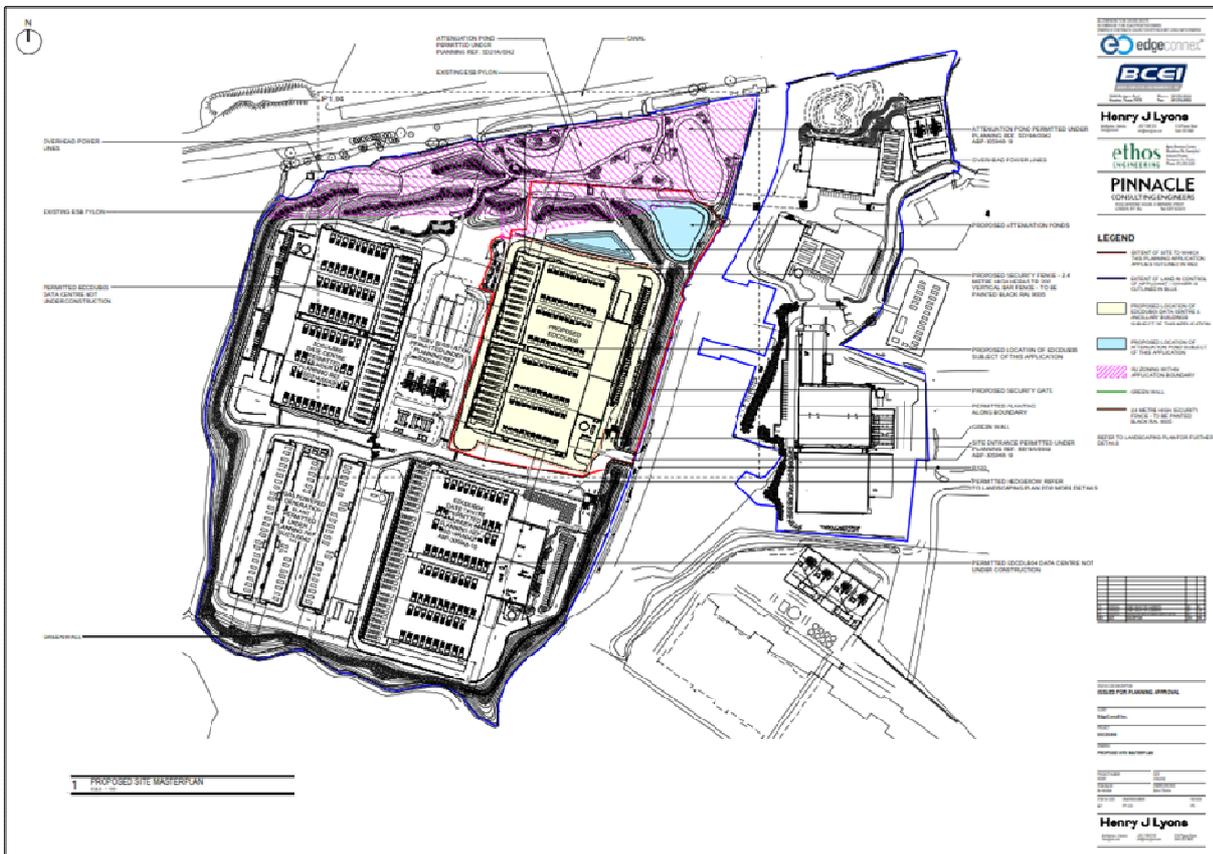


Figure 11 Plan of the proposed development.

## **APPENDIX 15.1**

# **RESOURCE WASTE MANAGEMENT PLAN FOR A DATA CENTRE, GRANGECastle BUSINESS PARK, DUBLIN 22**

**GRANGE CASTLE  
BUSINESS PARK,  
NANGOR ROAD,  
CLONDALKIN, DUBLIN 22**

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Report Prepared For

**EdgeConnex Ireland**

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Report Prepared By

**Elaine Neary**  
Associate

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Our Reference

EN/227501.0262WMR01

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Date of Issue

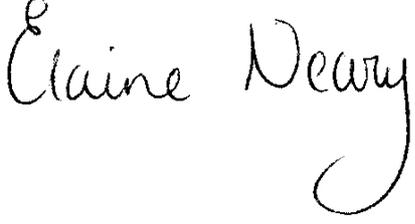
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## 1. INTRODUCTION

AWN Consulting Ltd. (AWN) has prepared this Resource Waste Management Plan (RWMP) on behalf of EdgeConnex Ireland. The Proposed Development will consist of the construction of two no. single storey data centres with associated office and service areas within the townland of Ballymakailly to the west of the Newcastle Road (R120), Lucan, Co. Dublin.

The Environmental Protection Agency (EPA) of Ireland issued '*Best Practice Guidelines for the Preparation of Resource & Waste Management Plans for Construction & Demolition Projects*' in 2021. These guidelines replace the previous 2006 guidelines issued by The National Construction and Demolition Waste Council (NCDWC) and the Department of the Environment, Heritage and Local Government (DoEHLG) in 2006. The RWMP would be the replacement document for the Construction & Demolition Waste Management Plan. Further detail can be found in section 2.

This plan will provide information necessary to ensure that the management of C&D waste at the site is undertaken in accordance with the current legal and industry standards including the *Waste Management Act 1996* as amended and associated Regulations <sup>1</sup>, *Environmental Protection Agency Act 1992* as amended <sup>2</sup>, *Litter Pollution Act 1997* as amended <sup>3</sup> and the *Eastern-Midlands Region Waste Management Plan 2015 – 2021* <sup>4</sup>. In particular, this plan aims to ensure maximum recycling, reuse and recovery of waste with diversion from landfill, wherever possible. It also seeks to provide guidance on the appropriate collection and transport of waste from the site to prevent issues associated with litter or more serious environmental pollution (e.g. contamination of soil and/or water).

This RWMP includes information on the legal and policy framework for C&D waste management in Ireland, estimates of the type and quantity of waste to be generated by the Proposed Development and makes recommendations for management of different waste streams. The RWMP should be viewed as a live document and will be regularly revisited throughout a project's lifecycle so that opportunities to maximise waste reduction / efficiencies are exploited throughout, and that data is collected on an ongoing basis so that it is as accurate as possible

## 2. RESOURCE & WASTE MANAGEMENT IN IRELAND

### 2.1 National Level

The Irish Government issued a policy statement in September 1998, *Changing Our Ways* <sup>5</sup>, which identified objectives for the prevention, minimisation, reuse, recycling, recovery and disposal of waste in Ireland. The target for C&D waste in this report was to recycle at least 50% of C&D waste within a five year period (by 2003), with a progressive increase to at least 85% over fifteen years (i.e. 2013).

In response to the *Changing Our Ways* report, a task force (Task Force B4) representing the waste sector of the already established Forum for the Construction Industry, released a report entitled '*Recycling of Construction and Demolition Waste*' <sup>6</sup> concerning the development and implementation of a voluntary construction industry programme to meet the Government's objectives for the recovery of C&D waste.

In September 2020, the Irish Government published a policy document outlining a new action plan for Ireland to cover the period of 2020-2025. This plan, '*A Waste Action Plan for a Circular Economy*' <sup>7</sup> (WAPCE), replaces the previous national waste management plan, '*A Resource Opportunity*' (2012), and was prepared in response to the 'European Green Deal' which sets a roadmap for a transition to an altered economical model, where climate and environmental challenges are turned into opportunities.

The WAPCE sets the direction for waste planning and management in Ireland up to 2025. This reorientates policy from a focus on managing waste to a much greater focus on creating circular patterns of production and consumption. Other policy statements of a number of public bodies already acknowledge the circular economy as a national policy priority.

The policy document contains over 200 measures across various waste areas including circular economy, municipal waste, consumer protection and citizen engagement, plastics and packaging, construction and demolition, textiles, green public procurement and waste enforcement.

One of the first actions to be taken was the development of the Whole of Government Circular Economy Strategy 2022-2023 'Living More, Using Less' (2021) <sup>8</sup> to set a course for Ireland to transition across all

sectors and at all levels of Government toward circularity and was issued in December 2021. It is anticipated that the Strategy will be updated in full every 18 months to 2 years.

The Environmental Protection Agency (EPA) of Ireland issued '*Best Practice Guidelines for the Preparation of Resource & Waste Management Plans for Construction & Demolition Projects*' in November 2021<sup>9</sup>. These guidelines replace the previous 2006 guidelines issued by The National Construction and Demolition Waste Council (NCDWC) and the Department of the Environment, Heritage and Local Government (DoEHLG) in 2006<sup>10</sup>. The guidelines provide a practical approach which is informed by best practice in the prevention and management of C&D wastes and resources from design to construction of a project, including consideration of the deconstruction of a project. These guidelines have been followed in the preparation of this document and include the following elements:

- Predicted C&D wastes and procedures to prevent, minimise, recycle and reuse wastes;
- Design teams roles and approach;
- Relevant EU, national and local waste policy, legislation and guidelines;
- Waste disposal/recycling of C&D wastes at the site;
- Provision of training for Resource Waste Manager (RM) and site crew;
- Details of proposed record keeping system;
- Details of waste audit procedures and plan; and
- Details of consultation with relevant bodies i.e. waste recycling companies, Local Authority, etc.

Section 3 of the Guidelines identifies thresholds above which there is a requirement for the preparation of a RWMP for developments. The new guidance classifies developments on a two-tiered system. Developments which do not exceed any of the following thresholds may be classed as Tier 1 development:

- New residential development of less than 10 dwellings.
- Retrofit of 20 dwellings or less.
- New commercial, industrial, infrastructural, institutional, educational, health and other developments with an aggregate floor area less than 1,250m<sup>2</sup>.
- Retrofit of commercial, industrial, infrastructural, institutional, educational, health and other developments with an aggregate floor area less than 2,000m<sup>2</sup>; and
- Demolition projects generating in total less than 100m<sup>3</sup> in volume of C&D waste.

A development which exceeds one or more of these thresholds is classed as a Tier-2 project. This development is a Tier 2 development as it exceeds the following threshold:

- New commercial, industrial, infrastructural, institutional, educational, health and other developments with an aggregate floor area less than 1,250m<sup>2</sup>.

Other guidelines followed in the preparation of this report include '*Construction and Demolition Waste Management – a handbook for Contractors and Site Managers*'<sup>11</sup>, published by FÁS and the Construction Industry Federation in 2002 and the previous guidelines, '*Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects*' (2006).

These guidance documents are considered to define best practice for C&D projects in Ireland and describe how C&D projects are to be undertaken such that environmental impacts and risks are minimised and maximum levels of waste recycling are achieved.

## 2.2 Regional Level

The Proposed Development is located in the Local Authority area of South Dublin County Council (SDCC).

The *EMR Waste Management Plan 2015 – 2021* is the regional waste management plan for the SDCC area published in May 2015. Currently the EMR and other regional waste management plans are under review and the Regional Waste Management Planning Offices expect to publish the final plan in 2022. The regional plan sets out the following strategic targets for waste management in the region:

- A 1% reduction per annum in the quantity of household waste generated per capita over the period of the plan;
- Achieve a recycling rate of 50% of managed municipal waste by 2020; and

- Reduce to 0% the direct disposal of unprocessed residual municipal waste to landfill (from 2016 onwards) in favour of higher value pre-treatment processes and indigenous recovery practices.

Municipal landfill charges in Ireland are based on the weight of waste disposed. In the Leinster Region, charges are approximately €130 - €150 per tonne of waste which includes a €75 per tonne landfill levy specified in the *Waste Management (Landfill Levy) Regulations 2015*.

The *South Dublin County Council Development Plan 2022 – 2028*<sup>12</sup> sets out a number of objectives and actions for the South Dublin area in line with the objectives of the waste management plan.

Waste policies, objectives and actions with a particular relevance to the Proposed Development are as follows:

Policies:

**Policy IE7**

Implement European Union, National and Regional waste and related environmental policy, legislation, guidance and codes of practice to improve management of material resources and wastes

Objectives:

**IE6 Objective 1**

To encourage a just transition from a waste management economy to a green circular economy to enhance employment and increase the value, recovery and recirculation of resources through compliance with the provisions of the Waste Action Plan for a Circular Economy 2020 – 2025 and to promote the use of, but not limited to, reverse vending machines and deposit return schemes or similar to ensure a wider and varying ways of recycling.

**IE7 Objective 2**

To support the implementation of the Eastern Midlands Region Waste Management Plan 2015-2021 or as amended by adhering to overarching performance targets, policies and policy actions.

**IE7 Objective 4**

To provide for and maintain the network of bring infrastructure (e.g. civic amenity facilities, bring banks) in the County to facilitate the recycling and recovery of hazardous and non-hazardous municipal wastes.

**IE7 Objective 7**

To require the appropriate provision for the sustainable management of waste within all developments, ensuring it is suitably designed into the development, including the provision of facilities for the storage, separation and collection of such waste.

**IE7 Objective 8**

To adhere to the recommendations of the National Hazardous Waste Management Plan 2014-2020 and any subsequent plan, and to co-operate with other agencies including the EPA in the planning, organisation and supervision of the disposal of hazardous waste streams, including hazardous waste identified during construction and demolition projects.

## 2.3 Legislative Requirements

The primary legislative instruments that govern waste management in Ireland and applicable to the project are:

- Waste Management Act 1996 (No. 10 of 1996) as amended.
- Environmental Protection Act 1992 (No. 7 of 1992) as amended.
- Litter Pollution Act 1997 (No. 12 of 1997) as amended.
- Planning and Development Act 2000 (No. 30 of 2000) as amended<sup>13</sup>.

One of the guiding principles of European waste legislation, which has in turn been incorporated into the *Waste Management Act 1996 - 2001* and subsequent Irish legislation, is the principle of “*Duty of Care*”. This implies that the waste producer is responsible for waste from the time it is generated through until its legal recycling, recovery or disposal (including its method of disposal). As it is not practical in most cases for the waste producer to physically transfer all waste from where it is produced to the final destination, waste contractors will be employed to physically transport waste to the final destination. Following on from this is the concept of “*Polluter Pays*” whereby the waste producer is liable to be prosecuted for pollution incidents,

which may arise from the incorrect management of waste produced, including the actions of any contractors engaged (e.g. for transportation and disposal/recovery/recycling of waste).

It is therefore imperative that the appointed construction contractor(s) are legally compliant with respect to waste transportation, reuse, recycling, recovery and disposal. This includes the requirement that a contractor handle, transport and recycle/recover/dispose of waste in a manner that ensures that no adverse environmental impacts occur as a result of any of these activities.

A collection permit to transport waste must be held by each waste contractor which is issued by the National Waste Collection Permit Office (NWCPO). Waste receiving facilities must also be appropriately permitted or licensed. Operators of such facilities cannot receive any waste, unless in possession of a Certificate of Registration (COR) or waste permit granted by the relevant Local Authority under the *Waste Management (Facility Permit & Registration) Regulations 2007 and Amendments* or a waste or IE licence granted by the EPA. The COR/permit/licence held will specify the type and quantity of waste able to be received, stored, sorted, recycled, recovered and/or disposed of at the specified site.

### **3. DESIGN APPROACH**

The client and the design team have integrated the '*Best Practice Guidelines for the Preparation of Resource & Waste Management Plans for Construction & Demolition Projects*' guidelines into the design workshops, to help review processes, identify and evaluate resource reduction measures and investigate the impact on cost, time, quality, buildability, second life and management post construction. Further details on these design principals can be found within the aforementioned guidance document.

The design team have undertaken the design process in line with the international best practice principles to firstly prevent wastes, reuse where possible and thereafter sustainably reduce and recover materials. The below sections have been the focal point of the design process and material selections and will continued to be analysed and investigated throughout the design process and when selecting material.

The approaches presented are based on international principles of optimising resources and reducing waste on construction projects through:

- Prevention;
- Reuse;
- Recycling;
- Green Procurement Principles;
- Off-Site Construction;
- Materials Optimisation; and
- Flexibility and Deconstruction.

#### **3.1 Designing For Prevention, Reuse and Recycling**

Undertaken at the outset and during project feasibility and evaluation the Client and Design Team considered establishing the potential for any reusable soils. It is proposed to reuse all the topsoil/subsoil generated from the excavations for berms and other landscaping purposes on the site and within the overall data centre campus.

#### **3.2 Designing for Green Procurement**

Waste prevention and minimisation pre-procurement have been discussed and will be further discussed in this section. The Design Team will discuss proposed design solutions, encourage innovation in tenders and incentivise competitions to recognise sustainable approaches. They should also discuss options for packaging reduction with the main Contractor and subcontractors/suppliers using measures such as 'Just-in-Time' delivery and use ordering procedures that avoid excessive waste. The Green procurement extends from the planning stage into the detailed design and tender stage and will be an ongoing part of the long-term design and selection process for this development.

#### **3,3 Designing for Off-Site Construction**

Use of off-site manufacturing has been shown to reduce residual wastes by up to 90% (volumetric building

versus traditional). The decision to use offsite construction is typically cost led but there are significant benefits for resource management. Some further considerations for procurement which are being investigated as part of the planning stage design process are listed as follows:

- Modular buildings as these can displace the use of concrete and the resource losses associated with concrete blocks such as broken blocks, mortars, etc.;
  - Modular buildings are typically pre-fitted with fixed plasterboard and installed insulation, eliminating these residual streams from site.
- Use of pre-cast structural concrete panels which can reduce the residual volumes of concrete blocks, mortars, plasters, etc.;
- The use of prefabricated composite panels for walls and roofing to reduce residual volumes of insulation and plasterboards;
- Using pre-cast hollow-core flooring instead of in-situ ready mix flooring or timber flooring to reduce the residual volumes of concrete/formwork and wood/packaging, respectively; and
- Designing for the preferential use of offsite modular units.

### 3.4 Designing for Materials Optimisation During Construction

To ensure manufacturers and construction companies adopt lean production models, including maximising the reuse of materials onsite. This helps to reduce the environmental impacts associated with transportation of materials and from waste management activities. This includes investigating the use of standardised sizes for certain materials to help reduce the amount of offcuts produced on site, focusing on promotion and development of off-site manufacture.

### 3.5 Designing for Flexibility and Deconstruction

Design flexibility has and will be investigated throughout the design process to ensure that where possible products (including buildings) only contain materials that can be recycled and are designed to be easily disassembled. Material efficiency is being considered for the duration and end of life of a building project to produce; flexible, adaptable spaces that enable a resource-efficient, low-waste future change of use; durability of materials and how they can be recovered effectively when maintenance and refurbishment are undertaken and during disassembly/deconstruction.

## 4. DESCRIPTION OF THE PROJECT

### 4.1 Location, Size and Scale of the Development

The site is located within an existing data centre campus in the townland of Ballymakailly to the west of the Newcastle Road (R120), Lucan, Co. Dublin. The proposed development site area is 5.1 hectares (ha) in extent.

The development will consist of the construction of two no. single storey data centres with associated office and service areas with an overall gross floor area of 15,274sqm that will comprise of the following:

- Construction of 2 no. adjoined single storey data centres with a gross floor area of 12,859sqm that will include a single storey goods receiving area / store and single storey office area (2,415sqm) with PV panels above, located to the east of the data centres as well as associated water tower, sprinkler tank, pump house and other services;
- The data centres will also include plant at roof level; with 24 no. standby diesel generators with associated flues (each 25m high) that will be located within a generator yard to the west of the data centres;
- New internal access road and security gates to serve the proposed development that will provide access to 36 no. new car parking spaces (including 4 no. electric and 2 no. disabled spaces) and sheltered bicycle parking to serve the new data centres;
- New attenuation ponds to the north of the proposed data centres; and
- Green walls are proposed to the south and east that will enclose the water tower and pump house compound.

The development will also include ancillary site works, connections to existing infrastructural services as well as fencing and signage. The development will include minor modifications to the permitted landscaping to the west of the site as granted under SDCC Planning Ref. SD19A/0042 / ABP Ref. PL06S.305948 and Ref.

SD21A/0042. The site will remain enclosed by landscaping to all boundaries. The development will be accessed off the R120 via the permitted access granted under SDCC Planning Ref. SD19A/0042 / ABP Ref. PL06S.305948 and SD21A/0042.

#### 4.2 Details of the Non-Hazardous Wastes to be produced

During the construction phase, waste will be produced from surplus materials such as broken or off-cuts of metal, concrete, plastic, etc. Waste from packaging (cardboard, plastic, timber) and oversupply of materials may also be generated. The appointed Contractor will be contractually required to ensure that oversupply of materials is kept to a minimum and opportunities for reuse of suitable materials is maximised.

There will be soil excavation works required during the construction phase to facilitate site levelling, foundation construction, service trenches and access routes. It is anticipated that excavated soils/stones will be inert/non-hazardous material suitable for re-use on site. The project engineers (Pinnacle) have estimated the amount of topsoil and subsoil that will be excavated. It is currently proposed that all of this excavated material will be reused on site for berms and other landscaping purposes, where possible. These estimates will be refined prior to commencement of construction.

Waste will also be generated from construction and demolition workers e.g. organic/food waste, dry mixed recyclables (waste paper, newspaper, plastic bottles, packaging, aluminium cans, tins and Tetra Pak cartons), mixed non-recyclables and potentially sewage sludge from temporary welfare facilities provided onsite during the construction and demolition phases. Waste printer/toner cartridges, waste electrical and electronic equipment (WEEE) and waste batteries may also be generated infrequently from site offices.

#### 4.3 Potential Hazardous Wastes to be produced

##### **Contaminated Soil**

Geotechnical and environmental site investigations were carried out by Causeway Geotech in September 2018 during the preparation of the EIA Report for the permitted development under South Dublin County Council Reg. Ref. SD19A/0042 / An Bord Pleanála Ref. ABP-305948-19.

During the site investigation, a number of samples were collected from a select number of trial pits and boreholes and were analysed to identify and possible contamination on site. Samples were analysed for hydrocarbons (mineral oils, BTEX), PAHs, metals and phenols. There are no legislative thresholds for soil in Ireland and therefore results were compared with the Land Quality Management (LQM)/Chartered Institute of Environmental Health (CIEH) Suitable for Use Levels (S4ULs) for Human Health Risk Assessment (Nathaniel et al, 2015) which allow assessment based on health risk and use of the site. A review of the representative soil quality analysis results is provided in EIA Report Chapter 7 (Land Soil, Geology and Hydrogeology). The results do not indicate any notable contamination across the site.

All excavations should still be carefully monitored by a suitably qualified person to ensure that, if encountered, potentially contaminated soil is identified and segregated from clean/inert material. In the event that any potentially contaminated material is encountered, it will need to be tested and classified as either non-hazardous or hazardous in accordance with the EPA publication entitled '*Waste Classification: List of Waste & Determining if Waste is Hazardous or Non-Hazardous*'<sup>14</sup> using the *HazWasteOnline* application (or similar approved classification method). The material will then need to be classified as clean, inert, non-hazardous or hazardous in accordance with the waste acceptance criteria as set out in *Decision 2003/33/EC*<sup>15</sup>.

If asbestos or asbestos containing material (ACMs) are identified in any further soil samples or during excavation, the removal will only be carried out by a suitably permitted waste contractor, in accordance with *S.I. No. 386 of 2006 Safety, Health and Welfare at Work (Exposure to Asbestos) Regulations 2006-2010*. All asbestos will be taken to a suitably licensed or permitted facility.

In the event that hazardous soil, or historically deposited waste is encountered during the construction phase, the contractor will notify SDCC and provide a Hazardous / Contaminated Soil Management Plan, to include estimated tonnages, description of location, any relevant mitigation, destination for disposal / treatment, in addition to information on the authorised waste collector(s).

**Fuel/Oils**

As fuels and oils are classed as hazardous materials, any on-site storage of fuel/oil, all storage tanks and all draw-off points will be bunded (or stored in double-skinned tanks) and located in a dedicated, secure area of the site. Provided that these requirements are adhered to and site crew are trained in the appropriate refuelling techniques, it is not expected that there will be any fuel/oil wastage at the site.

**Invasive Plant Species**

A site walkover was undertaken by Scott Cawley included a site walkover survey of the entire site, and around part of the outside perimeter to search for any invasive species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011.

No Japanese Knotweed or any third schedule invasive species were detected. If any are detected during the construction phase of the development, then an invasive species management plan will be produced and submitted to SDCC.

**Other known Hazardous Substances**

Paints, glues, adhesives and other known hazardous substances will be stored in designated areas. They will generally be present in small volumes only and associated waste volumes generated will be kept to a minimum. Wastes will be stored in appropriate receptacles pending collection by an authorised waste contractor.

In addition, WEEE (containing hazardous components), printer toner/cartridges, batteries (Lead, Ni-Cd or Mercury) and/or light bulbs and other mercury containing waste may be generated from during C&D activities or temporary site offices. These wastes (if encountered) will be stored in appropriate receptacles in designated areas of the site pending collection by an authorised waste contractor.

**5. ROLES AND RESPONSIBILITIES**

The *Best Practice Guidelines on the Preparation of Resource Waste Management Plans for Construction and Demolition Projects* promotes that a RM will be appointed. The RM may be performed by number of different individuals over the life-cycle of the Project, however it is intended to be a reliable person chosen from within the Planning/Design/Contracting Team, who is technically competent and appropriately trained, who takes the responsibility to ensure that the objectives and measures within the Project RWMP are complied with. The RM is assigned the requisite authority to meet the objective and obligations of the RWMP. The role will include the important activities of conducting waste checks/audits and adopting construction and demolition methodology that is designed to facilitate maximum reuse and/or recycling of waste.

**5.1 Role of the Client**

EdgeConnex Ireland are Client and the body establishing the aims and the performance targets for the project.

- The Client has commissioned the preparation and submission of a preliminary RWMP as part of the design and planning submission;
- The Client is to commission the preparation and submission of an updated RWMP as part of the construction and demolition tendering process;
- The Client will ensure that the RWMP is agreed on and submitted to the local authority prior to commencement of works on site;
- The Client is to request the end-of-project RWMP from the Contractor.

**5.2 Role of the Client Advisory Team**

The Client Advisory Team or Design Team is responsible for:

- Drafting and maintaining the RWMP through the design, planning and procurement phases of the project;
- Appointing a Resource Manager (RM) to track and document the design process, inform the Design Team and prepare the RWMP.

- Including details and estimated quantities of all projected waste streams with the support of environmental consultants/scientists. This will also include data on waste types (e.g. waste characterisation data, contaminated land assessments, site investigation information) and prevention mechanisms (such as by-products) to illustrate the positive circular economy principles applied by the Design Team;
- Handing over of the RWMP to the selected Contractor upon commencement of construction of the development, in a similar fashion to how the safety file is handed over to the Contractor;
- Working with the Contractor as required to meet the performance targets for the project.

### 5.3 Future Role of the Contractor

The construction Contractors have not yet been decided upon for this RWMP. However, once selected they will have major roles to fulfil. They will be responsible for:

- Preparing, implementing and reviewing the RWMP during the construction phase (including the management of all suppliers and sub-contractors) as per the requirements of these guidelines;
- Identifying a designated and suitably qualified RM who will be responsible for implementing the RWMP;
- Identifying all hauliers to be engaged to transport each of the resources / wastes off-site;
- Implementing waste management policies whereby waste materials generated on site are to be segregated as far as practicable;
- Identifying all destinations for resources taken off-site. As above, any resource that is legally classified as a 'waste' must only be transported to an authorised waste facility;
- End-of-waste and by-product notifications addressed with the EPA where required;
- Clarification of any other statutory waste management obligations, which could include on-site processing;
- Full records of all resources (both wastes and other resources) will be maintained for the duration of the project; and
- Preparing a RWMP Implementation Review Report at project handover.

## 6. KEY MATERIALS & QUANTITIES

### 6.1 Project Resource Targets

Project specific resource and waste management targets for the site have not yet been set and this information will be updated for these targets once these targets have been confirmed by the client. However, it is expected for projects of this nature that a minimum of 70% of waste is fully re-used, recycled or recovered where possible. Target setting will inform the setting of project-specific benchmarks to track target progress. Typical Key Performance Indicators (KPIs) that may be used to set targets include (as per guidelines):

- Weight (tonnes) or Volume (m<sup>3</sup>) of waste generated per construction value;
- Weight (tonnes) or Volume (m<sup>3</sup>) of waste generated per construction floor area (m<sup>2</sup>);
- Fraction of resource reused on site;
- Fraction of resource notified as by-product;
- Fraction of waste segregated at source before being sent off-site for recycling/recovery; and
- Fraction of waste recovered, fraction of waste recycled, or fraction of waste disposed.

### 6.2 Main C&D Waste Categories

The main non-hazardous and hazardous waste streams that could be generated by the construction activities at a typical site are shown in Table 6.1. The List of Waste (LoW) code (as effected from 1 June 2015) (also referred to as the European Waste Code or EWC) for each waste stream is also shown.

**Table 6.1** Typical waste types generated and LoW codes (\*individual waste types may contain hazardous substances)

Waste Material	LoW/EWC Code
Concrete, bricks, tiles, ceramics	17 01 01-03 & 07
Wood, glass and plastic	17 02 01-03
Bituminous mixtures, coal tar and tarred products	17 03 01*, 02 & 03*
Metals (including their alloys) and cable	17 04 01-11
Soil and stones	17 05 03* & 04
Paper and cardboard	20 01 01
Mixed C&D waste	17 09 04
Green waste	20 02 01
Electrical and electronic components	20 01 35 & 36
Batteries and accumulators	20 01 33 & 34
Liquid fuels	13 07 01-10
Chemicals (solvents, pesticides, paints, adhesives, detergents etc.)	20 01 13, 19, 27-30
Organic (food) waste	20 01 08
Mixed Municipal Waste	20 03 01

## 7. WASTE MANAGEMENT

There will be some waste materials generated from modifications required to the existing internal access road and surface water, foul and process wastewater drainage systems. Table 7.1 shows the breakdown of C&D waste types produced on a typical site based on data from the EPA *National Waste Reports* <sup>16</sup>, the *GMIT* <sup>17</sup> and other research reports.

**Table 7.1** Waste materials generated on a typical Irish construction site

Waste Types	%
Mixed C&D	33
Timber	28
Metals	8
Concrete	6
Other	15
<b>Total</b>	<b>100</b>

Table 7.2 shows the predicted construction waste generation for the Proposed Development based on the information available to date along with the targets for management of the waste streams. The predicted waste amounts are based on an average largescale development waste generation rate per m<sup>2</sup>, using the waste breakdown rates shown in Table 7.1.

**Table 7.2** Estimated off-site reuse, recycle and disposal rates for construction waste

Waste Type	Tonnes	Reuse		Recycle/Recovery		Disposal	
		%	Tonnes	%	Tonnes	%	Tonnes
Mixed C&D	299.9	10	30.0	80	239.9	10	30.0
Timber	254.5	40	101.8	55	140.0	5	12.7
Plasterboard	90.9	30	27.3	60	54.5	10	9.1
Metals	72.7	5	3.6	90	65.4	5	3.6
Concrete	54.5	30	16.4	65	35.4	5	2.7
Other	136.3	20	27.3	60	81.8	20	27.3
<b>Total</b>	<b>908.8</b>		<b>206.3</b>		<b>617.1</b>		<b>85.4</b>

In addition to the information in Table 7.2, it is estimated that c. 11,321m<sup>3</sup> of topsoil and c. 7.034m<sup>3</sup> of subsoil will be excavated to facilitate site levelling, foundation construction, service trenches and access routes. It is

currently proposed that all of this excavated material will be reused on site for berms and other landscaping purposes.

## 7.2 Proposed Resource and Waste Management Options

Waste materials generated will be segregated on site, where it is practical. Where the on-site segregation of certain wastes types is not practical, off-site segregation will be carried out. There will be skips and receptacles provided to facilitate segregation at source where feasible. All waste receptacles leaving site will be covered or enclosed. The appointed waste contractor will collect and transfer the wastes as receptacles are filled. There are numerous waste contractors in the SDCC Region that provide this service.

All waste arisings will be handled by an approved waste contractor holding a current waste collection permit. All waste arising's requiring disposal off-site will be reused, recycled, recovered or disposed of at a facility holding the appropriate registration, permit or licence, as required.

Written records will be maintained by the contractor(s) detailing the waste arising throughout the C&D phases, the classification of each waste type, waste collection permits for all waste contractors who collect waste from the site and COR/permit or licence for the receiving waste facility for all waste removed off site for appropriate reuse, recycling, recovery and/or disposal.

Dedicated banded storage containers will be provided for hazardous wastes which may arise such as batteries, paints, oils, chemicals etc, if required.

The management of the main waste streams is outlined as follows:

### Soil, Subsoil

The waste hierarchy states that the preferred option for waste management is prevention and minimisation of waste, followed by preparing for reuse and recycling / recovery, energy recovery (i.e. incineration) and, least favoured of all, disposal. The excavations are required to facilitate construction works so the preferred option (prevention and minimisation) cannot be accommodated for the excavation phase. However, it is proposed to reuse all of this material onsite for berms and other landscaping purposes.

In the event that there are excess soils that are not required and/or suitable for reuse on-site, it could be reused as a by-product (and not as a waste). If this is done, it will be done in accordance with Regulation 15 (By-products) (Previously Article 27 and referred to as Article 27 in this report) of S.I. No. 323/2020 - European Union (Waste Directive) Regulations 2020, which requires that certain conditions are met and that by-product notifications are made to the EPA via their online notification form. Excavated material should not be removed from site until approval from the EPA has been received. The potential to reuse material as a by-product will be confirmed during the course of the excavation works, with the objective of eliminating any unnecessary disposal of material.

The next option (beneficial reuse) may be appropriate for the excavated material. Clean inert material may be used as fill material in other construction projects or engineering fill for waste licensed sites. Beneficial reuse of surplus excavation material as engineering fill may be subject to further testing to determine if materials meet the specific engineering standards for their proposed end use.

Any nearby sites requiring clean fill/capping material will be contacted to investigate reuse opportunities for clean and inert material. If any of the material is to be reused on another site as a by-product (and not as a waste), this will be done in accordance with Regulation 15 (Article 27).

If the material is deemed to be a waste, then removal and reuse / recovery / disposal of the material will be carried out in accordance with the *Waste Management Act 1996* as amended, the *Waste Management (Collection Permit) Regulations 2007* as amended and the *Waste Management (Facility Permit & Registration) Regulations 2007* as amended. Once all available beneficial reuse options have been exhausted, the options of recycling and recovery at waste permitted and licensed sites will be considered.

In the unlikely event that contaminated material is encountered and subsequently classified as hazardous, this material will be stored separately to any non-hazardous material. It will require off-site treatment at a suitable facility or disposal abroad via Transfrontier Shipment of Wastes (TFS).

### Bedrock

While it is not envisaged that bedrock will be encountered, if bedrock is encountered, it is anticipated that it will not be crushed on site. Any excavated rock is expected to be removed off-site for appropriate reuse, recovery and / or disposal.

### Silt & Sludge

Silt and petrochemical interception will be carried out on runoff and pumped water from site works, where required. Sludge and silt will then be collected by a suitably licensed contractor and removed offsite.

### Concrete Blocks, Bricks, Tiles & Ceramics

The majority of concrete generated as part of the construction works are expected to be clean, inert material and will be recycled, where possible.

### Hard Plastic

As hard plastic is a highly recyclable material, much of the plastic generated will be primarily from material off-cuts. All recyclable plastic will be segregated and recycled, where possible.

### Timber

Timber that is uncontaminated, i.e. free from paints, preservatives, glues etc., will be disposed of in a separate skip and recycled off-site.

### Metal

Metals will be segregated where practical and stored in skips. Metal is highly recyclable and there are numerous companies that will accept these materials.

### Waste Electrical and Electronic Equipment (WEEE)

Any WEEE will be stored in dedicated covered cages/receptacles/pallets pending collection for recycling.

### Other Recyclables

Where any other recyclable wastes such as cardboard and soft plastic are generated, these will be segregated at source into dedicated skips and removed off-site.

### Non-Recyclable Waste

C&D waste which is not suitable for reuse or recovery, such as polystyrene, some plastics and some cardboards, will be placed in separate skips or other receptacles. Prior to removal from site, the non-recyclable waste skip/receptacle will be examined by a member of the waste team (see Section 10.0) to determine if recyclable materials have been placed in there by mistake. If this is the case, efforts will be made to determine the cause of the waste not being segregated correctly and recyclable waste will be removed and placed into the appropriate receptacle.

### Other Hazardous Wastes

On-site storage of any hazardous wastes produced (i.e. contaminated soil if encountered and/or waste fuels) will be kept to a minimum, with removal off-site organised on a regular basis. Storage of all hazardous wastes on-site will be undertaken so as to minimise exposure to on-site personnel and the public and to also minimise potential for environmental impacts. Hazardous wastes will be recovered, wherever possible, and failing this, disposed of appropriately.

## **7.3 Tracking and Documentation Procedures for Off-Site Waste**

All waste will be documented prior to leaving the site. Waste will be weighed by the contractor, either by weighing mechanism on the truck or at the receiving facility. These waste records will be maintained on site by the nominated project RM (see Section 9.0).

All movement of waste and the use of waste contractors will be undertaken in accordance with the *Waste Management Acts 1996 - 2011*, *Waste Management (Collection Permit) Regulations 2007* as amended and *Waste Management (Facility Permit & Registration) Regulations 2007* and amended. This includes the requirement for all waste contractors to have a waste collection permit issued by the NWCPO. The nominated project waste manager (see Section 10.0) will maintain a copy of all waste collection permits on-site.

If the waste is being transported to another site, a copy of the Local Authority waste COR/permit or EPA Waste/IE Licence for that site will be provided to the nominated project resource manager (Refer to Section 9.0). If the waste is being shipped abroad, a copy of the Transfrontier Shipping (TFS) notification document will be obtained from DCC (as the relevant authority on behalf of all local authorities in Ireland) and kept on-site along with details of the final destination (COR, permits, licences etc.). A receipt from the final destination of the material will be kept as part of the on-site waste management records.

All information will be entered in a waste management recording system to be maintained on site.

## **8. ESTIMATED COST OF WASTE MANAGEMENT**

An outline of the costs associated with different aspects of waste management is provided below.

The total cost of C&D waste management will be measured and will take into account handling costs, storage costs, transportation costs, revenue from rebates and disposal costs.

### **8.1 Reuse**

By reusing materials on site, there will be a reduction in the transport and recycle/recovery/disposal costs associated with the requirement for a waste contractor to take the material off-site.

Clean and inert soils, gravel, stones etc. which cannot be reused on site may be used as access roads or capping material for landfill sites etc. This material is often taken free of charge or a reduced fee for such purposes, reducing final waste disposal costs.

### **8.2 Recycling**

Salvageable metals will earn a rebate which can be offset against the costs of collection and transportation of the skips.

Clean uncontaminated cardboard and certain hard plastics can also be recycled. Waste contractors will charge considerably less to take segregated wastes, such as recyclable waste, from a site than mixed waste.

Timber can be recycled as chipboard. Again, waste contractors will charge considerably less to take segregated wastes such as timber from a site than mixed waste.

### **8.3 Disposal**

Landfill charges are currently at around €130 - €150 per tonne which includes a €75 per tonne landfill levy specified in the *Waste Management (Landfill Levy) Regulations 2015*. In addition to disposal costs, waste contractors will also charge a collection fee for skips.

Collection of segregated C&D waste usually costs less than municipal waste. Specific C&D waste contractors take the waste off-site to a licensed or permitted facility and, where possible, remove salvageable items from the waste stream before disposing of the remainder to landfill. Clean soil, rubble, etc. is also used as fill/capping material, wherever possible.

## **9. TRAINING PROVISIONS**

A member of the demolition and construction teams will be appointed as the Resource Manager (RM) to ensure commitment, operational efficiency and accountability in relation to waste management during the C&D phases of the development.

### **9.1 Resource Waste Manager Training and Responsibilities**

The nominated RM will be given responsibility and authority to select a waste team if required, i.e. members of the site crew that will aid them in the organisation, operation and recording of the waste management system implemented on site.

The RM will have overall responsibility to oversee, record and provide feedback to the client on everyday waste management at the site. Authority will be given to the Waste Manager to delegate responsibility to sub-contractors, where necessary, and to coordinate with suppliers, service providers and sub-contractors to prioritise waste prevention and material salvage.

The RM will be trained in how to set up and maintain a record keeping system, how to perform an audit and how to establish targets for waste management on site. The RM will also be trained in the best methods for segregation and storage of recyclable materials, have information on the materials that can be reused on site and be knowledgeable in how to implement this RWMP.

## 9.2 Site Crew Training

Training of site crew in relation to waste is the responsibility of the RM and, as such, a waste training program will be organised. A basic awareness course will be held for all site crew to outline the RWMP and to detail the segregation of waste materials at source. This may be incorporated with other site training needs such as general site induction, health and safety awareness and manual handling.

This basic course will describe the materials to be segregated, the storage methods and the location of the Waste Storage Area (WSA). A sub-section on hazardous wastes will be incorporated into the training program and the particular dangers of each hazardous waste will be explained.

## 10. TRACKING AND TRACING / RECORD KEEPING

Records will be kept for all waste material which leaves the site, either for reuse on another site, recycling or disposal. A recording system will be put in place to record the waste arisings on Site.

A waste tracking log will be used to track each waste movement from the site. On exit from the site, the waste collection vehicle driver will stop at the site office and sign out as a visitor and provide the security personnel or RM with a waste docket (or Waste Transfer Form (WTF) for hazardous waste) for the waste load collected. At this time, the security personnel will complete and sign the Waste Tracking Register with the following information:

- Date
- Time
- Waste Contractor
- Company waste contractor appointed by, e.g. Contractor or subcontractor name
- Collection Permit No.
- Vehicle Reg.
- Driver Name
- Docket No.
- Waste Type
- EWC / LoW

The waste vehicle will be checked by security personal or the RM to ensure it has the waste collection permit no. displayed and a copy of the waste collection permit in the vehicle before they are allowed to remove the waste from the site.

The waste transfer dockets will be transferred to the RM on a weekly basis and can be placed in the Waste Tracking Log file. This information will be forwarded onto the SDCC Waste Regulation Unit when requested.

Each subcontractor that has engaged their own waste contractor will be required to maintain a similar waste tracking log with the waste dockets / WTF maintained on file and available for inspection on site by the main contractor as required. These subcontractor logs will be merged with the main waste log.

Waste receipts from the receiving waste facility will also be obtained by the site contractor(s) and retained. A copy of the Waste Collection Permits, CORs, Waste Facility Permits and Waste Licences will be maintained on site at all times and will be periodically checked by the RM. Subcontractors who have engaged their own waste contractors, will provide the main contractor with a copy of the waste collection permits and COR / permit / licence for the receiving waste facilities and maintain a copy on file, available for inspection on site as required.

## **11. OUTLINE WASTE AUDIT PROCEDURE**

### **11.1 Responsibility for Waste Audit**

The appointed RM will be responsible for conducting a waste audit at the site during the C&D phase of the proposed Project. Contact details for the nominated RM will be provided to the SDCC Waste Regulation Unit after the main contractor is appointed and prior to any material being removed from site.

### **11.2 Review of Records and Identification of Corrective Actions**

A review of all waste management costs and the records for the waste generated and transported off-site should be undertaken mid-way through the construction phase of the proposed Project.

If waste movements are not accounted for, the reasons for this will be established in order to see if and why the record keeping system has not been maintained. The waste records will be compared with the established recovery / reuse / recycling targets for the site. Each material type will be examined, in order to see where the largest percentage waste generation is occurring. The waste management methods for each material type will be reviewed in order to highlight how the targets can be achieved.

Upon completion of the C&D phase, a final report will be prepared, summarising the outcomes of waste management processes adopted and the total recycling / reuse / recovery figures for the development.

## **12. CONSULTATION WITH RELEVANT BODIES**

### **12.1 Local Authority**

Once the construction contractor has been appointed and they have appointed waste contractors, and prior to removal of any C&D waste materials off-site, details of the proposed destination of each waste stream will be provided to the SDCC Waste Regulation Unit.

SDCC will also be consulted, as required, throughout the excavation and construction phases in order to ensure that all available waste reduction, reuse and recycling opportunities are identified and utilised and that compliant waste management practices are carried out.

### **12.2 Recycling / Salvage Companies**

The appointed waste contractor for the main waste streams managed by the construction and demolition contractors will be audited in order to ensure that relevant and up-to-date waste collection permits and facility registrations / permits / licences are held. In addition, information will be obtained regarding the feasibility of recycling each material, the costs of recycling / reclamation, the means by which the wastes will be collected and transported off-site, and the recycling / reclamation process each material will undergo off-site.

### 13. REFERENCES

1. Waste Management Act 1996 (No. 10 of 1996) as amended.
2. Environmental Protection Agency Act 1992 as amended.
3. Litter Pollution Act 1997 (S.I. No. 12 of 1997) as amended
4. Eastern-Midlands Region Waste Management Plan 2015 – 2021 (2015).
5. Department of Environment and Local Government (DoELG) *Waste Management – Changing Our Ways, A Policy Statement* (1998).
6. Forum for the Construction Industry – *Recycling of Construction and Demolition Waste*.
7. Department of Communications, Climate Action and Environment (DCCAE), *Waste Action Plan for the Circular Economy - Ireland's National Waste Policy 2020-2025* (Sept 2020).
8. DCCAE, *Whole of Government Circular Economy Strategy 2022-2023 'Living More, Using Less'* (2021)
9. Environmental Protection Agency (EPA) *'Best Practice Guidelines for the Preparation of Resource and Waste Management Plans for Construction & Demolition Projects'* ( 2021)
10. Department of Environment, Heritage and Local Government, *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects* (2006).
11. FÁS and the Construction Industry Federation (CIF), *Construction and Demolition Waste Management – a handbook for Contractors and site Managers* (2002).
12. South Dublin County Council (SDCC), *South Dublin County Council Development Plan 2022 – 2028* (2022).
13. Planning and Development Act 2000 (S.I. No. 30 of 2000) as amended
14. EPA, *Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous* (2015)
15. Council Decision 2003/33/EC, establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC.
16. Environmental Protection Agency (EPA), *National Waste Database Reports 1998 – 2012*.
17. EPA and Galway-Mayo Institute of Technology (GMIT), *EPA Research Report 146 – A Review of Design and Construction Waste Management Practices in Selected Case Studies – Lessons Learned* (2015).